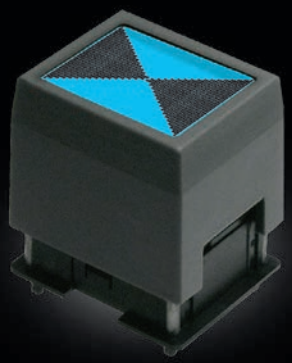
NKK SWITCHES

New Products

SmartSwitch Frameless OLED Pushbutton

Full Screen, high definition programmable pushbutton switch. Features contrast and resolution of 96x64 pixels in a compact screen. Range of over 65,000 colors. Guaranteed operating life of 50,000 hours minimum. Consists of dust tight construction with low energy consumption.



SmartSwitch Wide View Switches

LCD 64 x 32 high resolution pushbuttons, compact pushbutton and display with larger screen, narrow frame, superior visibility. Standard pushbuttons, compact pushbuttons or display with wider view and 36 x 24 resolution.

What is a SmartSwitch?

SmartSwitch products combine a pushbutton or rocker switch with a programmable OLED or LCD display for a space saving, simplified, multi-function device.

Why SmartSwitch?

- **Simplify complex, multi-decision operations**
- **Reduce panel space, installation time and cost**
- **Smallest off-the-shelf OLED and LCD devices**

Series KP, NP01, & UB2 with Alternating Legends

Bicolor LED illumination paired with alternating legends allows for a multitude of customized legend display options. New super bright bicolors Red/Green or Amber/Blue.

nikk SWITCHES

Series M Dual Seal Waterproof Toggle

Superb quality and construction design eliminates the need for a separate waterproof boot. Dual seal provides increased protection against wet environments and debris. Polished, chrome-plated actuator delivers in terms of sleek design and functionality.

Series SK Antistatic Snap-in Keylock

Totally sealed quality construction with internal o-ring, gasket between base and housing and insert-molded terminals provide increased protection. Housing and bushing of high insulating material withstands over 15 kilovolts of electrostatic discharge.

Series UB Alternating Legands

Bicolors red/green and amber/blue with alternating standard or custom legands. Super bright LED provides brilliant uniform illumination. Small behind panel dimension for easy snap-in mounting in tight spaces.

Series YB2 Panel Seal Pushbuttons

Innovative new caps with the look of classic, elegant stainless steel when nonilluminated. Features LED color or legands when illuminated. Antistatic properties with enhanced durability against environmental concerns. Meets IP65 of IEC60529 standards.

NIKK SWITCHES

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MB2500 Series C116
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WB Series C134

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LB Series Illum & Nonillum D48
LP01 Series Illum & Nonillum D68
NP01 Series Illum & Nonillum. . . . D74
UB Series Illum & Nonillum D80
UB2 Series Illum & Nonillum D92
YB Series Illum & Nonillum D104
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A	Subminiature/Indicator/PC Mount	M3
AB	Subminiature/Pushbutton/Process Seal	C6
AS	Subminiature/Slide/PC Mount	H4
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B	Subminiature/Fully Illuminated Toggle/Process Seal	A20
BB	Subminiature/Pushbutton/Antistatic/Process Seal	C12
CB	6mm/Process Seal Tactile/Through-Hole Mount	J4
CB3	6mm/Process Seal Tactile/SMT	J8
CK	16 & 19mm Hi Security Keylock/Bushing Mount	F3
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CW	Miniature/Power Rocker/Snap-in/Panel Mount	B12
CWSB	Miniature/Power Rocker/Neon Lighted	B18
CWSC	Miniature/Power Rocker/LED Lighted	B22
D2	Miniature/Toggle/Light Duty	A24
DB	Miniature/Pushbutton/Light Touch	C18
DSA	Mercury-free/Sealed/Tilt Switch	K3
DSB	Contactless/Photo Interrupter/Sealed/Tilt Switch	K3
EB	Miniature/Light Touch Pushbutton/Panel Mount	C24
EB	Miniature/Light Touch Pushbutton/Snap-in Mount	C30
FB	Subminiature/Pushbutton/Panel Mount	C38
FM	Illum, 12 or 16 Keys/Nonillum, 4 or 16/Membrane	L15
FP01	Contactless/Illuminated Pushbutton/Snap-in Mount	D4
FR01	10mm Ultra-Thin/DIP Rotary/Through-hole	G4
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FS	Miniature/Slide/High Frequency/PC Mount	H14
FT	Resistive/5-Wire, 4-Wire & Digital/Touch Screen	L3
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G	Ultra-miniature/Illum Toggle/Process Seal/PC Mnt	A38
G	Ultra-miniature/Rocker/Process Seal/PC Mount	B28
G	Ultra-miniature/Indicator/PC Mount	M5
GB	Ultra-miniature/Pushbutton/Process Seal/PC Mnt	C44
GB	Ultra-miniature/Illum Plunger/Process Seal/PC Mnt	D8
GB2	Ultra-thin/Pushbutton/PC Mount	C48
G3B	Ultra-miniature/Process Seal Pushbutton/SMT	C52
G3T	Ultra-miniature/Process Seal Toggle/SMT	A42
GW	Ultra-thin/Rocker/PC Mount	B32
GW	Ultra-thin/Fully Illuminated Paddle/PC Mount	B36
HB	Subminiature/Illum & Nonillum PB/Panel Mount	D12
HB	Subminiature/Indicator/Panel Mount	M6
HB2	Subminiature/Audio-Video Pushbutton/PC Mount	D18
HP02	6mm Tactile/Through-hole Mount	J12
HP03	6mm Tactile/SMT	J16
HS	Standard Size/Rotary/6 & 12 amp/1-6 Pole	G46
IS	Programmable/Frameless OLED Pushbutton/96 x 64	E4
IS	Programmable/OLED Pushbutton/64 x 48	E8
IS	Programmable/OLED Display/52 x 36	E8
IS	Programmable/OLED Rocker/96 x 64	E15
IS	Programmable/Pushbutton/LCD 64 x 32	E22
IS	Programmable/Display/LCD 64 x 32	E26
IS	Programmable/Compact Pushbutton/LCD 64 x 32	E28
IS	Programmable/Pushbutton/LCD 36 x 24	E35
IS	Programmable/Display/LCD 36 x 24	E39
IS	Programmable/Compact Pushbutton/LCD 36 x 24	E43
JB	Low Profile/Tactile/Process Seal	J20
JB	Low Profile/Illuminated Tactile/Process Seal	J28
JF	Ultra-thin/Tactile/Process Seal	J34
JF	Ultra-thin/Illuminated Tactile/Process Seal	J40
JF	Ultra-thin/Indicator/Process Seal	M8
JL	Ultra-thin/Illuminated Tactile/PC Mount	J46
JP	TV Rated/Pushbutton/Snap-in Mount	C58
JS01	DIP Slide/Through-hole/Standard Actuator	H18
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Contents by Series

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JWS	10 Amp Rocker/Snap-in Mount	B50
KB	Miniature/Illum, Nonillum Pushbutton/Panel Mount	D22
KB	Miniature/Indicator/Panel Mount	M9
KP	Illuminated Audio-Video Pushbutton	D36
LB	Standard Size/Illum, Nonillum PB/Panel Mount	D48
LB	Standard Size/Illum, Nonillum PB/Panel Seal	D59
LB	Standard Size/Indicator/Panel Mount	M14
LP01	Short Body/Illum, Nonillum PB/Panel Mount	D68
LW	Standard Size/Dual Lamp Rocker/Power Rated	B56
LW	Standard Size/Illuminated Rocker/Hi Capacity	B61
M	Miniature/Toggle/Multi-function	A48
M	Miniature/Rocker & Paddle/Multi-function	B62
M2B	Miniature/Pushbutton/Process Seal	C64
M2T	Miniature/Toggle/Process Seal	A88
M2T	Miniature/Rocker & Paddle/Process Seal	B98
M2100	Miniature/LED Tip Toggle	A80
M2100	Miniature/LED Tip Rocker & Paddle	B92
MB2000	Miniature/Pushbutton/Momentary & Alternate Action	C72
MB2400	Miniature/Pushbutton/Light Touch/Momentary	C96
MB2500	Miniature/Pushbutton/Light Touch/Momentary	C116
MLW	Miniature/Illuminated Rocker, Paddle/Power Rated	B106
MR	Rotary/Logic Level/1/2" Diameter/Process Seal	G16
MR	Rotary/Power Level/1/2" Diameter/Enclosed	G22
MRB	Rotary/Process Seal/Logic Level/PC Mount	G28
MS	Miniature/Slide/Power & Logic Level	H30
MS	Miniature/Illuminated Slide/Power Level	H38
ND	8mm DIP Rotary/Process Seal/Binary Coded	G34
ND3	8mm DIP Rotary/SMT/Binary Coded	G38
NP01	Submini/Illumin PB/Smooth Actuation/PC Mount	D74
P	Standard Size/Toggle/Panel Mount	A96
P	Standard Size/Rocker & Paddle/Panel Mount	B114
P01	Miniature/Indicator/for MLW Series	M19
PS	Standard Size/Rotary/30 Amp/1-5 Pole	G46
S	Standard Size/Toggle/Low Capacity	A101
S	Standard Size/Toggle/Medium Capacity	A103
S	Standard Size/Toggle/Medium-High Capacity	A108
S	Standard Size/Toggle/High Capacity	A119
SB	Standard Size/Pushbutton/Low-Medium Capacity	C128
SB40	Miniature/Pushbutton/Panel Mount	C38
SCB	Standard Size/Pushbutton/Snap Action	C131
SK	12mm Low & Med Security Keylock/Bushing Mnt	F9
SK	Subminiature Keylock/Antistatic/Process Seal	F15
SK	Miniature Keylock/Process Seal	F19
SK	Miniature Keylock/Antistatic/Snap-in/Custom	F25
SM	Ultra-miniature/Slide/PC Mount	H42
SS	Ultra-miniature/Slide/PC Mount	H44
SS	Ultra-miniature/Illuminated Slide/PC Mount	H49
SS3	Ultra-miniature/Slide/SMT	H53
SW	Standard Size/Rockers/Medium Capacity	B120
SW	Standard Size/Rockers/High Capacity	B122
TL	Miniature/Illuminated Toggle/Panel Mount	A126
TS	Standard Size/Rotary/6 Amp/1-5 Pole	G46
UB	Low Profile/Illum, Nonillum PB/PC & Snap-in	D80
UB	Low Profile/Indicator/PC & Snap-in	M21
UB2	Low Profile/Illum, Nonillum PB/PC & Snap-in	D92
UB2	Low Profile/Indicator/PC & Snap-in	M26
WB	Std Size/Pushbutton/Environmentally Sealed	C134
WR	Standard Size/Rocker/Environmentally Sealed	B124
WT	Standard Size/Toggle/Environmentally Sealed	A132
YB	Short Body/Illum, Nonillum PB/Panel Mount	D104
YB	Short Body/Indicator/Panel Mount	M29
YB2	22mm/Short Body/Illuminated PB/Panel Mount	D118

Switch Selection Guide

TOGGLES - SECTION A

MAXIMUM RATING	SIZE	MOUNTING				TERMINALS						PROCESS SEAL	SERIES	PAGE NO.
		PC Board	Bush-ing	Snap-in	Two Screw	Solder Lug	PC	Quick Connect	Wire-Wrap	Screw	SMT Gull Wing			
0.4VA @ 28V AC/DC	ultra-mini	•					•					•	G	A34
0.4VA @ 28V AC/DC	ultra-mini	•					•					•	G Illum	A38
0.4VA @ 28V AC/DC	ultra-mini										•	•	G3T	A42
0.4VA @ 28V AC/DC	submini	•					•					•	A	A4
0.4VA @ 28V AC/DC	submini	•					•					•	B	A12
0.4VA @ 28V AC/DC	submini	•					•					•	B Illum	A20
0.4VA @ 28V AC/DC	miniature	•	•			•	•	•	•				M	A48
0.4VA @ 28V AC/DC	miniature	•					•					•	M2T	A88
0.4VA @ 28V AC/DC	miniature	•	•			•	•	•					M2100	A80
0.4VA @ 28V AC/DC	miniature		•			•							TL	A126
0.4VA @ 48V AC/DC	miniature	•	•				•						D2	A24
6A @ 125V AC	miniature	•	•			•	•	•	•				M	A48
6A @ 125V AC	miniature	•					•					•	M2T	A88
6A @ 125V AC	miniature	•	•			•	•	•					M2100	A80
6A @ 125V AC	miniature		•			•							TL	A126
10A @ 125V AC	standard	•	•			•	•	•					P	A96
10A @ 125V AC	standard		•			•			wire lead	•			WT	A132
5A @ 125V AC	standard		•			•							S Low Cap	A101
15~20A @ 125V AC	standard		•			•		•					S Med Cap	A103
15~25A @ 125V AC	standard		•			•		•		•			S Med/Hi	A108
30~50A @ 125V AC	standard		•							•			S Hi Cap	A119
30A @ 125V AC/DC	standard		•							•			S AC/DC	A119

ROCKERS - SECTION B

MAXIMUM RATING	SIZE	MOUNTING				TERMINALS					PROCESS SEAL	SERIES	PAGE NO.
		PC Board	Bush-ing	Snap-in	Two Screw	Solder Lug	PC	Quick Connect	Wire-Wrap	Screw			
0.4VA @ 28V AC/DC	ultra-mini	•					•				•	G	B28
0.4VA @ 28V AC/DC	ultra-mini	•					•					GW	B32
0.4VA @ 28V AC/DC	ultra-mini	•					•					GW Illum	B36
0.4VA @ 28V AC/DC	submini	•					•				•	A	B4
0.4VA @ 28V AC/DC	miniature	•		•	•	•	•	•	•			M	B62
0.4VA @ 28V AC/DC	miniature	•					•				•	M2T	B98
0.4VA @ 28V AC/DC	miniature	•		•	•	•	•	•				M2100	B92
3A @ 250V AC	miniature			•		•						CWT	B12
5A @ 125V AC	miniature			•		•						MLW	B106
6A @ 125V AC	miniature			•		•						CWT	B12
6A @ 125V AC	miniature	•		•	•	•	•	•	•			M	B62
6A @ 125V AC	miniature	•					•				•	M2T	B98
6A @ 125V AC	miniature	•		•	•	•	•	•				M2100	B92
6A @ 125/250V AC	miniature			•		•		•				JWS	B50
6A @ 250V AC	miniature	•		•		•	•	•				CWS	B12
9A @ 125V AC	miniature			•		•		•				CWSB Illum	B18
9A @ 125V AC	miniature			•		•		•				CWSC Illum	B22
10A @ 125V AC	standard				•	•	•	•				P	B114
10A @ 125V AC	standard			•		•						LW	B56
10A @ 125/250V AC	miniature			•		•		•				JWS	B50
10A @ 125/250V AC	standard			•		•		•				JWM	B40
15A @ 125/250V AC	standard			•		•		•	wire lead	•		WR	B124
16A @ 125/250V AC	standard			•		•		•				JWL	B40
20A @ 110V AC	standard				•	•						LW	B56
15~20A @ 125V AC	standard				•	•						SW Med	B120
30A @ 125V AC/DC	standard				•					•		SW Hi Cap	B122

Switch Selection Guide

PUSHBUTTONS - SECTION C

MAXIMUM RATING	SIZE	MOUNTING				TERMINALS						PROCESS SEAL	SERIES	PAGE NO.
		PC Board	Bush-ing	Snap-in	Two Screw	Solder Lug	PC	Quick Connect	Wire-Wrap	Screw	SMT Gull Wing			
0.4VA @ 28V AC/DC	ultra-mini	•					•					•	GB	C44
0.4VA @ 28V AC/DC	ultra-mini	•					•						GB2	C48
0.4VA @ 28V AC/DC	ultra-mini										•	•	G3B	C52
0.4VA @ 28V AC/DC	submini	•					•					•	AB	C6
0.4VA @ 28V AC/DC	submini	•					•					•	BB	C12
0.4VA @ 28V AC/DC	miniature	•	•				•						DB	C18
0.4VA @ 28V AC/DC	miniature	•	•	•		•	•						EB	C24
0.4VA @ 28V AC/DC	submini		•				turret						FB	C38
0.4VA @ 28V AC/DC	miniature	•					•					•	M2B	C64
0.4VA @ 28V AC/DC	miniature	•	•	•		•	•	•	•				MB2000	C72
0.4VA @ 28V AC/DC	miniature	•	•	•		•	•		•				MB2400	C96
0.4VA @ 28V AC/DC	miniature	•	•	•		•	•						MB2500	C116
0.4VA @ 28V AC/DC	miniature		•			•							SB4011	C38
500mA @ 125V AC	submini		•				turret						FB	C38
1A @ 125V AC	miniature	•					•					•	M2B	C64
3A @ 125V AC	miniature	•	•	•		•	•						EB	C24
3A @ 125V AC	miniature	•	•	•		•	•		•				MB2400	C96
3A @ 125V AC	miniature	•	•	•		•	•						MB2500	C116
3A @ 125V AC	miniature		•			•							SB4011	C38
6A @ 125V AC	miniature	•	•	•		•	•	•	•				MB2000	C72
6A @ 125V AC	standard		•			•			wire lead	•			WB	C134
10A @ 125/250V AC	standard			•		•		•					JPM	C58
15A @ 125V AC	standard		•			•				•			SB	C128
15A @ 125V AC	standard		•					•					SCB	C131
16A @ 125/250V AC	standard			•		•		•					JPL	C58

ILLUMINATED PUSHBUTTONS - SECTION D

MAXIMUM RATING	SIZE	MOUNTING				TERMINALS					PROCESS SEAL	SERIES	PAGE NO.
		PC Board	Bush-ing	Snap-in	Two Screw	Solder Lug	PC	Quick Connect	Wire-Wrap	Screw			
0.4VA @ 28V AC/DC	ultra-mini	•					•					GB	D8
0.4VA @ 28V AC/DC	submini	•					•					HB2	D18
0.4VA @ 28V AC/DC	submini	•					•					NP01	D74
0.4VA @ 28V AC/DC	miniature	•	•	•		•	•					KB	D22
0.4VA @ 28V AC/DC	miniature	•		•		•	•					UB	D80
0.4VA @ 28V AC/DC	miniature	•		•		•	•					UB2	D92
0.4VA @ 28V AC/DC	miniature		•	•		•	•	•				YB	D104
0.4VA @ 28V AC/DC	standard	•	•	•		•	•	•				LB	D48
0.4VA @ 28V AC/DC	standard		•			•		•			•	YB2	D118
0.1A @ 30V AC/DC	submini		•			•						HB	D12
100mA @ 12V DC	miniature	•					•					KP	D36
1A @ 125/250V AC	miniature	•	•	•		•	•					KB	D22
3A @ 125/250V AC	miniature		•	•		•	•	•				YB	D104
3A @ 125/250V AC	miniature		•	•		•		•				LP01	D68
3A @ 125/250V AC	standard	•	•	•		•	•	•				LB	D48
3A @ 125/250V AC	standard		•			•		•			•	YB2	D118
5A @ 125/250V AC	miniature	•		•		•	•					UB	D80
5A @ 125/250V AC	miniature	•		•		•	•					UB2	D92
5V Photo Interrupter	standard			•								* FP01	D4

* See FP01 Series for connector options

Switch Selection Guide

SMARTSWITCH PROGRAMMABLE - SECTION E

MAXIMUM RATING	SIZE	LCD	OLED	RESOLUTION (PIXELS)	MOUNTING		TERMINALS	SERIES	PAGE NO.
					PC Board	Snap-in	PC		
PUSHBUTTON									
100mA @ 12V DC	standard		•	96 x 64	•		•	IS	E4
100mA @ 12V DC	standard		•	64 x 48	•		•	IS	E8
100mA @ 12V DC	standard	•		64 x 32	•		•	IS	E22
100mA @ 12V DC	compact	•		64 x 32	•		•	IS	E28
100mA @ 12V DC	standard	•		36 x 24	•	* •	•	IS	E35
100mA @ 12V DC	compact	•		36 x 24	•		•	IS	E41
DISPLAY	standard		•	52 x 36				IS	E8
	standard	•		64 x 32				IS	E26
	standard	•		36 x 24				IS	E39
ROCKER									
3VA maximum DC			•	96 x 64		•		IS	E15

* Mounting option with Panel Mount Housing

KEYLOCKS - SECTION F

MAXIMUM RATING	SIZE	MOUNTING	INDEXING	TERMINALS	POSITIONS	PROCESS SEAL	SERIES	PAGE NO.
0.4VA @ 28V AC/DC	submini	PC Board	45°	PC	3	•	SK	F15
0.4VA @ 28V AC/DC	submini	PC Board	45°	PC	5	•	SK	F15
0.4VA @ 28V AC/DC	miniature	PC Board	90°	PC	2	•	SK	F19
0.4VA @ 28V AC/DC	miniature	PC Board	45°	PC	3	•	SK	F19
0.4VA @ 28V AC/DC	miniature	Snap-in	45°	Solder Lug	3		SK	F25
3A @ 125V AC	miniature	Bushing	45°	Solder Lug	3		SK	F9
3A @ 125V AC	miniature	Bushing	90°	Solder Lug	2		SK	F9
3A @ 250V AC	standard	Bushing	90°	Solder Lug	2		CK	F3
3A @ 250V AC	standard	Bushing	45°	Solder Lug	3		CK	F3

ROTARIES - SECTION G

MAXIMUM RATING	SIZE	MOUNTING		INDEXING	TERMINALS				PROCESS SEAL	SERIES	PAGE NO.
		PC Board	Bushing	Step Size	Solder Lug	PC	Screw	SMT Gull Wing			
0.4VA @ 28V AC/DC	miniature	•		30°		•			•	MRF	G16
0.4VA @ 28V AC/DC	miniature	•	•	30°		•			•	MRK	G16
0.4VA @ 28V AC/DC	miniature	•	•	45° & 90°		•			•	MRB	G28
0.4VA @ 28V AC/DC	miniature		•	60°		turret				MRY	G22
100mA @ 5/50V DC	ultra-mini	•		22.5° & 36°		•			•	ND	G34
100mA @ 5/50V DC	ultra-mini			22.5° & 36°				•	•	ND3	G38
100mA @ 5/50V DC	submini	•	•	22.5° & 36°		•				FR01	G4
100mA @ 5/50V DC	submini			22.5° & 36°				•		FR02	G12
250mA @ 125V AC	miniature	•	•	30°		•			•	MRA	G16
1A @ 30V DC	miniature		•	45°		turret				MRX	G22
2A @ 30V DC	miniature		•	60°		turret				MRY	G22
2A @ 125V AC	miniature		•	45°		turret				MRX	G22
3A @ 30V DC	miniature		•	60°	•					MRT23	G22
3A @ 125V AC	miniature		•	60°		turret				MRY	G22
4A @ 30V DC	miniature		•	120°	•					MRT22	G22
5A @ 125V AC	miniature		•	60°	•					MRT23	G22
6A @ 125V AC	standard		•	45°	•					HS13	G46
6A @ 125/250V AC	standard		•	30°			•			TS	G46
10A @ 125V AC	miniature		•	120°	•					MRT22	G22
12A @ 125V AC	standard		•	30°	•					HS16	G46
30A @ 125/250V AC	standard		•	30°			•			PS	G46

Switch Selection Guide

SLIDES - SECTION H

MAXIMUM RATING	SIZE	MOUNTING				TERMINALS						PROCESS SEAL	SERIES	PAGE NO.
		PC Board	Bush-ing	Snap-in	Two Screw	Solder Lug	PC	Quick Connect	Wire-Wrap	Screw	SMT Gull Wing			
0.4VA @ 28V AC/DC	ultra-mini	•					•						SS	H44
0.4VA @ 28V AC/DC	ultra-mini										•		SS3	H53
0.4VA @ 28V AC/DC	submini	•					•						AS	H4
0.4VA @ 28V AC/DC	miniature	•					•						FS	H14
0.4VA @ 28V AC/DC	miniature	•			•	•	•						MS	H30
1.0mA @ 10mV AC/DC	ultra-mini	•					•						SM	H42
25mA @ 24V DC	ultra-mini	•					•						JS01, JS03	H18
25mA @ 24V DC	ultra-mini										•		JS02, JS04	H24
0.1A @ 12V DC	ultra-mini										•		SS3	H53
0.1A @ 30V DC	ultra-mini	•					•						SS	H44
0.1A @ 30V DC	ultra-mini	•					•						SS Illum	H49
0.1A @ 50V DC	ultra-mini	•					•						JS01, JS03	H18
0.1A @ 50V DC	ultra-mini										•		JS02, JS04	H24
500mA @ 12V DC	ultra-mini	•					•						SM	H42
3A @ 125V AC	miniature	•					•						CS	H10
6A @ 125V AC	miniature	•			•	•	•						MS	H30
6A @ 125V AC	miniature	•			•	•	•						MS Illum	H38

TACTILES - SECTION J

MAXIMUM RATING	SIZE	MOUNTING				TERMINALS						PROCESS SEAL	SERIES	PAGE NO.
		PC Board	Bush-ing	Snap-in	Two Screw	Solder Lug	PC	Quick Connect	Wire-Wrap	Screw	SMT Gull Wing			
0.4VA @ 28V AC/DC	ultra-mini	•					•						HP02	J12
0.4VA @ 28V AC/DC	ultra-mini										•		HP03	J16
3VA @ 28V DC	ultra-mini	•					•						HP02	J12
3VA @ 28V DC	ultra-mini										•		HP03	J16
50mA @ 24V DC	ultra-mini	•					•					•	CB	J4
50mA @ 24V DC	ultra-mini										•	•	CB3	J8
50mA @ 24V DC	submini	•					•					•	JF	J34
50mA @ 24V DC	submini	•					•						JF Illum	J40
50mA @ 24V DC	submini	•					•					•	JB	J20
50mA @ 24V DC	submini	•					•					•	JB Illum	J28
50mA @ 24V DC	submini	•					•						JL	J46
125mA @ 24V DC	submini	•					•					•	JB	J20
125mA @ 24V DC	submini	•					•					•	JB Illum	J28

TILT SWITCHES - SECTION K

MAXIMUM RATING	SIZE	MOUNTING				TERMINALS					PROCESS SEAL	SERIES	PAGE NO.
		PC Board	Bush-ing	Snap-in	Two Screw	Solder Lug	PC	Quick Connect	Wire-Wrap	Screw			
0.1A @ 12V DC	miniature	•					•					DSA	K3
5V Photo Interrupter	submini	•					•				•	DSB	K3

Switch Selection Guide

TOUCH SCREENS - SECTION L

MAXIMUM RATING	TECHNOLOGY	INPUT METHOD	*STANDARD SCREEN SIZES	SERIES	PAGE NO.
5.5V DC	5-Wire Resistive	Finger, Gloved Finger or Stylus	10.4″ ~ 15.0″	FT	L3
1mA @ 5V DC (resistive load)	4-Wire Resistive		5.7″ ~ 15.0″	FT	L8
	Digital	Finger	5.7″	FT	L14

* Custom sizes available; contact factory for more information.

MEMBRANE SWITCH KEYPADS - SECTION L

MAXIMUM RATING	ILLUMINATION	NUMBER OF KEYS	SURFACE SHEET		Overlay	SERIES	PAGE NO.
			Black	Gray			
20mA @ 24V DC	Nonilluminated	4	•			FM	L15
		4		•			
		16	•				
		16		•			
	Dot Illuminated with Overlay	12			Gray Surface Sheet with Embossed White Keypad & Gray Legends		
		16					

NKK SWITCHES

Toggles

Contents Toggles

A Series.....A4
0.4VA Logic Level; Process Sealed
Straight, Right Angle, & Vertical PC
PCB Mount

B Series.....A12
Antistatic; Process Sealed
0.4VA Logic Level
Straight, Right Angle, & Vertical PC
PCB Mount

B Series Illuminated.....A20
Subminiature Fully Illuminated; Process Sealed
0.4VA Logic Level
Straight, Right Angle, & Vertical PC
PCB Mount

D2 Series.....A24
0.4VA Logic Level
Straight, Right Angle, & Vertical PC
PCB Mount

G Series.....A34
Ultra-Miniature; Process Sealed
0.4VA Logic Level
Straight, Right Angle, & Vertical PC
PCB Mount

G Series Illuminated.....A38
Ultra-Miniature Fully Illuminated
0.4VA Logic Level
Straight, Right Angle, & Vertical PC
PCB Mount

G3T Series.....A42
Ultra-Miniature; Process Sealed SMT
0.4VA Logic Level
Gull-wing Terminals
Upright & Right Angle Mount

M Series.....A48
Dual Seal Waterproof, IP67 Rated
6A Power Level & 0.4VA Logic Level
12mm Bushing, Solder Lug Terminals

M Series.....A52
Bushing Mount
6A Power Level & 0.4VA Logic Level
Solder Lug, Quick Connect, Straight PC, & Wirewrap

Contents

M Series A64
Straight PC with Bracket
6A Power Level & 0.4VA Logic Level
PCB Mount

M Series A70
Right Angle & Vertical PC
6A Power Level & 0.4VA Logic Level
PCB Mount

M2100 Series Illuminated A80
6A Power Level & 0.4VA Logic Level
LED Tipped Toggle
Solder Lug, Quick Connect, & PC
Bushing, Flat Frame & Snap-in Mount

M2T Series A88
Process Sealed
6A Power Level & 0.4VA Logic Level
Straight, Right Angle, Vertical, & Extended PC
PCB Mount

P Series A96
Internationally Approved
10A Power Level
Solder Lug, Straight PC, & Quick Connect
Bushing Mount

S Series A100
5A to 50A Low, Medium, & High Capacity
Solder Lug, Quick Connect, & Screw Lug
Bushing Mount

TL Series Illuminated A126
6A Power Level or 0.4VA Logic Level
Translucent Toggle with Bright or Super Bright LED
Solder Lug; Bushing Mount

WT Series A132
Environmentally Sealed
10A Power Level
Solder Lug, Screw Lug, & Wire Lead
Bushing Mount

General Specifications

Electrical Capacity (Resistive Load)

Logic Level: 0.4VA maximum @ 28V AC/DC maximum
(Applicable Range 0.1mA ~ 0.1A @ 20mV ~ 28V)
Note: Find additional explanation of operating range in Supplement section.

Other Ratings

Contact Resistance: 50 milliohms maximum
Insulation Resistance: 500 megohms minimum @ 500V DC
Dielectric Strength: 500V AC minimum between contacts for 1 minute minimum;
500V AC minimum between contacts & case for 1 minute minimum
Mechanical Life: 100,000 operations minimum for On-None-On & On-Off-On
50,000 operations minimum for other circuits
Electrical Life: 50,000 operations minimum
Nominal Operating Force: 1.47N (momentary); 1.18N (maintained) for .394" (10.0mm) toggles
2.73N (momentary); 1.84N (maintained) for all other toggles
Contact Timing: Nonshorting (break-before-make)
Angle of Throw: 26°

Materials & Finishes

Toggle: Glass fiber reinforced polyamide for antistatic; nickel plated brass for all others
Case Housing: Glass fiber reinforced polyamide
Support Bracket: Tin plated phosphor bronze
Movable Contact: Phosphor bronze with gold plating
Stationary Contacts: Brass with gold plating
Terminals: Brass with gold plating

Environmental Data

Operating Temperature Range: –30°C through +85°C (–22°F through +185°F)
Humidity: 90 ~ 95% humidity for 240 hours @ 40°C (104°F)
Vibration: 10 ~ 55Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range
& returning in 1 minute; 3 right angled directions for 2 hours
Shock: 50G (490m/s^2) acceleration (tested in 6 right angled directions, with 5 shocks in each direction)

PCB Processing

Soldering: Wave Soldering Recommended. See Profile A in Supplement section.
Manual Soldering: See Profile B in Supplement section.
Cleaning: Automated cleaning. See Cleaning Specifications in Supplement section.

Standards & Certifications

The A Series toggles have not been tested for UL recognition or CSA certification.
These switches are designed for use in a low-voltage, low-current, logic-level circuit.
When used as intended in a logic-level circuit, the results do not produce hazardous energy.

Distinctive Characteristics

Subminiature size saves space on PC boards.

Specifically developed for logic-level applications.

Totally sealed body construction prevents contact contamination and allows time- and money-saving automated soldering and cleaning.

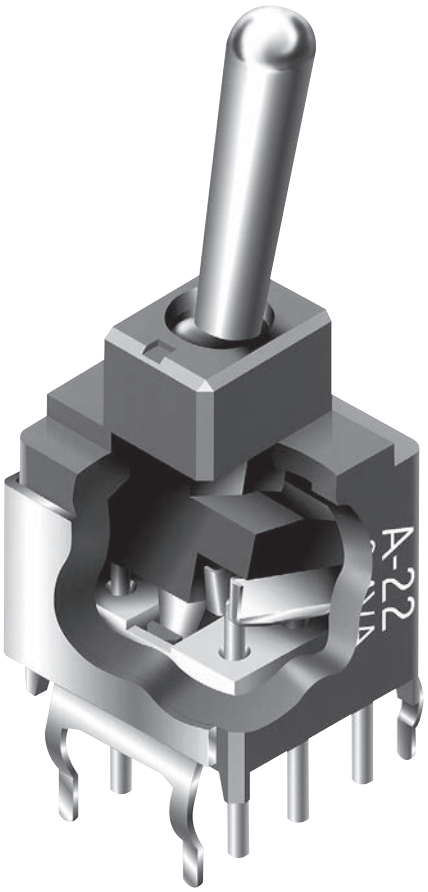
Award-winning STC contact mechanism with benefits unavailable in conventional mechanisms: smoother, positive detent actuation, increased contact stability and unparalleled logic-level reliability. (Additional STC details in Terms & Acronyms; see Supplement contents.)

Molded-in, epoxy sealed or ultrasonically welded terminals lock out flux, solvents, and other contaminants.

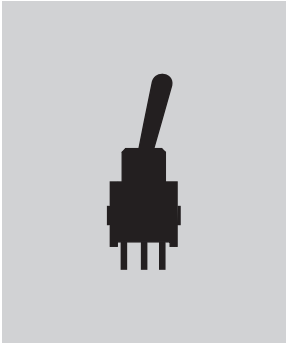
.100" x .100" (2.54mm x 2.54mm) terminal spacing conforms to standard PC board grid spacing.

Toggle option in antistatic material available for dissipating electrostatic discharges.

Matching indicators available.



Actual Size



TYPICAL SWITCH ORDERING EXAMPLE

A | 1 | 2 | J | V | — | | |

Poles

1	SPST SPDT
2	DPDT SP3T

Toggles

A	.394″ (10.0mm) Bat
J	.248″ (6.3mm) Bat
J2	.248″ (6.3mm) Antistatic Bat
E	.394″ (10.0mm) Flatted
H	.248″ (6.3mm) Flatted
K	Snap Top for A or B Paddle

Optional Caps

G	.394″ (10.0mm) Bat Lever Cap
J	.248″ (6.3mm) Bat Lever Cap

Paddles

A	Short Paddle for K Toggle
B	Long Paddle for K Toggle

Circuits

1	OFF	NONE	ON
2	ON	NONE	ON
3	ON	OFF	ON
5	ON	NONE	(ON)
R	(ON)	NONE	ON
8	(ON)	OFF	(ON)
9	ON	OFF	(ON)
S	(ON)	OFF	ON
*4	ON	ON	ON
*6	(ON)	ON	(ON)
*7	ON	ON	(ON)

( ) = Momentary

*3-ON circuits

PC Terminals

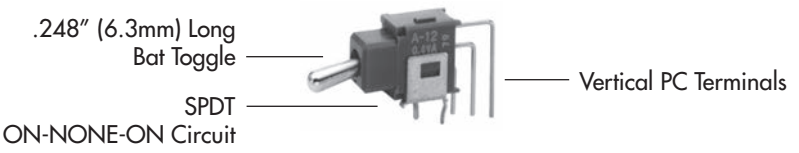
P	Straight
B	Straight with Bracket
B1	Straight with Inline Bracket (Single Pole only)
H	Right Angle with Bracket
V	Vertical with Bracket
V1	Vertical with Inline Bracket (Single Pole only)

Cap Colors / Paddle Colors

Cap Colors		Paddle Colors
A	Black	A
B	White	B
C	Red	C
---	Yellow	E
---	Green	F
---	Blue	G
---	Gray	H

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

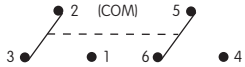
A12JV



POLES & CIRCUITS

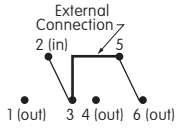
Pole	Model	Toggle Position ( ) = Momentary: Up	Center	Down	Connected Terminals: Up	Center	Down	Throw & Schematics
SP	**A11**	OFF	NONE	ON	OPEN	OPEN	3-1	SPST
SP	**A12** **A13** **A15** **A1R** **A18** **A19** **A1S**	ON ON ON (ON) (ON) ON (ON)	NONE OFF NONE NONE OFF OFF OFF	ON ON (ON) ON (ON) (ON) ON	2-3	OPEN	2-1	SPDT
DP	**A22** **A23** **A25** **A2R** **A28** **A29** **A2S**	ON ON ON (ON) (ON) ON (ON)	NONE OFF NONE NONE OFF OFF OFF	ON ON (ON) ON (ON) (ON) ON	2-3 5-6	OPEN	2-1 5-4	DPDT

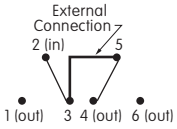
Note: Terminal numbers are not actually on the switch.

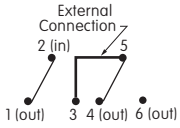


For 3 Throw (3-on)

Pole	Model	Connected Terminals & Schematics: Up	Center	Down
SP	**A24** **A26** **A27**	ON (ON) ON	ON ON ON	ON (ON) (ON)
		2-3 5-6	2-3 5-4	2-1 5-4



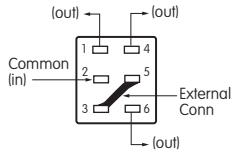




External Connection

The SP3T model utilizes a double pole base.

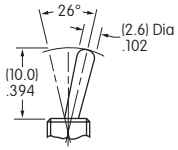
External connections must be made during field installation.



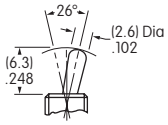
TOGGLES

Standard Material & Finish: Brass with Bright Nickel **Material & Finish for J2:** Matte finish black glass fiber reinforced polyamide

A **.394" (10.0mm) Bat**



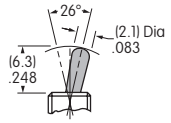
J **.248" (6.3mm) Bat**



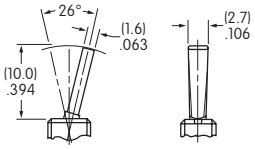
J2 **.248" (6.3mm) Antistatic Bat**

Dissipating 20Kv ESD: Straight PC

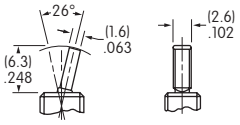
Dissipating 10Kv ESD: Straight PC with Bracket, Right Angle, & Vertical



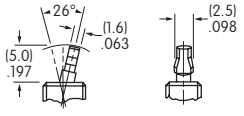
E **.394" (10.0mm) Flatted**



H **.248" (6.3mm) Flatted**



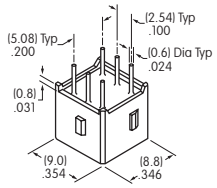
K **Snap Top for Paddles**



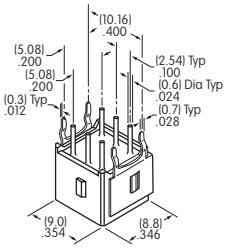
PC TERMINALS

Use of a support bracket is recommended to increase PCB mounting strength and stability.

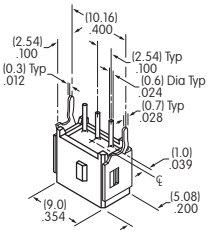
P **Straight**



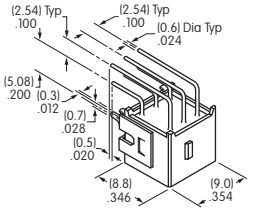
B **Straight with Bracket**



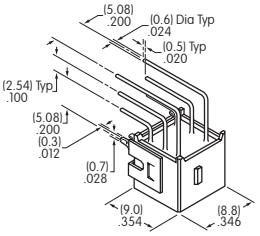
B1 **Straight with Inline Bracket**
Single Pole only



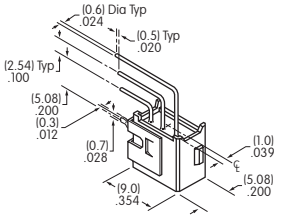
H **Right Angle with Bracket**



V **Vertical with Bracket**



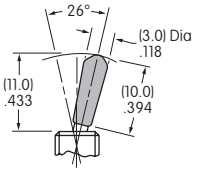
V1 **Vertical with Inline Bracket**
Single Pole only



CAPS & PADDLES

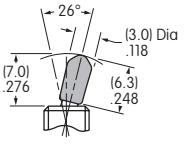
G **AT4003**
.394" (10.0mm) Bat Lever Cap

Material: PVC
Colors Available:
A, B, C



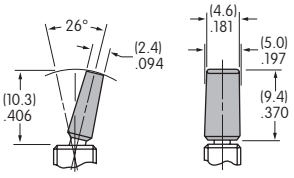
J **AT4064**
.248" (6.3mm) Bat Lever Cap

Material: PVC
Colors Available:
A, B, C



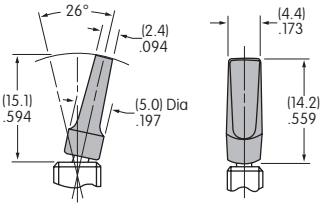
A **AT467**
Short Paddle

Material: Polyamide
Colors Available:
A, B, C, E, F, G, H



B **AT468**
Long Paddle

Material: Polyamide
Colors Available:
A, B, C, E, F, G, H

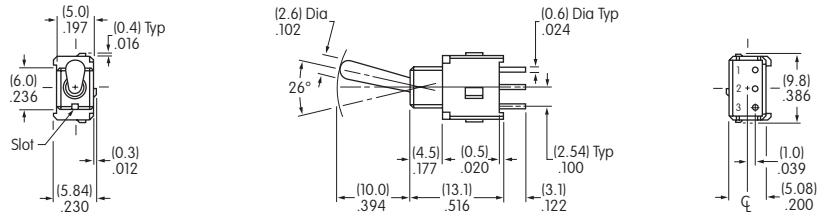


Color Codes:

A Black **B** White **C** Red **E** Yellow **F** Green **G** Blue **H** Gray

TYPICAL SWITCH DIMENSIONS

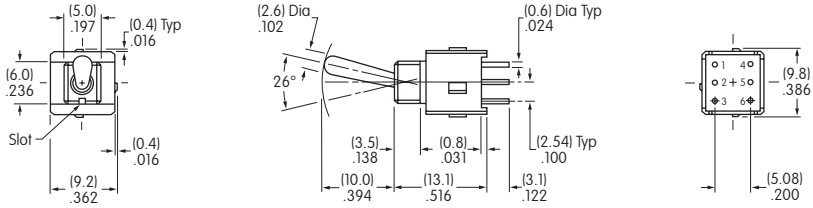
Single Pole — Straight PC



A11 models do not have Terminal 2

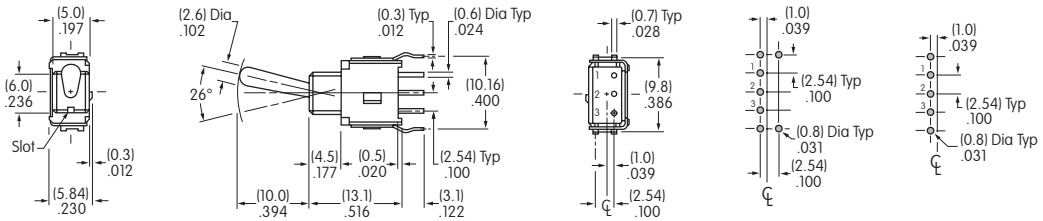
A12AP

Double Pole — Straight PC



A22AP

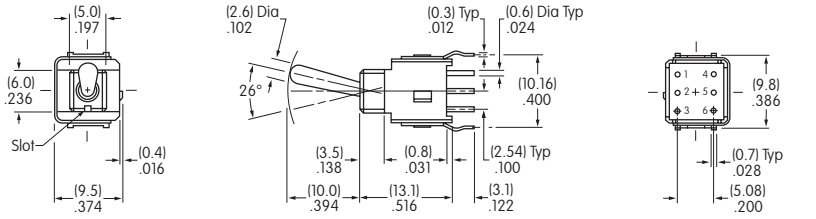
Single Pole — Straight PC • Bracket



B Terminals B1 Terminals

A12AB

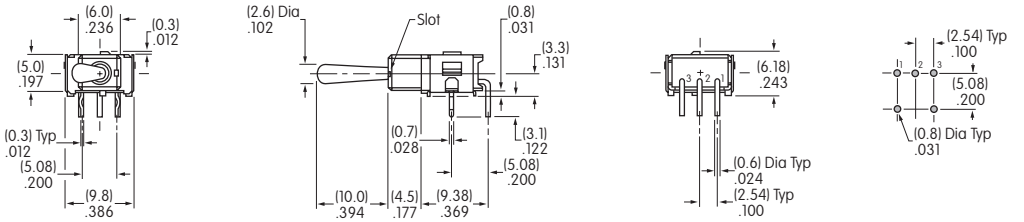
Double Pole — Straight PC • Bracket



A22AB

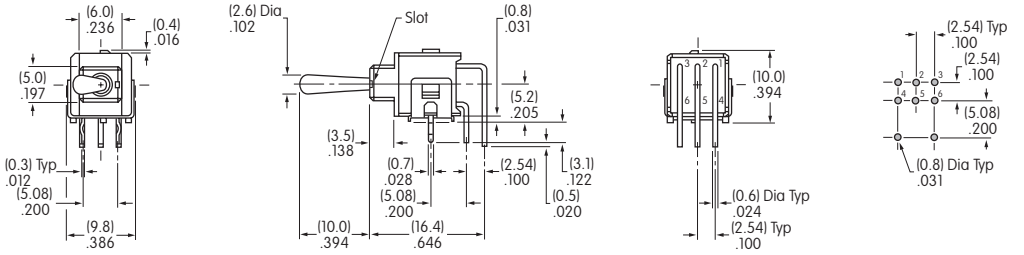
TYPICAL SWITCH DIMENSIONS

Right Angle PC — Single Pole



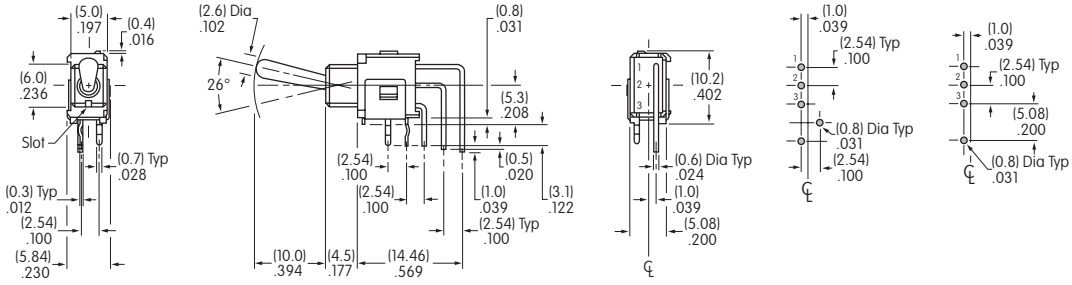
A12AH

Right Angle PC — Double Pole



A22AH

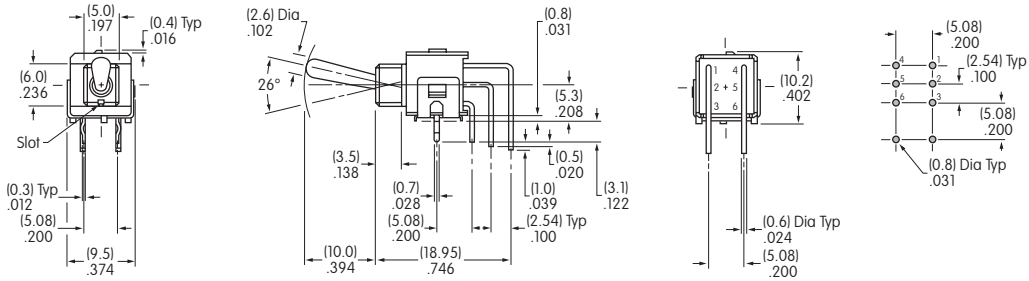
Vertical PC — Single Pole



A12AV

V Terminals V1 Terminals

Vertical PC — Double Pole



A22AV

General Specifications

Electrical Capacity (Resistive Load)

Logic Level: 0.4VA maximum @ 28V AC/DC maximum
(Applicable Range 0.1mA ~ 0.1A @ 20mV ~ 28V)
Note: Find additional explanation of operating range in Supplement section.

Other Ratings

Contact Resistance: 50 milliohms maximum
Insulation Resistance: 500 megohms minimum @ 500V DC
Dielectric Strength: 500V AC minimum for 1 minute minimum
Mechanical Life: 100,000 operations minimum for On-None-On & On-Off-On
50,000 operations minimum for other circuits
50,000 operations minimum for locking lever models
Electrical Life: 50,000 operations minimum
Nominal Operating Force: Toggles A, A1, E & K with Long Paddle: 1.47N (momentary); 1.18N (maintained)
Toggles J & H & K with Short Paddle: 2.72N (momentary); 1.84N (maintained)
Toggle L: 0.59N
Contact Timing: Nonshorting (break-before-make)
Angle of Throw: 26°

Materials & Finishes

Toggle: Nickel plated brass
Bushing: Carbon blended polyamide; nickel plated zinc alloy for locking levers & threaded bushing
Gasket: Nitrile butadiene rubber
Case Housing: Glass fiber reinforced polyamide
Support Bracket: Tin plated phosphor bronze
Movable Contact: Phosphor bronze with gold plating
Stationary Contacts: Copper alloy with gold plating
Terminals: Copper alloy with gold plating

Environmental Data

Operating Temperature Range: –30°C through +85°C (–22°F through +185°F)
Humidity: 90 ~ 95% humidity for 96 hours @ 40°C (104°F)
Vibration: 10 ~ 55Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in 1 minute; 3 right angled directions for 2 hours
Shock: 50G (490m/s^2) acceleration (tested in 6 right angled directions, with 5 shocks in each direction)

Installation

Mounting Torque: .30 ~ .45Nm (2.65 ~ 3.98 lb•in) for A1 actuator with threaded bushing only

PCB Processing

Soldering: Wave Soldering Recommended: See Profile A in Supplement section.
Manual Soldering: See Profile A in Supplement section.
Cleaning: Automated cleaning. See Cleaning specifications in Supplement section.

Standards & Certifications

Flammability Standards: UL94V-0 available
The B Series toggles have not been tested for UL recognition or CSA certification.
These switches are designed for use in a low-voltage, low-current, logic-level circuit.
When used as intended in a logic-level circuit, the results do not produce hazardous energy.

Distinctive Characteristics

Subminiature size saves space on PC boards.

Specifically developed for logic-level applications.

Antistatic superstructure, consisting of the carbon impregnated bushing and the support bracket, prevents static discharge to the contacts. Static electricity from an operator's touch travels from actuator through the bushing and bracket to the PC board.

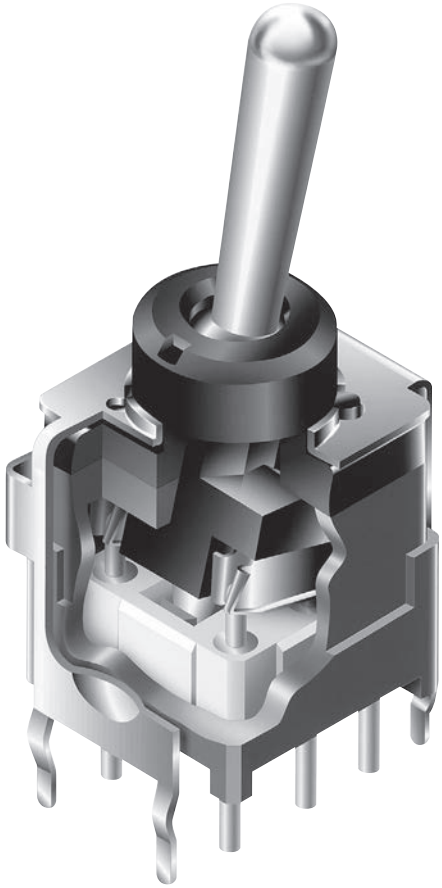
Locking lever mechanism offered as a toggle option.

Optional threaded, 6mm diameter bushing for panel seal mounting meets IP65 of IEC60529 specifications (similar to NEMA 4 and 13).

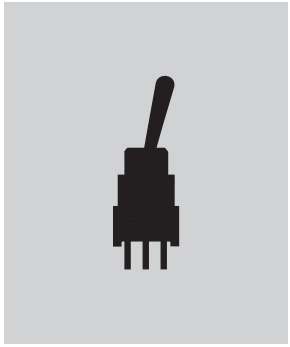
Totally sealed body construction prevents contact contamination and allows time- and money-saving soldering and cleaning. Epoxy sealed terminals lock out flux and other contaminants.

Award-winning STC contact mechanism with benefits unavailable in conventional mechanisms: smoother, positive detent actuation, increased contact stability and unparalleled logic-level reliability. (Additional STC details in Terms & Acronyms; see Supplement section.)

.100" x .100" (2.54mm x 2.54mm) terminal spacing conforms to standard PC board grid spacing.



Actual Size



TYPICAL SWITCH ORDERING EXAMPLE

B 1 2 A B — ☐ ☐

Poles

1	SPDT
2	DPDT

Toggles

A	.394" (10.0mm) Bat
A1	.315" (8.0mm) Bat with Panel Seal Threaded Bushing (Straight PC only)
J	.248" (6.3mm) Bat
E	.394" (10.0mm) Flatted
H	.248" (6.3mm) Flatted
L	Locking Lever (with Circuits 2 & 3 only)

Optional Caps

G	.394" (10.0mm) Bat Lever Cap
J	.248" (6.3mm) Bat Lever Cap

Circuits

2	ON	NONE	ON
3	ON	OFF	ON
5	ON	NONE	(ON)
*R	(ON)	NONE	ON
8	(ON)	OFF	(ON)
9	ON	OFF	(ON)
*S	(ON)	OFF	ON

( ) = Momentary

* Reverse circuits R & S available with right angle & vertical only

PC Terminals

P	Straight
*B	Straight with Bracket
*H	Right Angle with Bracket
*V	Vertical with Bracket

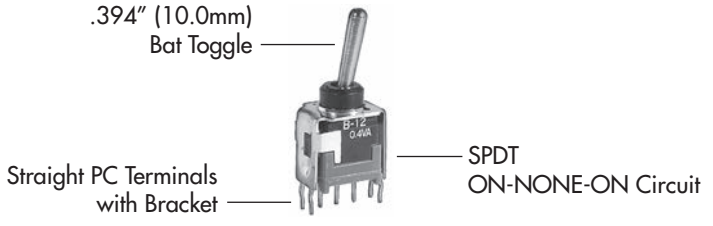
* Bracketed models are ESD protected

Cap Colors / Paddle Colors

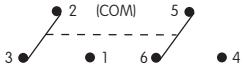
Cap Colors		Paddle Colors
A	Black	A
B	White	B
C	Red	C
---	Yellow	E
---	Green	F
---	Blue	G
---	Gray	H

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

B12AB



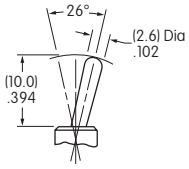
POLES & CIRCUITS

Pole	Model	Toggle Position ( ) = Momentary: Up	Center	Down	Connected Terminals: Up	Center	Down	Throw & Schematics
		Slot			Slot			Note: Terminal numbers are not actually on the switch.
SP	B12	ON	NONE	ON	2-3	OPEN	2-1	SPDT
	B13	ON	OFF	ON				
	B15	ON	NONE	(ON)				
	B1R	(ON)	NONE	ON				
	B18	(ON)	OFF	(ON)				
	B19	ON	OFF	(ON)				
	B1S	(ON)	OFF	ON				
DP	B22	ON	NONE	ON	2-3 5-6	OPEN	2-1 5-4	DPDT 
	B23	ON	OFF	ON				
	B25	ON	NONE	(ON)				
	B2R	(ON)	NONE	ON				
	B28	(ON)	OFF	(ON)				
	B29	ON	OFF	(ON)				
	B2S	(ON)	OFF	ON				

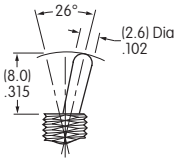
TOGGLES

Standard Material & Finish: Brass with Bright Nickel

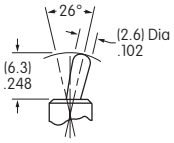
A **.394" (10.0mm) Bat**



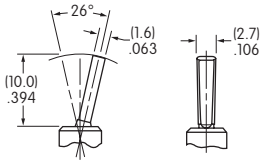
A1 **.315" (8.0mm) Bat with Panel Seal Threaded Bushing**



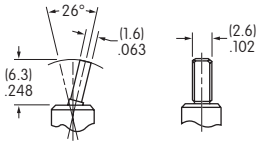
J **.248" (6.3mm) Bat**



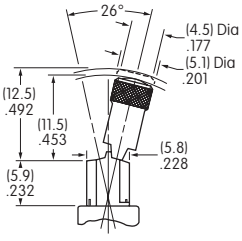
E **.394" (10.0mm) Flatted**



H **.248" (6.3mm) Flatted**



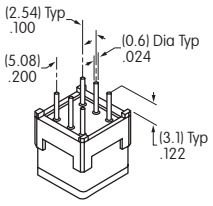
L **Locking Lever**



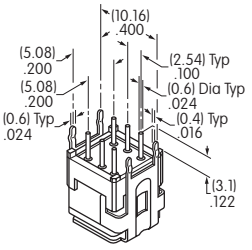
PC TERMINALS

Use of a support bracket is recommended to increase PCB mounting strength and stability.

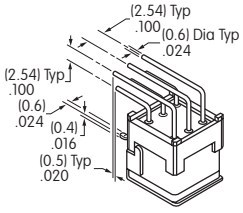
P **Straight**



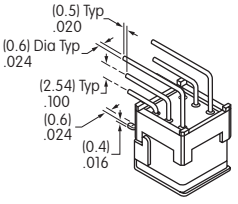
B **Straight with Bracket**



H **Right Angle with Bracket**



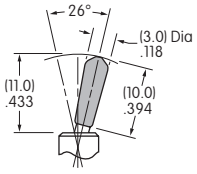
V **Vertical with Bracket**



OPTIONAL CAPS

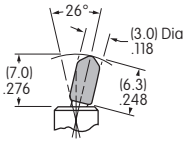
G **AT4003**
.394" (10.0mm) Bat Lever Cap

Material: PVC
Colors Available:
A, B, C



J **AT4064**
.248" (6.3mm) Bat Lever Cap

Material: PVC
Colors Available:
A, B, C

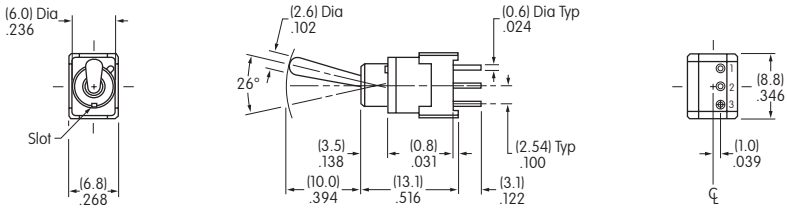


Color Codes:

A Black **B** White **C** Red **E** Yellow **F** Green **G** Blue **H** Gray

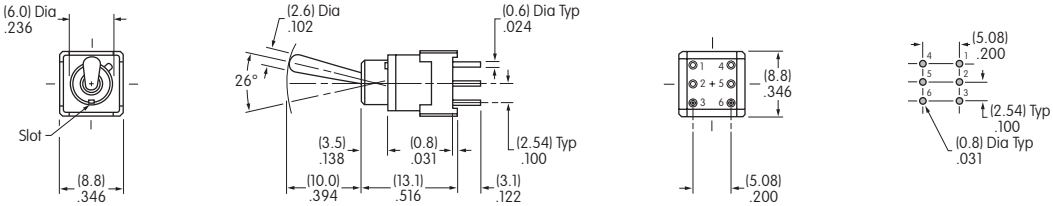
TYPICAL SWITCH DIMENSIONS

Single Pole — Straight PC



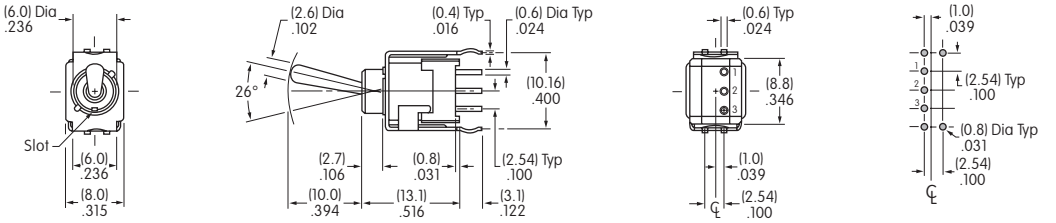
B12AP

Double Pole — Straight PC



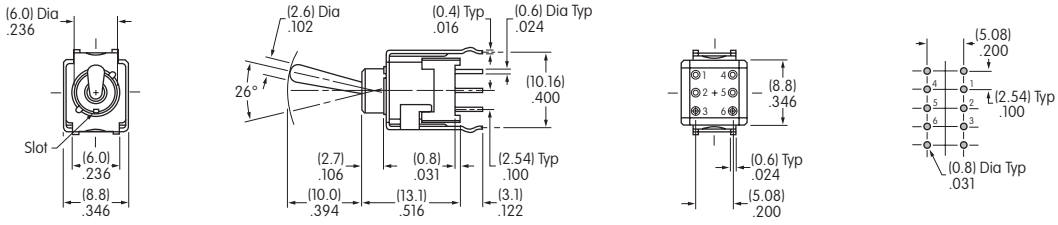
B22AP

Single Pole — Straight PC • Bracket



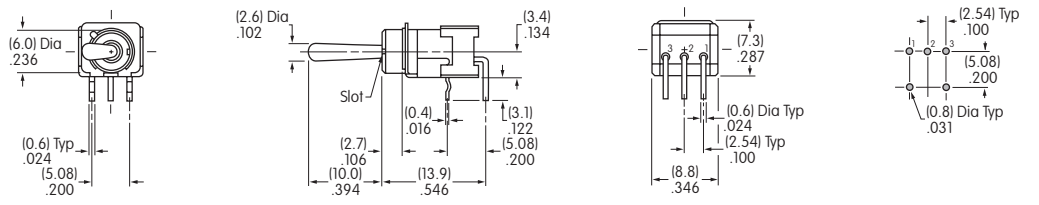
B12AB

Double Pole — Straight PC • Bracket



B22AB

Single Pole — Right Angle PC

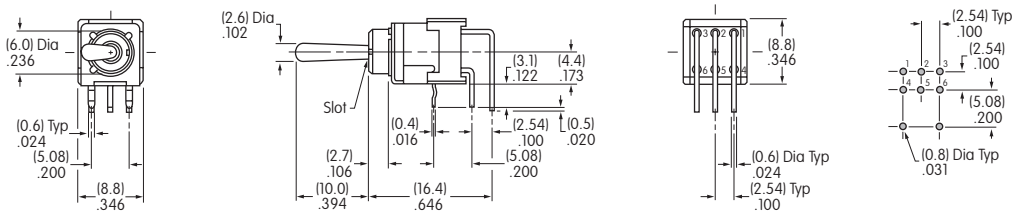


B12AH

TYPICAL SWITCH DIMENSIONS

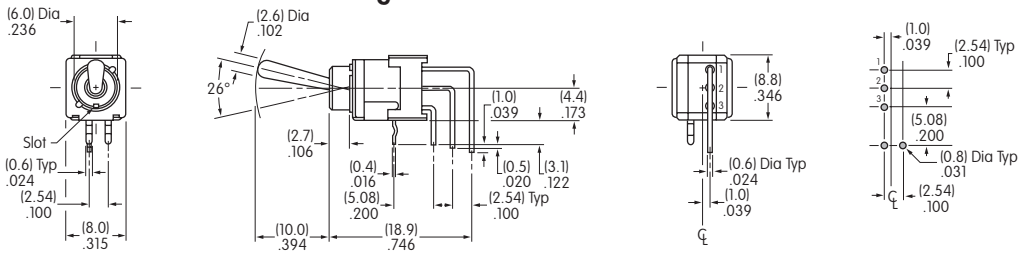
Right Angle PC — Double Pole

B22AH



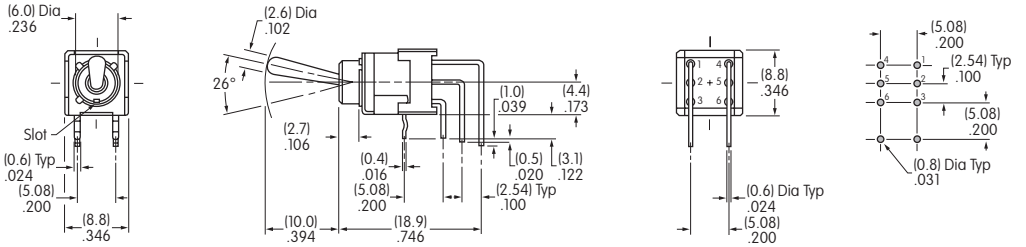
Vertical PC — Single Pole

B12AV



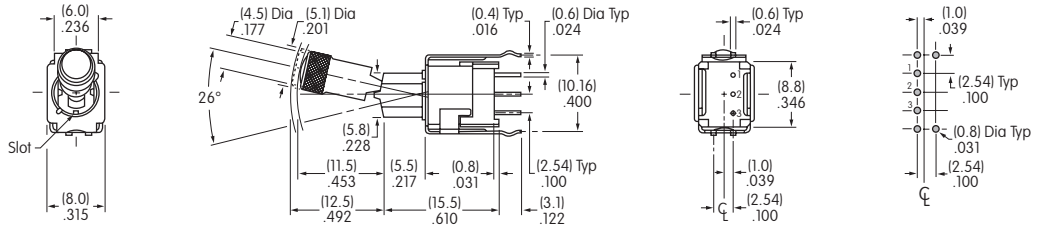
Vertical PC — Double Pole

B22AV



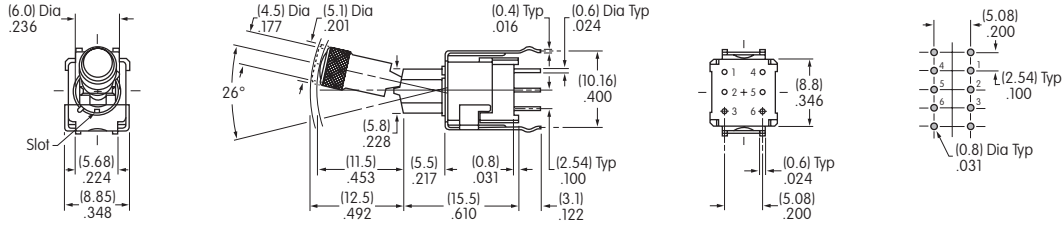
Locking Lever • Straight PC • Bracket — Single Pole

B12LB



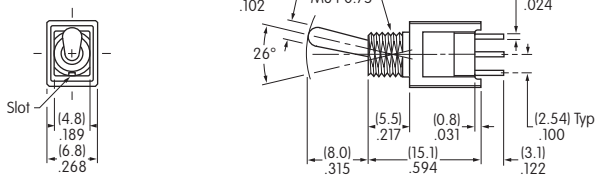
Locking Lever • Straight PC • Bracket — Double Pole

B22LB

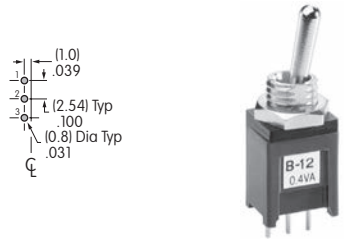


TYPICAL SWITCH DIMENSIONS

Panel Seal • Single Pole

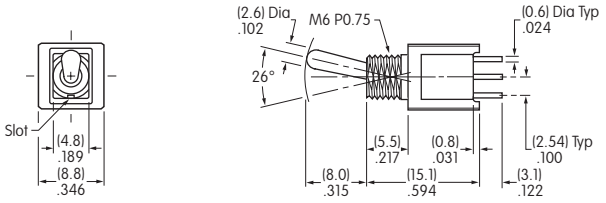


Threaded Bushing • Straight PC

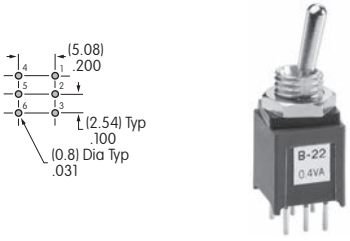


B12A1P

Panel Seal • Double Pole



Threaded Bushing • Straight PC

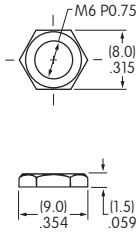


B22A1P

STANDARD HARDWARE & PANEL CUTOUT

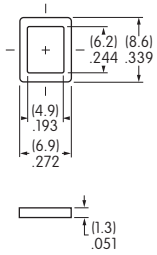
AT513M
Metric Hex Nut

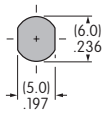
Material:
Brass,
Nickel plated



AT063
Gasket

Material:
Nitrile butadiene rubber





Maximum Panel Thickness with Standard Hardware: .087" (2.2mm)

General Specifications

Electrical Capacity (Resistive Load)

Logic Level: 0.4VA maximum @ 28V AC/DC maximum
(Applicable Range 0.1mA ~ 0.1A @ 20mV ~ 28V)
Note: Find additional explanation of operating range in Supplement section.

Other Ratings

Contact Resistance: 50 milliohms maximum
Insulation Resistance: 500 megohms minimum @ 500V DC
Dielectric Strength: 500V AC minimum for 1 minute minimum
Mechanical Life: 100,000 operations minimum
Electrical Life: 50,000 operations minimum
Nominal Operating Force: 1.18N
Contact Timing: Nonshorting (break-before-make)
Angle of Throw: 26°

Materials & Finishes

Actuator: Polyamide
Bushing Housing: Polyamide
Case Housing: Glass fiber reinforced polyamide
Support Bracket: Phosphor bronze with tin plating
Movable Contact: Phosphor bronze with gold plating
Stationary Contacts: Brass with tin plating
Terminals: Brass with gold plating

Environmental Data

Operating Temperature Range: –25°C through +55°C (–13°F through +131°F)
Humidity: 90 ~ 95% humidity for 240 hours @ 40°C (104°F)
Vibration: 10 ~ 55Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in 5 minutes; 3 right angled directions for 2 hours
Shock: 50G (490m/s^2) acceleration (tested in 3 right angled directions, with 5 shocks in each direction)

PCB Processing

Soldering: Wave Soldering recommended. See Profile A in Supplement section.
Manual Soldering: See Profile A in Supplement section.
Cleaning: Automated alcohol based cleaning recommended, 5 minutes maximum. Do not use high-purity alcohol (50% alcohol or more) or organic solvent. High alcohol solution can damage clear plastic. See Cleaning specifications in Supplement section.

Standards & Certifications

The B Series illuminated toggles have not been tested for UL recognition or CSA certification.
These switches are designed for use in a low-voltage, low-current, logic-level circuit.
When used as intended in a logic-level circuit, the results do not produce hazardous energy.

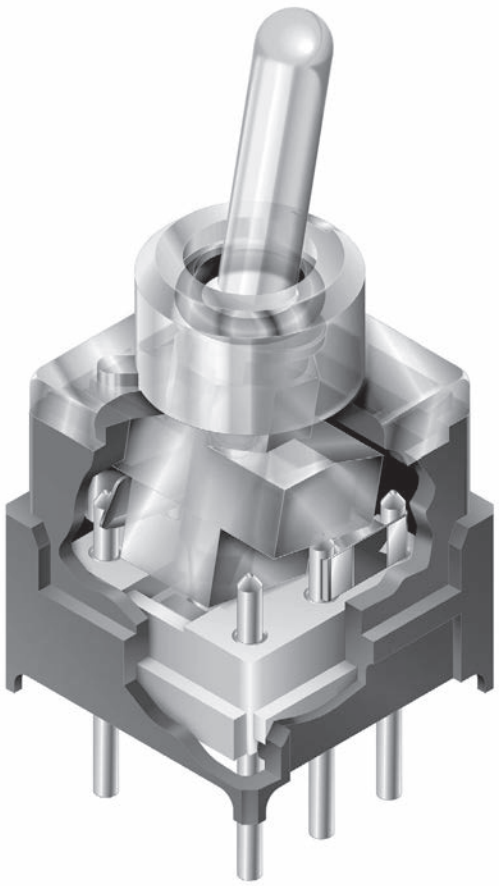
Distinctive Characteristics

LED provides maximum illumination to bushing and actuator, indicating actuator status in highly visible green, red, or amber for single color or red/green for bicolor.

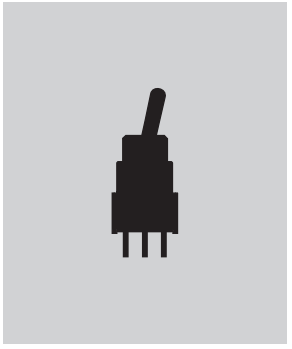
Totally sealed body construction prevents contact contamination and allows time- and money-saving automated soldering and cleaning. Molded-in, epoxy sealed terminals lock out flux and other contaminants.

Award-winning STC contact mechanism with benefits unavailable in conventional mechanisms: smoother, positive detent actuation, increased contact stability, and unparalleled logic-level reliability. (Additional STC details in Terms & Acronyms; see Supplement section.)

.100" x .100" (2.54mm x 2.54mm) terminal spacing conforms to standard PC board grid spacing.



Actual Size



TYPICAL SWITCH ORDERING EXAMPLE

B	1	2	J	J	P	C
	Poles	Circuits	Actuator	Bushing	PC Terminals	LEDs

Poles

1	SPDT

Circuits

2	ON	NONE	ON

Combines with single color or bicolor LEDs

3	ON	OFF	ON

Combines with bicolor LED only

Actuator

J	Clear

Bushing

J	Clear

PC Terminals

P	Straight
H	Right Angle
V	Vertical

LEDs

Single Color	
C	Red
D	Amber
F	Green

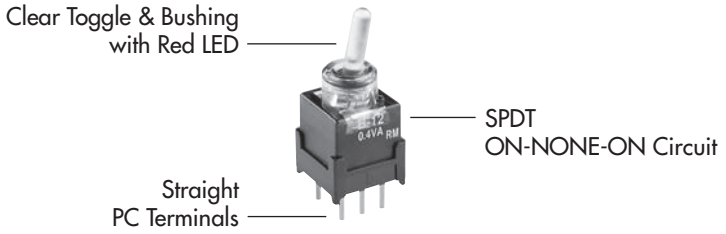
ON-NONE-ON only

Bicolor	
CF	Red/Green

ON-NONE-ON & ON-OFF-ON

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

B12JJPC



POLE & CIRCUITS

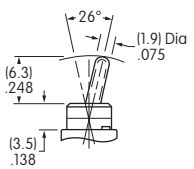
Pole Throw	Model	Toggle Position: Up	Toggle Position: Center	Toggle Position: Down	Connected Terminals: Up	Connected Terminals: Center	Connected Terminals: Down
SPDT	B12	ON	NONE	ON	2-3	NONE	2-1
	B13	ON	OFF	ON	2-3	OPEN	2-1

Note: Terminal numbers are not actually on the switch. LED circuit is isolated and requires an external power source.

Single Color Bicolor

ACTUATOR & BUSHING

J Clear Toggle



J Clear Bushing

LED COLORS & SPECIFICATIONS

LEDs are an integral part of the switch and not available separately. The electrical specifications shown are determined at a basic temperature of 25°C. If the source voltage exceeds the rated voltage, a ballast resistor is required.
The resistor value can be calculated by using the formula in the Supplement section.

		Single Color			Bicolor
	Colors	C Red	D Amber	F Green	CF Red/Green
Maximum Forward Current	I_{FM}	30mA	30mA	25mA	30mA/25mA
Typical Forward Current	I_F	20mA	20mA	20mA	20mA/20mA
Forward Voltage	V_F	1.95V	2.0V	3.3V	1.95V/3.3V
Maximum Reverse Voltage	V_{RM}	5V	5V	5V	5V/5V
Current Reduction Rate Above 25°C	ΔI_F	0.40mA/°C		0.33mA/°C	0.40mA/°C/0.33mA/°C
Ambient Temperature Range		–25°C ~ +55°C			

PC TERMINALS

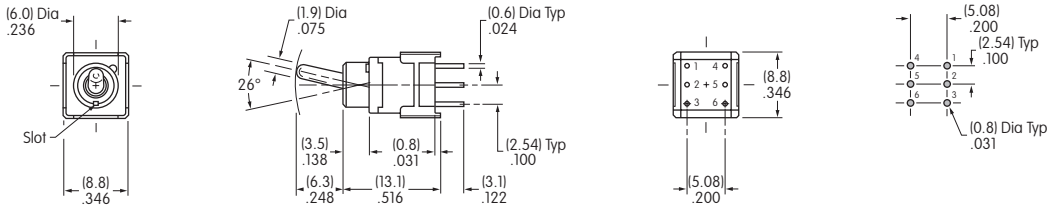
P Straight

H Right Angle with Bracket

V Vertical with Bracket

TYPICAL SWITCH DIMENSIONS

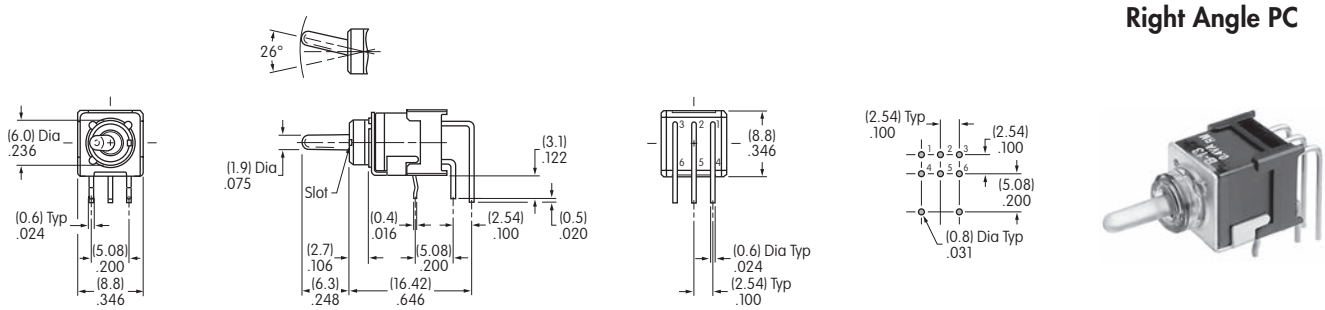
Straight PC



Terminal 4 is a support pin on single color models.

B12JJPC

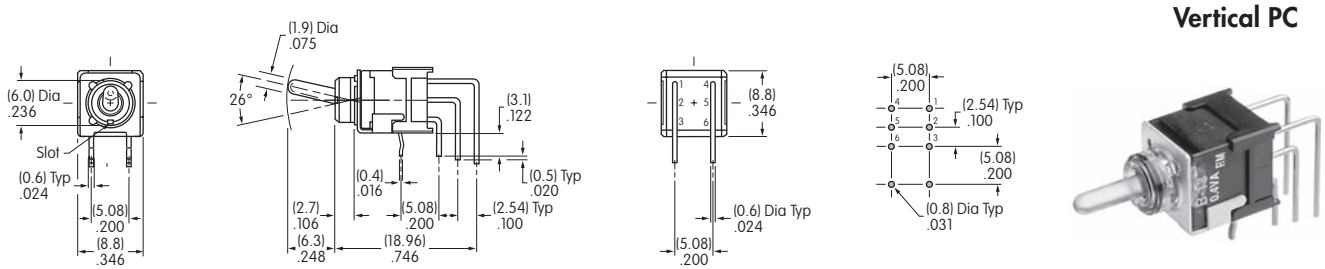
Right Angle PC



Terminal 4 is a support pin on single color models.

B13JJHCF

Vertical PC



Terminal 4 is a support pin on single color models.

B13JJVCF

General Specifications

Electrical Capacity (Resistive Load)

Logic Level: 0.4VA maximum @ 48V AC/DC maximum
(Applicable Range 0.1mA ~ 0.1A @ 20mV ~ 48V)
Note: Find additional explanation of operating range in Supplement section.

Other Ratings

Contact Resistance: 50 milliohms maximum
Insulation Resistance: 1,000 megohms minimum @ 500V DC
Dielectric Strength: 1,000V AC minimum between contacts for 1 minute minimum;
1,500V AC minimum between contacts & case for 1 minute minimum
Mechanical Life: 100,000 operations minimum for bat lever models
50,000 operations minimum for locking lever models
Electrical Life: 50,000 operations minimum
Contact Timing: Nonshorting (break-before-make)
Angle of Throw: 24°

Materials & Finishes

Toggle/Lever: Brass with chrome plating
Bushing: Brass with nickel plating
Support Bracket: Straight PC: phosphor bronze with tin plating; right angle & vertical: brass with tin plating
Housing: Polybutylene terephthalate (PBT) (UL94V-0)
Base: 1- and 2-pole GFR polyamide (UL94V-0); 4-pole liquid crystal polymer (LCP) (UL94V-0)
Movable Contacts: Phosphor bronze with gold plating
Stationary Contacts: Brass with gold plating
Terminals: Brass with gold plating

Environmental Data

Operating Temp Range: –10°C through +70°C (+14°F through +158°F)
Humidity: 90 ~ 95% humidity for 240 hours @ 40°C (104°F)
Vibration: 10 ~ 55Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in 1 minute; 3 right angled directions for 2 hours
Shock: 50G (490m/s^2) acceleration (tested in 6 right angled directions, with 5 shocks in each direction)

PCB Processing

Soldering: Wave Soldering recommended. See Profile A in Supplement section.
Manual Soldering: 1- & 2-pole: 3 seconds maximum @ 350°C maximum;
4-pole: 4 seconds maximum @ 410°C maximum
Cleaning: Hand clean locally using alcohol based solution.
See Cleaning specifications in Supplement section.

Standards & Certifications

Flammability Standards: UL94V-0 rated housing & base
The D2 Series toggles have not been tested for UL recognition or CSA certification.
These switches are designed for use in a low-current, logic level circuit.
When used as intended in a logic level circuit, the results do not produce hazardous energy.

Distinctive Characteristics

Base of heat resistant resin meets UL94V-0 flammability rating.

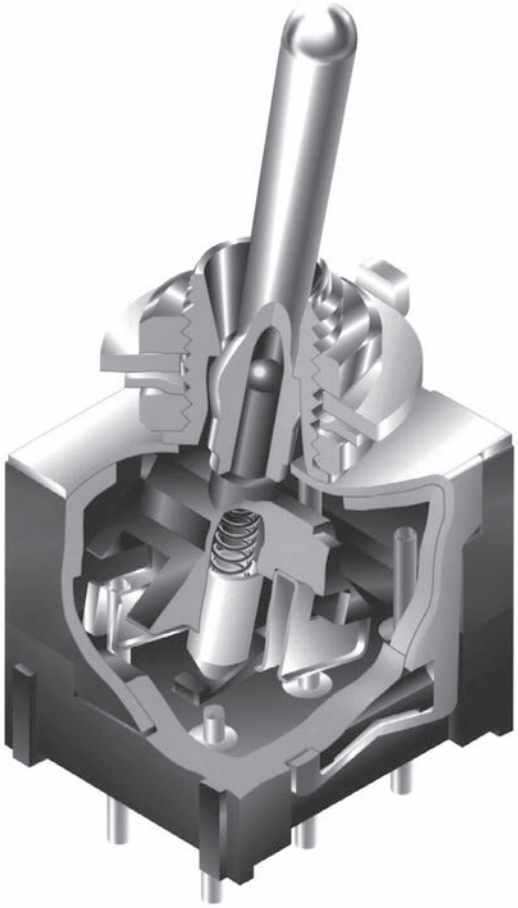
Maximized voltage capability of 48V allows use in medium source applications and increases operating life.

Award-winning STC contact mechanism with benefits unavailable in conventional mechanisms: smoother positive detent actuation, increased contact stability, and unparalleled reliability. (Additional STC details under Terms and Acronyms in the Supplement section.)

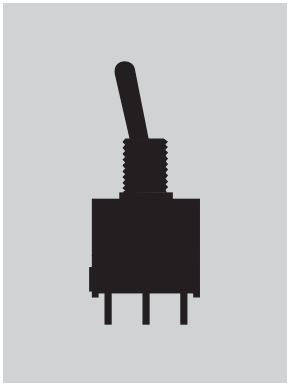
Round .031" (0.8mm) diameter PC terminals for easy PCB assembly.

Terminal spacing conforms to standard .100" (2.54mm) PC board grid spacing.

Molded-in terminals prevent entry of flux, solvents, and other contaminants.



Actual Size



TYPICAL SWITCH ORDERING EXAMPLE

D220 [1] [2] [ ] [P]

Poles

1	SPDT
2	DPDT
*4	4PDT

* Combines with ON-NONE-ON circuit only & not available with Right Angle

Actuators

No Code	.413″ (10.5mm) Bat Lever
L	.200″ (5.1mm) Diameter Locking Lever

Circuits

2	ON	NONE	ON
3	ON	OFF	ON
5	ON	NONE	(ON)
8	(ON)	OFF	(ON)
9	ON	OFF	(ON)

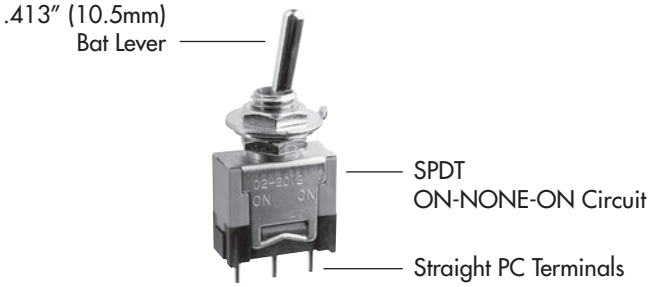
( ) = Momentary

PC Terminals

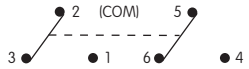
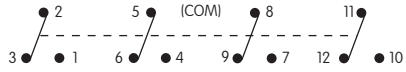
P	Straight
B	Straight with Bracket
H	Right Angle w/Bracket
V	Vertical with Bracket

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

D22012P



POLES & CIRCUITS

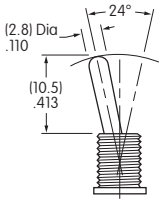
Pole	Model	Toggle Position ( ) = Momentary: Down (Keyway)	Center	Up	Connected Terminals: Down (Keyway)	Center	Up	Throw & Schematics
SP	**D22012** **D22013** **D22015** **D22018** **D22019**	ON ON ON (ON) ON	NONE OFF NONE OFF OFF	ON ON (ON) (ON) (ON)	2-3	OPEN	2-1	SPDT
DP	**D22022** **D22023** **D22025** **D22028** **D22029**	ON ON ON (ON) ON	NONE OFF NONE OFF OFF	ON ON (ON) (ON) (ON)	2-3 5-6	OPEN	2-1 5-4	DPDT 
4P	**D22042**	ON	NONE	ON	2-3 5-6 8-9 11-12	OPEN	2-1 5-4 8-7 11-10	4PDT 

Note: Terminal numbers are not actually on the switch.

ACTUATORS

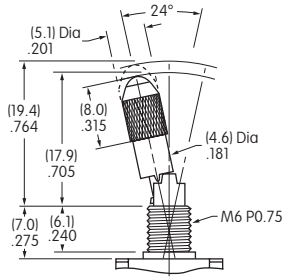
No Code **.413" (10.5mm) Bat Lever**

Material:
Chrome over brass



L **.413" (5.1mm) Diameter Locking Lever**

Material:
Chrome over brass

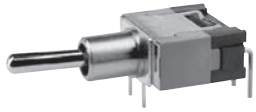


PC TERMINALS

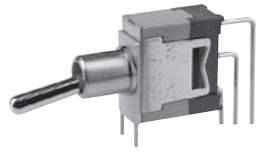
P **Straight**

B **Straight with Bracket**

H **Right Angle with Bracket**



V **Vertical with Bracket**

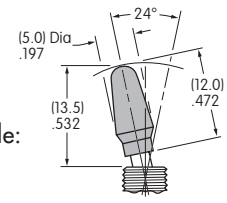


OPTIONAL CAPS & CAP COLORS

AT415
Bat Lever Cap

Material:
Polyethylene

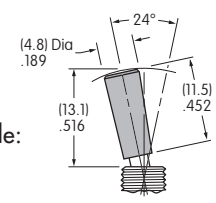
Colors Available:
A B C E F G



AT444 Bat Lever
Conical Cap

Material:
Polyethylene

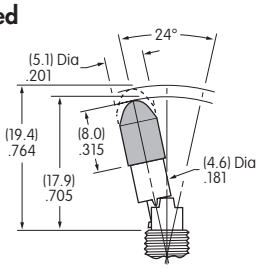
Colors Available:
A B C E F G



AT427 Cap Supplied with Locking Lever

Material:
Anodized
Aluminum

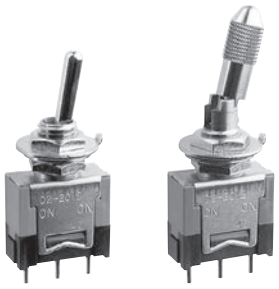
Colors Available:
A C G



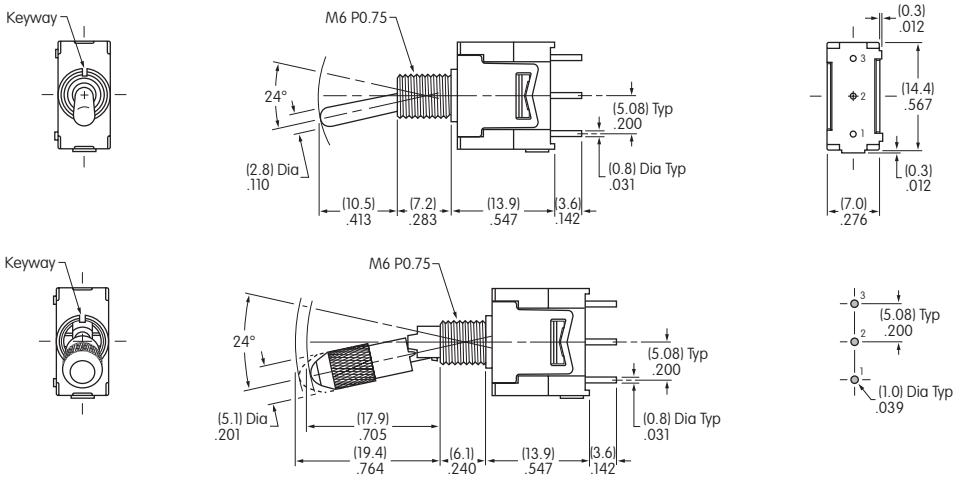
Colors Codes: **A** Black **B** White **C** Red **E** Yellow **F** Green **G** Blue

TYPICAL SWITCH DIMENSIONS

Straight PC • Single Pole



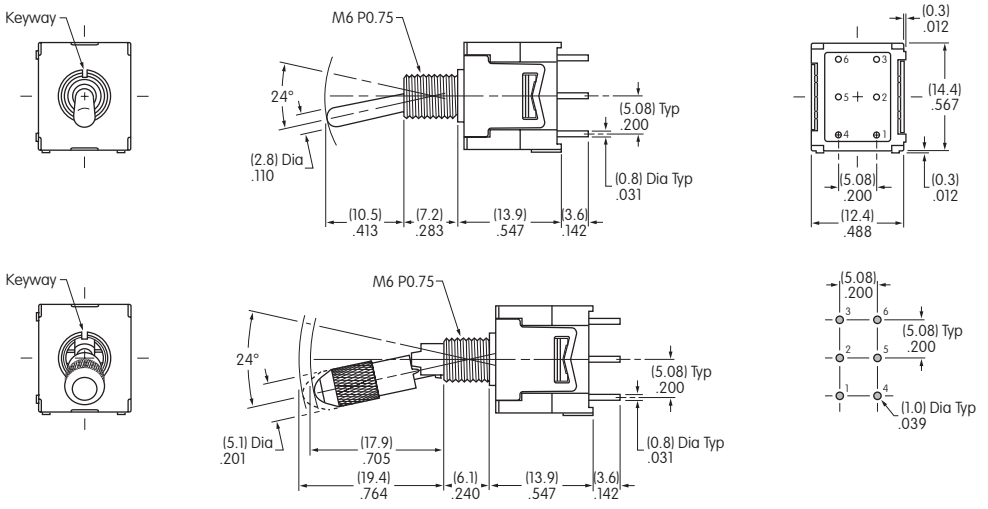
D22012P D22012LP



Actuator in Down Position

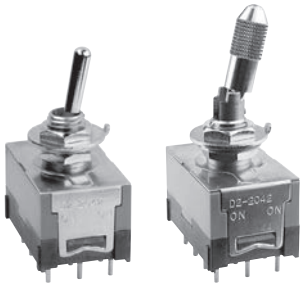
Straight PC • Double Pole

D22022P D22022LP

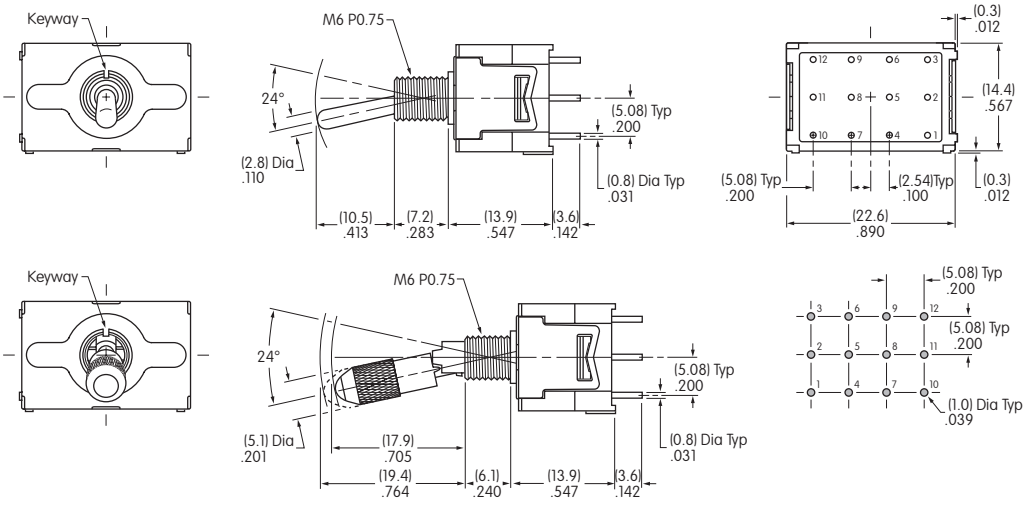


Actuator in Down Position

Straight PC • Four Pole

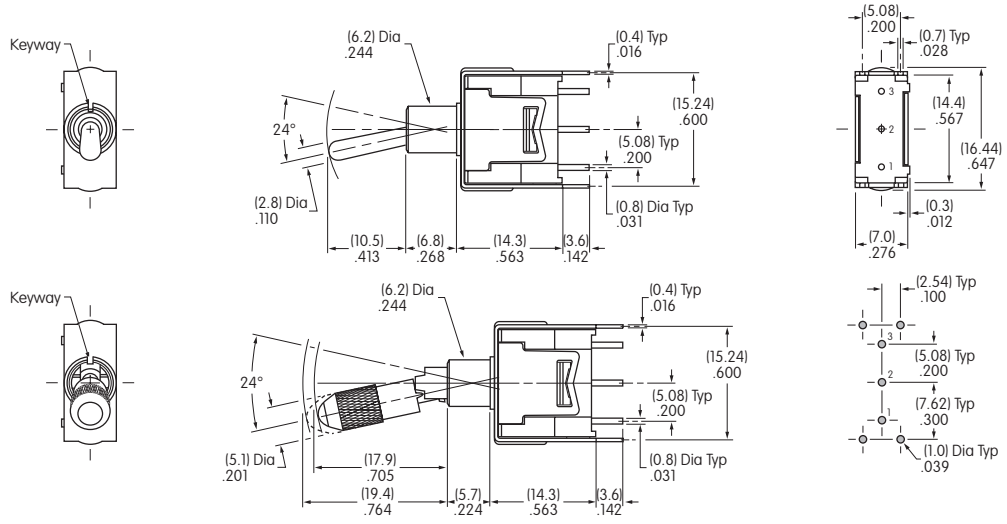


D22042P D22042LP



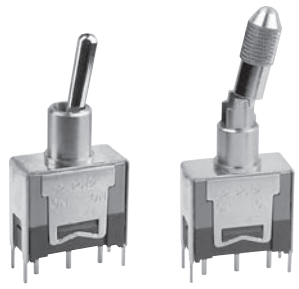
Actuator in Down Position

TYPICAL SWITCH DIMENSIONS

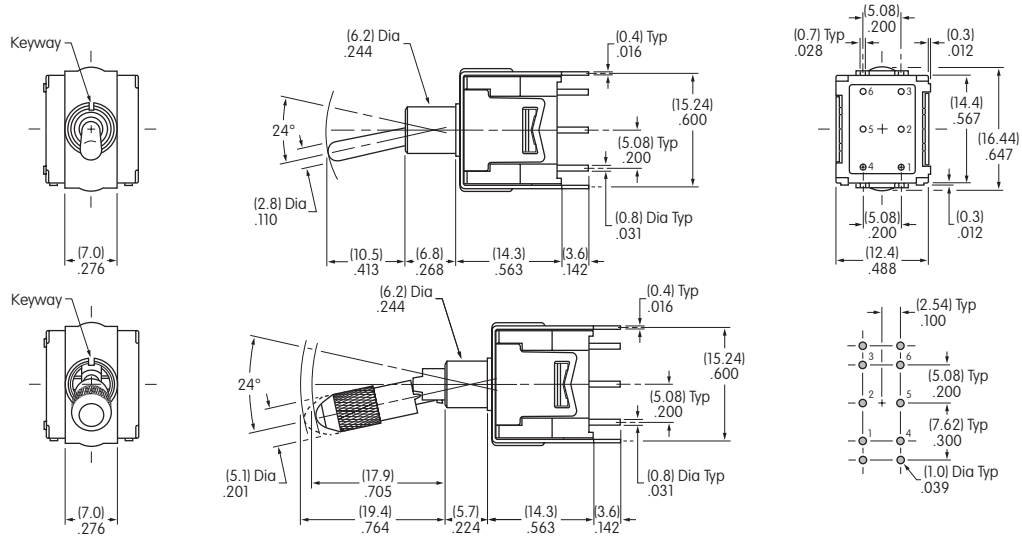


Actuator in Down Position

Straight PC • Bracket Single Pole

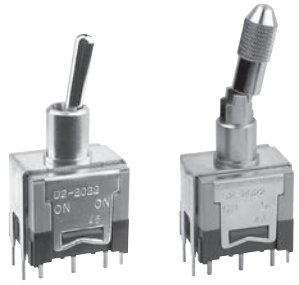


D22012B D22012LB

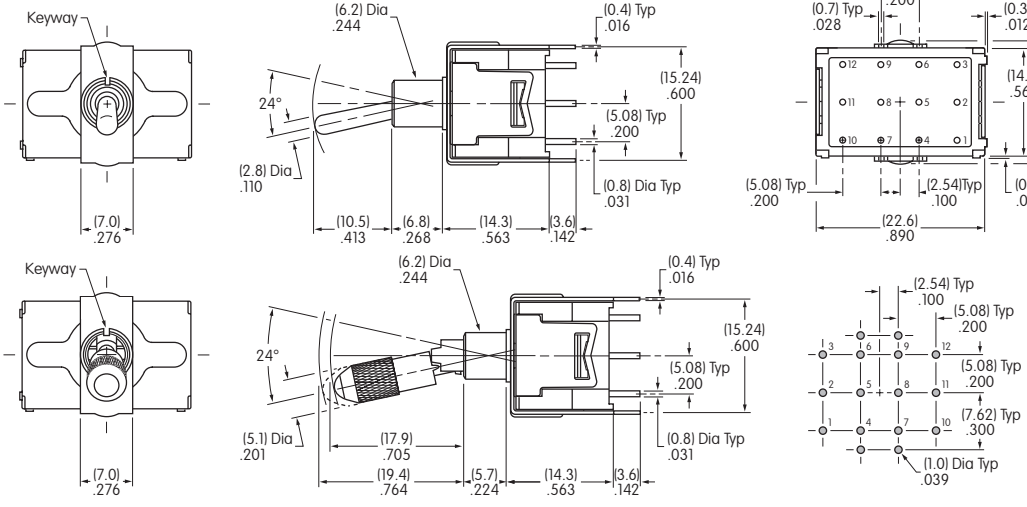


Actuator in Down Position

Straight PC • Bracket Double Pole

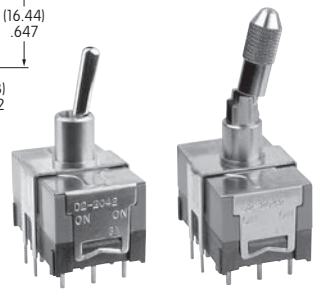


D22022B D22022LB



Actuator in Down Position

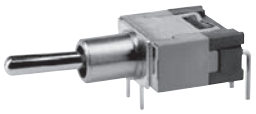
Straight PC • Bracket Four Pole

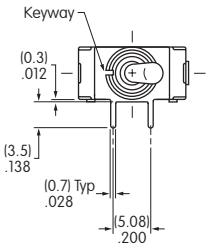


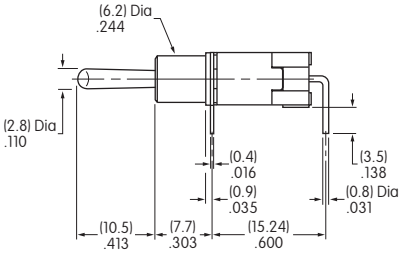
D22042B D22042LB

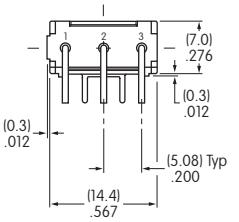
TYPICAL SWITCH DIMENSIONS

Right Angle PC • Single Pole

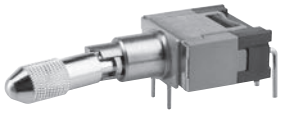


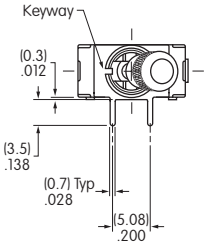


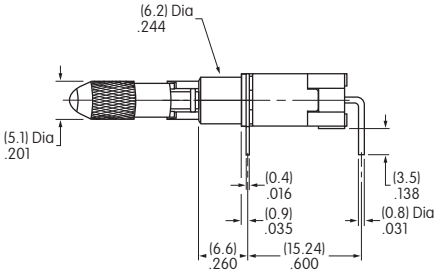


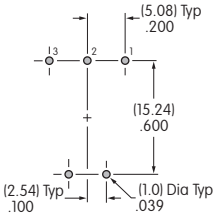


D22012H





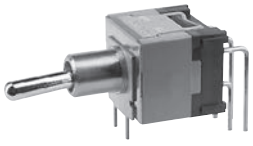


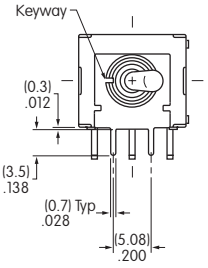


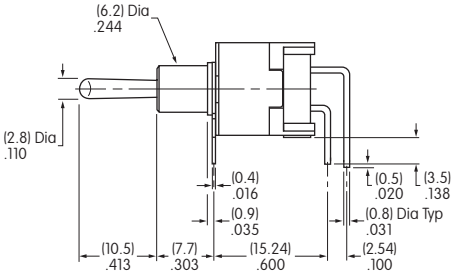
D22012LH

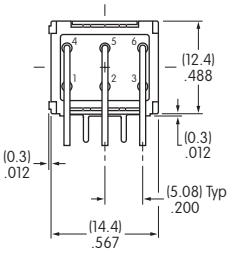
Actuator in Down Position

Right Angle PC • Double Pole

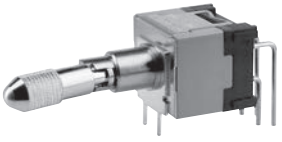


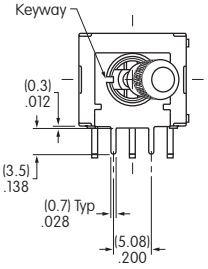


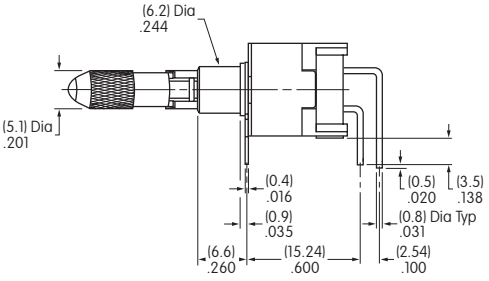


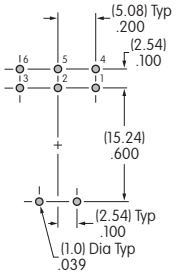


D22022H







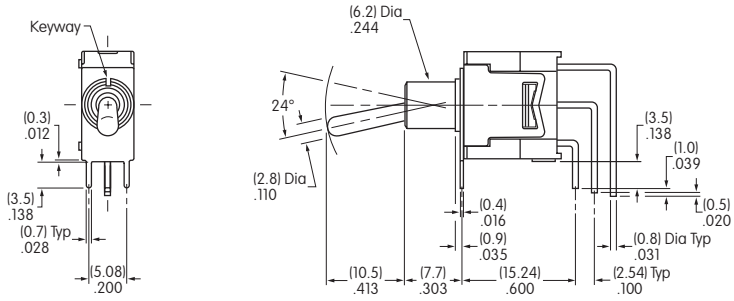


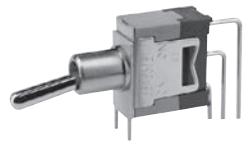
D22022LH

Actuator in Down Position

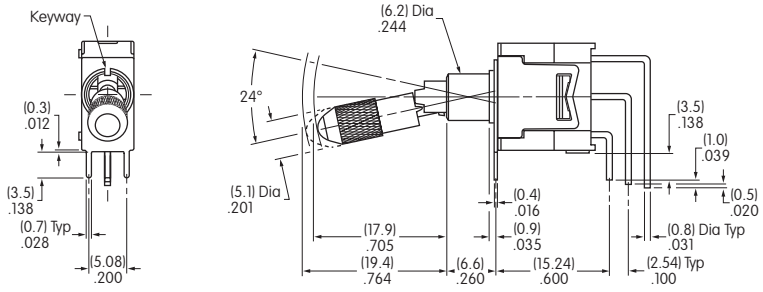
TYPICAL SWITCH DIMENSIONS

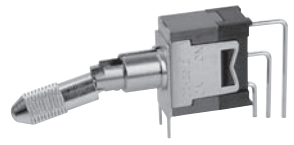
Vertical PC • Single Pole





D22012V

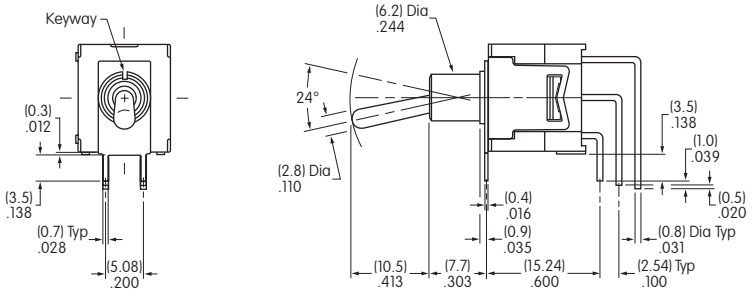


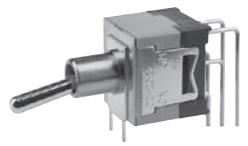


Actuator in Down Position

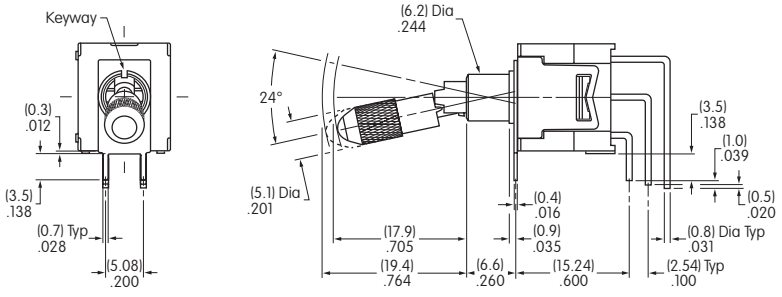
D22012LV

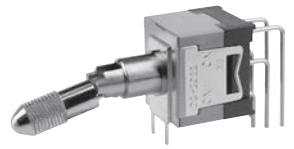
Vertical PC • Double Pole





D22022V



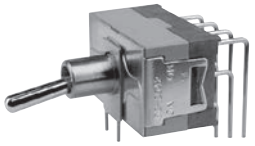


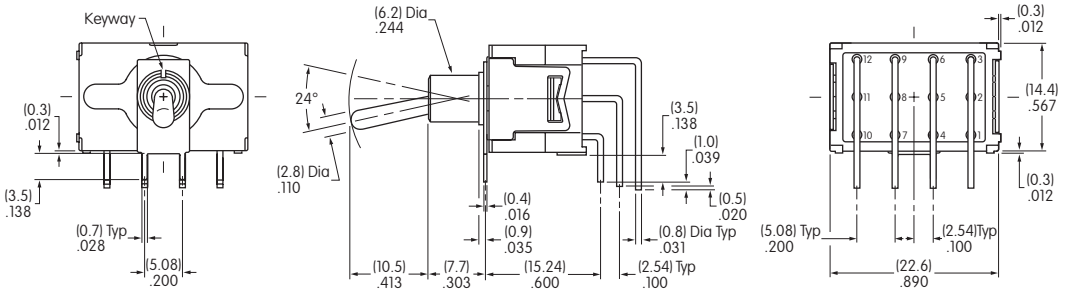
Actuator in Down Position

D22022LV

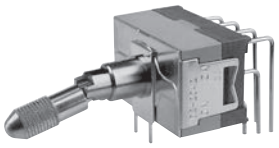
TYPICAL SWITCH DIMENSIONS

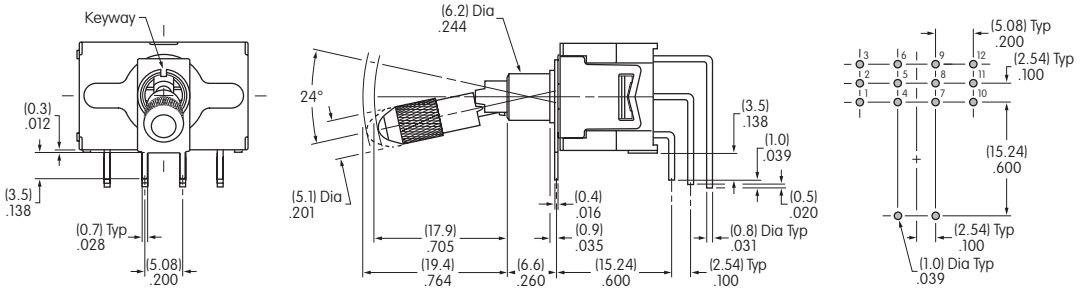
Vertical PC • Four Pole





D22042V



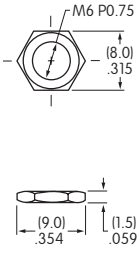


D22042LV

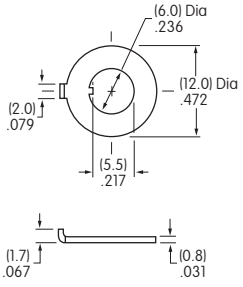
Actuator in Down Position

STANDARD HARDWARE

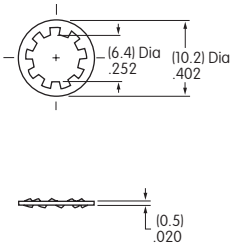
AT513M
Hex Nut
Brass with nickel plating
2 supplied



AT507M
Locking Ring
Steel with zinc/chromate
1 supplied

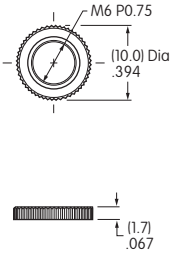


AT509
Lockwasher
Steel with zinc/chromate
1 supplied



OPTIONAL

AT501M
Knurled Face Nut
Brass with chrome plating

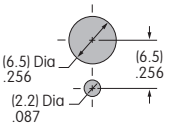


PANEL CUTOUTS & MAXIMUM PANEL THICKNESS

With Standard Hardware

.087" (2.2mm) for Standard Lever

.051" (1.3mm) for Locking Lever



Without Bottom Hex Nut

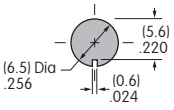
.154" (3.9mm) for Standard Lever

.110" (2.8mm) for Locking Lever

Without Locking Ring

.118" (3.0mm) for Standard Lever

.083" (2.1mm) for Locking Lever



Without Locking Ring & Bottom Hex Nut

.185" (4.7mm) for Standard Lever

.142" (3.6mm) for Locking Lever

General Specifications

Electrical Capacity (Resistive Load)

Logic Level: 0.4VA maximum @ 28V AC/DC maximum
(Applicable Range 0.1mA ~ 0.1A @ 20mV ~ 28V)
Note: Find additional explanation of operating range in Supplement section.

Other Ratings

Contact Resistance: 80 milliohms maximum
Insulation Resistance: 500 megohms minimum @ 500V DC
Dielectric Strength: 500V AC minimum for 1 minute minimum
Mechanical Life: 100,000 operations minimum for On-None-On & On-Off-On
50,000 operations minimum for other circuits
Electrical Life: 100,000 operations minimum for On-None-On & On-Off-On
50,000 operations minimum for other circuits
Nominal Operating Force: 0.93N for momentary & 1.20N for maintained
Angle of Throw: 28°

Materials & Finishes

Actuator: Glass fiber reinforced polyamide
Case: Glass fiber reinforced polyamide
Sealing Rings: Nitrile butadiene rubber
Movable Contacts: Phosphor bronze with gold plating
Stationary Contacts: Phosphor bronze with gold plating
Base: Glass fiber reinforced polyamide
Terminals: Phosphor bronze with gold plating
Support Bracket: Phosphor bronze with tin plating

Environmental Data

Operating Temperature Range: –25°C through +85°C (–13°F through +185°F)
Humidity: 90 ~ 95% humidity for 96 hours @ 40°C (104°F)
Vibration: 10 ~ 55Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in 1 minute; 3 right angled directions for 2 hours
Shock: 50G (490m/s^2) acceleration (tested in 6 right angled directions, with 5 shocks in each direction)

PCB Processing

Soldering: Wave Soldering recommended: See Profile A in Supplement section.
Manual Soldering: See Profile A in Supplement section.
Cleaning: Automated cleaning. See Cleaning specifications in Supplement section.

Standards & Certifications

The G Series toggles have not been tested for UL recognition or CSA certification.
These switches are designed for use in a low-voltage, low-current, logic-level circuit.
When used as intended in a logic-level circuit, the results do not produce hazardous energy.

Distinctive Characteristics

Ultra-miniature size allows high density mounting, and extremely light weight of 0.25 gram makes these switches ideal for handheld equipment.

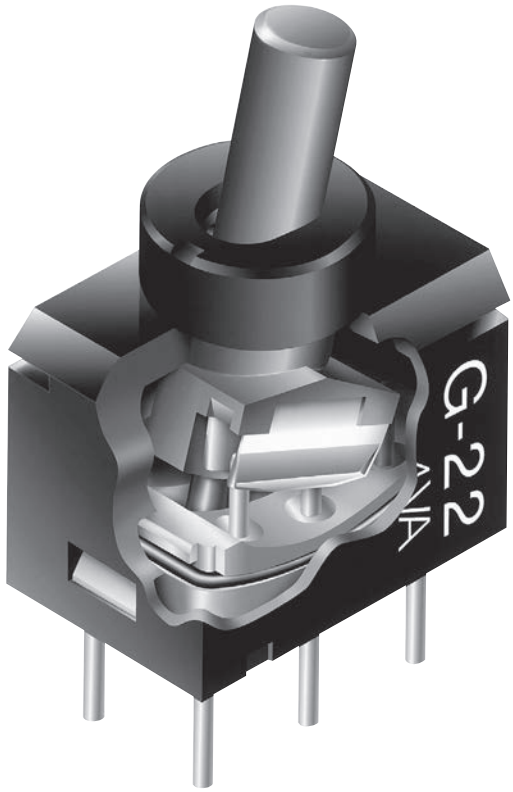
Totally sealed body construction prevents contact contamination and allows time- and money-saving automated soldering and cleaning.

Molded-in, epoxy sealed terminals lock out flux, solvents, and other contaminants.

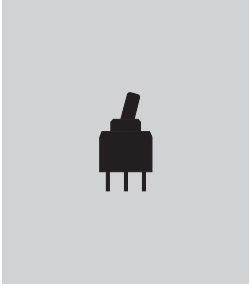
Award-winning STC contact mechanism with benefits unavailable in conventional mechanisms: smooth, positive detent actuation, increased contact stability, and unparalleled logic-level reliability. (Additional STC details in Terms & Acronyms; see Supplement section.)

.100" x .100" (2.54mm x 2.54mm) terminal spacing conforms to standard PC board grid spacing. Round terminals facilitate easier through-hole mounting on PC boards.

Matching indicators available.



Actual Size



TYPICAL SWITCH ORDERING EXAMPLE

G **1** **3** **A** **H**

Poles	
1	SPDT
2	DPDT

Circuits			
2	ON	NONE	ON
3	ON	OFF	ON
5	ON	NONE	(ON)
8	(ON)	OFF	(ON)
9	ON	OFF	(ON)

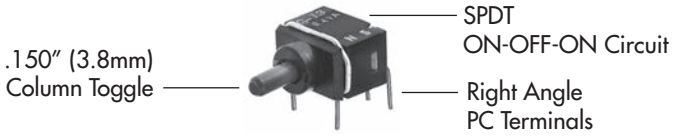
( ) = Momentary

Actuator	
A	.150" (3.8mm) Column Toggle

PC Terminals	
P	Straight
H	Right Angle
V	Vertical

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

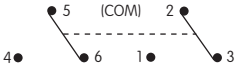
G13AH



POLES & CIRCUITS

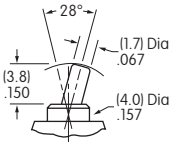
		Toggle Position ( ) = Momentary			Connected Terminals			Throw & Schematics
Pole	Model	Up	Center	Down	Up	Center	Down	
SP	G12 G13 G15 G18 G19	ON ON ON (ON) ON	NONE OFF NONE OFF OFF	ON ON (ON) (ON) (ON)	5-6	OPEN	5-4	SPDT
DP	G22 G23 G25 G28 G29	ON ON ON (ON) ON	NONE OFF NONE OFF OFF	ON ON (ON) (ON) (ON)	5-6 2-3	OPEN	5-4 2-1	DPDT

Note: Terminal numbers are not actually on the switch.



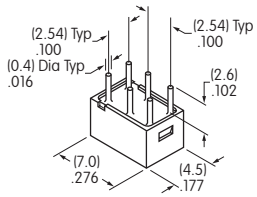
ACTUATOR

A **.150" (3.8mm) Column Toggle**

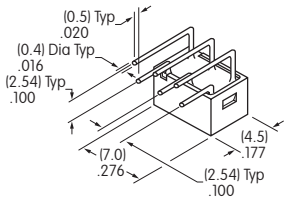


PC TERMINALS

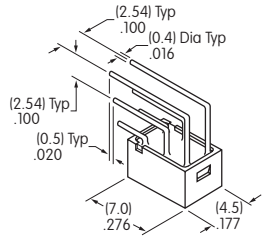
P Straight



H Right Angle

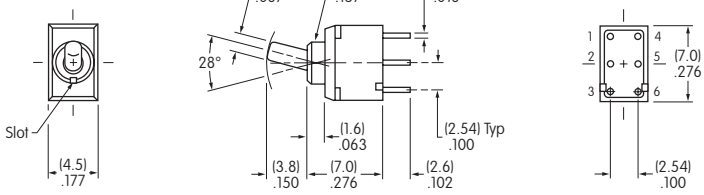


V Vertical

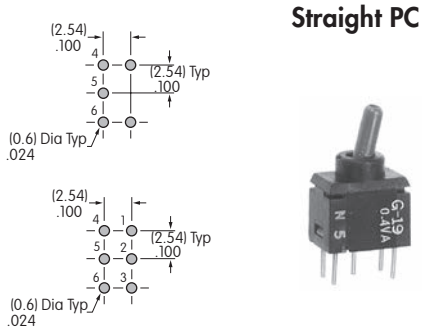


TYPICAL SWITCH DIMENSIONS

Single & Double Pole



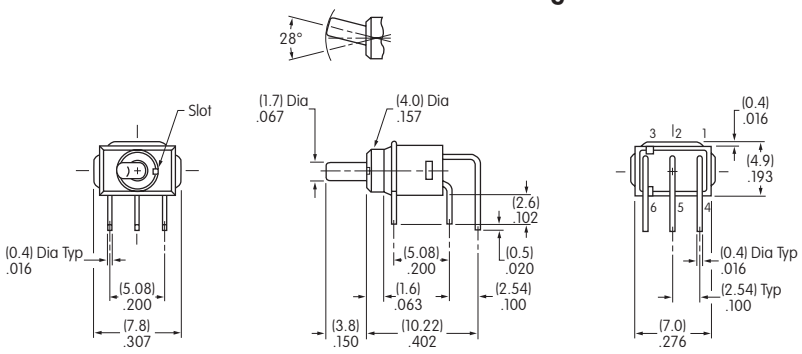
Straight PC



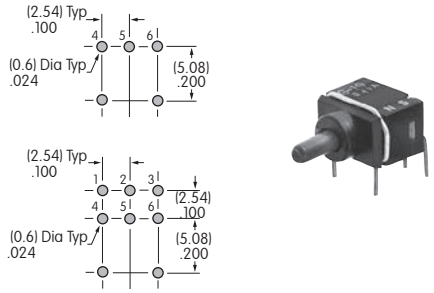
On single pole models, locations 1 & 3 are for support pins.

G19AP

Single & Double Pole

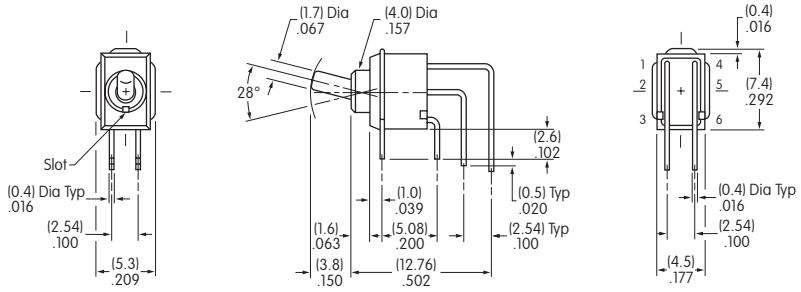


Right Angle PC

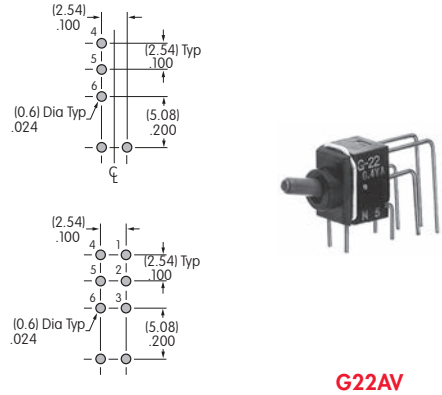


G19AH

Single & Double Pole



Vertical PC



G22AV

General Specifications

Electrical Capacity (Resistive Load)

Logic Level: 0.4VA maximum @ 28V AC/DC maximum
(Applicable Range 0.1mA ~ 0.1A @ 20mV ~ 28V)
Note: Find additional explanation of operating range in Supplement section.

Other Ratings

Contact Resistance: 80 milliohms maximum
Insulation Resistance: 500 megohms minimum @ 500V DC
Dielectric Strength: 500V AC minimum for 1 minute minimum
Mechanical Life: 100,000 operations minimum
Electrical Life: 100,000 operations minimum
10,000 operations minimum @ 0.1A @ 28V AC/DC
Nominal Operating Force: 1.30N
Angle of Throw: 28°

Materials & Finishes

Actuator: Polyamide
Case: Glass fiber reinforced polyamide
Sealing Rings: Nitrile butadiene rubber
Movable Contacts: Phosphor bronze with gold plating
Stationary Contacts: Phosphor bronze with gold plating
Base: Glass fiber reinforced polyamide
Power Terminals: Phosphor bronze with gold plating
Lamp Terminals: Phosphor bronze with gold plating

Environmental Data

Operating Temperature Range: –25°C through +55°C (–13°F through +131°F)
Humidity: 90 ~ 95% humidity for 240 hours @ 40°C (104°F)
Vibration: 10 ~ 500Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in 1 minute; 3 right angled directions for 2 hours
Shock: 50G (490m/s^2) acceleration (tested in 6 right angled directions, with 5 shocks in each direction)

PCB Processing

Soldering: Wave Soldering recommended. See Profile A in Supplement section.
Manual Soldering: See Profile A in Supplement section.
Cleaning: Automated cleaning. See Cleaning specifications in Supplement section.

Standards & Certifications

The G Series toggles have not been tested for UL recognition or CSA certification.
These switches are designed for use in a low-voltage, low-current, logic-level circuit.
When used as intended in a logic-level circuit, the results do not produce hazardous energy.

Distinctive Characteristics

Fully illuminated toggle for highly visible status indication with LED in red, green, or amber for single color and red/green for bicolor.

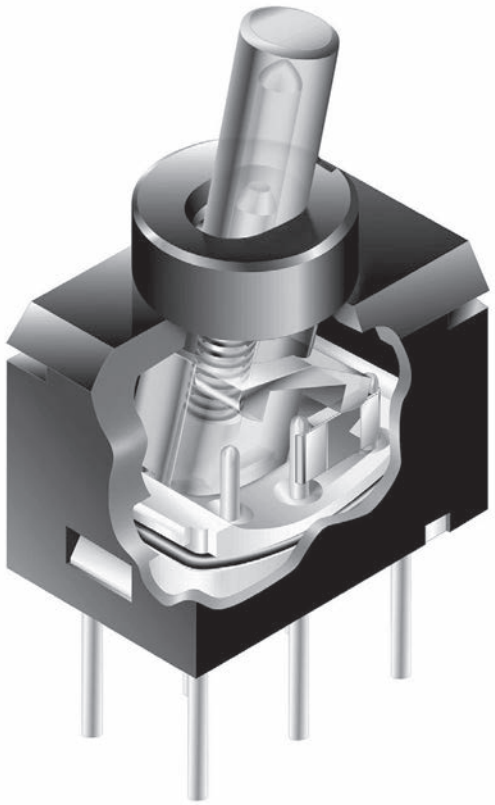
Ultra-miniature size allows high density mounting, and extremely light weight makes these switches ideal for handheld equipment.

Totally sealed body construction prevents contact contamination and allows time- and money-saving automated soldering and cleaning.

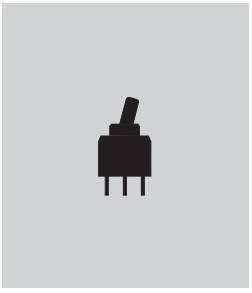
Molded-in, epoxy sealed terminals lock out flux, solvents, and other contaminants.

Award-winning STC contact mechanism with benefits unavailable in conventional mechanisms: smooth, positive detent actuation, increased contact stability, and unparalleled logic-level reliability. (Additional STC details in Terms & Acronyms; see Supplement section.)

.100" x .100" (2.54mm x 2.54mm) terminal spacing conforms to standard PC board grid spacing. Round terminals facilitate easier through-hole mounting on PC boards.



Actual Size



Series G

Fully Illuminated Ultra-Miniature Toggles

TYPICAL SWITCH ORDERING EXAMPLE

G | 1 | 2 | J | H | C

Pole	
1	SPDT

Circuits			
2	ON	NONE	ON
Combines with single color or bicolor LEDs			
3	ON	OFF	ON
Combines with bicolor LED only			

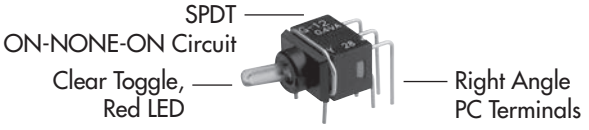
Actuator	
J	Clear

PC Terminals	
P	Straight
H	Right Angle
V	Vertical

LEDS	
Single Color	
C	Red
D	Amber
F	Green
ON-NONE-ON only	
Bicolor	
CF	Red/Green
ON-NONE-ON & ON-OFF-ON	

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

G12JHC



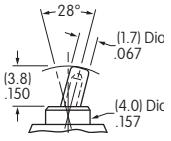
POLES & CIRCUITS

Pole Throw	Model	Toggle Position: Up	Center	Down	Connected Terminals: Up	Center	Down
SPDT	G12	ON	NONE	ON	2-3	NONE	2-1
	G13	ON	OFF	ON	2-3	OPEN	2-1

Note: Terminal numbers are not actually on the switch. LED circuit is isolated and requires an external power source.

ACTUATOR

J **Clear Toggle**



LED COLORS & SPECIFICATIONS

LEDs are an integral part of the switch and not available separately. The electrical specifications shown are determined at a basic temperature of 25°C.

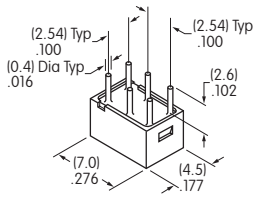
If the source voltage exceeds the rated voltage, a ballast resistor is required.

The resistor value can be calculated by using the formula in the Supplement; see Supplement Index.

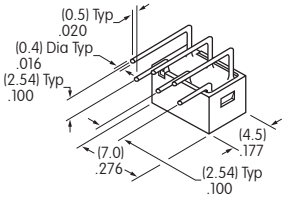
		Single Color			Bicolor
	Colors	C Red	D Amber	F Green	CF Red/Green
Maximum Forward Current	I_{FM}	30mA	30mA	25mA	30mA/25mA
Typical Forward Current	I_F	20mA	20mA	20mA	20mA/20mA
Forward Voltage	V_F	2.0V	2.0V	2.1V	2.0V/2.1V
Maximum Reverse Voltage	V_{RM}	5V	5V	5V	5V/5V
Current Reduction Rate Above 25°C	ΔI_F	0 - No current Reduction Rate within Ambient Temperature Range			
Ambient Temperature Range		−25° ~ +55°C			

PC TERMINALS

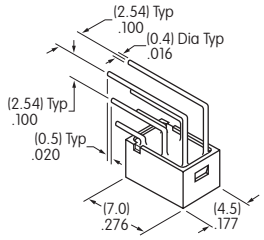
P Straight



H Right Angle

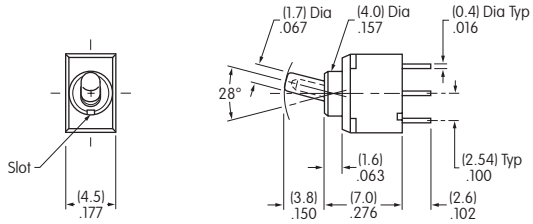


V Vertical



TYPICAL SWITCH DIMENSIONS

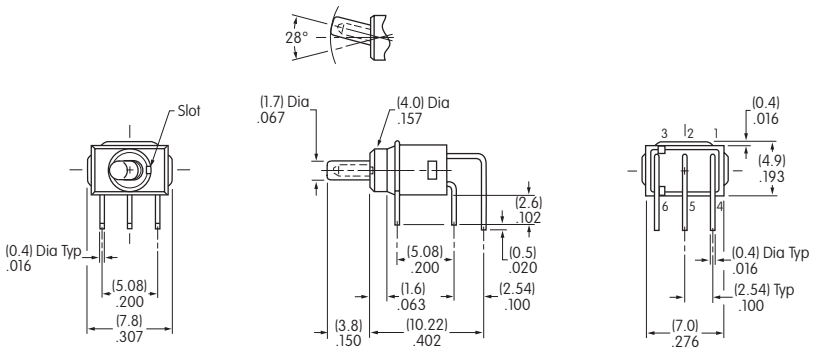
Straight PC

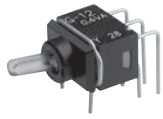


5 & 6 are LED terminals; 4 is a support pin on single color models & an LED terminal on bicolor models.

G12JPC

Right Angle PC

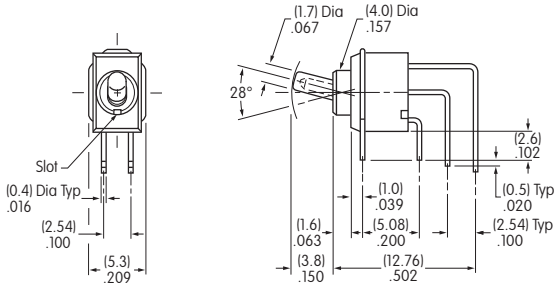


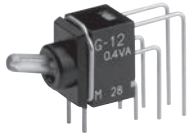


5 & 6 are LED terminals; 4 is a support pin on single color models & an LED terminal on bicolor models.

G12JHD

Vertical PC





5 & 6 are LED terminals; 4 is a support pin on single color models & an LED terminal on bicolor models.

G12JVCF

General Specifications

Electrical Capacity (Resistive Load)

Logic Level: 0.4VA maximum @ 28V AC/DC maximum
(Applicable Range 0.1mA ~ 0.1A @ 20mV ~ 28V)
Note: See Supplement section for explanation of operating range.

Other Ratings

Contact Resistance: 80 milliohms maximum
Insulation Resistance: 500 megohms minimum @ 500V DC
Dielectric Strength: 500V AC minimum for 1 minute minimum
Mechanical Life: 50,000 operations minimum
Electrical Life: 50,000 operations minimum
Nominal Operating Force: 1.6N for momentary & 1.7N for maintained
Angle of Throw: 28°

Materials & Finishes

Actuator: Polyphenylene sulfide (UL94V-0)
Case: Polyphenylene sulfide (UL94V-0)
Sealing Rings: Nitrile butadiene rubber
Movable Contacts: Phosphor bronze with gold plating
Stationary Contacts: Phosphor bronze with gold plating
Base: Polyphenylene sulfide (UL94V-0)
Terminals: Phosphor bronze with gold plating

Environmental Data

Operating Temperature Range: –30°C through +85°C (–22°F through +185°F)
Humidity: 90 ~ 95% humidity for 96 hours @ 40°C (104°F)
Vibration: 10 ~ 500Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in 1 minute; 3 right angled directions for 2 hours
Shock: 50G (490m/s^2) acceleration (tested in 6 right angled directions, with 5 shocks in each direction)

Installation

Mounting: It is recommended that the body of models for upright mounting without bracket be fastened to a panel or similar support for protection of solder joints from mechanical stress.
Coplanarity: See specifications in Terms & Acronyms in Supplement section

Processing

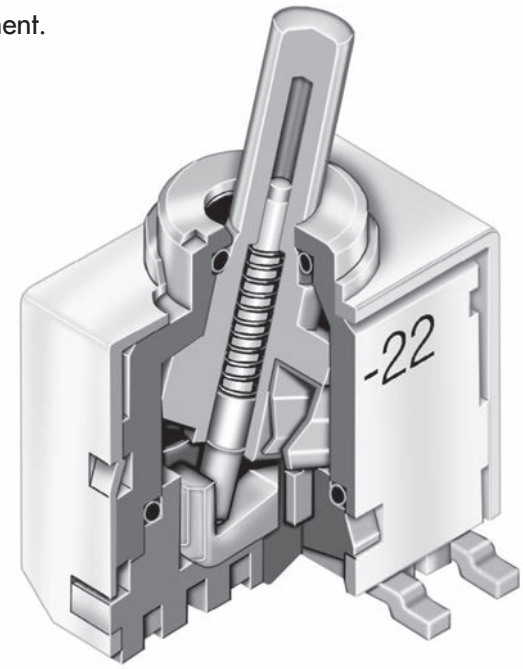
Soldering: Reflow Soldering recommended. See Profile B in Supplement section.
Manual Soldering: See Profile B in Supplement section.
Cleaning: Automated cleaning. See Cleaning specifications in Supplement section.

Standards & Certifications

Flammability Standard: UL94V-0 actuator, case & base
The G3T Series toggles have not been tested for UL recognition or CSA certification.
These switches are designed for use in a low-voltage, low-current, logic-level circuit.
When used as intended in a logic-level circuit, the results do not produce hazardous energy.

Distinctive Characteristics

Ultra-miniature size allows high density mounting, and extremely light weight of 0.6 gram makes these switches ideal for handheld equipment.



Tape-reel and stick-tube packaging allow rapid automated placement of surface mount devices. Tape-reel packaging meets EIA-481-D Standard.

Heat resistant resin used for housing, base, and lever allows vapor phase and infrared convection reflow soldering.

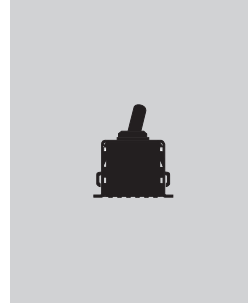
Combination of design features achieves total seal and allows automated processing techniques, including flux cleaning procedures: one-piece bushing and housing, rubber seals surrounding actuator and base, epoxy at joint of case and base, and molded-in, epoxy-sealed terminals.

Award-winning STC contact mechanism with benefits unavailable in conventional mechanisms: smoother, positive detent actuation, increased contact stability and unparalleled logic-level reliability. (Additional STC details in Terms & Acronyms; see Supplement section.)

Gull-wing terminals provide mechanical stability during soldering and simplified solder joint inspection.

Coplanarity: all considered surfaces must lie between two parallel planes that are a maximum distance apart of .0059" (0.15mm). (Additional coplanarity details in Terms and Acronyms in the Supplement section.)

Actual Size



Series G3T

Process Sealed Ultra-Miniature SMT Toggles

TYPICAL SWITCH ORDERING EXAMPLE

G3T [1] [2] [A] [H] — [ ]

Poles

1	SPDT
2	DPDT

Actuator

A	.150" (3.8mm) Column Toggle

Packaging

R	Tape-Reel for Right Angle Only 500 Pieces/Reel
S	Stick-Tube for Upright Mount 50 Pieces/Stick
No Code	Partitioned Tray for Upright & Right Angle Any Quantity

Packaging details at end of G3T Series

Circuits

2	ON	NONE	ON
3	ON	OFF	ON
5	ON	NONE	(ON)
8	(ON)	OFF	(ON)
9	ON	OFF	(ON)

( ) = Momentary

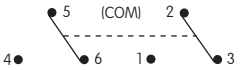
Terminals

P	Gull Wing for Upright Mount
B	Gull Wing for Upright with Bracket Mount
H	Gull Wing for Right Angle Mount

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

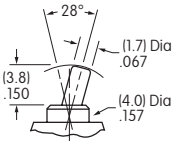
G3T12AH

POLES & CIRCUITS

		Toggle Position ( ) = Momentary			Connected Terminals			Throw & Schematics
Pole	Model	Up	Center	Down	Up	Center	Down	Note: Terminal numbers are not actually on switch.
SP	G3T12 G3T13 G3T15 G3T18 G3T19	ON ON ON (ON) ON	NONE OFF NONE OFF OFF	ON ON (ON) (ON) (ON)	5-6	OPEN	5-4	SPDT
DP	G3T22 G3T23 G3T25 G3T28 G3T29	ON ON ON (ON) ON	NONE OFF NONE OFF OFF	ON ON (ON) (ON) (ON)	5-6 2-3	OPEN	5-4 2-1	DPDT 

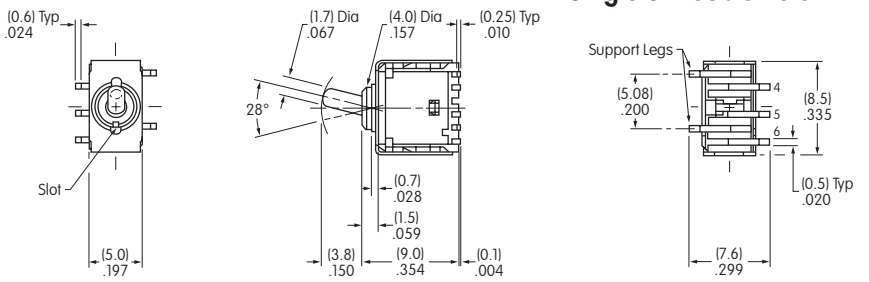
ACTUATOR

A .150" (3.8mm) Column Toggle



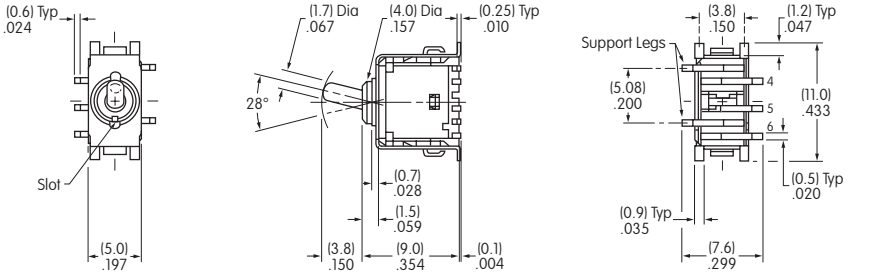
TYPICAL SWITCH DIMENSIONS

Single & Double Pole — Upright Mounting



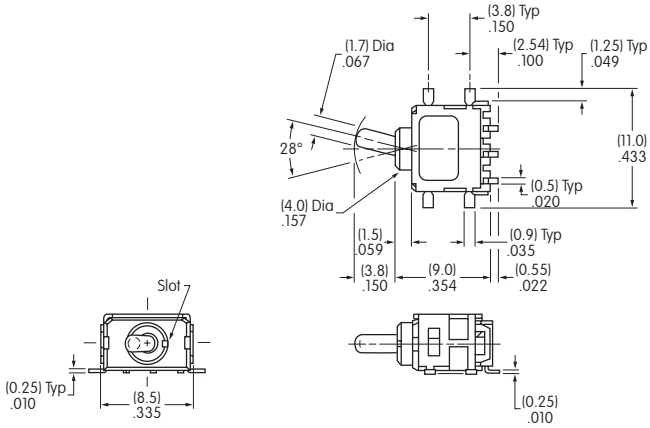
G3T12AP

Single & Double Pole — Upright Mounting with Bracket

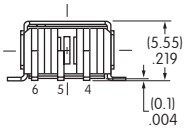


G3T22AB

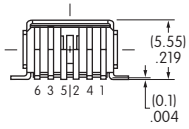
Right Angle Mounting



Single Pole



Double Pole

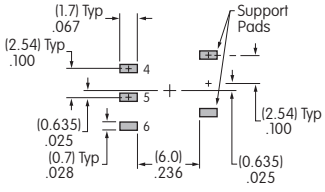


G3T12AH

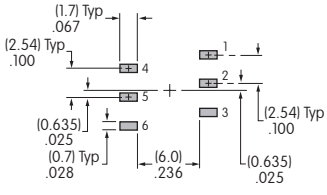
Pad Layouts for Surface Mount Terminals

Upright Mounting

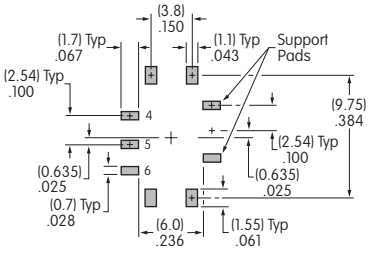
Single Pole Double Throw

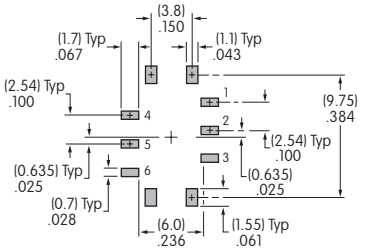


Double Pole Double Throw

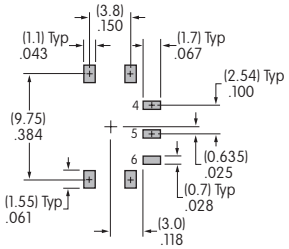


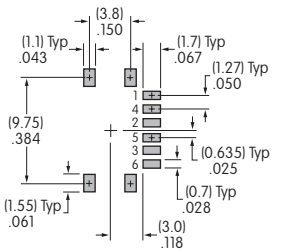
Upright Mounting with Bracket





Right Angle Mounting





PACKAGING

R **Tape-Reel for Right Angle**

500 pieces per reel

Switches must be ordered in 500-piece increments when tape-reel packaging is selected.

This packaging meets EIA-481-D Standard for "16mm and 24mm Embossed Carrier Taping of Surface Mount Components for Automatic Handling."

S **Stick-Tube for Upright Mount**

50 pieces per stick

Switches must be ordered in 50-piece increments when stick-tube packaging is selected.

No Code **Partitioned Tray for Upright & Right Angle**

Any quantity

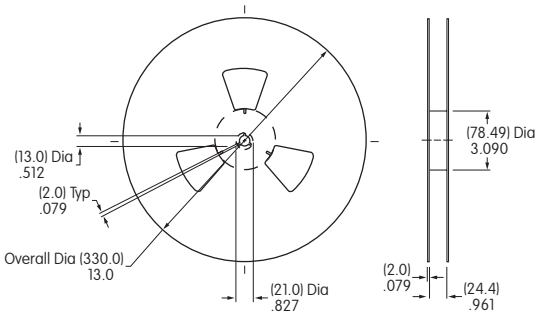
If the G3 upright models are ordered in less than 50-piece increments or the right angle models in less than 500-piece increments, the switches are packaged in a partitioned tray. No code is required.

PACKAGING (CONTINUED)

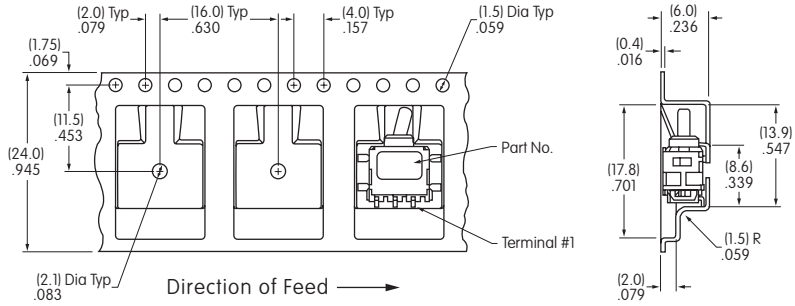
Tape-Reel Packaging for Right Angle Mount

Each tape-reel of 550 pockets contains 500 switches.

Minimum Leader Length: 7.87" (200mm) Minimum Trailer Length: 1.97" (50mm)



Reel Dimensions



Tape Dimensions

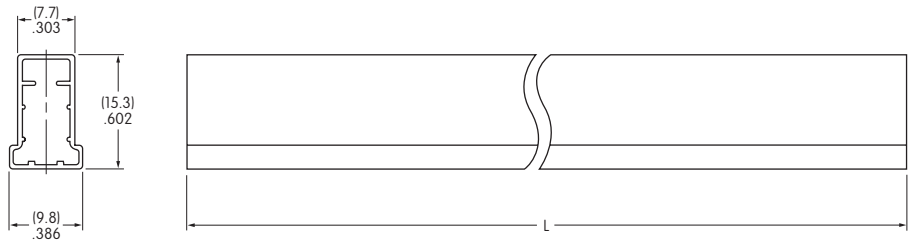
Stick-Tube Packaging for Upright Mount

Each stick-tube contains 50 switches.

L = Length

G3T Upright (code P)
18.31" (465mm)

G3T Upright with Bracket (code B)
21.26" (540mm)



Stick-Tube Dimensions

General Specifications

Electrical Capacity (Resistive Load)

Power Level (silver): 6A @ 125V AC & 3A @ 250V AC
4A @ 30V DC for On-None-On; 3A @ 30V DC for all other circuits

Logic Level (gold): 0.4VA maximum @ 28V AC/DC maximum (Applicable Range 0.1mA ~ 0.1A @ 20mV ~ 28V)

Other Ratings

Contact Resistance: 10 milliohms maximum for silver; 20 milliohms maximum for gold

Insulation Resistance: 1,000 megohms minimum @ 500V DC

Dielectric Strength: 1,000V AC minimum between contacts for 1 minute minimum;
1,500V AC minimum between contacts and case for 1 minute minimum

Mechanical Life: 50,000 operations minimum

Electrical Life: 50,000 operations minimum for silver at 3A @ 250V AC; 25,000 operations minimum for silver at 6A @ 125V AC; 50,000 operations minimum for gold

Angle of Throw: 25°

Environmental Data

Operating Temp Range: –30°C through +85°C (–22°F through +185°F)

Sealing: Waterproofing, achieved with boot at base of lever plus o-rings inside and outside of bushing, meets IP67 of IEC60529 Standards (dust tight and protection against effects of temporary immersion). See further explanation on page A51.

Processing

Soldering: Manual Soldering for SIlver: ON-NONE-ON: See Profile B in Supplement section.
ON-OFF-ON and (ON)-OFF-(ON): See Profile A in Supplement section.
Manual Soldering for Gold, all circuits: See Profile A in Supplement section.
Note: Lever must be in OFF (center) position while soldering.

Distinctive Characteristics

Inner o-ring and external rubber washer seal the switch to achieve IP67 of IEC60529 Standards (dust tight and water protected for temporary immersion).

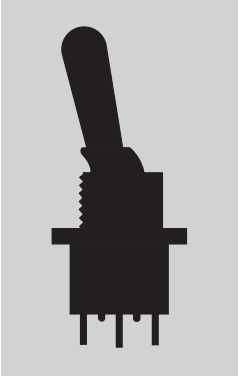
Waterproof boot at base of toggle further ensures protection against wet environments.

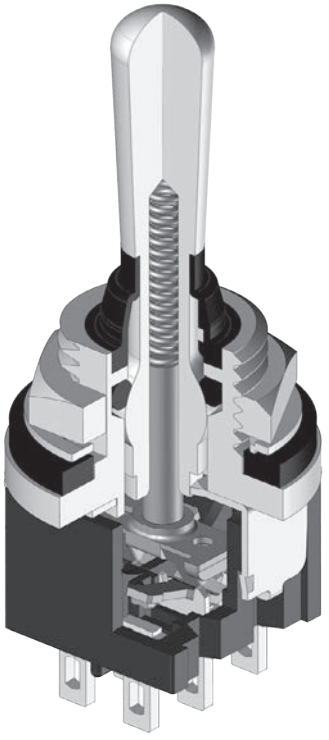
Actuation provides smooth, sturdy tactile feel.

Polished, chrome-plated actuator paired with the waterproof boot not only delivers in terms of sleek design, but also functionality and reliability.

Superb quality and construction design prohibit entry of harmful particles that may otherwise compromise lever operation.

Actual Size





TYPICAL SWITCH ORDERING EXAMPLE

M20 | 1 | 2 | WB | G | 01

Poles

1	SPDT
2	DPDT

Circuits

2	ON	NONE	ON
3	ON	OFF	ON
8	(ON)	OFF	(ON)

( ) = Momentary

Toggle with Large Bushing

WB	.787" (20.0mm) Bat with Large .472" (12.0mm) Threaded Bushing with D Flat

Contact Material & Ratings

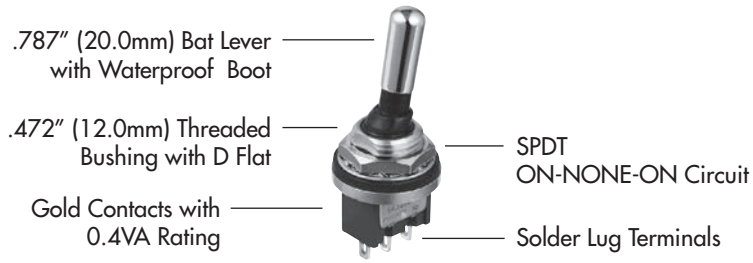
W	Silver; Rated 6A @ 125V AC & 3A @ 250V AC
G	Gold; Rated 0.4VA max @ 28V AC/DC max

Terminals

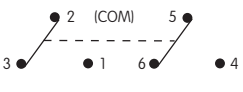
01	Solder Lug

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

M2012WBG01

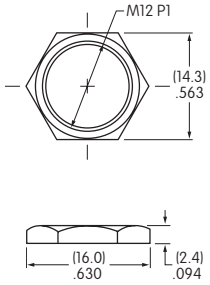


POLES & CIRCUITS

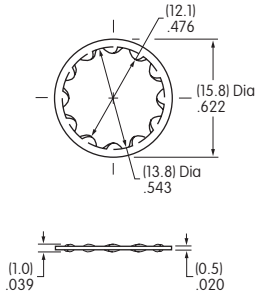
Pole	Model	Toggle Position ( ) = Momentary: Up	Center	Down	Connected Terminals: Up	Center	Down	Throw & Schematics
								Note: Terminal numbers are not actually on the switch.
SP	**M2012 M2013 M2018**	ON ON (ON)	NONE OFF OFF	ON ON (ON)	2-3	OPEN	2-1	SPDT
DP	**M2022 M2023 M2028**	ON ON (ON)	NONE OFF OFF	ON ON (ON)	2-3 5-6	OPEN	2-1 5-4	DPDT 

STANDARD HARDWARE

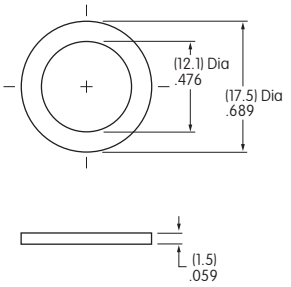
AT503M Hex Face Nut
Brass/Chrome



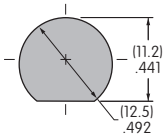
AT508 Lockwasher
Steel with Zinc/Chromate



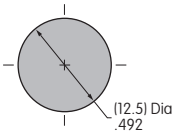
AT401P O-ring
Nitrile Butadiene Rubber



PANEL CUTOUTS & THICKNESS



Anti-rotation

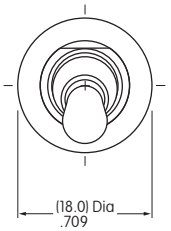


No
Anti-rotation

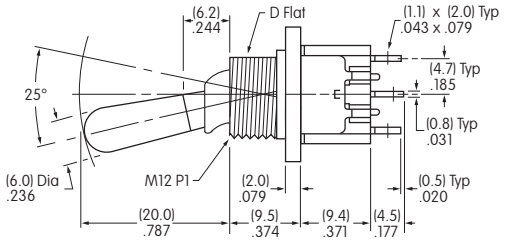
Maximum Effective Panel Thickness
.138" (3.5mm)

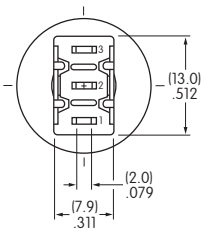
TYPICAL SWITCH DIMENSIONS

Solder Lug



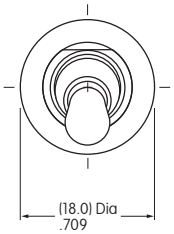
Single Pole



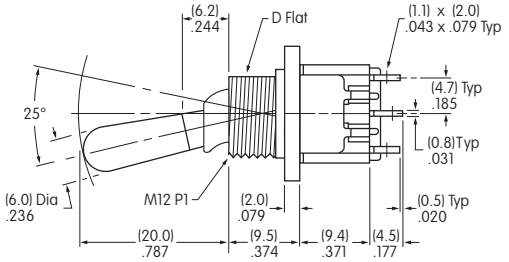


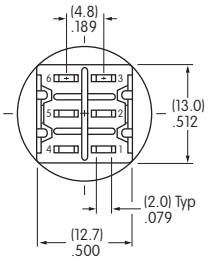
M2012WBG01

Solder Lug



Double Pole





M2022WBG01

APPLICATION CONSIDERATIONS

The Dual Seal Waterproof M Toggle is designed as a panel seal switch, and not to be used under water.

Material Properties

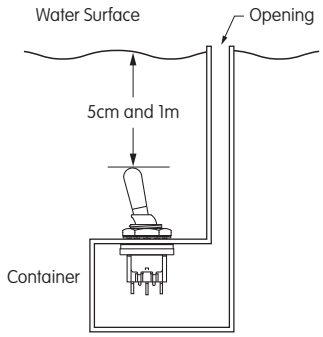
The material for the waterproof boot is silicone rubber. While silicone rubber has excellent heat, cold and weather resistant properties, it has less durability and oil resistance.

The o-rings are made of nitrile butadiene rubber, which excels in durability and oil and chemical resistance. Its performance is less durable with lower weather and ozone resistant characteristics.

Evaluate the products in reguard to your application and intended environment with these properties in mind.

Waterproof Test Conditions

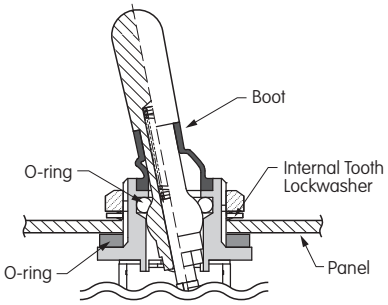
Waterproofing is measured by submersing the switch 5 centimeters from the water surface (see illustration), and opening and closing 50 times at a frequency of 50 – 60 times per minute. The switch is then submersed 1 meter from the surface and left in this position for 30 minutes.



Repeat opening and closing same as previous test. The resulting insulation resistance and voltage capacity are both within the rated values, and water has not entered inside the switch or installation panel.

Panel Installation

For panel installation, the internal tooth lockwasher is installed above the panel. The external o-ring mounts below the panel.



Applications

- Construction Equipment
- Hospitality and Restaurant
- Transportation
- Medical Equipment
- Machine Tooling
- Marine Equipment *

* Salt spray tested as per Mil-STD-810G section 509.5.

General Specifications

Electrical Capacity (Resistive Load)

Power Level (silver): 6A @ 125V AC & 3A @ 250V AC
4A @ 30V DC for On-None-On & On-None-Off; 3A @ 30V DC for all other circuits
Logic Level (gold): 0.4VA maximum @ 28V AC/DC maximum (Applicable Range 0.1mA ~ 0.1A @ 20mV ~ 28V)
Logic/Power Level (gold over silver): Combines silver & gold ratings
Note: Find additional explanation of dual rating & operating range in Supplement section.

Other Ratings

Contact Resistance: 10 milliohms maximum for silver; 20 milliohms maximum for gold
Insulation Resistance: 1,000 megohms minimum @ 500V DC
Dielectric Strength: 1,000V AC minimum between contacts for 1 minute minimum;
1,500V AC minimum between contacts and case for 1 minute minimum
Mechanical Life: 100,000 operations minimum; 50,000 operations minimum for flat, locking & splashproof devices
Electrical Life: 25,000 operations minimum for silver; 50,000 operations minimum for gold;
50,000 operations minimum for silver at 3A @ 125V AC
Angle of Throw: 25°

Materials & Finishes

Toggle: Brass with chrome plating
Bushing: Brass with nickel plating
Case: Diallyl phthalate resin (UL94V–0)
Movable Contactor: Phosphor bronze with silver or gold plating
Movable Contacts: Silver alloy (code W); copper with gold plating (code G); or silver alloy with gold plating (code A)
Stationary Contacts: Silver with silver plating (code W); copper or brass with gold plating (code G);
or silver with gold plating (code A)
Terminals: Copper or brass with silver plating; or copper or brass with gold plating
Frame: Stainless steel
Support Bracket: Brass with tin plating

Environmental Data

Operating Temp Range: –30°C through +85°C (–22°F through +185°F)
Humidity: 90 ~ 95% humidity for 96 hours @ 40°C (104°F)
Vibration: 10 ~ 55Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in 1 minute; 3 right angled directions for 2 hours
Shock: 50G (490m/s^2) acceleration (tested in 6 right angled directions, with 5 shocks in each direction)
Sealing: Splashproof bushing options B3, D3, D8, L3, & L8, which have o-rings inside & outside the bushing, meet IP67 of IEC60529 Standards.

Installation

Mounting Torque: 3.0Nm (26.55 lb•in) double nut for large bushing;
1.5Nm (13 lb•in) double nut & 0.7Nm (6 lb•in) single nut for all other bushings

Processing

Soldering: Wave Soldering (PC version) for Gold: See Profile A in Supplement section.
Manual Soldering for Gold: See Profile A in Supplement section.
Wave Soldering (PC version) for Silver: See Profile B in Supplement section.
Manual Soldering for Silver: See Profile B in Supplement section.
Note: Lever must be in OFF (center) position while soldering.
Cleaning: These devices are not process sealed. Hand clean locally using alcohol based solution.

Standards & Certifications

Flammability Standards: UL94V–0 for case
UL: **File No. E44145 - Recognized only when ordered with marking on switch.**
Add "/U" or "/CUL" before dash in part number to order UL recognized switch.
All models recognized at 6A @ 125V AC, 3A @ 250V AC or 0.4VA maximum @ 28V DC maximum.
CSA: **File No. 023535_0_000 - Certified only when ordered with marking on switch.**
Add "/C" before dash in part number to order CSA certified switch.
All models certified at 6A @ 125V AC or 3A @ 250V AC or 0.4VA maximum @ 28V maximum.

Distinctive Characteristics

Antirotation design, standard on noncylindrical levers, mates toggle and bushing; bottom of toggle has two flatted sides which fit into a complementary opening inside bushing.

Antijamming design protects contacts from damage due to excessive downward force on actuator.

High torque bushing construction prevents rotation or separation from frame during installation.

High insulating barriers increase isolation of circuits in multipole devices and provide added protection to contact points.

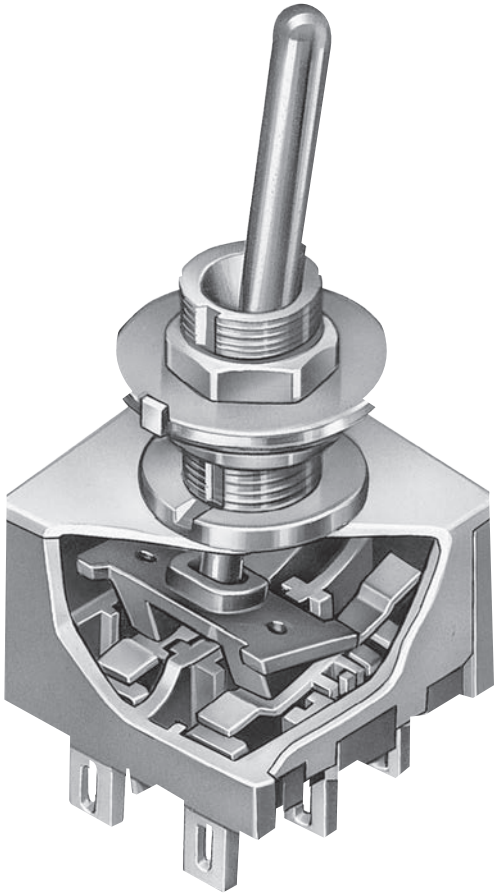
Molded diallyl phthalate case has a UL flammability rating of 94V-0.

Epoxy sealed terminals prevent entry of solder flux and other contaminants.

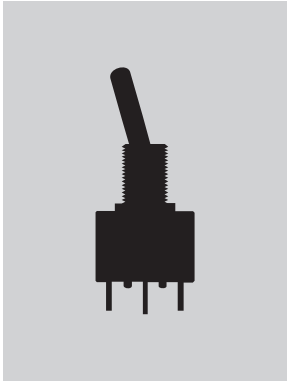
Prominent external insulating barriers increase insulation resistance and dielectric strength.

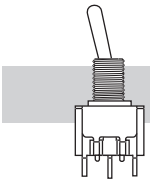
Interlocked actuator block, lever, and interior guide prevent switch failure due to biased lever movement.

Clinching of frame to case well above base and terminals provides 1,500V dielectric strength.

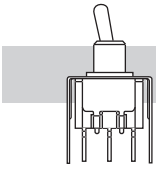


Actual Size

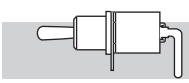




Bushing Mount Page A52



Bracket PC Mount Page A64



Angle PC Mount Page A70

Series M

Bushing Mount Miniature Toggles

TYPICAL SWITCH

M20 | 1 | 3 | S | S1

Poles

1	SPST SPDT
2	DPST DPDT SP3T
3	3PDT
4	4PDT DP3T

Circuits

*1	ON	NONE	OFF
2	ON	NONE	ON
3	ON	OFF	ON
5	ON	NONE	(ON)
8	(ON)	OFF	(ON)
9	ON	OFF	(ON)
**4	ON	ON	ON
**6	(ON)	ON	(ON)
**7	ON	ON	(ON)

( ) = Momentary

* ON-NONE-OFF circuit available in 1- and 2-pole only.

** 3-ON circuits

Small Toggles

S	.413″ (10.5mm) Bat
S2	.200″ (5.08mm) Bat
S3	.256″ (6.5mm) Bat
E	.450″ (11.4mm) Flatted
* E2	.256″ (6.5mm) Flatted
E4	.840″ (21.3mm) Flatted
* Q	.550″ (14.0mm) Cone
* Q2	.640″ (16.26mm) Cone
* Q4	.840″ (21.3mm) Cone
* C	.571″ (14.5mm) Color Tipped Cone (available in colors A, B & C only)
D	.840″ (21.3mm) Color Capped Cone

Specify cap color for toggles C & D at the end of the part number.
* Available on 1- and 2-pole only.

Large Toggles

B	.453″ (11.5mm) Large Bat
B2	.689″ (17.5mm) Large Bat
R	.610″ (15.5mm) Large Flatted

Locking Lever

L	.201″ (5.1mm) Dia. Locking Lever

Small Bushings

S1	.350″ (8.9mm) Threaded with Keyway
S4	6mm .350″ (8.9mm) Threaded with Keyway
S2	.350″ (8.9mm) Smooth with Keyway
A1	.280″ (7.1mm) Threaded with Keyway
A2	.280″ (7.1mm) Smooth with Keyway
D1	.350″ (8.9mm) Threaded with D Flat
D4	6mm .350″ (8.9mm) Threaded with D Flat
D3	.350″ (8.9mm) Threaded Splashproof with D Flat (combines only with S, S2 & S3)
D8	6mm .350″ (8.9mm) Threaded Splash-proof with D Flat (combines only with S, S2 & S3)

Large Bushings

B1	Large .472″ (12mm) Threaded with Keyway
B3	Large .472″ (12mm) Threaded Splashproof with D Flat

Bushings For Locking Levers

L1	.291″ (7.4mm) Threaded with Keyway for Lever Lock
L4	6mm .291″ (7.4mm) Threaded with Keyway for Lever Lock
L2	Smooth with Keyway for Lever Lock
L3	.295″ (7.5mm) Threaded Splashproof with D Flat for Lever Lock
L8	6mm .295″ (7.5mm) Threaded Splash-proof with D Flat for Lever Lock

IMPORTANT:

Switches are supplied without UL, cULus & CSA marking unless specified.
UL, cULus & CSA recognized only when ordered with marking on the switch.
Specific models, ratings, & ordering instructions are noted on the General Specifications page.

ORDERING EXAMPLE

W 01 — □ □

Contact Materials & Ratings

W	Silver; Rated 6A @ 125V AC & 3A @ 250V AC
G	Gold; Rated 0.4VA max @ 28V AC/DC max
A	Gold over Silver; Rated 6A @ 125V AC & 0.4VA max @ 28V AC/DC max

Terminals

01	Solder Lug
02	Quick Connect
03	.250″ (6.35mm) Straight PC
05	.425″ (10.8mm) Wirewrap
06	.750″ (19.05mm) Wirewrap
07	.964″ (24.5mm) Wirewrap
08	1.062″ (27.0mm) Wirewrap

Optional Caps

For Small Bat Toggles	
B	For S Bat Toggle
C	Conical Cap for S Bat Toggle
For Large Bat Toggles	
R	For B Toggle
V	For B2 Toggle

Cap for Locking Lever

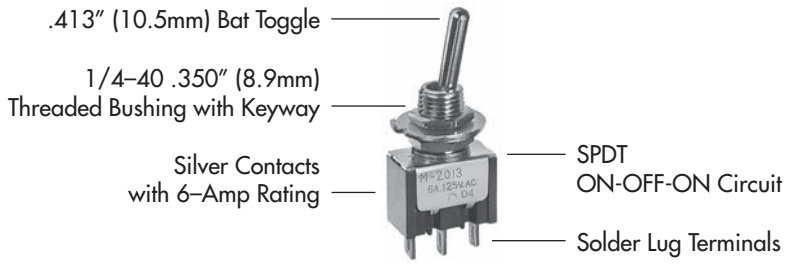
No Code	Nickel Plated Supplied with Switch
A	Black
C	Red
G	Blue

Cap Colors

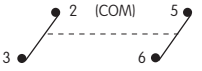
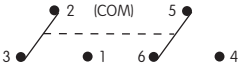
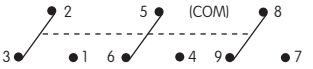
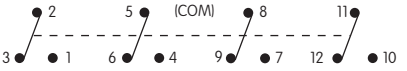
A	Black
B	White
C	Red
E	Yellow
F	Green
G	Blue

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

M2013SS1W01

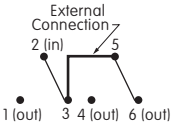
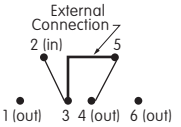
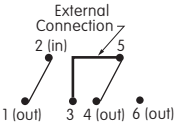
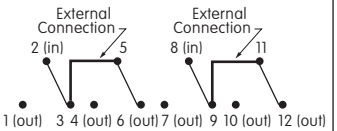
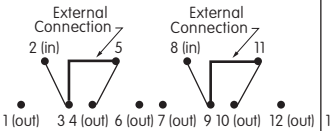
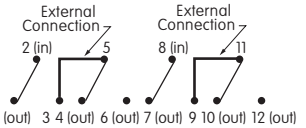


POLES & CIRCUITS

Pole	Model	Toggle Position ( ) = Momentary: Down	Center	Up	Connected Terminals: Down	Center	Up	Throw & Schematics
		Keyway			Keyway			Note: Terminal numbers are not actually on the switch.
SP	**M2011**	ON	NONE	OFF	2-3	OPEN	OPEN	SPST
SP	**M2012** **M2013** **M2015** **M2018** **M2019**	ON ON ON (ON) ON	NONE OFF NONE OFF OFF	ON ON (ON) (ON) (ON)	2-3	OPEN	2-1	SPDT
DP	**M2021**	ON	NONE	OFF	2-3 5-6	OPEN	OPEN	DPST 
DP	**M2022** **M2023** **M2025** **M2028** **M2029**	ON ON ON (ON) ON	NONE OFF NONE OFF OFF	ON ON (ON) (ON) (ON)	2-3 5-6	OPEN	2-1 5-4	DPDT 
3P	**M2032** **M2033** **M2035** **M2038** **M2039**	ON ON ON (ON) ON	NONE OFF NONE OFF OFF	ON ON (ON) (ON) (ON)	2-3 5-6 8-9	OPEN	2-1 5-4 8-7	3PDT 
4P	**M2042** **M2043** **M2045** **M2048** **M2049**	ON ON ON (ON) ON	NONE OFF NONE OFF OFF	ON ON (ON) (ON) (ON)	2-3 5-6 8-9 11-12	OPEN	2-1 5-4 8-7 11-10	4PDT 

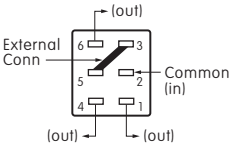
For 3 Throw (3-On)

Connected Terminals & Schematic

Pole	Model	Down	Center	Up	Down	Center	Up
SP	**M2024** **M2026** **M2027**	ON (ON) ON	ON ON ON	ON (ON) (ON)	 2-3 5-6	 2-3 5-4	 2-1 5-4
DP	**M2044** **M2046** **M2047**	ON (ON) ON	ON ON ON	ON (ON) (ON)	 2-3 5-6 8-9 11-12	 2-3 5-4 8-9 11-10	 2-1 5-4 8-7 11-10

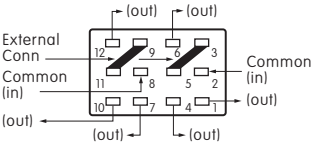
The SP3T model utilizes a double pole base.

External connection must be made during field installation.



The DP3T model utilizes a four pole base.

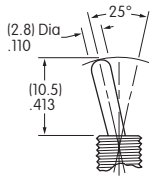
External connection must be made during field installation.



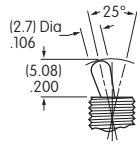
SMALL TOGGLES

Important:
Toggle length changes based on bushing selected. All illustrations are shown with .350" long bushing. When using a .280" long bushing, toggle length increases .070".

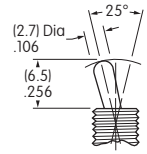
S .413" (10.5mm) Bat



S2 .200" (5.08mm) Bat

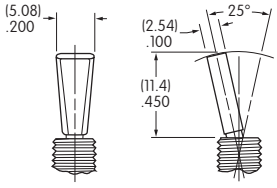


S3 .256" (6.5mm) Bat

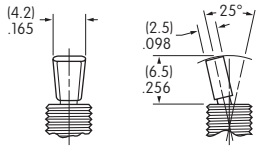


Standard Material & Finish: Brass with Bright Chrome
Contact factory for optional finishes.

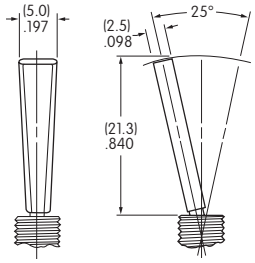
E .450" (11.4mm) Flatted



E2 .256" (6.5mm) Flatted



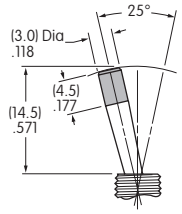
E4 .840" (21.3mm) Flatted



Only Available in 1- & 2-Pole

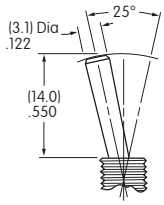
C .571" (14.5mm) Color Tipped Cone Supplied with Cap AT445

Colors: A B C
Material: Polycarbonate

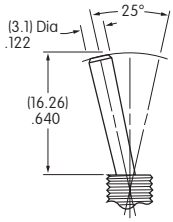


Only Available in 1- & 2-Pole

Q .550" (14.0mm) Cone

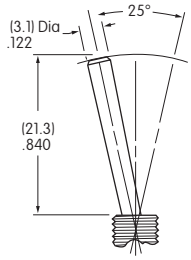


Q2 .640" (16.26mm) Cone



Only Available in 1- & 2-Pole

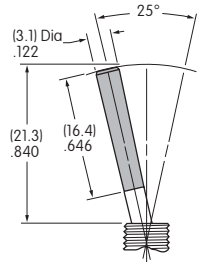
Q4 .840" (21.3mm) Cone



Only Available in 1- & 2-Pole

D .840" (21.3mm) Color Capped Cone Supplied with Cap AT460

Colors: A B C E F G
Material: Polyethylene

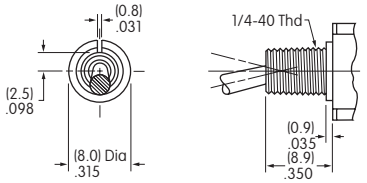


Only Available in 1- & 2-Pole

Cap Colors Available: A Black · B White · C Red · E Yellow · F Green · G Blue

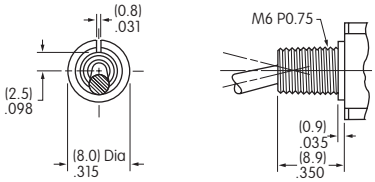
SMALL BUSHINGS

S1 — 1/4-40 .350" (8.9mm) Threaded with Keyway



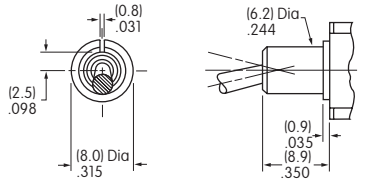
Maximum Panel Thickness with Standard Hardware: .102" (2.6mm)

S4 — 6mm/.350" (8.9mm) Threaded with Keyway

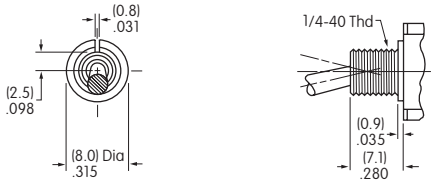


Maximum Panel Thickness with Standard Hardware: .102" (2.6mm)

S2 — .350" (8.9mm) Smooth with Keyway

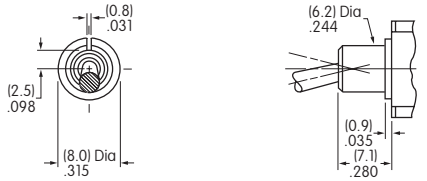


A1 — 1/4-40 .280" (7.1mm) Threaded with Keyway



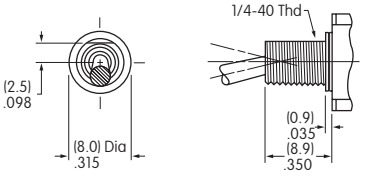
When using this bushing, toggle length is increased by .070". Maximum Panel Thickness with Standard Hardware: .031" (0.8mm)

A2 — .280" (7.1mm) Smooth with Keyway



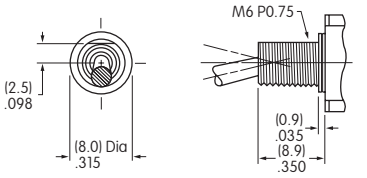
When using this bushing, toggle length is increased by .070".

D1 — 1/4-40 .350" (8.9mm) Threaded with D Flat



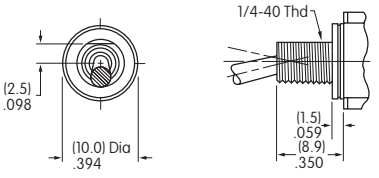
Maximum Panel Thickness with Standard Hardware: .102" (2.6mm)

D4 — 6mm/.350" (8.9mm) Threaded with D Flat



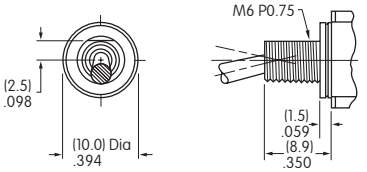
Maximum Panel Thickness with Standard Hardware: .102" (2.6mm)

D3 — 1/4-40 .350" (8.9mm) Threaded Splashproof with D Flat



D3 combines only with S, S2 & S3 toggles. Maximum Panel Thickness with Standard Hardware: .193" (4.9mm)

D8 — 6mm/.350" (8.9mm) Threaded Splashproof with D Flat

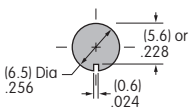


D8 combines only with S, S2 & S3 toggles. Maximum Panel Thickness with Standard Hardware: .193" (4.9mm)

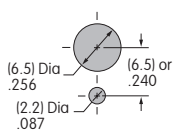
Standard Hardware Supplied for Small Bushings

	Bushing Codes	S1/S4	A1	D1/D4	D3/D8	L1/L4	L3/L8
Hardware and Quantity	Hex Nut	2	2	2	1	2	1
	Locking Ring	1	1	0	0	1	0
	Lockwasher	1	1	1	0	1	0
	O-ring	0	0	0	1	0	1

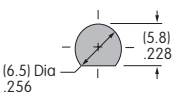
For S1, S2, A1, A2 or S4 Bushing with Keyway & for L1 or L4 Bushing



For S1, A1 or S4 Bushing with Locking Ring & for L1 or L4 Bushing



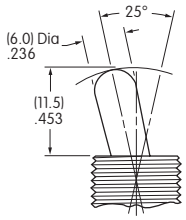
For D1, D4, D3 or D8 Bushing with D Flat & for L3 or L8 Bushing



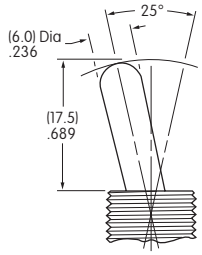
LARGE TOGGLES

Toggle & Bushing Combinations: These toggles combine with the 12mm bushings B1 & B3.

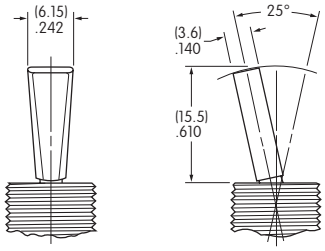
B **.453" (11.5mm) Large Bat**



B2 **.689" (17.5mm) Large Bat**



R **.610" (15.5mm) Large Flatted**

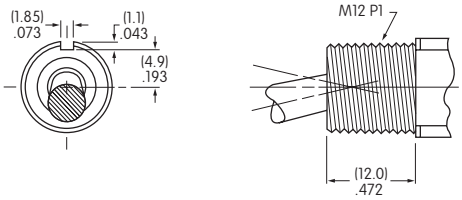


Standard Material & Finish: Brass with Bright Chrome

Optional Finishes: Contact factory for satin chrome or black.

LARGE BUSHINGS

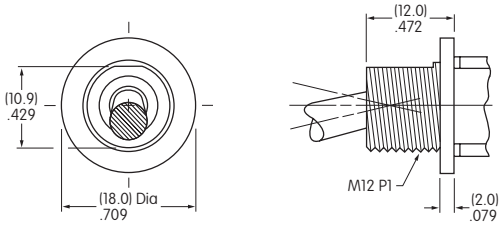
B1 **Large .472" (12.0mm) Threaded with Keyway**



Maximum Panel Thickness with Standard Hardware: .216" (5.5mm)

Standard Hardware for B1:
1 hex face nut AT503M, 1 locking ring AT506M, 1 lockwasher AT508, and 1 hex backup nut AT527M

B3 **Large .472" (12.0mm) Threaded Splashproof with D Flat**

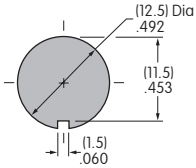


Maximum Panel Thickness with Standard Hardware: .256" (6.5mm)

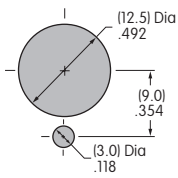
Standard Hardware for B3:
1 hex face nut AT503M and 1 o-ring AT401P

Panel Cutouts

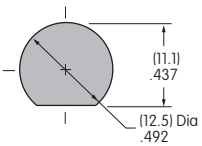
For B1 Bushing with Keyway



For B1 Bushing with Locking Ring

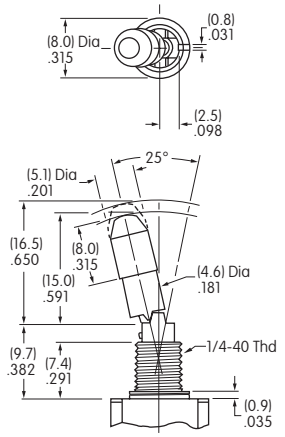


For B3 Bushing with D Flat

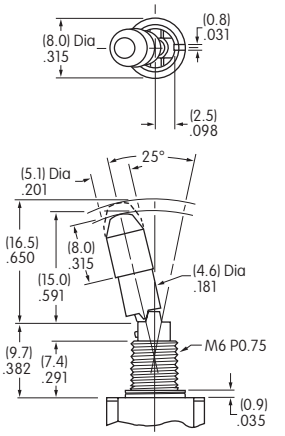


LOCKING LEVER & BUSHINGS

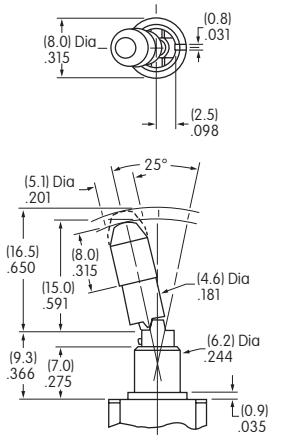
LL1 1/4-40 .291" (7.4mm) Threaded with Keyway



LL4 6mm/.291" (7.4mm) Threaded with Keyway

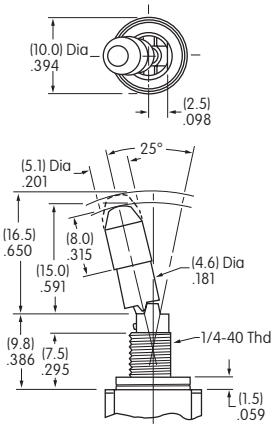


LL2 Smooth with Keyway

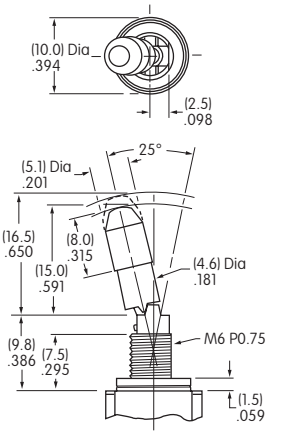


Maximum Panel Thickness with Standard Hardware: .047" (1.2mm)
Standard Hardware for L1 & L4: 2 hex nuts AT513H or AT513M,
1 locking ring AT507H or AT507M, and 1 lockwasher AT509

LL3 1/4-40 .295" (7.5mm) Threaded Splashproof with D Flat



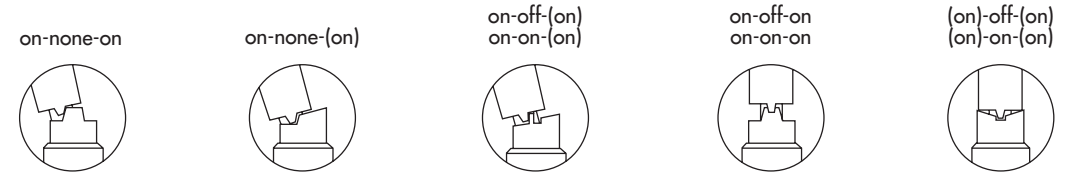
LL8 6mm/.295" (7.5mm) Threaded Splashproof with D Flat



Maximum Panel Thickness with Standard Hardware: .047" (1.2mm)
Standard Hardware for L3 and L8: 1 hex nut AT513H or AT513M and 1 o-ring AT516

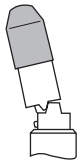
Lever Material & Finish: Brass with Chrome Plating

Locking Mechanism



No Code **Supplied with Cap AT427**

Cap Material:
Brass with Nickel Plating



Color Codes for Optional Anodized Aluminum Caps

A Black C Red G Blue

CONTACT MATERIALS & RATINGS

W	**Silver over Silver**	**Power Level**	**6A @ 125V AC & 3A @ 250V AC**
G	**Gold over Brass or Copper**	**Logic Level**	**6A @ 125V AC & 3A @ 250V AC**

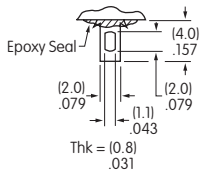
Note: See Supplement section to find complete explanation of operating range.

A	**Gold over Silver**	**Power Level or Logic Level**	**6A @ 125V AC or 0.4VA maximum @ 28V AC/DC maximum**

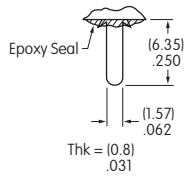
Note: This dual rated option is suitable when two or more identical switches are used in logic and in power circuits within the same application. See Supplement section to find complete explanation of dual rating and operating range.

TERMINALS

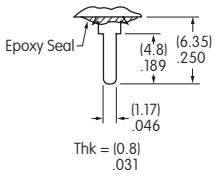
01 **Solder Lug**

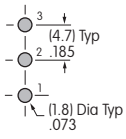


02 **.062" (1.57mm) Wide Quick Connect**

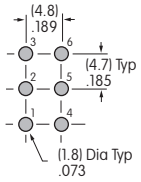


03 **.250" (6.35mm) Straight PC**

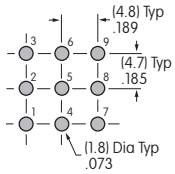




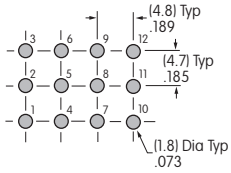
Single Pole



Double Pole



Three Pole



Four Pole

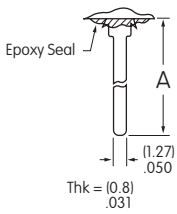
05 **.425" (10.8mm) Wirewrap or Extended PC**

06 **.750" (19.05mm) Wirewrap or Extended PC**

07 **.964" (24.5mm) Wirewrap or Extended PC**

08 **1.062" (27.0mm) Wirewrap or Extended PC**

If using as extended PC terminal, refer to the above footprints.

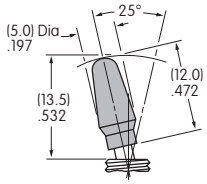


Dimension A = terminal lengths as shown beside the terminal codes at the left.

OPTIONAL CAPS & CAP COLORS

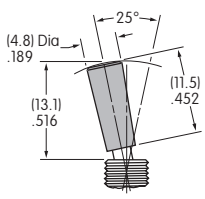
B *** AT415 Lever Cap for S Bat Toggle**

Material: Polyethylene



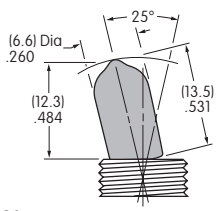
C *** AT444 Conical Cap for S Bat Toggle**

Material: Polyethylene



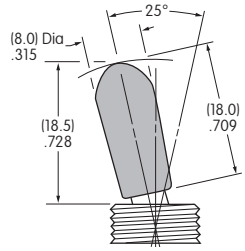
R **AT434 Lever Cap for B Toggle**

Material: Polyvinyl Chloride



V **AT406 Lever Cap for B2 Toggle**

Material: Polyvinyl Chloride



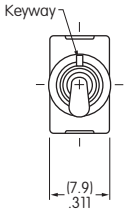
* AT415 and AT444 for use with S toggles only, not S2 or S3 toggles.

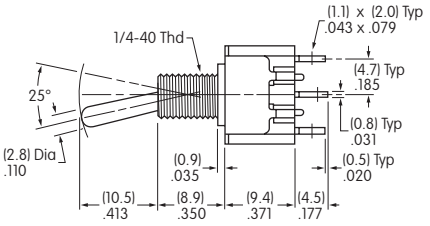
Cap Colors Available: **A** Black **B** White **C** Red **E** Yellow **F** Green **G** Blue

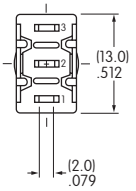
TYPICAL SWITCH DIMENSIONS

Solder Lug

Single Pole





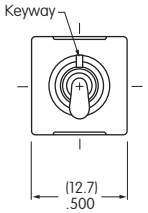


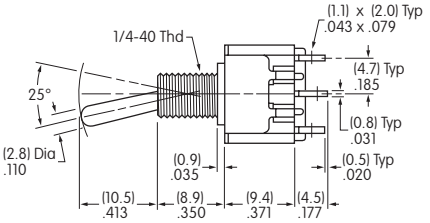
M2012SS1W01

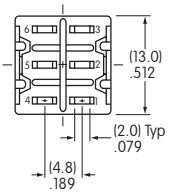
M2011 model does not have terminal 1.

Solder Lug

Double Pole





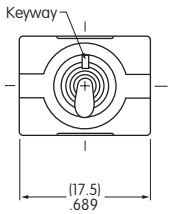


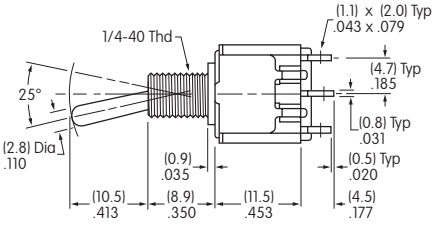
M2022SS1W01

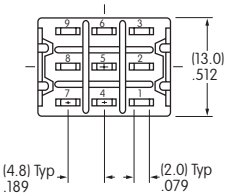
M2021 model does not have terminals 1 & 4.

Solder Lug

Three Pole



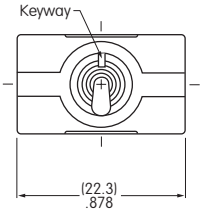


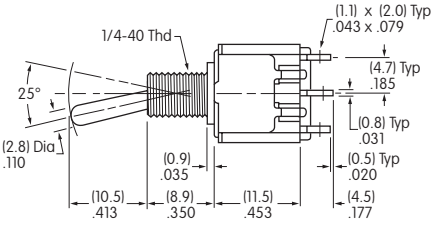


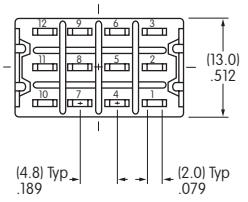
M2032SS1W01

Solder Lug

Four Pole



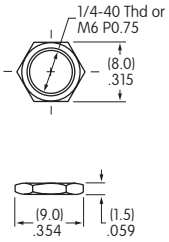




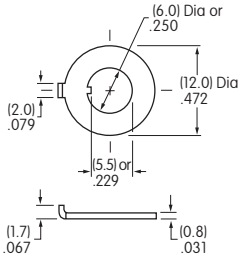
M2042SS1W01

STANDARD HARDWARE FOR SMALL & LARGE BUSHINGS

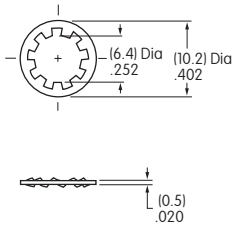
AT513H for Inch
AT513M for Metric
Hex Nut
Brass/Nickel



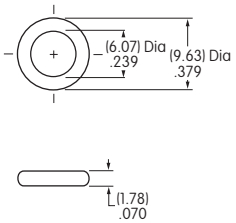
AT507H for Inch
AT507M for Metric
Locking Ring
Steel with Zinc/Chromate



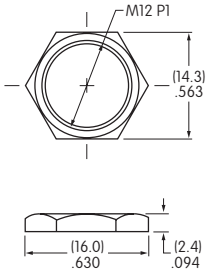
AT509
Lockwasher
Steel with Zinc/Chromate
(not supplied with splashproof models)



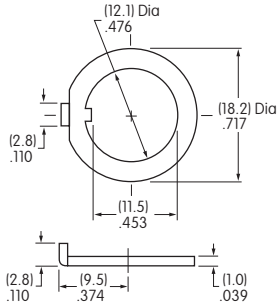
AT516
O-ring for
Splashproof Models
Nitrile Butadiene Rubber



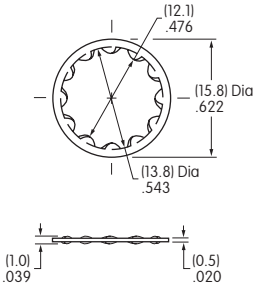
AT503M
Hex Face Nut
Brass/Chrome



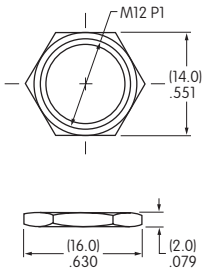
AT506M
Locking Ring
Steel with Zinc/Chromate



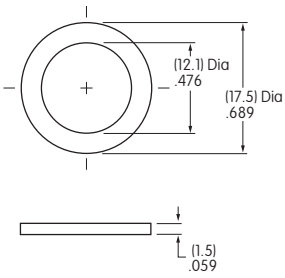
AT508
Lockwasher
Steel with Zinc/Chromate
(not supplied with splashproof models)



AT527M
Hex Nut
Steel with
Nickel Plating



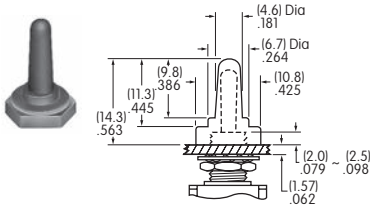
AT401P
O-ring for Splashproof Models
Nitrile butadiene rubber



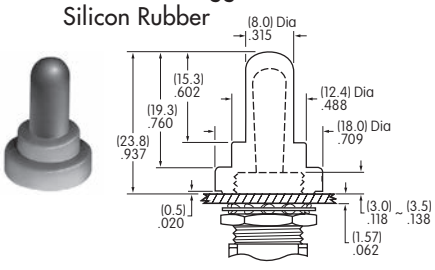
OPTIONAL SPLASHPROOF BOOTS

Various optional nuts and ON-OFF plates are available; dimensions are shown in the Accessories & Hardware section.

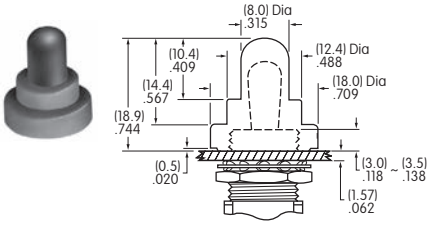
AT428 (M-metric H-Inch)
.445" (11.3mm)
Boot for S Toggle
Silicon Rubber



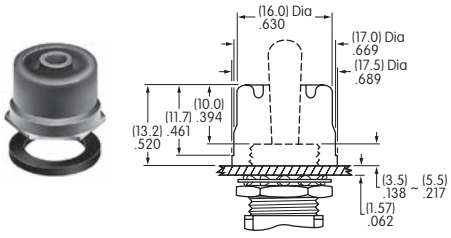
AT402
.760" (19.3mm)
Boot for B2 Toggle
Silicon Rubber



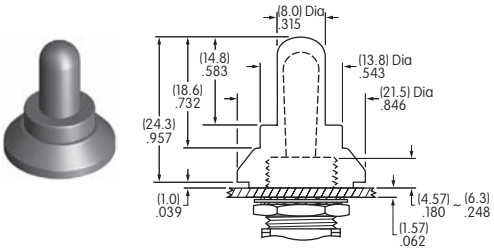
AT402S
.567" (14.4mm)
Boot for B Toggle
Silicon Rubber



AT401A/H/S
.461" (11.7mm)
Boot, Nut and O-ring for B2 Toggle
More details in Accessories section



AT4181
.732" (18.6mm)
Boot, Nut and O-ring for B2 Toggle
More details in Accessories section



Series M

Bracket PC Mount Miniature Toggles

TYPICAL SWITCH

M20 2 2 S S2

Poles

1	SPDT
2	DPDT SP3T

Circuits

2	ON	NONE	ON
3	ON	OFF	ON
5	ON	NONE	(ON)
8	(ON)	OFF	(ON)
9	ON	OFF	(ON)
*4	ON	ON	ON
*6	(ON)	ON	(ON)
*7	ON	ON	(ON)

( ) = Momentary

*3-ON circuits

Small Toggles

S	.413″ (10.5mm) Bat
S2	.200″ (5.08mm) Bat
S3	.256″ (6.5mm) Bat
E	.450″ (11.4mm) Flatted
E2	.256″ (6.5mm) Flatted
E4	.840″ (21.3mm) Flatted
Q	.550″ (14.0mm) Cone
Q2	.640″ (16.26mm) Cone
Q4	.840″ (21.3mm) Cone

Toggle dimensions are based on use with a .350″ (8.9mm) bushing; add .070″ (1.78mm) to toggle length when combining with a .280″ (7.1mm) bushing

Small Bushings

A2	.280″ (7.1mm) Smooth with Keyway
S2	.350″ (8.9mm) Smooth with Keyway
A1	.280″ (7.1mm) Threaded with Keyway
S1	.350″ (8.9mm) Threaded with Keyway

Deduct bracket thickness of .020″ (0.51mm) from above dimensions

Locking Lever

L	.201″ (5.1mm) Dia. Locking Lever

Bushing For Locking Levers

L2	Smooth with Keyway for Lever Lock

Standard Toggle & Bushing Combinations:

SS2 & S2A2

IMPORTANT:

Switches are supplied without UL, cULus & CSA marking unless specified. **UL, cULus & CSA recognized only when ordered with marking on the switch.** Specific models, ratings & ordering instructions are noted on the General Specifications page.

ORDERING EXAMPLE

G — 13 — B — C

Contact Materials & Ratings

W	Silver; Rated 6A @ 125V AC & 3A @ 250V AC
G	Gold; Rated 0.4VA max @ 28V AC/DC max
A	Gold over Silver; Rated 6A @ 125V AC & 0.4VA max @ 28V AC/DC max

Terminals

With Bracket	
13	.250″ (6.35mm) Straight PC with .465″ (11.8mm) Bracket
15	.425″ (10.8mm) Straight PC with .630″ (16.0mm) Bracket
17	.964″ (24.5mm) Straight PC with 1.150″ (29.2mm) Bracket
With Reinforced Bracket	
23	.250″ (6.35mm) Straight PC with .465″ (11.8mm) Bracket
25	.425″ (10.8mm) Straight PC with .630″ (16.0mm) Bracket
26	.750″ (19.05mm) Straight PC with .953″ (24.2mm) Bracket

Optional Caps

B	For S Bat Toggle
C	Conical Cap for S Bat Toggle

Cap for Locking Lever

No Code	Nickel Plated Supplied with Switch
A	Black
C	Red
G	Blue

Cap Colors

A	Black
B	White
C	Red
E	Yellow
F	Green
G	Blue

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

M2022SS2G13-BC

Red Cap on .413″ (10.5mm) Bat Toggle

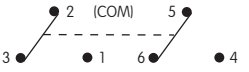
.350″ (8.9mm) Smooth Bushing with Keyway

DPDT ON-NONE-ON Circuit

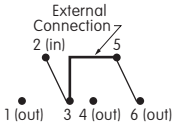
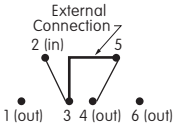
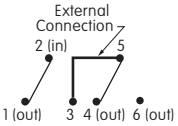
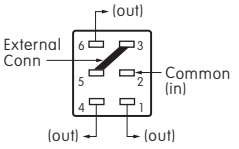
Gold Contacts with 0.4VA Rating

.250″ (6.35mm) Straight PC Terminals with Bracket .465″ (11.8mm) Long

POLES & CIRCUITS

Pole	Model	Toggle Position ( ) = Momentary: Down	Center	Up	Connected Terminals: Down	Center	Up	Throw & Schematics
		Keyway			Keyway			Note: Terminal numbers are not actually on the switch.
SP	M2012 M2013 M2015 M2018 M2019	ON ON ON (ON) ON	NONE OFF NONE OFF OFF	ON ON (ON) (ON) (ON)	2-3	OPEN	2-1	SPDT
DP	M2022 M2023 M2025 M2028 M2029	ON ON ON (ON) ON	NONE OFF NONE OFF OFF	ON ON (ON) (ON) (ON)	2-3 5-6	OPEN	2-1 5-4	DPDT 

For 3 Throw (3-On)

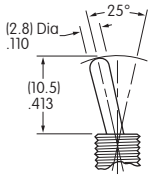
Pole	Model	Connected Terminals & Schematics: Down	Center	Up	External Connection
SP	M2024 M2026 M2027	ON (ON) ON  2-3 5-6	ON ON ON  2-3 5-4	ON (ON) (ON)  2-1 5-4	**The SP3T model utilizes a double pole base.** External connection must be made during field installation. 

SMALL TOGGLES

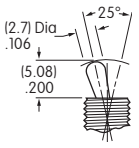
Important:
Toggle length changes based on bushing selected. All illustrations are shown with .350" (8.9mm) long bushing. When using a .280" (7.1mm) long bushing, toggle length increases .070" (1.78mm).

Standard Material & Finish:
Brass with Bright Chrome
Contact factory for optional finishes.

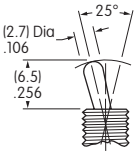
S .413" (10.5mm) Bat



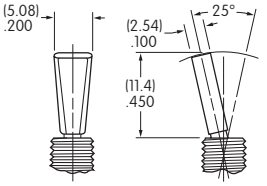
S2 .200" (5.08mm) Bat



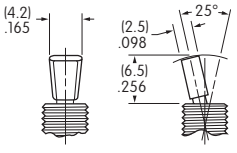
S3 .256" (6.5mm) Bat



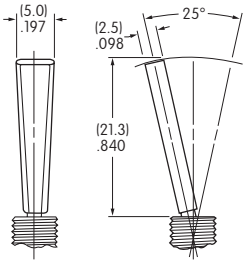
E .450" (11.4mm) Flatted



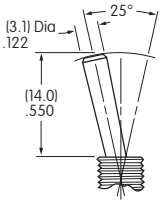
E2 .256" (6.5mm) Flatted



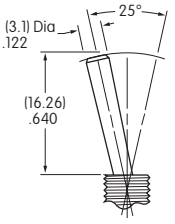
E4 .840" (21.3mm) Flatted



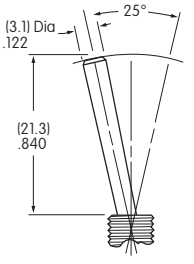
Q .550" (14.0mm) Cone



Q2 .640" (16.26mm) Cone

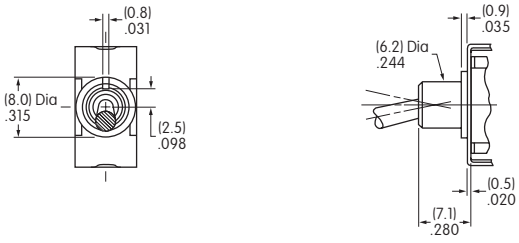


Q4 .840" (21.3mm) Cone



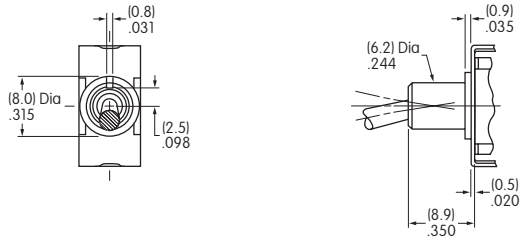
SMALL BUSHINGS

A2 **.280" (7.1mm) Smooth with Keyway**

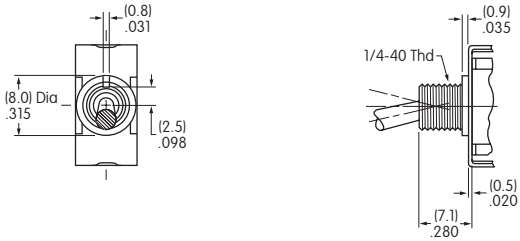


When using this bushing, toggle length is increased by .070" (1.78mm).

S2 **.350" (8.9mm) Smooth with Keyway**

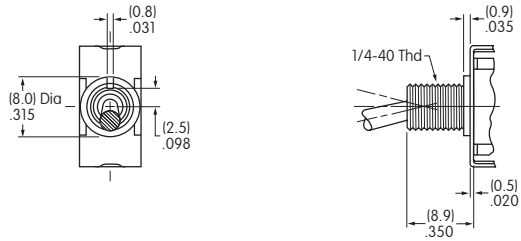


A1 **.280" (7.1mm) Threaded with Keyway**



When using this bushing, toggle length is increased by .070" (1.78mm). Maximum Panel Thickness with Standard Hardware: .031" (0.8mm)

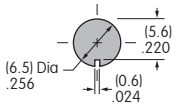
S1 **.350" (8.9mm) Threaded with Keyway**



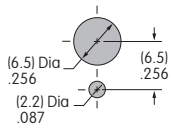
Maximum Panel Thickness with Standard Hardware: .102" (2.6mm)

Panel Cutouts

For A2, S2, A1, or S1 Bushing with Keyway



For A1 or S1 Bushing with Locking Ring



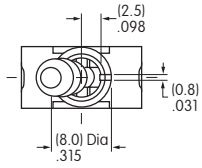
Standard Hardware:

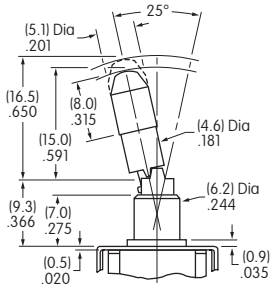
2 Hex Nuts (AT513H)
1 Lockwasher (AT509)
1 Locking Ring (AT507H)

For dimensions, see Accessories & Hardware section.

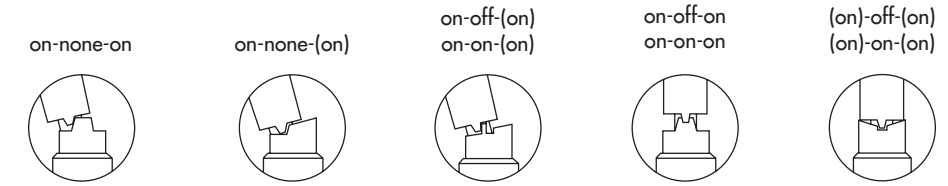
LOCKING LEVER & BUSHING

LL2 **Smooth with Keyway**

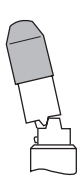




Locking Mechanism



No Code



Cap for Locking Lever

Supplied with Cap AT427
Material & Finish:
Brass with Nickel Plating

Lever Material & Finish:
Brass with Chrome Plating

Color Codes for Optional Anodized Aluminum Caps

A Black
C Red
G Blue

CONTACT MATERIALS & RATINGS

W	Silver over Silver	Power Level	6A @ 125V AC & 3A @ 250V AC
G	Gold over Brass or Copper	Logic Level	0.4VA maximum @ 28V AC/DC maximum

Note: See Supplement section to find complete explanation of operating range.

A	Gold over Silver	Power Level or Logic Level	6A @ 125V AC or 0.4VA maximum @ 28V AC/DC maximum

Note: This dual rated option is suitable when two or more identical switches are used in logic and in power circuits within the same application. See Supplement section to find complete explanation of dual rating and operating range.

TERMINALS

Straight PC Mount with Bracket

13 .250" (6.35mm) Terminal with .465" (11.8mm) Bracket

15 .425" (10.8mm) Terminal with .630" (16.0mm) Bracket

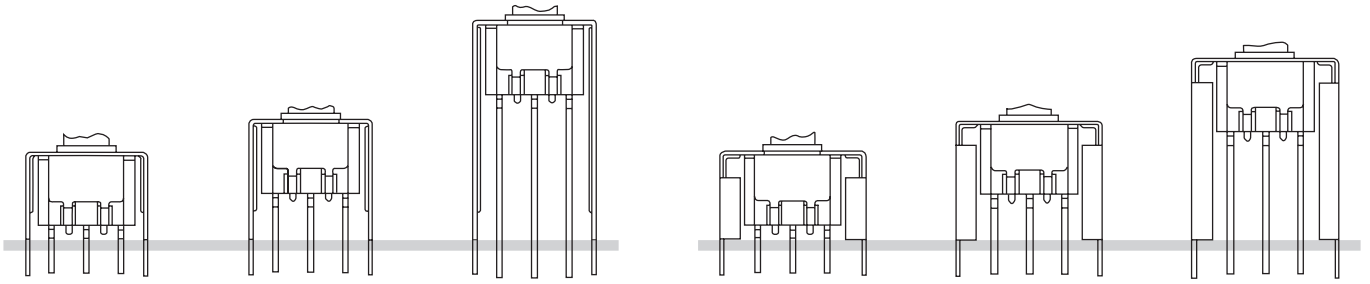
17 .964" (24.5mm) Terminal with 1.150" (29.2mm) Bracket

Straight PC Mount with Reinforced Bracket

23 .250" (6.35mm) Terminal with .465" (11.8mm) Bracket

25 .425" (10.8mm) Terminal with .630" (16.0mm) Bracket

26 .750" (19.05mm) Terminal with .953" (24.2mm) Bracket

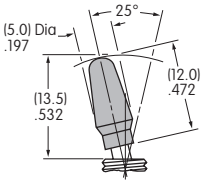


PCB footprints are on the following Typical Switch Dimension page.

OPTIONAL CAPS & CAP COLORS

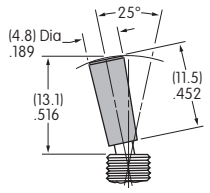
B * AT415 for S Bat Toggle

Material: Polyethylene



C * AT444 Conical Cap for S Bat Toggle

Material: Polyethylene

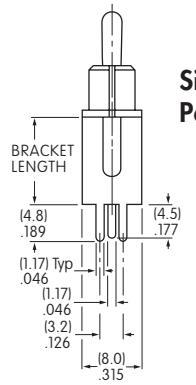


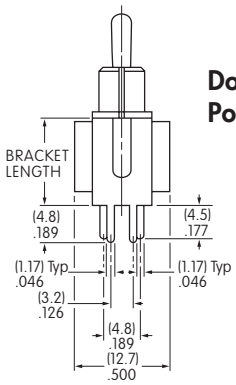
* AT415 and AT444 for use with S toggles only, not S2 or S3 toggles.

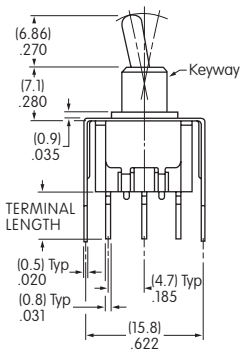
Cap Colors Available: A Black, B White, C Red, E Yellow, F Green, G Blue

TYPICAL SWITCH DIMENSIONS

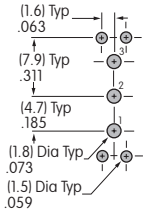
Straight PC • Bracket

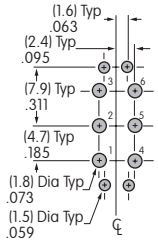






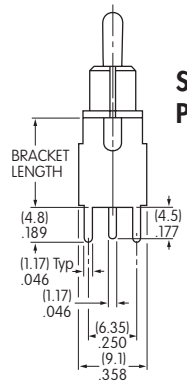
M2012S2A2G13

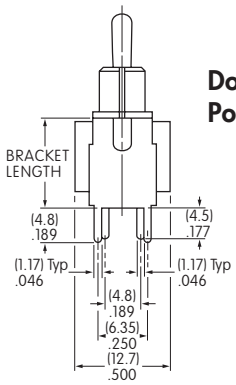


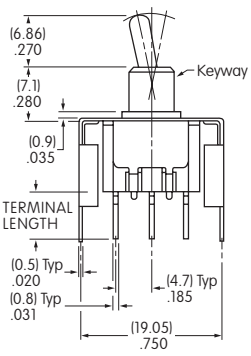


Terminal Code:	Terminal Length:	Bracket Length:
13	.250″ (6.35mm)	.465″ (11.8mm)
15	.425″ (10.8mm)	.630″ (16.0mm)
17	.964″ (24.5mm)	1.150″ (29.2mm)

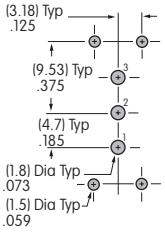
Straight PC • Reinforced Bracket

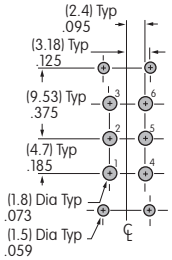






M2012S2A2G23





Terminal Code:	Terminal Length:	Bracket Length:
23	.250″ (6.35mm)	.465″ (11.8mm)
25	.425″ (10.8mm)	.630″ (16.0mm)
26	.750″ (19.05mm)	.953″ (24.2mm)

Series M

Angle PC Mount Miniature Toggles

TYPICAL SWITCH

M20 — 1 — 2 — S2 — A2

Poles

1	SPDT
2	DPDT SP3T
3	3PDT
*4	4PDT DP3T

*4-pole available on vertical models only.

Small Toggles

S	.413″ (10.5mm) Bat
S2	.200″ (5.08mm) Bat
S3	.256″ (6.5mm) Bat
E	.450″ (11.4mm) Flatted
E2	.256″ (6.5mm) Flatted

Toggle dimensions are based on use with a .350″ (8.9mm) bushing; add .070″ (1.78mm) to toggle length when combining with a .280″ (7.1mm) bushing.

Small Bushings

A2	.280″ (7.1mm) Smooth with Keyway
S2	.350″ (8.9mm) Smooth with Keyway
A1	.280″ (7.1mm) Threaded with Keyway
S1	.350″ (8.9mm) Threaded with Keyway

Circuits

2	ON	NONE	ON
3	ON	OFF	ON
5	ON	NONE	(ON)
8	(ON)	OFF	(ON)
9	ON	OFF	(ON)
*4	ON	ON	ON
*6	(ON)	ON	(ON)
*7	ON	ON	(ON)

( ) = Momentary

* 3-ON circuits available with double and four pole bases only

Locking Lever

L	.201″ (5.1mm) Dia. Locking Lever

Bushing For Locking Levers

L2	Smooth with Keyway for Lever Lock

Standard Toggle, Bushing, & Terminal Combinations:

S2A2G30, S2A2G40, SS2G30, SS2G40, LL2G30, & LL2G40

IMPORTANT:

Switches are supplied without UL, cULus & CSA marking unless specified.
UL, cULus & CSA recognized only when ordered with marking on the switch.
Specific models, ratings & ordering instructions are noted on the General Specifications page.

ORDERING EXAMPLE

G 40 — □ □

Contact Materials & Ratings

W	Silver; Rated 6A @ 125V AC & 3A @ 250V AC
G	Gold; Rated 0.4VA max @ 28V AC/DC max
A	Gold over Silver; Rated 6A @ 125V AC & 0.4VA max @ 28V AC/DC max

Terminals

30	.150" (3.81mm) Right Angle PC (1-3 Pole)
32	Right Angle PCB (1 Pole & 0.4VA Rating Only)
40	.150" (3.81mm) Vertical PC (1-4 Pole)
45	.100" (2.54mm) Vertical PC (1-4 Pole)

Optional Caps

B	For S Bat Toggle
C	Conical Cap for S Bat Toggle

Cap for Locking Lever

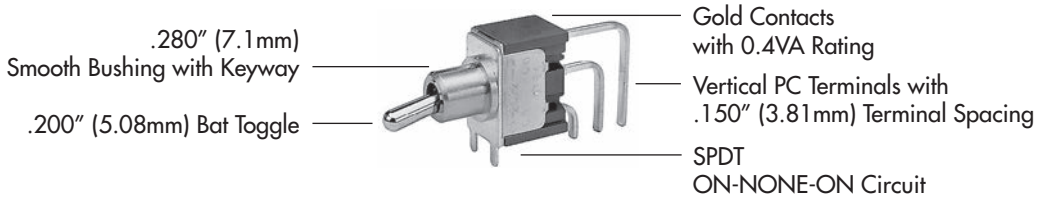
No Code	Nickel Plated Supplied with Switch
A	Black
C	Red
G	Blue

Cap Colors

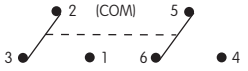
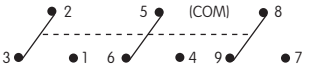
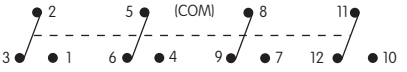
A	Black
B	White
C	Red
E	Yellow
F	Green
G	Blue

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

M2012S2A2G40

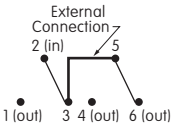
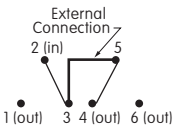
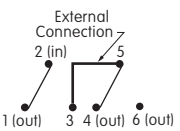
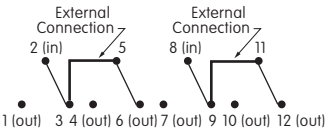
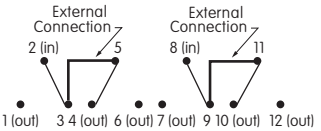
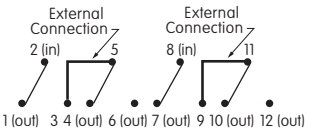


POLES & CIRCUITS

Pole	Model	Toggle Position ( ) = Momentary: Down (Keyway)	Center	Up	Connected Terminals: Down (Keyway)	Center	Up	Throw & Schematics
								Note: Terminal numbers are not actually on the switch. * Reverse circuits available for vertical mount SP & DP upon request.
SP	*M2012	ON	NONE	ON	2-3	OPEN	2-1	SPDT
	M2013	ON	OFF	ON				
	*M2015	ON	NONE	(ON)				
	*M2018	(ON)	OFF	(ON)				
	M2019	ON	OFF	(ON)				
DP	*M2022	ON	NONE	ON	2-3 5-6	OPEN	2-1 5-4	DPDT 
	M2023	ON	OFF	ON				
	*M2025	ON	NONE	(ON)				
	*M2028	(ON)	OFF	(ON)				
	M2029	ON	OFF	(ON)				
3P	M2032	ON	NONE	ON	2-3 5-6 8-9	OPEN	2-1 5-4 8-7	3PDT 
	M2033	ON	OFF	ON				
	M2035	ON	NONE	(ON)				
	M2038	(ON)	OFF	(ON)				
	M2039	ON	OFF	(ON)				
4P	M2042	ON	NONE	ON	2-3 5-6 8-9 11-12	OPEN	2-1 5-4 8-7 11-10	4PDT 
	M2043	ON	OFF	ON				
	M2045	ON	NONE	(ON)				
	M2048	(ON)	OFF	(ON)				
	M2049	ON	OFF	(ON)				

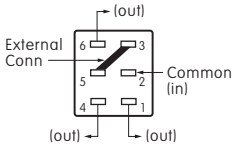
For 3 Throw (3-On)

Connected Terminals & Schematics

Pole	Model	Down	Center	Up	Down	Center	Up
SP	M2024	ON	ON	ON	 2-3 5-6	 2-3 5-4	 2-1 5-4
	M2026	(ON)	ON	(ON)			
	M2027	ON	ON	(ON)			
DP	M2044	ON	ON	ON	 2-3 5-6 8-9 11-12	 2-3 5-4 8-9 11-10	 2-1 5-4 8-7 11-10
	M2046	(ON)	ON	(ON)			
	M2047	ON	ON	(ON)			

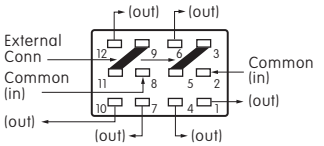
The SP3T model utilizes a double pole base.

External connection must be made during field installation.



The DP3T model utilizes a four pole base.

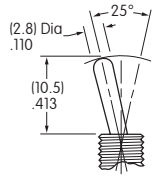
External connection must be made during field installation.



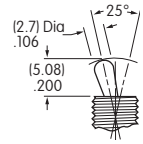
SMALL TOGGLES

Important:
Toggle length changes based on bushing selected. All illustrations are shown with .350" (8.9mm) long bushing. When using a .280" (7.1mm) long bushing, toggle length increases .070" (1.78mm).

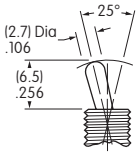
S **.413" (10.5mm) Bat**



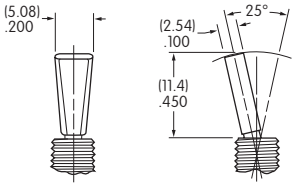
S2 **.200" (5.08mm) Bat**



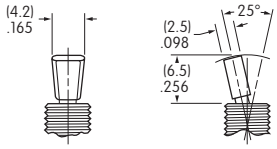
S3 **.256" (6.5mm) Bat**



E **.450" (11.4mm) Flatted**



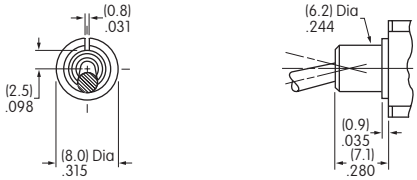
E2 **.256" (6.5mm) Flatted**



Standard Material & Finish: Brass with Bright Chrome
Contact factory for optional finishes.

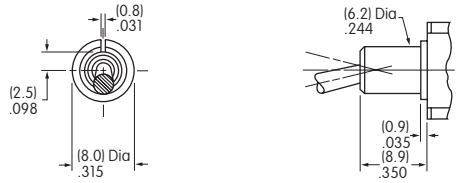
SMALL BUSHINGS

A2 **.280" (7.1mm) Smooth with Keyway**

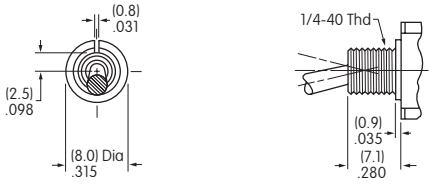


When using this bushing, toggle length is increased by .070" (1.78mm).

S2 **.350" (8.9mm) Smooth with Keyway**

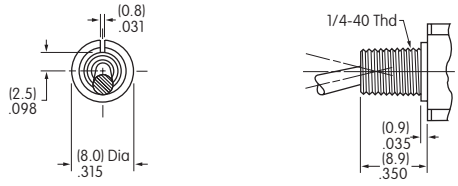


A1 **.280" (7.1mm) Threaded with Keyway**



When using this bushing, toggle length is increased by .070" (1.78mm). Maximum Panel Thickness with Standard Hardware: .031" (0.8mm)

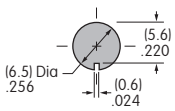
S1 **.350" (8.9mm) Threaded with Keyway**



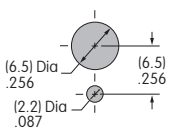
Maximum Panel Thickness with Standard Hardware: .102" (2.6mm)

Panel Cutouts

For A2, S2, A1 or S1 Bushing with Keyway



For A1 or S1 Bushing with Locking Ring

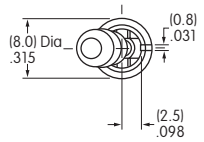


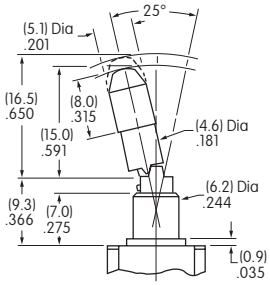
Standard Hardware:
2 Hex Nuts (AT513H)
1 Lockwasher (AT509)
1 Locking Ring (AT507H)

For dimensions, see Accessories & Hardware section.

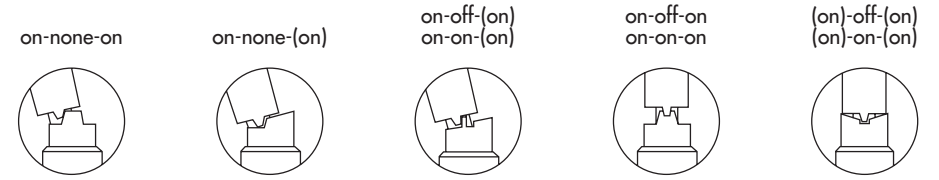
LOCKING LEVER & BUSHING

LL2 **Smooth with Keyway**



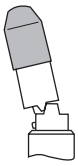


Locking Mechanism



2 positions lock | 1 position locks | 2 positions lock | 3 positions lock | 1 position locks

No Code **Cap for Locking Lever**



Supplied with Cap AT427
Material & Finish:
Brass with Nickel Plating

Lever Material & Finish:
Brass with Chrome Plating

Color Codes for Optional Anodized Aluminum Caps

A Black
C Red
G Blue

CONTACT MATERIALS & RATINGS

W	**Silver over Silver**	**Power Level**	**6A @ 125V AC & 3A @ 250V AC**
G	**Gold over Brass or Copper**	**Logic Level**	**0.4VA maximum @ 28V AC/DC maximum**

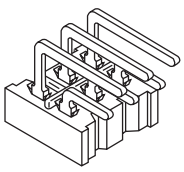
Note: See Supplement section to find complete explanation of operating range.

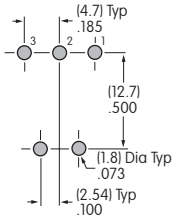
A	**Gold over Silver**	**Power Level or Logic Level**	**6A @ 125V AC or 0.4VA maximum @ 28V AC/DC maximum**

Note: This dual rated option is suitable when two or more identical switches are used in logic and in power circuits within the same application. See Supplement section to find complete explanation of dual rating and operating range.

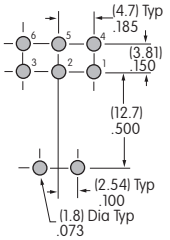
TERMINALS

30 **.150" (3.81mm) Right Angle PC (1-3 Pole)**

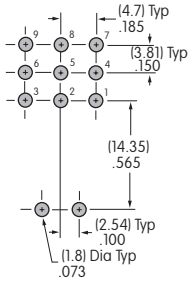




Single Pole

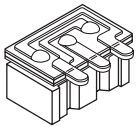


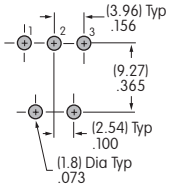
Double Pole



Three Pole

32 **Right Angle PCB with Reverse Circuit (1 Pole & 0.4VA Rating Only)**

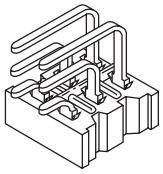


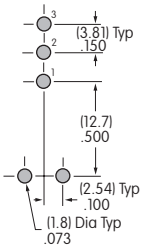


Terminal dimensions are shown on the Typical Switch Dimensions pages which follow.

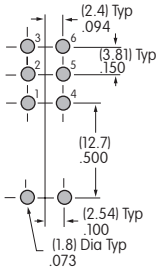
TERMINALS (Continued)

40 **.150" (3.81mm)**
Vertical PC (1-4 Pole)

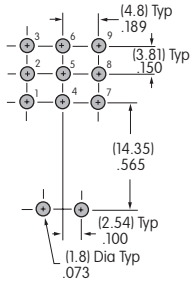




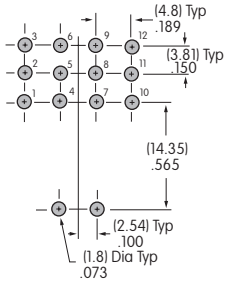
Single Pole



Double Pole

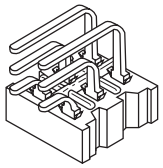


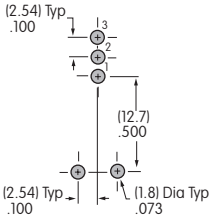
Three Pole



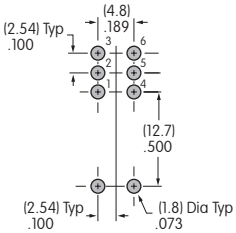
Four Pole

45 **.100" (2.54mm)**
Vertical PC (1-4 Pole)

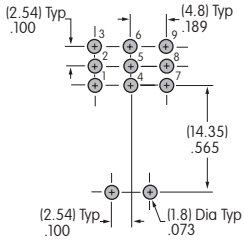




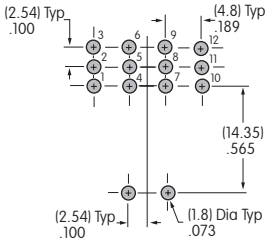
Single Pole



Double Pole



Three Pole



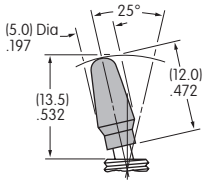
Four Pole

Terminal dimensions are shown on the Typical Switch Dimensions pages which follow.

OPTIONAL CAPS & CAP COLORS

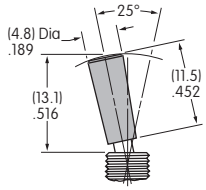
B *** AT415**
for S Bat Toggle

Material:
Polyethylene



C *** AT444**
Conical Cap for S Bat Toggle

Material:
Polyethylene



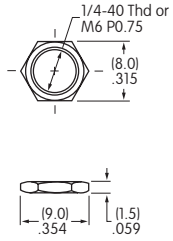
Colors Available

A	Black	**E**	Yellow
B	White	**F**	Green
C	Red	**G**	Blue

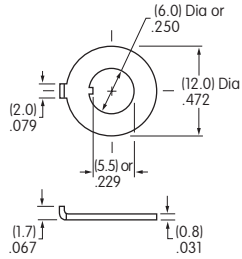
* AT415 and AT444 for use with S toggles only, not S2 or S3 toggles.

STANDARD HARDWARE

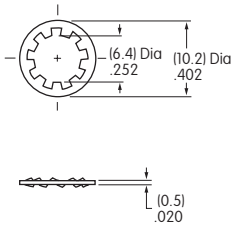
AT513H for Inch
AT513M for Metric
Hex Nut (2 per switch)
Brass/Nickel



AT507H for Inch
AT507M for Metric
Locking Ring (1 per switch)
Steel with Zinc/Chromate

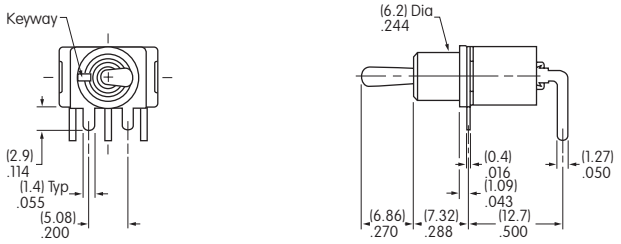


AT509
Lockwasher (1 per switch, none with splashproof)
Steel with Zinc/Chromate



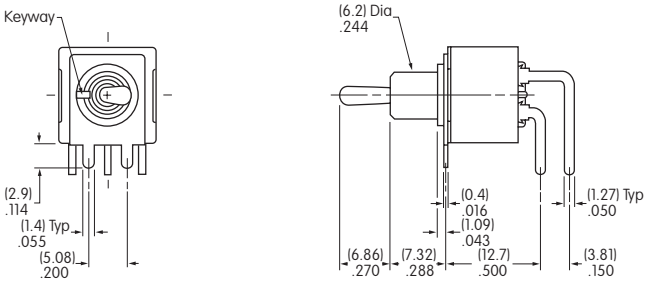
TYPICAL SWITCH DIMENSIONS

.150" (3.81mm) Right Angle PC — Single Pole



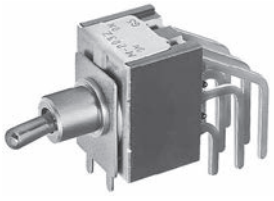
M2012S2A2G30

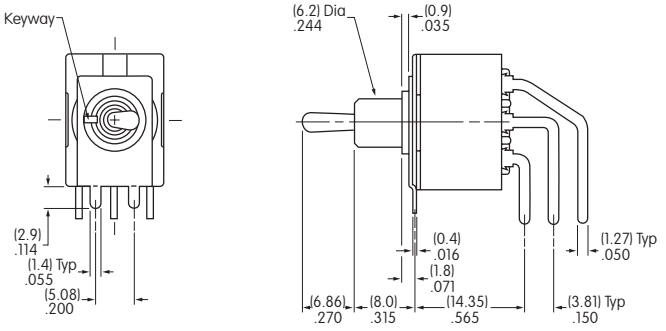
.150" (3.81mm) Right Angle PC — Double Pole



M2022S2A2G30

.150" (3.81mm) Right Angle PC — Three Pole



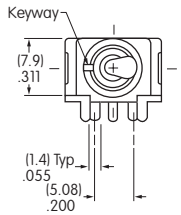


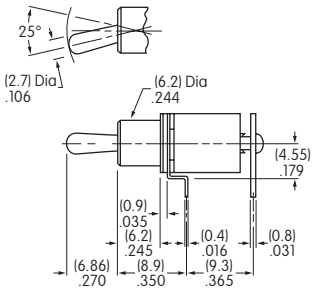
M2032S2A2G30

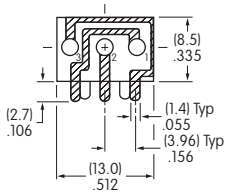
TYPICAL SWITCH DIMENSIONS

Single Pole • Reverse Circuit

Right Angle PCB



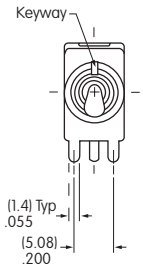


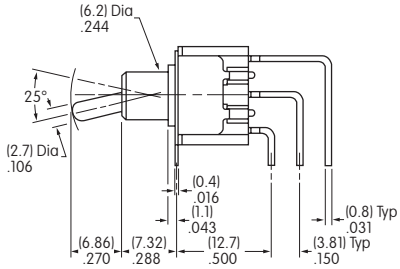


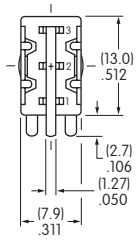
M2012S2A2G32

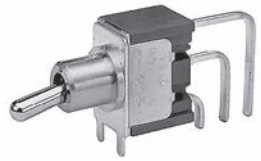
Single Pole

.150" (3.81mm) Vertical PC





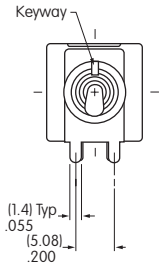


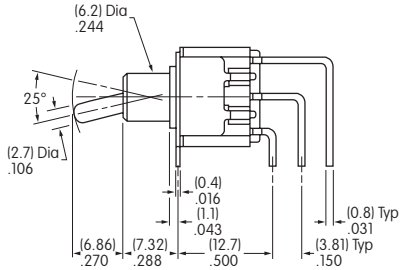


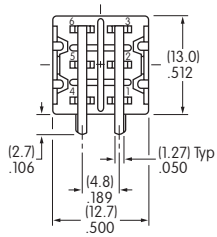
M2012S2A2G40

Double Pole

.150" (3.81mm) Vertical PC



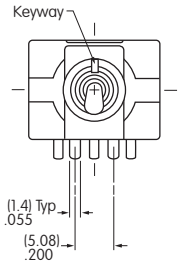


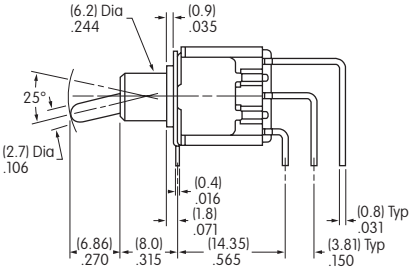


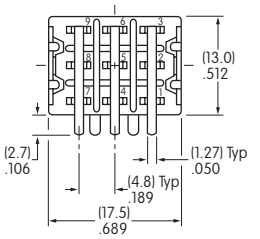
M2022S2A2G40

TYPICAL SWITCH DIMENSIONS

.150" (3.81mm) Vertical PC — Three Pole

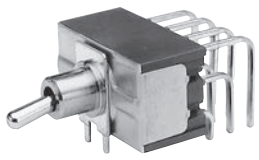


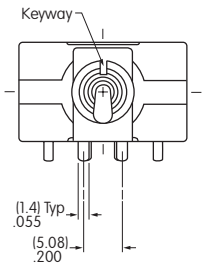


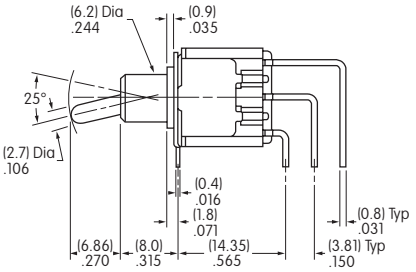


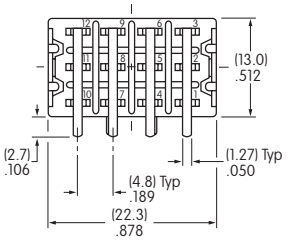
M2032S2A2G40

.150" (3.81mm) Vertical PC — Four Pole



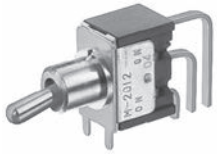


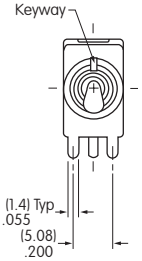


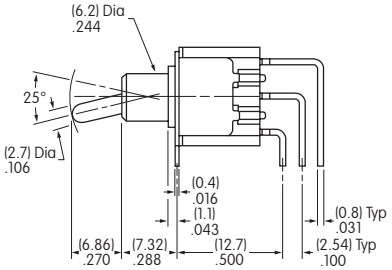


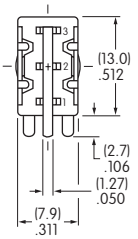
M2042S2A2G40

.100" (2.54mm) Vertical PC — Single Pole





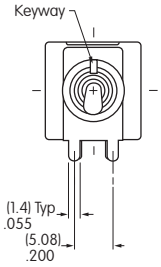


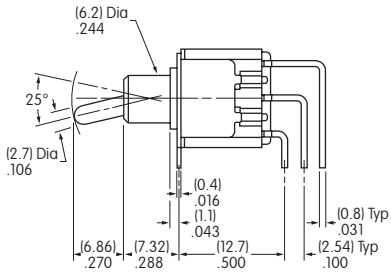


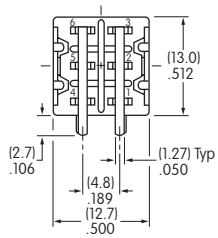
M2012S2A2G45

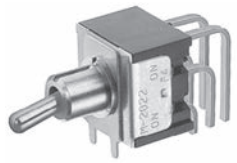
TYPICAL SWITCH DIMENSIONS

Double Pole — .100" (2.54mm) Vertical PC



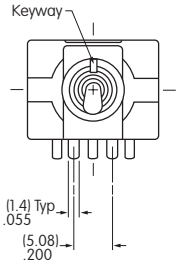


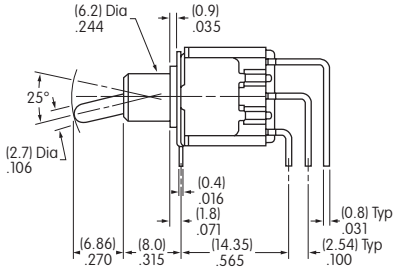


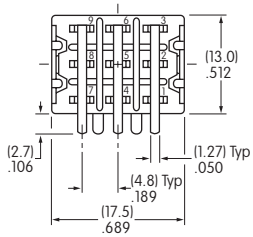


M2022S2A2G45

Three Pole — .100" (2.54mm) Vertical PC

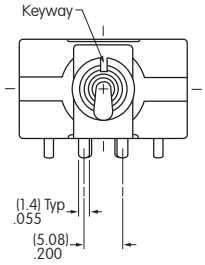


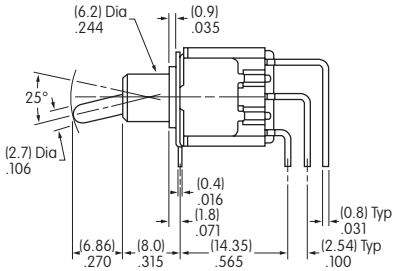


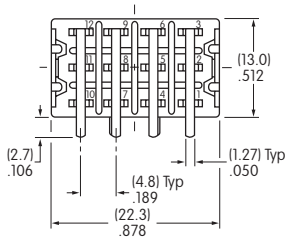


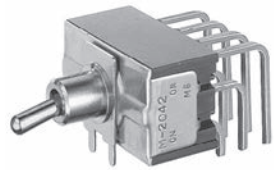
M2032S2A2G45

Four Pole — .100" (2.54mm) Vertical PC









M2042S2A2G45

General Specifications

Electrical Capacity (Resistive Load)

Power Level (silver): 6A @ 125V AC or 3A @ 250V AC or 3A @ 30V DC
Logic Level (gold): 0.4VA maximum @ 28V AC/DC maximum
(Applicable Range 0.1mA ~ 0.1A @ 20mV ~ 28V)
Note: Find additional explanation of operating range in Supplement section.

Other Ratings

Contact Resistance: 10 milliohms maximum for silver; 20 milliohms maximum for gold
Insulation Resistance: 1,000 megohms minimum @ 500V DC
Dielectric Strength: 1,000V AC minimum between contacts for 1 minute minimum;
1,500V AC minimum between contacts & case for 1 minute minimum
Mechanical Life: 50,000 operations minimum
Electrical Life: 25,000 operations minimum
Nominal Operating Force:

	On-to-On Position	Off-to-On Position
Single Pole	3.19N	3.92N
Double Pole	4.41N	7.06N

Angle of Throw: 20°

Materials & Finishes

Bushing: Brass with nickel plating
Housing: Stainless steel
Mounting Bracket: Steel with tin plating
Movable Contacts: Silver alloy or silver alloy with gold plating
Stationary Contacts: Silver with silver plating or copper or brass with gold plating
Lamp Contacts: Phosphor bronze
Base: Diallyl phthalate (UL94V-0)
Switch Terminals: Copper with silver or gold plating
Lamp Terminals: Brass with silver or gold plating

Environmental Data

Operating Temp Range: –10°C through +55°C (+14°F through +131°F)
Humidity: 90 ~ 95% humidity for 96 hours @ 40°C (104°F)
Vibration: 10 ~ 55Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in 1 minute; 3 right angled directions for 2 hours
Shock: 50G (490m/s²) acceleration (tested in 6 right angled directions, with 5 shocks in each direction)

Installation

Mounting Torque: 1.47Nm (13 lb•in) for double nut; .67Nm (6 lb•in) for single nut
Soldering Time & Temp: Wave Soldering (PC version): See Profile B in Supplement section.
Manual Soldering: See Profile B in Supplement section.
Note: Lever must be in center position while soldering.
Cleaning: PC mountable device is not process sealed. Hand clean locally using alcohol based solution.

Standards & Certifications

Flammability Standards: UL94V-0 base
UL: **File No. E44145 - Recognized only when ordered with marking on switch.**
Add "/U" to end of part number to order UL recognized switch.
Single pole with synchronous circuits & single color LEDs & solder lug or PC recognized at 6A @ 125V AC.
CSA: **File No. 023535_0_000 - Certified only when ordered with marking on switch.**
Add "/C" to end of part number to order CSA certified switch.
All single pole with synchronous circuits & single color LEDs certified at 6A @ 125V AC.

Distinctive Characteristics

Industry's first LED illumination at tip of toggle switches.

Single color LEDs of red, yellow, and green, plus bicolor red/green, to meet varied design requirements.

LEDs can operate independently from or synchronously with switching operation.

Antijamming feature to protect contacts from damage due to excessive downward force on the toggle.

High torque bushing prevents the bushing from rotating or separating from the metal frame during installation.

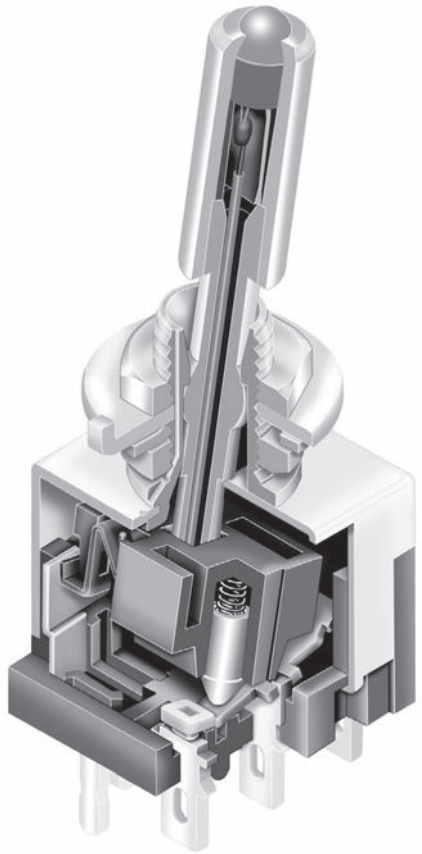
Stainless steel frame resists corrosion.

Silver contacts are of specially composed alloy for hardness.

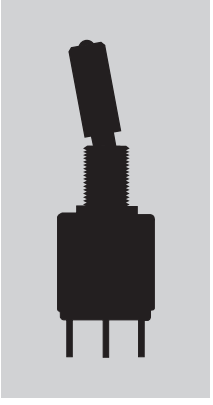
High insulating barriers protect against crossover in double pole devices.

Terminals are molded in and epoxy sealed to lock out flux, dust, and other contaminants.

1,500V dielectric strength between switch contacts and case is accomplished by clinching the frame away from the terminals.



Actual Size



Series M2100

LED Tipped Toggles

TYPICAL SWITCH ORDERING EXAMPLE

M21 [1] [2] [T] [C] [W] [01] [ ]

Poles

1	SPDT
* 2	DPDT

* Available only with Terminals 01, 02, 03

LED Circuits & Actuator Types

L	Isolated
T	Synchronous

Contact Materials & Ratings

W	Silver; Rated 6A @ 125V AC
G	Gold; Rated 0.4VA max @ 28V AC/DC max

Threaded Bushings

No Code	1/4–40 Thread (Inch)
/M	6mm Thread (Metric)

Circuits

2	ON	NONE	ON
3	ON	OFF	ON

LED Colors

Single Color	
C	Red
E	Yellow
F	Green
Bicolor	
CF	Red/Green

Terminals & Mounting Types

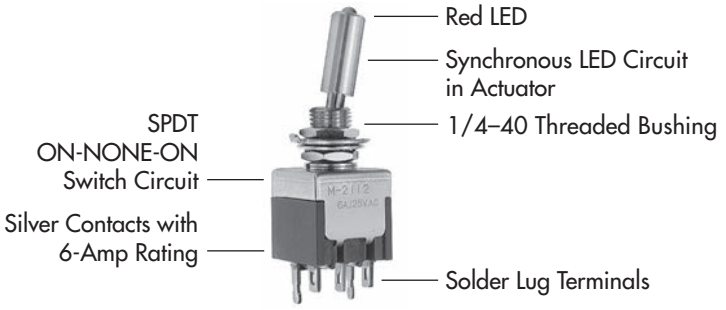
01	Solder Lug with Threaded Bushing
02	Quick Connect with Threaded Bushing
03	Straight PC with Threaded Bushing
30	Right Angle PC with Smooth Bushing (available with gold contacts only)

IMPORTANT:

Switches are supplied without UL & CSA marking unless specified.
UL & CSA recognized only when ordered with marking on the switch.
Specific models, ratings, & ordering instructions are noted on the General Specifications page.

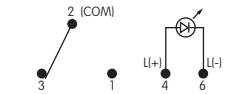
DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

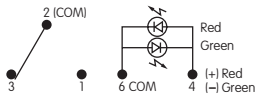
M2112TCW01

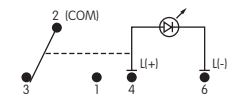


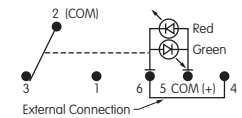
POLES & CIRCUITS & LED ILLUMINATION

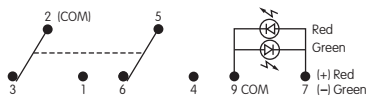
Model	Pole & Throw	Toggle Position & Terminal Numbers: Down (Keyway)	Center	Up	Schematics
					Notes: Terminal numbers are not actually on the switch. LEDs require an external power source.
M2112	**SPDT**	ON	NONE	ON	Isolated Single Color LED
Connected Power Terminals		2-3	NONE	2-1	
LED Circuit: **Isolated LEDs** (see schematics) Connected LED Terminals		ON 4-6	NONE NONE	ON 4-6	
LED Circuit: **Synchronous Single Color LED** Connected LED Terminals		ON 4-6	NONE NONE	OFF OPEN	Isolated Bicolor LED
LED Circuit: **Synchronous Bicolor LED** Connected LED Terminals		Red 5-6	NONE NONE	Green 5-4	
M2113	**SPDT**	ON	OFF	ON	Synchronous Single Color LED
Connected Power Terminals		2-3	OPEN	2-1	
LED Circuit: **Isolated LEDs** (see schematics) Connected LED Terminals		ON 4-6	ON 4-6	ON 4-6	
LED Circuit: **Synchronous Single Color LED** Connected LED Terminals		ON 4-6	OFF OPEN	ON 4-6	Synchronous Bicolor LED
LED Circuit: **Synchronous Bicolor LED** Connected LED Terminals		Red 5-6	OFF OPEN	Green 5-4	
M2122	**DPDT**	ON	NONE	ON	Isolated Single Color LED
Connected Power Terminals		2-3 5-6	NONE	2-1 5-4	
LED Circuit: **Isolated LEDs** (see schematics) Connected LED Terminals		ON 7-9	NONE NONE	ON 7-9	
LED Circuit: **Synchronous Single Color LED** Connected LED Terminals		ON 7-9	NONE NONE	OFF OPEN	Isolated Bicolor LED
LED Circuit: **Synchronous Bicolor LED** Connected LED Terminals		Red 8-9	NONE NONE	Green 8-7	
M2123	**DPDT**	ON	OFF	ON	Synchronous Single Color LED
Connected Power Terminals		2-3 5-6	OPEN	2-1 5-4	
LED Circuit: **Isolated LEDs** (see schematics) Connected LED Terminals		ON 7-9	ON 7-9	ON 7-9	
LED Circuit: **Synchronous Single Color LED** Connected LED Terminals		ON 7-9	OFF OPEN	ON 7-9	Synchronous Bicolor LED
LED Circuit: **Synchronous Bicolor LED** Connected LED Terminals		Red 8-9	OFF OPEN	Green 8-7	

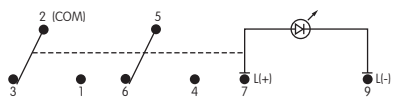


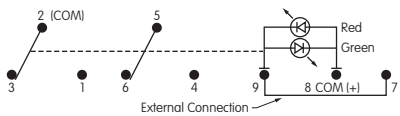












Series M2100

LED Tipped Toggles

LED COLORS & SPECIFICATIONS

The electrical specifications shown are determined at a basic temperature of 25°C. LED circuit is isolated and requires an external power source. If the source voltage exceeds the rated voltage, a ballast resistor is required. The resistor value can be calculated by using the formula in Supplement Section.

The LED is an integral part of the switch and not available separately. Bicolor LED is translucent white when unlit.		Single Color			Bicolor	
	Color	C Red	E Yellow	F Green	CF Red/Green	Units
Maximum Forward Current	I_{FM}	25	30	30	25	mA
Typical Forward Current	I_F	20	20	20	10	mA
Forward Voltage	V_F	2.1	2.1	2.1	1.7/2.0	V
Maximum Reverse Voltage	V_{RM}	4	4	4	——	V
Current Reduction Rate Above 25°C	ΔI_F	0.33	0.40	0.40	0.33/0.33	mA/°C
Ambient Temperature Range		−10° ~ +55°C				

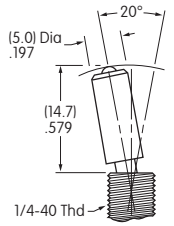
LED CIRCUIT, TOGGLE, & MOUNTING TYPE COMBINATIONS

L **Toggle with Isolated LED Circuit**

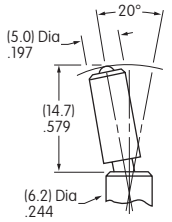
T **Toggle with Synchronous LED Circuit**

Finish: Brushed aluminum

Standard Hardware: 2 AT513H Hex Nuts, 1 AT507H Locking Ring, 1 AT509 Lockwasher Standard & optional hardware details in Accessories & Hardware section.

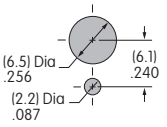


Threaded Bushing combines with Terminal codes 01, 02, & 03.

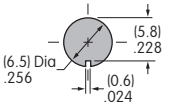


Smooth Bushing combines with Terminal code 30.

Max. Panel Thickness with Standard Hardware .102" (2.6mm)



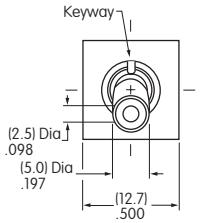
Max. Panel Thickness without Locking Ring .134" (3.4mm)



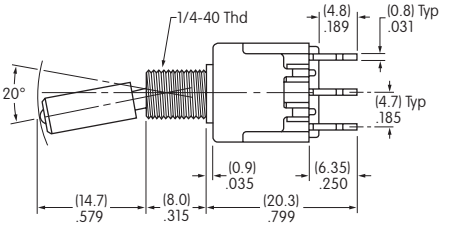
TYPICAL SWITCH DIMENSIONS

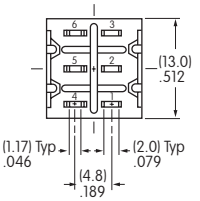
Solder Lug

M2112TCFW01



Single Pole

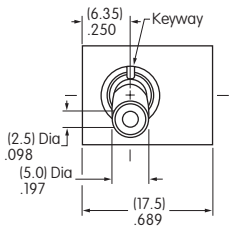


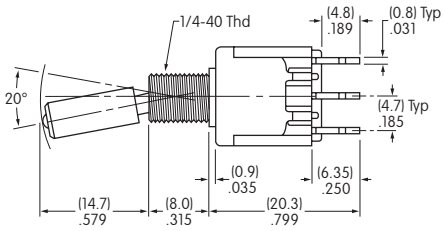


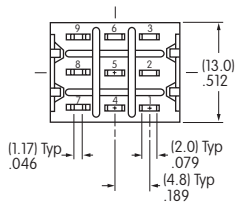
Single color LED switch does not have terminal 5.

TYPICAL SWITCH DIMENSIONS

Double Pole





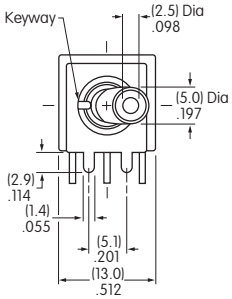


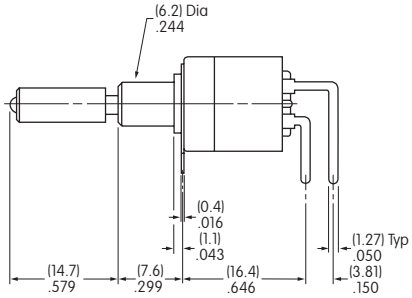
Solder Lug

Single color LED switch does not have terminal 8.

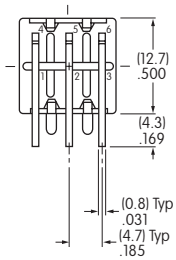
M2122TCFW01

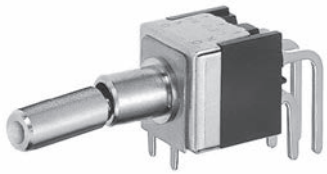
Single Pole Only





Right Angle PC





Single color LED switch does not have terminal 5.

Gold contact material only

M2112TCFG30

CONTACT MATERIALS & RATINGS

W	**Silver over Silver**	**Power Level**	**6A @ 125V AC & 3A @ 250V AC**
G	**Gold over Brass or Copper**	**Logic Level**	**0.4VA maximum @ 28V AC/DC maximum**

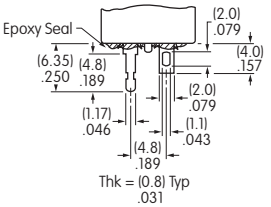
Complete explanation of operating range in Supplement section.

Series M2100

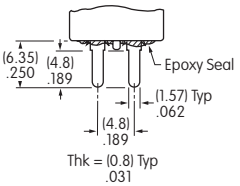
LED Tipped Toggles

TERMINALS

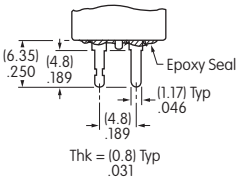
01 Solder Lug with Turret LED Terminal



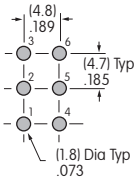
02 Quick Connect



03 Straight PC with Turret LED Terminal

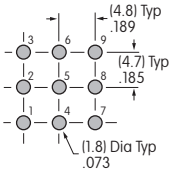


Single Pole



Single color LED & isolated bicolor LED switches do not have terminal 5.

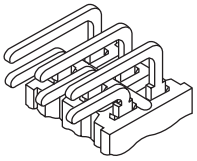
Double Pole



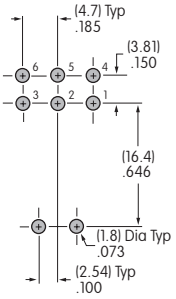
Single color LED & isolated bicolor LED switches do not have terminal 8.

30 Right Angle PC

LED terminals only available in brass with silver plating



Single Pole

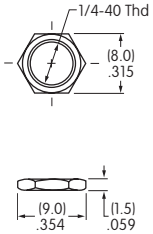


Single color LED & isolated bicolor LED switches do not have terminal 5.

STANDARD MOUNTING HARDWARE

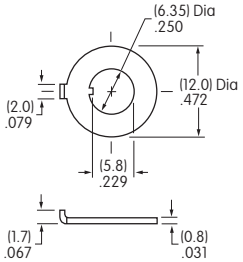
AT513H Hexagon Nut
(2 per switch)

Material:
Brass with nickel plating



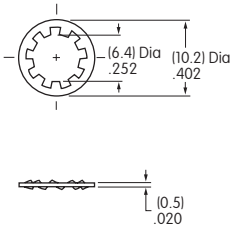
AT507H Locking Ring
(1 per switch)

Material:
Steel with chromate over zinc



AT509 Lockwasher
(1 per switch)

Material:
Steel with chromate over zinc



Optional Hardware: Knurled nuts, dress nuts, and ON-OFF plates are available; see details in Accessories & Hardware section.

General Specifications

Electrical Capacity (Resistive Load)

Power Level (silver): 6A @ 125V AC or 3A @ 250V AC;
4A @ 30V DC (On-On circuit) & 3A @ 30V DC (all other circuits)

Logic Level (gold): 0.4VA maximum @ 28V AC/DC maximum
(Applicable Range 0.1mA ~ 0.1A @ 20mV ~ 28V)

Logic/Power Level (gold over silver): Combines silver & gold ratings

Note: Find additional explanation of dual rating & operating range in Supplement section.

Other Ratings

Contact Resistance: 10 milliohms maximum for silver; 20 milliohms maximum for gold

Insulation Resistance: 1,000 megohms minimum @ 500V DC

Dielectric Strength: 1,000V AC minimum between contacts for 1 minute minimum;
1,500V AC minimum between contacts & case for 1 minute minimum

Mechanical Life: 100,000 operations minimum

Electrical Life: 25,000 operations minimum for silver; 50,000 operations minimum for gold

Contact Timing: Nonshorting (break-before-make)

Angle of Throw: 26°

Materials & Finishes

Toggle/Lever: Brass with nickel plating

Support Bracket: Brass with tin plating

Bushing/Housing: Glass fiber reinforced polyamide (UL94V-0)

Sealing Ring: Nitrile butadiene rubber

Base: Glass fiber reinforced polyamide (UL94V-0)

Movable Contacts: Silver alloy with silver plating (code W); copper or phosphor bronze with gold plating (code G);
or silver alloy with gold plating (code A)

Stationary Contacts: Silver alloy with silver plating (code W); copper or brass with gold plating (code G);
or silver alloy with gold plating (code A)

Terminals: Copper or brass with silver or gold plating

Environmental Data

Operating Temp Range: –30°C through +85°C (–22°F through +185°F)

Humidity: 90 ~ 95% humidity for 96 hours @ 40°C (104°F)

Vibration: 10 ~ 55Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in
1 minute; 3 right angled directions for 2 hours

Shock: 50G (490m/s^2) acceleration (tested in 6 right angled directions, with 5 shocks in each direction)

PCB Processing

Soldering: Wave Soldering Recommended: See Profile B in Supplement section.
Manual Soldering: See Profile B in Supplement section.

Cleaning: Automated cleaning. See Cleaning specifications in Supplement section.

Standards & Certifications

Flammability Standards: UL94V-0 rated bushing/housing & base

UL: **File No. E44145 - Recognized only when ordered with marking on switch.**
Add "/U" or "/CUL" before first dash in part number to order UL recognized switch.
All models recognized at 6A @ 125V AC, 3A @ 250V AC, & 4A @ 30V DC or 0.4A @ 28V DC.

CSA: **File No. 023535_0_000 - Certified only when ordered with marking on switch.**
Add "/C" to end of part number to order CSA certified switch.
All models certified at 6A @ 125V AC, 3A @ 250V AC, & 4A @ 30V DC.

Distinctive Characteristics

Antijamming actuator design protects against mechanism damage from downward force on the toggle.

Single unit construction of the bushing and top of the housing gives protection from cleaning fluids or other liquids.

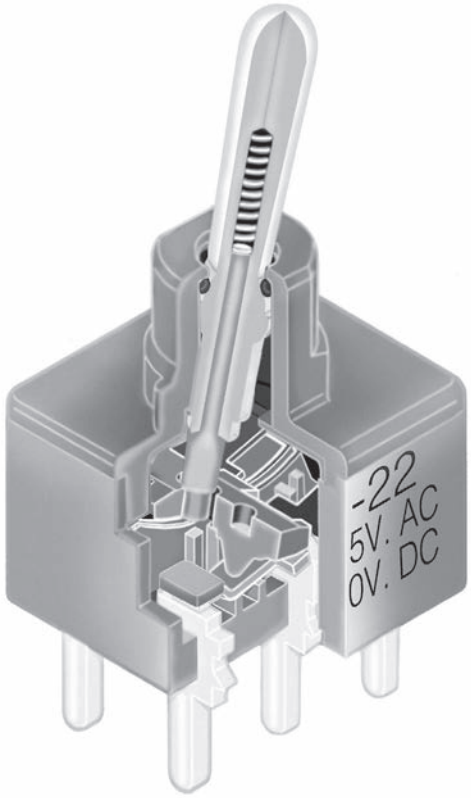
O-ring surrounding actuator at top of bushing interior prevents liquids from reaching switch mechanism.

Ultrasonic welding of upper and lower housing seals out contaminants and allows automated soldering and cleaning.

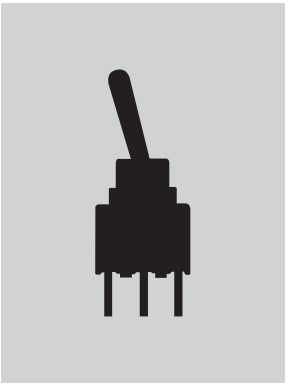
Terminals are epoxy sealed to prevent entry of flux, solvents, and other contaminants.

Bracketed models have crimped legs to ensure secure PC mounting and prevent dislodging during automated soldering.

Logic level and power capabilities are available to suit varying applications.



Actual Size



TYPICAL SWITCH ORDERING EXAMPLE

M2T | 1 | 2 | S | A5 | G | 03

Poles

1	SPDT
2	DPDT

Bushing

A5	.250″ (6.35mm) Double Flatted

PC Terminals

03	Straight
13	Straight with .460″ (11.7mm) Bracket
30	.150″ (3.81mm) Right Angle
40	.150″ (3.81mm) Vertical
05	.390″ (9.9mm) Extended PC
06	.728″ (18.5mm) Extended PC
07	.945″ (24.0mm) Extended PC

Circuits

2	ON	NONE	ON
3	ON	OFF	ON
5	ON	NONE	(ON)
8	(ON)	OFF	(ON)
9	ON	OFF	(ON)

( ) = Momentary

Contact Materials & Ratings

W	Silver; Rated 6A @ 125V AC & 3A @ 250V AC
G	Gold; Rated 0.4VA max @ 28V AC/DC max
A	Gold over Silver; Rated 6A @ 125V AC & 0.4VA max @ 28V AC/DC max

Actuators

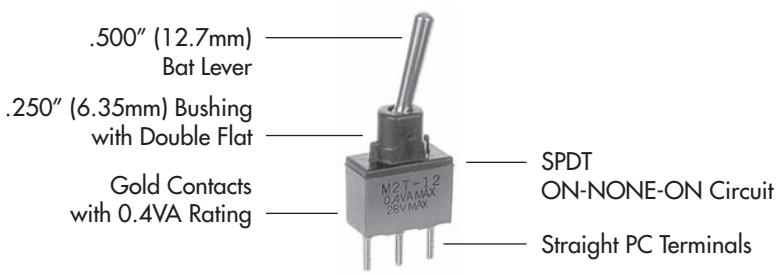
S	.500″ (12.7mm) Bat Lever (standard combination with code 03 straight terminals)
S4	.300″ (7.62mm) Bat Lever (standard combinations with codes 13, 30 & 40 bracketed terminals)

IMPORTANT:

Switches are supplied without UL, cULus & CSA marking unless specified. **UL, cULus & CSA recognized only when ordered with marking on the switch.** Specific models, ratings & ordering instructions are noted on the General Specifications page.

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

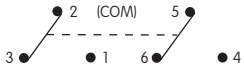
M2T12SA5G03



POLES & CIRCUITS

Pole	Model	Toggle Position ( ) = Momentary: Down	Center	Up	Connected Terminals: Down	Center	Up	Throw & Schematics
SP	**M2T12** **M2T13** **M2T15** **M2T18** **M2T19**	ON ON ON (ON) ON	NONE OFF NONE OFF OFF	ON ON (ON) (ON) (ON)	2-3	OPEN	2-1	SPDT
DP	**M2T22** **M2T23** **M2T25** **M2T28** **M2T29**	ON ON ON (ON) ON	NONE OFF NONE OFF OFF	ON ON (ON) (ON) (ON)	2-3 5-6	OPEN	2-1 5-4	DPDT

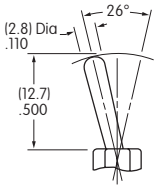
Note: Terminal numbers are not actually on the switch.



ACTUATORS

S **.500" (12.7mm) Bat Lever**

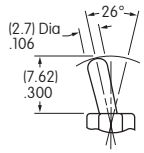
Material:
Nickel over Brass



Standard Combinations: S Bat Lever with straight terminals (code 03) with silver or gold contacts.

S4 **.300" (7.62mm) Bat Lever**

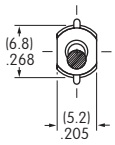
Material:
Nickel over Brass

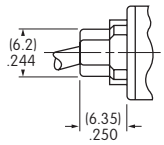


Standard Combinations: S4 Bat Lever with bracketed terminals (codes 13, 30, 40) with silver or gold contacts.

BUSHING

A5 **.250" (6.35mm) Double Flatted**





CONTACT MATERIALS & RATINGS

W	**Silver over Silver**	**Power Level**	**6A @ 125V AC & 3A @ 250V AC**
G	**Gold over Brass or Copper**	**Logic Level**	**0.4VA maximum @ 28V AC/DC maximum**

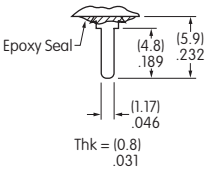
Complete explanation of operating range in Supplement section.

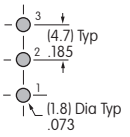
A	**Gold over Silver**	**Power Level or Logic Level**	**6A @ 125V AC or 0.4VA maximum @ 28V AC/DC maximum**

Note: This dual rated option is suitable when two or more identical switches are used in logic and in power circuits within the same application. See Supplement section for complete explanation of dual rating and operating range.

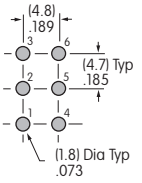
PC TERMINALS

03 Straight



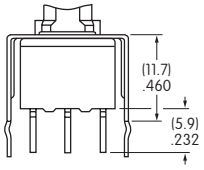


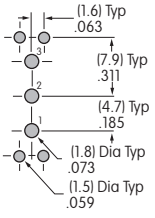
Single Pole



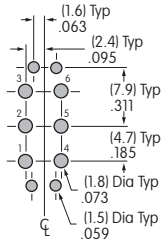
Double Pole

13 Straight with .460" (11.7mm) Bracket



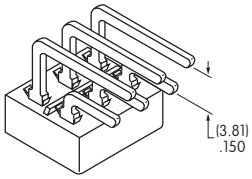


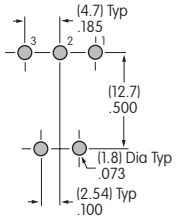
Single Pole



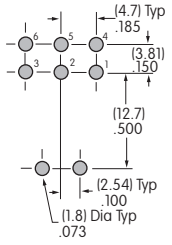
Double Pole

30 .150" (3.81mm) Right Angle



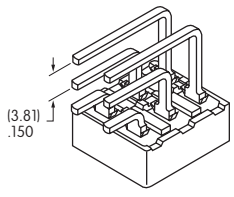


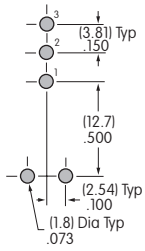
Single Pole



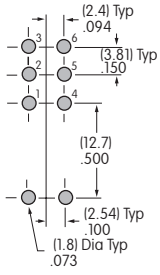
Double Pole

40 .150" (3.81mm) Vertical





Single Pole

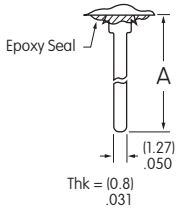


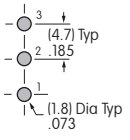
Double Pole

05 .390" (9.9mm) Extended PC

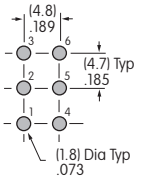
06 .728" (18.5mm) Extended PC

07 .945" (24.0mm) Extended PC





Single Pole

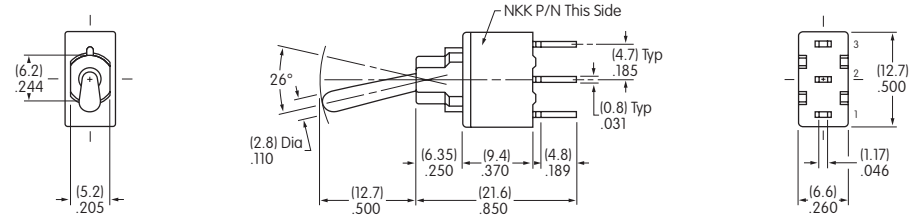


Double Pole

Dimension A = terminal lengths as shown beside the terminal codes at the left.

TYPICAL SWITCH DIMENSIONS

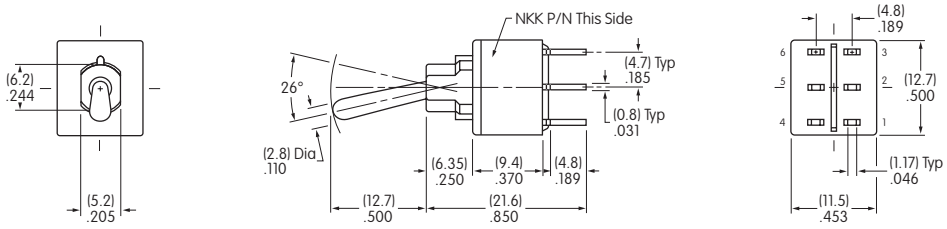
Single Pole — Straight PC



Actuator in Down Position

M2T12SA5G03

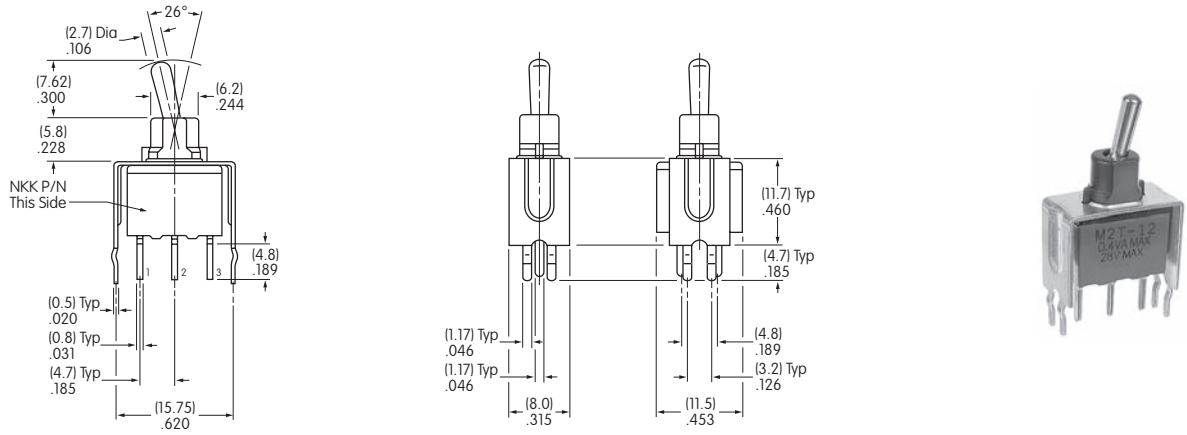
Double Pole — Straight PC



Actuator in Down Position

M2T22SA5G03

Single & Double Pole — Straight PC • Bracket



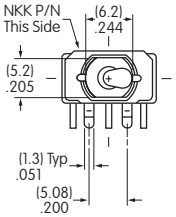
Actuator in Down Position

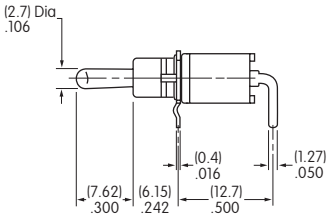
M2T12S4A5G13

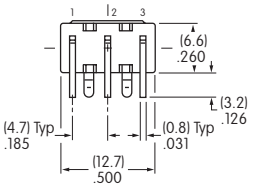
TYPICAL SWITCH DIMENSIONS

Right Angle PC

Single Pole





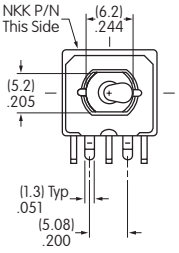


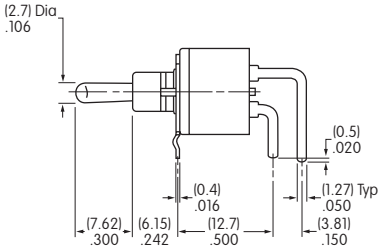
M2T12S4A5G30

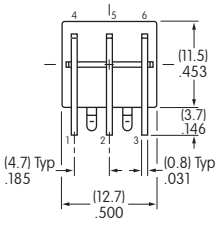
Actuator in Down Position

Right Angle PC

Double Pole





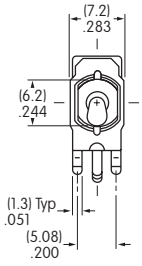


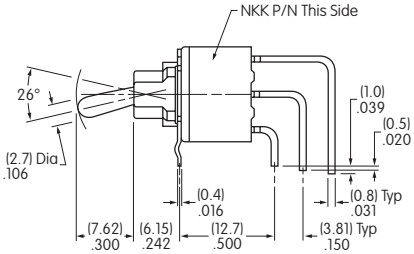
M2T22S4A5G30

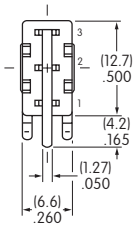
Actuator in Down Position

Vertical PC

Single Pole







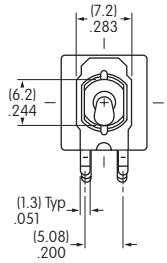
M2T12S4A5G40

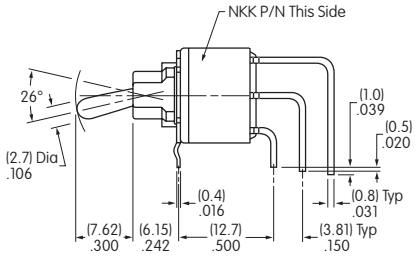
Actuator in Down Position

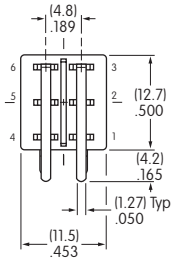
TYPICAL SWITCH DIMENSIONS

Double Pole

Vertical PC







Actuator in Down Position

M2T22S4A5G40

HANDLING PRECAUTION

When an application employs M2T model with silver contacts, 5 to 6A @ 125V AC, and the switch will be actuated 100 or more times per day, note these instructions:

Peel off the film seal on the switch body situated over the part number after cleaning.

General Specifications

Electrical Capacity

Resistive Load: 10A @ 125V AC or 6A @ 250V AC
Motor Load: 400W @ 125V AC
Lamp Load: 2A @ 125V AC for On-Off-On circuit & 3A @ 125V AC for other circuits

Other Ratings

Contact Resistance: 10 milliohms maximum
Insulation Resistance: 1,000 megohms minimum @ 500V DC
Dielectric Strength: 2,000V AC minimum between contacts for 1 minute minimum;
4,000V AC minimum between contacts & case for 1 minute minimum
Mechanical Life: 100,000 operations minimum
Electrical Life: 25,000 operations minimum
Angle of Throw: 25°

Materials & Finishes

Toggle Cap: Polypropylene
Lever: Brass with chrome plating
Bushing: Brass with nickel plating
Frame: Stainless steel
Case/Base: Diallyl phthalate resin (UL94V-0)
Movable Contacts: Silver alloy with silver plating
Stationary Contacts: Pure silver with silver plating
Terminals: Copper with silver plating

Environmental Data

Operating Temp Range: –10°C through +85°C (+14°F through +185°F)
Humidity: 90 ~ 95% humidity for 96 hours @ 40°C (104°F)
Vibration: 10 ~ 55Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in 1 minute; 3 right angled directions for 2 hours
Shock: 50G (490m/s^2) acceleration (tested in 6 right angled directions, with 5 shocks in each direction)

Installation

Soldering Time & Temp: Wave Soldering Recommended (Straight PC): See Profile A in Supplement section.
Manual Soldering: See Profile A in Supplement section.
Cleaning: These devices are not process sealed. Hand clean locally using alcohol based solution.

Standards & Certifications

Flammability Standards: UL94V-0 rated case/base
UL: **File No. E44145 - Recognized only when ordered with marking on switch.**
Add "/U" or "/CUL" to end of part number to order UL recognized switch.
All models recognized at 10A @ 125V AC & 6A @ 250V AC.

CSA: **File No. 023535_0_000 - Certified only when ordered with marking on switch.**
Add "/C" to end of part number to order CSA certified switch.
All models certified at 10A @ 125V AC & 6A @ 250V AC.

VDE: **License No. 119174**
All models approved at 10A @ 125V AC & 6A @ 250V AC.
Marking on switch is standard. All models meet EN 61058-1 standard.

Distinctive Characteristics

Meets EN 61058-1 standard.

High torque bushing construction prevents rotation or separation from frame during installation.

Stainless steel frame resists corrosion and increases environmental safety.

Case/base of heat resistant resin meets UL94V-0 flammability standard.

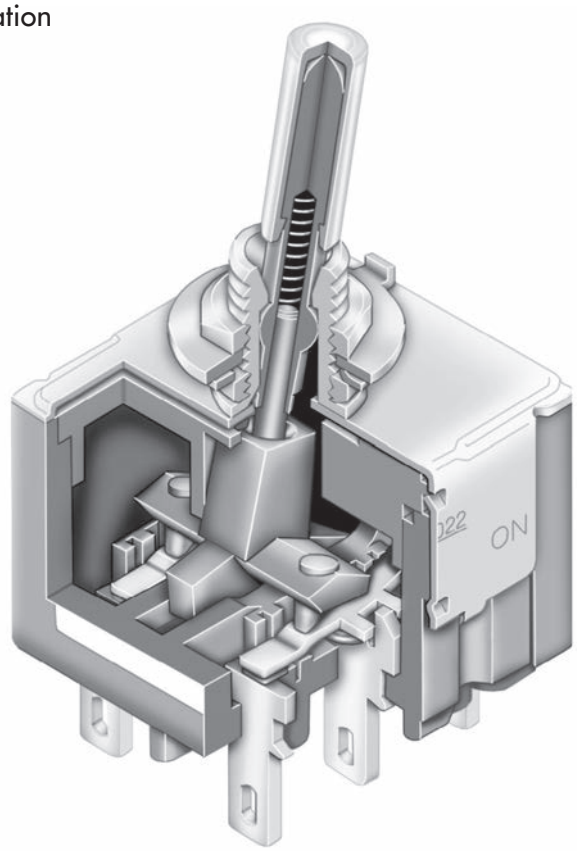
Contacts of special silver alloy resist arcing and guarantee stable electrical contact and long life.

High insulating barriers increase isolation of circuits in double pole devices and provide added protection to contact points.

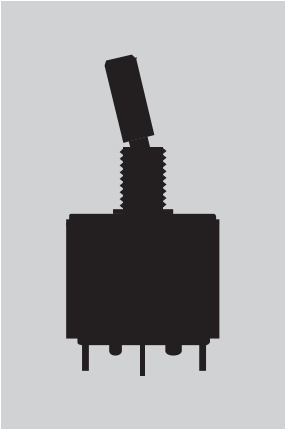
Prominent external insulating barriers increase insulation resistance and dielectric strength.

Epoxy sealed terminals prevent entry of flux, solvents, and other contaminants.

Clinching of the frame to the case well above the base and terminals provides 4,000V dielectric strength.



Actual Size



Series P

Internationally Approved Toggles

TYPICAL SWITCH ORDERING EXAMPLE

P20 | 22 | B | [ ]

Poles & Circuits

11	SPST	ON	NONE	OFF
12	SPDT	ON	NONE	ON
13	SPDT	ON	OFF	ON
21	DPST	ON	NONE	OFF
22	DPDT	ON	NONE	ON
23	DPDT	ON	OFF	ON

Toggles & Bushings

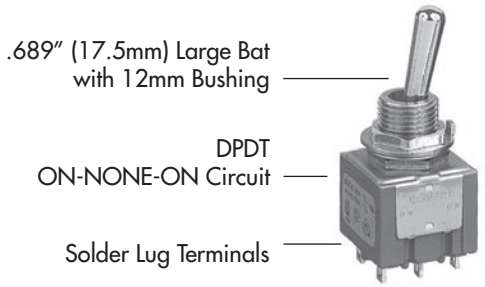
No Code	.512″ (13.0mm) White Cap with 6mm Bushing
E	.450″ (11.4mm) Flatted with 6mm Bushing
B	.689″ (17.5mm) Large Bat with 12mm Bushing
D	.748″ (19.0mm) White Capped Column with 12mm Bushing

Terminals

No Code	Solder Lug
P	Straight PC
Z	.187″ (4.75mm) Quick Connect

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

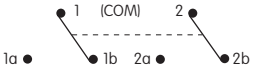
P2022B



IMPORTANT:

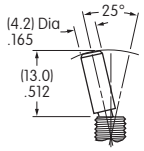
VDE is marked on all models. Switches are supplied without UL, cULus & CSA marking unless specified. **UL, cULus & CSA recognized only when ordered with marking on the switch.** Specific models, ratings, & ordering instructions are noted on the General Specifications page.

POLES & CIRCUITS

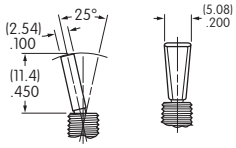
		Toggle Position			Connected Terminals			Throw & Schematics
Pole	**Model**	**Down** Keyway	**Center**	**Up**	**Down** Keyway	**Center**	**Up**	Note: Terminal numbers are on the switch.
SP	**P2011**	ON	NONE	OFF	1-1b	OPEN	OPEN	SPST
SP	**P2012** **P2013**	ON ON	NONE OFF	ON ON	1-1b	OPEN	1-1a	SPDT
DP	**P2021**	ON	NONE	OFF	1-1b 2-2b	OPEN	OPEN	DPST
DP	**P2022** **P2023**	ON ON	NONE OFF	ON ON	1-1b 2-2b	OPEN	1-1a 2-2a	DPDT 

TOGGLES & BUSHINGS

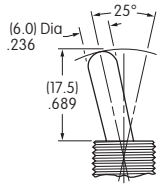
No Code .512" (13.0mm) White Cap with 6mm Bushing



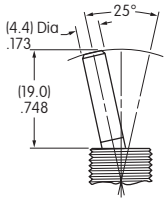
E .450" (11.4mm) Flatted with 6mm Bushing



B .689" (17.5mm) Large Bat with 12mm Bushing

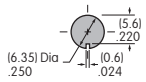


D .748" (19.0mm) White Capped Column with 12mm Bushing

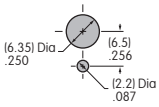


Panel Cutouts

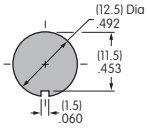
Panel Thickness with Keyway .134" (3.4mm) maximum



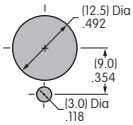
Panel Thickness with Locking Ring .102" (2.6mm) maximum



Panel Thickness with Keyway .256" (6.5mm) maximum



Panel Thickness with Locking Ring .217" (5.5mm) maximum

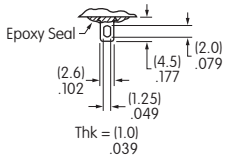


Standard Hardware

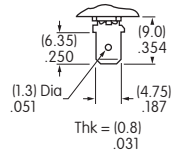
For 6mm Bushing: 1 Locking Ring AT507M, 1 Internal Tooth Lockwasher AT509, 2 Hex Nuts AT513M
For 12mm Bushing: 1 Hex Face Nut AT503M, 1 Locking Ring AT506M, 1 Internal Tooth Lockwasher AT508, 1 Hex Mounting Nut AT527M
Optional Splashproof Boot Assemblies (for code B): AT401 & AT4181 boots plus hex nut & o-ring; see Accessories & Hardware section.

TERMINALS

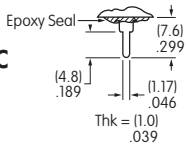
No Code Solder Lug



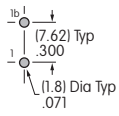
Z .187" (4.75mm) Quick Connect



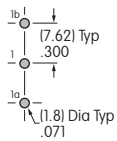
P Straight PC



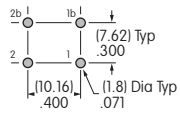
SPST



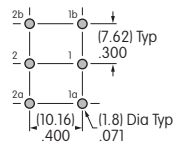
SPDT



DPST



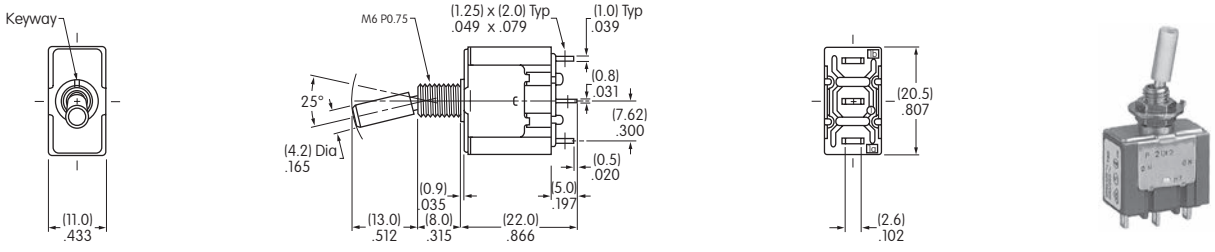
DPDT



TYPICAL SWITCH DIMENSIONS

P2011, P2012, P2013

6mm Bushing

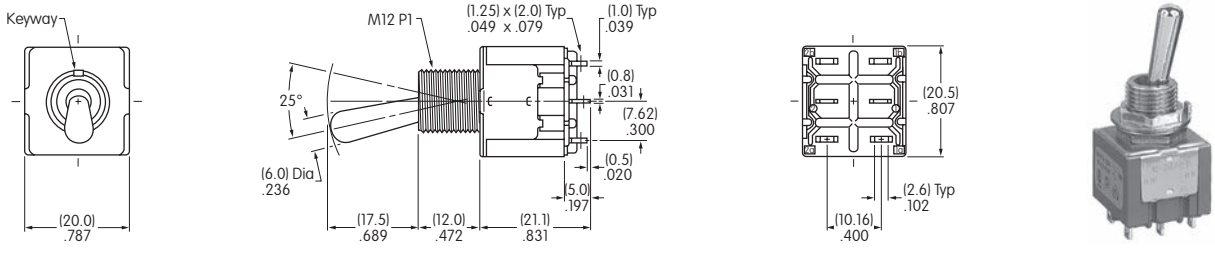


P2011 models do not have terminal 1a.

P2012

P2021B, P2022B, P2023B

12mm Bushing



P2021 models do not have terminals 1a & 2a.

P2022B

Contents for Standard Size Toggles

Low Capacity ..... Page A101

5A Power Level
Solder Lug Terminals
Bushing Mount
Double Pole

Medium Capacity ..... Page A103

15~20A Power Level
Solder Lug, Quick Connect Terminals
Bushing Mount
Single & Double Pole

Medium/High Capacity.... Page A108

15~25A Power Level
Solder Lug, Screw Lug, Quick Connect Terminals
Bushing Mount
One through Four Pole

High Capacity ..... Page A119

30~50A Power Level
Screw Lug Terminals
Bushing Mount or Mounting Screws
Double Pole & Three Pole

GENERAL SPECIFICATIONS FOR S100s

Electrical Capacity (Resistive & Inductive Load)

Power Level: Shown in the following table

Other Ratings

Contact Resistance: 10 milliohms maximum
Insulation Resistance: 200 megohms minimum @ 500V DC
Dielectric Strength: 1,500V AC minimum for 1 minute minimum
Mechanical Life: 30,000 operations minimum
Electrical Life: 10,000 operations minimum
Operating Temp Range: –10°C through +70°C (+14°F through +158°F)

Materials & Finishes

Toggle: Brass with chrome plating
Bushing: Brass with chrome or nickel plating
Case: Phenolic resin
Case Cover: Steel with zinc plating
Movable Contactor Plate: Copper with silver plating
Movable & Stationary Contacts: Silver alloy plus copper with silver plating
Terminals: Copper with silver plating

Environmental Data

Operating Temp Range: –10°C through +70°C (+14°F through +158°F)

Installation

Mounting Torque: 2.94Nm (26 lb•in) for double nut
Soldering Time & Temperature: Manual Soldering: See Profile A in Supplement section.

Standards & Certifications

CSA: **File No. 023535_0_000 - Certified only when ordered with marking on switch.**
Add "/C" to end of part number to order CSA certified switch.
Certified at 5A @ 125V AC & 2A @ 250V AC.

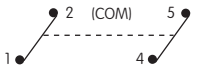
DOUBLE POLE WITH SOLDER LUG

* CSA certified only when ordered with marking on switch (see General Specs)

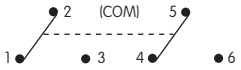
Model	*Approvals		Pole & Throw	Toggle Position/Connected Terminals: Down	Center	Up	Electrical Capacity: Resistive AC 125V	Resistive AC 250V	Resistive DC 30V	Inductive AC 125V PF 0.6	Angle of Throw
S114	—	✓	DPST	ON 2-1 5-4	NONE	OFF —	5A	2A	5A	3A	25°
S116	—	✓	DPDT	ON 2-1 5-4	NONE	ON 2-3 5-6	5A	2A	5A	3A	25°
S116R	—	—	DPDT	ON 2-1 5-4	NONE	ON 2-3 5-6	5A	2A	5A	3A	25°

Throw & Schematics:

DPST



DPDT

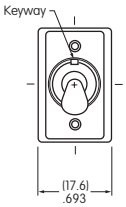


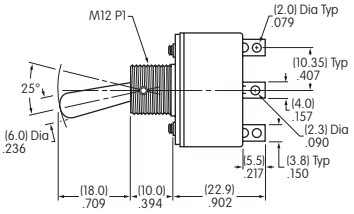
Note: Terminal numbers are actually on the switch

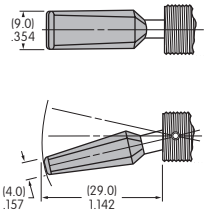
Notes: Standard Hardware: AT504M Knurled Nut, AT508 Lockwasher, AT527M Backup Hex Nut. See Accessories & Hardware section.
Optional Splashproof Boot Assemblies (only for bat lever models): AT401 & AT4181 boots plus hex nut and o-ring. See Accessories & Hardware section.

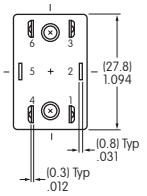
S114 & S116

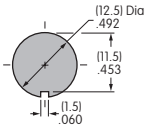
S116R Black Polyamide Paddle











S116

S114 does not have terminals 3 & 6

Maximum Panel Thickness: .158" (4.0mm)

GENERAL SPECIFICATIONS FOR S1 ~ S29

Electrical Capacity (Resistive & Inductive Load)

Power Level: Shown in the following tables

Other Ratings

Contact Resistance: 10 milliohms maximum
Insulation Resistance: 1,000 megohms minimum @ 500V DC
Dielectric Strength: 2,000V AC minimum for 1 minute minimum
Mechanical Life: 30,000 operations minimum for S5AW, S8AW, S9AW, S25AW, S28AW, S29AW
50,000 operations minimum for all other models
Electrical Life: 25,000 operations minimum
Angle of Throw (α): Shown in tables on following pages

Materials & Finishes

Toggle: Brass with chrome plating
Bushing: Brass with chrome plating
Case: Phenolic resin
Case Cover: Steel with zinc plating
Movable Contactor: Copper with silver plating
Movable Contacts: Silver alloy capped on copper with silver plating
Stationary Contacts: Silver alloy capped on copper with silver plating
Terminals: Brass with tin plating

Environmental Data

Operating Temp Range: –30°C through +70°C (–22°F through +158°F) for Splashproof models;
–10°C through +70°C (+14°F through +158°F) for all other models
Sealing: Splashproof & lever lock panel seal models meet IP67 standard

Installation

Mounting Torque: 1.47Nm (13 lb•in) for single nut on AW & AL models
2.94Nm (26 lb•in) for double nut on other models
Maximum Panel Thickness: Shown beneath panel cutout in switch dimension drawings
Soldering Time & Temperature: Manual Soldering: See Profile A in Supplement section.

Standards & Certifications

UL: **File No. E44145 - Recognized only when ordered with marking on switch.**
Add "/U" or "/CUL" to end of part number to order UL recognized switch.
UL or cULus recognition designated beside part numbers on following pages.
See Supplement section to find UL or cULus rating details.

CSA: **File No. 023535_0_000 - Certified only when ordered with marking on switch.**
Add "/C" to end of part number to order CSA certified switch.
CSA certification designated beside part numbers on following pages.
See Supplement section to find CSA rating details.

SINGLE POLE WITH SOLDER LUG

Model	*Approvals	Pole & Throw	Toggle Position/Connected Terminals: Down	Center	Up	Electrical Capacity: Resistive AC 125V	Resistive AC 250V	Resistive DC 30V	Inductive AC 125V PF 0.6	Angle of Throw
S1A	✓ ✓ ✓	SPST	ON 1-3	NONE	OFF —	15A	6A	20A	8A	25°
S2A	✓ ✓ ✓	SPDT	ON 2-3	NONE	ON 2-1	15A	6A	20A	8A	25°
S3A	✓ ✓ ✓	SPDT	ON 2-3	OFF	ON 2-1	15A	6A	20A	8A	25°

* UL, cULus & CSA recognized only when ordered with marking on switch (see General Specs)

Throw & Schematics:

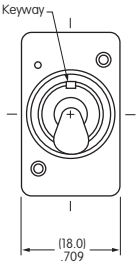
SPST

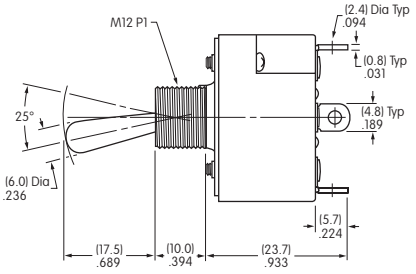
SPDT

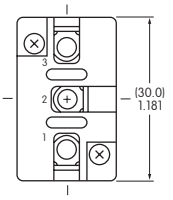
Note: Terminal numbers are actually on the switch

Notes: Standard Hardware: AT504M Knurled Nut, AT508 Lockwasher, AT527M Backup Hex Nut. See Accessories & Hardware section.
Optional Splashproof Boot Assemblies: AT401 & AT4181 boots plus hex nut & o-ring. See Accessories & Hardware section.

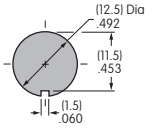
S2A







S1A does not have terminal 2



Maximum Panel Thickness: .158" (4.0mm)

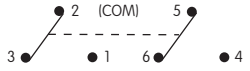
DOUBLE POLE WITH SOLDER LUG

Model	*Approvals	Pole & Throw	Toggle Position/Connected Terminals: Down	Center	Up	Electrical Capacity: Resistive AC 125V	Resistive AC 250V	Resistive DC 30V	Inductive AC 125V PF 0.6	α = Angle of Throw
S21A	— — —	DPST	ON 1-3 4-6	NONE	OFF —	15A	15A	15A	8A	21°
S6A	✓ ✓ ✓	DPDT	ON 2-3 5-6	NONE	ON 2-1 5-4	20A	10A	20A	8A	21°
S7A	— — ✓	DPDT	ON 2-3 5-6	OFF	ON 2-1 5-4	20A	10A	20A	8A	28°

* UL, cULus & CSA recognized only when ordered with marking on switch (see General Specs)

Throw & Schematics:

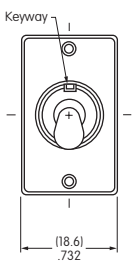
DPST

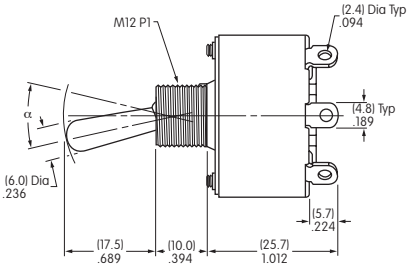
DPDT 

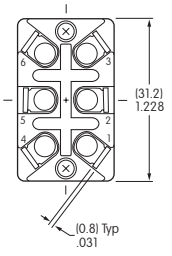
Note: Terminal numbers are actually on the switch

Notes: Standard Hardware: AT504M Knurled Nut, AT508 Lockwasher, AT527M Backup Hex Nut. See Accessories & Hardware section.
Optional Splashproof Boot Assemblies: AT401 & AT4181 boots plus hex nut & o-ring. See Accessories & Hardware section.

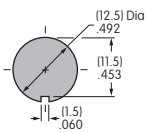
S6A







S21A does not have terminals 2 & 5



Maximum Panel Thickness: .158" (4.0mm)

SINGLE POLE WITH QUICK CONNECT

Model	Approvals		Pole & Throw	Toggle Position/Connected Terminals: Down		Center		Up		Electrical Capacity: Resistive AC 125V	Resistive AC 250V	Resistive DC 30V	Inductive AC 125V PF 0.6	Angle of Throw
				Keyway										
S1F	—	—	SPST	ON	1-3	NONE		OFF	—	15A	6A	20A	8A	25°
S2F	—	—	SPDT	ON	2-3	NONE		ON	2-1	15A	6A	20A	8A	25°
S3F	—	—	SPDT	ON	2-3	OFF		ON	2-1	15A	6A	20A	8A	25°

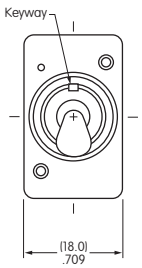
Throw & Schematics:

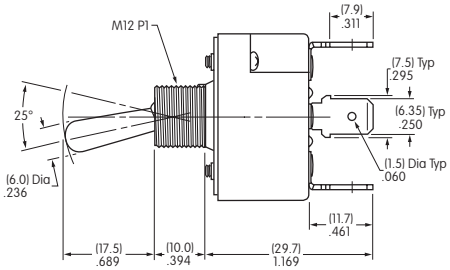
SPST

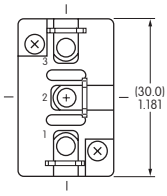
SPDT

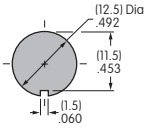
Note: Terminal numbers are actually on the switch

Notes: Standard Hardware: AT504M Knurled Nut, AT508 Lockwasher, AT527M Backup Hex Nut. See Accessories & Hardware section.
Optional Splashproof Boot Assemblies: AT401 & AT4181 boots plus hex nut & o-ring. See Accessories & Hardware section.









S1F does not have terminal 2

Maximum Panel Thickness: .158" (4.0mm)

S2F

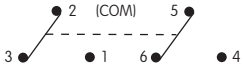
DOUBLE POLE WITH QUICK CONNECT

Model	Approvals		Pole & Throw	Toggle Position/Connected Terminals: Down		Center		Up		Electrical Capacity: Resistive AC 125V	Resistive AC 250V	Resistive DC 30V	Inductive AC 125V PF 0.6	α = Angle of Throw
				Keyway										
S21F	—	—	DPST	ON	1-3 4-6	NONE		OFF	—	15A	15A	15A	8A	21°
S6F	—	—	DPDT	ON	2-3 5-6	NONE		ON	2-1 5-4	20A	10A	20A	8A	21°
S7F	—	—	DPDT	ON	2-3 5-6	OFF		ON	2-1 5-4	20A	10A	20A	8A	28°

Throw & Schematics:

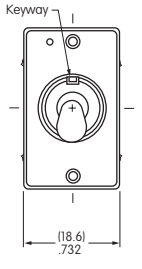
DPST

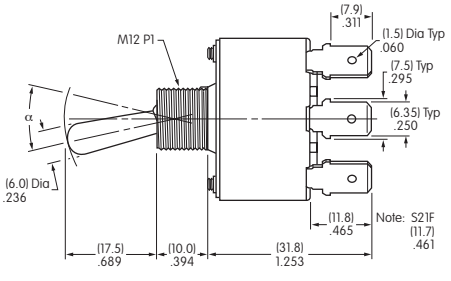
DPDT

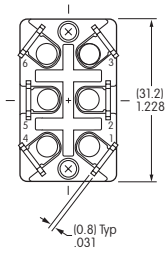


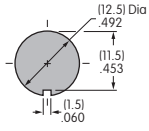
Note: Terminal numbers are actually on the switch

Notes: Standard Hardware: AT504M Knurled Nut, AT508 Lockwasher, AT527M Backup Hex Nut. See Accessories & Hardware section.
Optional Splashproof Boot Assemblies: AT401 & AT4181 boots plus hex nut & o-ring. See Accessories & Hardware section.









S21F does not have terminals 2 & 5

Maximum Panel Thickness: .158" (4.0mm)

S6F

SINGLE POLE SOLDER LUG WITH PANEL SEAL

Model	Approvals	Pole & Throw	Toggle Position/Connected Terminals ( ) = Momentary: Down (Keyway)	Center	Up	Electrical Capacity: Resistive AC 125V	AC 250V	DC 30V	α = Angle of Throw
S1AW	— —	SPST	ON 1-3	NONE	OFF —	15A	6A	20A	24°
S2AW	— —	SPDT	ON 2-3	NONE	ON 2-1	15A	6A	20A	24°
S3AW	— —	SPDT	ON 2-3	OFF	ON 2-1	15A	6A	20A	28°
S5AW	— —	SPDT	ON 2-3	NONE	(ON) 2-1	15A	6A	20A	20°
S8AW	— —	SPDT	(ON) 2-3	OFF	(ON) 2-1	15A	6A	20A	24°
S9AW	— —	SPDT	ON 2-3	OFF	(ON) 2-1	15A	6A	20A	24°

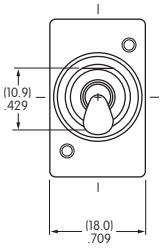
Throw & Schematics: SPST

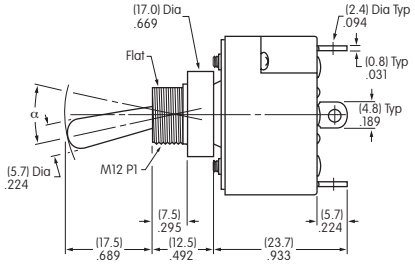
SPDT

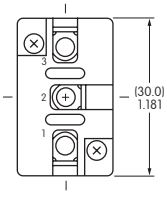
Note: Terminal numbers are actually on the switch

Notes: Standard Hardware: AT503M Face Hex Nut, AT508 Lockwasher, AT537 O-ring. See Accessories & Hardware section.
For **.250" Quick Connect terminals**, add "F" to end of part number. See **Quick Connect terminal** dimensions on previous page.
For further information, contact factory.

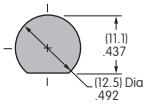
S2AW







S1AW does not have terminal 2

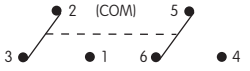


Maximum Panel Thickness: .158" (4.0mm)

DOUBLE POLE SOLDER LUG WITH PANEL SEAL

Model	Approvals	Pole & Throw	Toggle Position/Connected Terminals ( ) = Momentary: Down (Keyway)	Center	Up	Electrical Capacity: Resistive AC 125V	AC 250V	DC 30V	α = Angle of Throw
S21AW	— —	DPST	ON 1-3 4-6	NONE	OFF —	15A	15A	15A	22°
S6AW	— —	DPDT	ON 2-3 5-6	NONE	ON 2-1 5-4	20A	10A	20A	22°
S7AW	— —	DPDT	ON 2-3 5-6	OFF	ON 2-1 5-4	20A	10A	20A	28°
S25AW	— —	DPDT	ON 2-3 5-6	NONE	(ON) 2-1 5-4	15A	6A	20A	20°
S28AW	— —	DPDT	(ON) 2-3 5-6	OFF	(ON) 2-1 5-4	15A	6A	20A	22°
S29AW	— —	DPDT	ON 2-3 5-6	OFF	(ON) 2-1 5-4	15A	6A	20A	22°

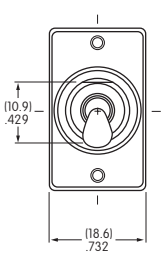
Throw & Schematics: DPST

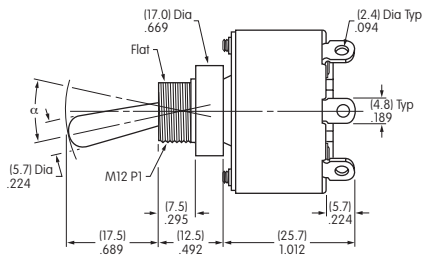
DPDT 

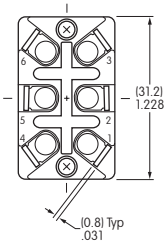
Note: Terminal numbers are actually on the switch

Notes: Standard Hardware: AT503M Face Hex Nut, AT508 Lockwasher, AT537 O-ring. See Accessories & Hardware section.
For **.250" Quick Connect terminals**, add "F" to end of part number. See **Quick Connect terminal** dimensions on previous page.
For further information, contact factory.

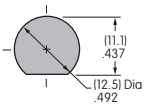
S6AW







S21AW does not have terminals 2 & 5



Maximum Panel Thickness: .158" (4.0mm)

SINGLE POLE SOLDER LUG WITH LOCKING LEVER & PANEL SEAL

Model	Approvals	Pole & Throw	Toggle Position/Connected Terminals: Down (Keyway)	Center	Up	Electrical Capacity: Resistive AC 125V	Resistive AC 250V	Resistive DC 30V	Inductive AC 125V PF 0.6	α = Angle of Throw
S1AL	— —	SPST	ON 1-3	NONE	OFF —	15A	6A	20A	8A	24°
S2AL	— —	SPDT	ON 2-3	NONE	ON 2-1	15A	6A	20A	8A	24°
S3AL	— —	SPDT	ON 2-3	OFF	ON 2-1	15A	6A	20A	8A	28°

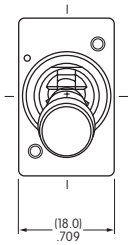
Throw & Schematics:

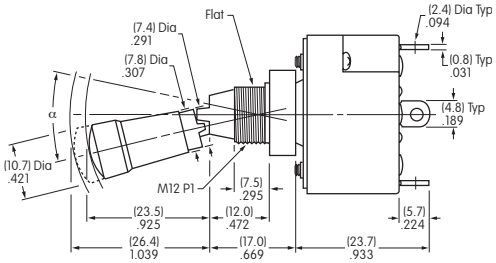
SPST

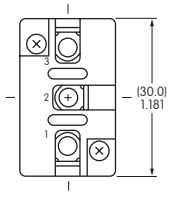
SPDT

Note: Terminal numbers are actually on the switch

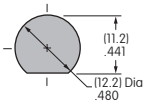
Notes: Standard Hardware: AT503M Face Hex Nut, AT508 Lockwasher, AT537 O-ring. See Accessories & Hardware section.







S1AL does not have terminal 2



Maximum Panel Thickness: .158" (4.0mm)

S2AL

DOUBLE POLE SOLDER LUG WITH LOCKING LEVER & PANEL SEAL

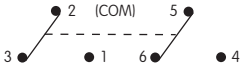
* UL & cULus recognized only when ordered with marking on switch (see General Specs)

Model	*Approvals	Pole & Throw	Toggle Position/Connected Terminals: Down (Keyway)	Center	Up	Electrical Capacity: Resistive AC 125V	Resistive AC 250V	Resistive DC 30V	Inductive AC 125V PF 0.6	α = Angle of Throw
S21AL	— —	DPST	ON 1-3 4-6	NONE	OFF —	15A	15A	15A	8A	22°
S6AL	✓ ✓	DPDT	ON 2-3 5-6	NONE	ON 2-1 5-4	20A	10A	20A	8A	22°
S7AL	— —	DPDT	ON 2-3 5-6	OFF	ON 2-1 5-4	20A	10A	20A	8A	28°

Throw & Schematics:

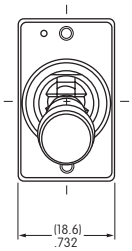
DPST

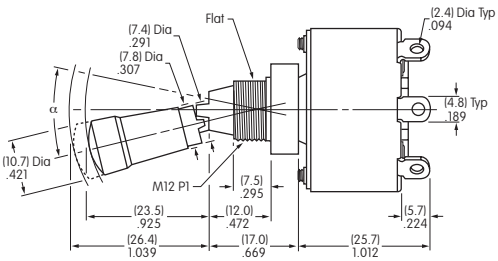
DPDT

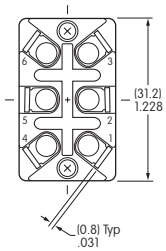


Note: Terminal numbers are actually on the switch

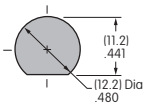
Notes: Standard Hardware: AT503M Face Hex Nut, AT508 Lockwasher, AT537 O-ring. See Accessories & Hardware section.







S21AL does not have terminals 2 & 5



Maximum Panel Thickness: .158" (4.0mm)

S6AL

GENERAL SPECIFICATIONS FOR S301 ~ S339

Electrical Capacity (Resistive & Inductive Load)

Power Level: Shown in the following tables

Other Ratings

Contact Resistance: 10 milliohms maximum
Insulation Resistance: 1,000 megohms minimum @ 500V DC
Dielectric Strength: 2,000V AC minimum for 1 minute minimum
Mechanical Life: 50,000 operations minimum
Electrical Life: 6,000 operations minimum for S331F; 15,000 operations minimum for all other S331s; 25,000 operations minimum for all others
Angle of Throw (α): Shown on following tables

Materials & Finishes

Toggle: PBT for flatted lever; brass with chrome plating for all others
Bushing: Brass with chrome plating
Case: Melamine phenol
Case Cover: Steel with zinc plating
Movable Contactor: Copper with silver plating
Movable & Stationary Contacts: Silver alloy capped on copper with silver plating
Terminals: Brass with tin plating

Environmental Data

Operating Temperature Range: –10°C ~ +70°C (+14°F ~ +158°F)

Installation

Mounting Torque: 2.94Nm (26 lb•in) for double nut; 1.47Nm (13 lb•in) for single nut
Soldering Time & Temperature: Manual Soldering: See Profile A in Supplement section.

Standards & Certifications

UL: **File No. E44145 - Recognized only when ordered with marking on switch.**
Add "/U" or "/CUL" to end of part number to order UL recognized switch.
UL or cULus recognition designated beside part numbers on following pages.
See Supplement section to find UL or cULus rating details.

CSA: **File No. 023535_0_000 - Certified only when ordered with marking on switch.**
Add "/C" to end of part number to order CSA certified switch.
CSA certification designated beside part numbers on following pages.
See Supplement section to find CSA rating details

SINGLE POLE WITH SOLDER LUG

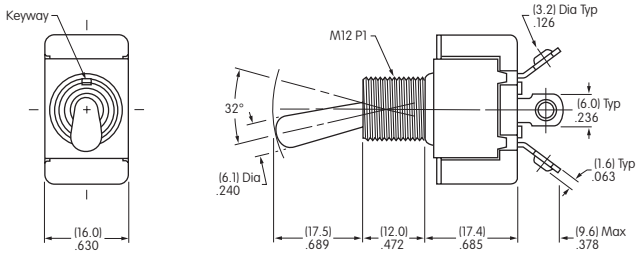
Model	*Approvals	Pole & Throw	Toggle Position/Connected Terminals ( ) = Momentary: Down	Center	Up	Electrical Capacity: Resistive AC 125V	Resistive AC 250V	Resistive DC 30V	Inductive AC 125V PF 0.6	Angle of Throw
S301	✓ ✓ ✓	SPST	ON 1-3	NONE	OFF —	15A	6A	20A	10A	32°
S302	✓ ✓ ✓	SPDT	ON 2-3	NONE	ON 2-1	15A	6A	20A	10A	32°
S303	✓ ✓ ✓	SPDT	ON 2-3	OFF	ON 2-1	15A	6A	20A	10A	32°
S305	— — ✓	SPDT	ON 2-3	NONE	(ON) 2-1	15A	6A	20A	8A	32°
S308	— — ✓	SPDT	(ON) 2-3	OFF	(ON) 2-1	15A	6A	20A	8A	32°
S309	— — ✓	SPDT	ON 2-3	OFF	(ON) 2-1	15A	6A	20A	8A	32°

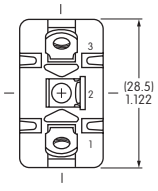
* UL, cULus & CSA recognized only when ordered with marking on switch (see General Specs)

Throw & Schematics: SPST 1 3 INTERNAL CONNECTION; SPDT 3 2 (COM) 1

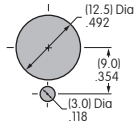
Note: Terminal numbers are actually on the switch

Notes: Standard Hardware: AT503M Face Hex Nut, AT506M Locking Ring, AT508 Lockwasher, AT527M Backup Hex Nut. See Accessories & Hardware section. Optional Splashproof Boot Assemblies: AT401 & AT4181 boots plus hex nut & o-ring. See Accessories & Hardware section.





S301 does not have terminal 2



Maximum Panel Thickness: .185" (4.7mm)

S301

DOUBLE POLE WITH SOLDER LUG

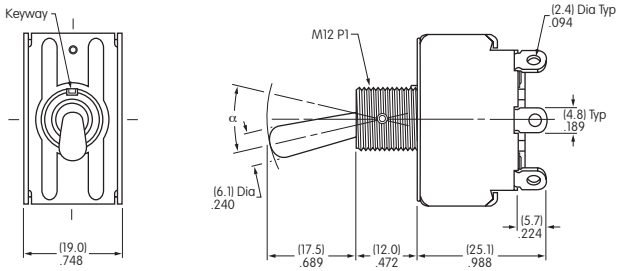
Model	*Approvals	Pole & Throw	Toggle Position/Connected Terminals ( ) = Momentary: Down	Center	Up	Electrical Capacity: Resistive AC 125V	Resistive AC 250V	Resistive DC 30V	Inductive AC 125V PF 0.6	α = Angle of Throw
S331	✓ ✓ ✓	DPST	ON 1-3 4-6	NONE	OFF —	25A	25A	25A	10A	25°
S332	✓ ✓ ✓	DPDT	ON 2-3 5-6	NONE	ON 2-1 5-4	25A	15A	25A	10A	25°
S333	✓ ✓ ✓	DPDT	ON 2-3 5-6	OFF	ON 2-1 5-4	25A	15A	25A	10A	30°
S335	✓ ✓ ✓	DPDT	ON 2-3 5-6	NONE	(ON) 2-1 5-4	15A	6A	20A	8A	25°
S338	✓ ✓ —	DPDT	(ON) 2-3 5-6	OFF	(ON) 2-1 5-4	15A	6A	20A	8A	25°
S339	✓ ✓ —	DPDT	ON 2-3 5-6	OFF	(ON) 2-1 5-4	15A	6A	20A	8A	25°

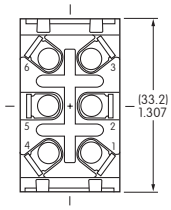
* UL, cULus & CSA recognized only when ordered with marking on switch (see General Specs)

Throw & Schematics: DPST 1 3 4 6 INTERNAL CONNECTION; DPDT 3 2 (COM) 5 1 6 4

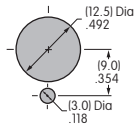
Note: Terminal numbers are actually on the switch

Notes: Standard Hardware: AT503M Face Hex Nut, AT506M Locking Ring, AT508 Lockwasher, AT527M Backup Hex Nut. See Accessories & Hardware section. Optional Splashproof Boot Assemblies: AT401 & AT4181 boots plus hex nut & o-ring. See Accessories & Hardware section.





S331 does not have terminals 2 & 5



Maximum Panel Thickness: .185" (4.7mm)

S331

DOUBLE POLE WITH SOLDER LUG & FLATTED LEVER

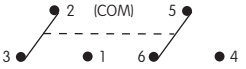
* UL & cULus recognized only when ordered with marking on switch (see General Specs)

Model	*Approvals	Pole & Throw	Toggle Position/Connected Terminals ( ) = Momentary: Down	Center	Up	Electrical Capacity: Resistive AC 125V	Resistive AC 250V	Resistive DC 30V	Inductive AC 125V PF 0.6	α = Angle of Throw
S331R	✓ ✓ —	DPST	ON 1-3 4-6	NONE	OFF —	25A	25A	25A	10A	25°
S332R	✓ ✓ —	DPDT	ON 2-3 5-6	NONE	ON 2-1 5-4	25A	15A	25A	10A	25°
S333R	✓ ✓ —	DPDT	ON 2-3 5-6	OFF	ON 2-1 5-4	25A	15A	25A	10A	30°
S338R	✓ ✓ —	DPDT	(ON) 2-3 5-6	OFF	(ON) 2-1 5-4	15A	6A	20A	8A	25°
S339R	✓ ✓ —	DPDT	ON 2-3 5-6	OFF	(ON) 2-1 5-4	15A	6A	20A	8A	25°

Throw & Schematics:

DPST

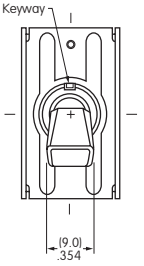
DPDT

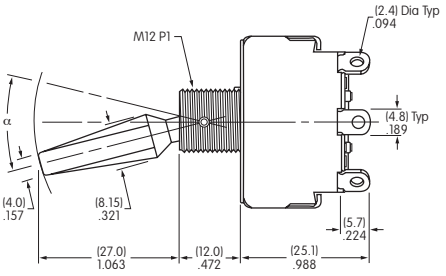


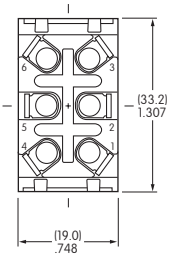
Note: Terminal numbers are actually on the switch

Notes: Standard Hardware: AT504M Knurled Nut, AT508 Lockwasher, AT527M Backup Hex Nut. See Accessories & Hardware section.

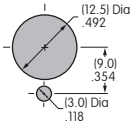
S331R







S331R does not have terminals 2 & 5



Maximum Panel Thickness: .220" (5.6mm)

SINGLE POLE WITH SCREW LUG

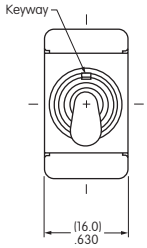
* UL, cULus & CSA recognized only when ordered with marking on switch (see General Specs)				Toggle Position/Connected Terminals ( ) = Momentary						Electrical Capacity				
	*Approvals				Down		Center	Up		Resistive			Inductive	
Model				Pole & Throw	Keyway					AC 125V	AC 250V	DC 30V	AC 125V PF 0.6	α = Angle of Throw
S301T	✓	✓	✓	SPST	ON	1-3	NONE	OFF	—	15A	6A	20A	10A	32°
S302T	✓	✓	✓	SPDT	ON	2-3	NONE	ON	2-1	15A	6A	20A	10A	32°
S303T	✓	✓	✓	SPDT	ON	2-3	OFF	ON	2-1	15A	6A	20A	10A	32°
S305T	—	—	✓	SPDT	ON	2-3	NONE	(ON)	2-1	15A	6A	20A	8A	32°
S308T	—	—	✓	SPDT	(ON)	2-3	OFF	(ON)	2-1	15A	6A	20A	8A	32°
S309T	—	—	✓	SPDT	ON	2-3	OFF	(ON)	2-1	15A	6A	20A	8A	32°

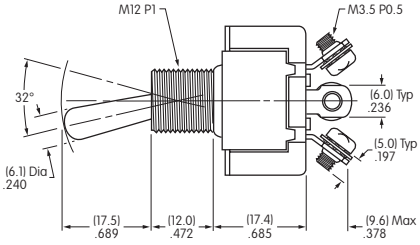
Throw & Schematics: SPST

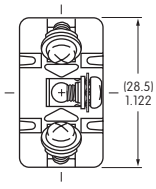
SPDT

Note: Terminal numbers are actually on the switch

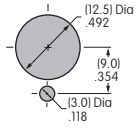
Notes: Standard Hardware: AT503M Face Hex Nut, AT506M Locking Ring, AT508 Lockwasher, AT527M Backup Hex Nut. See Accessories & Hardware section. Optional Splashproof Boot Assemblies: AT401 & AT4181 boots plus hex nut & o-ring. See Accessories & Hardware section.







S301T does not have terminal 2



Maximum Panel Thickness: .185" (4.7mm)

S301T

DOUBLE POLE WITH SCREW LUG

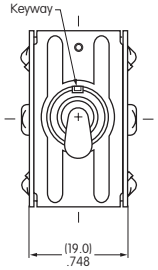
* UL & cULus recognized only when ordered with marking on switch (see General Specs)				Toggle Position/Connected Terminals ( ) = Momentary						Electrical Capacity				
	*Approvals				Down		Center	Up		Resistive			Inductive	
Model				Pole & Throw	Keyway					AC 125V	AC 250V	DC 30V	AC 125V PF 0.6	α = Angle of Throw
S331T	✓	✓	—	DPST	ON	1-3 4-6	NONE	OFF	—	15A	15A	15A	10A	25°
S332T	✓	✓	—	DPDT	ON	2-3 5-6	NONE	ON	2-1 5-4	15A	15A	15A	10A	25°
S333T	✓	✓	—	DPDT	ON	2-3 5-6	OFF	ON	2-1 5-4	15A	15A	15A	10A	30°
S335T	✓	✓	—	DPDT	ON	2-3 5-6	NONE	(ON)	2-1 5-4	15A	6A	20A	8A	25°
S338T	✓	✓	—	DPDT	(ON)	2-3 5-6	OFF	(ON)	2-1 5-4	15A	6A	20A	8A	25°
S339T	✓	✓	—	DPDT	ON	2-3 5-6	OFF	(ON)	2-1 5-4	15A	6A	20A	8A	25°

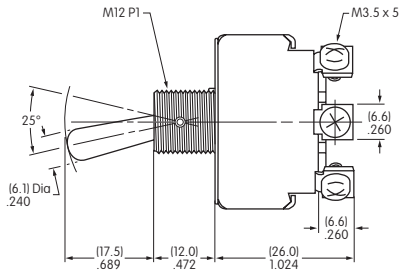
Throw & Schematics: DPST

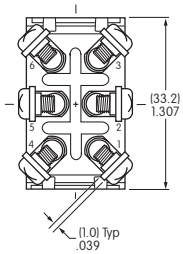
DPDT

Note: Terminal numbers are actually on the switch

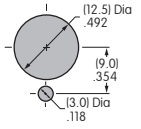
Notes: Standard Hardware: AT503M Face Hex Nut, AT506M Locking Ring, AT508 Lockwasher, AT527M Backup Hex Nut. See Accessories & Hardware section. Optional Splashproof Boot Assemblies: AT401 & AT4181 boots plus hex nut & o-ring. See Accessories & Hardware section.







S331T does not have terminals 2 & 5



Maximum Panel Thickness: .185" (4.7mm)

S331T

Series S

Medium/High Capacity Standard Size Toggles

SINGLE POLE WITH QUICK CONNECT

Model	*Approvals	Pole & Throw	Toggle Position/Connected Terminals: Down (Keyway)	Center	Up	Electrical Capacity: Resistive AC 125V	Resistive AC 250V	Resistive DC 30V	Inductive AC 125V PF 0.6	α = Angle of Throw
S301F	✓ ✓ ✓	SPST	ON 1-3	NONE	OFF —	15A	6A	20A	10A	32°

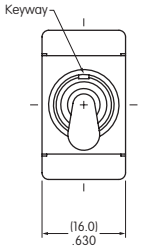
* UL, cULus & CSA recognized only when ordered with marking on switch (see General Specs)

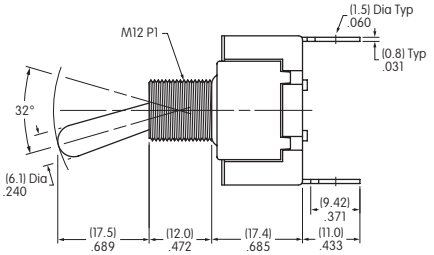
Throw & Schematics: SPST

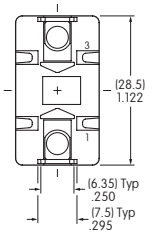
Note: Terminal numbers are actually on the switch

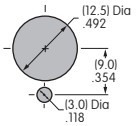
Notes: Standard Hardware: AT503M Face Hex Nut, AT506M Locking Ring, AT508 Lockwasher, AT527M Backup Hex Nut. See Accessories & Hardware section. Optional Splashproof Boot Assemblies: AT401 & AT4181 boots plus hex nut & o-ring. See Accessories & Hardware section.

S301F









Maximum Panel Thickness: .185" (4.7mm)

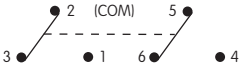
DOUBLE POLE WITH QUICK CONNECT

Model	*Approvals	Pole & Throw	Toggle Position/Connected Terminals ( ) = Momentary: Down (Keyway)	Center	Up	Electrical Capacity: Resistive AC 125V	Resistive AC 250V	Resistive DC 30V	Inductive AC 125V PF 0.6	α = Angle of Throw
S331F	✓ ✓ —	DPST	ON 1-3 4-6	NONE	OFF —	25A	25A	25A	10A	25°
S332F	✓ ✓ —	DPDT	ON 2-3 5-6	NONE	ON 2-1 5-4	25A	15A	25A	10A	25°
S333F	✓ ✓ —	DPDT	ON 2-3 5-6	OFF	ON 2-1 5-4	25A	15A	25A	10A	30°
S335F	✓ ✓ —	DPDT	ON 2-3 5-6	NONE	(ON) 2-1 5-4	15A	6A	20A	8A	25°

* UL & cULus recognized only when ordered with marking on switch (see General Specs)

Throw & Schematics: DPST

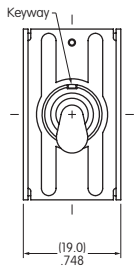
DPDT

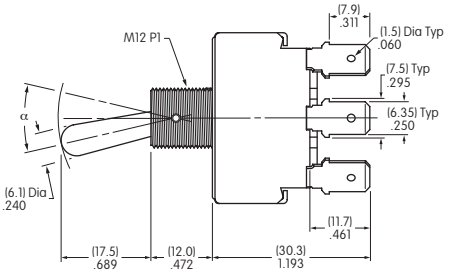


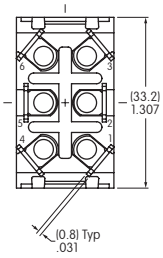
Note: Terminal numbers are actually on the switch

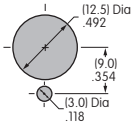
Notes: Standard Hardware: AT503M Face Hex Nut, AT506M Locking Ring, AT508 Lockwasher, AT527M Backup Hex Nut. See Accessories & Hardware section. Optional Splashproof Boot Assemblies: AT401 & AT4181 boots plus hex nut & o-ring. See Accessories & Hardware section.

S332F









S331F does not have terminals 2 & 5

Maximum Panel Thickness: .185" (4.7mm)

GENERAL SPECIFICATIONS FOR S31 ~ S49

Electrical Capacity (Resistive & Inductive Load)

Power Level: Shown in the following tables

Other Ratings

Contact Resistance: 10 milliohms maximum
Insulation Resistance: 1,000 megohms minimum @ 500V DC
Dielectric Strength: 2,000V AC minimum for 1 minute minimum
Mechanical Life: 50,000 operations minimum
Electrical Life: 25,000 operations minimum
Angle of Throw (α): Shown on following tables

Materials & Finishes

Toggle: PBT resin for flatted lever; brass with chrome plating for all others
Bushing: Brass with chrome plating
Case: Phenolic resin
Case Cover: Steel with chromate plating over zinc plating
Movable Contactor: Copper with silver plating
Movable Contacts: Silver alloy capped on copper with silver plating
Stationary Contacts: Silver alloy capped on copper with silver plating
Terminals: Brass with tin plating

Environmental Data

Operating Temp Range: –10°C through +70°C (+14°F through +158°F)

Installation

Mounting Torque: 2.94Nm (26 lb•in) for double nut
Maximum Panel Thickness: Shown beneath panel cutout in switch dimension drawings
Soldering Time & Temperature: Manual Soldering: See Profile A in Supplement section.

Standards & Certifications

UL: **File No. E44145 - Recognized only when ordered with marking on switch.**
Add "/U" or "/CUL" to end of part number to order UL recognized switch.
UL or cULus recognition designated beside part numbers on following pages.
See Supplement section to find UL or cULus rating details.

CSA: **File No. 023535_0_000 - Certified only when ordered with marking on switch.**
Add "/C" to end of part number to order CSA certified switch.
CSA certification designated beside part numbers on following pages.
See Supplement section to find CSA rating details.

Series S

Medium/High Capacity Standard Size Toggles

THREE POLE WITH SOLDER LUG

Model	*Approvals	Pole & Throw	Toggle Position/Connected Terminals ( ) = Momentary: Down	Center	Up	Electrical Capacity: Resistive AC 125V	Resistive AC 250V	Resistive DC 30V	Inductive AC 125V PF 0.6	α = Angle of Throw
S31	✓ ✓ ✓	3PST	ON 1-3 4-6 7-9	NONE	OFF —	25A	9A	20A	10A	25°
S32	✓ ✓ ✓	3PDT	ON 2-3 5-6 8-9	NONE	ON 2-1 5-4 8-7	25A	9A	20A	10A	25°
S33	✓ ✓ ✓	3PDT	ON 2-3 5-6 8-9	OFF	ON 2-1 5-4 8-7	25A	9A	20A	10A	30°
S35	✓ ✓ ✓	3PDT	ON 2-3 5-6 8-9	NONE	(ON) 2-1 5-4 8-7	15A	6A	20A	8A	25°
S38	✓ ✓ ✓	3PDT	(ON) 2-3 5-6 8-9	OFF	(ON) 2-1 5-4 8-7	15A	6A	15A	8A	25°
S39	✓ ✓ ✓	3PDT	ON 2-3 5-6 8-9	OFF	(ON) 2-1 5-4 8-7	15A	6A	15A	8A	25°

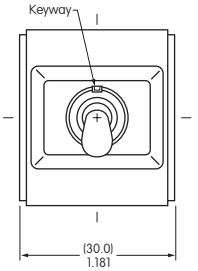
* UL, cULus & CSA recognized only when ordered with marking on switch (see General Specs)

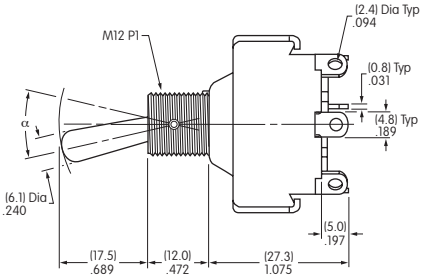
Throw & Schematics:

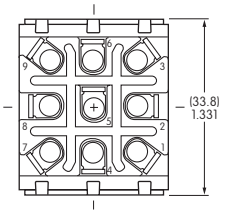
Note: Terminal numbers are on the switch

Notes: Standard Hardware: AT503M Face Hex Nut, AT506M Locking Ring, AT508 Lockwasher, AT527M Backup Hex Nut. See Accessories & Hardware section.
Optional Splashproof Boot Assemblies: AT401 & AT4181 boots plus hex nut & o-ring. See Accessories & Hardware section.

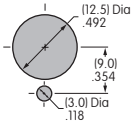
S32







S31 does not have terminals 2, 5, & 8



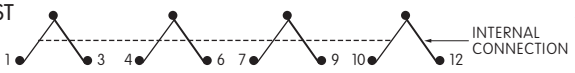
Maximum Panel Thickness: .181" (4.6mm)

FOUR POLE WITH SOLDER LUG

Model Suffix R = Flatted Lever	*Approvals	Pole & Throw	Toggle Position/Connected Terminals ( ) = Momentary: Down	Center	Up	Electrical Capacity: Resistive AC 125V	Resistive AC 250V	Resistive DC 30V	Inductive AC 125V PF 0.6	α = Angle of Throw
S41/S41R	✓ ✓ ✓	4PST	ON 1-3 4-6 7-9 10-12	NONE	OFF —	25A	9A	20A	10A	25°
S42/S42R	✓ ✓ ✓	4PDT	ON 2-3 5-6 8-9 11-12	NONE	ON 2-1 5-4 8-7 11-10	25A	9A	20A	10A	25°
S43/S43R	✓ ✓ ✓	4PDT	ON 2-3 5-6 8-9 11-12	OFF	ON 2-1 5-4 8-7 11-10	25A	9A	20A	10A	30°
S45 –	✓ ✓ —	4PDT	ON 2-3 5-6 8-9 11-12	NONE	(ON) 2-1 5-4 8-7 11-10	15A	6A	20A	8A	25°
S48/S48R	✓ ✓ —	4PDT	(ON) 2-3 5-6 8-9 11-12	OFF	(ON) 2-1 5-4 8-7 11-10	15A	6A	20A	8A	25°
S49/S49R	✓ ✓ —	4PDT	ON 2-3 5-6 8-9 11-12	OFF	(ON) 2-1 5-4 8-7 11-10	15A	6A	20A	8A	25°

* UL, cULus & CSA recognized only when ordered with marking on switch (see General Specs)

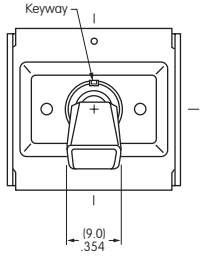
Throw & Schematics:

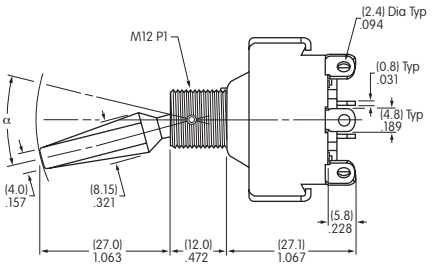


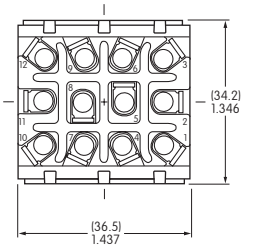
Note: Terminal numbers are on the switch

Notes: Standard Hardware for **Bat Lever**: AT503M Face Hex Nut, AT506M Locking Ring, AT508 Lockwasher, AT527M Backup Hex Nut;
for **Flatted Lever** (R): AT504M Knurled Face Nut, AT508 Lockwasher, AT527M Backup Hex Nut. See Accessories & Hardware section.
Optional Splashproof Boot Assemblies (only for bat lever models): AT401 & AT4181 boots plus hex nut and o-ring. See Accessories & Hardware section.

S42R

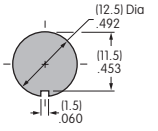




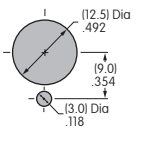


Bat lever dimensions are same as on S30 models above.

S41 and S41R do not have terminals 2, 5, 8, & 11.



Max. Panel Thickness: .220" (5.6mm)



Max. Panel Thickness: .181" (4.6mm)

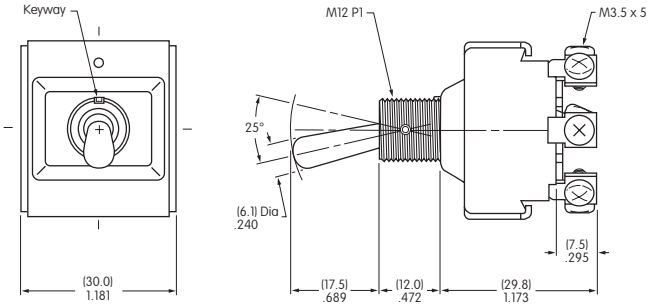
THREE POLE WITH SCREW LUG

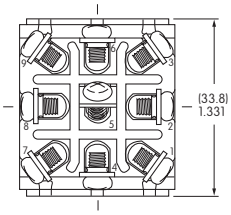
* UL, cULus & CSA recognized only when ordered with marking on switch (see General Specs)					Toggle Position/Connected Terminals				Electrical Capacity					
Model	*Approvals			Pole & Throw	Down (Keyway)		Center	Up	Resistive			Inductive		α = Angle of Throw
									AC 125V	AC 250V	DC 30V	AC 125V PF 0.6	AC 250V PF 0.6	
S31T	✓	✓	✓	3PST	ON	1-3 4-6 7-9	NONE	OFF —	25A	9A	20A	10A	5A	25°
S32T	✓	✓	✓	3PDT	ON	2-3 5-6 8-9	NONE	ON 2-1 5-4 8-7	25A	9A	20A	10A	5A	25°
S33T	✓	✓	✓	3PDT	ON	2-3 5-6 8-9	OFF	ON 2-1 5-4 8-7	25A	9A	20A	10A	5A	30°

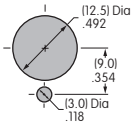
Throw & Schematics:

Note: Terminal numbers are on the switch

Notes: Standard Hardware: AT503M Face Hex Nut, AT506M Locking Ring, AT508 Lockwasher, AT527M Backup Hex Nut. See Accessories & Hardware section.
Optional Splashproof Boot Assemblies: AT401 & AT4181 boots plus hex nut & o-ring. See Accessories & Hardware section.







Maximum Panel Thickness: .181" (4.6mm)

S32T

S31T does not have terminals 2, 5, & 8

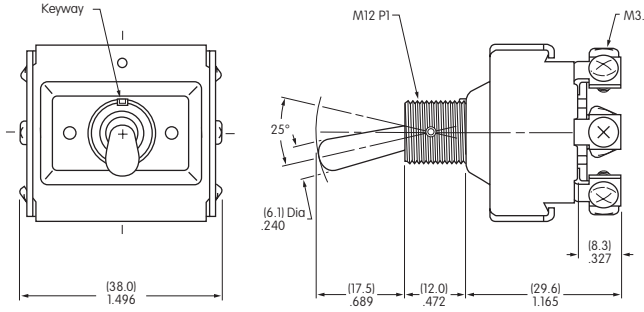
FOUR POLE WITH SCREW LUG

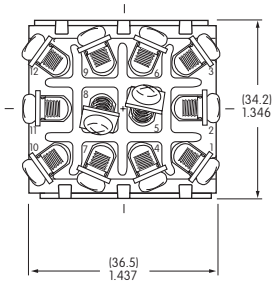
* UL, cULus & CSA recognized only when ordered with marking on switch (see General Specs)					Toggle Position/Connected Terminals				Electrical Capacity					
Model	*Approvals			Pole & Throw	Down (Keyway)		Center	Up	Resistive			Inductive		α = Angle of Throw
									AC 125V	AC 250V	DC 30V	AC 125V PF 0.6	AC 250V PF 0.6	
S41T	✓	✓	✓	4PST	ON	1-3 4-6 7-9 10-12	NONE	OFF —	25A	9A	20A	10A	5A	25°
S42T	✓	✓	✓	4PDT	ON	2-3 5-6 8-9 11-12	NONE	ON 2-1 5-4 8-7 11-10	25A	9A	20A	10A	5A	25°
S43T	✓	✓	✓	4PDT	ON	2-3 5-6 8-9 11-12	OFF	ON 2-1 5-4 8-7 11-10	25A	9A	20A	10A	5A	30°

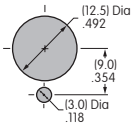
Throw & Schematics:

Note: Terminal numbers are on the switch

Notes: Standard Hardware: AT503M Face Hex Nut, AT506M Locking Ring, AT508 Lockwasher, AT527M Backup Hex Nut. See Accessories & Hardware section.
Optional Splashproof Boot Assemblies: AT401 & AT4181 boots plus hex nut & o-ring. See Accessories & Hardware section.







Maximum Panel Thickness: .181" (4.6mm)

S42T

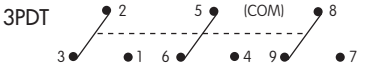
S41T does not have terminals 2, 5, 8, & 11

THREE POLE WITH QUICK CONNECT

* UL, cULus & CSA recognized only when ordered with marking on switch (see General Specs)

Model	*Approvals	Pole & Throw	Toggle Position/Connected Terminals: Down (Keyway)	Center	Up	Electrical Capacity: Resistive AC 125V	Resistive AC 250V	Resistive DC 30V	Inductive AC 125V PF 0.6	α = Angle of Throw
S31F	✓ ✓ ✓	3PST	ON 1-3 4-6 7-9	NONE	OFF —	25A	9A	20A	10A	25°
S32F	✓ ✓ ✓	3PDT	ON 2-3 5-6 8-9	NONE	ON 2-1 5-4 8-7	25A	9A	20A	10A	25°
S33F	✓ ✓ ✓	3PDT	ON 2-3 5-6 8-9	OFF	ON 2-1 5-4 8-7	25A	9A	20A	10A	30°

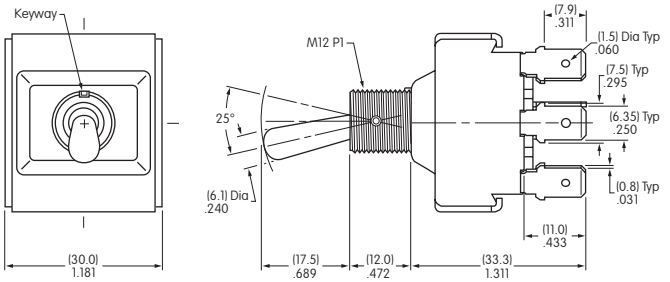
Throw & Schematics:



Note: Terminal numbers are on the switch

Notes: Standard Hardware: AT503M Face Hex Nut, AT506M Locking Ring, AT508 Lockwasher, AT527M Backup Hex Nut. See Accessories & Hardware section.
Optional Splashproof Boot Assemblies: AT401 & AT4181 boots plus hex nut & o-ring. See Accessories & Hardware section.

S32F



S31F does not have terminals 2, 5, & 8

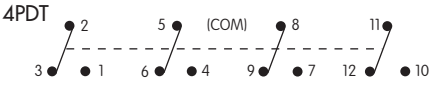
Maximum Panel Thickness: .181" (4.6mm)

FOUR POLE WITH QUICK CONNECT

* UL, cULus & CSA recognized only when ordered with marking on switch (see General Specs)

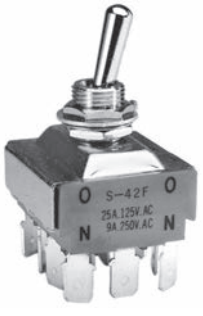
Model	*Approvals	Pole & Throw	Toggle Position/Connected Terminals: Down (Keyway)	Center	Up	Electrical Capacity: Resistive AC 125V	Resistive AC 250V	Resistive DC 30V	Inductive AC 125V PF 0.6	α = Angle of Throw
S41F	✓ ✓ ✓	4PST	ON 1-3 4-6 7-9 10-12	NONE	OFF —	25A	9A	20A	10A	25°
S42F	✓ ✓ ✓	4PDT	ON 2-3 5-6 8-9 11-12	NONE	ON 2-1 5-4 8-7 11-10	25A	9A	20A	10A	25°
S43F	✓ ✓ ✓	4PDT	ON 2-3 5-6 8-9 11-12	OFF	ON 2-1 5-4 8-7 11-10	25A	9A	20A	10A	30°

Throw & Schematics:

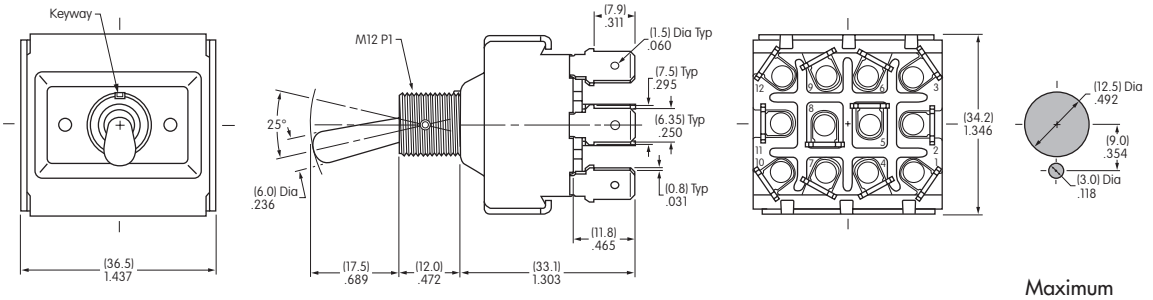


Note: Terminal numbers are on the switch

Notes: Standard Hardware: AT503M Face Hex Nut, AT506M Locking Ring, AT508 Lockwasher, AT527M Backup Hex Nut. See Accessories & Hardware section.
Optional Splashproof Boot Assemblies: AT401 & AT4181 boots plus hex nut & o-ring. See Accessories & Hardware section.



S42F



S41F does not have terminals 2, 5, 8, & 11

Maximum Panel Thickness: .181" (4.6mm)

GENERAL SPECIFICATIONS FOR S421 ~ S429

Electrical Capacity (Resistive & Inductive Load)

Power Level: Shown in the following tables

Other Ratings

Contact Resistance: 10 milliohms maximum
Insulation Resistance: 1,000 megohms minimum @ 500V DC
Dielectric Strength: 2,000V AC minimum for 1 minute minimum
Mechanical Life: 50,000 operations minimum
Electrical Life: 15,000 operations minimum
Angle of Throw (α): Shown in tables on following pages

Materials & Finishes

Toggle: Brass with chrome plating
Bushing: Brass with chrome plating
Case: Melamine phenol
Case Cover: Steel with chromate plating over zinc plating
Movable Contactor: Copper with silver plating
Movable Contacts: Silver alloy capped on copper with silver plating
Stationary Contacts: Silver alloy capped on copper with silver plating
Terminals: Brass with tin plating

Environmental Data

Operating Temp Range: –10°C through +70°C (+14°F through +158°F)

Installation

Mounting Torque: 2.94Nm (26 lb•in) for double nut
Maximum Panel Thickness: Shown beneath panel cutout in switch dimension drawings
Soldering Time & Temperature: Manual Soldering: See Profile A in Supplement section.

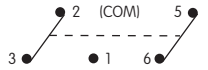
DOUBLE POLE WITH SOLDER LUG

Model	Approvals	Pole & Throw	Toggle Position/Connected Terminals ( ) = Momentary: Down (Keyway)	Center	Up	Electrical Capacity: Resistive AC 125V	Resistive AC 250V	Inductive PF 0.75 - 0.8 AC 125V	Inductive PF 0.75 - 0.8 AC 250V	Motor Load AC 125V	α = Angle of Throw
S421	— —	DPST	ON 1-3 4-6	NONE	OFF —	25A	25A	25A	25A	750W	24°
S422	— —	DPDT	ON 2-3 5-6	NONE	ON 2-1 5-4	25A	25A	25A	25A	750W	24°
S423	— —	DPDT	ON 2-3 5-6	OFF	ON 2-1 5-4	25A	25A	25A	25A	750W	28°
S425	— —	DPDT	ON 2-3 5-6	NONE	(ON) 2-1 5-4	15A	15A	15A	15A	400W	24°
S428	— —	DPDT	(ON) 2-3 5-6	OFF	(ON) 2-1 5-4	15A	15A	15A	15A	400W	24°
S429	— —	DPDT	ON 2-3 5-6	OFF	(ON) 2-1 5-4	15A	15A	15A	15A	400W	24°

Throw & Schematics:

DPST

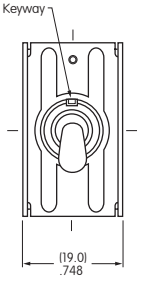
DPDT

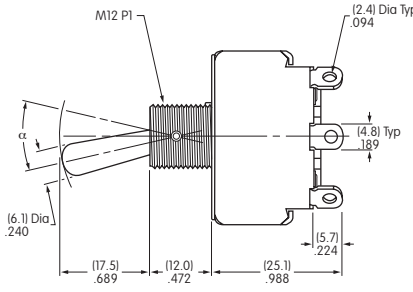


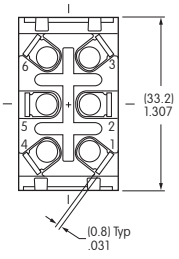
Note: Terminal numbers are on the switch

Notes: Standard Hardware: AT503M Face Hex Nut, AT506M Locking Ring, AT508 Lockwasher, AT527M Backup Hex Nut. See Accessories & Hardware section.
Optional Splashproof Boot Assemblies: AT401 & AT4181 boots plus hex nut & o-ring. See Accessories & Hardware section.

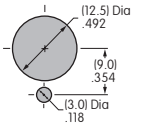
S422







S421 does not have terminals 2 & 5



Maximum Panel Thickness: .185" (4.7mm)

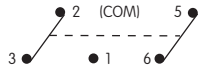
DOUBLE POLE WITH SCREW LUG

Model	Approvals	Pole & Throw	Toggle Position/Connected Terminals ( ) = Momentary: Down (Keyway)	Center	Up	Electrical Capacity: Resistive AC 125V	Resistive AC 250V	Inductive PF 0.75 - 0.8 AC 125V	Inductive PF 0.75 - 0.8 AC 250V	Motor Load AC 125V	α = Angle of Throw
S421T	— —	DPST	ON 1-3 4-6	NONE	OFF —	20A	20A	20A	20A	750W	24°
S422T	— —	DPDT	ON 2-3 5-6	NONE	ON 2-1 5-4	20A	20A	20A	20A	750W	24°
S423T	— —	DPDT	ON 2-3 5-6	OFF	ON 2-1 5-4	20A	20A	20A	20A	750W	28°
S425T	— —	DPDT	ON 2-3 5-6	NONE	(ON) 2-1 5-4	15A	15A	15A	15A	400W	24°
S428T	— —	DPDT	(ON) 2-3 5-6	OFF	(ON) 2-1 5-4	15A	15A	15A	15A	400W	24°
S429T	— —	DPDT	ON 2-3 5-6	OFF	(ON) 2-1 5-4	15A	15A	15A	15A	400W	24°

Throw & Schematics:

DPST

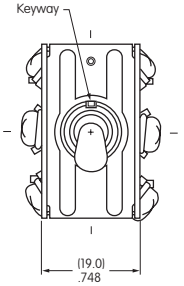
DPDT

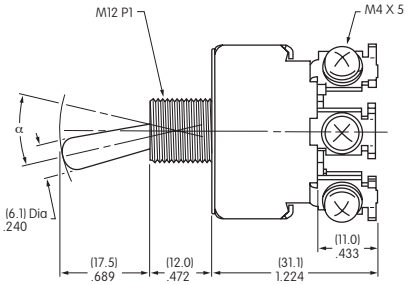


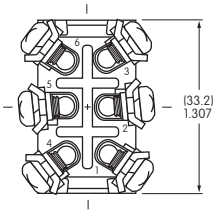
Note: Terminal numbers are on the switch

Notes: Standard Hardware: AT503M Face Hex Nut, AT506M Locking Ring, AT508 Lockwasher, AT527M Backup Hex Nut. See Accessories & Hardware section.
Optional Splashproof Boot Assemblies: AT401 & AT4181 boots plus hex nut & o-ring. See Accessories & Hardware section.

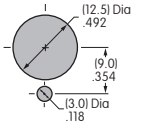
S423T







S421T does not have terminals 2 & 5



Maximum Panel Thickness: .185" (4.7mm)

GENERAL SPECIFICATIONS FOR S800s ~ S732

Electrical Capacity (Resistive & Inductive Load)

Power Level: Shown in the following tables

Other Ratings

Contact Resistance: 10 milliohms maximum
Insulation Resistance: 1,000 megohms minimum @ 500V DC
Dielectric Strength: 2,000V AC minimum for 1 minute minimum for S800s & S800Ds
3,000V AC minimum for 1 minute minimum for S732
Mechanical Life: 50,000 operations minimum
Electrical Life: 10,000 operations minimum for S800Ds
25,000 operations minimum for S800s & S732

Materials & Finishes

Toggle: Brass with nickel plating for S732
Brass with chrome plating for S800s & S800Ds
Bushing: Brass with chrome plating
Case: Phenolic resin for S732; melamine phenol for S800s
Case Cover: Steel with chromate plating over zinc plating
Movable Contactor Plate: Copper with silver plating
Movable & Stationary Contacts: Silver alloy capped on copper with silver plating
Common Terminals: Brass
Contact Terminals: Brass with silver or nickel plating

Environmental Data

Operating Temp Range: –10°C through +70°C (+14°F through +158°F)

Installation

Mounting Torque: 2.94Nm (26 lb•in) for double nut
Maximum Panel Thickness: Shown beneath panel cutout in switch dimension drawings

Standards & Certifications

UL: **File No. E44145 - Recognized only when ordered with marking on switch.**
Add "/U" or "/CUL" to end of part number to order UL recognized switch.
UL or cULus recognition designated beside part numbers on following pages.
See Supplement section to find UL or cULus rating details.

CSA: **File No. 023535_0_000 - Certified only when ordered with marking on switch.**
Add "/C" to end of part number to order CSA certified switch.
CSA certification designated beside part numbers on following pages.
See Supplement section to find CSA rating details.

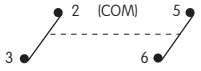
DOUBLE POLE WITH SCREW LUG

* UL, cULus & CSA recognized only when ordered with marking on switch (see General Specs)

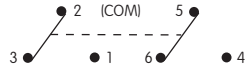
Model	*Approvals	Pole & Throw	Toggle Position/Connected Terminals: Down	Center	Up	Electrical Capacity: Resistive AC 125V	Resistive AC 250V	Resistive DC 30V	Resistive DC 125V	Inductive AC 125V PF 0.6	Inductive AC 250V PF 0.6	Motor Load AC 125V
S821	✓ ✓ ✓	DPST	ON 2-3 5-6	NONE	OFF —	30A	30A	30A	1A	30A	15A	750W
S822	✓ ✓ ✓	DPDT	ON 2-3 5-6	NONE	ON 2-1 5-4	30A	30A	30A	1A	30A	15A	—
S823	✓ ✓ ✓	DPDT	ON 2-3 5-6	OFF	ON 2-1 5-4	30A	30A	30A	1A	30A	15A	—

Throw & Schematics:

DPST



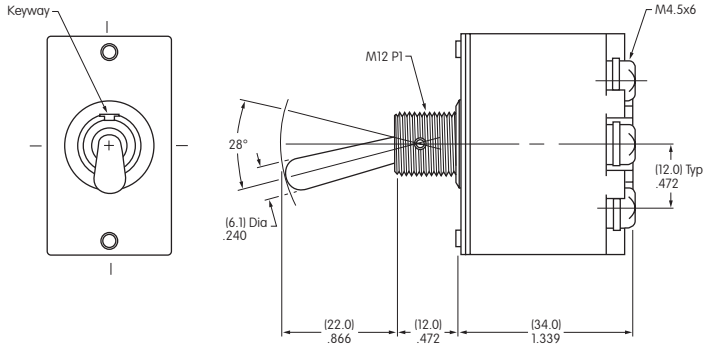
DPDT



Note: Terminal numbers are on the switch

Notes: Standard Hardware: AT503M Face Hex Nut, AT506M Locking Ring, AT508 Lockwasher, AT527M Backup Hex Nut. See Accessories & Hardware section.
Optional Splashproof Boot Assembly: AT401 boot plus hex nut & o-ring. See Accessories & Hardware section.

S822



S821 does not have terminals 1 & 4

Maximum Panel Thickness: .177" (4.5mm)

THREE POLE WITH SCREW LUG

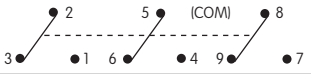
* UL, cULus & CSA recognized only when ordered with marking on switch (see General Specs)

Model	*Approvals	Pole & Throw	Toggle Position/Connected Terminals: Down	Center	Up	Electrical Capacity: Resistive AC 125V	Resistive AC 250V	Resistive DC 30V	Resistive DC 125V	Inductive AC 125V PF 0.6	Inductive AC 250V PF 0.6
S831	✓ ✓ ✓	3PST	ON 2-3 5-6 8-9	NONE	OFF —	30A	30A	30A	1A	30A	15A
S832	✓ ✓ ✓	3PDT	ON 2-3 5-6 8-9	NONE	ON 2-1 5-4 8-7	30A	30A	30A	1A	30A	15A
S833	✓ ✓ ✓	3PDT	ON 2-3 5-6 8-9	OFF	ON 2-1 5-4 8-7	30A	30A	30A	1A	30A	15A

Throw & Schematics:

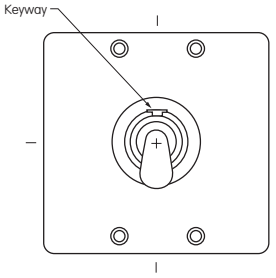
3PST

3PDT

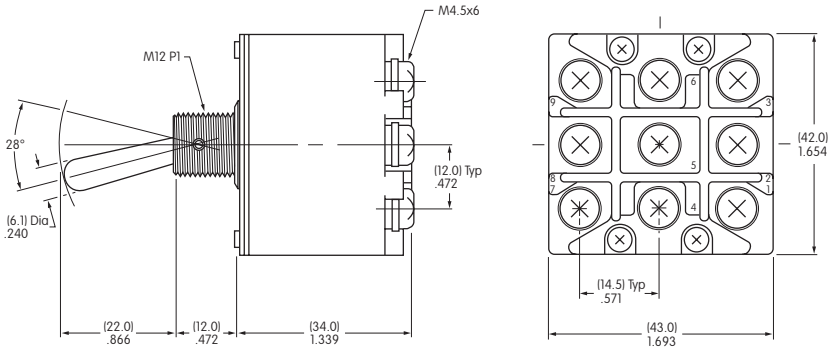


Note: Terminal numbers are on the switch

Notes: Standard Hardware: AT503M Face Hex Nut, AT506M Locking Ring, AT508 Lockwasher, AT527M Backup Hex Nut. See Accessories & Hardware section.
Optional Splashproof Boot Assembly: AT401 boot plus hex nut & o-ring. See Accessories & Hardware section.



S833



S831 does not have terminals 1, 4 & 7

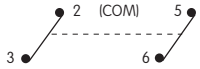
Maximum Panel Thickness: .177" (4.5mm)

DOUBLE POLE WITH SCREW LUG & FLATTED LEVER

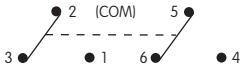
* UL, cULus & CSA recognized only when ordered with marking on switch (see General Specs)			Toggle Position/Connected Terminals			Electrical Capacity								
	*Approvals			Down	Center	Up	Resistive					Inductive L/R = 3ms			
Model		Pole & Throw	Keyway				DC 30V	DC 48V	DC 125V	DC 250V	DC 400V	DC 24V	DC 48V	DC 125V	DC 250V
S821D	✓ ✓ ✓	DPST	ON 2-3 5-6		NONE	OFF —	30A	30A	20A	15A	4A (10A)	15A	10A	6A	3A
S822D	✓ ✓ ✓	DPDT	ON 2-3 5-6		NONE	ON 2-1 5-4	30A	30A	20A	15A	4A	15A	10A	6A	3A
S823D	✓ ✓ ✓	DPDT	ON 2-3 5-6		OFF	ON 2-1 5-4	30A	30A	15A	7.5A	—	15A	10A	6A	3A

( ) capacity is due to wiring. Refer to instructions below.

Throw & Schematics: DPST

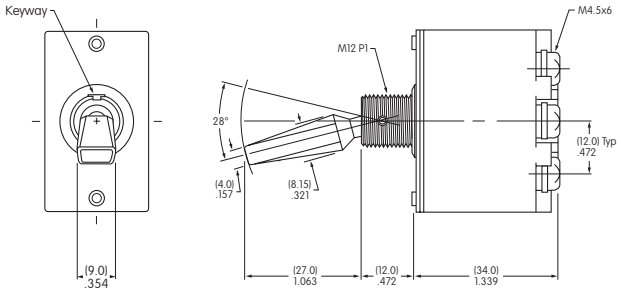


DPDT

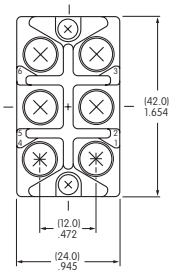


Note: Terminal numbers are on the switch

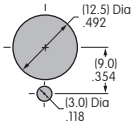
Notes: Standard Hardware: AT503M Face Hex Nut, AT506M Locking Ring, AT508 Lockwasher, AT527M Backup Hex Nut. See Accessories & Hardware section.



Double Pole



S821D does not have terminals 1 & 4



Maximum Panel Thickness: .177" (4.5mm)

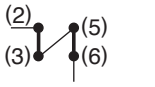
S822D

400V DC WIRING INSTRUCTIONS

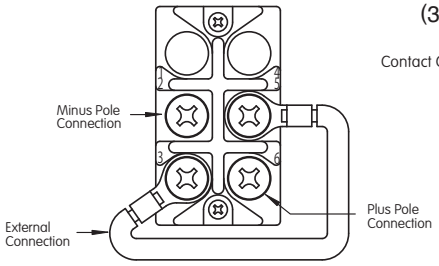
1. DC Switch Use

- Middle terminal shall be the minus pole when using DC circuit. Switch case is marked with (+) and (–).
- Do not store near (5cm) highly magnetic items.
- If actuation is interrupted when switching from ON to OFF, arcing may continue and switch could be burned.

2. Wiring for DC400V 10A

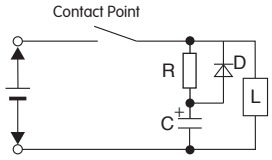


Contact Connection Position



3. Inductive Load

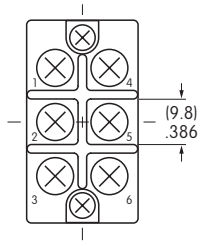
Inductive loads produce an arc caused by counter-electromotive force when opening the circuit. Recommend inserting spark elimination circuit. Contact factory for details.



(Patent Pending)

4. Compressed Terminal Connection

When connecting screw terminal with compressed terminal, select compressed terminal using drawing below.

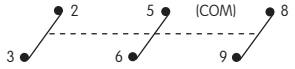


THREE POLE WITH SCREW LUG & FLATTED LEVER

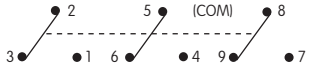
* UL, cULus & CSA recognized only when ordered with marking on switch (see General Specs)				Toggle Position/Connected Terminals			Electrical Capacity							
	*Approvals				Down	Center	Up	Resistive				Inductive L/R = 3ms			
Model				Pole & Throw	Keyway			DC 30V	DC 48V	DC 125V	DC 250V	DC 24V	DC 48V	DC 125V	DC 250V
S831D	✓	✓	✓	3PST	ON 2-3 5-6 8-9	NONE	OFF —	30A	30A	15A	7.5A	15A	10A	6A	3A
S832D	✓	✓	✓	3PDT	ON 2-3 5-6 8-9	NONE	ON 2-1 5-4 8-7	30A	30A	15A	7.5A	15A	10A	6A	3A
S833D	✓	✓	✓	3PDT	ON 2-3 5-6 8-9	OFF	ON 2-1 5-4 8-7	30A	30A	15A	7.5A	15A	10A	6A	3A

Throw & Schematics:

3PST

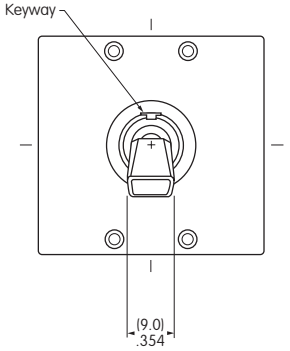


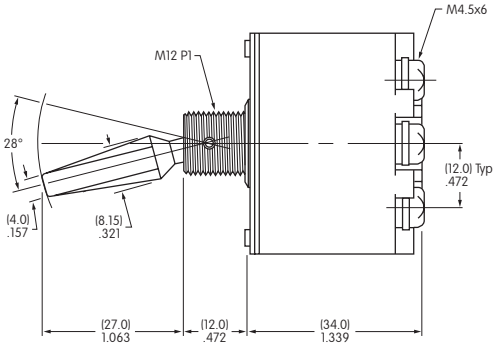
3PDT



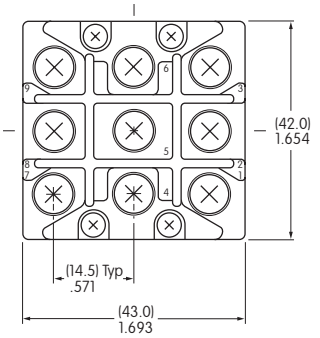
Note: Terminal numbers are on the switch

Notes: Standard Hardware: AT503M Face Hex Nut, AT506M Locking Ring, AT508 Lockwasher, AT527M Backup Hex Nut. See Accessories & Hardware section.



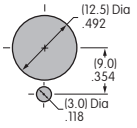


Three Pole



S831D does not have terminals 1, 4 & 7.
Positive (+) must be connected to end terminals & negative to common terminals.

S832D

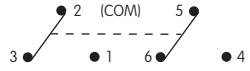


Maximum Panel Thickness: .177" (4.5mm)

DOUBLE POLE WITH SCREW LUG

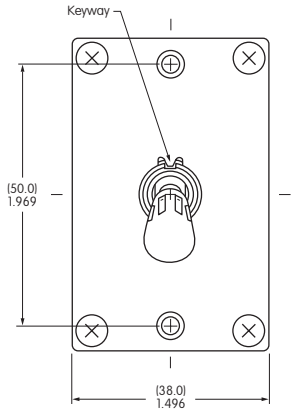
Model	Approvals	Pole & Throw	Toggle Position/Connected Terminals: Down (Keyway)	Center	Up	Electrical Capacity: Resistive AC 125V	Resistive AC 250V	Resistive DC 30V	Inductive AC 125V PF 0.6
S732	— —	DPDT	ON 2-3 5-6	NONE	ON 2-1 5-4	50A	30A	50A	25A

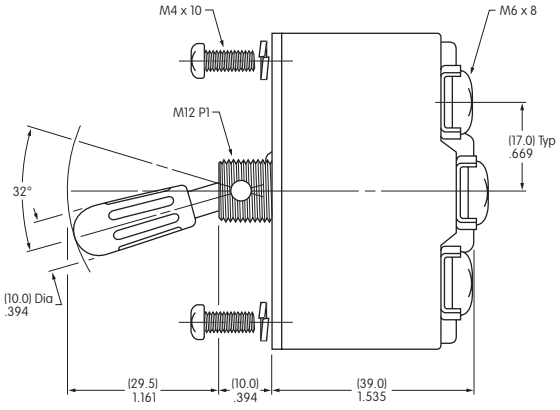
Throw & Schematics: DPDT

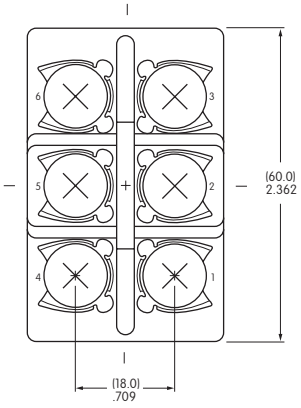


Note: Terminal numbers are on the switch

Notes: Standard Hardware: AT503M Face Hex Nut, AT506M Locking Ring, AT508 Lockwasher, AT527M Backup Hex Nut. See Accessories & Hardware section.

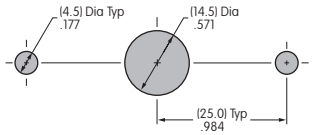






Cap of phenolic resin is black

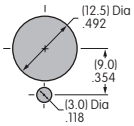
Panel Mount with Mounting Screws



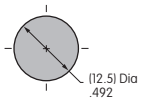
Maximum
Panel Thickness:
.158" (4.0mm)

S732

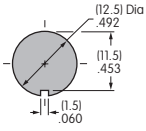
Panel Mount with Bushing Hardware



Maximum
Panel Thickness:
.079" (2.0mm)



Maximum
Panel Thickness:
.118" (3.0mm)



Maximum
Panel Thickness:
.118" (3.0mm)

Notes

General Specifications

Electrical Capacity (Resistive Load)

Power Level (silver): 6A @ 125V AC or 3A @ 250V AC or 6A @ 12V DC for silver
Logic Level (gold): 0.4VA maximum @ 28V AC/DC maximum for gold
(Applicable Range 0.1mA ~ 0.1A @ 20mV ~ 28V)
Note: See Supplement Index for explanation of operating range.

Other Ratings

Contact Resistance: 10 milliohms maximum for silver; 20 milliohms maximum for gold
Insulation Resistance: 1,000 megohms minimum @ 500V DC
Dielectric Strength: 1,000V AC minimum between contacts for 1 minute minimum;
1,500V AC minimum between contacts & case for 1 minute minimum
Mechanical Life: 50,000 operations minimum
Electrical Life: 25,000 operations minimum for silver; 50,000 operations minimum for gold
Static Capability: Withstands 20 kilovolts ESD minimum
Nominal Operating Force: 1.9N for .689" (17.5mm) toggle; 2.5N for .433" (11.0mm) toggle
Angle of Throw: 25°

Materials & Finishes

Toggle: Polycarbonate
Housing: Glass fiber reinforced polyamide
Sealing Ring: Nitrile butadiene rubber
Base: Diallyl phthalate (UL94V-0)
Movable Contactor: Phosphor bronze with silver or gold plating
Movable Contacts: Silver alloy or copper with gold plating
Stationary Contact: Silver plus copper with silver plating or copper with gold plating
Lamp Contacts: Beryllium copper with silver plating
Power Terminals: Copper with silver or gold plating
Lamp Terminals: Brass with silver plating

Environmental Data

Operating Temperature Range: –10°C through +55°C (+14°F through +131°F)
Humidity: 90 ~ 95% humidity for 240 hours @ 40°C (104°F)
Vibration: 10 ~ 55Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in 1 minute; 3 right angled directions for 1.75 hours
Shock: 50G (490m/s^2) acceleration (tested in 6 right angled directions, with 5 shocks in each direction)

Installation

Mounting Torque: .98Nm (8.67 lb•in) maximum
Soldering Time & Temperature: Manual Soldering: See Profile B in Supplement section.

Standards & Certifications

Flammability Standards: UL94V-0 base

Distinctive Characteristics

Choice of long or short toggles in translucent colors combine with bright LEDs available in red, amber, and green, plus super bright LEDs available in white, green, and blue.

Black face nut enhances front panel appearance.

Antistatic material used for toggle withstands 20 kilovolts electrostatic discharge.

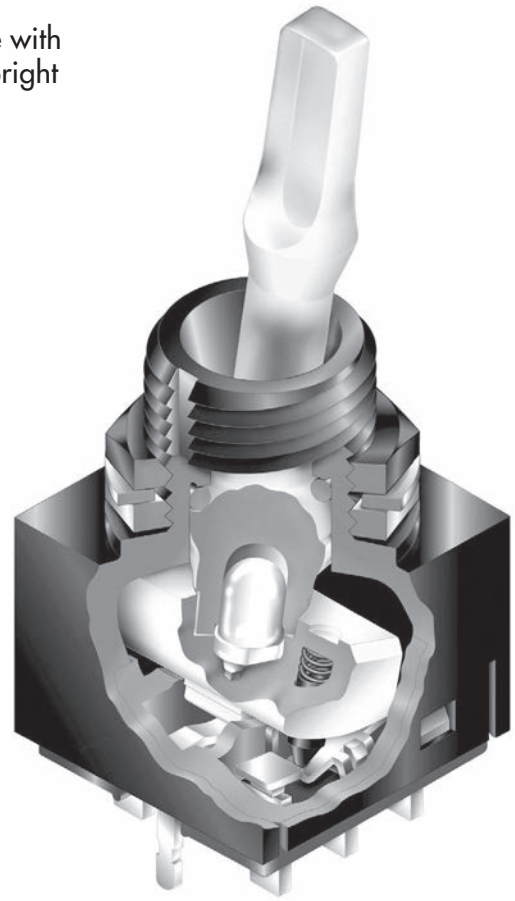
Panel seal, achieved with use of optional exterior o-ring, conforms to IP65 of IEC60529 Standards.

Interior o-ring protects contacts from oil, dust, water, and other contaminants.

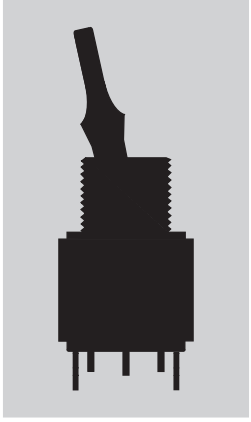
UL94V-0 flammability rated for base.

High insulating barriers protect against crossover.

Terminals are molded in and epoxy sealed to lock out flux, dust, and other contaminants.



Actual Size



TYPICAL SWITCH ORDERING EXAMPLE

TL	2	2	D	N	A	W01	6G

Pole

2	DPDT

Circuit

2	ON	NONE	ON

Toggle Lengths

D	.689" (17.5mm) (combines with silver contacts only)
S	.433" (11.0mm) (combines with gold contacts only)

Toggle Colors

For Bright	
C	Red
D	Amber
F	Green
For Super Bright	
N	No Color

Housing

A	Black

Terminals, Contacts & Ratings

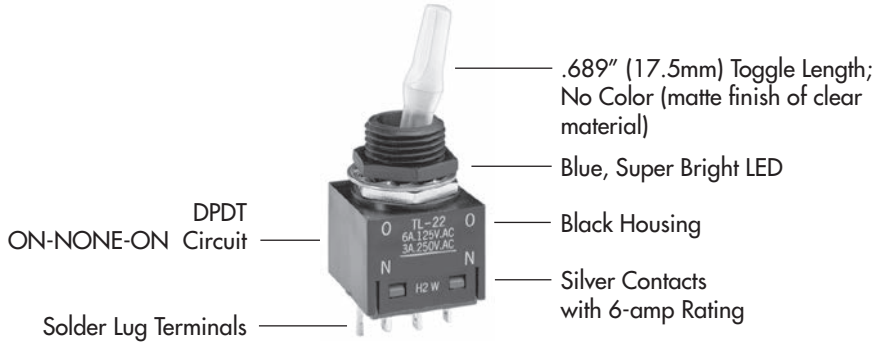
W01	Solder Lug Terminals Silver 6A @ 125V AC for .689" (17.5mm) Toggle only
G01	Solder Lug Terminals Gold 0.4VA @ 28V AC/DC for .433" (11.0mm) Toggle only

LED Colors

Bright	
5C	Red
5D	Amber
5F	Green
Super Bright	
6B	White
6F	Green
6G	Blue

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

TL22DNAW016G



POLE & CIRCUIT

		Toggle Position			Connected Terminals			Throw & Power/Lamp Schematics
Pole	Model	Down	Center	Up	Down	Center	Up	
DP	TL22	ON	NONE	ON	1-1b 2-2b	OPEN	1-1a 2-2a	DPDT

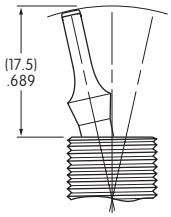
Notes: Terminal numbers are not actually on switch. Lamp circuit is isolated and requires an external power source.

TOGGLE LENGTHS & COLORS

D **.689" (17.5mm)**

Combines with Silver Contacts only

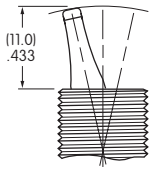
Material: Polycarbonate



S **.433" (11.0mm)**

Combines with Gold Contacts only

Material: Polycarbonate



Colors Available for Bright LED

C Red **D** Amber **F** Green

Color Available for Super Bright LED

N No Color (Appearance is matte finish of clear material)

HOUSING

A **Black**

The housing consists of the one-piece bushing/case of glass fiber reinforced polyamide in black color only.

The diallyl phthalate material used for the base is UL flammability rated 94V-0; housing material is not.

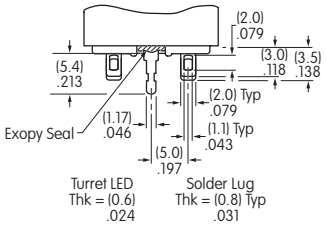
CONTACT MATERIALS, RATINGS, & TERMINALS

W **Silver Contacts** **Power Level**
6A @ 125V AC & 3A @ 250V AC
& 6A @ 12V DC

G **Gold Contacts** **Logic Level**
0.4VA maximum @ 28V AC/DC

See Supplement Index for complete explanation of operating range.

01 **Solder Lug Terminals**



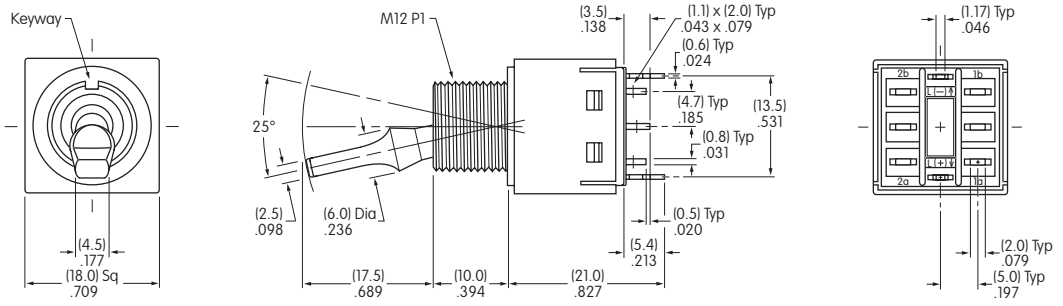
LED CODES & SPECIFICATIONS

Electrical specifications are determined at a basic temperature of 25°C. Lamp circuit is independent of switch operation.
If the source voltage is greater than rated voltage, a ballast resistor is required.
The ballast resistor calculation and more lamp detail are shown in Supplement section.

Super Bright LEDs are Electrostatic Sensitive — ATTENTION ELECTROSTATIC SENSITIVE DEVICES		Colored Toggles			Clear Toggles		
		5 Bright			6 Super Bright		
LED Factory Assembled **Not Available Separately**	Color	C Red	D Amber	F Green	B White	F Green	G Blue
Maximum Forward Current	I_{FM}	30mA	30mA	50mA	30mA	30mA	30mA
Typical Forward Current	I_F	20mA	20mA	20mA	20mA	20mA	20mA
Forward Voltage	V_F	2.0V	2.1V	2.27V	3.3V	3.3V	3.3V
Maximum Reverse Voltage	V_{RM}	4V	4V	4V	7V	7V	7V
Current Reduction Rate Above 25°C	ΔI_F	0.32mA/°C	0.32mA/°C	0.50mA/°C	0.40mA/°C	0.40mA/°C	0.40mA/°C
Ambient Temperature Range		−10°C ~ +55°C			−10°C ~ +55°C		

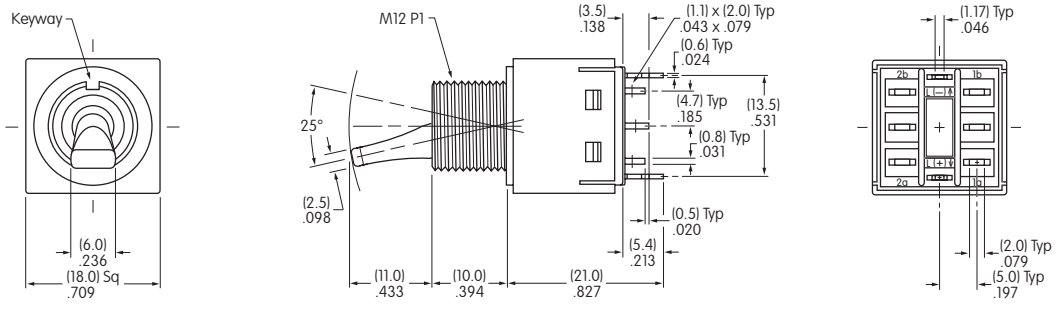
TYPICAL SWITCH DIMENSIONS

17.5mm Toggle



TL22DNAW016G

11.0mm Toggle

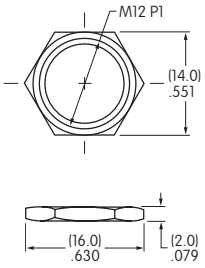


TL22SCAG015C

STANDARD HARDWARE

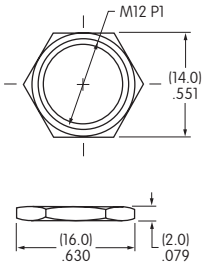
AT527MA Black Hex Nut

Use as Face Nut
Chrome/Steel



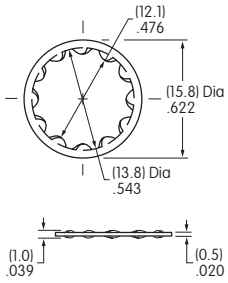
AT527M Hex Nut

Use as Backup Nut
Nickel/Steel



AT508 Lockwasher

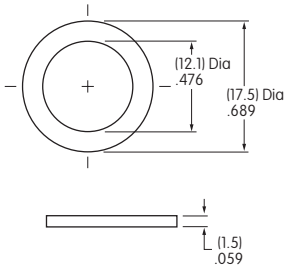
Not to use with Panel Seal
Steel with Chromate/Zinc



OPTIONAL HARDWARE

AT401P O-ring

Use for Panel Seal
Nitrile butadiene rubber

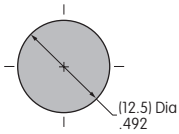


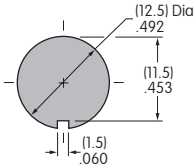
Hardware details in Accessories & Hardware section.

Panel Cutouts

Maximum Panel Thickness
with Standard Hardware:

.157" (4.0mm)





Maximum Panel Thickness
with Standard Hardware
& AT401P O-ring:

.236" (6.0mm)

General Specifications

Electrical Capacity (Resistive Load)

Power Level: 10A @ 125V AC or 6A @ 250V AC or 10A @ 30V DC

Other Ratings

Contact Resistance: 10 milliohms maximum for solder lug & screw terminal models;
30 milliohms maximum for wire lead terminal models
Insulation Resistance: 200 megohms minimum @ 500V DC
Dielectric Strength: 1,500V AC minimum for 1 minute minimum
Mechanical Life: 50,000 operations minimum for On-None-Off, On-None-On, & On-Off-On models
30,000 operations minimum for all other models
Electrical Life: 15,000 operations minimum
Angle of Throw: 24°

Materials & Finishes

Toggle: Brass with chrome plating
Bushing & Outer Case: Glass fiber reinforced polyamide (UL94V-0)
Inner Case: Melamine
Inner Sealing Ring: Nitrile butadiene rubber for On-None-Off, On-None-On, & On-Off-On models;
silicone rubber for all other models
Outer Sealing Ring: Nitrile butadiene rubber
Movable Contactor: Copper with silver plating
Movable Contacts: Silver alloy plus copper with silver plating
Stationary Contacts: Silver alloy plus copper with silver plating
Terminals: Brass with tin plating
Wire Lead Covers: Heat resistant polyvinyl chloride (Leads are AWG 16)

Environmental Data

Operating Temp Range: –30°C through +70°C (–22°F through +158°F)
Humidity: 90 ~ 95% humidity for 96 hours @ 40°C (104°F)
Vibration: 10 ~ 55Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range
& returning in 1 minute; 3 right angled directions for 2 hours
Shock: 50G (490m/s^2) acceleration (tested in 6 right angled directions, with 5 shocks in each direction)
Front Panel Seal: IP67 of IEC60529, dust tight & water protected during temporary immersion for all models;
optional toggle boot AT401 for additional protection (details at end of WT section)
Behind Panel Seal: IP60 of IEC60529, dust tight but not water protected
for solder lug & screw terminal models
IP67 of IEC60529, dust tight & water protected during temporary immersion
for wire lead models

Installation

Soldering Time & Temp: Manual Soldering: See Profile A in Supplement section.
Mounting Torque: 1.47Nm (13 lb•in)

Standards & Certifications

Flammability Standards: UL94V-0 outer case
Wiring Material Standards: UL AWM 1015 Recognized at Flammability VW-1;
Temperature Range –20°C ~ +105°C; Maximum Load 600V; AWG 16.
CSA TEW 105 Certified at Temperature Range –20°C ~ +105°C;
Maximum Load 600V

Distinctive Characteristics

Sealing for wire lead models meets IP67 of IEC60529 Standards at front and back panel.

Sealing for solder lug or screw lug models meets IP67 at front panel and IP60 at back panel.

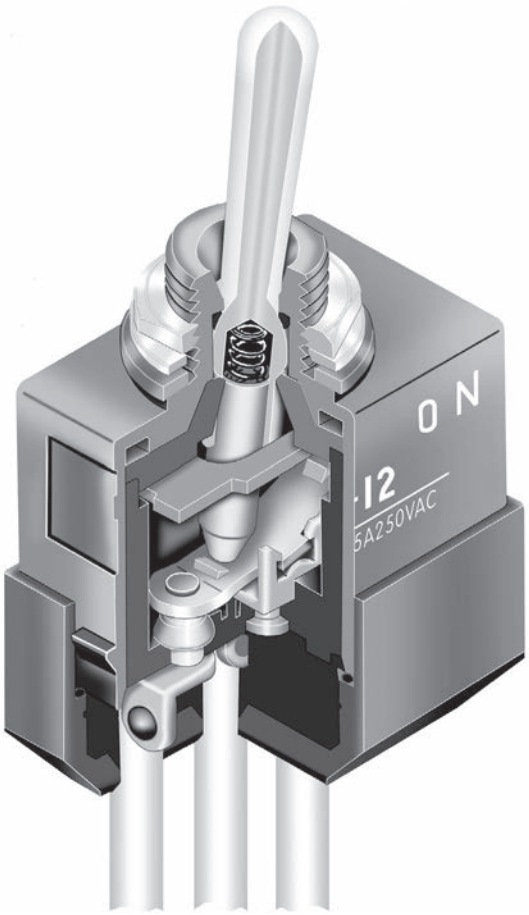
Single unit construction of bushing and case gives added protection from environmental elements.

Epoxy sealed base covered by outer case doubles protection from dust and water (not operable under water or oil).

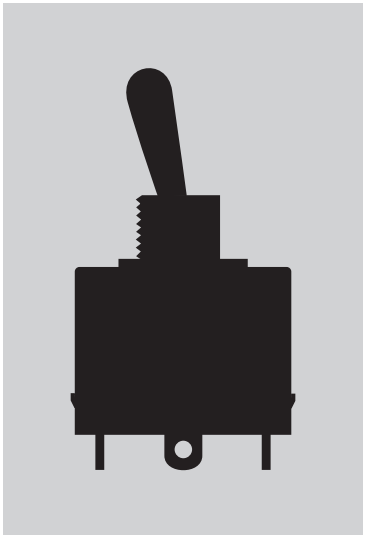
Specially designed contact mechanism that breaks light contact welds for circuits 11, 12, 21 and 22.

Interlocked movable contact mechanism provides highly reliable switching by minimizing contact bounce over center contact.

Heat resistant resin used for outer housing meets UL94V-0 flammability standard and provides high arc and tracking resistance.



Actual Size



Series WT

Environmentally Sealed Toggles

TYPICAL SWITCH ORDERING EXAMPLE

WT **2** **2** **S**

Poles	
1	SPST SPDT
2	DPST DPDT

Circuits			
1	ON	NONE	OFF
2	ON	NONE	ON
3	ON	OFF	ON
5	ON	NONE	(ON)
8	(ON)	OFF	(ON)
9	ON	OFF	(ON)
( ) = Momentary			

Terminals	
S	Solder Lug
T	Screw Lug
L	Wire Lead

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

WT22S

DPDT
ON-NONE-ON Circuit

Solder Lug Terminals

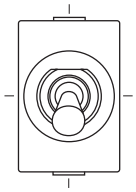
POLES & CIRCUITS

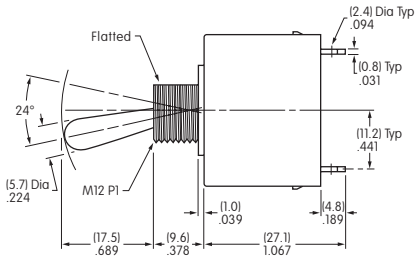
Pole	Model	Toggle Position ( ) = Momentary Down	Center	Up	Connected Terminals Down	Center	Up	Throw & Schematics
SP	**WT11**	ON	NONE	OFF	1a-1b	OPEN	OPEN	SPST
SP	**WT12** **WT13** **WT15** **WT18** **WT19**	ON ON ON (ON) ON	NONE OFF NONE OFF OFF	ON ON (ON) (ON) (ON)	1-1b	OPEN	1-1a	SPDT
DP	**WT21**	ON	NONE	OFF	1a-1b 2a-2b	OPEN	OPEN	DPST
DP	**WT22** **WT23** **WT25** **WT28** **WT29**	ON ON ON (ON) ON	NONE OFF NONE OFF OFF	ON ON (ON) (ON) (ON)	1-1b 2-2b	OPEN	1-1a 2-2a	DPDT

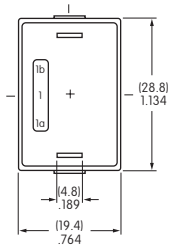
Note: Terminal numbers are not actually on wire lead models.

TYPICAL SWITCH DIMENSIONS

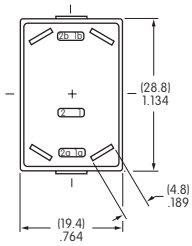
Single Throw • Solder Lug







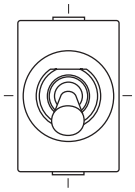
Single Pole

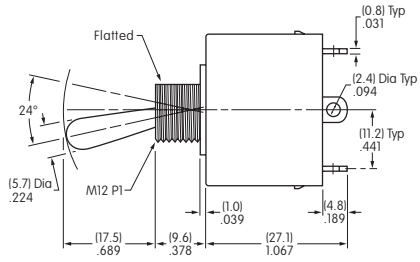


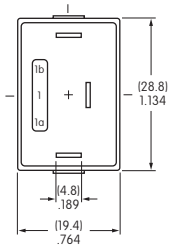
Double Pole

WT11S

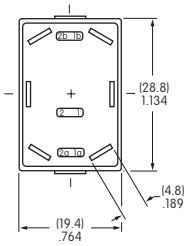
Double Throw • Solder Lug







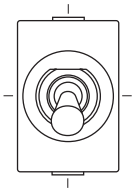
Single Pole

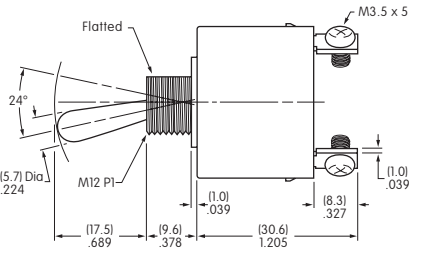


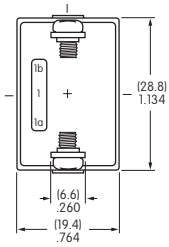
Double Pole

WT22S

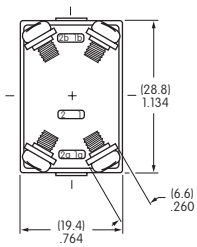
Single Throw • Screw Lug







Single Pole



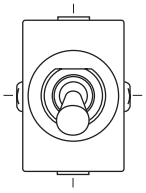
Double Pole

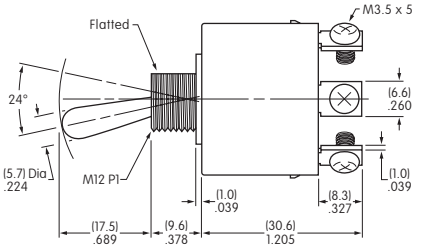
WT21T

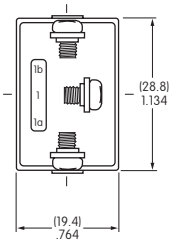
TYPICAL SWITCH DIMENSIONS

Double Throw • Screw Lug

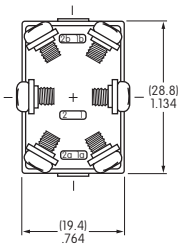
WT22T







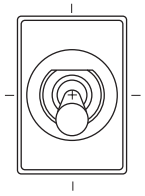
Single Pole

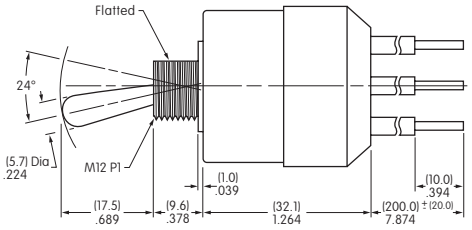


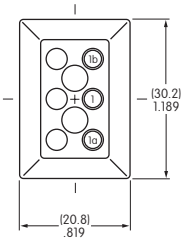
Double Pole

Single & Double Pole • Wire Lead

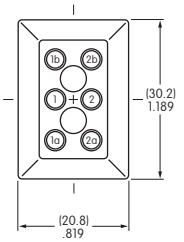
WT22L







Single Pole



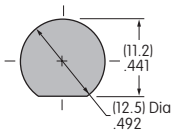
Double Pole

STANDARD WIRE COLOR SCHEME

Wire leads are covered with heat resistant vinyl in accordance to UL 1015 and CSA TEW 105 Standards for Appliance Wiring Material (AWM).

	Terminal Numbers & Wire Colors					
	1a	1	1b	2a	2	2b
WT11	Black		White			
WT12-19	White	Black	Red			
WT21	Black		White	Blue		Yellow
WT22-29	White	Black	Red	Yellow	Blue	Green

PANEL CUTOUT & THICKNESS



Maximum Effective Panel Thickness

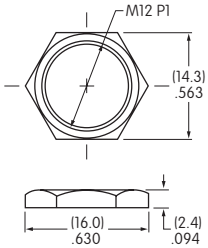
With Standard Hardware: .157" (4.0mm)
With optional Boot Assembly AT401A/H/S: .063" (1.6mm)
With optional Boot Assembly AT4181: .083" (2.1mm)

STANDARD HARDWARE

AT503M Hex Face Nut

Material: Brass with Chrome Plating

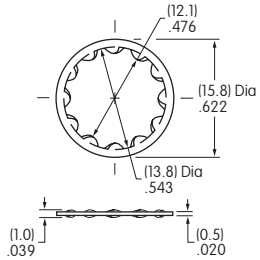
1 supplied with each switch



AT508 Internal Tooth Lockwasher

Material: Steel with Zinc/Chromate

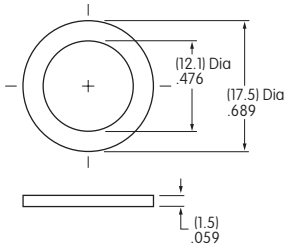
1 supplied with each switch



AT401P O-ring

Material: Nitrile butadiene rubber

1 supplied with each switch



OPTIONAL ACCESSORIES

Boot Assemblies for High Particulate Contamination Applications

AT401A for Oil Resistance

Boot Material:
Black nitrile butadiene rubber

Hex Nut Material & Finish:
Nickel plated brass

O-ring Material: Nitrile butadiene rubber

AT401H for Dust & Ozone Resistance

Boot Material:
Gray ethylene propylene rubber

Hex Nut Material & Finish:
Nickel plated brass

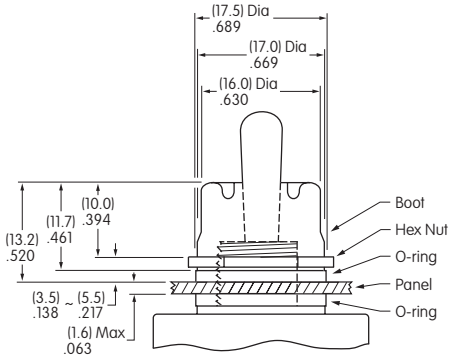
O-ring Material: Nitrile butadiene rubber

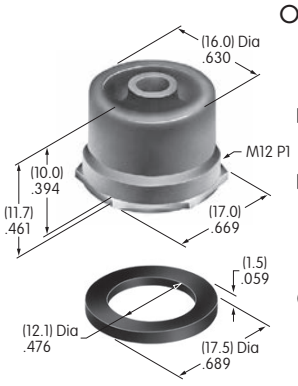
AT401S for Retention of Flexibility, Resilience & Tensile Strength Over Wide Temperature Range

Boot Material: Black silicone rubber

Hex Nut Material & Finish:
Nickel plated brass

O-ring Material: Nitrile butadiene rubber



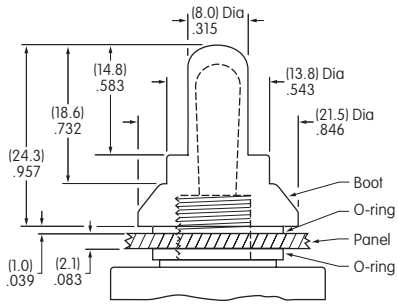


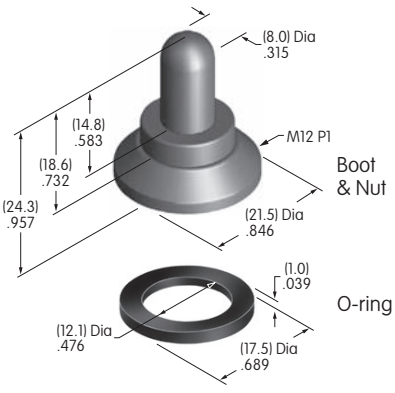
AT4181 Splashproof Boot Assembly

Boot Material:
Black Silicon rubber

Nut Material & Finish:
Nickel plated brass

O-ring Material: Nitrile butadiene rubber





Note: When using boot assemblies
AT401A/H/S or AT4181, also use o-ring AT401P from the standard hardware supplied.
Hex face nut AT503M and lockwasher AT508 are not used with these boot assemblies.

Notes

NKK SWITCHES

Rockers

Contents Rockers

A Series B4
Process Sealed
0.4VA Logic Level
Straight, Right Angle, & Vertical PC

CW Series B12
6A Power Level
Solder Lug, Quick Connect, & Right Angle PC
Snap-in Mount

CWSB Series Illuminated B18
Neon; 9A Power Level
Quick Connect; Snap-in Mount

CWSC Series Illuminated B22
LED; 9A Power Level
Solder Lug/Quick Connect; Snap-in Mount

G Series B28
Process Sealed
0.4VA Logic Level
Straight PC

GW Series B32
Ultra-Thin
0.4VA Logic Level
Straight, Right Angle, & Vertical PC

GW Series Illuminated B36
Fully Illuminated Paddle
0.4VA Logic Level
Straight, Right Angle, & Vertical PC

JW Series B40
Internationally Approved
10A & 16A Power Level
Solder Lug; Snap-in-Mount

JWS Series Illuminated & Nonilluminated ... B50
Internationally Approved
6A & 10A Power Level
Solder Lug; Snap-in-Mount

LW Series Illuminated B56
10A Power Level
Incandescent Dual Lamps
Solder Lug; Snap-in Mount

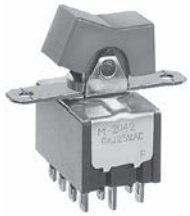
Contents

M Series B62

Snap-in Mount
6A Power Level & 0.4VA Logic Level
Solder Lug, Quick Connect, Straight PC, & Wirewrap

M Series B72

Bracketed PC Mount
6A Power Level & 0.4VA Logic Level
Straight, Right Angle, & Vertical PC with Bracket



M Series B83

Flat Frame Mount
6A Power Level & 0.4VA Logic Level
Solder Lug & Straight PC

M2100 Series Illuminated B92

6A Power Level & 0.4VA Logic Level
Solder Lug, Quick Connect, & PC
Flat Frame & Snap-in Mount

M2T Series B98

Process Sealed
6A Power Level & 0.4VA Logic Level
Straight, Right Angle, & Vertical PC

MLW Series Illuminated B106

5A Power Level
Incandescent, Neon, & LED Lamps
Solder Lug; Snap-in Mount

P Series B114

Internationally Approved
10A Power Level
Solder Lug, Straight PC, & Quick Connect; Flat Frame Mount

SW Series B120

15A to 30A Medium & High Capacity
Solder Lug & Screw Lug
Screw Mount

WR Series B124

Environmentally Sealed
15A Power Level
Solder Lug, Screw Lug, Wire Lead, & Quick Connect
Snap-in Mount

General Specifications

Electrical Capacity (Resistive Load)

Logic Level: 0.4VA maximum @ 28V AC/DC maximum
(Applicable Range 0.1mA ~ 0.1A @ 20mV ~ 28V)
Note: Find additional explanation of operating range in Supplement section.

Other Ratings

Contact Resistance: 50 milliohms maximum
Insulation Resistance: 500 megohms minimum @ 500V DC
Dielectric Strength: 500V AC minimum for 1 minute minimum
Mechanical Life: 100,000 operations minimum for On-None-On & On-Off-On
50,000 operations minimum for other circuits
Electrical Life: 50,000 operations minimum
Nominal Operating Force: 2.73N (momentary); 1.84N (maintained)
Contact Timing: Nonshorting (break-before-make)
Angle of Throw: 26°

Materials & Finishes

Actuator or Toggle: Nickel plated brass
Case Housing: Glass fiber reinforced polyamide
Support Bracket: Tin plated phosphor bronze
Movable Contact: Phosphor bronze with gold plating
Stationary Contacts: Brass with gold plating
Terminals: Brass with gold plating

Environmental Data

Operating Temperature Range: –30°C through +85°C (–22°F through +185°F)
Humidity: 90 ~ 95% humidity for 240 hours @ 40°C (104°F)
Vibration: 10 ~ 55Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in 1 minute; 3 right angled directions for 2 hours
Shock: 50G (490m/s^2) acceleration (tested in 6 right angled directions, with 5 shocks in each direction)

Installation

Cap Installation Force: 39.23N (8.82 lbf) maximum downward force on actuator

PCB Processing

Soldering: Wave Soldering Recommended: See Profile A in Supplement section.
Manual Soldering: See Profile B in Supplement section.
Cleaning: Automated cleaning. See Cleaning specifications in Supplement section.

Standards & Certifications

The A Series rockers have not been tested for UL recognition or CSA certification.
These switches are designed for use in a low-voltage, low-current, logic-level circuit.
When used as intended in a logic-level circuit, the results do not produce hazardous energy.

Distinctive Characteristics

Subminiature size saves space on PC boards.

Specifically developed for logic-level applications.

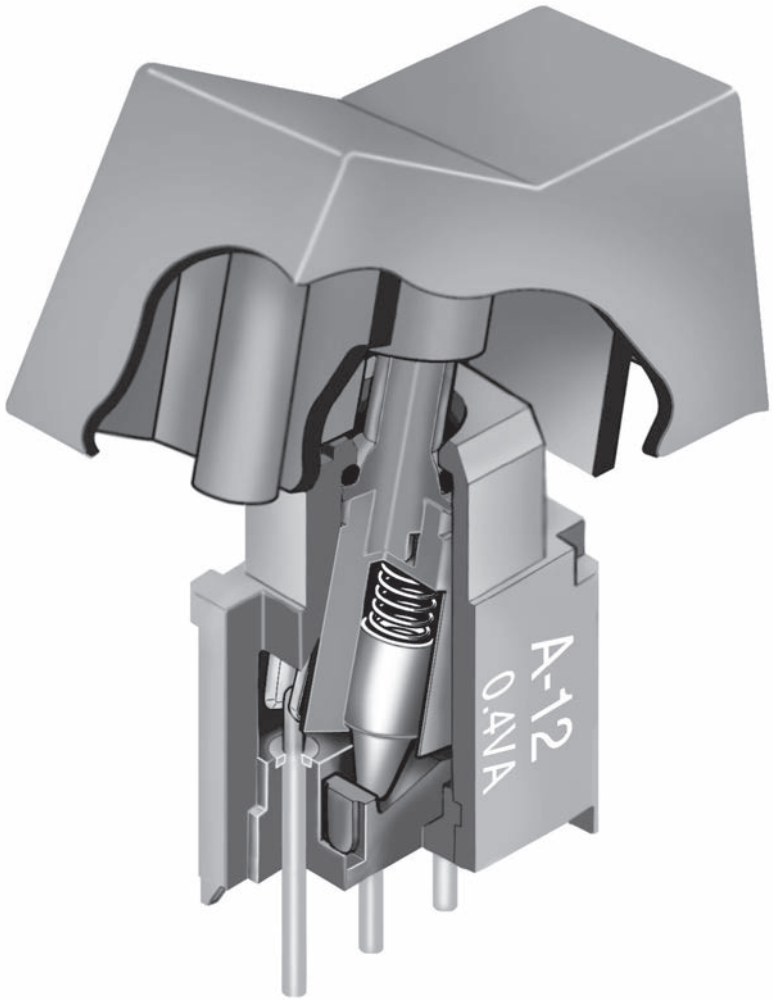
Totally sealed body construction prevents contact contamination and allows time- and money-saving automated soldering and cleaning.

Award-winning STC contact mechanism with benefits unavailable in conventional mechanisms: smoother, positive detent actuation, increased contact stability and unparalleled logic-level reliability. (Additional STC details in Terms & Acronyms; see Supplement section.)

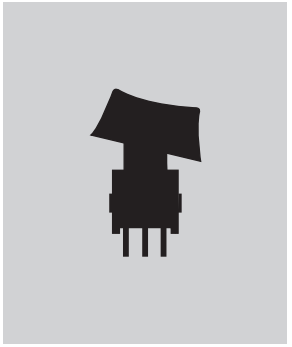
Molded-in, epoxy sealed or ultrasonically welded terminals lock out flux, solvents, and other contaminants.

.100" x .100" (2.54mm x 2.54mm) terminal spacing conforms to standard PC board grid spacing.

Matching indicators available.



Actual Size



TYPICAL SWITCH ORDERING EXAMPLE

A 2 2 K1 H – D A

Poles

1	SPDT
2	DPDT SP3T

Circuits

2	ON	NONE	ON
3	ON	OFF	ON
5	ON	NONE	(ON)
R	(ON)	NONE	ON
8	(ON)	OFF	(ON)
9	ON	OFF	(ON)
S	(ON)	OFF	ON
*4	ON	ON	ON
*6	(ON)	ON	(ON)
*7	ON	ON	(ON)

( ) = Momentary

*3-ON circuits

PC Terminals

P	Straight
B	Straight with Bracket
B1	Straight with Inline Bracket (Single Pole only)
H	Right Angle with Bracket
V	Vertical with Bracket
V1	Vertical with Inline Bracket (Single Pole only)

Actuators

K	Snap Top for Rocker Code C
* K1	Snap Top for Rockers Codes D & E

*Available in Americas only

Rockers

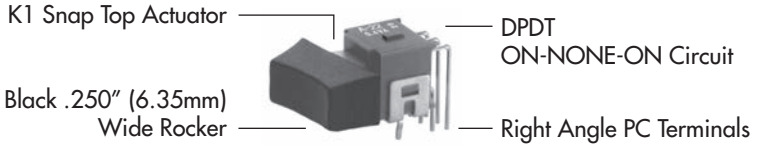
C	.260″ (6.6mm) Wide (K only)
D	.250″ (6.35mm) Wide (K1 only)
E	.300″ (7.6mm) Wide (K1 only)

Colors

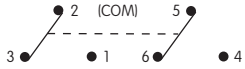
Rocker C		Rockers D & E
A	Black	A
B	White	B
C	Red	C
E	Yellow	—
F	Green	—
G	Blue	—
H	Gray	—

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

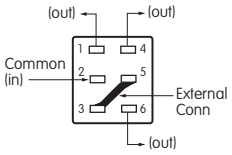
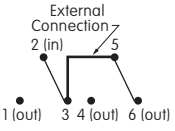
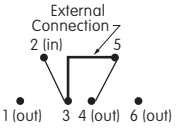
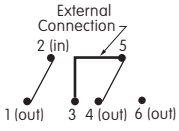
A22K1H-DA



POLES & CIRCUITS

Pole	Model	Rocker Position ( ) = Momentary: Up	Center	Down	Connected Terminals: Up	Center	Down	Throw & Schematics
		Slot			Slot			Note: Terminal numbers are not actually on the switch.
SP	**A12** **A13** **A15** **A1R** **A18** **A19** **A1S**	ON ON ON (ON) (ON) ON (ON)	NONE OFF NONE NONE OFF OFF OFF	ON ON (ON) ON (ON) (ON) ON	2-3	OPEN	2-1	SPDT
DP	**A22** **A23** **A25** **A2R** **A28** **A29** **A2S**	ON ON ON (ON) (ON) ON (ON)	NONE OFF NONE NONE OFF OFF OFF	ON ON (ON) ON (ON) (ON) ON	2-3 5-6	OPEN	2-1 5-4	DPDT 

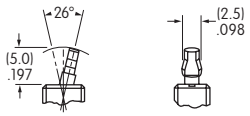
For 3 Throw (3-On)

Pole	Model	Connected Terminals & Schematics: Up	Center	Down	External Connection
SP	**A24** **A26** **A27**	ON (ON) ON	ON ON ON	ON (ON) (ON)	The SP3T model utilizes a double pole base. External connections must be made during field installation. 
		 2-3 5-6	 2-3 5-4	 2-1 5-4	

ACTUATORS

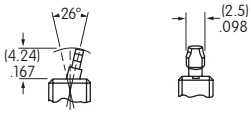
K **Snap Top**

For Rocker AT469



K1 **Snap Top**

For Rockers AT062 and AT066



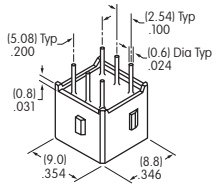
Series A

Process Sealed Subminiature Rockers

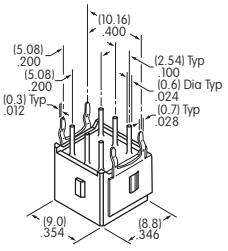
PC TERMINALS

Use of a support bracket is recommended to increase PCB mounting strength and stability.

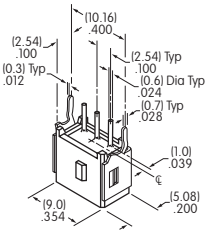
P Straight



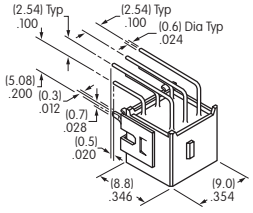
B Straight with Bracket



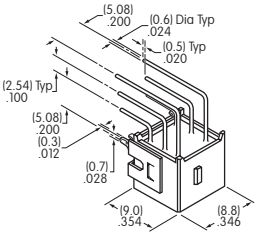
B1 Straight with Inline Bracket Single Pole only



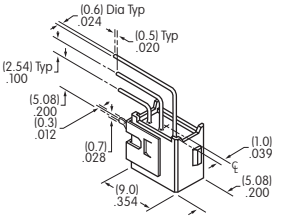
H Right Angle with Bracket



V Vertical with Bracket



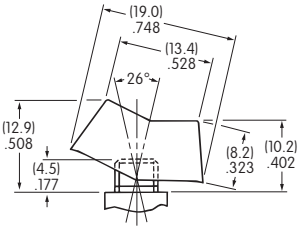
V1 Vertical with Inline Bracket Single Pole only

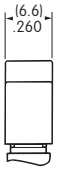


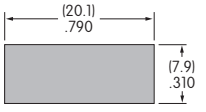
ROCKERS & COLORS

C AT469 .260" (6.6mm) Wide Rocker

Antirotational
Material: Polyamide
Colors Available:
A, B, C, E, F, G, H

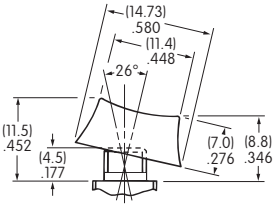


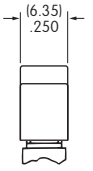


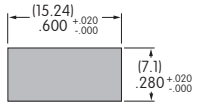


D AT062 .250" (6.35mm) Wide Rocker

Antirotational
Material: Polyamide
Colors Available:
A, B, C

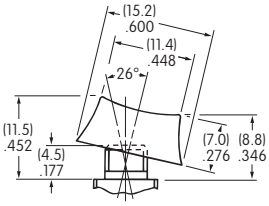


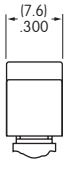


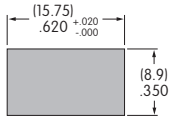


E AT066 .300" (7.6mm) Wide Rocker

Antirotational
Material: Polyamide
Colors Available:
A, B, C



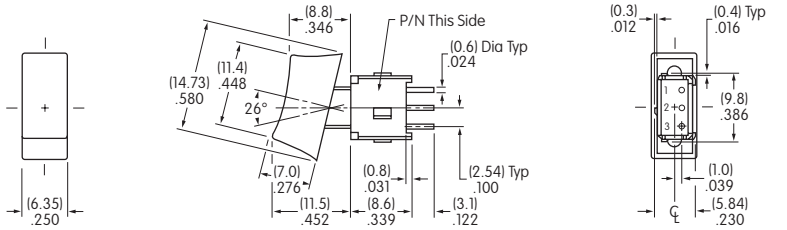




Color Codes: A Black · B White · C Red · E Yellow · F Green · G Blue · H Gray

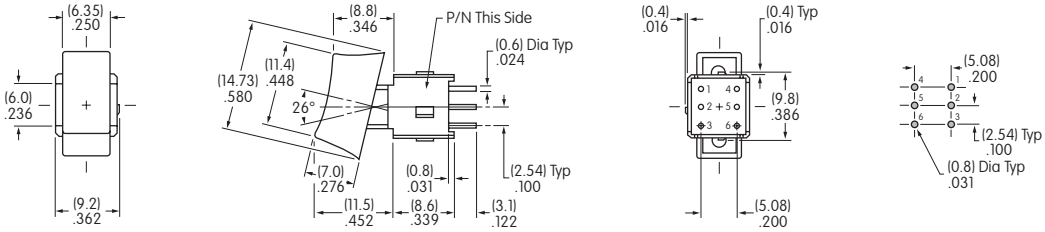
TYPICAL SWITCH DIMENSIONS

Single Pole — Straight PC



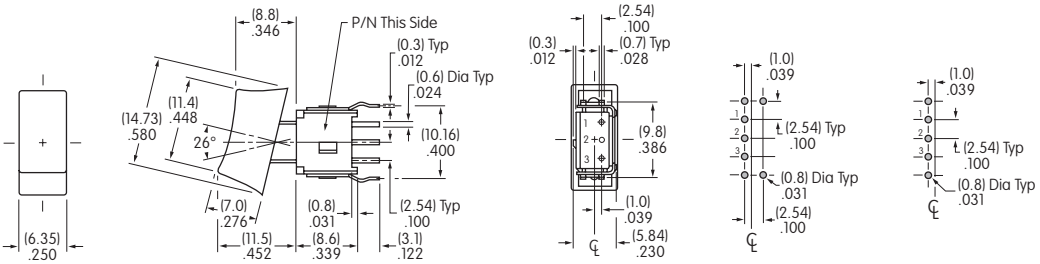
A12K1P-DA

Double Pole — Straight PC



A22K1P-DA

Single Pole — Straight PC • Bracket

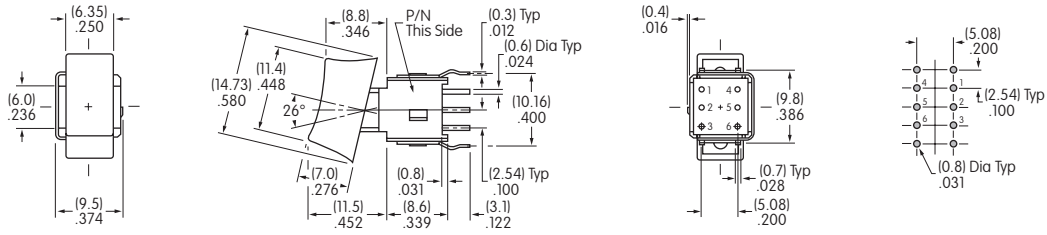


B Terminals

B1 Terminals

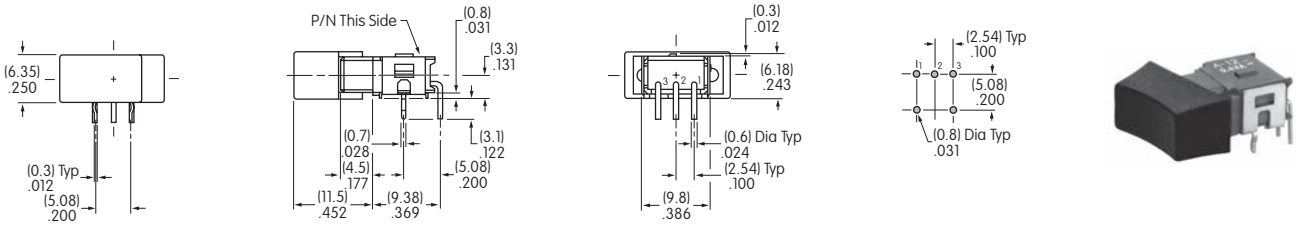
A12K1B-DA

Double Pole — Straight PC • Bracket



A22K1B-DA

Single Pole — Right Angle PC

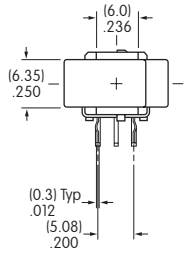


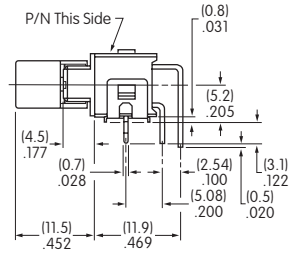
A12K1H-DA

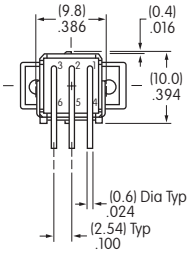
TYPICAL SWITCH DIMENSIONS

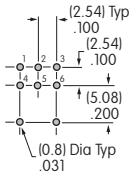
Right Angle PC

Double Pole





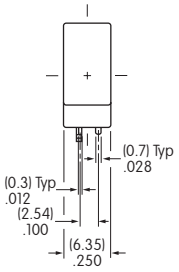


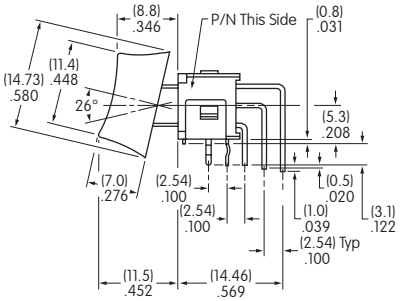


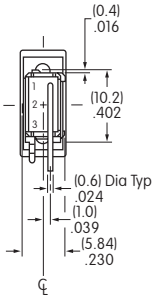
A22K1H-DA

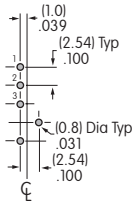
Vertical PC

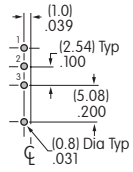
Single Pole









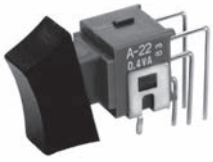


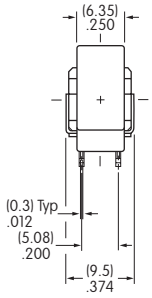
A12K1V-DA

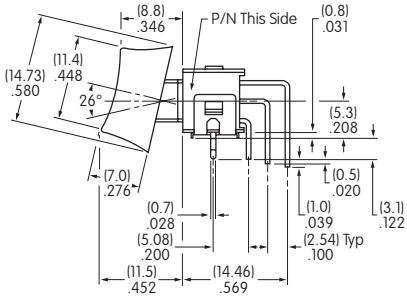
V Terminals V1 Terminals

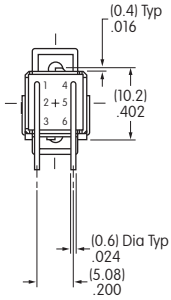
Vertical PC

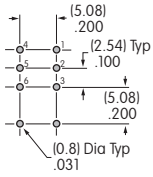
Double Pole











A22K1V-DA

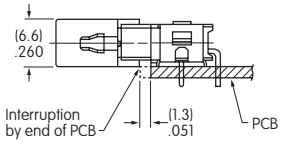
ROCKER MOUNTING PRECAUTION

Rocker switches with vertical and right angle terminals must be mounted so that extension of the PC board beyond the top of the switch housing does not interrupt rocker movement, in turn causing incomplete switching operation.

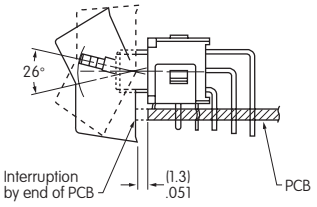
The MAXIMUM limit of the PC board extension is .051" (1.3mm), as illustrated below.

This precaution does not apply to the double pole switch with right angle terminals due to the extra width of the switch allowing the rocker to clear the PC board.

Side View of Rocker
Right Angle Mounting PC
Single Pole Only



Side View of Rocker
Vertical Mounting PC
Single Pole and
Double Pole



General Specifications

CWSA

Electrical Capacity

Power Level: For Resistive Load 6A @ 250V AC

Other Ratings

Contact Resistance: 20 milliohms maximum
Insulation Resistance: 500 megohms minimum @ 500V DC
Dielectric Strength: 1,500V AC minimum between contacts for 1 minute minimum
3,000V AC minimum between contacts & case for 1 minute minimum
Mechanical Life: 30,000 operations minimum
Electrical Life: 10,000 operations minimum with Resistive Load & 6,000 operations with Inductive Load
Nominal Operating Force: 2.50N
Angle of Throw: 30°
Operating Temperature Range: –10°C ~ +70°C (+14°F ~ +158°F)

Materials & Finishes

Rocker: Polycarbonate
Housing: Polyamide
Movable Contactor: Brass with silver alloy plating
Movable Contacts: Silver alloy
Stationary Contacts: Silver alloy
Base: Laminated thermosetting sheets
Contact Terminals: Copper with silver plating
Common Terminals: Brass with silver plating

CWSB

Electrical Capacity

Power Level: For Resistive Load 6A @ 250V AC

Other Ratings

Contact Resistance: 20 milliohms maximum
Insulation Resistance: 500 megohms minimum @ 500V DC
Dielectric Strength: 1,500V AC minimum between contacts for 1 minute minimum
3,000V AC minimum between contacts & case for 1 minute minimum
Mechanical Life: 30,000 operations minimum
Electrical Life: 10,000 operations minimum with Resistive Load & 6,000 operations with Inductive Load
Nominal Operating Force: 6.50N for single pole models; 10.0N for double pole models
Angle of Throw: 30°
Operating Temperature Range: –10°C ~ +70°C (+14°F ~ +158°F)

Materials & Finishes

Rocker: Polycarbonate
Housing: Polyamide
Movable Contactor: Beryllium copper w/silver alloy plating
Movable Contacts: Silver
Stationary Contacts: Silver alloy
Base: Laminated thermosetting sheets
Terminals: Brass with silver plating

CWT

Electrical Capacity

Power Level: For Resistive Load 6A @ 125V AC; 3A @ 250V AC; 4A @ 30V DC

Other Ratings

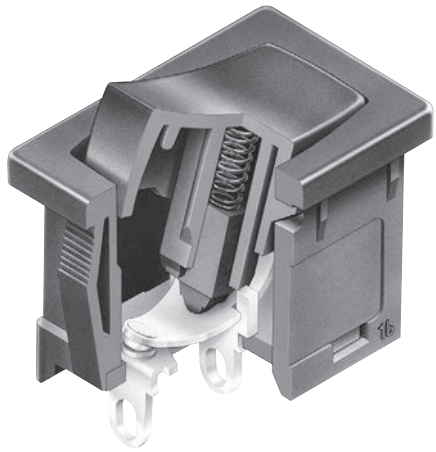
Contact Resistance: 20 milliohms maximum
Insulation Resistance: 1,000 megohms minimum @ 500V DC
Dielectric Strength: 1,000V AC minimum between contacts for 1 minute minimum
1,500V AC minimum between contacts & case for 1 minute minimum
Mechanical Life: 50,000 operations minimum
Electrical Life: 25,000 operations minimum
Nominal Operating Force: 2.0N
Angle of Throw: 30°
Operating Temperature Range: –25°C ~ +70°C (–13°F ~ +158°F)

Materials & Finishes

Rocker: Glass fiber reinforced polyamide
Housing: Polyamide
Movable Contactor: Phosphor bronze w/silver plating
Movable Contacts: Silver alloy
Base: LCP (Liquid Crystal Polymer)
Contact Terminals: Brass + silver with silver plating
Common Terminals: Brass with silver plating

Distinctive Characteristics

CWSA



Low cost molded rocker.

See-saw contact mechanism

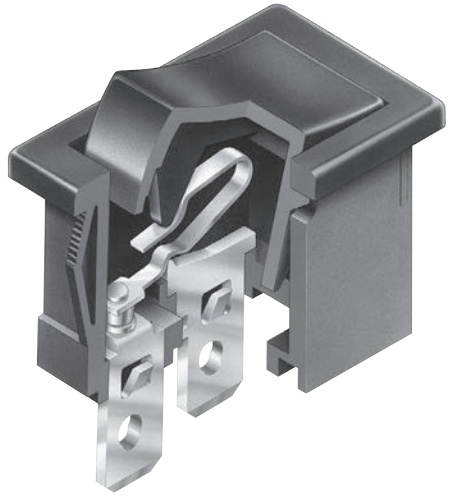
Stable stationary contact construction for high reliability.

Easily installed with snap-in mounting.

Large terminal hole dimensioned .067" x .098" (1.7mm x 2.5mm) simplifies wiring and soldering.

Wave Soldering (PC version): See Profile A in Supplement section.
Manual Soldering: See Profile A in Supplement section.

CWSB



Low cost molded rocker.

Snap-acting contact mechanism gives smooth actuation and audible feedback.

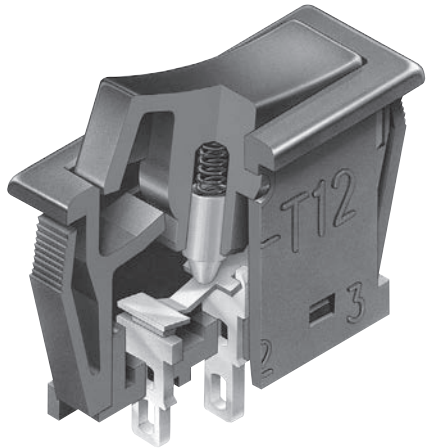
Stable stationary contact construction for high reliability.

Front panel, snap-in mounting for labor-saving installation.

Solder lug/quick connect terminals can be used with connectors.

Manual Soldering: See Profile B in Supplement section.

CWT



Low cost molded rocker in compact, slim design.

See-saw contact mechanism

Outstanding insulation resistance and dielectric strength.

Dust proof construction protects contact area.

Stable stationary contact construction for high reliability.

Front panel, snap-in mounting for labor-saving installation.

Terminals are molded in and epoxy sealed to lock out flux, dust, and other contaminants.

Manual Soldering: See Profile A in Supplement section.

STANDARDS & CERTIFICATIONS

CWSA

Specific CWSA models listed below are qualified for Underwriters Laboratories Inc. recognition and Canadian Standards Association certification. cULus marking on case is standard as noted in following table.

Model	Ratings @ AC	cULus File No.	Marking on Case
CWSA11	6A @ 250V	E44145	Standard
CWSA12	6A @ 250V	E44145	Standard

CWSB

Specific CWSB models listed below are qualified for Underwriters Laboratories Inc. recognition and Canadian Standards Association certification. cULus marking on case is standard as noted in following table.

Model	Ratings @ AC	cULus File No.	Marking on Case
CWSB11	6A @ 250V	E44145	Standard
CWSB21	6A @ 250V	E44145	Standard

CWT

Specific CWT model listed below is qualified for Underwriters Laboratories Inc. recognition and Canadian Standards Association certification. cULus marking on case is standard as noted in following table.

Model	Ratings @ AC	cULus File No.	Marking on Case
CWT12	6A @ 125V 3A @ 250V	E44145	Standard

TYPICAL SWITCH ORDERING EXAMPLES

CWSA [1] [1] [A] [A] N [ ] [S]

Pole	
1	SPST & SPDT

Circuits			
1	ON	NONE	OFF
2	ON	NONE	ON

Cap Color	
A	Black

Housing	
A	Black

Inscription	
For SPST & SPDT	
No Code	None
For SPST	
1	Horizontal
2	Vertical
3	Dot Marking

Terminals	
S	Solder Lug
H	Right Angle PC

TYPICAL ORDERING EXAMPLE
CWSA11AANS

CWSB [2] [1] [A] [A] [2] [F]

Poles	
1	SPST
2	DPST

Circuit			
1	ON	NONE	OFF

Cap Color	
A	Black

Housing	
A	Black

Inscription	
No Code	None (SPST only)
1	Horizontal
2	Vertical
3	Dot Marking (SPST only)

Terminals	
F	Quick Connect
H	Right Angle PC

TYPICAL ORDERING EXAMPLE
CWSB21AA2F

CWT [1] [2] [A] [A] [S1]

Pole	
1	SPDT

Circuit			
2	ON	NONE	ON

Housing	
A	Black

Cap Color	
A	Black

Terminals	
S1	Solder Lug

TYPICAL ORDERING EXAMPLE
CWT12AAS1

INSCRIPTIONS

No Code **None**

Not available in double pole.

1 **Horizontal Orientation**

Only On-None-Off models are available with the horizontal inscription.

2 **Vertical Orientation**

Only On-None-Off models are available with the vertical inscription.

3 **Dot Marking**

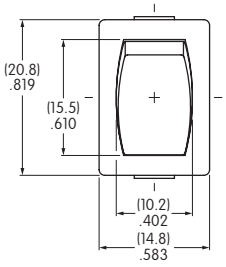
Only Single Pole On-None-Off models are available with the dot inscription.

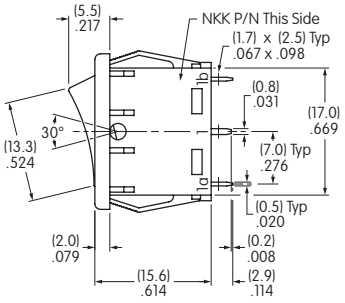
The IEC symbols for On-Off are supplied with Single Throw models only. Orientation of inscription must be selected.
Inscription color is white ink on black.

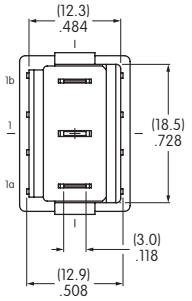
TYPICAL SWITCH DIMENSIONS FOR CWSA

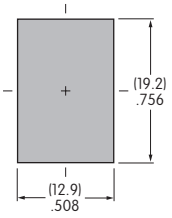
Solder Lug

Single Pole • No Inscription









CWSA12AANS

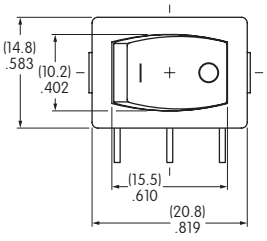
Single throw model does not have terminal 1b

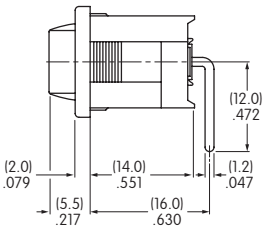
Terminal numbers are on side of switch body

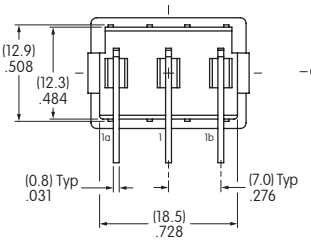
Panel Thickness
.030" ~ .079"
(0.75mm ~ 2.0mm)

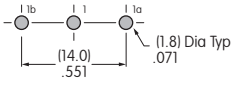
Right Angle

Single Pole • Horizontal On-Off Inscription









CWSA11AAN1H

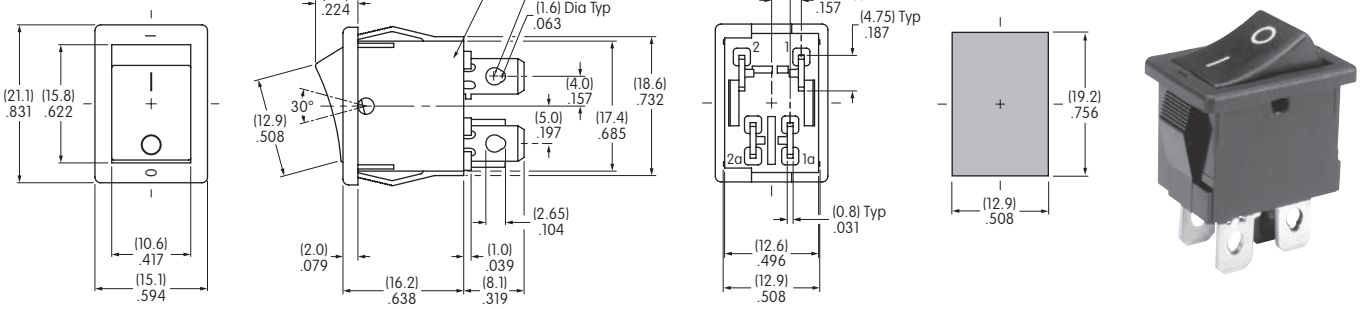
Single throw model does not have terminal 1b

Terminal numbers are on side of switch body

TYPICAL SWITCH DIMENSIONS FOR CWSB

Double Pole • Vertical On-Off Inscription

Quick Connect



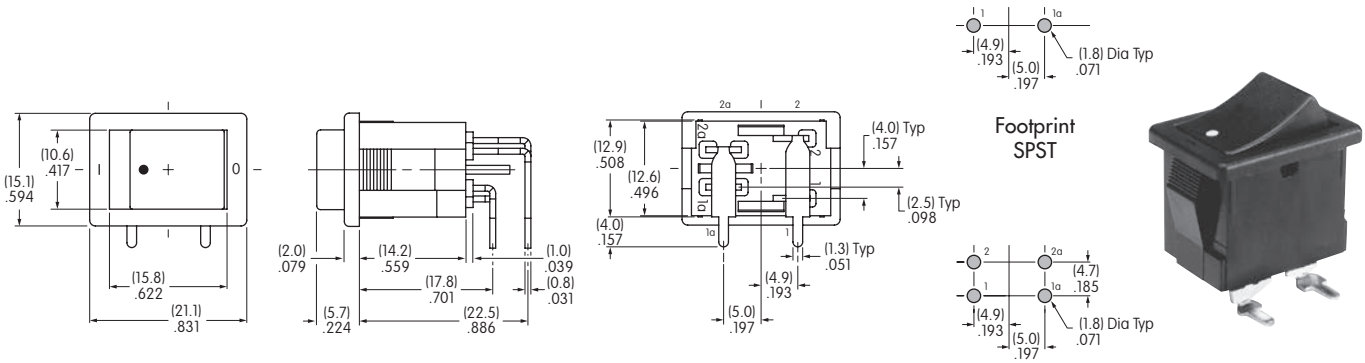
Terminal numbers are on bottom of switch

Panel Thickness .030″ ~ .079″ (0.75mm ~ 2.0mm)

CWSB21AA2F

Single Pole • Dot Inscription

Right Angle



Terminal numbers are on bottom of switch

Footprint SPST

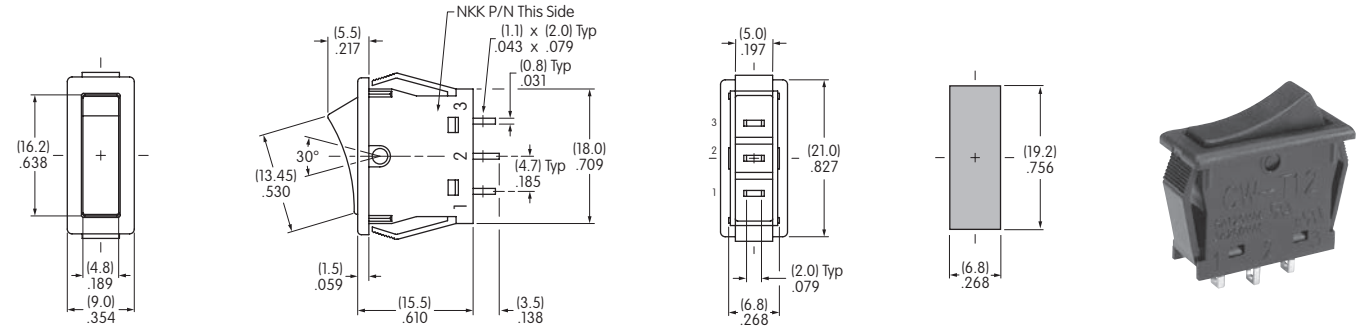
Footprint DPST

CWSB11AA3H

TYPICAL SWITCH DIMENSIONS FOR CWT

Single Pole • No Inscription

Solder Lug



Terminal numbers are on side of switch body

Panel Thickness .030″ ~ .079″ (0.75mm ~ 2.0mm)

CWT12AAS1

General Specifications

Electrical Capacity (Resistive Load)

Power Level: 9A @ 125V AC

Other Ratings

Contact Resistance: 20 milliohms maximum
Insulation Resistance: 500 megohms minimum @ 500V DC
Dielectric Strength: 1,500V AC minimum between contacts for 1 minute minimum;
3,000V AC minimum between contacts & case for 1 minute minimum
Mechanical Life: 30,000 operations minimum
Electrical Life: 10,000 operations minimum
Nominal Operating Force: 10.0N
Angle of Throw: 30°

Materials & Finishes

Rocker: Polycarbonate
Housing: Polyamide
Movable Contactor: Beryllium copper with silver plating
Movable Contacts: Silver alloy
Stationary Contacts: Silver alloy
Switch Terminals: Brass with silver plating
Lamp Terminals: Brass with silver plating

Environmental Data

Operating Temp Range: –20°C through +85°C (–4°F through +185°F)
Humidity: 90 ~ 95% humidity for 96 hours @ 40°C (104°F)
Vibration: 10 ~ 55Hz with peak-to-peak amplitude of 0.75mm traversing the frequency range
& returning in 1 minute; 3 right angled directions for 2 hours
Shock: 50G (490m/s^2) acceleration (tested in 6 right angled directions, with 5 shocks in each direction)

Installation

Soldering Time & Temp: Manual Soldering: See Profile B in Supplement section.

Standards & Certifications

UL: File No. E44145
9A @ 125V AC
Markings on case are standard.

CSA: File No. 0701166_0_000
9A @ 125V AC
Markings on case are standard.

Distinctive Characteristics

Full face, Neon illumination in choice of red, amber, or green.

Neon lamp suited to 125V AC applications.

9-amp electrical capacity in compact body.

Built-in resistor for direct connection to 125V AC power source.

Low cost molded rocker.

Front panel, snap-in mounting assures labor-saving installation.

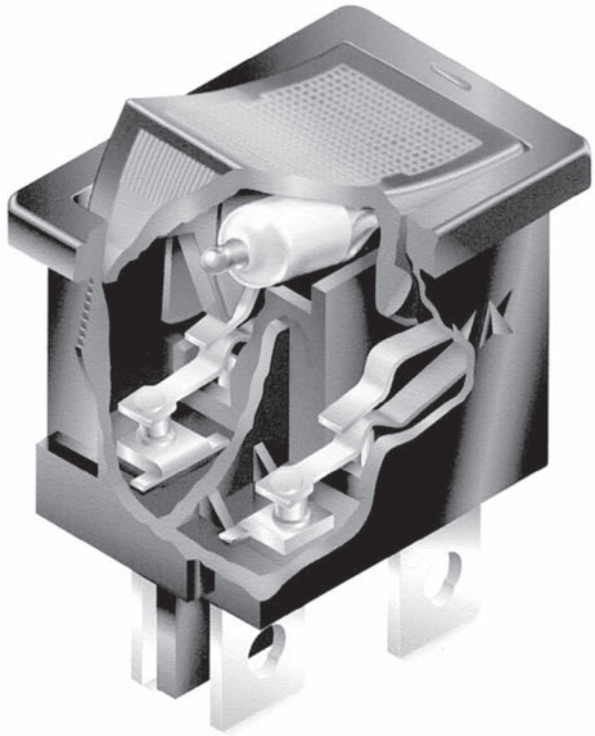
Single-break, snap-acting contact mechanism gives smooth actuation and audible feedback.

Quick-make, quick-break characteristic limits arcing and prolongs electrical life.

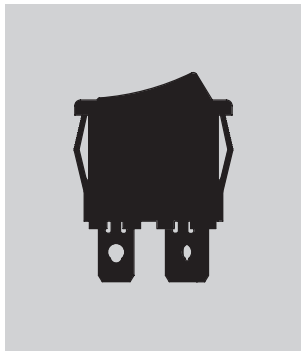
Stable stationary contact construction for high reliability.

Offset terminal alignment gives outstanding insulation resistance and dielectric strength.

Solder lug/.187" quick connect terminals can be used with connectors.



Actual Size



TYPICAL SWITCH ORDERING EXAMPLE

CWSB 2 1 C A C F

Poles

2	DPST

Circuit

1	ON	NONE	OFF

Neon Lamp Colors

C	Red
D	Amber
F	Green

Housing

A	Black

Cap Colors

C	Red
D	Amber
F	Green

Terminals

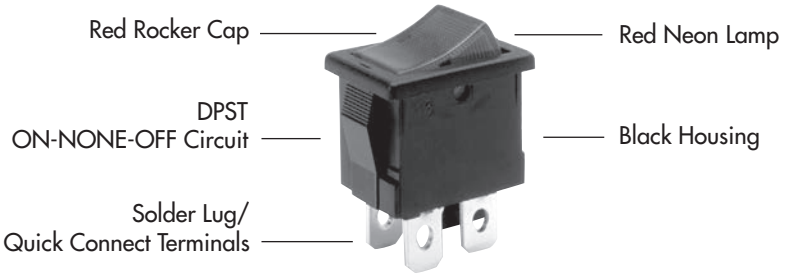
F	Solder Lug/ .187" (4.75mm) Quick Connect

IMPORTANT:

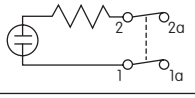
Switches are supplied with UL & CSA markings on the case. Specific models & ratings noted on the General Specifications page.

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

CWSB21CACF



POLE & CIRCUIT

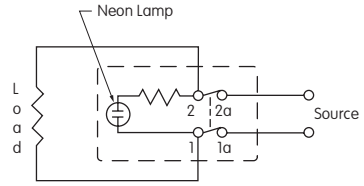
		Rocker Position			Connected Terminals			Throw & Switch/Lamp Schematic
Pole	Model	Down	Center	Up	Down	Center	Up	Note: Terminal numbers "1a" & "2a" are actually on the switch.
DP	**CWSB21**	ON	NONE	OFF	1-1a 2-2a	OPEN	OPEN	DPST 

NEON LAMP COLORS & SPECIFICATIONS

The Neon lamp is factory assembled and not available separately. The lamp circuit is synchronous to switching circuit.

The electrical specifications shown are determined at a basic temperature of 25°C.

Values for the built-in resistors are given in the accompanying table.

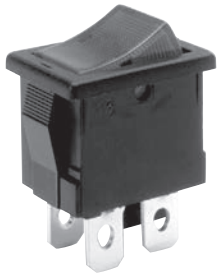


		Colors		
		C Red	D Amber	F Green
Voltage	V	125V AC	125V AC	125V AC
Internal Series Resistance		33K ohms	33K ohms	68K ohms
Current	I	1.4mA	1.4mA	0.6mA
Endurance	Hours	15,000	15,000	8,000

HOUSING

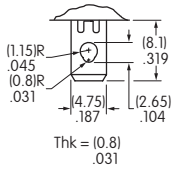
A **Black Housing with Snap-in Mounting**

On Off (I O) symbols are molded on the bezel.



TERMINALS

F **Solder Lug/ .187" (4.75mm) Quick Connect**



CAP COLOR CODES

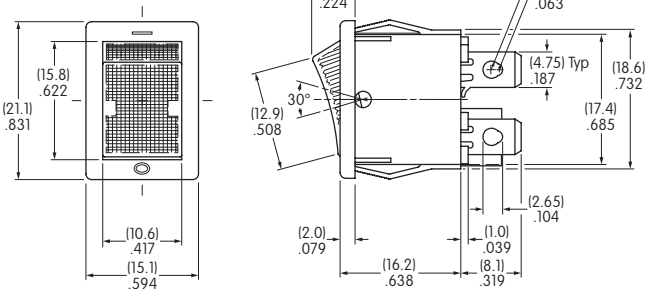
Cap Colors Available

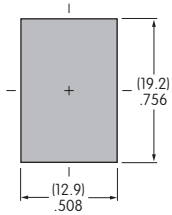
C **Red** **D** **Amber** **F** **Green**

Caps are factory assembled and are not available separately.

TYPICAL SWITCH DIMENSIONS

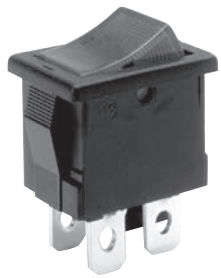
Double Pole





Panel Thickness
.030" ~ .079"
(0.75mm ~ 2.0mm)

Neon Illuminated



CWSB21CACF

General Specifications

Electrical Capacity (Resistive Load)

Power Level: 9A @ 125V AC or 6A @ 250V AC

Other Ratings

Contact Resistance: 20 milliohms maximum
Insulation Resistance: 500 megohms minimum @ 500V DC
Dielectric Strength: 1,500V AC minimum between contacts for 1 minute minimum;
3,000V AC minimum between contacts & case for 1 minute minimum
Mechanical Life: 30,000 operations minimum
Electrical Life: 10,000 operations minimum
Nominal Operating Force: Single Pole 4.50N; Double Pole 10.0N
Angle of Throw: 33°

Materials & Finishes

Rocker: Polycarbonate
Housing: Polyamide
Movable Contactor: Beryllium copper with silver plating
Movable Contacts: Silver alloy
Stationary Contacts: Silver alloy
Switch Terminals: Brass with silver plating
Lamp Terminals: Brass with silver plating

Environmental Data

Operating Temp Range: –10°C through +50°C (+14°F through +122°F)
Humidity: 90 ~ 95% humidity for 96 hours @ 40°C (104°F)
Vibration: 10 ~ 55Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in 1 minute; 3 right angled directions for 2 hours
Shock: 50G (490m/s^2) acceleration (tested in 6 right angled directions, with 5 shocks in each direction)

Installation

Soldering Time & Temp: Manual Soldering: See Profile A in Supplement section.

Standards & Certifications

UL: File No. E44145
All models recognized at 9A @ 125V AC & 6A @ 250V AC.
cULus marking on case is standard.

Distinctive Characteristics

Full face, bright LED illumination in choice of red, amber, or green for visible status indication.

9-amp or 6-amp electrical capacity in compact body.

Interior shield prevents contamination of the rocker by carbon from arcing.

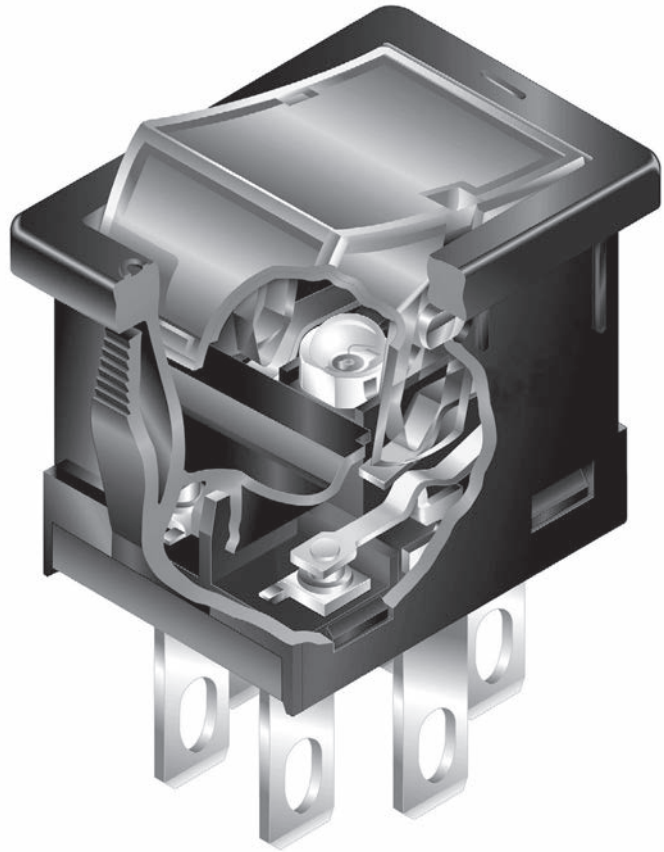
Front panel, snap-in mounting assures labor-saving installation.

Single-break, snap-acting contact mechanism gives smooth actuation and audible feedback.

Quick-make, quick-break characteristic limits arcing and prolongs electrical life.

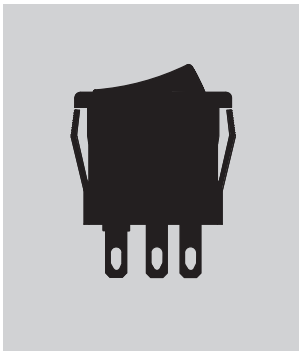
Stable stationary contact construction for high reliability.

Offset terminal alignment gives outstanding insulation resistance and dielectric strength.



Solder lug/.110" quick connect terminals can be used with connectors.

Actual Size



TYPICAL SWITCH ORDERING EXAMPLE

CWSC | 2 | 1 | JC | A | C | S

Poles

1	SPST
2	DPST

Circuit

1	ON	NONE	OFF

Cap/Diffuser Colors

JC	Clear/Red
JD	Clear/Amber
JF	Clear/Green

Housing

A	Black

LED Colors

C	Red
D	Amber
F	Green

Terminals

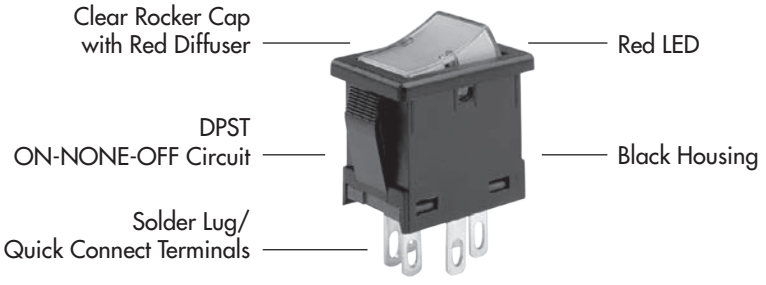
S	Solder Lug/ .110" (2.79mm) Quick Connect

IMPORTANT:

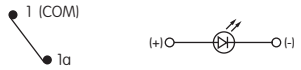
Switches are supplied with cULus marking on the case. Specific models & ratings noted on the General Specifications page.

TYPICAL ORDERING EXAMPLE

CWSC21JCACS



POLE & CIRCUITS

		Rocker Position			Connected Terminals			Throw & Switch/Lamp Schematics
Pole	Model	Down	Center	Up	Down	Center	Up	Notes: Terminal numbers and polarity are actually on the switch.
SP	**CWSC11**	ON	NONE	OFF	1-1a	OPEN	OPEN	SPST 
DP	**CWSC21**	ON	NONE	OFF	1-1a 2-2a	OPEN	OPEN	DPST

CAP TYPES & COLORS

Rocker Cap/Diffuser

Caps are factory assembled and are not available separately.

Cap/Diffuser Colors Available

- **JC** Clear/Red
- **JD** Clear/Amber
- **JF** Clear/Green

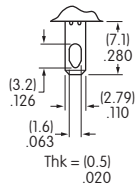
HOUSING

A **Black Housing with Snap-in Mounting**

On Off (I O) symbols are molded on the bezel.

TERMINALS

S **Solder Lug/ .110" (2.79mm) Quick Connect**

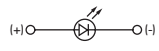


LED SPECIFICATIONS & COLORS

The LED is factory assembled and not available separately. LED circuit is isolated and requires an external power source. Polarity marks are on the bottom of the switch.

The electrical specifications shown are determined at a basic temperature of 25°C.

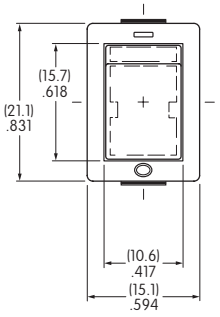
If the source voltage exceeds the rated voltage, a ballast resistor is required. The resistor value can be calculated by using the formula in the Supplement.

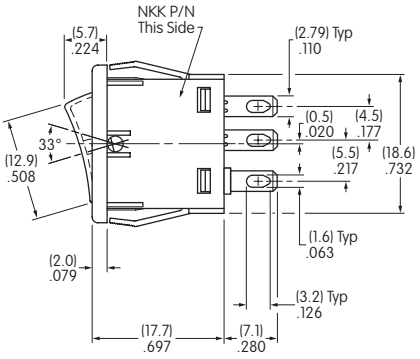
	Colors:	**C** Red	**D** Amber	**F** Green
Maximum Forward Current	I_{FM}	30mA	30mA	30mA
Typical Forward Current	I_F	20mA	20mA	20mA
Forward Voltage	V_F	1.95V	2.0V	2.1V
Maximum Reverse Voltage	V_{RM}	5V	5V	5V
Current Reduction Rate above 25°C	ΔI_F	0.41mA/°C	0.29mA/°C	0.39mA/°C
Ambient Temperature Range		−10°C ~ +50°C		

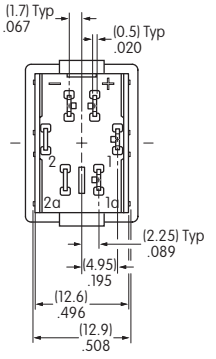
TYPICAL SWITCH DIMENSIONS

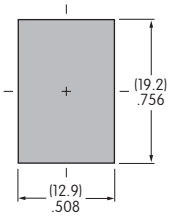
LED Illuminated — Single Pole

CWSC11JCACS





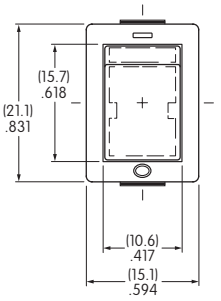


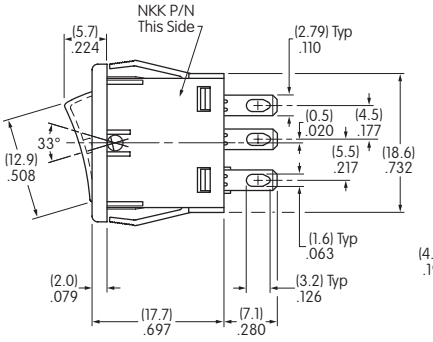


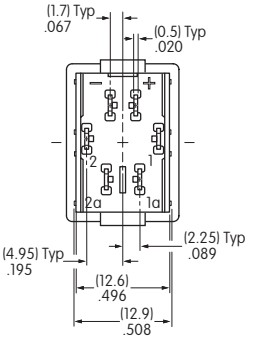
Panel Thickness
.030" ~ .079"
(0.75mm ~ 2.0mm)

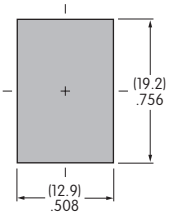
LED Illuminated — Double Pole

CWSC21JCACS









Panel Thickness
.030" ~ .079"
(0.75mm ~ 2.0mm)

General Specifications

Electrical Capacity (Resistive Load)

Logic Level: 0.4VA maximum @ 28V AC/DC maximum
(Applicable Range 0.1mA ~ 0.1A @ 20mV ~ 28V)
Note: Find additional explanation of operating range in Supplement section.

Other Ratings

Contact Resistance: 80 milliohms maximum
Insulation Resistance: 500 megohms minimum @ 500V DC
Dielectric Strength: 500V AC minimum for 1 minute minimum
Mechanical Life: 100,000 operations minimum for On-None-On & On-Off-On
50,000 operations minimum for other circuits
Electrical Life: 100,000 operations minimum for On-None-On & On-Off-On
50,000 operations minimum for other circuits
Nominal Operating Force: .81N for momentary & 1.06N for maintained
Angle of Throw: 28°

Materials & Finishes

Actuator: Glass fiber reinforced polyamide
Case: Glass fiber reinforced polyamide
Sealing Rings: Nitrile butadiene rubber
Movable Contact: Phosphor bronze with gold plating
Stationary Contacts: Phosphor bronze with gold plating
Base: Glass fiber reinforced polyamide
Terminals: Phosphor bronze with gold plating

Environmental Data

Operating Temperature Range: –25°C through +85°C (–13°F through +185°F)
Humidity: 90 ~ 95% humidity for 96 hours @ 40°C (104°F)
Vibration: 10 ~ 55Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in 1 minute; 3 right angled directions for 2 hours
Shock: 50G (490m/s^2) acceleration (tested in 6 right angled directions, with 5 shocks in each direction)

Installation

Cap Installation Force: 39.1N (8.8 lbf) maximum downward force on actuator

PCB Processing

Soldering: Wave Soldering Recommended: See Profile A in Supplement section.
Manual Soldering: See Profile A in Supplement section.
Cleaning: Automated cleaning. See Cleaning specifications in Supplement section.

Standards & Certifications

The G Series rockers have not been tested for UL recognition or CSA certification.
These switches are designed for use in a low-voltage, low-current, logic-level circuit.
When used as intended in a logic-level circuit, the results do not produce hazardous energy.

Distinctive Characteristics

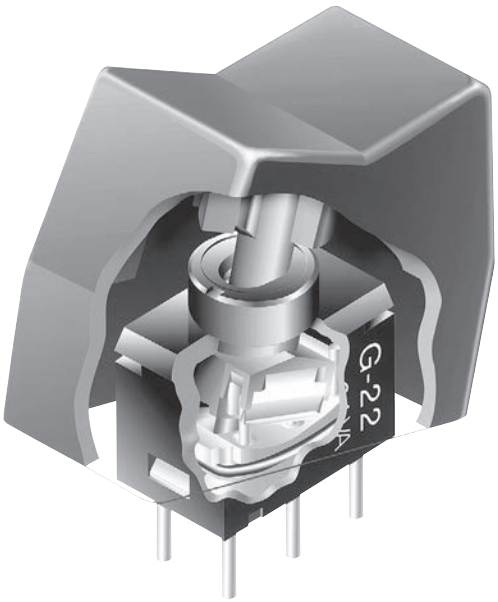
Ultra-miniature size allows high density mounting, and extremely light weight of 0.25 gram makes these switches ideal for handheld equipment.

Totally sealed body construction prevents contact contamination and allows time-and money-saving automated soldering and cleaning.

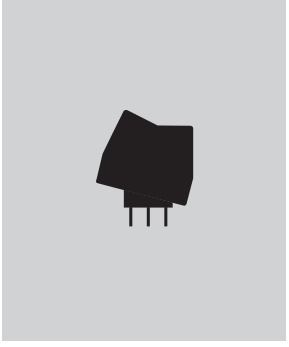
Award-winning STC contact mechanism with benefits unavailable in conventional mechanisms: smoother, positive detent actuation, increased contact stability and unparalleled logic-level reliability. (Additional STC details in Terms & Acronyms; see Supplement section.)

.100" x .100" (2.54mm x 2.54mm) terminal spacing conforms to standard PC board grid spacing. Round terminals facilitate easier through-hole mounting on PC boards.

Matching indicators available.



Actual Size



TYPICAL SWITCH ORDERING EXAMPLE

G | 2 | 2 | K | P | – | Y | A

Poles

1	SPDT
2	DPDT

Circuits

2	ON	NONE	ON
3	ON	OFF	ON
5	ON	NONE	(ON)
8	(ON)	OFF	(ON)
9	ON	OFF	(ON)

( ) = Momentary

Actuator

K	Snap Top

PC Terminals

P	Straight

Rocker Cap

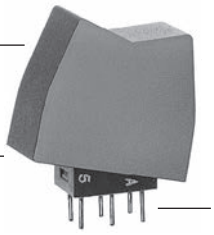
Y	Rocker

Cap Colors

A	Black
B	White
C	Red

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

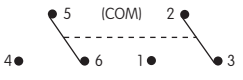
G22KP-YA



POLES & CIRCUITS

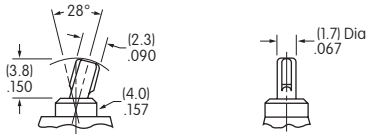
Pole	Model	Rocker Position ( ) = Momentary: Up	Center	Down	Connected Terminals: Up	Center	Down	Throw & Schematics
SP	G12	ON	NONE	ON	5-6	OPEN	5-4	SPDT
	G13	ON	OFF	ON				
	G15	ON	NONE	(ON)				
	G18	(ON)	OFF	(ON)				
	G19	ON	OFF	(ON)				
DP	G22	ON	NONE	ON	5-6 2-3	OPEN	5-4 2-1	DPDT
	G23	ON	OFF	ON				
	G25	ON	NONE	(ON)				
	G28	(ON)	OFF	(ON)				
	G29	ON	OFF	(ON)				

Note: Terminal numbers are not actually on the switch.



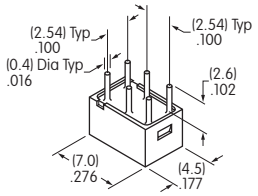
ACTUATOR

K **Snap Top for Rocker**



PC TERMINALS

P **Straight**



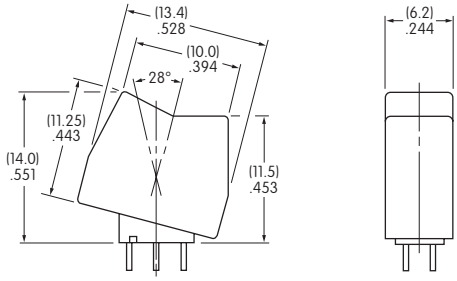
ROCKER CAP & COLORS

Y **AT4062 Rocker**

Material: Polyamide
Finish: Matte

Colors Available:
A, B, C

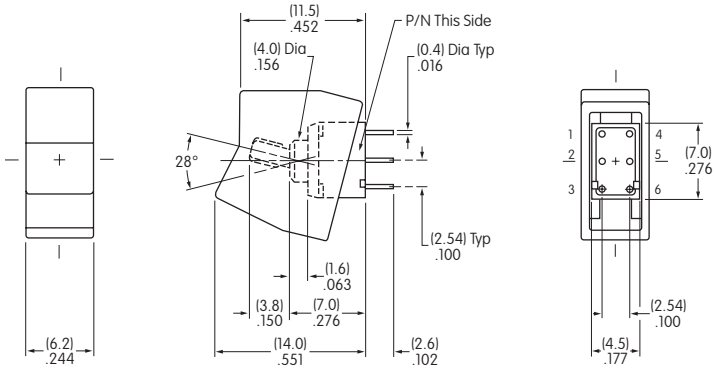
Actual Size



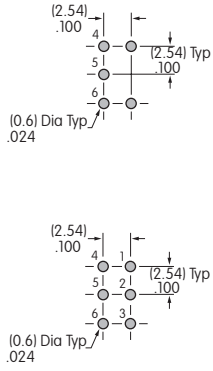
Color Codes: **A** Black **B** White **C** Red

TYPICAL SWITCH DIMENSIONS

Single & Double Pole



Straight PC



On single pole models positions 1 & 3 are support pins.

G23KP-YA

General Specifications

Electrical Capacity (Resistive Load)

Logic Level: 0.4VA maximum @ 28V AC/DC maximum
(Applicable Range 0.1mA ~ 0.1A @ 20mV ~ 28V)
Note: Find additional explanation of operating range in Supplement section.

Other Ratings

Contact Resistance: 80 milliohms maximum
Insulation Resistance: 500 megohms minimum @ 500V DC
Dielectric Strength: 500V AC minimum for 1 minute minimum
Mechanical Life: 50,000 operations minimum
Electrical Life: 50,000 operations minimum
Nominal Operating Force: For Rockers 1.70N; for Paddles 1.30N
Angle of Throw: 28°

Materials & Finishes

Actuator: Glass fiber reinforced polyamide (UL94V-0)
Case: Glass fiber reinforced polyamide (UL94V-0)
Sealing Ring: Nitrile butadiene rubber
Movable Contact: Phosphor bronze with gold plating
Stationary Contacts: Phosphor bronze with gold plating
Base: Glass fiber reinforced polyamide (UL94V-0)
Mounting Bracket: Phosphor bronze with tin plating
Terminals: Phosphor bronze with gold plating

Environmental Data

Operating Temperature Range: –30°C through +85°C (–22°F through +185°F)
Humidity: 90 ~ 95% humidity for 240 hours @ 40°C (104°F)
Vibration: 10 ~ 55Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in 1 minute; 3 right angled directions for 2 hours
Shock: 50G (490m/s^2) acceleration (tested in 6 right angled directions, with 5 shocks in each direction)

PCB Processing

Soldering: Wave Soldering Recommended: See Profile A in Supplement section.
Manual Soldering: See Profile A in Supplement section..
Cleaning: These devices are not process sealed. Hand clean locally using alcohol based solution.

Standards & Certifications

Flammability Standards: UL94V-0 actuator & case/base

The GW Series rockers have not been tested for UL recognition or CSA certification.
These switches are designed for use in a low-voltage, low-current, logic-level circuit.
When used as intended in a logic-level circuit, the results do not produce hazardous energy.

Distinctive Characteristics

Various colored rockers and paddles.

Combination of dust cover and closely fit housing, actuator, and interior pivot provides protection for contacts.

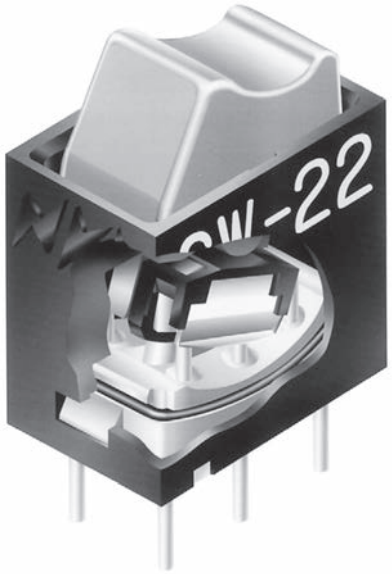
Detent mechanism design of coil spring, plunger, and plastic detent results incrisp and positive actuation.

Extremely thin size allows high density PCB mounting and makes these switchesideal for handheld equipment.

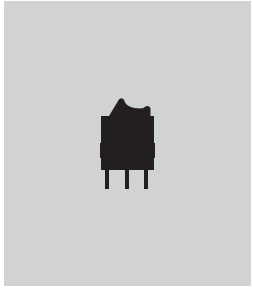
Award-winning STC contact mechanism with benefits unavailable in conventional mechanisms: smoother, positive detent actuation, increased contact stability and unparalleled logic-level reliability. (Additional STC details in Terms & Acronyms; see Supplement section.)

Molded-in, epoxy sealed terminals lock out flux and other contaminants.

.100" x .100" (2.54mm x 2.54mm) terminal spacing conforms to standard PC board grid spacing for straight and angle mounting.



Actual Size



Series GW

Ultra-Thin Rockers

TYPICAL SWITCH ORDERING EXAMPLE

GW | 1 | 2 | R | C | P

Poles	
1	SPDT
2	DPDT

Circuit			
2	ON	NONE	ON

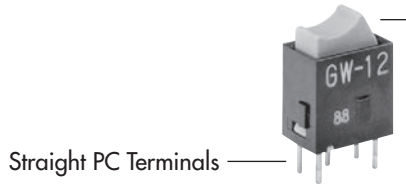
Actuators	
R	Rocker
L	Paddle

Actuator Colors	
B	White
C	Red
H	Gray

PC Terminals	
P	Straight
H	Right Angle
V	Vertical

DESCRIPTION FOR TYPICAL ROCKER ORDERING EXAMPLE

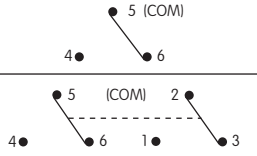
GW12RCP



POLES & CIRCUIT

Pole	Model	Rocker Position: Up	Center	Down	Connected Terminals: Up	Center	Down	Throw & Schematics
SP	**GW12**	ON	NONE	ON	5-6	OPEN	5-4	SPDT
DP	**GW22**	ON	NONE	ON	5-6 2-3	OPEN	5-4 2-1	DPDT

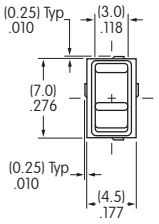
Note: Terminal numbers are not actually on the switch.

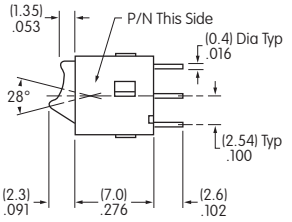


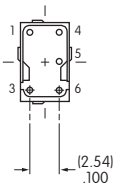
TYPICAL SWITCH DIMENSIONS

Straight PC

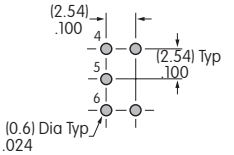
GW12RCP







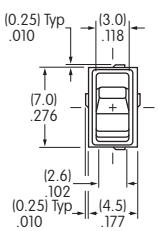
Single Pole

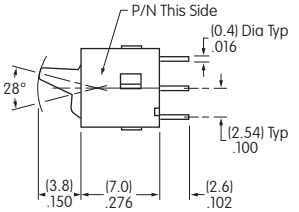


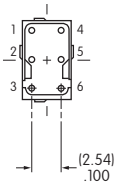
On single pole models positions 1 & 3 are support pins.

Straight PC

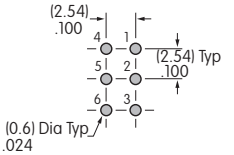
GW22LCP





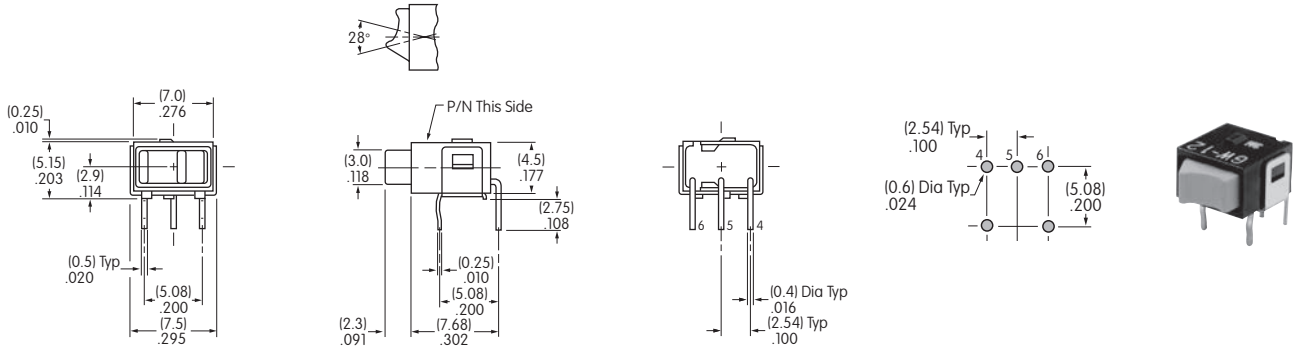


Double Pole



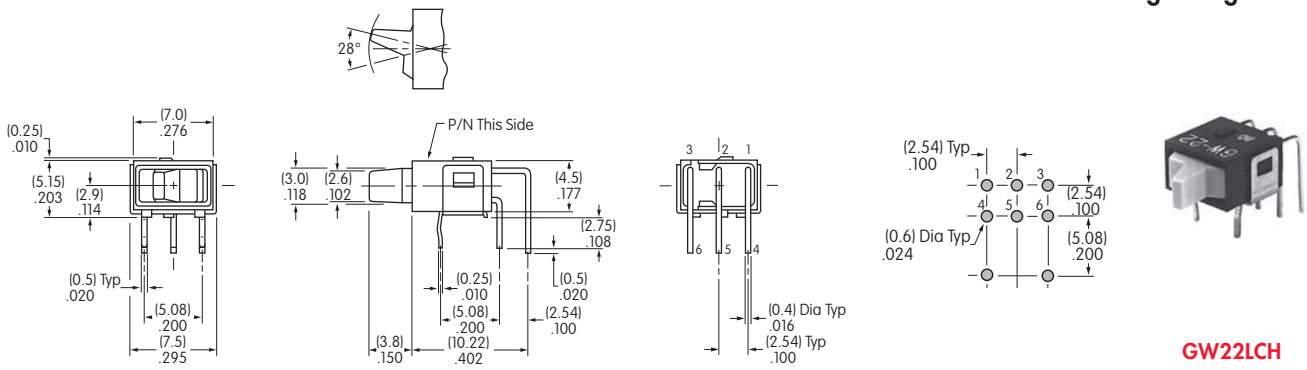
TYPICAL SWITCH DIMENSIONS

Single Pole — Right Angle PC



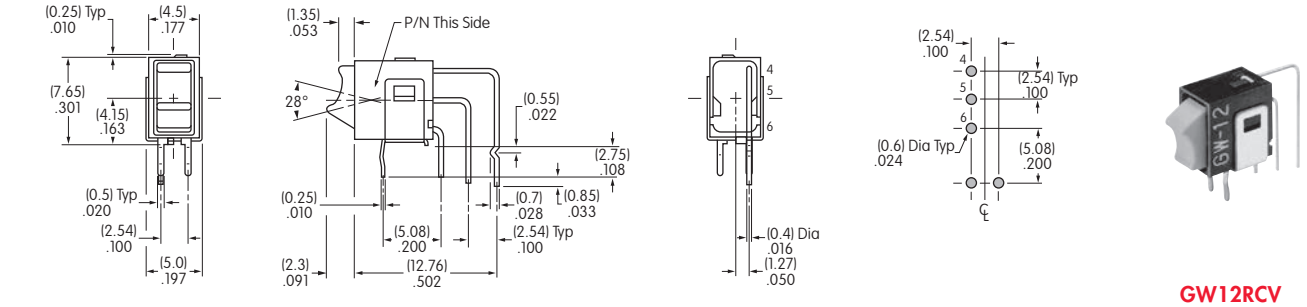
GW12RCH

Double Pole — Right Angle PC



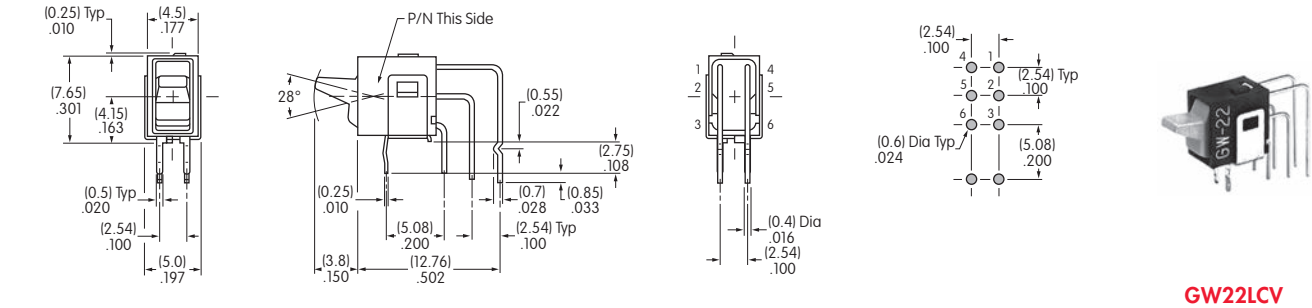
GW22LCH

Single Pole — Vertical PC



GW12RCV

Double Pole — Vertical PC



GW22LCV

General Specifications

Electrical Capacity (Resistive Load)

Logic Level: 0.4VA maximum @ 28V AC/DC maximum
(Applicable Range 0.1mA ~ 0.1A @ 20mV ~ 28V)
Note: Find additional explanation of operating range in Supplement section.

Other Ratings

Contact Resistance: 80 milliohms maximum
Insulation Resistance: 500 megohms minimum @ 500V DC
Dielectric Strength: 500V AC minimum for 1 minute minimum
Mechanical Life: 50,000 operations minimum
Electrical Life: 50,000 operations minimum
Nominal Operating Force: 1.0N
Angle of Throw: 28°

Materials & Finishes

Actuator: Polycarbonate resin (UL94V-0)
Case: Glass fiber reinforced polyamide (UL94V-0)
Sealing Ring: Nitrile butadiene rubber
Base: Glass fiber reinforced polyamide
Movable Contact: Phosphor bronze with gold plating
Stationary Contact: Phosphor bronze with gold plating
Terminals: Phosphor bronze with gold plating

Environmental Data

Operating Temperature Range: –25°C through +55°C (–13°F through +131°F)
Humidity: 90 ~ 95% humidity for 240 hours @ 40°C (104°F)
Vibration: 10 ~ 55Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in 5 minutes; 3 right angled directions for 2 hours
Shock: 50G (490m/s^2) acceleration (tested in 3 right angled directions, with 5 shocks in each direction)

PCB Processing

Soldering: Wave Soldering recommended. See Profile A in Supplement section.
Manual Soldering: See Profile A in Supplement section.
Cleaning: These devices are not process sealed. Hand clean locally using alcohol based solution.

Standards & Certifications

Flammability Standard: UL94V-0 actuator & case

The GW Series illuminated paddles have not been tested for UL recognition or CSA certification.
These switches are designed for use in a low-voltage, low-current, logic-level circuit.
When used as intended in a logic-level circuit, the results do not produce hazardous energy.

Distinctive Characteristics

World's smallest fully illuminated paddles for highly visible status indication; LEDs available in red, green, or amber for single color and red/green for bicolor.

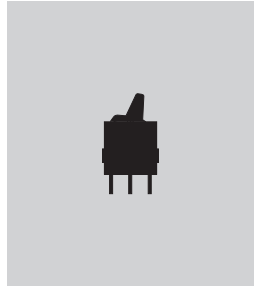
Specially designed switching mechanism provides crisp actuation feedback to positively indicate circuit transfer.

Insert molded terminals prevent entry of flux and other contaminants.

Award-winning STC contact mechanism with benefits unavailable in conventional mechanisms: smoother, positive detent actuation, increased contact stability, and unparalleled logic-level reliability. (Additional STC details in Terms & Acronyms; see Supplement section.)

.100" x .100" (2.54mm x 2.54mm) terminal spacing conforms to standard PC board grid spacing for straight and angle mounting.

Actual Size



Series GW

Ultra-Thin Fully Illuminated Paddles

TYPICAL SWITCH ORDERING EXAMPLE

GW | 1 | 2 | L | J | P | D

Pole

1	SPDT

Circuit

2	ON	NONE	ON

Actuator

L	Paddle

Actuator Color

J	Clear

PC Terminals

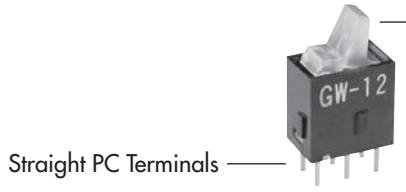
P	Straight
H	Right Angle
V	Vertical

LED Colors

Single Color	
C	Red
D	Amber
F	Green
Bicolor	
CF	Red/Green

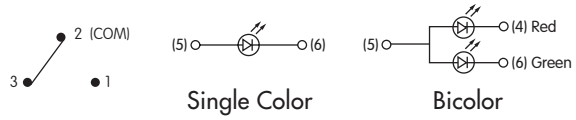
DESCRIPTION FOR TYPICAL PADDLE ORDERING EXAMPLE

GW12LJPD



POLE & CIRCUIT

		Paddle Position			Connected Terminals			Throw & Schematics
Pole	Model	Up	Center	Down	Up	Center	Down	Note: Terminal numbers are not actually on the switch. LED circuit is isolated and requires an external power source.
SP	**GW12**	ON	NONE	ON	2-3	OPEN	2-1	SPDT



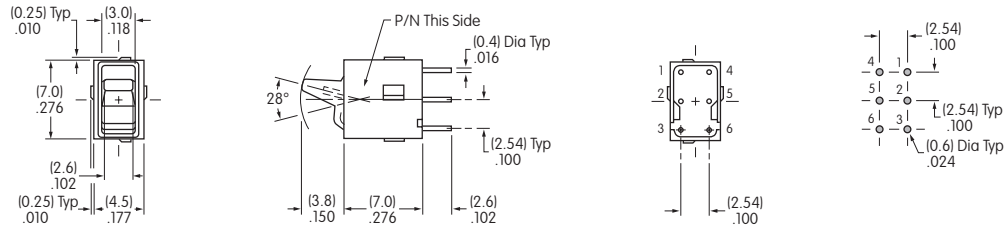
LED COLORS & SPECIFICATIONS

LEDs are an integral part of the the switch and not available separately. The electrical specifications shown are determined at a basic temperature of 25°C. If the source voltage exceeds the rated voltage, a ballast resistor is required. The resistor value can be calculated by using the formula in the Supplement section.

		Single Color			Bicolor
Colors		C Red	D Amber	F Green	CF Red/Green
Maximum Forward Current	I_{FM}	30mA	30mA	25mA	30mA/25mA
Typical Forward Current	I_F	20mA	20mA	20mA	20mA/20mA
Forward Voltage	V_F	2.0V	2.0V	2.1V	2.0V/2.1V
Maximum Reverse Voltage	V_{RM}	5V	5V	5V	5V/5V
Current Reduction Rate Above 25°C	ΔI_F	No Current Reduction Rate within Ambient Temperature Range			
Ambient Temperature Range		–25°C ~ +55°C			

TYPICAL SWITCH DIMENSIONS

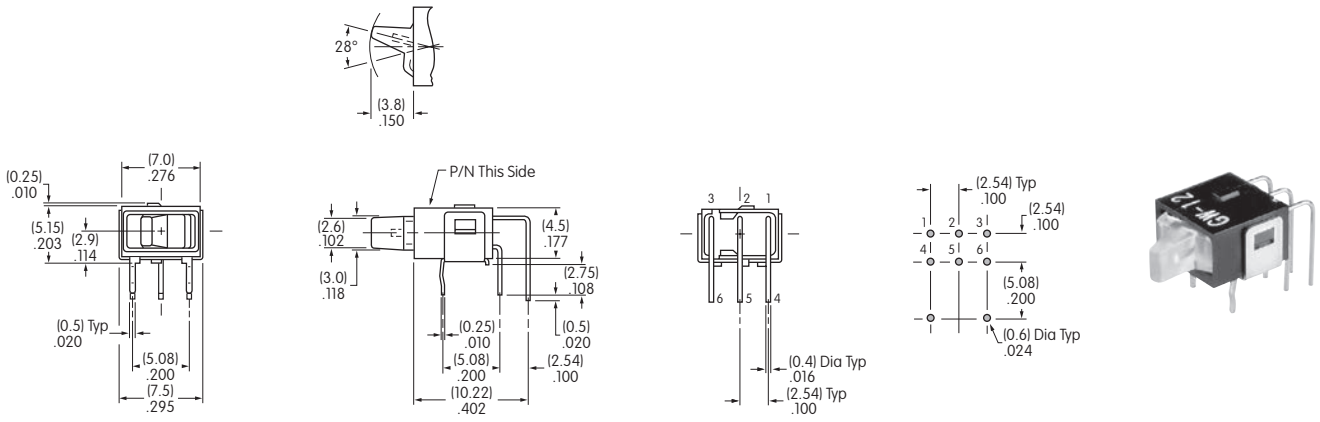
Straight PC



5 & 6 are LED terminals; 4 is a support pin on single color models & an LED terminal on bicolor models.

GW12LJPC

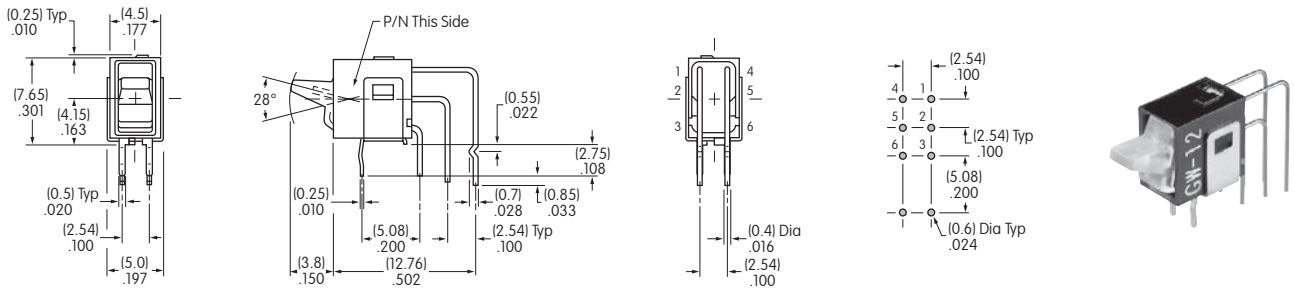
Right Angle PC



5 & 6 are LED terminals; 4 is a support pin on single color models & an LED terminal on bicolor models.

GW12LJHD

Vertical PC



5 & 6 are LED terminals; 4 is a support pin on single color models & an LED terminal on bicolor models.

GW12LJVCF

General Specifications

Electrical Capacity (Resistive Load)

Power Level: 10A @ 125/250V AC for JWM & JWMW models; 10A @ 30V DC for JWMW;
16A @ 125/250V AC for JWL & JWLW models; 5A @ 72V DC for telecommunication applications

Other Ratings

Contact Resistance: 10 milliohms maximum for JWM & JWMW; 20 milliohms maximum for JWL & JWLW
Insulation Resistance: 1,000 megohms minimum @ 500V DC
Dielectric Strength: 2,000V AC minimum between contacts for 1 minute minimum;
4,000V AC minimum between contacts & case for 1 minute minimum
Mechanical Life: 25,000 operations minimum
Electrical Life: 25,000 operations minimum
Nominal Operating Force: JWM & JWMW Single Pole 3.92N & Double Pole 7.84N
JWL Single Pole 5.00N & Double Pole 10.00N; JWLW Double Pole 10.00N
Angle of Throw: 26°

Materials & Finishes

Rocker: Polyphenylene ether (UL94V-0)
Housing/Frame & Barrier: Polyamide (UL94V-0)
Interior Seal for JWM & JWL: Polyphenylene sulfide (UL94V-0)
Case/Base: Melamine (UL94V-0)
Contacts: JWM & JWMW: Silver alloy with silver plating
JWL & JWLW: Silver alloy plus copper with silver plating
Terminals: Brass with silver plating

Environmental Data

Operating Temperature Range: –25°C through +70°C (–13°F through +158°F) for JWM & JWL;
–25°C through +85°C (–13°F through +185°F) for panel seal JWMW & JWLW models
Humidity: 90 ~ 95% humidity for 96 hours @ 40°C (104°F)
Vibration: 10 ~ 55Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in 1 minute; 3 right angled directions for 2 hours
Shock: 50G (490m/s^2) acceleration (tested in 6 right angled directions, with 5 shocks in each direction)
Sealing: IP67 of IEC60529 standard for panel seal JWMW & JWLW models; dust resistant inner seal for others

Installation

Soldering Time & Temperature: Manual Soldering: See Profile A in Supplement section.

Standards & Certifications

Flammability Standards: UL94V-0 for rocker, housing, seal & case/base of JWL, JWM, JWMW & JWLW models
TV Ratings for UL & CSA: JWM (TV-5) Overload Test @ 120V AC for 50 operations:
Steady State Current (rms) 7.5A; Minimum Inrush Current (peak) 111A.
JWM (TV-5) Endurance Test @ 120V AC for 25,000 operations:
Steady State Current (rms) 5A; Minimum Inrush Current (peak) 78A.
JWL (TV-8) Overload Test @ 120V AC for 50 operations:
Steady State Current (rms) 12A; Minimum Inrush Current (peak) 163A.
JWL (TV-8) Endurance Test @ 120V AC for 25,000 operations:
Steady State Current (rms) 8A; Minimum Inrush Current (peak) 117A.

UL: File No. E44145
JWM & JWMW models recognized at 10A @ 250V AC.
JWMW recognized at 10A @ 30V DC.
JWL & JWLW models recognized at 16A @ 250V AC; JWL at 5A @ 72V DC.

Models below recognized only when ordered with marking on switch.
JWMW: add "/U" to end of part number to order UL mark on switch; add "/CUL" to end of part number to order cULus mark on switch.
JWL: add "/U-DC" to end of part number to request UL rating on DC rated switch.

CSA: File No. 023535_0_000
JWM & JWMW models certified at 10A @ 250V AC; JWL models certified at 16A @ 250V AC

VDE: License No. 115674
JWM models approved at steady state 5A, inrush 80A, resistive 10A, & motor load 6A all at 250V AC; JWL models approved at steady state inrush 128A, resistive 16A, & motor load 8A all at 250V AC.
Note: JWM & JWL Double Pole, Single Throw models approved only with the international ON-OFF symbols on the actuator.

Distinctive Characteristics

Industry's first molded rocker with TV rating. Designed to handle large inrush current, with high electrical capacity of 10 and 16 Amps. JWM models certified for TV-5 rating and JWL models for TV-8 rating.

JWMW and JWLW panel seal versions meet IP67 of IEC60529 Standards (similar to NEMA 4 and 6).

Prominent external insulating barriers increase insulation resistance and dielectric strength.

Uniquely constructed to break light contact welds.

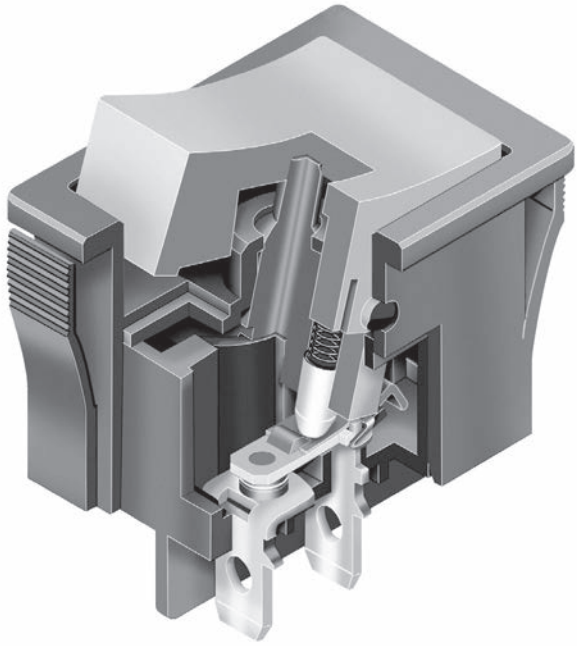
Increased electrical life with specially designed plate to minimize contact bounce.

Constructed for dust resistance with interior cover between actuator and contact area.

Terminals are molded in and epoxy sealed to lock out flux, dust, and other contaminants.

Solder lug/quick connect terminals can be used with connector.

Housing and case of heat resistant resin meet UL94V-0 standard.



Actual Size JWM

TYPICAL SWITCH ORDERING EXAMPLE

JW | LW | 2 | 1 | R | A | 1 | A | — | ☐

Ratings

M	10A @ 125/250V AC
MW	Panel Seal 10A @ 125/250V AC
L	16A @ 125/250V AC
LW	Panel Seal 16A @ 125/250V AC

Poles

1	SPST SPDT
2	DPST DPDT

Notes:
DPST must have international ON-OFF symbols for VDE approval.
JWLW available in DPST & DPDT only.

Circuits

1	ON	NONE	OFF
2	ON	NONE	ON

Barrier Types

R	No Barrier
B	With Barrier

Note: JWMW & JWLW combine with code R only.

Cap Colors

A	Black
B	Ivory
C	Red
H	Gray

Note: JWMW & JWLW available with black or red caps only.

Inscription Orientation

No Code	No Inscription
1	Horizontal
2	Vertical

These are inscriptions for Single Throw models only.

Housing Colors

A	Black
B	Ivory
H	Gray

Note: JWMW & JWLW available with black only.

Barrier Colors

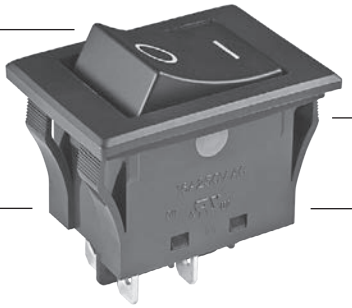
A	Black
B	Ivory
H	Gray

IMPORTANT:

Standard markings for JWM & JWL: TV Rating, UL, CSA & VDE.
Standard marking for JWLW: cULus.
Specific models, ratings & ordering instructions for international approvals are noted on General Specifications page.

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

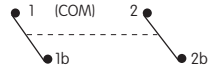
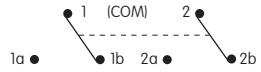
JWLW21RA1A



RATINGS

M	Power Level	10A @ 125/250V AC	MW	Panel Seal	Power Level	10A @ 125/250V AC
L	Power Level	16A @ 125/250V AC	LW	Panel Seal	Power Level	16A @ 125/250V AC

POLES & CIRCUITS

		Rocker Position			Connected Terminals			Throw & Schematics
Pole	Model	Down	Center	Up	Down	Center	Up	Note: Terminal numbers are not actually on the switch. Actuator positions oriented with switch part number facing front.
SP	JWM11 JWMW11 JWL11	ON	NONE	OFF	1-1b	OPEN	OPEN	SPST
SP	JWM12 JWMW12 JWL12	ON	NONE	ON	1-1b	OPEN	1-1a	SPDT
DP	JWM21 JWMW21 JWL21 JWLW21	ON	NONE	OFF	1-1b 2-2b	OPEN	OPEN	DPST 
DP	JWM22 JWMW22 JWL22 JWLW22	ON	NONE	ON	1-1b 2-2b	OPEN	1-1a 2-2a	DPDT 

BARRIER TYPES & COLORS

R **No Barrier**

JWM

JWL

No-barrier type has a flat flange which is an integral part of the switch.

JWMW and JWLW panel seal devices have exterior seal of acrylonitrile butadiene rubber covering the flange.

Flange/Housing Material: Polyamide Finish: Matte

B **With Barrier**

JWM

JWL

Barrier type designates that either AT217 (for JWM) or AT218 (for JWL) is factory assembled.
Dimensions for barriers are shown in the Accessories section.

Barrier Colors Available: A Black B Ivory H Gray

Barrier Material: Polyamide Finish: Matte

CAP COLORS

Cap Colors Available: A Black B Ivory C Red H Gray

Cap Material: Polyphenelene Oxide

Finish: Matte

Rocker cap is an integral part of the switch and not available separately.

JWMW and JWLW available with black or red caps only.

Series JW

High Inrush 10 & 16 Amp Rockers

INSCRIPTIONS

No Code — **No Inscription**

DPST models without inscriptions do not have VDE approval.

1 — **Inscription for Horizontal Mounting**

2 — **Inscription for Vertical Mounting**

The IEC symbols for On-Off are supplied with Single Throw models only.
Orientation of inscription must be selected.
Inscription Colors: Black ink on Ivory or Gray cap. White ink on Black or Red cap.
Contact factory for other inscriptions.

HOUSING

Material: Polyamide

Finish: Matte

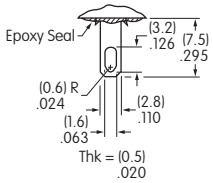
Colors Available: **A** Black **B** Ivory **H** Gray

JWMW and JWLW panel seal models available with black housing only.

TERMINALS

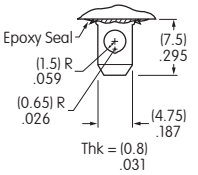
Solder Lug/Quick Connect .110" (2.8mm)

JWM & JWMW



Solder Lug/Quick Connect .187" (4.75mm)

JWL & JWLW



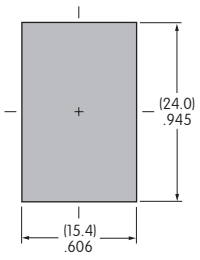
PANEL CUTOUTS

Panel Thickness Range

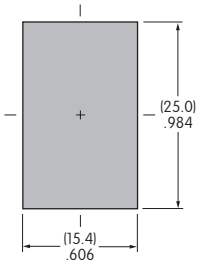
Without Barrier (JWM & JWMW):
.039" ~ .157" (1.0mm ~ 4.0mm)

With Barrier (JWM):
.024" ~ .126" (0.6mm ~ 3.2mm)

JWM



JWMW

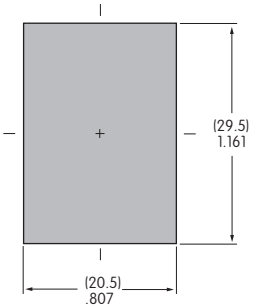


Panel Thickness Range

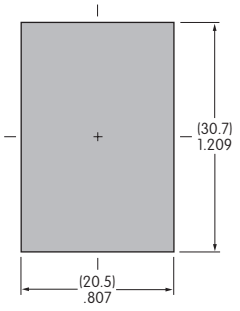
Without Barrier (JWL & JWLW):
.039" ~ .157" (1.0mm ~ 4.0mm)

With Barrier (JWL):
.024" ~ .126" (0.6mm ~ 3.2mm)

JWL

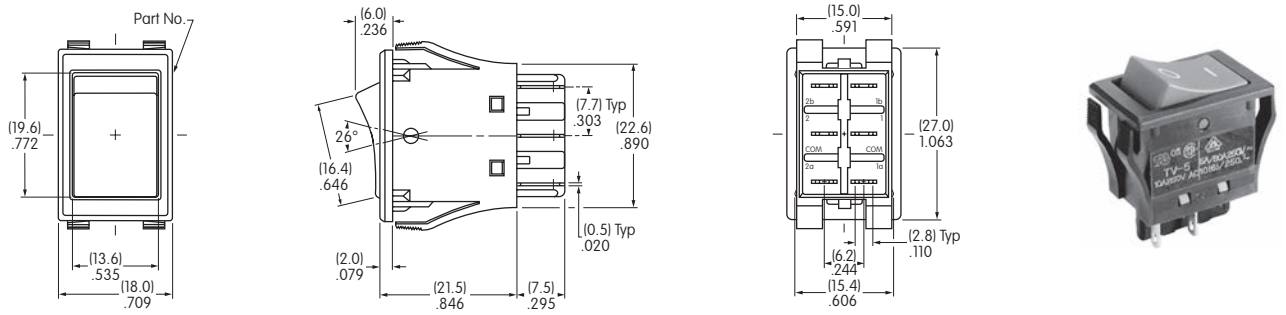


JWLW



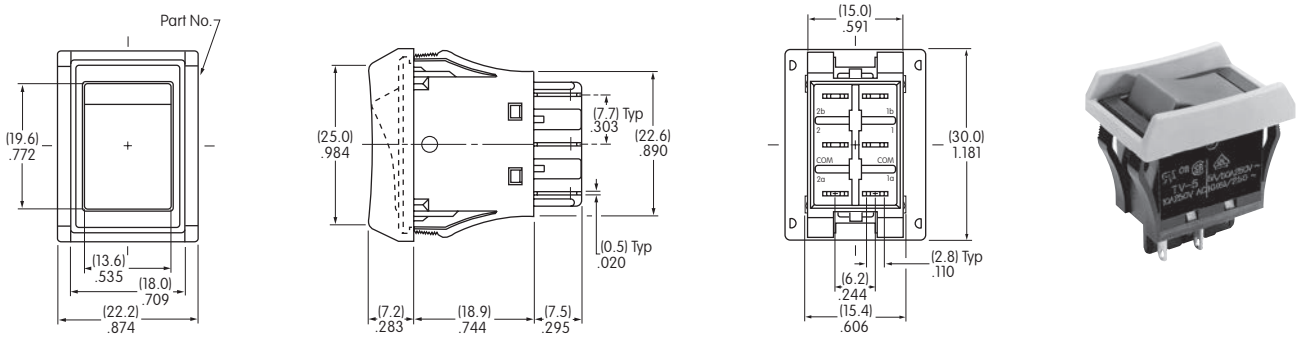
TYPICAL SWITCH DIMENSIONS FOR JWM & JWMW

Single & Double Pole — No Barrier • 10 Amp



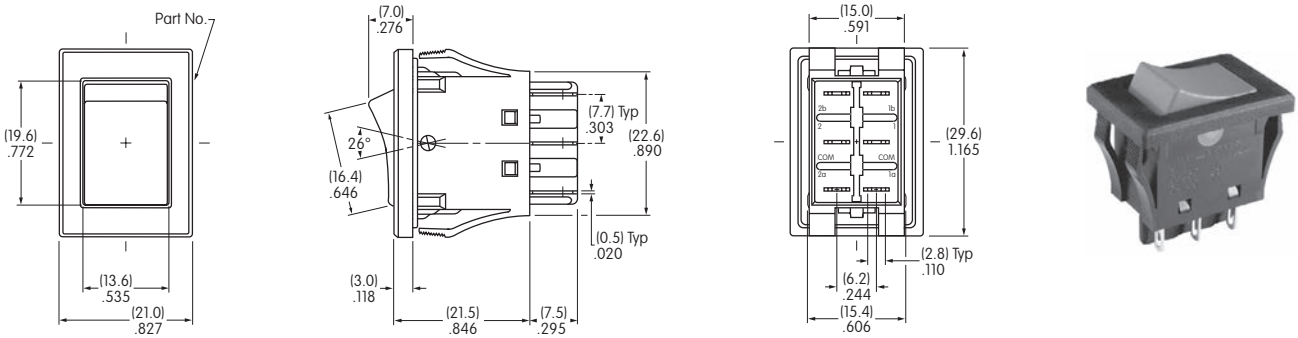
JWM11RC1A

Single & Double Pole — With Barrier • 10 Amp



JWM11BCA-H

Single & Double Pole — Panel Seal • No Barrier • 10 Amp



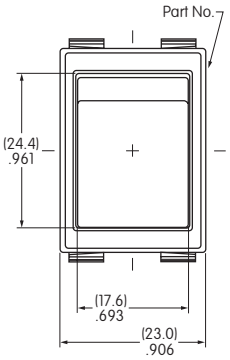
JWMW22RCA

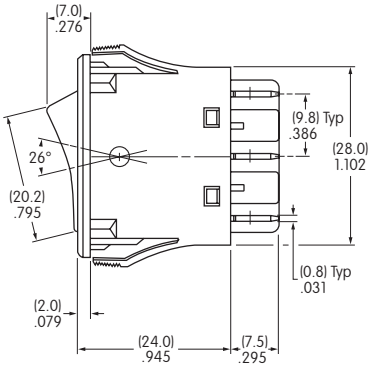
Single pole double throw models do not have terminals 2a, 2, & 2b; single throw models do not have 1a & 2a.

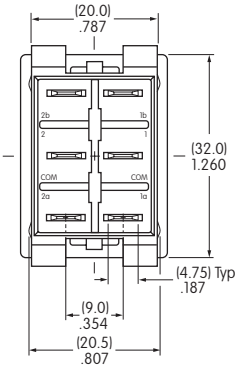
TYPICAL SWITCH DIMENSIONS FOR JWL & JWLW

No Barrier • 16 Amp

Single & Double Pole





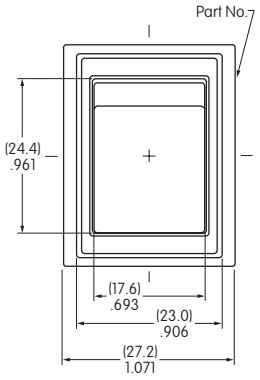


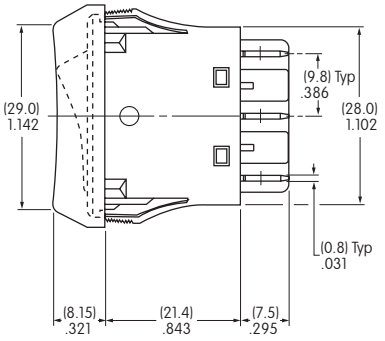
JWL21RC2A

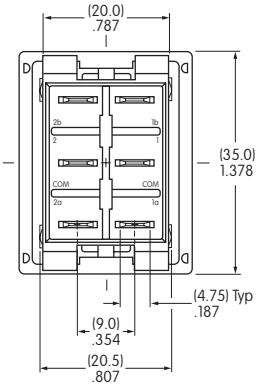
Single pole double throw models do not have terminals 2a, 2, & 2b; single throw models do not have 1a & 2a.

With Barrier • 16 Amp

Single & Double Pole





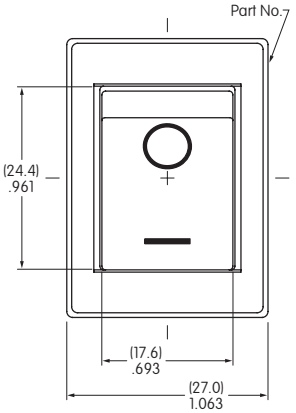


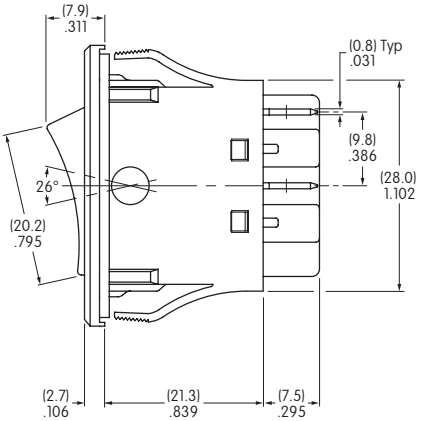
JWL11BCA-H

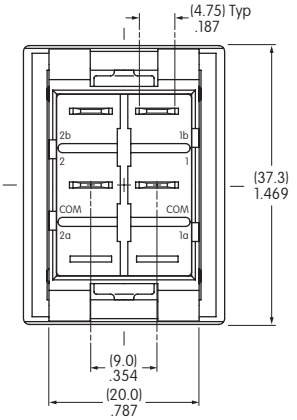
Single pole double throw models do not have terminals 2a, 2, & 2b; single throw models do not have 1a & 2a.

Panel Seal • 16 Amp • Inscription

Double Pole Single Throw



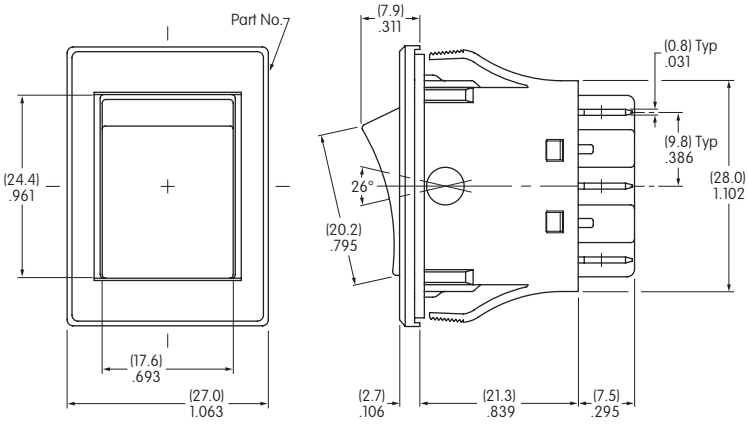




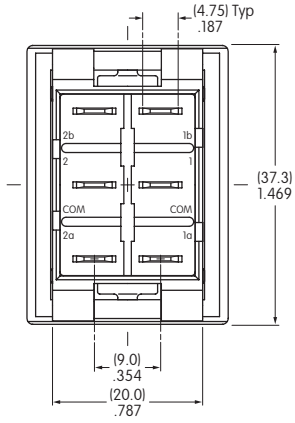
JWLW21RA1A

TYPICAL SWITCH DIMENSIONS FOR JWLW

Double Pole Double Throw



Panel Seal • 16 Amp • No Inscription

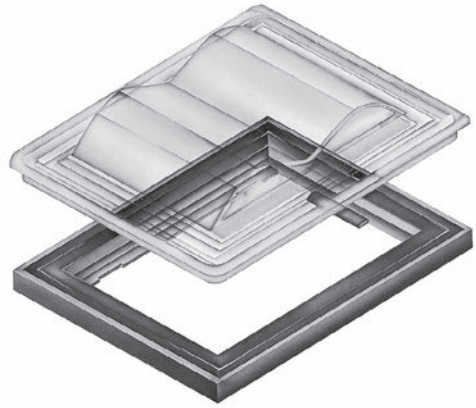


JWLW22RAA

OPTIONAL DUST COVER

AT4126
Dust Cover for JWL Rocker

When installed, the Dust Cover protects the switch from an environment containing small particles and dust. The switch is operable with the Dust Cover in place.



Materials:

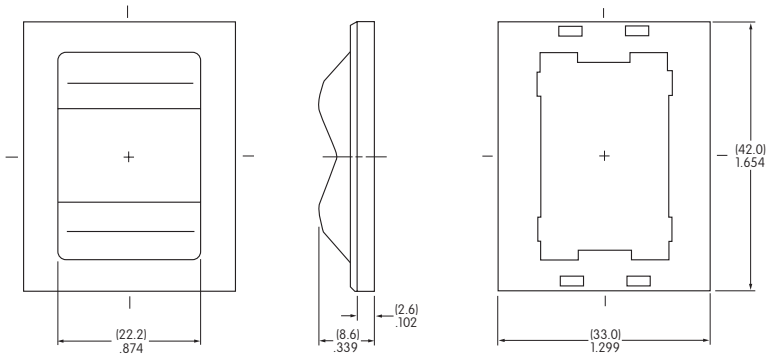
Lid: Clear Polyvinyl Chloride
Base: Black Polyamide

Recommended Temperature Range:

–10° ~ +70°C (+14°F ~ +158°F)
Loses pliability below 0°C (+32°F)

Recommended Panel Thickness:

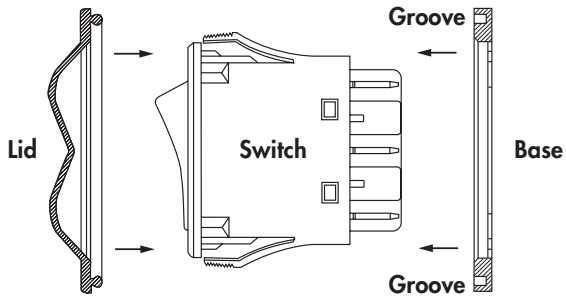
.031″ ~ .134″ (0.8mm ~ 3.4mm)



Top Side Bottom

Assembly Instructions:

1. Insert bottom of switch through the **base** until the tabs lock into place.
2. Snap the switch into the panel.
3. Seat the **lid** into the **grooves** of the **base**.



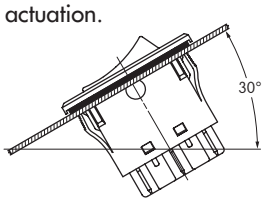
Notes

1. The dust cover is not for use with JWLW.
2. The dust cover cannot be used with the barrier option.

PRECAUTIONS FOR HANDLING & STORAGE FOR JWMW/LW (PANEL SEAL TYPES)

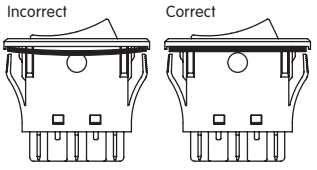
Operating Environment

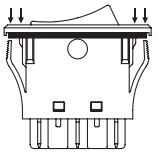
- Do not install switch where heavy dust collection occurs. Dust build-up under rocker may affect switch actuation.
- Do not actuate switch if submerged in water or oil.
- Installation is not recommended on horizontal surface in an environment where frequent splashing of water may occur. In such an environment, a minimum 30° angle installation is advisable. If there is a possibility of freezing, install vertically so no moisture will be retained within switch housing.

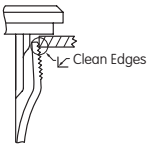


Panel Mounting

- Before snapping a switch into the panel, align the gasket evenly under bezel of the switch.
- When mounting into a panel, apply equal pressure to sides of bezel and insert parallel to panel.
- After mounting a switch, be sure there are no gaps between switch and panel. Lightly push into panel.
- After installing into panel, do not apply excessive force.
- After panel installation and wiring is completed, do not apply force horizontally or vertically from behind panel.
- Behind the panel, cut area should be squared. If front of panel is painted, do not allow any paint to collect in corners of cutout to prevent level mounting.
- Avoid reinstalling a switch once it has been mounted in a panel. This may cause deterioration of panel sealability.







General Specifications

Electrical Capacity (Resistive Load)

Power Level: 10A @ 125/250V AC
6A @ 125/250V AC (UL/CSA)
5A (3A) @ 125/250V AC (VDE)

Other Ratings

Contact Resistance: 10 milliohms maximum
Insulation Resistance: 500 megohms minimum @ 500V DC
Dielectric Strength: 2,000V AC minimum between contacts for 1 minute minimum;
4,000V AC minimum between contacts & case for 1 minute minimum
Mechanical Life: 30,000 operations minimum
Electrical Life: 10,000 operations minimum
Nominal Operating Force: Single Pole 3.92N & Double Pole 5.39N
Angle of Throw: 30°

Materials & Finishes

Rocker: Polyamide (UL94V-0)
Housing/Case: Polyamide (UL94V-0)
Movable Contactor: Copper with silver plating
Movable Contacts: Silver alloy
Stationary Contacts: Silver alloy
End Terminals: Brass with silver plating
Common Terminals: Copper with silver plating
Lamp Terminals: Phosphor bronze with tin plating (illuminated models only)

Environmental Data

Operating Temp Range: –25°C through +70°C (–13°F through +158°F) for nonilluminated models;
–25°C through +50°C (–13°F through +122°F) for illuminated models
Humidity: 90 ~ 95% humidity for 96 hours @ 40°C (104°F)
Vibration: 10 ~ 55Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in 15 minutes; 3 right angled directions for 2 hours
Shock: 50G (490m/s^2) acceleration (tested in 6 right angled directions, with 5 shocks in each direction)
Sealing: Dust resistant inner seal

Installation

Soldering: Manual Soldering: See Profile A in Supplement section.
Cleaning: These devices are not process sealed. Hand cleaning locally using alcohol based solution.

Standards & Certifications

Flammability Standards: UL94V-0 for rocker & housing/case
UL: File No. E44145
All JWS models recognized at 6A @ 125/250V AC
CSA: File No. 023535_0_000
All JWS models certified at 6A @ 125/250V AC
VDE: License No. 119153
All JWS models approved at 5A (3A) @ 125/250V AC

Distinctive Characteristics

Rocker caps and housing available in a variety of colors.

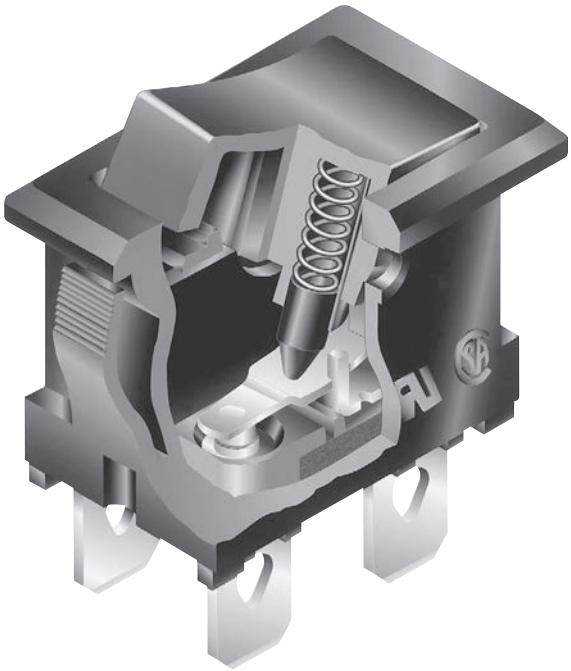
Protective barrier available to prevent accidental actuation.

Constructed for dust resistance with interior cover of polyamide between actuator and contact area.

Easy, crisp actuation.

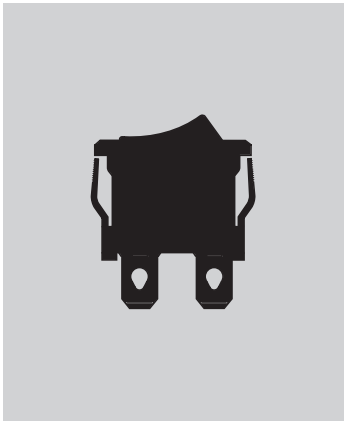
Small size well suited for telecommunication, measuring, automation, and consumer applications.

Terminals are molded in to lock out flux, dust, and other contaminants.



Outer case of heat resistant resin meets UL94V-0 flammability standard.

Actual Size



TYPICAL SWITCH ORDERING EXAMPLE

JW | S | 2 | 1 | R | A | A | ☐ | – | ☐

Rating

S	10A @ 125/250V AC 6A @ 125/250V AC (UL/CSA) 5A (3A) @ 125/250V AC (VDE)

Poles

1	SPST Nonilluminated & Illuminated
2	DPST Nonilluminated only

Circuit

1	ON	NONE	OFF

Barrier Types

R	No Barrier
B	With Barrier

Cap Colors

A	Black
* B	Ivory
C	Red

* For Nonilluminated only

Housing Colors

A	Black
* B	Ivory

* For Nonilluminated only

Spot Illumination

No Code	Nonilluminated
C	Red LED
D	Amber LED
F	Green LED

Barrier Color

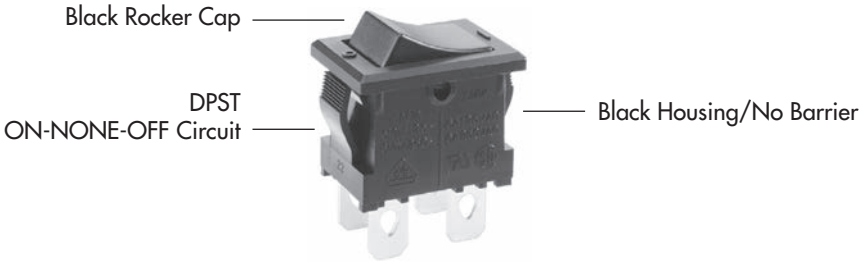
A	Black

IMPORTANT:

cULus & VDE markings are standard on all models. Models & specific ratings are noted on General Specifications page.

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

JWS21RAA



RATING

S	**Power Level**	10A @ 125/250V AC	6A @ 125/250V AC (UL/CSA)	5A (3A) @ 125/250V AC (VDE)

POLES & CIRCUITS

		Rocker Position			Connected Terminals			Throw & Schematics
Pole	**Model**	**Down**	**Center**	**Up**	**Down**	**Center**	**Up**	Note: Terminal numbers are actually on the switch.
SP	**JWS11**	ON	NONE	OFF	2-3	OPEN	OPEN	SPST
DP	**JWS21**	ON	NONE	OFF	1-3 4-6	OPEN	OPEN	DPST

BARRIER TYPES & COLORS

R **No Barrier**

No-barrier type has a flat flange which is an integral part of the switch.

B **With Barrier**

Barrier Material: Polyamide
Finish: Matte

Barrier AT219 is factory assembled. Dimensions for barrier are shown in the Accessories section.

Barrier Color Available: A Black

CAP COLORS

Cap Material: Polyamide

Finish: Matte

Rocker cap is an integral part of the switch and not available separately.
* Ivory for nonilluminated models only.

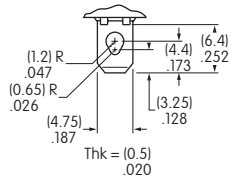
Cap Colors Available: A Black B * Ivory C Red

HOUSING

Material: Polyamide
Finish: Matte

Colors Available: A Black B Ivory (for nonilluminated models only)

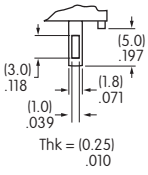
TERMINALS



Switch

Solder Lug/.187" (4.75mm) Quick Connect

Switch assembly with connectors is not UL, CSA, C-UL, or VDE approved.



Lamp
(spot illuminated models only)

LED COLORS & SPECIFICATIONS FOR SPOT ILLUMINATED MODELS

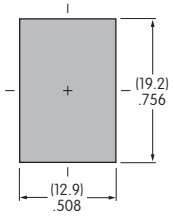
LEDs are supplied as an integral part of illuminated devices and are not available separately. LED polarity markings are on the bottom of the switch.

The electrical specifications shown here are determined at a basic temperature of 25°C.

If the source voltage exceeds the rated voltage, a ballast resistor is required. The resistor value can be calculated by using the formula in the Supplement section.

Color		C Red	D Amber	F Green
Maximum Forward Current	I_{FM}	30mA	20mA	30mA
Typical Forward Current	I_F	10mA	10mA	10mA
Forward Voltage	V_F	1.8V	2.0V	2.1V
Maximum Reverse Voltage	V_{RM}	5V	5V	5V
Current Reduction Rate Above 25°C	ΔI_F	No Current Reduction Rate Within Specified Operating Temperature		
Ambient Temperature Range		−25°C ~ +50°C		

PANEL CUTOUT & PANEL THICKNESS RANGES



Panel Thickness Ranges:

Without Barrier:
.030″ ~ .079″ (0.75mm ~ 2.0mm)

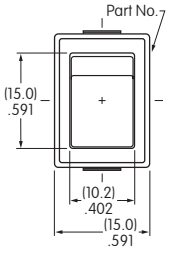
With Barrier:
.024″ ~ .059″ (0.6mm ~ 1.5mm)

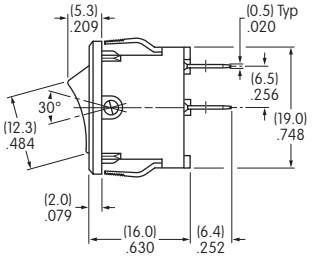
TYPICAL SWITCH DIMENSIONS

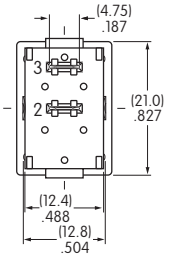
Nonilluminated • No Barrier

Single Pole

JWS11RCA



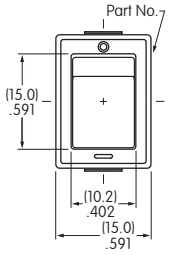


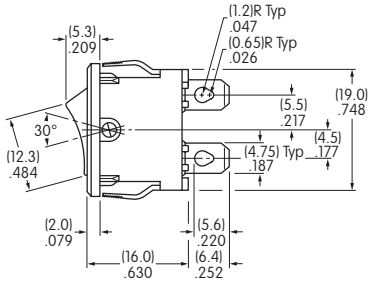


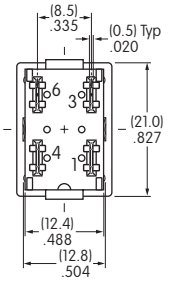
Nonilluminated • No Barrier

Double Pole

JWS21RAA



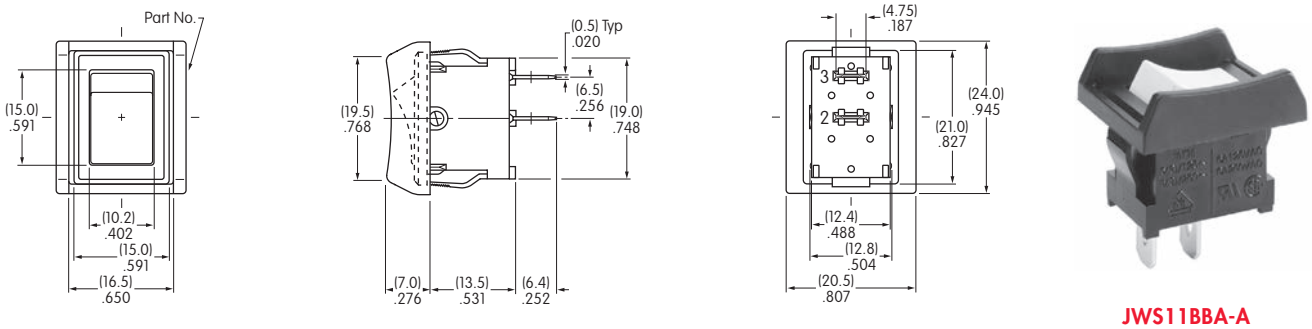




DPST models have IEC symbols for On-Off on the flange.

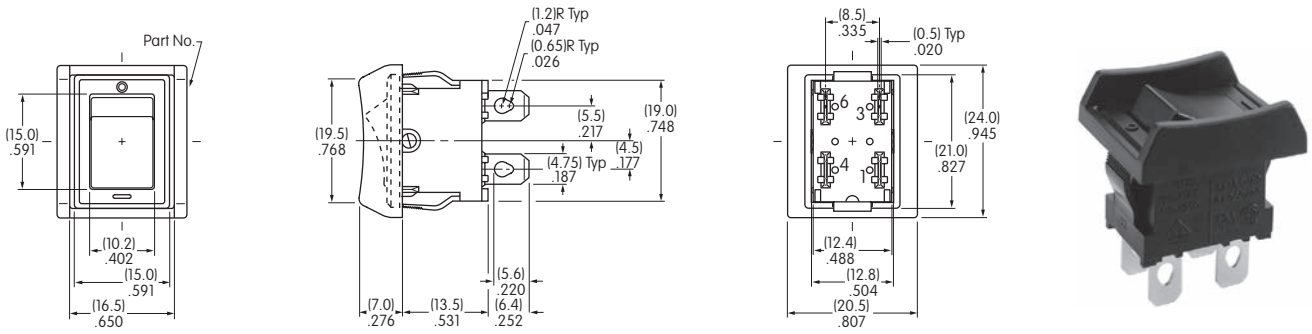
TYPICAL SWITCH DIMENSIONS

Single Pole — Nonilluminated • With Barrier



JWS11BBA-A

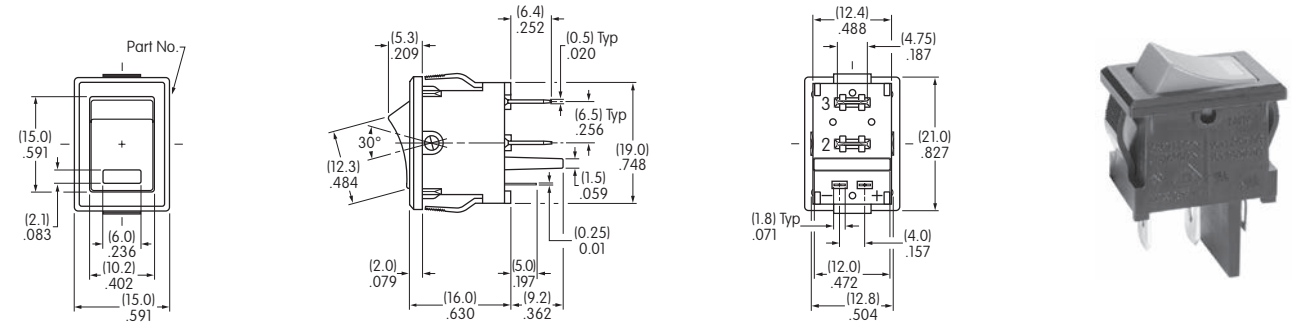
Double Pole — Nonilluminated • With Barrier



DPST models have IEC symbols for On-Off on the flange.

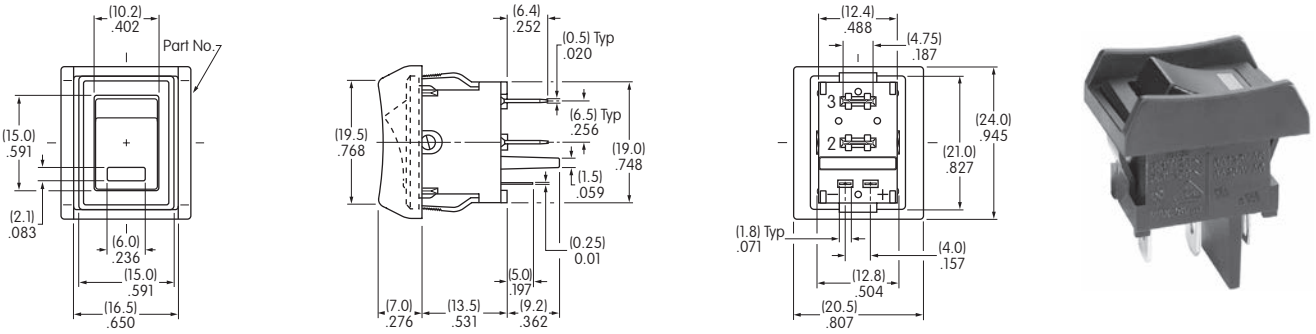
JWS21BAA-A

Single Pole — Spot Illuminated • No Barrier



JWS11RCAF

Single Pole — Spot Illuminated • With Barrier



JWS11BAAF-A

General Specifications

Electrical Capacity

Resistive Load: 10A @ 125V AC, 6A @ 250V AC, or 6A @ 30V DC
Inductive Load: 5A @ 125V AC (P. F. @ .60)

Other Ratings

Contact Resistance: 10 milliohms maximum
Insulation Resistance: 200 megohms minimum @ 500V DC
Dielectric Strength: 1,500V AC minimum for 1 minute minimum
Mechanical Life: 30,000 operations minimum
Electrical Life: 10,000 operations minimum
Nominal Operating Force: 11.77N for maintained & 17.65N for momentary
Angle of Throw: 34°

Materials & Finishes

Housing: Steel with chrome plating
Movable Contacts: Silver clad copper with silver plating
Stationary Contacts: Copper with silver plating
Base: Melamine
Common Terminal: Copper with tin plating
End Terminals: Brass with tin plating
Lamp Terminals: Phosphor bronze with nickel plating

Environmental Data

Operating Temperature Range: –20°C through +50°C (–4°F through +122°F)
Humidity: 90 ~ 95% humidity for 96 hours @ 40°C (104°F)
Vibration: 10 ~ 55Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in 1 minute; 3 right angled directions for 2 hours
Shock: 50G (490m/s^2) acceleration (tested in 3 right angled directions, with 3 shocks in each direction)

Installation

Cap Installation Force: 19.61N (4.41 lbf)
SolderingTime & Temperature: Manual Soldering: See Profile A in Supplement section.

Standards & Certifications

UL: **File No. E44145 - Recognized only when ordered with marking on switch.**
Add "/U" or "/CUL" before first dash in part number to order UL recognized switch.
All models recognized at 10A @ 125V AC & 6A @ 250V AC

Distinctive Characteristics

Each half of the rocker face is distinctly illuminated due to partitioned rocker construction and dual lamps.

Numerous lighting effects achievable by using white or clear rocker with colored filters or lamp covers, plus using different colors on each side of rocker.

Snap-in mounting allows fast, easy installation of switch into panel.

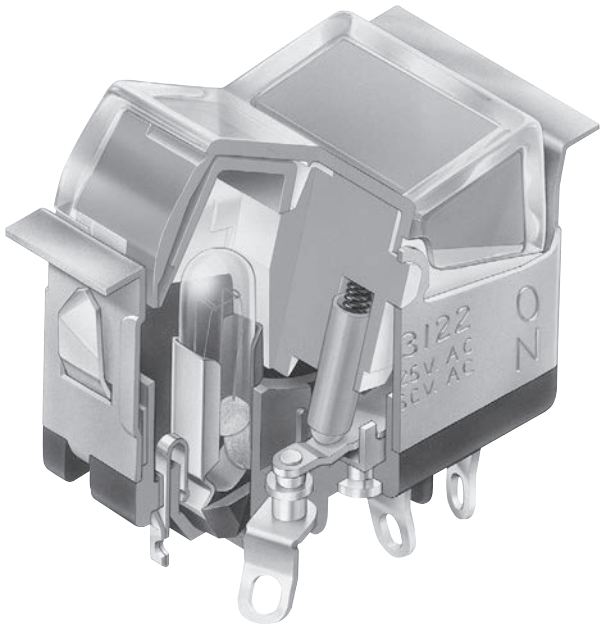
Stainless steel retaining clips provide secure mounting over a wide range of panel thicknesses.

Dual incandescent or neon lamps operate independently of each other.

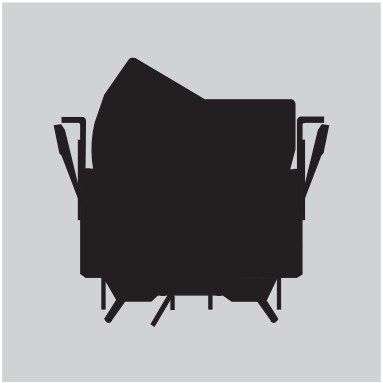
Front panel relamping.

Stationary lamp sockets are independent of rocker actuation, protecting lamps from damage due to shock and vibration.

Switch contacts are rated at 10 amps 125V AC which makes these devices well-suited for various power switching applications.



Actual Size



TYPICAL SWITCH ORDERING EXAMPLE

LW31 [2] [2] – [H] [4] [C] [F] – [A]

Pole

2	DPDT

Circuits

	Up	Center	Down
2	ON	NONE	ON
3	ON	OFF	ON
5	ON	NONE	(ON)
8	(ON)	OFF	(ON)
9	ON	OFF	(ON)

( ) = Momentary

Lamps

Incandescent	
E	6-volt
F	12-volt
H	18-volt
K	24-volt
L	28-volt
Neon	
N	110-volt
Not suitable with green & blue	
Nonilluminated	
0	No Lamp

Rocker Caps

1	White without filters or lamp covers
2	White with filters
3	White with lamp covers
4	Clear with filters

Lamp Cover/ Filter Colors For Up Position

0	No Cover/Filter
Lamp Cover	
C	Red
D	Amber
F	Green
Filter	
B	White
C	Red
D	Amber
E	Yellow
F	Green
G	Blue

Lamp Cover/ Filter Colors For Down Position

0	No Cover/Filter
Lamp Cover	
C	Red
D	Amber
F	Green
Filter	
B	White
C	Red
D	Amber
E	Yellow
F	Green
G	Blue

Bezel

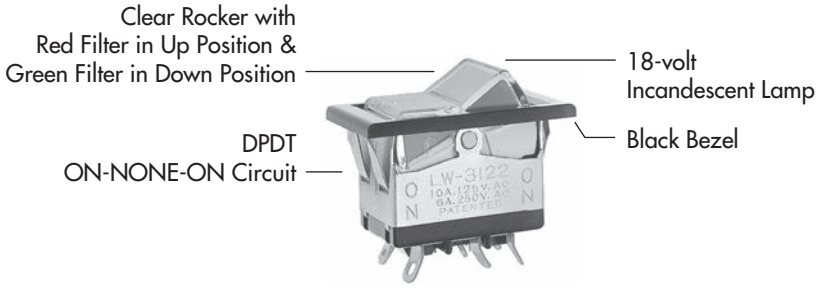
No Code	No Bezel
A	Black
B	White
C	Red
D	Amber
E	Yellow
F	Green
G	Blue
H	Gray

IMPORTANT:

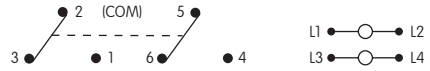
Switches are supplied without UL & cULus marking unless specified. **UL & cULus recognized only when ordered with marking on the switch.** Specific models, ratings, & ordering instructions are noted on General Specifications page.

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

LW3122-H4CF-A



POLES & CIRCUITS

Pole	Model	Rocker Position ( ) = Momentary: Up	Center	Down	Connected Terminals: Up	Center	Down	Throw & Power/Lamp Schematics
DP	LW3122	ON	NONE	ON	2-3 5-6	OPEN	2-1 5-4	Notes: Terminal numbers are not actually on switch. Lamp circuit is isolated and requires an external power source.
	LW3123	ON	OFF	ON				DPDT
	LW3125	ON	NONE	(ON)				
	LW3128	(ON)	OFF	(ON)				
	LW3129	ON	OFF	(ON)				

LAMP CODES & SPECIFICATIONS

Electrical specifications are determined at a basic temperature of 25°C. Lamp circuit is independent of switch operation.
For dimension drawing of lamps see Accessories & Hardware section.
For neon, if the source voltage is greater than rated voltage, a ballast resistor is required. The ballast resistor calculation and more lamp detail are shown in the Supplement section. Neon not for use with green lamp cover or blue and green filters.

Incandescent & Neon Lamps for Solid & Design Caps

AT602 Incandescent **AT602N Neon**

T-1½ Pilot Slide Base

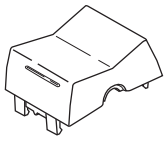
		E	F	H	K	L	N
Voltage	V	6V AC	12V AC	18V AC	24V AC	28V AC	110V AC
Current	I	80mA	50mA	35mA	25mA	22mA	1.5mA
MSCP		.159	.215	.398	.215	.247	NA
Endurance	Hours	2,000 Average					15,000 Average
Ambient Temperature Range		−20°C ~ +50°C					−20°C ~ +50°C

Recommended Resistor for Neon: 33K ohms for 110V AC; 100K ohms for 220V AC

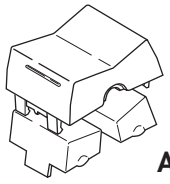
0 **No Lamp** Code 0 indicates that no lamp is used.

ROCKER CAPS, LAMP COVER & FILTER

1 **AT420B White Rocker without Filters or Lamp Covers**

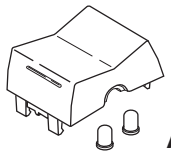


2 **AT420B White Rocker with Filters**



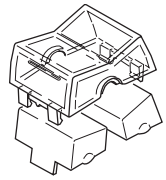
AT421

3 **AT420B White Rocker with Lamp Covers**



AT416

4 **AT420J Clear Rocker with Filters**



AT421

Rocker Cap Material: Polycarbonate Finish: Glossy

Indicate the lamp cover or filter color desired in both the up and down positions.

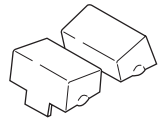
C Red
D Amber
F Green

AT416 Lamp Cover

Material: Silicon Rubber

B White
C Red
D Amber
E Yellow
F Green
G Blue

AT421 Filter



Material: Polycarbonate

Series LW

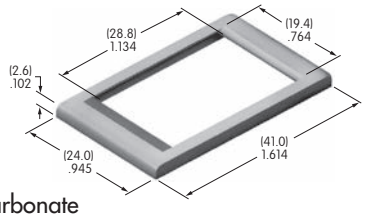
Power-Rated Snap-in Rockers

BEZEL & BEZEL COLORS

AT206 Bezel & Color Codes

No Code	No Bezel	B	White	D	Amber	F	Green
A	Black	C	Red	E	Yellow	G	Blue

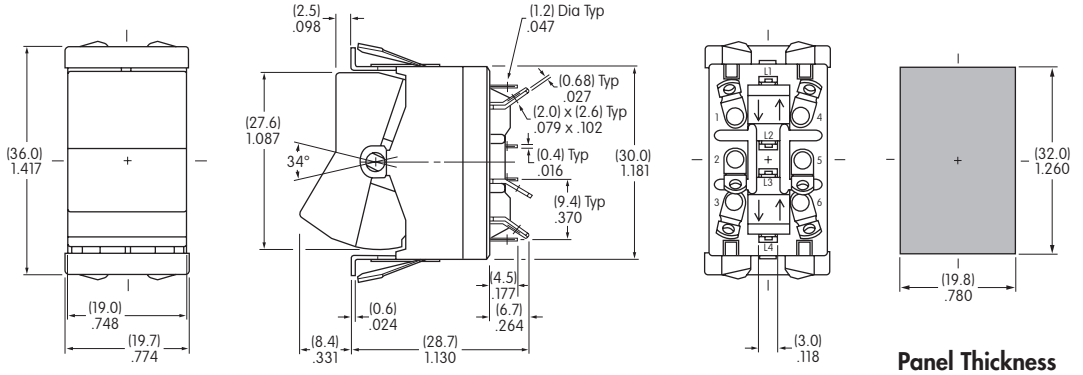
H Gray



Material: Polycarbonate

TYPICAL SWITCH DIMENSIONS

Solder Lug • Without Bezel

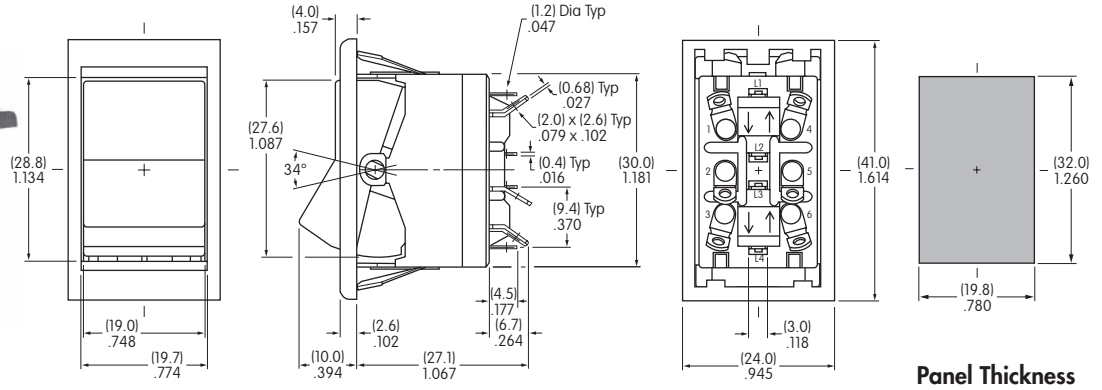


LW3122-F4CF

Actuator in UP position

Panel Thickness
.039" ~ .157"
(1.0mm ~ 4.0mm)

Solder Lug • With Bezel



LW3122-F3CF-A

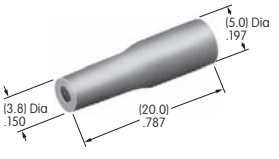
Actuator in UP position

Panel Thickness
.039" ~ .118"
(1.0mm ~ 3.0mm)

OPTIONAL ACCESSORY

AT107 Lamp Extractor

Lamps can be changed without removing the switch from the panel.
AT107 assists in removing lamps from the switch.



LEGENDS

Inscriptions can be placed on the rocker or filter.
Details regarding screen printing may be obtained from the factory.

GENERAL SPECIFICATIONS

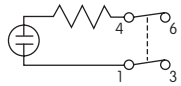
Electrical Capacity & Other Ratings

Resistive Load:	20A @ 110V AC
Contact Resistance:	10 milliohms maximum
Insulation Resistance:	1,000 megohms minimum @ 500V DC
Dielectric Strength:	2,000V AC minimum for 1 minute minimum
Mechanical Life:	30,000 operations minimum
Electrical Life:	10,000 operations minimum
Operating Temperature Range:	–10°C through +50°C (+14°F through +122°F)
Nominal Operating Force:	1,250 grams
Angle of Throw:	22°

Materials & Finishes

Rocker:	Polycarbonate resin
Mounting Frame:	Steel with chrome plating
Movable Contacts:	Silver alloy
Stationary Contacts:	Copper with silver plating
Base:	Melamine
Common & End Terminals:	Brass with tin plating

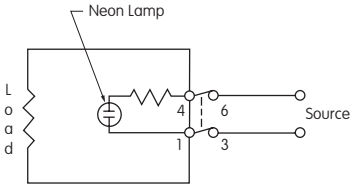
SINGLE POLE HIGH CAPACITY

		Rocker Position			Connected Terminals			Throw & Power/Lamp Schematics
Model	**Pole**	**Up**	**Center**	**Down**	**Up**	**Center**	**Down**	Notes: Terminal numbers are on switch. Lamp circuit is synchronous to switching circuit.
LW3021A	DP	ON	NONE	OFF	1-3 4-6	OPEN	OPEN	DPST 

Neon Lamp Specifications

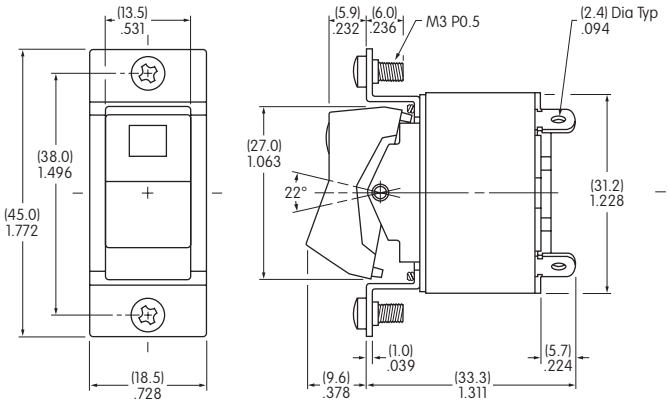
.234″ x .198″ (5.94mm x 5.03mm) window is translucent red. Neon lamp with built-in ballast resistor is integral part of switch.

Voltage	V	90 - 120V AC
Internal Series Resistance		100K ohms
Current	I	0.8mA
Endurance		10,000 hours minimum



Since this is a double break device, one side of the electrical source should be connected to terminal 3 and the other side to terminal 6. The electrical load should be connected between terminals 1 and 4.

2 screws supplied for flush panel mounting.



Actuator in UP position

Maximum Panel Thickness: .197″ (5.0mm)

LW3021A

General Specifications

Electrical Capacity (Resistive Load)

Power Level (silver): 6A @ 125V AC & 3A @ 250V AC
4A @ 30V DC for On-None-On; 3A @ 30V DC for all other circuits

Logic Level (gold): 0.4VA maximum @ 28V AC/DC maximum
(Applicable Range 0.1mA ~ 0.1A @ 20mV ~ 28V)

Logic/Power Level (gold over silver): Combines silver & gold ratings
Note: Find additional explanation of dual rating & operating range in Supplement section.

Other Ratings

Contact Resistance: 10 milliohms maximum for silver; 20 milliohms maximum for gold

Insulation Resistance: 1,000 megohms minimum @ 500V DC

Dielectric Strength: 1,000V AC minimum between contacts for 1 minute minimum;
1,500V AC minimum between contacts and case for 1 minute minimum

Mechanical Life: 50,000 operations minimum

Electrical Life: 25,000 operations minimum for silver; 50,000 operations minimum for gold;
50,000 operations minimum for silver at 3A @ 125V AC

Angle of Throw: 25°

Materials & Finishes

Actuator Clip & Mounting Frame: Stainless Steel

Body Frame: Stainless steel

Case: Diallyl phthalate resin (UL94V–0)

Movable Contactor: Phosphor bronze with silver or gold plating

Movable Contacts: Silver alloy (code W); copper with gold plating (code G); or silver alloy with gold plating (code A)

Stationary Contacts: Silver with silver plating (code W); copper or brass with gold plating (code G);
or silver with gold plating (code A)

Terminals: Copper or brass with silver plating; or copper or brass with gold plating

Environmental Data

Operating Temp Range: –30°C through +85°C (–22°F through +185°F)

Humidity: 90 ~ 95% humidity for 96 hours @ 40°C (104°F)

Vibration: 10 ~ 55Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning
in 1 minute; 3 right angled directions for 2 hours

Shock: 50G (490m/s^2) acceleration (tested in 6 right angled directions, with 5 shocks in each direction)

Processing

Soldering: Wave Soldering (PC version) for Gold: See Profile A in Supplement section.
Manual Soldering for Gold: See Profile A in Supplement section.
Wave Soldering (PC version) for Silver: See Profile B in Supplement section.
Manual Soldering for Silver: See Profile B in Supplement section.
Note: Actuator must be in OFF (center) position while soldering.

Cleaning: These devices are not process sealed. Hand clean locally using alcohol based solution.

Standards & Certifications

Flammability Standards: UL94V–0 for case

UL: **File No. E44145 - Recognized only when ordered with marking on switch.**
Add "/U" or "/CUL" before first dash in part number to order UL recognized switch.
All models recognized at 6A @ 125V AC, 3A @ 250V AC or 0.4VA maximum @ 28V DC maximum.

CSA: **File No. 023535_0_000 - Certified only when ordered with marking on switch.**
Add "/C" before first dash in part number to order CSA certified switch.
All models certified at 6A @ 125V AC or 3A @ 250V AC or 0.4VA maximum @ 28V maximum.

Distinctive Characteristics

Three methods of panel mounting: flat frame for flush with face or subpanel, snap-in, and PCB.

High insulating barriers increase isolation of circuits in multipole devices and provide added protection to contact points.

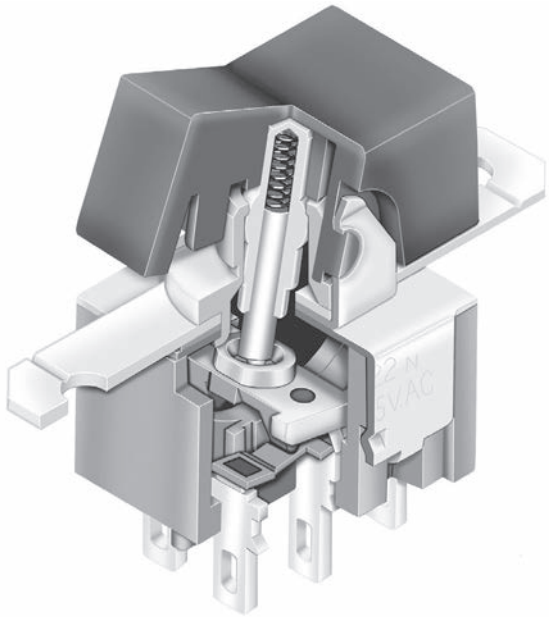
The molded diallyl phthalate case has a UL 94V-0 flammability rating.

Epoxy sealed terminals prevent entry of solder flux and other contaminants.

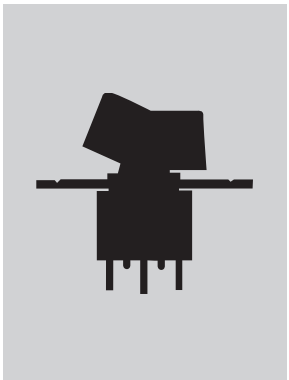
Prominent external insulating barriers increase insulation resistance and dielectric strength.

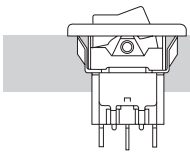
Bias guard prevents misalignment of contacts; interlocking of actuator block with rocker and internal guide does not allow transmission of diagonal force on rocker to reach contact mechanism.

Clinching of the frame to the case well above the base and terminals provides 1,500V dielectric strength.

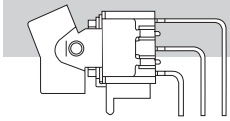


Actual Size

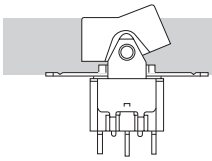




Snap-in Mount Page B64



Bracket PC Mount Page B72



Flat Frame Mount Page B83

TYPICAL SWITCH

M20 [1] [2] [TJ] [W] [01] — [F] [C]

Poles

1	SPDT
2	DPDT SP3T

Mounting Frame

TJ	Snap-in Frame

Terminals

01	Solder Lug
02	Quick Connect
03	.250" (6.35mm) Straight PC
05	.425" (10.8mm) Wirewrap
06	.750" (19.05mm) Wirewrap
07	.964" (24.5mm) Wirewrap
08	1.062" (27.0mm) Wirewrap

Rockers & Paddles

F	.450" (11.43mm) Wide Rocker
G	.450" (11.43mm) Wide Paddle
S	.453" (11.5mm) False Illluminated Rocker in Black only

Circuits

2	ON	NONE	ON
3	ON	OFF	ON
5	ON	NONE	(ON)
8	(ON)	OFF	(ON)
9	ON	OFF	(ON)
*4	ON	ON	ON
*6	(ON)	ON	(ON)
*7	ON	ON	(ON)

( ) = Momentary

* 3-ON circuits

Rocker & Paddle Colors

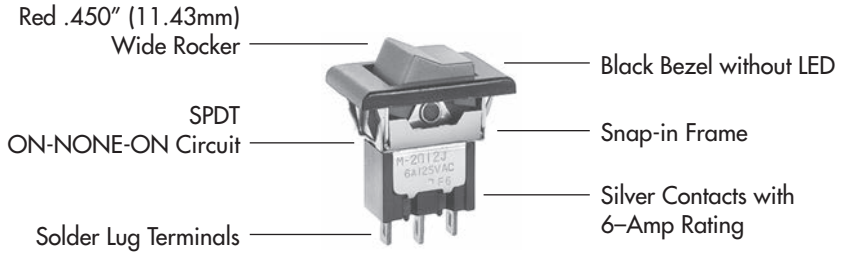
A	Black
B	White
C	Red
E	Yellow
F	Green
G	Blue
H	Gray

Contact Materials & Ratings

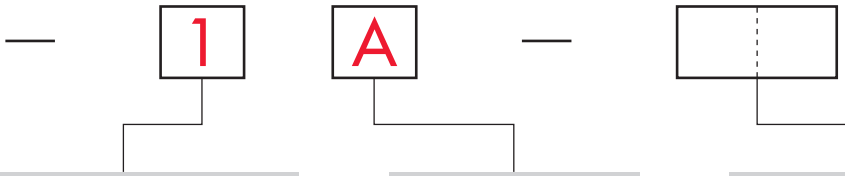
W	Silver; Rated 6A @ 125V AC & 3A @ 250V AC
G	Gold; Rated 0.4VA max @ 28V AC/DC max
A	Gold over Silver; Rated 6A @ 125V AC & 0.4VA max @ 28V AC/DC max

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

M2012TJW01-FC-1A



ORDERING EXAMPLE



Optional Bezels

1	Bezel without LED
2	Bezel with 1 Round LED
3	Bezel with 2 Round LEDs
4	Bezel with 2 Rectangular LEDs

Bezel Colors

A	Black
B	White
E	Yellow
F	Green
G	Blue
H	Gray

LED Colors

1 LED

C	Red
F	Green

2 LEDs

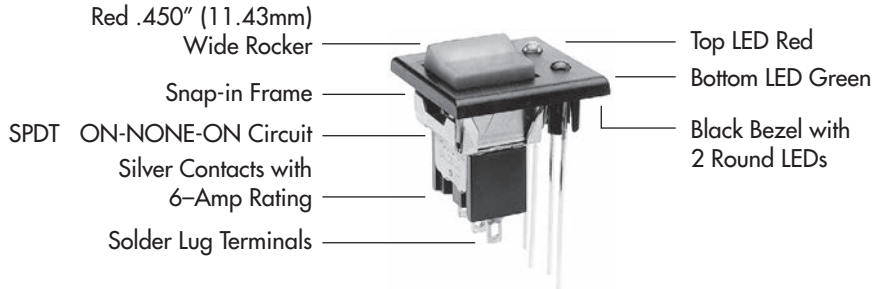
Top LED		Bottom LED	
C	Red	C	Red
E	Yellow	E	Yellow
F	Green	F	Green

IMPORTANT:

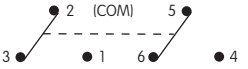
Switches are supplied without UL, cULus & CSA marking unless specified. **UL, cULus & CSA recognized only when ordered with marking on the switch.** Specific models, ratings, & ordering instructions are noted on the General Specifications page.

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

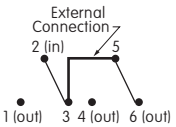
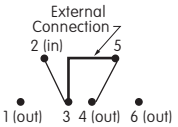
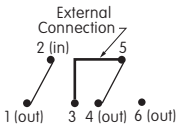
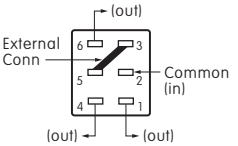
M2012TJW01-FC-3A-CF



POLES & CIRCUITS

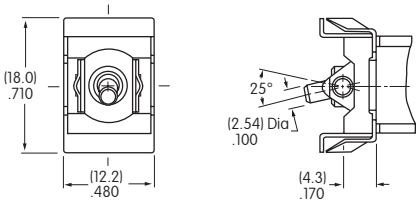
Pole	Model	Rocker Position ( ) = Momentary: Down	Center	Up	Connected Terminals: Down	Center	Up	Throw & Schematics
SP	**M2012** **M2013** **M2015** **M2018** **M2019**	ON ON ON (ON) ON	NONE OFF NONE OFF OFF	ON ON (ON) (ON) (ON)	2-3	OPEN	2-1	Note: Terminal numbers are not actually on the switch. SPDT
DP	**M2022** **M2023** **M2025** **M2028** **M2029**	ON ON ON (ON) ON	NONE OFF NONE OFF OFF	ON ON (ON) (ON) (ON)	2-3 5-6	OPEN	2-1 5-4	DPDT 

For 3 Throw (3-On)

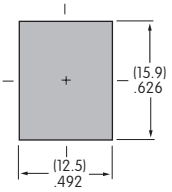
Pole	Model	Connected Terminals & Schematic: Down	Center	Up	External Connection
SP	**M2024** **M2026** **M2027**	ON (ON) ON  2-3 5-6	ON ON ON  2-3 5-4	ON (ON) (ON)  2-1 5-4	**The SP3T model utilizes a double pole base.** External connection must be made during field installation. 

MOUNTING FRAME

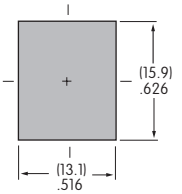
TJ **Snap-in Frame**



Panel Cutout for Single Pole without Bezel



Panel Cutout for Double Pole without Bezel



Panel Thickness without Bezel: .039" ~ .126" (1.0mm ~ 3.2mm)
Panel Thickness with Bezel: .039" ~ .098" (1.0mm ~ 2.5mm)

CONTACT MATERIALS & RATINGS

W	**Silver over Silver**	**Power Level**	**6A @ 125V AC & 3A @ 250V AC**
G	**Gold over Brass or Copper**	**Logic Level**	**0.4VA maximum @ 28V AC/DC maximum**

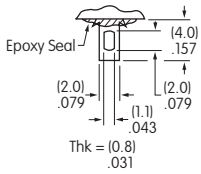
Note: See Supplement section to find complete explanation of operating range.

A	**Gold over Silver**	**Power Level or Logic Level**	**6A @ 125V AC or 0.4VA maximum @ 28V AC/DC maximum**

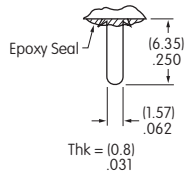
Note: This dual rated option is suitable when two or more identical switches are used in logic and in power circuits within the same application. See Supplement section to find complete explanation of dual rating and operating range.

TERMINALS

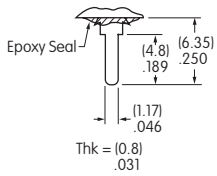
01 **Solder Lug**

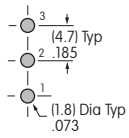


02 **.062" (1.57mm) Wide Quick Connect**

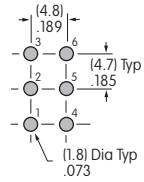


03 **.250" (6.35mm) Straight PC**





Single Pole



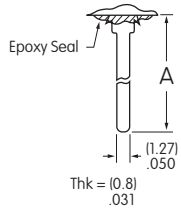
Double Pole

05 **.425" (10.8mm) Wirewrap or Extended PC**

06 **.750" (19.05mm) Wirewrap or Extended PC**

07 **.964" (24.5mm) Wirewrap or Extended PC**

08 **1.062" (27.0mm) Wirewrap or Extended PC**



If using as extended PC terminal, refer to the above footprints.

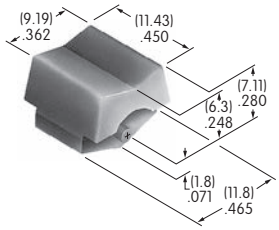
Dimension A = terminal lengths as shown beside the terminal codes at the left.

ROCKERS & PADDLES

F **AT4150**
.450" (11.43mm)
Wide Rocker

Material: Polyamide
Finish: Matte

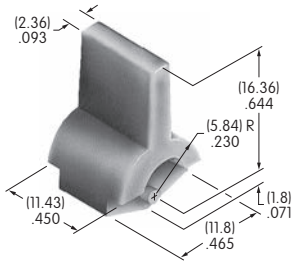
Colors Available:
A, B, C, E, F, G, H



G **AT4151**
.450" (11.43mm)
Wide Paddle

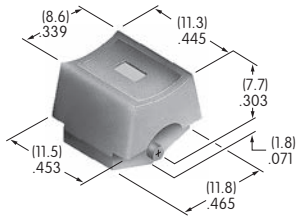
Material: Polyamide
Finish: Matte

Colors Available:
A, B, C, E, F, G, H



S **AT466 .453" (11.5mm)**
False Illuminated Rocker

	Rocker	False Illuminator
Material:	Polycarbonate	Acrylonitrile Butadiene Styrene
Finish:	Glossy	
Colors:	Black	White and Red



When a bezel is selected with AT466, glossy polycarbonate AT207 is supplied.

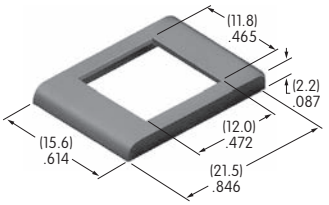
Cap Colors Available: **A** Black **B** White **C** Red **E** Yellow **F** Green **G** Blue **H** Gray

OPTIONAL SNAP-IN BEZELS & BEZEL COLORS

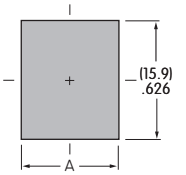
1 AT2107 Bezel

Material: Polyamide

Finish: Matte



A	Black
B	White
E	Yellow
F	Green
G	Blue
H	Gray



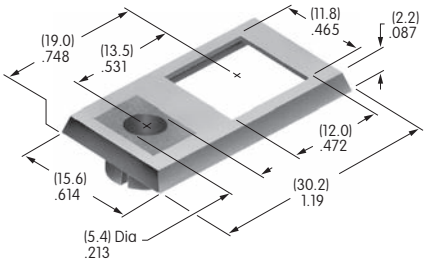
	Single Pole	Double Pole
A	(12.5)mm .492″	(13.1)mm .516″

2 AT208 Bezel for AT070 LED

Material: Polycarbonate

Finish: Glossy

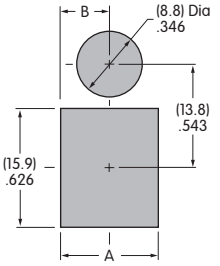
Contact factory for matte finish.



A	Black

LED colors & specifications on next page.

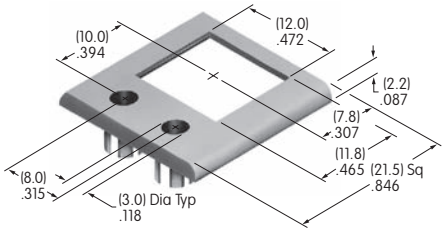
	Single Pole	Double Pole
A	(12.5)mm .492″	(13.1)mm .516″
B	(6.25)mm .246″	(6.55)mm .258″



3 AT212 Bezel for AT617 LED

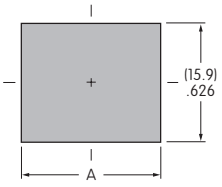
Material: Polycarbonate

Finish: Semi-glossy



A	Black

LED colors & specifications on next page.

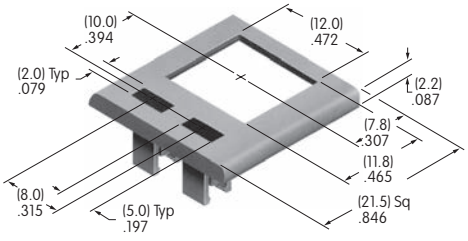


	Single Pole	Double Pole
A	(18.4)mm .724″	(18.7)mm .736″

4 AT213 Bezel for AT618 LED

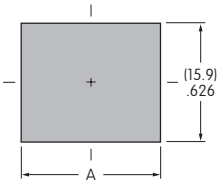
Material: Polycarbonate

Finish: Semi-glossy



A	Black

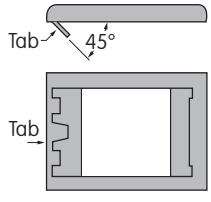
LED colors & specifications on next page.



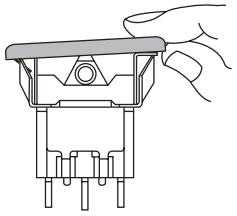
	Single Pole	Double Pole
A	(18.4)mm .724″	(18.7)mm .736″

Bezel Assembly

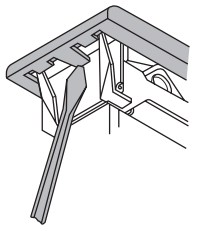
1. Pry out tab on bezel to a 45° angle.



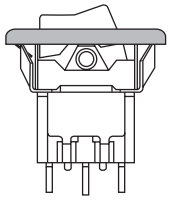
2. Insert switch frame under tab and snap on bezel.



3. Push tab back into place.



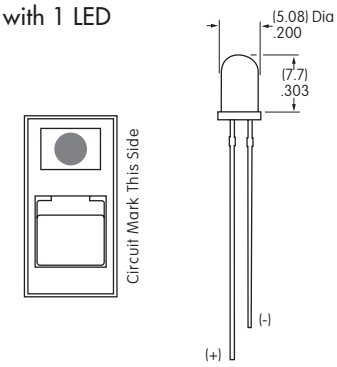
4. Snap assembled bezel and switch into panel.



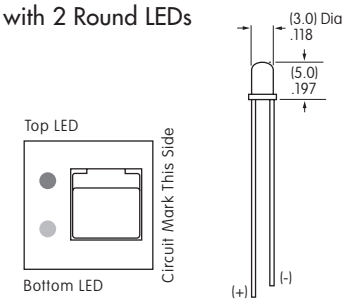
LED COLORS & SPECIFICATIONS

Bezel Orientation on Switch

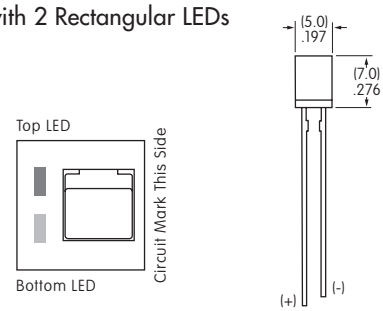
AT070 LED
For Bezel AT208
with 1 LED



AT617 LED
For Bezel AT212
with 2 Round LEDs



AT618 LED
For Bezel AT213
with 2 Rectangular LEDs



Note: Lead lengths may differ from manufacturing lot to lot. The longer lead is the anode (+).

		AT070		AT617			AT618		
(+) (-)		C	F	C	E	F	C	E	F
	Color	Red	Green	Red	Yellow	Green	Red	Yellow	Green
Maximum Forward Current	I_{FM}	25mA	50mA	30mA	30mA	25mA	25mA	30mA	25mA
Typical Forward Current	I_F	20mA	30mA	20mA	20mA	20mA	20mA	20mA	20mA
Forward Voltage	V_F	2.8V	2.1V	2.0V	2.1V	2.2V	2.25V	2.1V	2.2V
Maximum Reverse Voltage	V_{RM}	4V	5V	5V	5V	5V	5V	5V	5V
Current Reduction Rate Above 25°C	ΔI_F	0.33 mA/°C	0.40 mA/°C	0.40 mA/°C	0.40 mA/°C	0.33 mA/°C	0.33 mA/°C	0.40 mA/°C	0.33 mA/°C
Ambient Temperature Range (when used with a bezel)		−10° ~ +70°C		−15° ~ +70°C			−25° ~ +70°C		

The electrical specifications shown are determined at a basic temperature of 25°C.
LED circuit is independent of switch operation. LED is colored in OFF state.

If the source voltage is greater than the rated voltage of the LED, a ballast resistor must be connected in series with the lamp.
The ballast resistor calculation and more lamp detail are shown in the Supplement section.

LEGENDS

NKK Switches can provide custom legends for caps. Contact factory for more information.

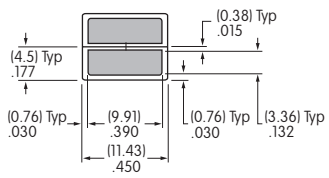
Suggested Printable Area for Cap

Recommended Print Method:

Pad Print

Epoxy based ink is recommended.

AT4150

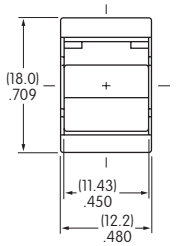


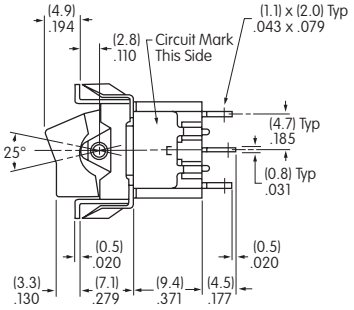
Shaded areas are printable areas.

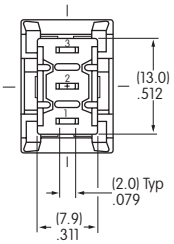
TYPICAL SWITCH DIMENSIONS

Snap-in Frame • Solder Lug

Single Pole



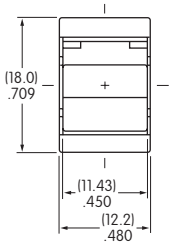


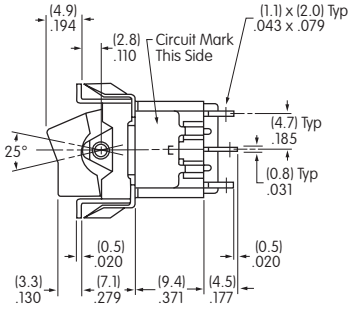


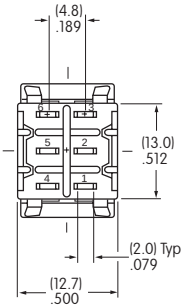
M2012TJW01-FC

Snap-in Frame • Solder Lug

Double Pole



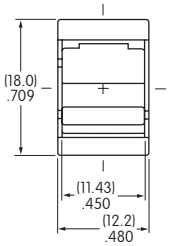


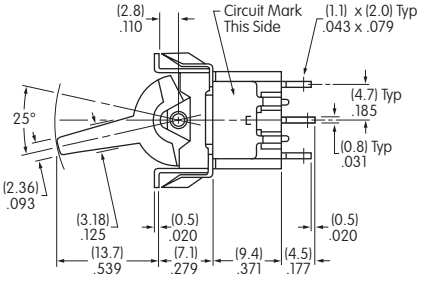


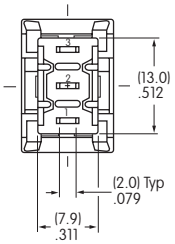
M2022TJW01-FC

Snap-in Frame • Solder Lug

Single Pole



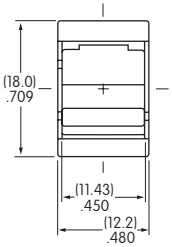


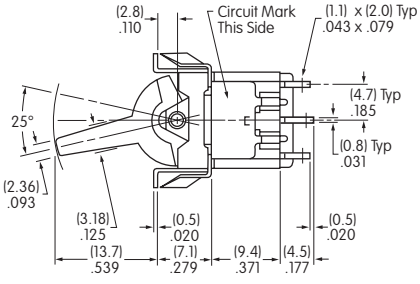


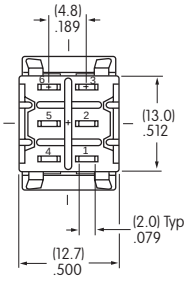
M2012TJW01-GC

Snap-in Frame • Solder Lug

Double Pole



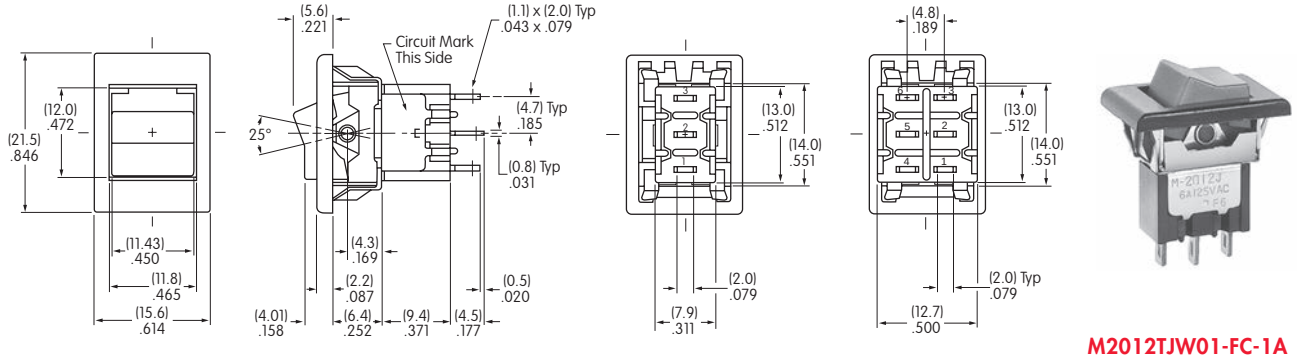




M2022TJW01-GC

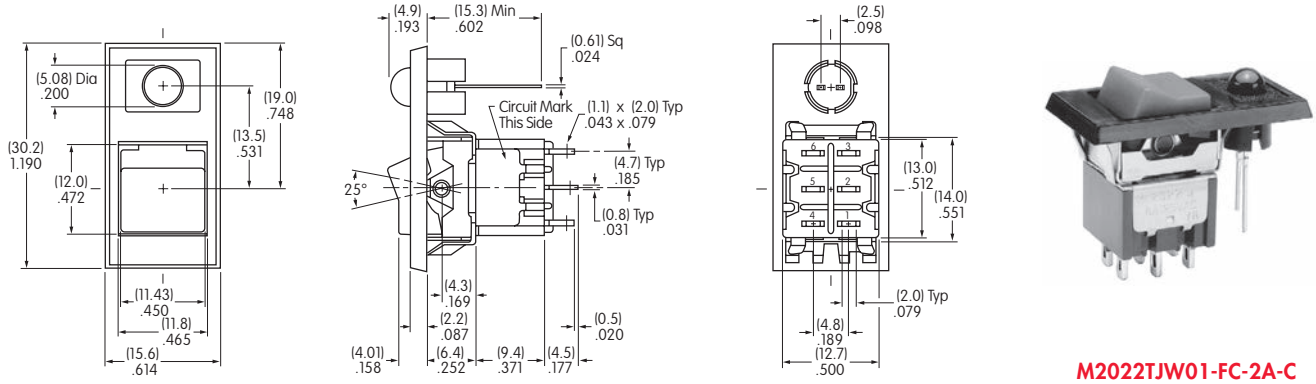
TYPICAL SWITCH DIMENSIONS

Single & Double Pole — Snap-in Frame • AT2107 Bezel • Solder Lug



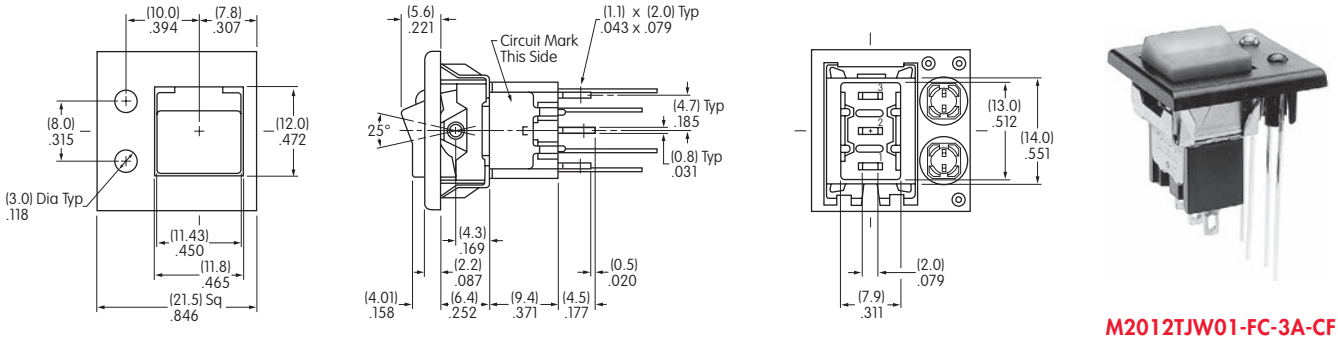
M2012TJW01-FC-1A

Double Pole — Snap-in Frame • AT208 Bezel • Solder Lug



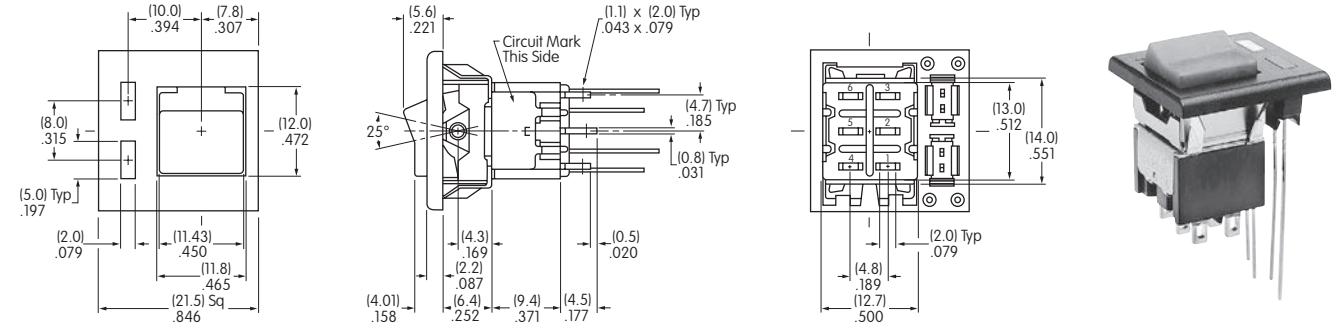
M2022TJW01-FC-2A-C

Single Pole — Snap-in Frame • AT212 Bezel • Solder Lug



M2012TJW01-FC-3A-CF

Double Pole — Snap-in Frame • AT213 Bezel • Solder Lug



M2022TJW01-FC-4A-CF

TYPICAL SWITCH

M20 | 1 | 3 | TX | G

Poles

1	SPDT
2	DPDT SP3T
3	3PDT (used only with terminal codes 30 & 41 & frame code TX)
4	4PDT DP3T (used only with terminal code 41 & frame code TX)

Mounting Frames

TX	Narrow Frame for Small Actuator
TZ	Wide Frame for Large Actuator

Circuits

2	ON	NONE	ON
3	ON	OFF	ON
5	ON	NONE	(ON)
8	(ON)	OFF	(ON)
9	ON	OFF	(ON)
*4	ON	ON	ON
*6	(ON)	ON	(ON)
*7	ON	ON	(ON)

( ) = Momentary

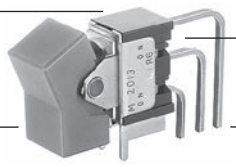
* 3-ON circuits

Contact Materials & Ratings

W	Silver; Rated 6A @ 125V AC & 3A @ 250V AC
G	Gold; Rated 0.4VA max @ 28V AC/DC max
A	Gold over Silver; Rated 6A @ 125V AC & 0.4VA max @ 28V AC/DC max

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

M2013TXG41-DC



SPDT
ON-OFF-ON Circuit

TX Frame with .365" (9.27mm)
Wide Red Rocker

Gold Contacts with
0.4VA Rating

.150" (3.81mm)
Vertical PC Terminals with Support

ORDERING EXAMPLE

41 — D C

Terminals For TX & TZ Frames

Straight PC with Bracket (1-2 Pole only)	
13	.250″ (6.35mm) Straight PC with .465″ (11.8mm) Bracket
15	.425″ (10.8mm) Straight PC with .630″ (16.0mm) Bracket
17	.964″ (24.5mm) Straight PC with 1.150″ (29.2mm) Bracket
Straight PC with Reinforced Bracket (1-2 Pole only)	
23	.250″ (6.35mm) Straight PC with .465″ (11.8mm) Bracket
25	.425″ (10.8mm) Straight PC with .630″ (16.0mm) Bracket
26	.750″ (19.05mm) Straight PC with .953″ (24.2mm) Bracket

Terminals For TX Frame Only

Right Angle PC with Support (1-3 Pole only)	
30	.150″ (3.81mm) Right Angle PC
Vertical PC with Support (1-4 Pole)	
41	.150″ (3.81mm) Vertical PC

Rockers & Paddles

Small Actuators (TX Frame)	
D	.365″ (9.27mm) Wide Rocker
E	.365″ (9.27mm) Wide Paddle
F	.450″ (11.43mm) Wide Rocker
G	.450″ (11.43mm) Wide Paddle
Large Actuators (TZ Frame)	
J	.595″ (15.11mm) Wide Rocker
H	.595″ (15.11mm) Wide Paddle

Rocker & Paddle Colors

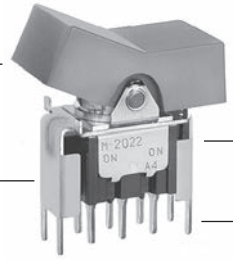
A	Black
B	White
C	Red
E	Yellow
F	Green
G	Blue
H	Gray

IMPORTANT:

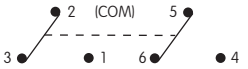
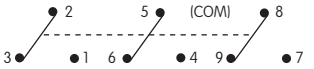
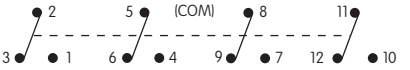
Switches are supplied without UL & CSA marking unless specified. **UL & CSA recognized only when ordered with marking on the switch.** Specific models, ratings and ordering instructions are noted on the General Specifications page.

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

M2022TZG23-JC



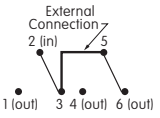
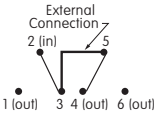
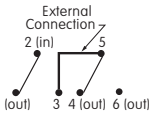
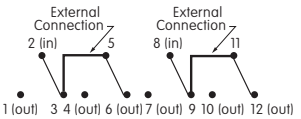
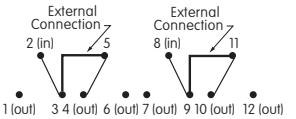
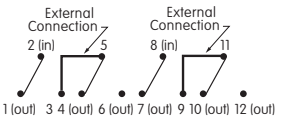
POLES & CIRCUITS

Pole	Model	Rocker Position ( ) = Momentary: Down	Center	Up	Connected Terminals: Down	Center	Up	Throw & Schematics
SP	M2012 M2013 *M2015 M2018 *M2019	ON ON ON (ON) ON	NONE OFF NONE OFF OFF	ON ON (ON) (ON) (ON)	2-3	OPEN	2-1	SPDT
DP	M2022 M2023 *M2025 M2028 *M2029	ON ON ON (ON) ON	NONE OFF NONE OFF OFF	ON ON (ON) (ON) (ON)	2-3 5-6	OPEN	2-1 5-4	DPDT 
3P	M2022 M2023 *M2025 M2028 *M2029	ON ON ON (ON) ON	NONE OFF NONE OFF OFF	ON ON (ON) (ON) (ON)	2-3 5-6 8-9	OPEN	2-1 5-4 8-7	3PDT 
4P	M2042 M2043 *M2045 M2048 *M2049	ON ON ON (ON) ON	NONE OFF NONE OFF OFF	ON ON (ON) (ON) (ON)	2-3 5-6 8-9 11-12	OPEN	2-1 5-4 8-7 11-10	4PDT 

Note: Terminal numbers are not actually on the switch.
* Reverse circuits available for vertical mount SP & DP upon request.

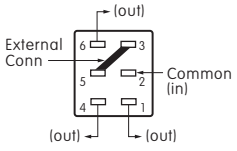
For 3 Throw (3-On)

Connected Terminals & Schematics

Pole	Model	Down	Center	Up	Down	Center	Up
SP	M2024 M2026 M2027	ON (ON) ON	ON ON ON	ON (ON) (ON)	 2-3 5-6	 2-3 5-4	 2-1 5-4
DP	M2044 M2046 M2047	ON (ON) ON	ON ON ON	ON (ON) (ON)	 2-3 5-6 8-9 11-12	 2-3 5-4 8-9 11-10	 2-1 5-4 8-7 11-10

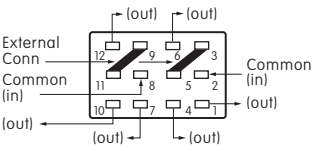
The SP3T model utilizes a double pole base.

External connection must be made during field installation.



The DP3T model utilizes a four pole base.

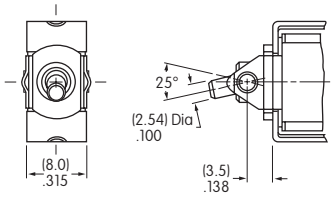
External connection must be made during field installation.



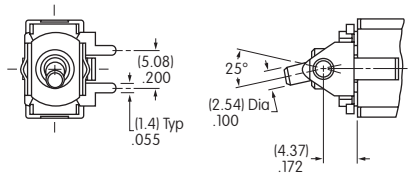
MOUNTING FRAMES

TX **Narrow Mounting Frame for Small Actuators with Straight PC Terminals (codes 13, 15, 17, 23, 25, & 26) or with Angle PC Terminals (codes 30 & 41)**

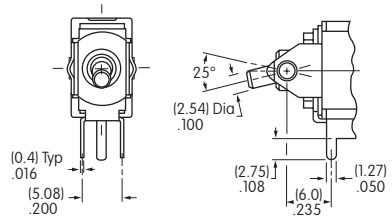
Straight PC Mounting



Right Angle PC Mounting

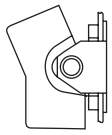


Vertical PC Mounting

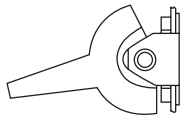


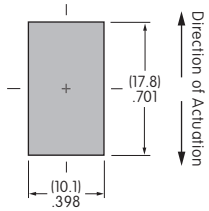
Small Actuators & Panel Cutouts for TX Frame (actuator details on the following pages)

AT4148

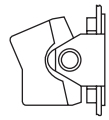


AT4149

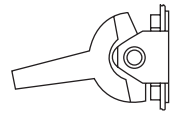


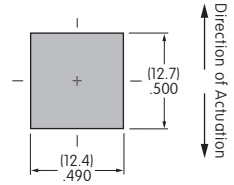


AT4150

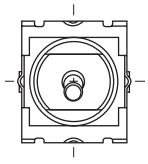


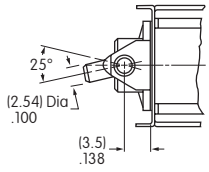
AT4151





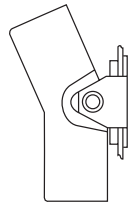
TZ **Wide Mounting Frame for Large Actuators with Straight PC Terminals (codes 13, 15, 17, 23, 25, & 26)**



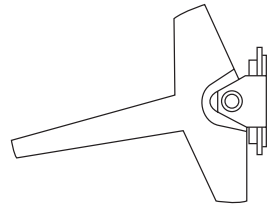


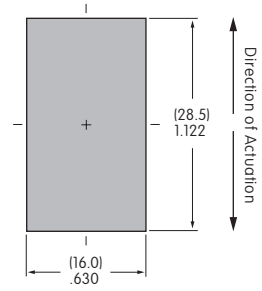
Large Actuators & Panel Cutouts for TZ Frame (actuator details on the following pages)

AT4156



AT4157





CONTACT MATERIALS & RATINGS

W	**Silver over Silver**	**Power Level**	**6A @ 125V AC & 3A @ 250V AC**
G	**Gold over Brass or Copper**	**Logic Level**	**0.4VA maximum @ 28V AC/DC maximum**

Note: See Supplement section to find complete explanation of operating range.

A	**Gold over Silver**	**Power Level or Logic Level**	**6A @ 125V AC or 0.4VA maximum @ 28V AC/DC maximum**

Note: This dual rated option is suitable when two or more identical switches are used in logic and in power circuits within the same application. See Supplement section to find complete explanation of dual rating and operating range.

TERMINALS

For TX and TZ 1-2 Pole Straight PC Mount with Bracket

13 .250" (6.35mm) Terminal with .465" (11.8mm) Bracket

15 .425" (10.8mm) Terminal with .630" (16.0mm) Bracket

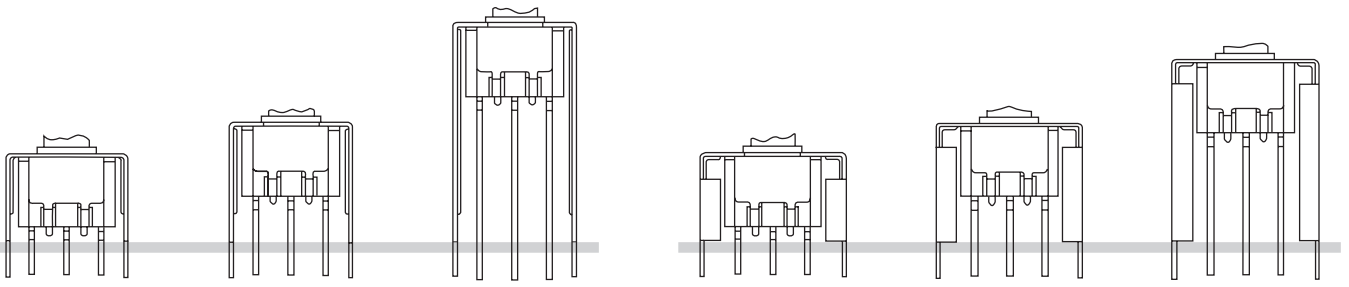
17 .964" (24.5mm) Terminal with 1.150" (29.2mm) Bracket

For TX and TZ 1-2 Pole Straight PC Mount with Reinforced Bracket

23 .250" (6.35mm) Terminal with .465" (11.8mm) Bracket

25 .425" (10.8mm) Terminal with .630" (16.0mm) Bracket

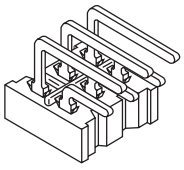
26 .750" (19.05mm) Terminal with .953" (24.2mm) Bracket



PCB footprints are on the following Typical Switch Dimension pages.

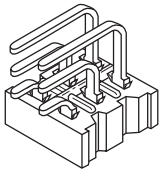
For TX 1-3 Pole Right Angle PC Mount

30 .150" (3.81mm) Right Angle PC



For TX 1-4 Pole Vertical PC Mount

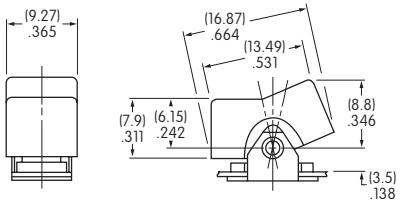
41 .150" (3.81mm) Vertical PC



ROCKERS & PADDLES FOR TX MOUNTING FRAMES

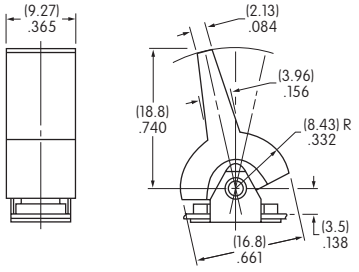
D AT4148 .365" (9.27mm) Wide Rocker

Material: Polyamide
Finish: Matte



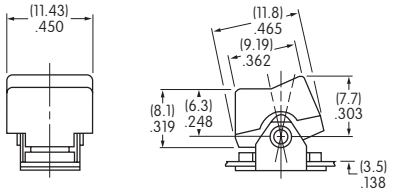
E AT4149 .365" (9.27mm) Wide Paddle

Material: Polyamide
Finish: Matte



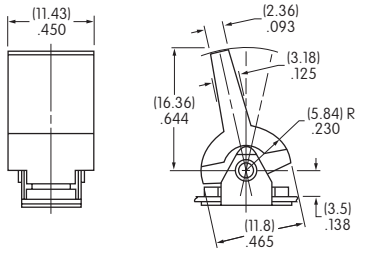
F AT4150 .450" (11.43mm) Wide Rocker

Material: Polyamide
Finish: Matte



G AT4151 .450" (11.43mm) Wide Paddle

Material: Polyamide
Finish: Matte



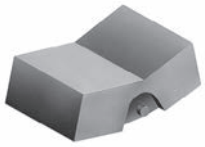
Cap Colors Available:

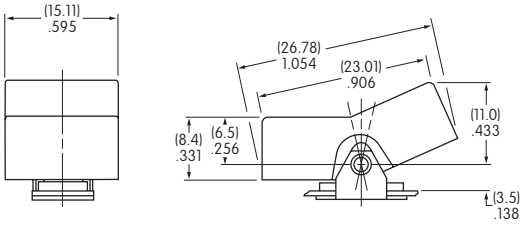
A Black **B** White **C** Red **E** Yellow **F** Green **G** Blue **H** Gray

ROCKERS & PADDLES FOR TZ MOUNTING FRAMES

J **AT4156 .595" (15.11mm) Wide Rocker**

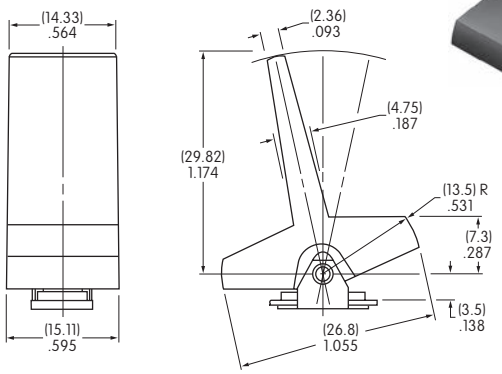
Material: Polyamide
Finish: Matte





H **AT4157 .595" (15.11mm) Wide Paddle**

Material: Polyamide
Finish: Matte



Cap Colors Available:

A	Black	**B**	White	**C**	Red	**E**	Yellow	**F**	Green	**G**	Blue	**H**	Gray

OPTIONAL SNAP-IN PANEL FRAMES

Used with AT4148 Rocker and AT4149 Paddle

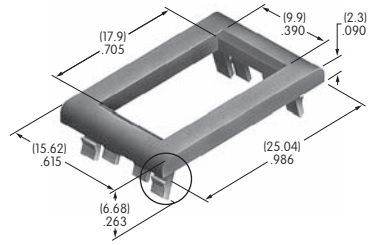
AT064-1
Accommodates .047" ~ .090"
(1.2 ~ 2.3mm) panel thickness

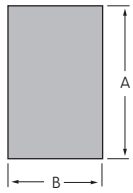
Material: Polyamide
Finish: Matte
Color: Black

Mounted separately from switches

Cutout Tolerances:
Dimension A:
.797" ~ .803" (20.24 ~ 20.4mm)
Dimension B:
.495" ~ .505" (12.57 ~ 12.83mm)

AT064-2
Accommodates .062" ~ .125"
(1.57 ~ 3.18mm) panel thickness





AT064–1 Enlarged Detail

Used with AT4150 Rocker and AT4151 Paddle

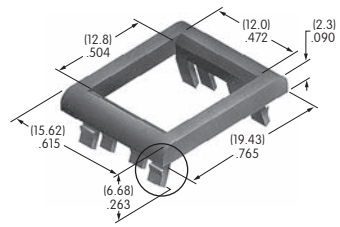
AT065-1
Accommodates .047" ~ .090"
(1.2 ~ 2.3mm) panel thickness

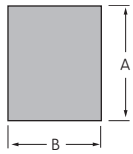
Material: Polyamide
Finish: Matte
Color: Black

Mounted separately from switches

Cutout Tolerances:
Dimension A:
.595" ~ .605" (15.11 ~ 15.37mm)
Dimension B:
.495" ~ .500" (12.57 ~ 12.7mm)

AT065-2
Accommodates .062" ~ .125"
(1.57 ~ 3.18mm) panel thickness



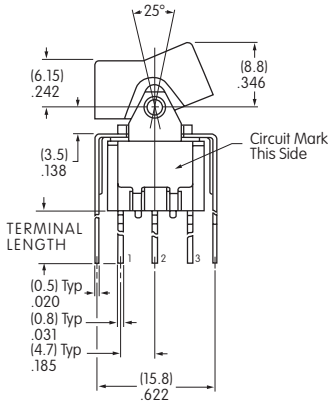


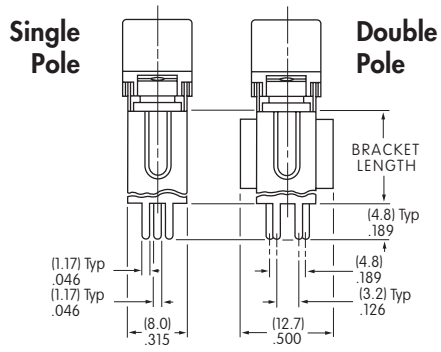
AT065–1 Enlarged Detail

AT065–2 Enlarged Detail

TYPICAL SWITCH DIMENSIONS

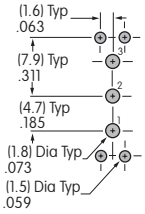
Straight PC • Bracket

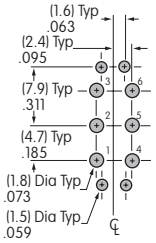




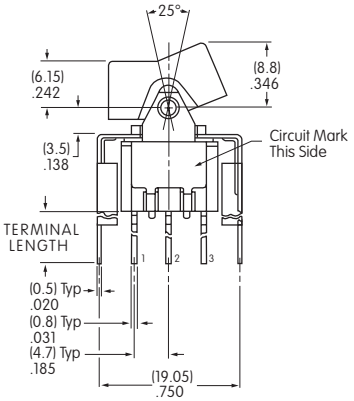
M2012TXG13-DC

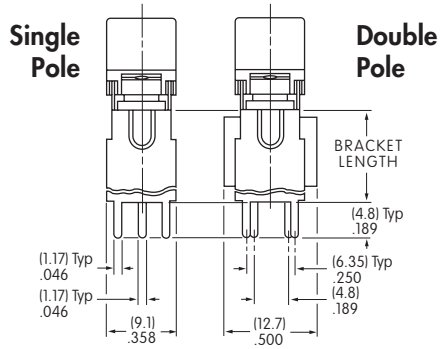
Terminal Code:	Terminal Length:	Bracket Length:
13	.250″ (6.35mm)	.465″ (11.8mm)
15	.425″ (10.8mm)	.630″ (16.0mm)
17	.964″ (24.5mm)	1.150″ (29.2mm)





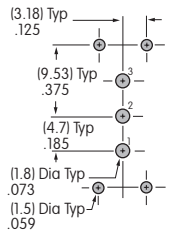
Straight PC • Reinforced Bracket

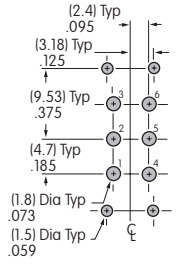




M2012TXG23-DC

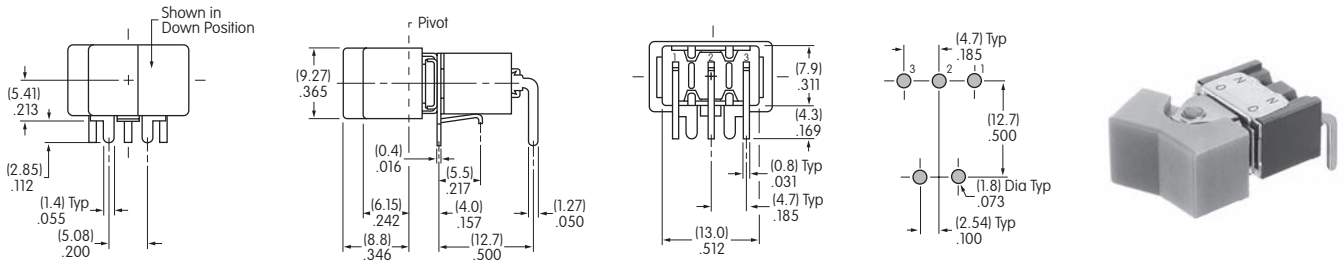
Terminal Code:	Terminal Length:	Bracket Length:
23	.250″ (6.35mm)	.465″ (11.8mm)
25	.425″ (10.8mm)	.630″ (16.0mm)
26	.750″ (19.05mm)	.953″ (24.2mm)





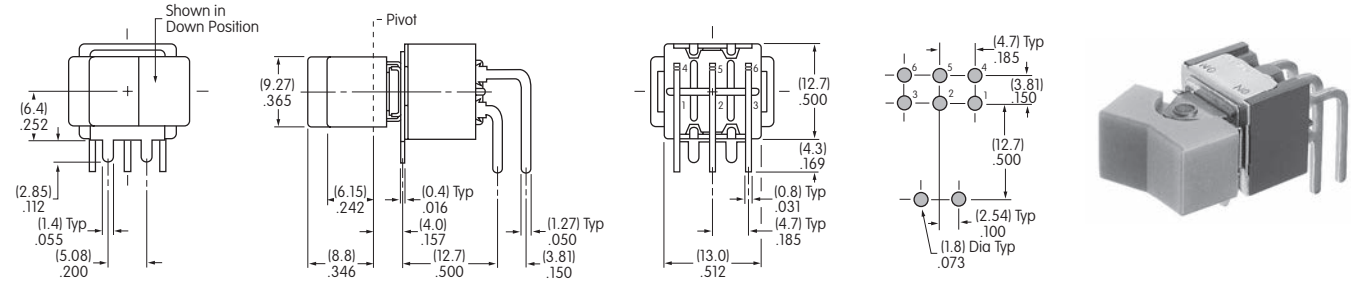
TYPICAL SWITCH DIMENSIONS

Single Pole — .150" (3.81mm) Right Angle PC



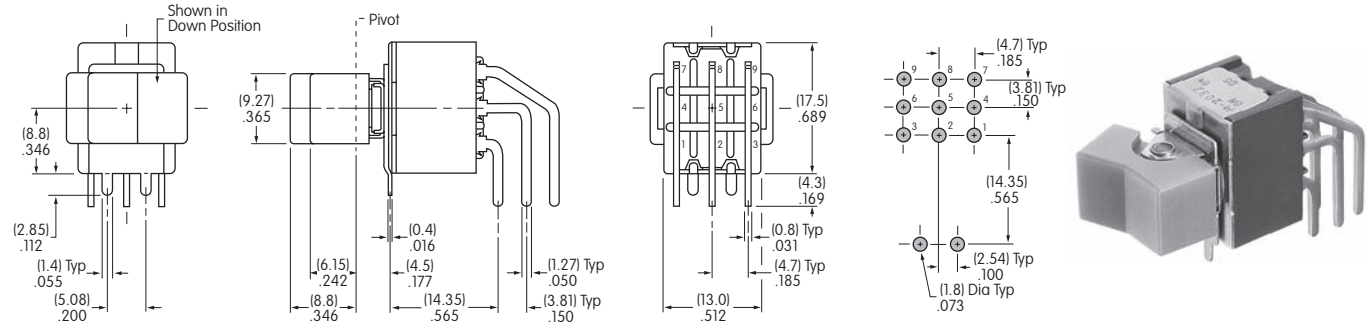
M2012TXG30-DC

Double Pole — .150" (3.81mm) Right Angle PC



M2022TXG30-DC

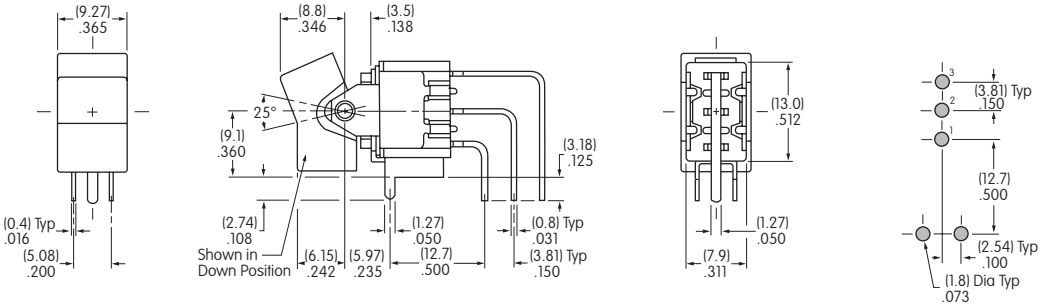
Three Pole — .150" (3.81mm) Right Angle PC



M2032TXG30-DC

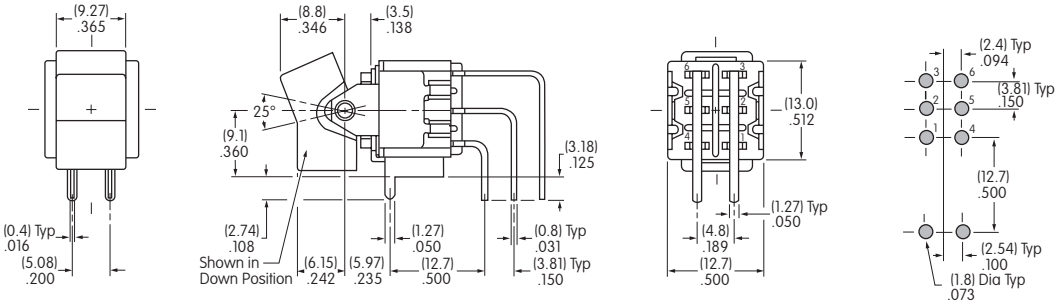
TYPICAL SWITCH DIMENSIONS

.150" (3.81mm) Vertical PC — Single Pole



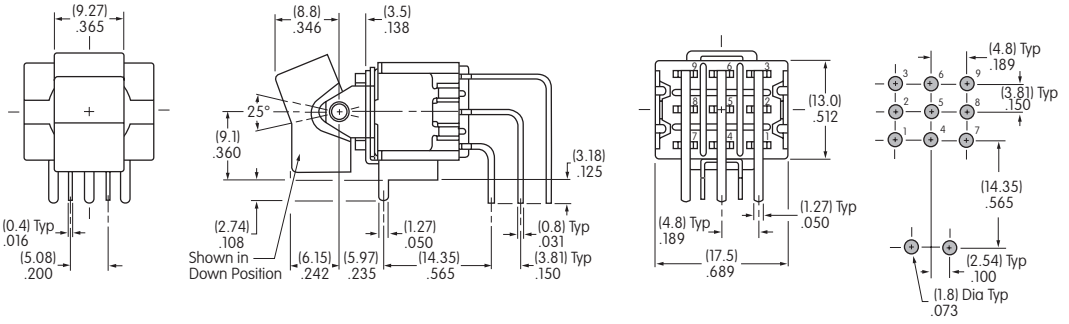
M2012TXG41-DC

.150" (3.81mm) Vertical PC — Double Pole



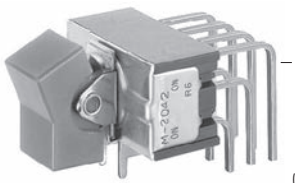
M2022TXG41-DC

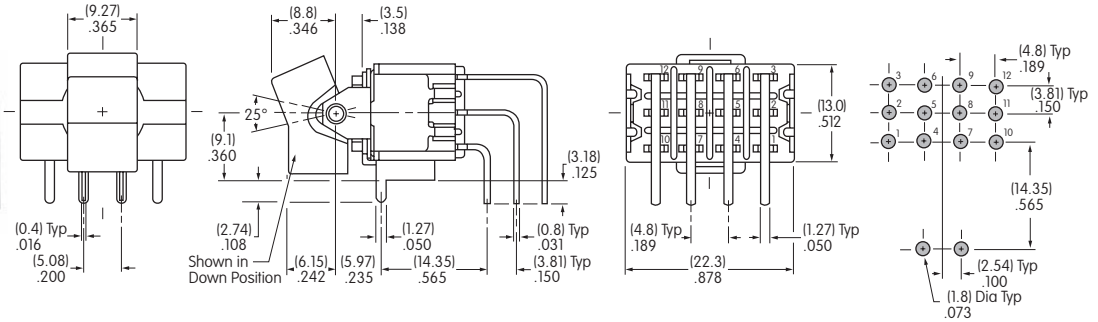
.150" (3.81mm) Vertical PC — Three Pole



M2032TXG41-DC

.150" (3.81mm) Vertical PC — Four Pole

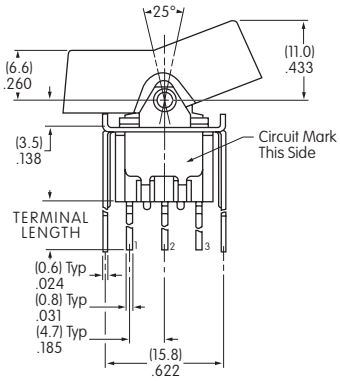


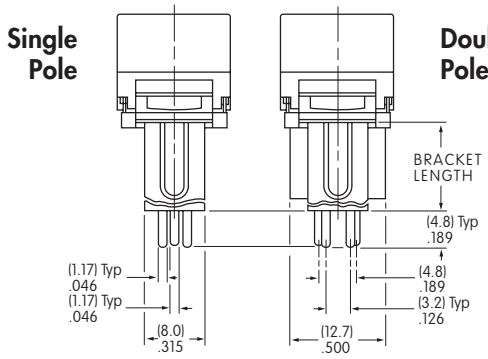


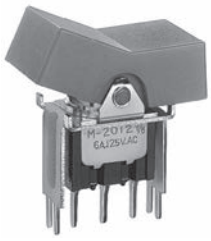
M2042TXG41-DC

TYPICAL SWITCH DIMENSIONS

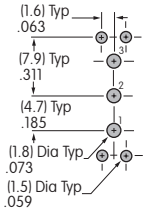
Straight PC • Bracket

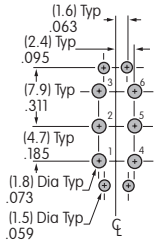






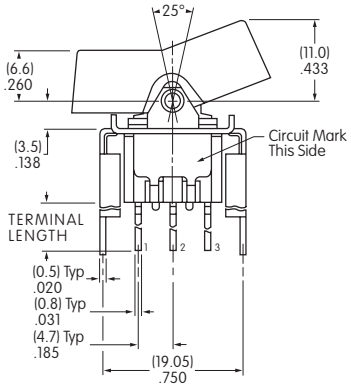
M2012TZG13-JC

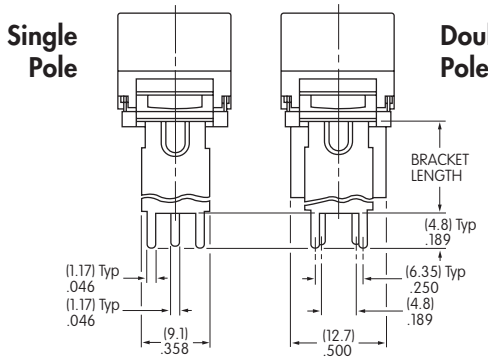




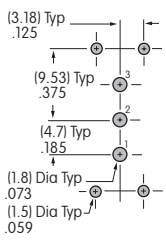
Terminal Code:	Terminal Length:	Bracket Length:
13	.250″ (6.35mm)	.465″ (11.8mm)
15	.425″ (10.8mm)	.630″ (16.0mm)
17	.964″ (24.5mm)	1.150″ (29.2mm)

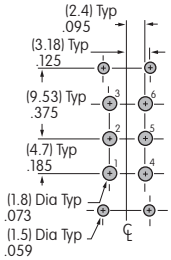
Straight PC • Reinforced Bracket





M2012TZG23-JC





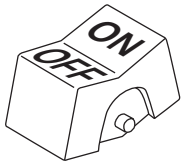
Terminal Code:	Terminal Length:	Bracket Length:
23	.250″ (6.35mm)	.465″ (11.8mm)
25	.425″ (10.8mm)	.630″ (16.0mm)
26	.750″ (19.05mm)	.953″ (24.2mm)

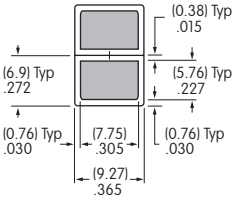
LEGENDS

NKK Switches can provide custom legends for caps. Contact factory for more information.

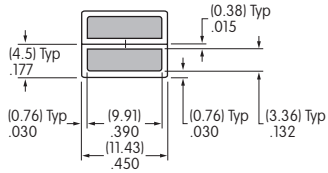
Suggested Printable Area for Cap

AT4148

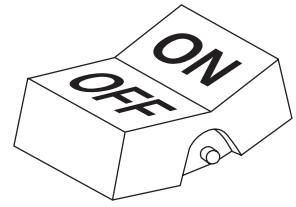


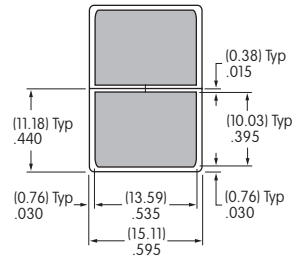


AT4150



AT4156





Shaded areas are printable areas.

Recommended Print Method:

Pad Print

Epoxy based ink is recommended.

TYPICAL SWITCH ORDERING EXAMPLE

M20 | 1 | 2 | TN | W | 01 | — | D | C

Poles

1	SPDT
2	DPDT SP3T
3	3PDT
4	4PDT DP3T

Mounting Frames

TN	.272" (6.9mm) Wide Flat Frame
TY	.504" (12.8mm) Wide Flat Frame

Rockers & Paddles

Small Actuators (TN Frame)

D	.365" (9.27mm) Wide Rocker
E	.365" (9.27mm) Wide Paddle
F	.450" (11.43mm) Wide Rocker
G	.450" (11.43mm) Wide Paddle

Large Actuators (TY Frame)

J	.595" (15.11mm) Wide Rocker
H	.595" (15.11mm) Wide Paddle

Circuits

2	ON	NONE	ON
3	ON	OFF	ON
5	ON	NONE	(ON)
8	(ON)	OFF	(ON)
9	ON	OFF	(ON)
*4	ON	ON	ON
*6	(ON)	ON	(ON)
*7	ON	ON	(ON)

( ) = Momentary

*3-ON circuits

Contact Materials & Ratings

W	Silver; Rated 6A @ 125V AC & 3A @ 250V AC
G	Gold; Rated 0.4VA max @ 28V AC/DC max
A	Gold over Silver; Rated 6A @ 125V AC & 0.4VA max @ 28V AC/DC max

Terminals

01	Solder Lug
03	.250" (6.35mm) Straight PC

Rocker & Paddle Colors

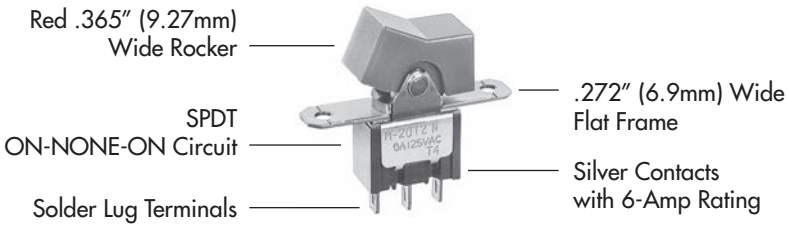
A	Black
B	White
C	Red
E	Yellow
F	Green
G	Blue
H	Gray

IMPORTANT:

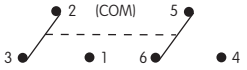
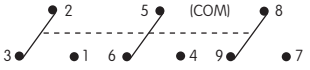
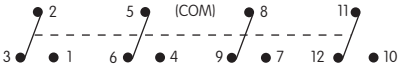
Switches are supplied without UL & CSA marking unless specified. **UL & CSA recognized only when ordered with marking on the switch.** Specific models, ratings and ordering instructions are noted on the General Specifications page.

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

M2012TNW01-DC

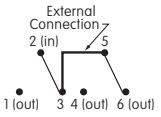
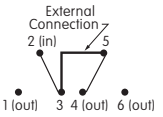
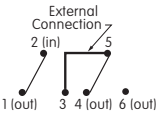
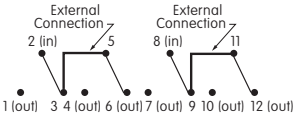
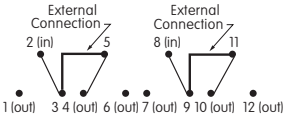
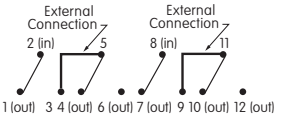


POLES & CIRCUITS

Pole	Model	Rocker Position ( ) = Momentary: Down	Center	Up	Connected Terminals: Down	Center	Up	Throw & Schematics
SP	M2012 M2013 M2015 M2018 M2019	ON ON ON (ON) ON	NONE OFF NONE OFF OFF	ON ON (ON) (ON) (ON)	2-3	OPEN	2-1	Note: Terminal numbers are not actually on the switch. SPDT
DP	M2022 M2023 M2025 M2028 M2029	ON ON ON (ON) ON	NONE OFF NONE OFF OFF	ON ON (ON) (ON) (ON)	2-3 5-6	OPEN	2-1 5-4	DPDT 
3P	M2032 M2033 M2035 M2038 M2039	ON ON ON (ON) ON	NONE OFF NONE OFF OFF	ON ON (ON) (ON) (ON)	2-3 5-6 8-9	OPEN	2-1 5-4 8-7	3PDT 
4P	M2042 M2043 M2045 M2048 M2049	ON ON ON (ON) ON	NONE OFF NONE OFF OFF	ON ON (ON) (ON) (ON)	2-3 5-6 8-9 11-12	OPEN	2-1 5-4 8-7 11-10	4PDT 

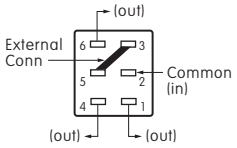
For 3 Throw (3-On)

Connected Terminals & Schematics

Pole	Model	Down	Center	Up	Down	Center	Up
SP	M2024 M2026 M2027	ON (ON) ON	ON ON ON	ON (ON) (ON)	 2-3 5-6	 2-3 5-4	 2-1 5-4
DP	M2044 M2046 M2047	ON (ON) ON	ON ON ON	ON (ON) (ON)	 2-3 5-6 8-9 11-12	 2-3 5-4 8-9 11-10	 2-1 5-4 8-7 11-10

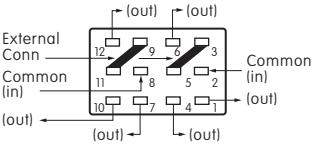
The SP3T model utilizes a double pole base.

External connection must be made during field installation.



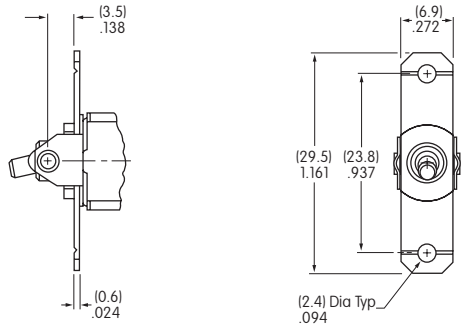
The DP3T model utilizes a four pole base.

External connection must be made during field installation.



MOUNTING FRAMES

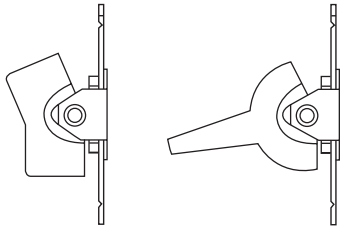
TN **.272" (6.9mm) Wide Flat Frame**

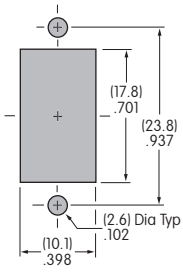


Mounting hardware kit HK-1, as shown on the following page, must be ordered separately.

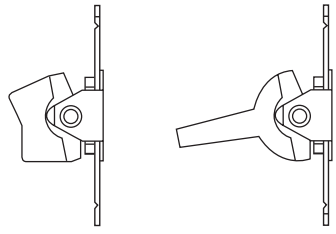
Small Actuators & Panel Cutouts for TN Frame (actuator details on the following pages)

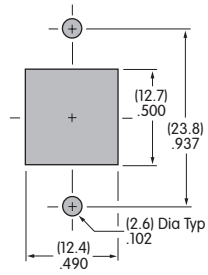
AT4148 AT4149





AT4150 AT4151

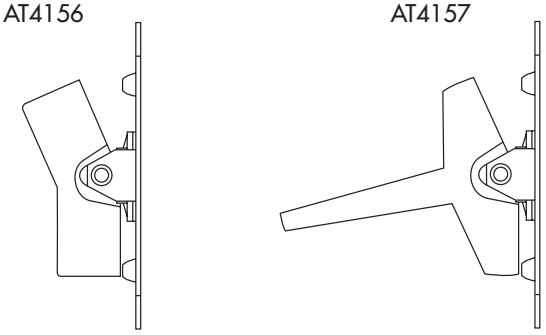




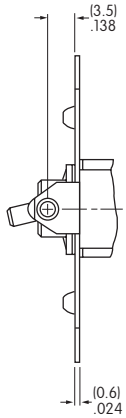
TY **.504" (12.8mm) Wide Flat Frame**

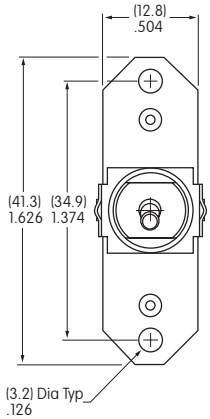
Large Actuators & Panel Cutout for TY Frame (actuator details on the following pages)

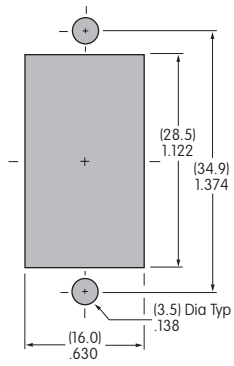
AT4156 AT4157



Mounting hardware kit HK-2, as shown on the following page, must be ordered separately.

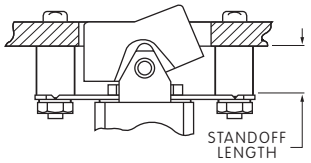






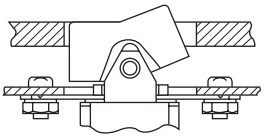
MOUNTING FRAMES (CONTINUED)

Face Panel Mounting



Flat frame devices may also be mounted to the face panel. Standoffs are used to recess the actuator and achieve an attractive front panel appearance.

Subpanel Mounting



These devices are especially designed for subpanel mounting. When installed on a mounting plate behind the panel, hardware is completely concealed and the front panel retains a clean, attractive appearance.

Optional Hardware Kits for Subpanel or Face Panel Mounting			
Frame	Panel Thickness	Standoff Length	Hardware Kit Number
TN Frame	.125" (3.175mm)	.233" (5.918mm)	ATHK-1
TY Frame	.125" (3.175mm)	.312" (7.925mm)	ATHK-2
Hardware kits include: 2 stainless steel screws, 2 hex nuts, 2 lockwashers, & 2 standoffs			

Optional Snap-in Panel Frames

AT064-1
AT064-2

Further details are shown in the previous bracketed PC mount subsection.

AT065-1
AT065-2

CONTACT MATERIALS & RATINGS

W	**Silver over Silver**	**Power Level**	**6A @ 125V AC & 3A @ 250V AC**
G	**Gold over Brass or Copper**	**Logic Level**	**0.4VA maximum @ 28V AC/DC maximum**

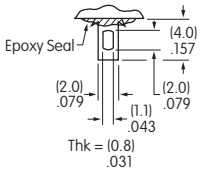
Note: See Supplement section to find complete explanation of operating range.

A	**Gold over Silver**	**Power Level or Logic Level**	**6A @ 125V AC or 0.4VA maximum @ 28V AC/DC maximum**

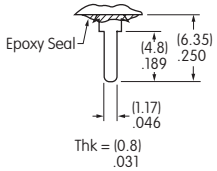
Note: This dual rated option is suitable when two or more identical switches are used in logic and in power circuits within the same application. See Supplement section to find complete explanation of dual rating and operating range.

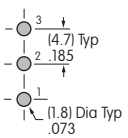
TERMINALS

01 **Solder Lug**

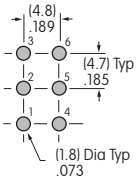


03 **.250" (6.35mm) Straight PC**

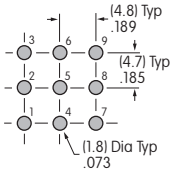




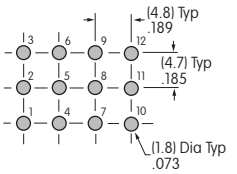
Single Pole



Double Pole



Three Pole



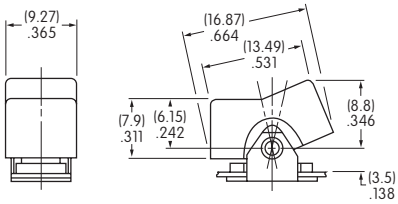
Four Pole

ROCKERS & PADDLES

For TN Frame

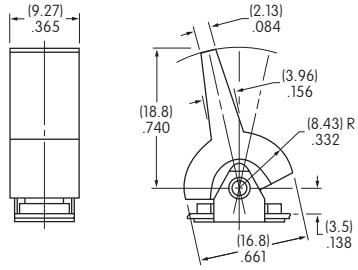
D **AT4148 .365" (9.27mm) Wide Rocker**

Material: Polyamide
Finish: Matte



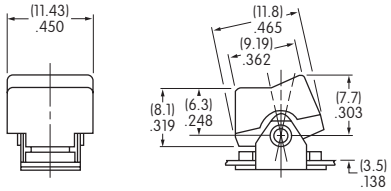
E **AT4149 .365" (9.27mm) Wide Paddle**

Material: Polyamide
Finish: Matte



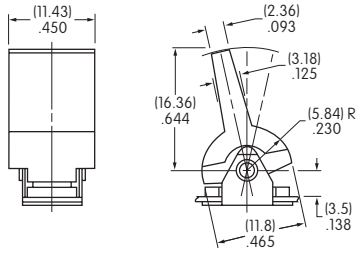
F **AT4150 .450" (11.43mm) Wide Rocker**

Material: Polyamide
Finish: Matte



G **AT4151 .450" (11.43mm) Wide Paddle**

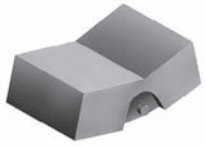
Material: Polyamide
Finish: Matte

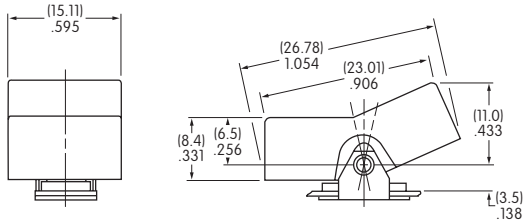


For TY Frame

J **AT4156 .595" (15.11mm) Wide Rocker**

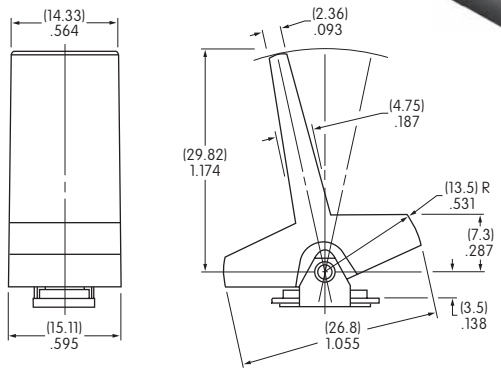
Material: Polyamide
Finish: Matte





H **AT4157 .595" (15.11mm) Wide Paddle**

Material: Polyamide
Finish: Matte



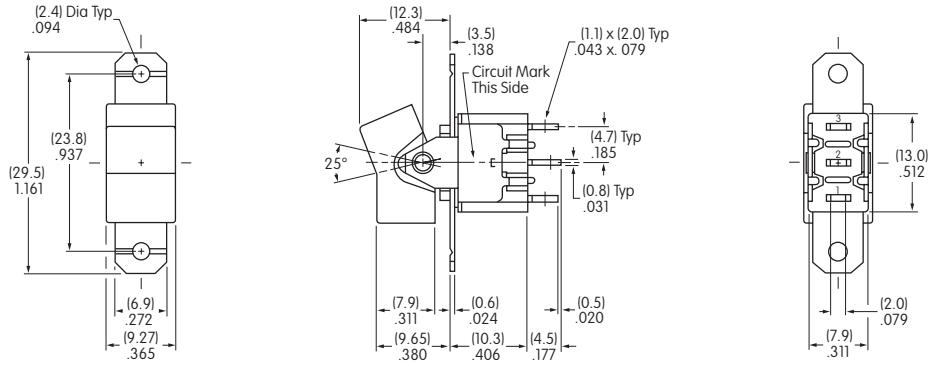
Cap Colors Available:

A	Black	B	White	C	Red	E	Yellow	F	Green	G	Blue	H	Gray

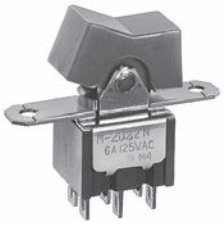
TYPICAL SWITCH DIMENSIONS

TN Frame • Solder Lug — Single Pole

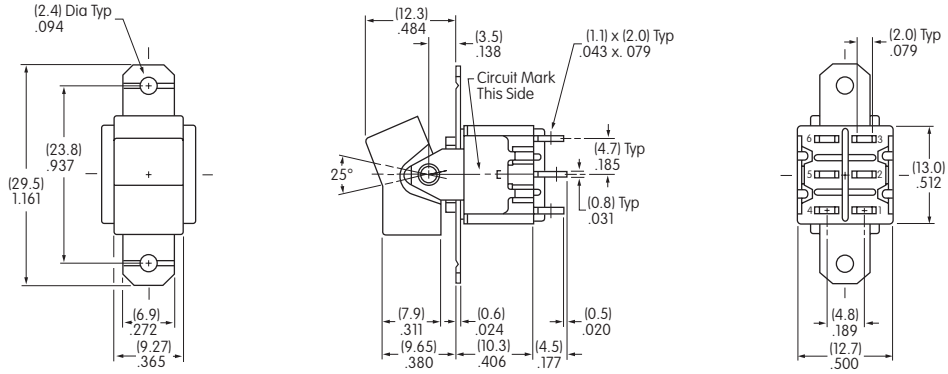
M2012TNW01-DC



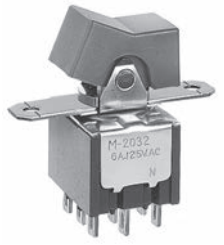
TN Frame • Solder Lug — Double Pole



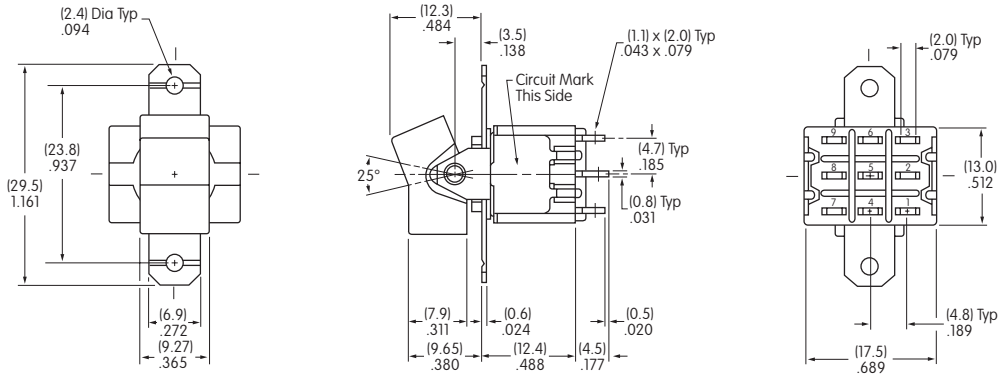
M2022TNW01-DC



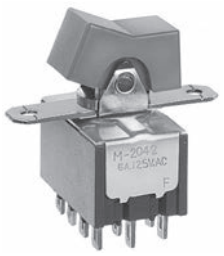
TN Frame • Solder Lug — Three Pole



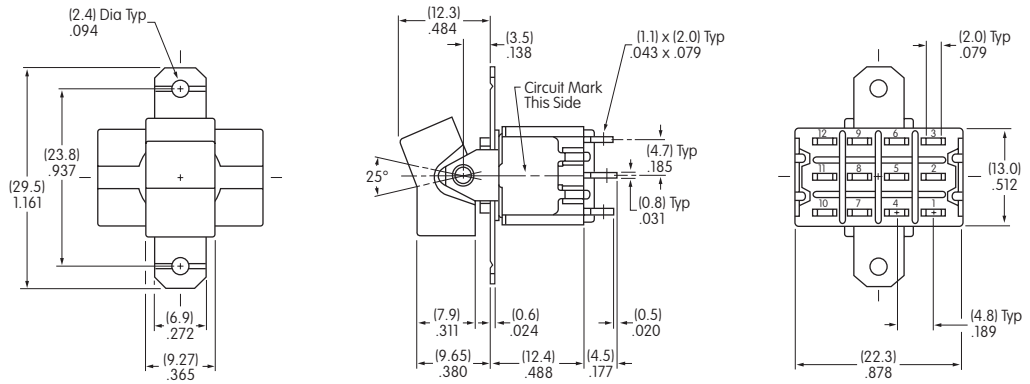
M2032TNW01-DC



TN Frame • Solder Lug — Four Pole



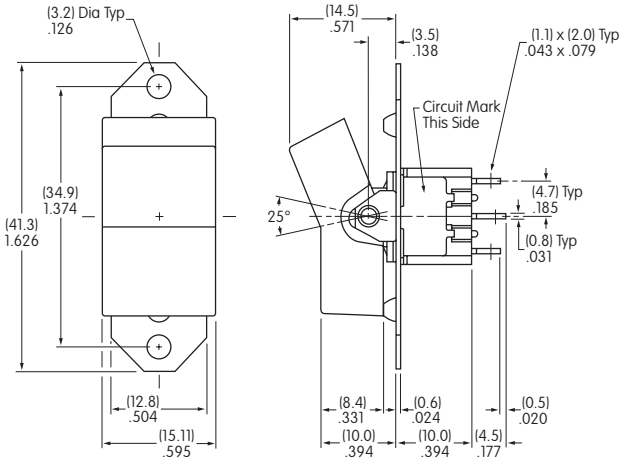
M2042TNW01-DC



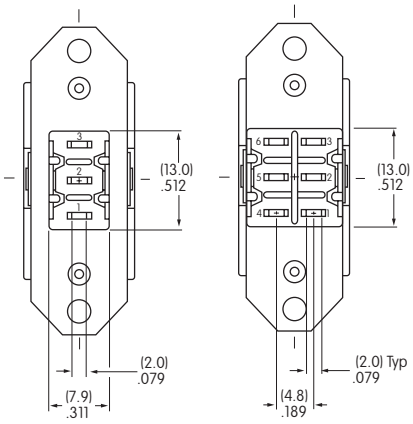
TYPICAL SWITCH DIMENSIONS

TY Frame • Solder Lug

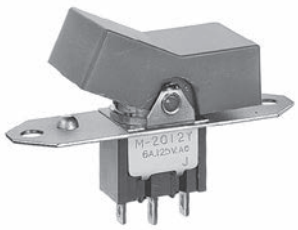
Single Pole



Double Pole



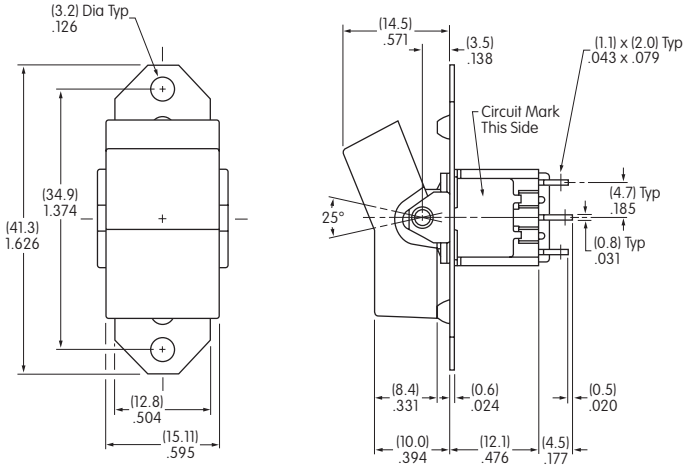
Double pole has barrier between terminals.

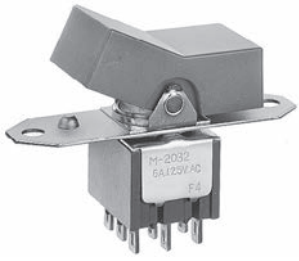


M2012TYW01-JC

Three Pole

TY Frame • Solder Lug

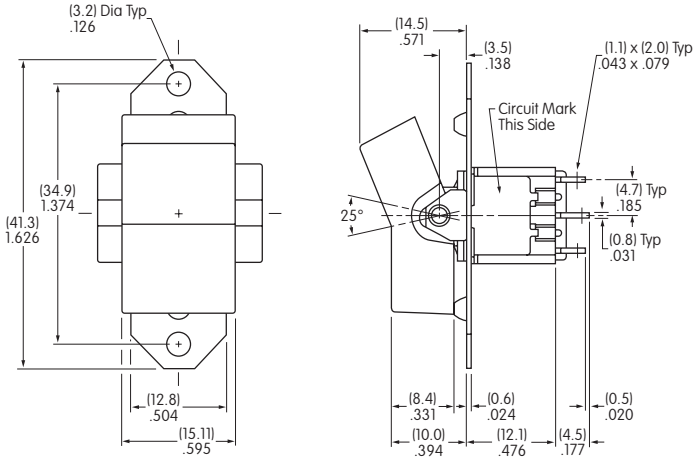


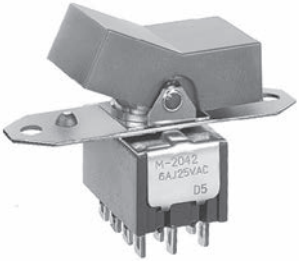


M2032TYW01-JC

Four Pole

TY Frame • Solder Lug





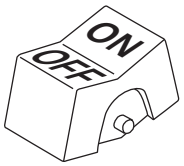
M2042TYW01-JC

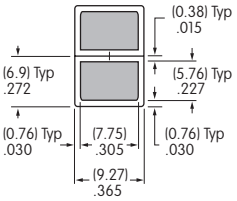
LEGENDS

NKK Switches can provide custom legends for caps. Contact factory for more information.

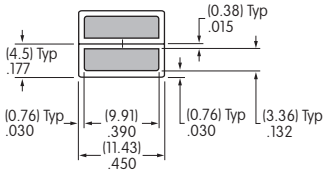
Suggested Printable Area for Caps

AT4148

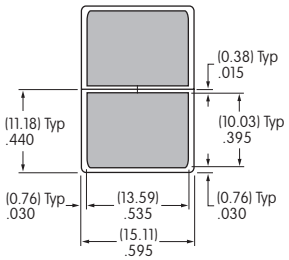




AT4150



AT4156



Shaded areas are printable areas.

Recommended Print Method:

Pad Print

Epoxy based ink is recommended.

General Specifications

Electrical Capacity (Resistive Load)

Power Level (silver): 6A @ 125V AC or 3A @ 250V AC or 3A @ 30V DC
Logic Level (gold): 0.4VA maximum @ 28V AC/DC maximum
(Applicable Range 0.1mA ~ 0.1A @ 20mV ~ 28V)
Note: Find additional explanation of operating range in Supplement section.

Other Ratings

Contact Resistance: 10 milliohms maximum for silver; 20 milliohms maximum for gold
Insulation Resistance: 1,000 megohms minimum @ 500V DC
Dielectric Strength: 1,000V AC minimum between contacts for 1 minute minimum;
1,500V AC minimum between contacts & case for 1 minute minimum
Mechanical Life: 50,000 operations minimum
Electrical Life: 25,000 operations minimum
Nominal Operating Force:

		On-to-On Position	Off-to-On Position
Paddles	Single Pole	3.19N	3.92N
	Double Pole	4.41N	7.06N
Rockers	Single Pole	6.37N	9.80N
	Double Pole	13.73N	17.65N

Angle of Throw: 20°

Materials & Finishes

Housing: Stainless steel
Mounting Bracket: Stainless steel
Movable Contacts: Silver alloy or silver alloy with gold plating
Stationary Contacts: Silver with silver plating or copper or brass with gold plating
Lamp Contacts: Phosphor bronze
Base: Diallyl phthalate (UL94V-0)
Switch Terminals: Copper with silver or gold plating
Lamp Terminals: Brass with silver or gold plating

Environmental Data

Operating Temp Range: –10°C through +55°C (+14°F through +131°F) for rockers
–25°C through +70°C (–13°F through +158°F) for paddles
Humidity: 90 ~ 95% humidity for 96 hours @ 40°C (104°F)
Vibration: 10 ~ 55Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in 1 minute; 3 right angled directions for 2 hours
Shock: 50G (490m/s²) acceleration (tested in 6 right angled directions, with 5 shocks in each direction)

Installation

Soldering Time & Temp: Wave Soldering (PC version): See Profile B in Supplement section.
Manual Soldering: See Profile B in Supplement section.
Note: Lever must be in center position while soldering.
Cleaning: PC mountable device is not process sealed. Hand clean locally using alcohol based solution.

Standards & Certifications

Flammability Standards: UL94V-0 base
UL: **File No. E44145 - Recognized only when ordered with marking on switch.**
Add "/U" before dash in part number to order UL recognized switch.
Single pole rockers with synchronous circuits & single color LEDs & solder lug or PC recognized at 6A @ 125V AC.
CSA: **File No. 023535_0_000 - Certified only when ordered with marking on switch.**
Add "/C" before dash in part number to order CSA certified switch.
All single pole rockers with synchronous circuits & single color LEDs certified at 6A @ 125V AC.

TYPICAL SWITCH ORDERING EXAMPLE

M21 [1] [2] [N] [CF] [W] [01] — [ ]

Poles

1	SPDT
* 2	DPDT

* Available only with Rockers with Terminals 01, 02, 03

Circuits

2	ON	NONE	ON
3	ON	OFF	ON

LED Colors

Single Color	
C	Red
E	Yellow
F	Green
Bicolor	
CF	Red/Green

Contact Materials & Ratings

W	Silver; Rated 6A @ 125V AC
G	Gold; Rated 0.4VA max @ 28V AC/DC max

LED Circuits & Actuator Types

Rocker	
R	Isolated
N	Synchronous

Paddle	
P	Isolated
J	Synchronous

Terminals & Mounting Types

01	Solder Lug with Flat Frame
02	Quick Connect with Flat Frame
03	Straight PC with Flat Frame
13	Straight PC with Bracket Mount

01	Solder Lug with Snap-in Frame
02	Quick Connect with Snap-in Frame
03	Straight PC with Snap-in Frame
13	Straight PC with Bracket Mount

Optional Bezel & Colors

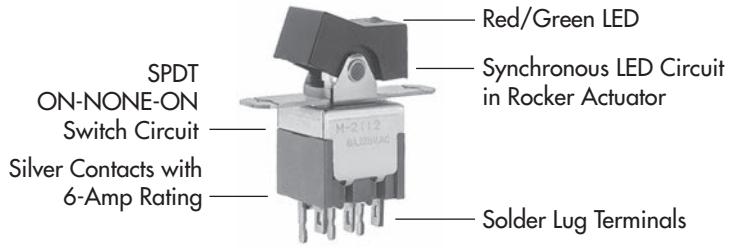
For Snap-in Frame	
A	Black
B	White
E	Yellow
F	Green
G	Blue
H	Gray

IMPORTANT:

Switches are supplied without UL & CSA marking unless specified.
UL & CSA recognized only when ordered with marking on the switch.
Specific models, ratings, & ordering instructions are noted on the General Specifications page.

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

M2112NCFW01



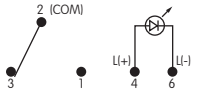
POLES & CIRCUITS & LED ILLUMINATION

Model	Pole & Throw	Toggle Position & Terminal Numbers: Down	Center	Up
M2112 Connected Power Terminals	**SPDT**	ON 2-3	NONE NONE	ON 2-1
LED Circuit: **Isolated LEDs** (see schematics) Connected LED Terminals		ON 4-6	NONE NONE	ON 4-6
LED Circuit: **Synchronous Single Color LED** Connected LED Terminals		ON 4-6	NONE NONE	OFF OPEN
LED Circuit: **Synchronous Bicolor LED** Connected LED Terminals		Red 5-6	NONE NONE	Green 5-4
M2113 Connected Power Terminals	**SPDT**	ON 2-3	OFF OPEN	ON 2-1
LED Circuit: **Isolated LEDs** (see schematics) Connected LED Terminals		ON 4-6	ON 4-6	ON 4-6
LED Circuit: **Synchronous Single Color LED** Connected LED Terminals		ON 4-6	OFF OPEN	ON 4-6
LED Circuit: **Synchronous Bicolor LED** Connected LED Terminals		Red 5-6	OFF OPEN	Green 5-4
M2122 Connected Power Terminals	**DPDT**	ON 2-3 5-6	NONE NONE	ON 2-1 5-4
LED Circuit: **Isolated LEDs** (see schematics) Connected LED Terminals		ON 7-9	NONE NONE	ON 7-9
LED Circuit: **Synchronous Single Color LED** Connected LED Terminals		ON 7-9	NONE NONE	OFF OPEN
LED Circuit: **Synchronous Bicolor LED** Connected LED Terminals		Red 8-9	NONE NONE	Green 8-7
M2123 Connected Power Terminals	**DPDT**	ON 2-3 5-6	OFF OPEN	ON 2-1 5-4
LED Circuit: **Isolated LEDs** (see schematics) Connected LED Terminals		ON 7-9	ON 7-9	ON 7-9
LED Circuit: **Synchronous Single Color LED** Connected LED Terminals		ON 7-9	OFF OPEN	ON 7-9
LED Circuit: **Synchronous Bicolor LED** Connected LED Terminals		Red 8-9	OFF OPEN	Green 8-7

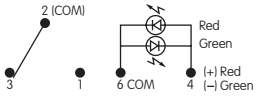
Schematics

Notes: Terminal numbers are not actually on the switch. LEDs require an external power source.

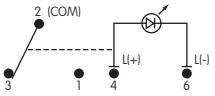
Isolated Single Color LED



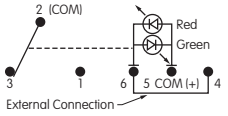
Isolated Bicolor LED



Synchronous Single Color LED

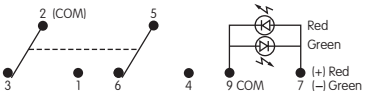


Synchronous Bicolor LED

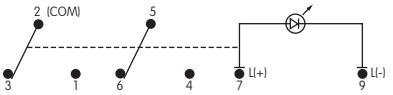


Isolated Single Color LED

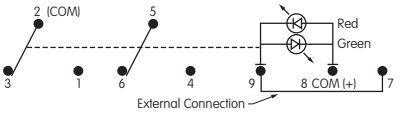
Isolated Bicolor LED



Synchronous Single Color LED



Synchronous Bicolor LED



LED COLORS & SPECIFICATIONS

The electrical specifications shown are determined at a basic temperature of 25°C. LED circuit is isolated and requires an external power source. If the source voltage exceeds the rated voltage, a ballast resistor is required. The resistor value can be calculated by using the formula in Supplement Section. The LED is an integral part of the switch and not available separately.
Bicolor LED is translucent white when unlit.

		Rockers: Single Color C	E	F	Bicolor CF	Paddles: Single Color C	E	F	Bicolor CF	Units
		Red	Yellow	Green	Red/Green	Red	Yellow	Green	Red/Green	
Maximum Forward Current	I_{FM}	25	30	30	25	25	30	25	30/25	mA
Typical Forward Current	I_F	20	20	20	20	20	20	20	20/20	mA
Forward Voltage	V_F	2.1	2.1	2.1	1.7/2.0	2.25	2.1	2.2	2.0/2.2	V
Maximum Reverse Voltage	V_{RM}	4	4	4	—	5	5	5	—	V
Current Reduction Rate Above 25°C	ΔI_F	0.33	0.40	0.40	0.33/0.33	0.33	0.40	0.33	0.43/0.38	mA/°C
Ambient Temperature Range		−10° ~ +55°C				−25° ~ +50°C			−25° ~ +70°C	

LED CIRCUIT, ROCKER, & MOUNTING TYPE COMBINATIONS

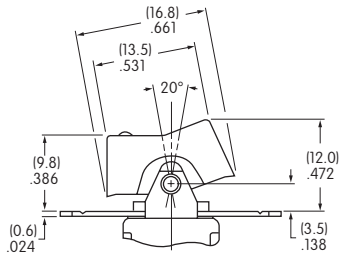
R **Rocker with Isolated LED Circuit**

N **Rocker with Synchronous LED Circuit**

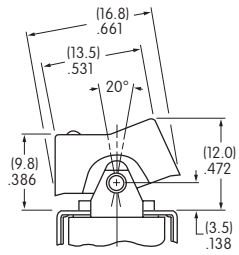
Material: Polyamide

Finish: Matte

Color: Black

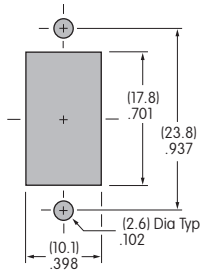


Flat Frame combines with Terminal codes 01, 02, & 03.



Bracket combines with Terminal code 13.

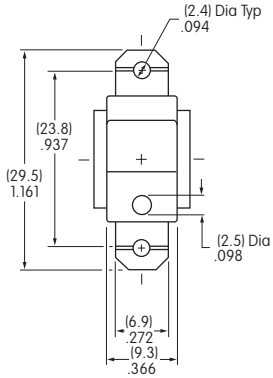
Maximum Panel Thickness .126" (3.2mm)

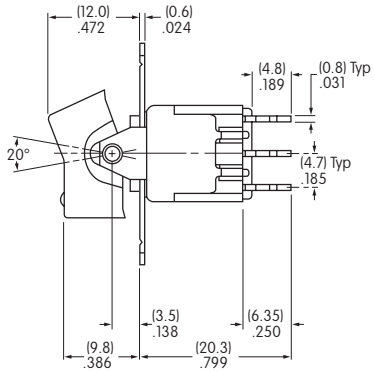


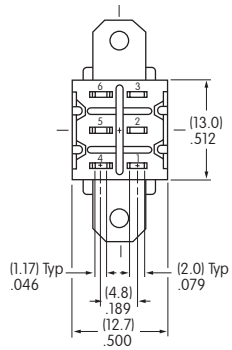
TYPICAL ROCKER SWITCH DIMENSIONS

Single Pole

Solder Lug





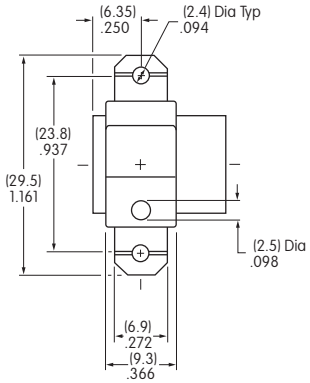


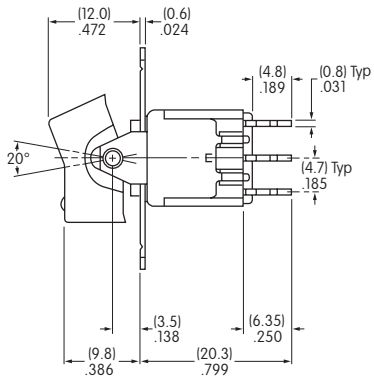
Single color LED switch does not have terminal 5.

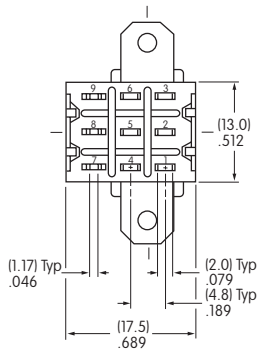
M2112NCFW01

Double Pole

Solder Lug





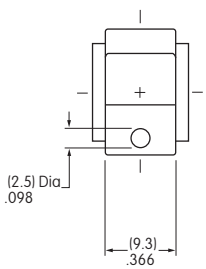


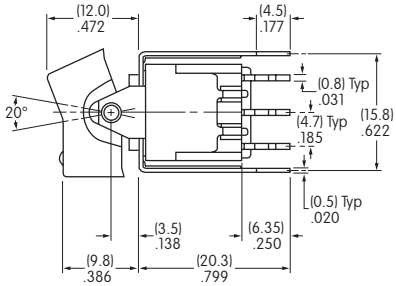
Single color LED switch does not have terminal 8.

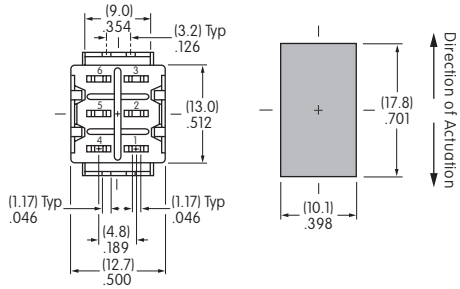
M2122NCFW01

Single Pole Only

Straight PC • Bracket







Single color LED switch does not have terminal 5. Silver contact material is standard.

M2112NCFW13

Series M2100

LED Tipped Rockers & Paddles

LED CIRCUIT, PADDLE, & MOUNTING TYPE COMBINATIONS

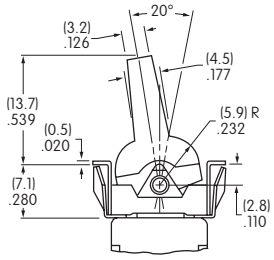
P **Paddle with Isolated LED Circuit**

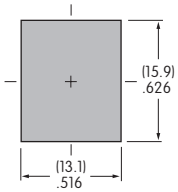
J **Paddle with Synchronous LED Circuit**

Maximum Panel Thickness
.039" ~ .126" (1.0 ~ 3.2mm)
without Bezel
.039" ~ .098" (1.0 ~ 2.5mm)
with Bezel

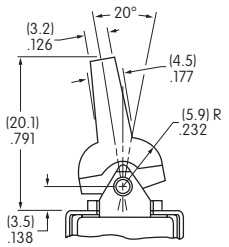
Maximum
Panel
Thickness
.126" (3.2mm)

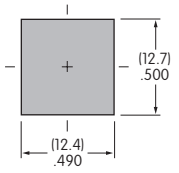
Material: Polyamide
Finish: Matte
Color: Black





Snap-in combines with Terminal codes 01, 02, & 03



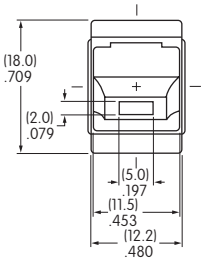


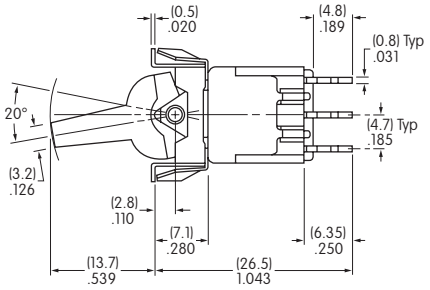
Bracket combines with Terminal code 13

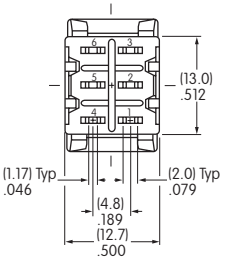
TYPICAL PADDLE SWITCH DIMENSIONS

Solder Lug • Snap-in

Single Pole Only





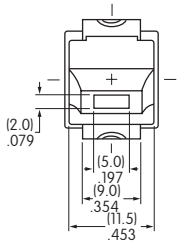


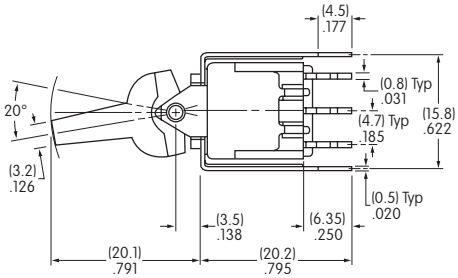
M2112JCFW01

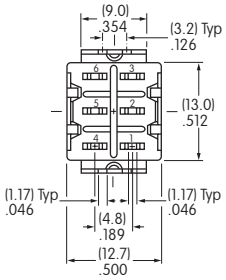
Single color LED switch does not have terminal 5.

Straight PC • Bracket

Single Pole Only







M2112JCFW13

Silver contact material is standard. Single color LED switch does not have terminal 5.

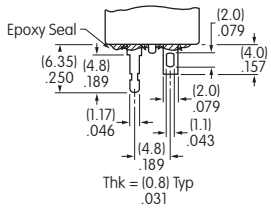
CONTACT MATERIALS & RATINGS

W	Silver over Silver	Power Level	6A @ 125V AC & 3A @ 250V AC
G	Gold over Brass or Copper	Logic Level	0.4VA maximum @ 28V AC/DC maximum

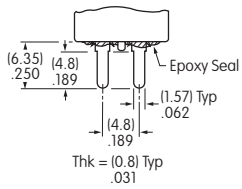
Complete explanation of operating range in Supplement section.

TERMINALS

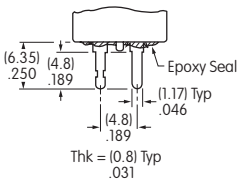
01 Solder Lug with Turret LED Terminal



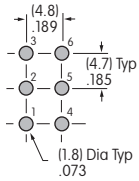
02 Quick Connect



03 Straight PC with Turret LED Terminal

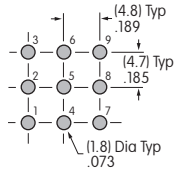


Single Pole



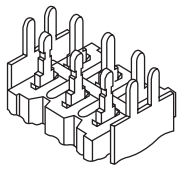
Single color LED & isolated bicolor LED switches do not have terminal 5.

Double Pole

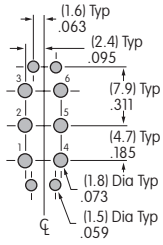


Single color LED & isolated bicolor LED switches do not have terminal 8.

13 Straight PC with Bracket & Turret LED Terminal



Single Pole



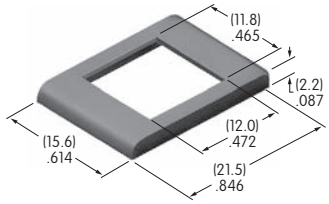
Single color LED & isolated bicolor LED switches do not have terminal 5.

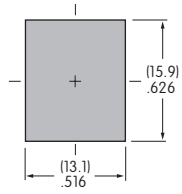
OPTIONAL BEZEL & COLORS

AT2107 Bezel for Snap-in Panel Frame

Material: Polyamide

Finish: Matte





Colors Available: A Black B White E Yellow F Green G Blue H Gray

General Specifications

Electrical Capacity (Resistive Load)

Power Level (silver): 6A @ 125V AC or 3A @ 250V AC;
4A @ 30V DC (On-On circuit) & 3A @ 30V DC (all other circuits)

Logic Level (gold): 0.4VA maximum @ 28V AC/DC maximum
(Applicable Range 0.1mA ~ 0.1A @ 20mV ~ 28V)

Logic/Power Level (gold over silver): Combines silver & gold ratings
Note: Find additional explanation of dual rating & operating range in Supplement section.

Other Ratings

Contact Resistance: 10 milliohms maximum for silver; 20 milliohms maximum for gold

Insulation Resistance: 1,000 megohms minimum @ 500V DC

Dielectric Strength: 1,000V AC minimum between contacts for 1 minute minimum;
1,500V AC minimum between contacts & case for 1 minute minimum

Mechanical Life: 50,000 operations minimum

Electrical Life: 25,000 operations minimum for silver; 50,000 operations minimum for gold

Contact Timing: Nonshorting (break-before-make)

Angle of Throw: 26°

Materials & Finishes

Lever: Brass with nickel plating

Actuator Clip: Polyacetal

Support Bracket: Brass with tin plating

Bushing/Housing: Glass fiber reinforced polyamide (UL94V-0)

Sealing Ring: Nitrile butadiene rubber

Base: Glass fiber reinforced polyamide (UL94V-0)

Movable Contacts: Silver alloy with silver plating (code W); copper or phosphor bronze with gold plating (code G);
or silver alloy with gold plating (code A)

Stationary Contacts: Silver alloy with silver plating (code W); copper or brass with gold plating (code G);
or silver alloy with gold plating (code A)

Terminals: Copper or brass with silver or gold plating

Environmental Data

Operating Temp Range: –30°C through +85°C (–22°F through +185°F)

Humidity: 90 ~ 95% humidity for 96 hours @ 40°C (104°F)

Vibration: 10 ~ 55Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in 1 minute; 3 right angled directions for 2 hours

Shock: 50G (490m/s^2) acceleration (tested in 6 right angled directions, with 5 shocks in each direction)

PCB Processing

Soldering: Wave Soldering Recommended: See Profile B in Supplement section.
Manual Soldering: See Profile B in Supplement section.

Cleaning: Automated cleaning. See Cleaning specifications in Supplement section.

Standards & Certifications

Flammability Standards: UL94V-0 rated bushing/housing & base

UL: **File No. E44145 - Recognized only when ordered with marking on switch.**
Add "/U" or "/CUL" before dash in part number to order UL recognized switch.
All models recognized at 6A @ 125V AC, 3A @ 250V AC, & 4A @ 30V DC or 0.4A @ 28V DC.

CSA: **File No. 023535_0_000 - Certified only when ordered with marking on switch.**
Add "/C" before dash in part number to order CSA certified switch.
All models certified at 6A @ 125V AC, 3A @ 250V AC, & 4A @ 30V DC.

Distinctive Characteristics

Antijamming design protects against mechanism damage from downward force on the actuator.

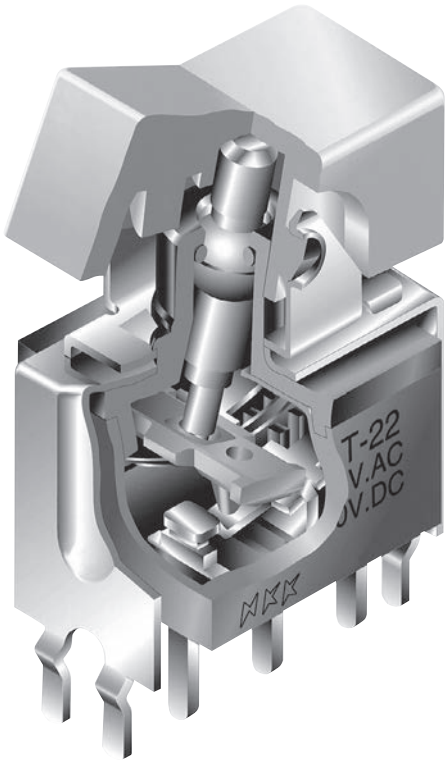
O-ring surrounding top of lever prevents liquids from reaching switch mechanism.

Ultrasonic welding of upper and lower housing seals out contaminants and allows automatedsoldering and cleaning.

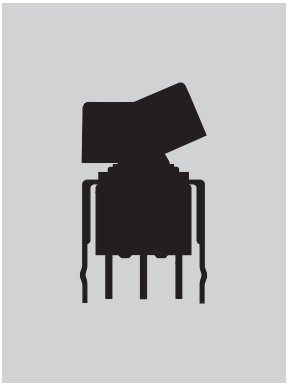
Terminals are epoxy sealed to prevent entry of flux, solvents, and other contaminants.

Bracketed models have crimped bracket legs to ensure secure PC mounting and prevent dislodging during automated soldering.

Logic level and power capabilities are available to suit varying applications.



Actual Size



TYPICAL SWITCH ORDERING EXAMPLE

M2T 2 2 TX G 41 — D C

Poles

1	SPDT
2	DPDT

Circuits

2	ON	NONE	ON
3	ON	OFF	ON
5	ON	NONE	(ON)
8	(ON)	OFF	(ON)
9	ON	OFF	(ON)

( ) = Momentary

Mounting Frame

TX	For Actuators with Straight or Angle PC Mount

Contact Materials & Ratings

W	Silver; Rated 6A @ 125V AC & 3A @ 250V AC
G	Gold; Rated 0.4VA max @ 28V AC/DC max
A	Gold over Silver; Rated 6A @ 125V AC & 0.4VA max @ 28V AC/DC max

PC Terminals

13	Straight with .460″ (11.7mm) Bracket
30	.150″ (3.81mm) Right Angle
41	.150″ (3.81mm) Vertical

Rockers/Paddles

D	.365″ (9.27mm) Wide Rocker
E	.365″ (9.27mm) Wide Paddle
F	.450″ (11.43mm) Wide Rocker
G	.450″ (11.43mm) Wide Paddle

Rocker/Paddle Colors

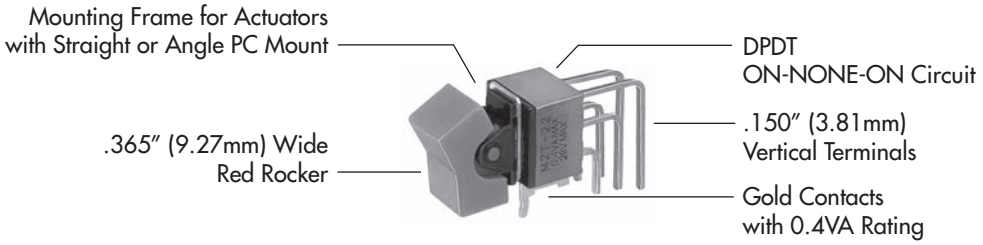
A	Black
B	White
C	Red
E	Yellow
F	Green
G	Blue
H	Gray

IMPORTANT:

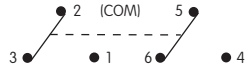
Switches are supplied without UL, cULus & CSA marking unless specified. **UL, cULus & CSA recognized only when ordered with marking on the switch.** Specific models, ratings and ordering instructions are noted on the General Specifications page.

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

M2T22TXG41-DC



POLES & CIRCUITS

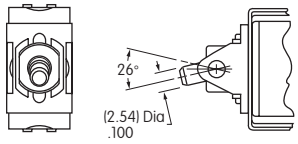
Pole	Model	Rocker Position ( ) = Momentary: Down	Center	Up	Connected Terminals: Down	Center	Up	Throw & Schematics
SP	**M2T12**	ON	NONE	ON	2-3	OPEN	2-1	SPDT
	M2T13	ON	OFF	ON				
	M2T15	ON	NONE	(ON)				
	M2T18	(ON)	OFF	(ON)				
	M2T19	ON	OFF	(ON)				
DP	**M2T22**	ON	NONE	ON	2-3 5-6	OPEN	2-1 5-4	DPDT 
	M2T23	ON	OFF	ON				
	M2T25	ON	NONE	(ON)				
	M2T28	(ON)	OFF	(ON)				
	M2T29	ON	OFF	(ON)				

Note: Terminal numbers are not actually on the switch.

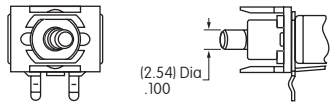
MOUNTING FRAME

TX **Mounting Frame for Rockers or Paddles with Straight or Angle PC Terminals**

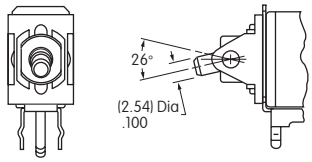
Straight PC Mounting



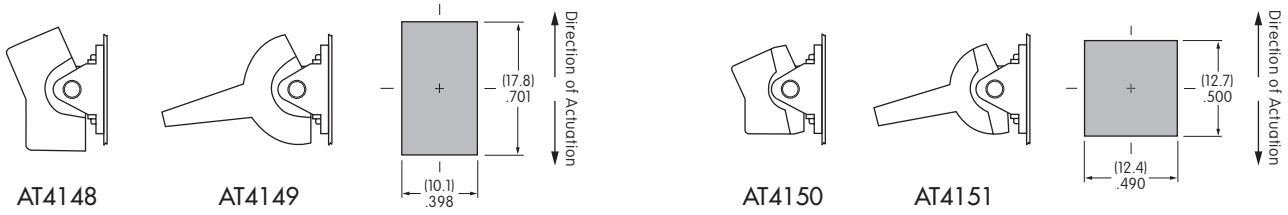
Right Angle PC Mounting



Vertical PC Mounting



Actuators & Panel Cutouts



AT4148 AT4149 AT4150 AT4151

CONTACT MATERIALS & RATINGS

W **Silver over Silver** — **Power Level** — **6A @ 125V AC & 3A @ 250V AC**

G **Gold over Brass or Copper** — **Logic Level** — **0.4VA maximum @ 28V AC/DC maximum**

Complete explanation of operating range in Supplement section.

A **Gold over Silver** — **Power Level or Logic Level** — **6A @ 125V AC or 0.4VA maximum @ 28V AC/DC maximum**

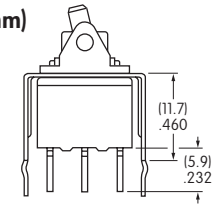
Note: This dual rated option is suitable when two or more identical switches are used in logic and in power circuits within the same application. See Supplement section for complete explanation of dual rating and operating range.

Series M2

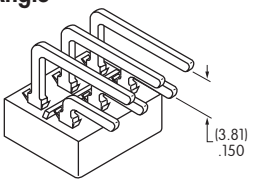
Process Sealed Miniature Rockers

PC TERMINALS

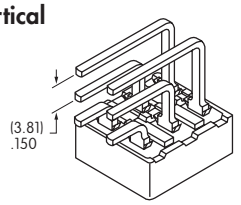
13 **Straight with .460" (11.7mm) Bracket**



30 **.150" (3.81mm) Right Angle**



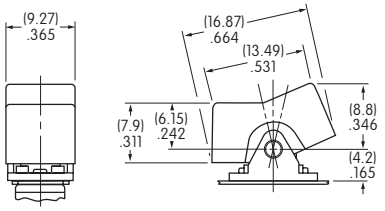
41 **.150" (3.81mm) Vertical**



ROCKERS & PADDLES

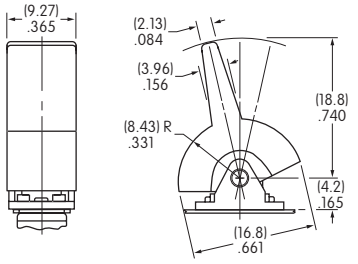
D **AT4148**
.365" (9.27mm) Wide Rocker

Material: Polyamide
Finish: Matte



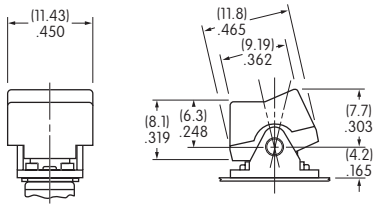
E **AT4149**
.365" (9.27mm) Wide Paddle

Material: Polyamide
Finish: Matte



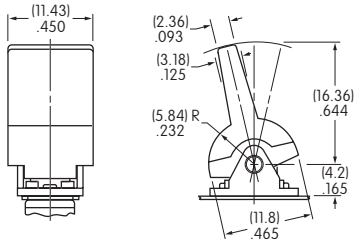
F **AT4150**
.450" (11.43mm) Wide Rocker

Material: Polyamide
Finish: Matte



G **AT4151**
.450" (11.43mm) Wide Paddle

Material: Polyamide
Finish: Matte



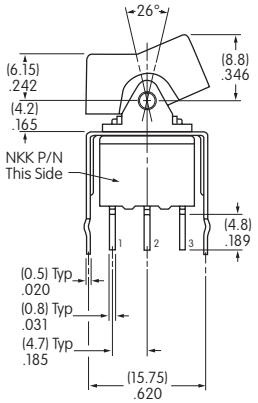
Cap Colors Available:

A	Black	**B**	White	**C**	Red	**E**	Yellow	**F**	Green	**G**	Blue	**H**	Gray

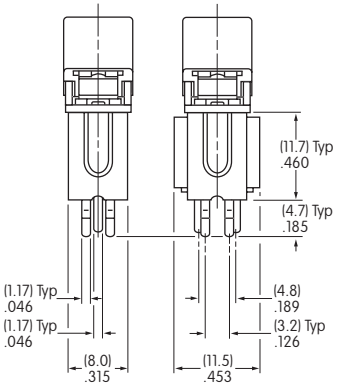
TYPICAL SWITCH DIMENSIONS

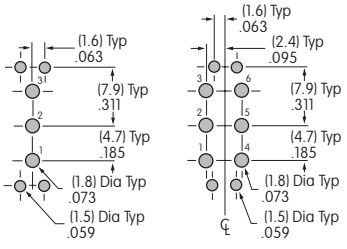
Straight PC • Bracket

M2T12TXG13-DC



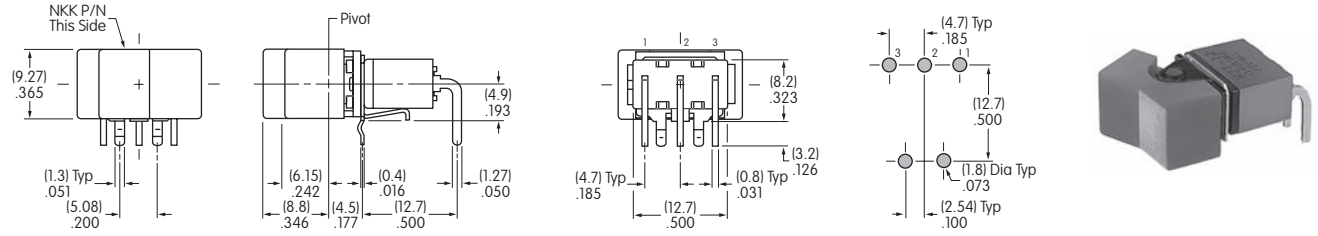
Single Pole **Double Pole**





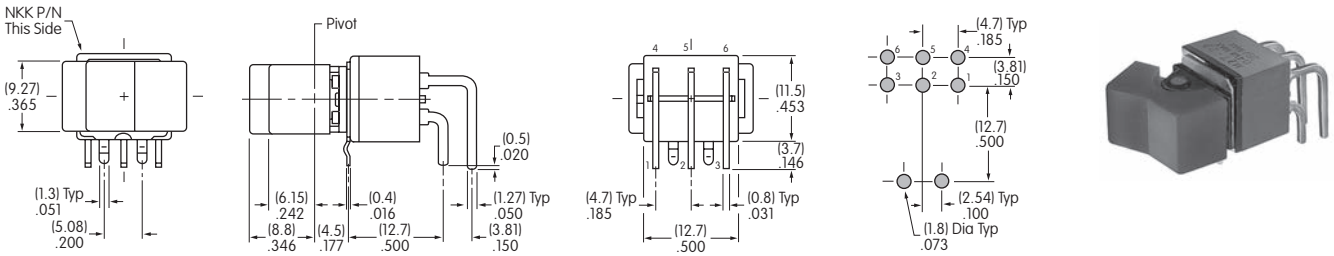
TYPICAL SWITCH DIMENSIONS

Single Pole — Right Angle PC



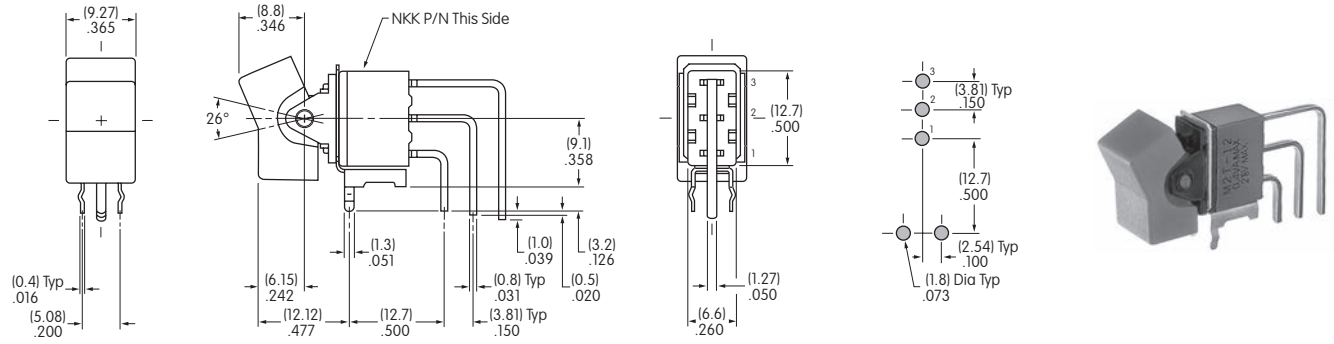
M2T12TXG30-DC

Double Pole — Right Angle PC



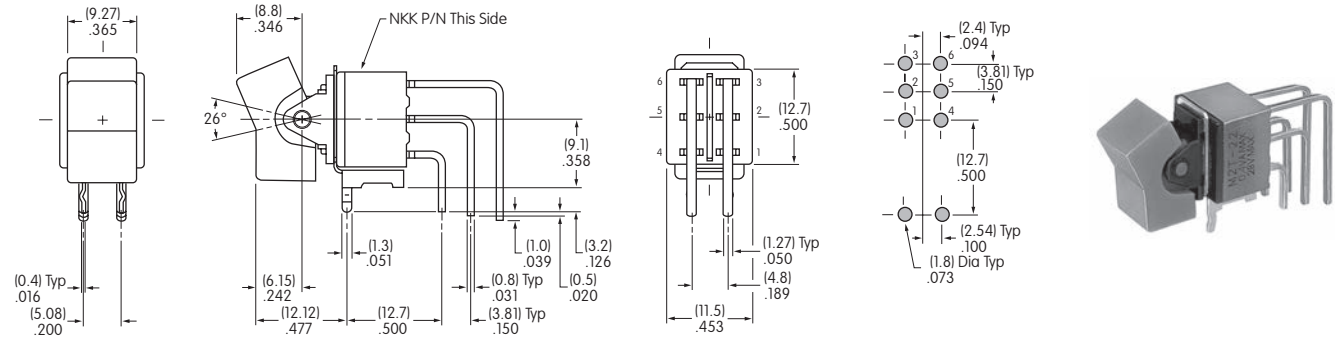
M2T22TXG30-DC

Single Pole — Vertical PC



M2T12TXG41-DC

Double Pole — Vertical PC

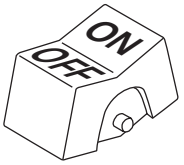


M2T22TXG41-DC

LEGENDS

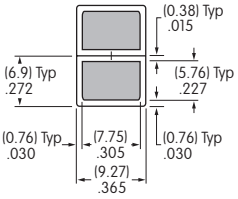
NKK Switches can provide custom legends for caps. Contact factory for more information.

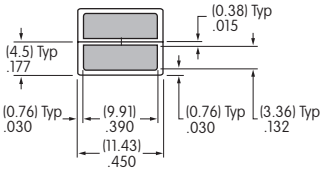
Suggested Printable Area for Cap



AT4148

AT4150



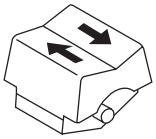


Shaded areas are printable areas.

Recommended Print Method:

Pad Print

Epoxy based ink is recommended.



General Specifications

Electrical Capacity

Power Level: 5A @ 125V AC, 3A @ 250V AC, & 3A @ 30V DC

Other Ratings

Contact Resistance: 10 milliohms maximum
Insulation Resistance: 200 megohms minimum @ 500V DC
Dielectric Strength: 1,000V AC minimum between contacts for 1 minute minimum;
1,500V AC minimum between contacts & case for 1 minute minimum
Mechanical Life: 30,000 operations minimum
Electrical Life: 10,000 operations minimum
Nominal Operating Force: 9.94N for rockers & 4.41N for paddles
Angle of Throw: 24° for On-None-(On); 28° for all other circuits

Materials & Finishes

Housing: Stainless steel
Movable Contacts: Silver alloy
Stationary Contacts: Silver
Base: Phenolic resin
Common Terminal: Copper with silver plating
End Terminals: Copper with silver plating
Lamp Terminals: Phosphor bronze with nickel plating

Environmental Data

Operating Temperature Range: –10°C through +50°C (+14°F through +122°F)
Humidity: 90 ~ 95% humidity for 96 hours @ 40°C (104°F)
Vibration: 10 ~ 55Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in 1 minute; 3 right angled directions for 2 hours
Shock: 50G (490m/s^2) acceleration (tested in 3 right angled directions, with 3 shocks in each direction)

Installation

Cap Installation Force: 9.80N (2.2 lbf) for rockers;
19.61N (4.4 lbf) for paddle
Soldering Time & Temperature: Manual Soldering: See Profile A in Supplement section.

Standards & Certifications

UL: **File No. E44145 - Recognized only when ordered with marking on switch.**
Add "/U" or "/CUL" before first dash in part number to order UL recognized switch.
All models recognized at 5A @ 125V AC & 3A @ 250V AC.

Distinctive Characteristics

Industry's first miniature snap-in, lighted rocker switch.

Actuators in various styles operate with firm, well-defined movements.

Interlocking actuator prevents switch failure due to jamming or window locking.

Two bezel sizes adapt to varied panel cutouts.

Unique stainless steel retaining clips securely hold switches over a range of panel thicknesses, even when exposed to vibration.

Space conserving front panel mounting with minimum behind panel dimension of .902" (22.9mm).

Durable stainless steel housing prevents corrosion.

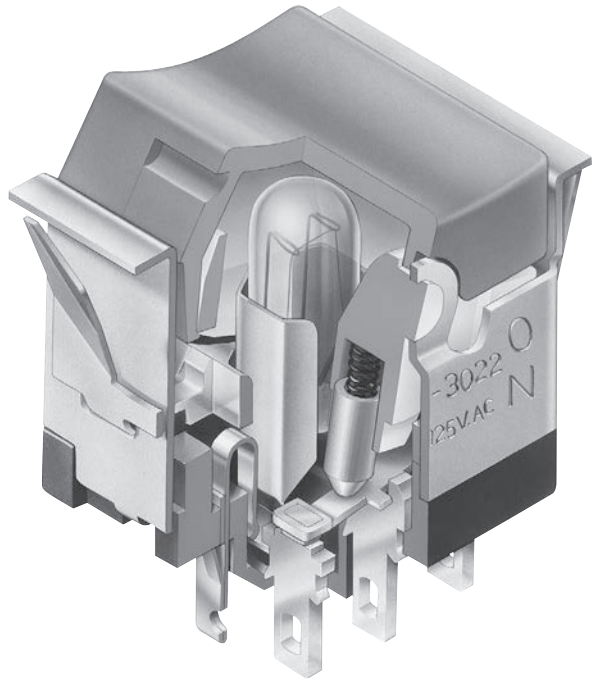
Isolated lamp circuit for incandescent, LED, and neon lamps. Front panel relamping.

Built-in protective cover shields contacts from dust.

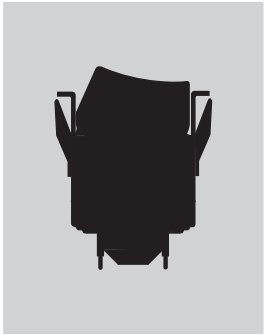
Epoxy sealed solder lug terminals lock out flux, dust, and other contaminants.

Extended lamp terminal for ease of wiring.

Matching indicators available.



Actual Size



TYPICAL SWITCH ORDERING EXAMPLE

MLW30 [2] [5] – [12] – [DC] – [1A]

Poles

1	SPDT
2	SP3T DPDT

Circuits

2	ON	NONE	ON
3	ON	OFF	ON
5	ON	NONE	(ON)
8	(ON)	OFF	(ON)
9	ON	OFF	(ON)
0	ON	ON	ON

( ) = Momentary

Lamps

Incandescent & Neon Lamps

00	No Lamp
06	6-volt
12	12-volt
18	18-volt
24	24-volt
28	28-volt
N	110-volt (not suitable with green & blue)

Single Element LED Colors

C	Red
E	Yellow
F	Green

Cap Types & Colors

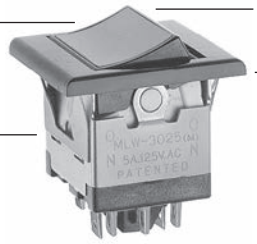
Rocker	
RA	Black
RB	White
RC	Red
RD	Orange
RE	Yellow
RF	Green
RG	Blue
Paddle	
PA	Black
PB	White
PC	Red
PD	Orange
PE	Yellow
PF	Green
PG	Blue
Design Rocker	
DB	White
DC	Red
DD	Orange
DF	Green
DG	Blue
LED Rocker	
LB	White
LC	Red
LE	Yellow
LF	Green
Sculptured Rocker	
SB	White
SC	Red
SE	Yellow
SF	Green

Bezels/Colors

Standard	
1A	Black
1B	White
1C	Red
1D	Orange
1E	Yellow
1F	Green
1G	Blue
1H	Gray
Large	
2A	Black
2B	White
2C	Red
2D	Orange
2E	Yellow
2F	Green
2G	Blue
2H	Gray

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

MLW3025-12-DC-1A



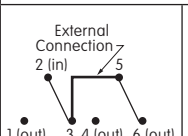
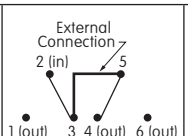
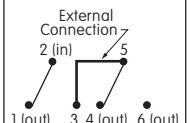
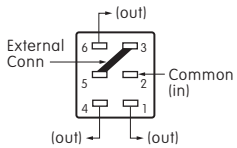
IMPORTANT:

Switches are supplied without UL & cULus markings unless specified.
UL & cULus recognized only when ordered with marking on the switch.
Specific models and ratings noted on the General Specifications page.

POLES & CIRCUITS

Pole	Model	Rocker Position ( ) = Momentary: Down	Center	Up	Connected Terminals: Down	Center	Up	Throw & Power/Lamp Schematics
								Notes: Terminal numbers are not actually on switch. Lamp circuit is isolated and requires an external power source.
SP	**MLW3012**	ON	NONE	ON	2-3	OPEN	2-1	SPDT
	MLW3013	ON	OFF	ON				
	MLW3015	ON	NONE	(ON)				
	MLW3018	(ON)	OFF	(ON)				
	MLW3019	ON	OFF	(ON)				
DP	**MLW3022**	ON	NONE	ON	2-3 5-6	OPEN	2-1 5-4	DPDT
	MLW3023	ON	OFF	ON				
	MLW3025	ON	NONE	(ON)				
	MLW3028	(ON)	OFF	(ON)				
	MLW3029	ON	OFF	(ON)				

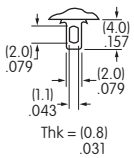
For 3 Throw (3-On)

Pole	Model	Down	Center	Up	Connected Terminals & Schematics			External Connection
SP	**MLW3020**	ON	ON	ON				**The SP3T model utilizes a double pole base.** External connection must be made during field installation. 
With External Connection					2-6	2-4	2-1	
Without External Connection					2-3 5-6	2-3 5-4	2-1 5-4	

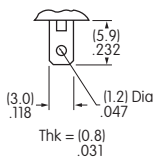
TERMINALS

Switch Terminals

Center terminal is .020" (0.5mm) longer



Lamp Terminals



LAMP CODES & SPECIFICATIONS

Electrical specifications are determined at a basic temperature of 25°C. Lamp circuit is independent of switch operation.
For dimension drawings of lamps see Accessories & Hardware section.
For neon, if the source voltage is greater than rated voltage, a ballast resistor is required.
The ballast resistor calculation and more lamp detail are shown in the Supplement.

Incandescent & Neon Lamps for Solid & Design Caps

AT602 Incandescent **AT602N Neon**

T-1½ Pilot Slide Base

L(+) L(-)	06	12	18	24	28	N
Voltage V	6V AC	12V AC	18V AC	24V AC	28V AC	110V AC
Current I	80mA	50mA	35mA	25mA	22mA	1.5mA
MSCP	.159	.215	.398	.215	.247	NA
Endurance Hours	2,000 Average					15,000 Average
Ambient Temperature Range	−10°C ~ +50°C					−10°C ~ +50°C

Recommended Resistor for Neon: 33K ohms for 110V AC; 100K ohms for 220V AC

00 **No Lamp** Code 00 indicates that no lamp is used.

Series MLW

Snap-in Miniature Rockers

LED COLOR CODES & SPECIFICATIONS

Single Element LED

AT622 LED

T-1¾ Pilot Slide Base

Resistor value calculation is shown in the Supplement.	Color	C Red	E Yellow	F Green
Maximum Forward Current	I_{FM}	30mA	30mA	30mA
Typical Forward Current	I_F	20mA	20mA	20mA
Forward Voltage	V_F	1.85V	2.0V	2.1V
Maximum Reverse Voltage	V_{RM}	5V	5V	5V
Current Reduction Rate Above 25°C	ΔI_F	0.40mA/°C	0.40mA/°C	0.40mA/°C
Ambient Temperature Range		−10°C ~ +50°C		

CAP TYPES & COLORS

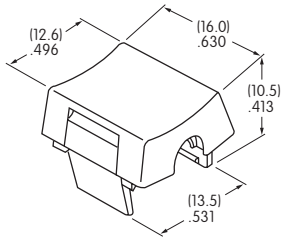
For Incandescent or Neon Lamps

RA **AT405 Rocker**

RB **RE**

RC **RF**

RD **RG**

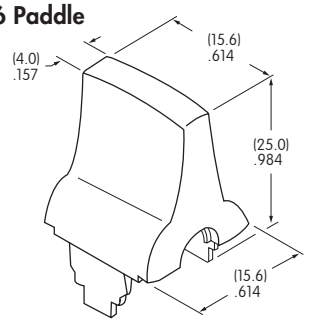


PA **AT426 Paddle**

PB **PE**

PC **PF**

PD **PG**



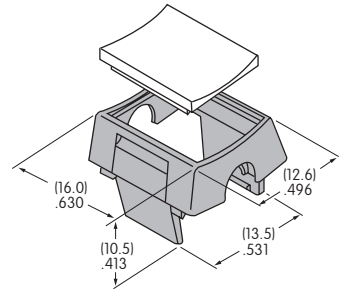
DB **AT438 Design Rocker**

DC

DD

DF

DG



Material: Translucent Polycarbonate Standard Finish: Glossy
Black Rocker/Paddle not for use with lamp

Translucent Colored Filter
Opaque Black Rocker Base

For LED

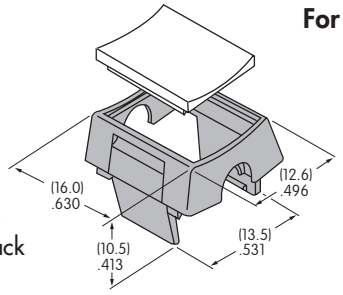
LB **AT4125 LED Rocker**

LC

LE

LF

Translucent Colored Diffuser and Opaque Black Rocker Base

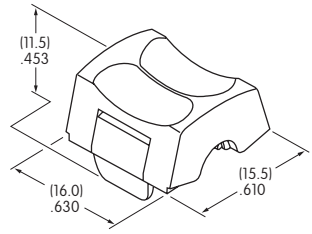


SB **AT4127 Sculptured Rocker**

SC

SE

SF



Material: Translucent Polycarbonate Standard Finish: Glossy

Color Codes: A Black B White C Red D Orange E Yellow F Green G Blue

OPTIONAL BEZELS

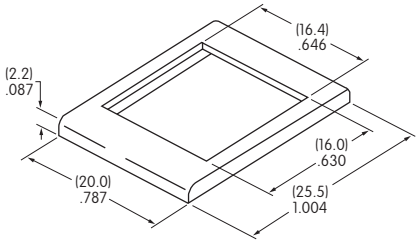
AT204 Standard Bezel .787" (20.0mm) Wide

1A **1E**

1B **1F**

1C **1G**

1D **1H**



Material: Polycarbonate Standard Finish: Glossy

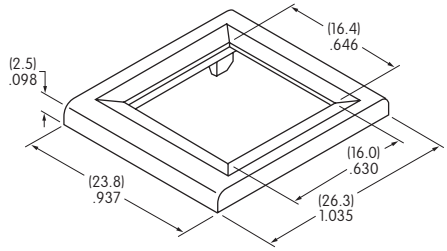
AT9201 Large Bezel .937" (23.8mm) Wide

2A **2E**

2B **2F**

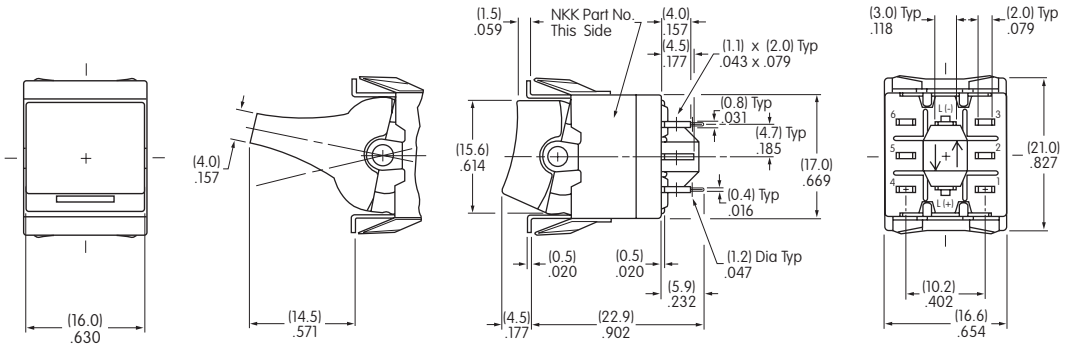
2C **2G**

2D **2H**



Material: Polycarbonate Standard Finish: Glossy

TYPICAL SWITCH DIMENSIONS

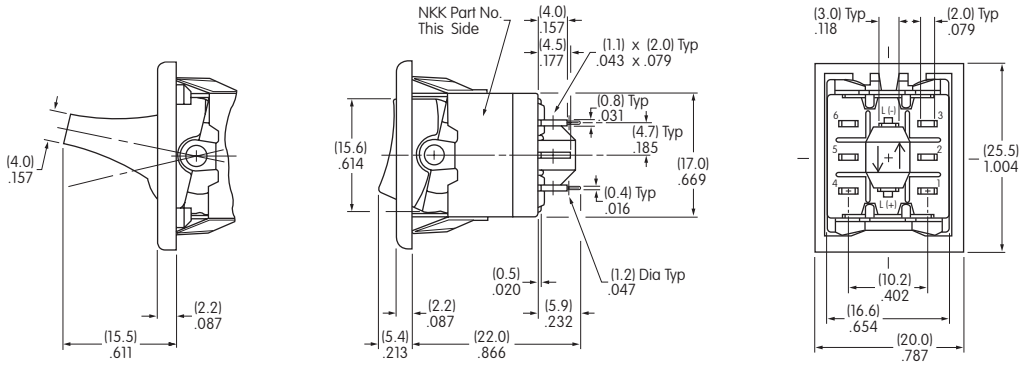


Without Bezel
Single & Double Pole

Actuator in UP position

Terminals 4, 5, & 6 are not on single pole models

MLW3022-12-PC

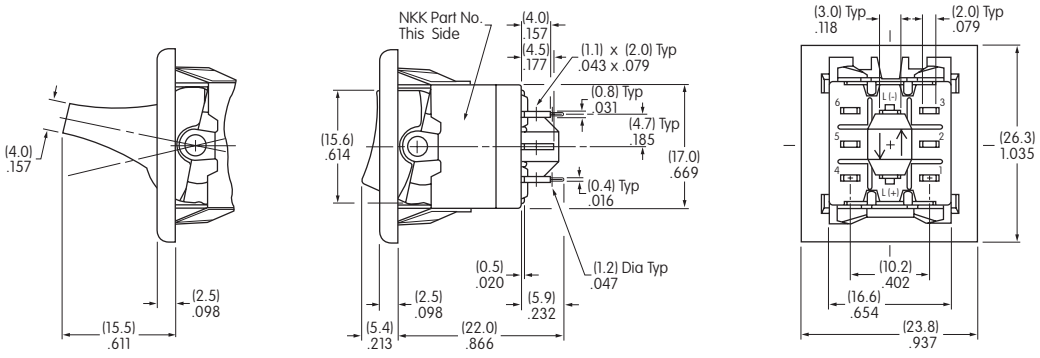


Standard Bezel
Single & Double Pole

Actuator in UP position

Terminals 4, 5, & 6 are not on single pole models

MLW3022-12-RC-1A

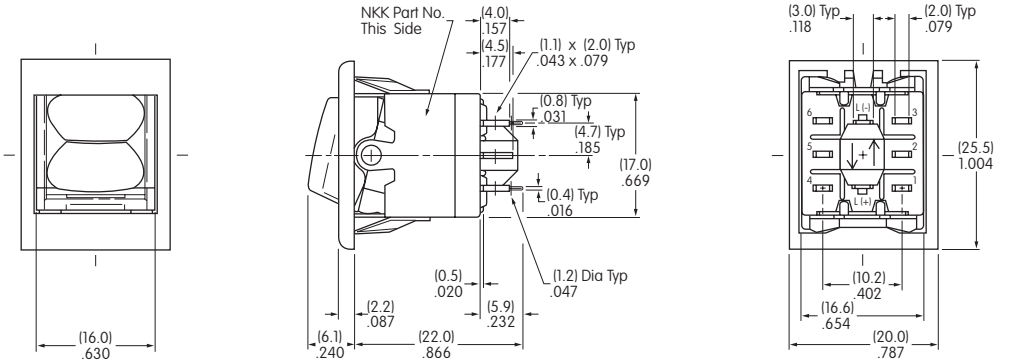


Large Bezel
Single & Double Pole

Actuator in UP position

Terminals 4, 5, & 6 are not on single pole models

MLW3022-12-PC-2A



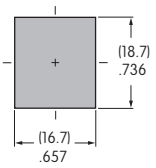
Sculptured Cap
Single & Double Pole

Actuator in UP position

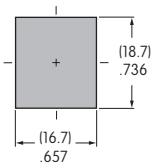
Terminals 4, 5, & 6 are not on single pole models

MLW3022-C-SC-1A

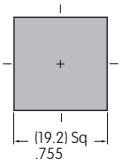
PANEL CUTOUTS & THICKNESSES



Without Bezel
.039" ~ .157" (1.0mm ~ 4.0mm)



With Standard Bezel AT204
.039" ~ .118" (1.0mm ~ 3.0mm)

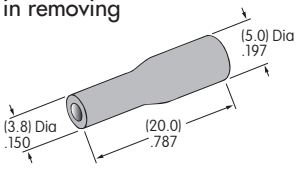


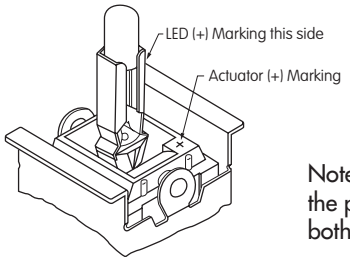
With Large Bezel AT9201
.039" ~ .118" (1.0mm ~ 3.0mm)

INSTALLATION & MAINTENANCE

Lamps and LEDs can be changed without removing the switch from the panel. The lamp extractor AT107 assists in removing lamps and LEDs.

AT107
Lamp Extractor

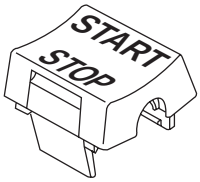




Note: When changing LEDs, match the positive polarity markings on both lamp base and actuator block.

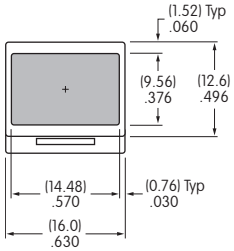
LEGENDS

NKK Switches can provide custom legends for caps. Contact factory for more information.

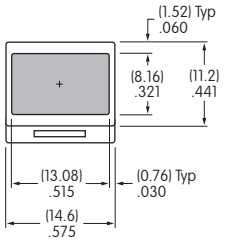


Recommended Print Method:
Pad Print
Epoxy based ink is recommended

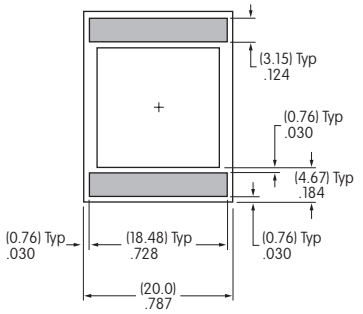
Rocker



Design Rocker & LED Rocker



Bezel



Shaded areas are printable areas.

General Specifications

Electrical Capacity

Resistive Load: 10A @ 125V AC or 6A @ 250V AC
Motor Load: 400W @ 125V AC
Lamp Load: 2A @ 125V AC for On-Off-On circuit & 3A @ 125V AC for other circuits

Other Ratings

Contact Resistance: 10 milliohms maximum
Insulation Resistance: 1,000 megohms minimum @ 500V DC
Dielectric Strength: 2,000V AC minimum between contacts for 1 minute minimum;
4,000V AC minimum between contacts & case for 1 minute minimum
Mechanical Life: 50,000 operations minimum
Electrical Life: 25,000 operations minimum
Angle of Throw: 25°

Materials & Finishes

Frame: Stainless steel
Case/Base: Diallyl phthalate resin (UL94V-0)
Movable Contacts: Silver alloy with silver plating
Stationary Contacts: Pure silver with silver plating
Terminals: Copper with silver plating

Environmental Data

Operating Temp Range: –10°C through +85°C (+14°F through +185°F)
Humidity: 90 ~ 95% humidity for 96 hours @ 40°C (104°F)
Vibration: 10 ~ 55Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in 1 minute; 3 right angled directions for 2 hours
Shock: 50G (490m/s^2) acceleration (tested in 6 right angled directions, with 5 shocks in each direction)

Installation

Soldering Time & Temp: Wave Soldering (Straight PC): See Profile A in Supplement section.
Manual Soldering: See Profile A in Supplement section.
Cleaning: These devices are not process sealed. Hand clean locally using alcohol based solution.

Standards & Certifications

Flammability Standards: UL94V-0 rated case/base

UL: **File No. E44145 - Recognized only when ordered with marking on switch.**
Add "/U" before dash in part number to order UL recognized switch.
Add "/CUL" before dash in part number to order cULus recognized switch.
All models recognized at 10A @ 125V AC & 6A @ 250V AC.

CSA: **File No. 023535_0_000 - Certified only when ordered with marking on switch.**
Add "/C" before dash in part number to order CSA certified switch.
All models certified at 10A @ 125V AC & 6A @ 250V AC.

VDE: License No. 119174
All models approved at 10A @ 125V AC & 6A @ 250V AC.
Marking on switch is standard. All models meet EN 61058-1 standard.

Distinctive Characteristics

Meets EN 61058-1 standard.

Contacts of special silver alloy resist arcing and guarantee stable electrical contact and long life.

Stainless steel frame resists corrosion and increases environmental safety.

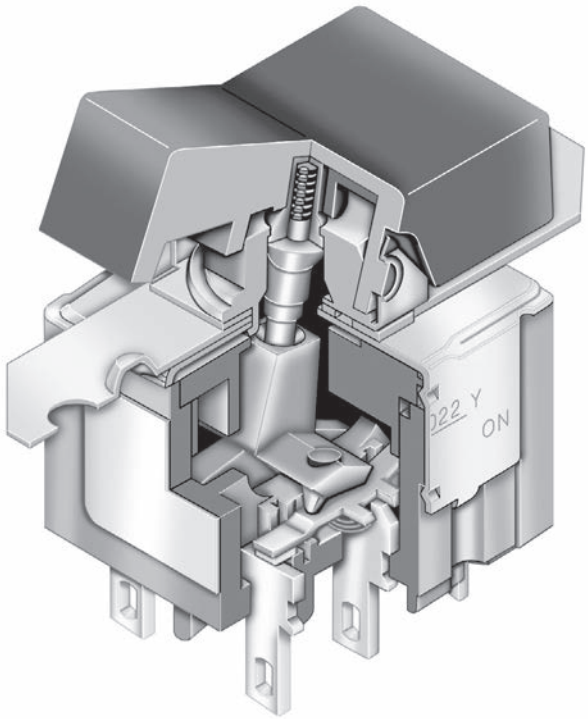
High insulating barriers increase isolation of circuits in double pole devices and provide added protection to contact points.

Case/base of heat resistant resin meets UL94V-0 flammability standard.

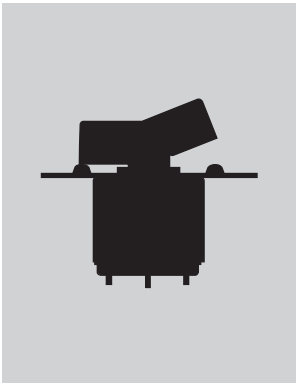
Prominent external insulating barriers increase insulation resistance and dielectric strength.

Clinching of the frame to the case well above the base and terminals provides 4,000V dielectric strength.

Epoxy sealed terminals prevent entry of flux, solvents, and other contaminants.



Actual Size



TYPICAL SWITCH ORDERING EXAMPLE

P20 [22] [Y] [ ] — [J] [C]

Poles & Circuits

11	SPST	ON	NONE	OFF
12	SPDT	ON	NONE	ON
13	SPDT	ON	OFF	ON
21	DPST	ON	NONE	OFF
22	DPDT	ON	NONE	ON
23	DPDT	ON	OFF	ON

Terminals

No Code	Solder Lug
P	Straight PC
Z	.187″ (4.75mm) Quick Connect

Paddle/Rocker Frames

N	Frame for Small Caps
Y	Frame for Large Caps

Rocker/Paddle Caps

For N Frame	
D	.365″ (9.27mm) Wide Rocker
E	.365″ (9.27mm) Wide Paddle
For Y Frame	
J	.595″ (15.11mm) Wide Rocker
H	.595″ (15.11mm) Wide Paddle

Cap Colors

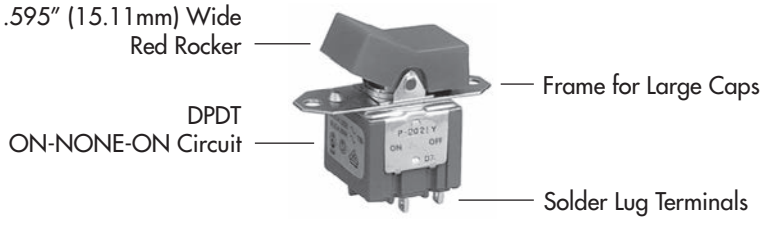
A	Black
B	White
C	Red
E	Yellow
F	Green
G	Blue
H	Gray

IMPORTANT:

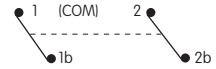
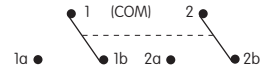
VDE is marked on all models. Switches are supplied without UL, cULus & CSA marking unless specified.
UL, cULus & CSA recognized only when ordered with marking on the switch.
Specific models, ratings, & ordering instructions are noted on General Specifications page.

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

P2022Y-JC



POLES & CIRCUITS

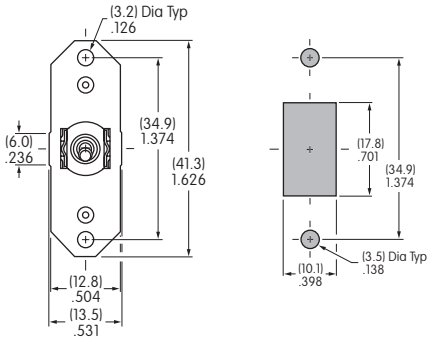
Pole	Model	Rocker Position: Down	Rocker Position: Center	Rocker Position: Up	Connected Terminals: Down	Connected Terminals: Center	Connected Terminals: Up	Throw & Schematics
SP	**P2011**	ON	NONE	OFF	1-1b	OPEN	OPEN	SPST
SP	**P2012** **P2013**	ON ON	NONE OFF	ON ON	1-1b	OPEN	1-1a	SPDT
DP	**P2021**	ON	NONE	OFF	1-1b 2-2b	OPEN	OPEN	DPST 
DP	**P2022** **P2023**	ON ON	NONE OFF	ON ON	1-1b 2-2b	OPEN	1-1a 2-2a	DPDT 

Note: Terminal numbers are on the switch.

ROCKER/PADDLE FRAMES

N **Frame for Small Actuator**

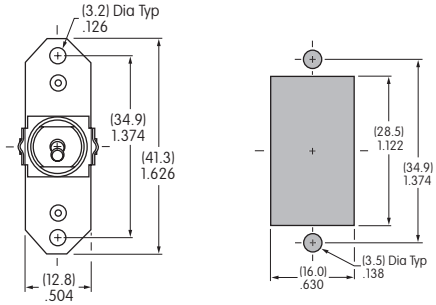
Using AT4148 & AT4149



Maximum Panel Thickness: .126" (3.2mm)

Y **Frame for Large Actuator**

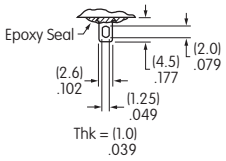
Using AT4156 & AT4157



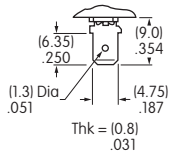
Maximum Panel Thickness: .126" (3.2mm)

TERMINALS

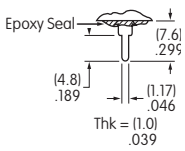
No Code **Solder Lug**

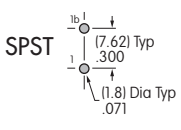


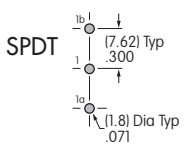
Z **.187" (4.75mm) Quick Connect**

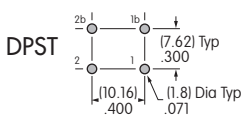


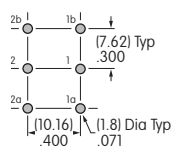
P **Straight PC**







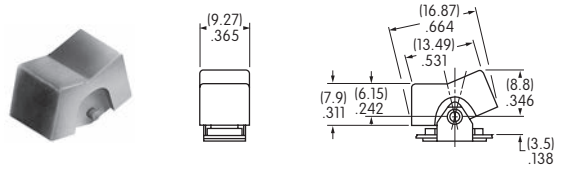




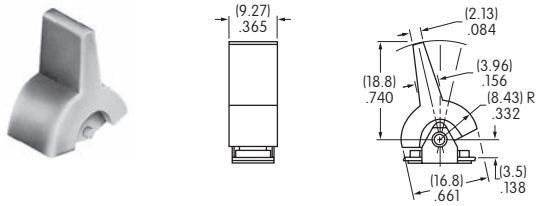
ROCKER/PADDLE CAPS

For N Frame

D **AT4148**
.365" (9.27mm) Wide Rocker

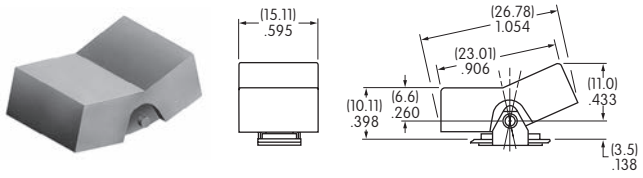


E **AT4149**
.365" (9.27mm) Wide Paddle

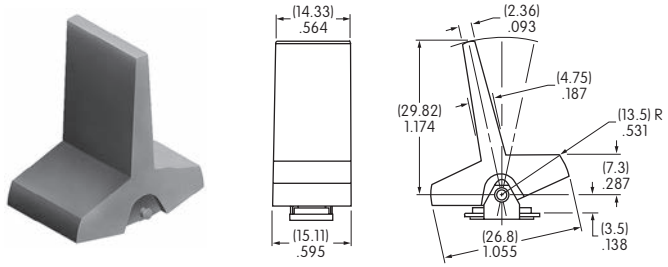


For Y Frame

J **AT4156**
.595" (15.11mm) Wide Rocker



H **AT4157**
.595" (15.11mm) Wide Paddle



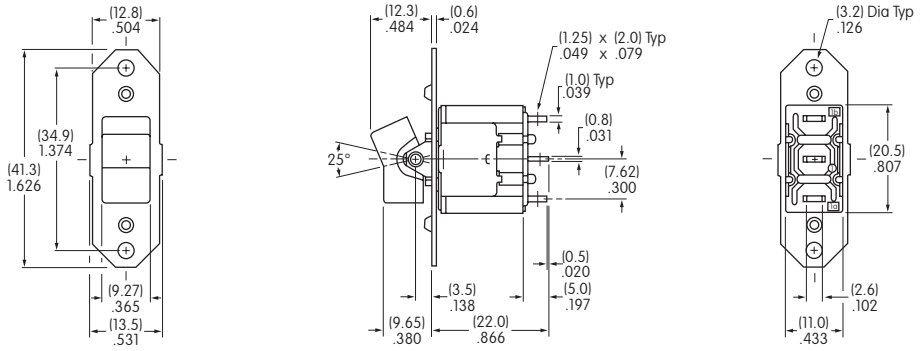
Cap Colors Available: **A** Black **B** White **C** Red **E** Yellow **F** Green **G** Blue **H** Gray

Material: Polyamide Finish: Matte

TYPICAL SWITCH DIMENSIONS

N Frame

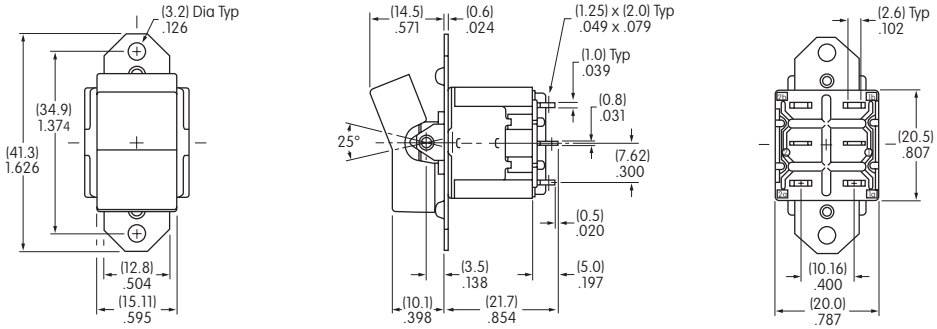
P2012N-DC



P2011 & P2021 models do not have terminals 1a & 2a.

Y Frame

P2022Y-JC



P2011 & P2021 models do not have terminals 1a & 2a.

GENERAL SPECIFICATIONS FOR SW3000s

Electrical Capacity (Resistive & Inductive Load)

Power Level: Shown in the following tables

Other Ratings

Contact Resistance: 10 milliohms maximum
Insulation Resistance: 1,000 megohms minimum @ 500V DC
Dielectric Strength: 2,000V AC minimum for 1 minute minimum
Mechanical Life: 30,000 operations minimum
Electrical Life: 10,000 operations minimum
Angle of Throw (α): Shown on drawings or following tables

Materials & Finishes

Rocker: Urea resin; all rockers are white.
Mounting Frame: Steel with chromate plating over zinc plating
Case Cover/Insulator: Phenolic resin
Case: Melamine phenol
Movable Contactor Plate: Copper with silver plating
Movable & Stationary Contacts: Silver alloy plus copper with silver plating
Terminals: Copper with tin plating

Environmental Data

Operating Temp Range: –10°C through +70°C (+14°F through +158°F)
Sealing: Dustproof cover of silicone rubber on SW3006A, SW3007A, & SW3008A

Installation

Maximum Panel Thickness: Shown with following drawings
Soldering Time & Temperature: Manual Soldering: See Profile A in Supplement section.

Standards & Certifications

UL: **File No. E44145 - Recognized only when ordered with marking on switch.**
Add "/U" or "/CUL" to end of part number to order UL recognized switch.
UL or cULus recognition designated beside part numbers on following pages.
See Supplement section to find UL or cULus rating details.

CSA: **File No. 023535_0_000 - Certified only when ordered with marking on switch.**
Add "/C" to end of part number to order CSA certified switch.
CSA certification designated beside part numbers on following pages.
See Supplement section to find CSA rating details.

VDE: **License No. 40028826 - Approved only when ordered with marking on switch.**
Add "/V" to end of part number to order VDE approved switch.
SW3006A at 20A @ 125V AC & 10A @ 250V AC

SINGLE POLE WITH SOLDER LUG

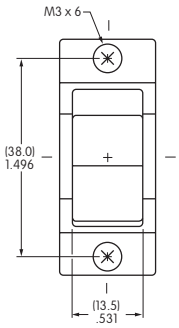
* UL & CSA recognized only when ordered with marking on switch (see General Specs)			Rocker Position/Connected Terminals						Electrical Capacity				
	*Approvals			Down		Center	Up		Resistive			Inductive	α =
Model			Pole						AC 125V	AC 250V	DC 30V	AC 125V PF 0.6	Angle of Throw
SW3001A	✓	✓	SPST	ON	1-3	NONE	OFF	—	15A	6A	15A	10A	24°
SW3002A	✓	✓	SPDT	ON	2-3	NONE	ON	2-1	15A	6A	15A	10A	24°
SW3003A	✓	✓	SPDT	ON	2-3	OFF	ON	2-1	15A	6A	15A	10A	28°

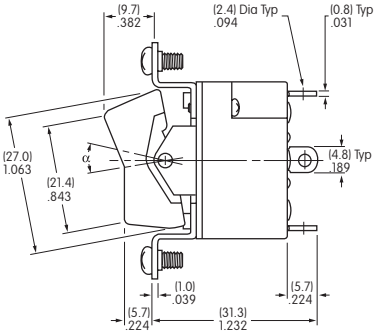
Throw & Schematics:

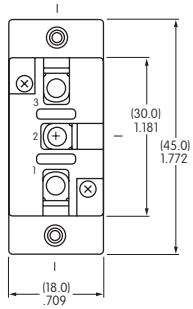
SPST

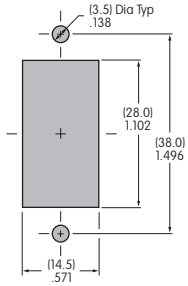
SPDT

Note: Terminal numbers are actually on the switch.









Maximum Effective Panel Thickness:
.197" (5.0mm) for SW3001A & SW3002A models; .177" (4.5mm) for SW3003A models

SW3001A does not have terminal 2.

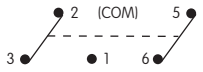
SW3001A

DOUBLE POLE WITH SOLDER LUG

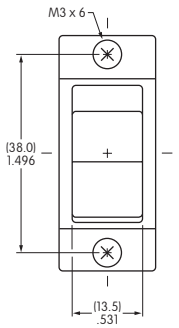
* UL, cULus & CSA recognized only when ordered with marking on switch (see General Specs)				Rocker Position/Connected Terminals ( ) = Momentary							Electrical Capacity				
	*Approvals				Down		Center	Up			Resistive			Inductive	α =
Model				Pole							AC 125V	AC 250V	DC 30V	AC 125V PF 0.6	Angle of Throw
SW3006A	✓	✓	✓	DPDT	ON	2-3 5-6	NONE	ON	2-1	5-4	20A	10A	20A	10A	24°
SW3007A	—	—	✓	DPDT	ON	2-3 5-6	OFF	ON	2-1	5-4	15A	6A	15A	10A	28°
SW3008A	—	—	—	DPDT	(ON)	2-3 5-6	OFF	(ON)	2-1	5-4	15A	6A	15A	10A	24°

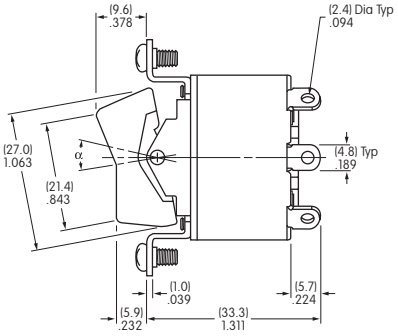
Throw & Schematic:

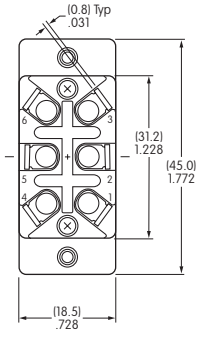
DPDT

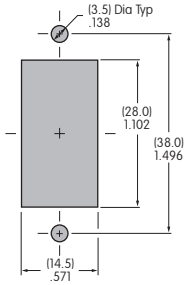


Note: Terminal numbers are actually on the switch.









Maximum Effective Panel Thickness:
.197" (5.0mm) for SW3006A & SW3008A models; .177" (4.5mm) for SW3007A models

SW3006A

GENERAL SPECIFICATIONS FOR SW3800s

Electrical Capacity (Resistive & Inductive Load)

Power Level: Shown in the following tables
Note: See Supplement section for details of design for inductive DC loads.

Other Ratings

Contact Resistance: 10 milliohms maximum
Insulation Resistance: 1,000 megohms minimum @ 500V DC
Dielectric Strength: 2,000V AC minimum for 1 minute minimum
Mechanical Life: 50,000 operations minimum
Electrical Life: 25,000 operations minimum
Angle of Throw: Shown on following drawings
Nominal Operating Force: 1,800 grams for SW3822
2,200 grams for SW3823 Off to On
800 grams for SW3823 On to Off

Materials & Finishes

Rocker: Urea resin; all rockers are white.
Mounting Frame: Steel with chromate plating over zinc plating
Case Cover/Insulator: Phenolic resin
Case: Melamine phenol
Movable Contacts: Copper with silver plating
Stationary Contacts: Silver alloy plus copper with silver plating
Terminals: Brass (terminal screws of brass with nickel plating)

Environmental Data

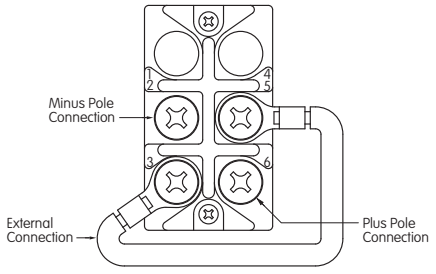
Operating Temp Range: –10°C through +70°C (+14°F through +158°F)

Standards & Certifications

UL: **File No. E44145 - Recognized only when ordered with marking on switch.**
Add "/U" or "/CUL" to end of part number to order UL recognized switch.
UL or cULus recognition designated beside part numbers on following pages.
See Supplement section to find UL or cULus rating details.

CSA: **File No. 023535_0_000 - Certified only when ordered with marking on switch.**
Add "/C" to end of part number to order CSA certified switch.
CSA certification designated beside part numbers on following pages.
See Supplement section to find CSA rating details.

Wiring for SW3821D with Electrical Capacity of DC400V 10A



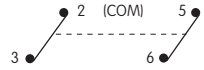
Contact Connection Position

DOUBLE POLE WITH SCREW LUG

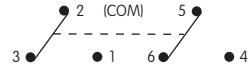
Model	*Approvals	Pole	Rocker Position/Connected Terminals: Down	Center	Up	Electrical Capacity: Resistive AC 125V	AC 250V	DC 30V	DC 48V	DC 125V	DC 250V	DC 400V	Inductive AC 125V PF 0.6	AC 250V PF 0.6
SW3821	✓ ✓ ✓	DPST	ON 2-3 5-6	NONE	OFF —	30A	30A	30A	—	1A	—	—	30A	15A
SW3822	✓ ✓ ✓	DPDT	ON 2-3 5-6	NONE	ON 2-1 5-4	30A	30A	30A	—	1A	—	—	30A	15A
SW3823	✓ ✓ ✓	DPDT	ON 2-3 5-6	OFF	ON 2-1 5-4	30A	30A	30A	—	1A	—	—	30A	15A
SW3821D	✓ ✓ ✓	DPST	ON 2-3 5-6	NONE	OFF —	—	—	30A	30A	20A	15A	4A (10A)	—	—
SW3822D	✓ ✓ ✓	DPDT	ON 2-3 5-6	NONE	ON 2-1 5-4	—	—	30A	30A	20A	15A	4A	—	—
SW3823D	✓ ✓ ✓	DPDT	ON 2-3 5-6	OFF	ON 2-1 5-4	—	—	30A	30A	15A	—	—	—	—

Throw & Schematics:

DPST



DPDT

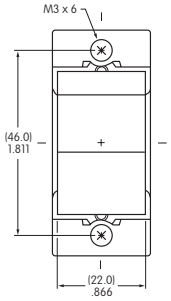


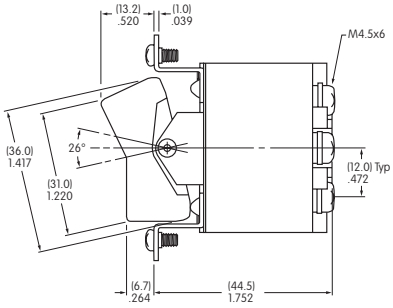
Note: Terminal numbers are actually on the switch.

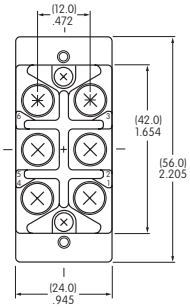
* UL/CUL & CSA for the following ratings: UL/CUL: 30A @ 30V DC, 15A @ 125V DC; CSA: 30A @ 30V DC, 15A @ 125V DC

*** UL, cULus & CSA recognized only when ordered with marking on switch (see General Specs)**

( ) capacity is due to series wiring, see General Specifications page.







SW3821 & SW3821D do not have terminals 1 & 4.

Maximum Effective Panel Thickness .177" (4.5mm). Panel cutout shown below.

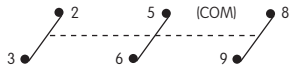
SW3822

THREE POLE WITH SCREW LUG

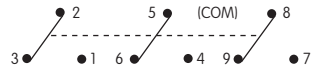
Model	*Approvals	Pole	Rocker Position/Connected Terminals: Down	Center	Up	Electrical Capacity: Resistive AC 125V	AC 250V	DC 30V	DC 125V	Inductive AC 125V PF 0.6	AC 250V PF 0.6
SW3831	✓ ✓ ✓	3PST	ON 2-3 5-6 8-9	NONE	OFF —	30A	30A	30A	1A	30A	15A
SW3832	✓ ✓ ✓	3PDT	ON 2-3 5-6 8-9	NONE	ON 2-1 5-4 8-7	30A	30A	30A	1A	30A	15A
SW3833	✓ ✓ ✓	3PDT	ON 2-3 5-6 8-9	OFF	ON 2-1 5-4 8-7	30A	30A	30A	1A	30A	15A
SW3831D	✓ ✓ ✓	3PST	ON 2-3 5-6 8-9	NONE	OFF —	—	—	30A	15A	—	—
SW3832D	✓ ✓ ✓	3PDT	ON 2-3 5-6 8-9	NONE	ON 2-1 5-4 8-7	—	—	30A	15A	—	—
SW3833D	✓ ✓ ✓	3PDT	ON 2-3 5-6 8-9	OFF	ON 2-1 5-4 8-7	—	—	30A	15A	—	—

Throw & Schematics:

3PST



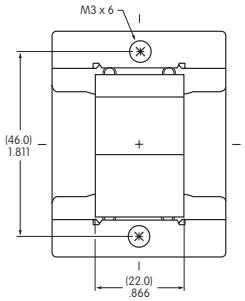
3PDT

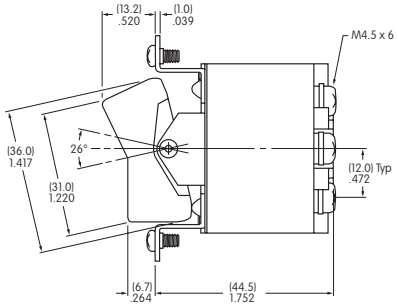


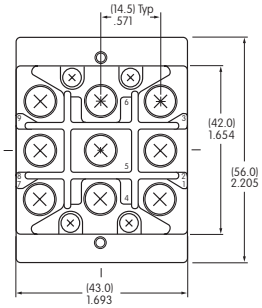
Note: Terminal numbers are actually on the switch.

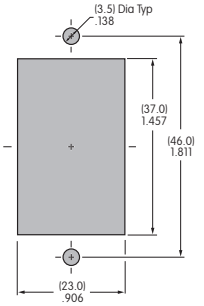
* UL/CUL & CSA for the following ratings: UL/CUL: 30A @ 30V DC, 15A @ 125V DC; CSA: 30A @ 30V DC, 15A @ 125V DC

*** UL, cULus & CSA recognized only when ordered with marking on switch (see General Specs)**









SW3831 & SW3831D do not have terminals 1, 4 & 7.

Maximum Effective Panel Thickness .177" (4.5mm)

General Specifications

Electrical Capacity (Resistive Load)

Power Level: 15A @ 125/250V AC or 15A @ 30V DC

Other Ratings

Contact Resistance: 10 milliohms maximum for solder lug, screw & quick connect terminal models
30 milliohms maximum for wire lead terminal models
Insulation Resistance: 200 megohms minimum @ 500V DC
Dielectric Strength: 1,250V AC minimum between contacts for 1 minute minimum
3,750V AC minimum between contacts & case for 1 minute minimum
Mechanical Life: 30,000 operations minimum
Electrical Life: 15,000 operations minimum for circuit 11 and 12 models
10,000 operations minimum for circuit 13, 15, 18, 19 models
Angle of Throw: 24°

Materials & Finishes

Rocker: Phenylene oxide
Outer Housing: Polyamide (UL94V-0)
Inner Case: Melamine (UL94V-0)
Cover for Wire Lead Models: Glass fiber reinforced polyamide (UL94V-0)
Flange Gasket: Nitrile butadiene rubber
Movable Contactor: Copper with silver plating
Movable Contacts: Silver alloy plus copper with silver plating
Stationary Contacts: Silver alloy plus copper with silver plating
Terminals: Brass with tin plating
Wire Lead Covers: Heat resistant polyvinyl chloride (Leads are AWG 14)

Environmental Data

Operating Temp Range: –25°C through +85°C (–13°F through +185°F)
Humidity: 90 ~ 95% humidity for 96 hours @ 40°C (104°F)
Vibration: 10 ~ 55Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in 1 minute; 3 right angled directions for 2 hours
Shock: 50G (490m/s^2) acceleration (tested in 6 right angled directions, with 5 shocks in each direction)
Front Panel Seal: IP67 of IEC60529, dust tight & water protected during temporary immersion for all models
Behind Panel Seal: IP60 of IEC60529, dust tight but not water protected for solder lug, screw & quick connect models
IP67 of IEC60529, dust tight & water protected during temporary immersion for wire lead models

Installation

Soldering Time & Temp: Manual Soldering: See Profile A in Supplement section.
Cleaning: Hand clean locally using alcohol based solution.

Standards & Certifications

Flammability Standards: UL94V-0 outer housing, inner case, & outer cover on wire lead models
UL: **File No. E44145 - Recognized only when ordered with marking on switch.**
Add "/U" or "/CUL" to end of part number to order UL recognized switch.
All models approved at 15A @ 125/250V AC & 15A @ 30V DC.
VDE: **License No. 40028806 - Approved only when ordered with marking on switch.**
Add "/V" to end of part number to order VDE approved switch.
All models approved at 15A @ 250V AC (pending for quick connect).
EN: **No. 61058-1**
WR11 & WR12 models meet European Norm for 3mm contact gap to prevent contact welds.
Wiring Material Standards: UL AWM 1015 Recognized at Flammability VW-1.
Temperature Range –20°C ~ +105°C; Maximum Load 600V; AWG 14.
CSA TEW 105 Certified at Temperature Range –20°C ~ +105°C; Maximum Load 600V.

Distinctive Characteristics

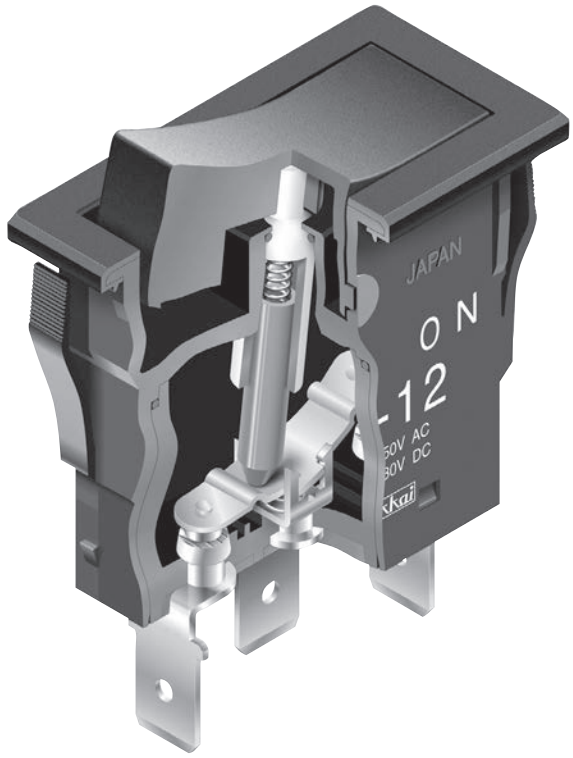
Single unit construction of the flange and outer housing gives added protection from environmental elements.

Specially designed contact mechanism for breaking light welds.

Minimal contact bounce achieved with specially designed interlocked switching mechanism.

Heat resistant resin used for outer housing, inner case, and cover on wire lead models meets UL94V-0 flammability standard and provides high arc and tracking resistance.

Available with solder lug, screw, quick connect, and wire lead terminations.



Sealed Construction Meets IP60 & IP67 Standards

Solder lug, screw, and quick connect terminal models meet IP67 of IEC60529 Standards at front panel (dust tight and water protected for temporary immersion, patent pending). Behind panel standard is IP60 (dust tight but not water protected).

Wire lead models conform fully to IP67 of IEC60529 Standards at front and behind panel (dust tight and water protected for temporary immersion). Switch base is epoxy sealed and covered by an outer case for further protection from dust and water. (Switches cannot be operated under water. Contact factory for further details regarding operating environment.)

Actual Size

TYPICAL SWITCH ORDERING EXAMPLE

WR | 1 | 2 | B | S

Poles

1	SPST SPDT

Circuits

1	ON	NONE	OFF
2	ON	NONE	ON
3	ON	OFF	ON
5	ON	NONE	(ON)
8	(ON)	OFF	(ON)
9	ON	OFF	(ON)

( ) = Momentary

Rockers

A	Black
* B	Ivory

* Contact Factory for Quick Connect with Ivory Rocker

Terminals

S	Solder Lug with Epoxy Seal
SN	Solder Lug without Epoxy Seal
T	Screw Lug with Epoxy Seal
TN	Screw Lug without Epoxy Seal
F	.250" (6.35mm) Quick Connect with Epoxy Seal
FN	.250" (6.35mm) Quick Connect without Epoxy Seal
L	Wire Lead

IMPORTANT:

Switches are supplied without UL, cULus & VDE marking unless specified. **UL, cULus & VDE recognized only when ordered with marking on the switch.** Specific models, ratings and ordering instructions are noted on the General Specifications page.

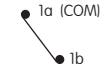
DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

WR12BS

POLES & CIRCUITS

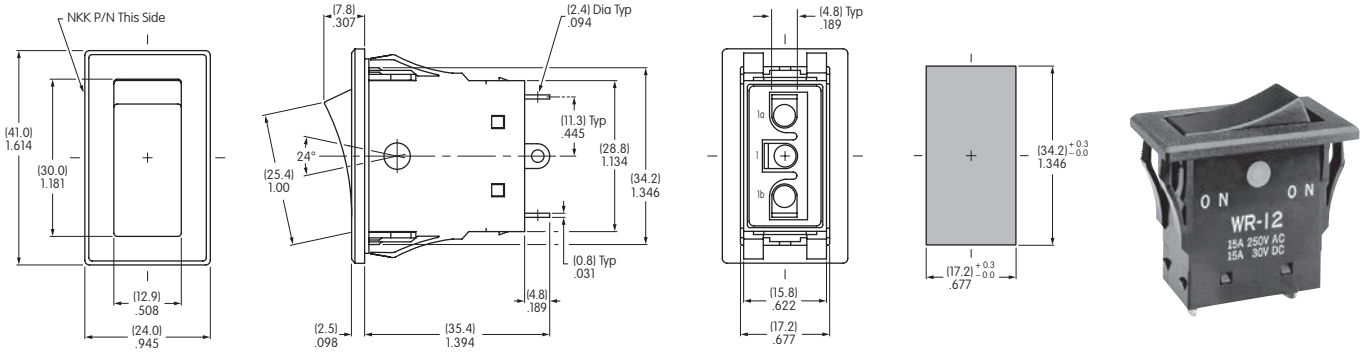
Pole	Model	Rocker Position ( ) = Momentary: Down	Center	Up	Connected Terminals: Down	Center	Up	Throw & Schematics
SP	**WR11**	ON	NONE	OFF	1a-1b	OPEN	OPEN	SPST
SP	**WR12** **WR13** **WR15** **WR18** **WR19**	ON ON ON (ON) ON	NONE OFF NONE OFF OFF	ON ON (ON) (ON) (ON)	1-1b	OPEN	1-1a	SPDT

Note: Terminal numbers are not actually on wire lead models.



TYPICAL SWITCH DIMENSIONS

Solder Lug Terminals

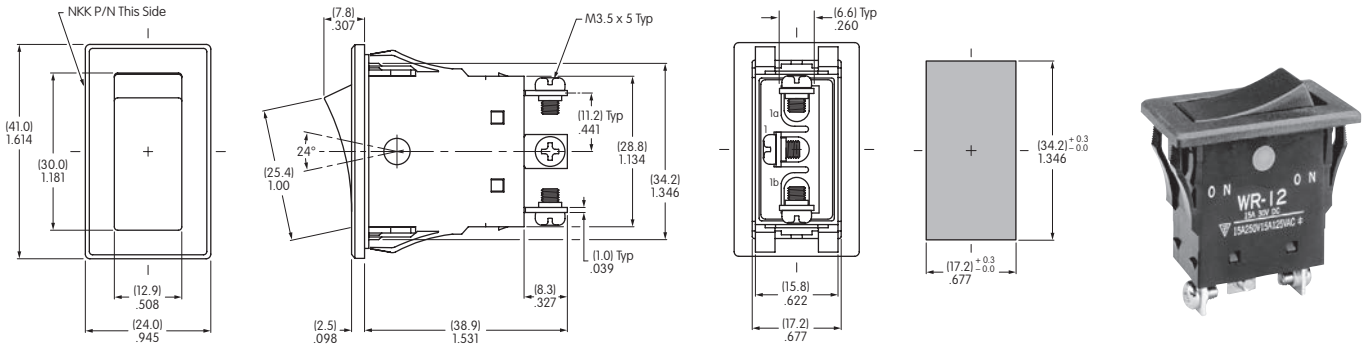


WR11 model does not have terminal 1.

Panel Thickness
.039" ~ .157"
(1.0mm ~ 4.0mm)

WR12AS

Screw Lug Terminals



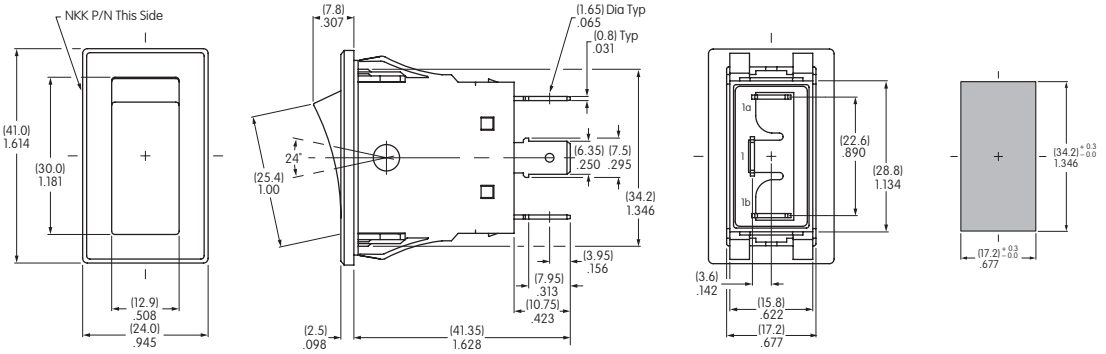
WR11 model does not have terminal 1.

Panel Thickness
.039" ~ .157"
(1.0mm ~ 4.0mm)

WR12AT

TYPICAL SWITCH DIMENSIONS

.250" (6.35mm) Quick Connect Terminals

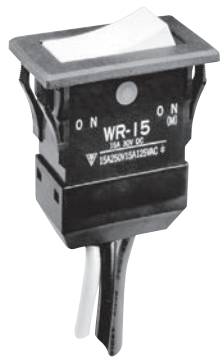


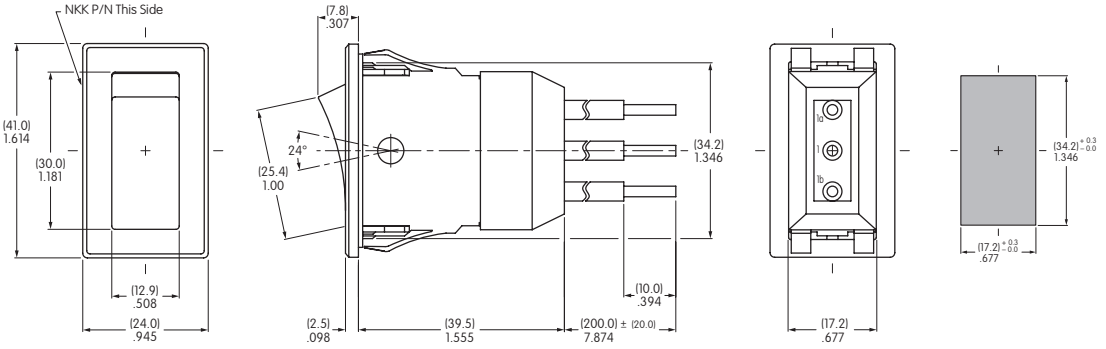
WR13AF

WR11 model does not have terminal 1.

Panel Thickness
.039" ~ .157"
(1.0mm ~ 4.0mm)

Wire Lead Terminals





WR15BL

WR11 model does not have terminal 1.

Panel Thickness
.039" ~ .157"
(1.0mm ~ 4.0mm)

STANDARD WIRE COLOR SCHEME

Wire leads are covered with heat resistant vinyl in accordance with UL 1015 and CSA TEW 105 Standards for Appliance Wiring Material (AWM).

Terminal Numbers & Wire Colors			
	1a	1	1b
WR11	Black		White
WR12-19	White	Black	Red

Notes

NKK SWITCHES

Pushbuttons

Contents Pushbuttons

AB Series C6
0.4VA Logic Level; Process Sealed
Straight, Right Angle, & Vertical PC

BB Series C12
Antistatic; 0.4VA Logic Level; Process Sealed
Straight, Right Angle, & Vertical PC

DB Series C18
0.4VA Logic Level
Threaded Bushing with Straight PC
Smooth Bushing with Straight, Right Angle, & Vertical PC

EB Series C24
3A Power Level & 0.4VA Logic Level
Solder Lug & Straight PC
Bushing Mount

EB Series C30
3A Power Level
Solder Lug & Straight PC
Snap-in Mount

FB Series C38
500mA Power Level & 0.4VA Logic Level
PC Turret
Bushing Mount

GB Series C44

0.4VA Logic Level; Process Sealed
Straight, Right Angle, & Vertical PC

GB2 Series C48

0.4VA Logic Level
Straight & Right Angle PC

G3B Series C52

0.4VA Logic Level; Process Sealed
Gull Wing Terminals
Upright & Right Angle Mount

JP Series C58

10A or 16A Power Level
Solder Lug
Snap-in Mount

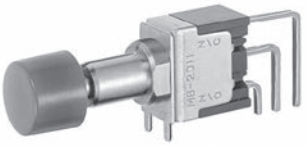
M2B Series C64

1A Power Level & 0.4VA Logic Level
Process Sealed
Straight, Right Angle, & Vertical PC

MB2000 Series C72

6A Power Level & 0.4VA Logic Level
Solder Lug, Quick Connect, Straight PC, & Wirewrap
Bushing Mount

Contents Pushbuttons



MB2000 Series C80
6A Power Level & 0.4VA Logic Level
Straight, Right Angle, & Vertical PC
PCB Mount

MB2000 Series C87
6A Power Level & 0.4VA Logic Level
Solder Lug, Quick Connect, Straight PC, & Wirewrap
Large Bushing (12mm)

MB2400 Series C96
3A Power Level & 0.4VA Logic Level
Solder Lug, Straight PC, & Wirewrap
Bushing Mount

MB2400 Series C102
3A Power Level & 0.4VA Logic Level
Straight, Right Angle, & Vertical PC
PCB Mount

MB2400 Series C108
3A Power Level & 0.4VA Logic Level
Solder Lug, Straight PC, & Wirewrap
Snap-in Mount

MB2500 Series C116
3A Power Level & 0.4VA Logic Level
Solder Lug & Straight PC
Bushing Mount

MB2500 Series C121

3A Power Level & 0.4VA Logic Level
Solder Lug & Straight PC
PCB Mount

MB2500 Series C124

3A Power Level & 0.4VA Logic Level
Solder Lug
Snap-in Mount

SB Series C128

3A to 15A Power Level
Solder Lug & Screw Lug
Bushing Mount

SB4011 Series C38

3A Power Level
Solder Lug
Bushing Mount

SCB Series.....C131

15A & 1/2 HP Power Level
Quick Connect
Bushing Mount

WB Series C134

Environmentally Sealed
6A Power Level
Solder Lug, Screw Lug, & Wire Lead
Bushing Mount

General Specifications

Electrical Capacity (Resistive Load)

Logic Level: 0.4VA maximum @ 28V AC/DC maximum
(Applicable Range 0.1mA ~ 0.1A @ 20mV ~ 28V)
Note: Find additional explanation of operating range in Supplement section.

Other Ratings

Contact Resistance: 50 milliohms maximum
Insulation Resistance: 500 megohms minimum @ 500V DC
Dielectric Strength: 500V AC minimum for 1 minute minimum
Mechanical Life: 50,000 operations minimum
Electrical Life: 50,000 operations minimum
Nominal Operating Force: 2.55N
Contact Timing: Nonshorting (break-before-make)
Travel: Pretravel .028" (0.7mm); Overtravel .016" (0.4mm); Total Travel .043" (1.1mm)

Materials & Finishes

Plunger: Polyacetal
Case Housing: Glass fiber reinforced polyamide
Support Bracket: Tin plated phosphor bronze
Movable Contact: Phosphor bronze with gold plating
Stationary Contacts: Brass with gold plating
Terminals: Brass with gold plating

Environmental Data

Operating Temp Range: –30°C through +85°C (–22°F through +185°F)
Humidity: 90 ~ 95% humidity for 96 hours @ 40°C (104°F)
Vibration: 10 ~ 55Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in 1 minute; 3 right angled directions for 2 hours
Shock: 50G (490m/s^2) acceleration (tested in 6 right angled directions, with 5 shocks in each direction)

Installation

Cap Installation Force: 49.03N (11.2 lbf) maximum downward force on actuator

PCB Processing

Soldering: Wave Soldering Recommended: See Profile A in Supplement section.
Manual Soldering: See Profile B in Supplement section.
Cleaning: Automated cleaning. See Cleaning specifications in Supplement section.

Standards & Certifications

The AB Series pushbuttons have not been tested for UL recognition or CSA certification.
These switches are designed for use in a low-voltage, low-current, logic-level circuit.
When used as intended in a logic-level circuit, the results do not produce hazardous energy.

Distinctive Characteristics

Subminiature size (1/3 size of Series M switches) saves space on PC boards.

Specifically developed for logic-level applications.

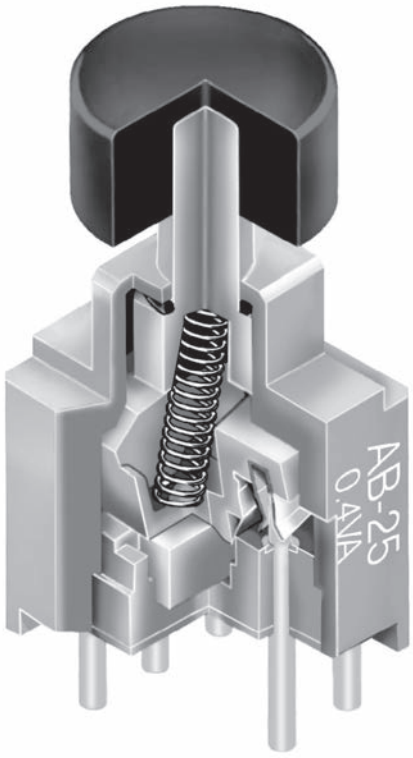
Totally sealed body construction prevents contact contamination and allows time- and money-saving automated soldering and cleaning.

Award-winning STC contact mechanism with benefits unavailable in conventional mechanisms: smoother, positive detent actuation, increased contact stability and unparalleled logic-level reliability. (Additional STC details in Terms & Acronyms; see Supplement section.)

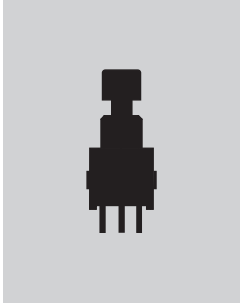
Molded-in, epoxy sealed or ultrasonically welded terminals lock out flux, solvents, and other contaminants.

.100" x .100" (2.54mm x 2.54mm) terminal spacing conforms to standard PC board grid spacing.

Matching indicators available.



Actual Size



TYPICAL SWITCH ORDERING EXAMPLE

AB 2 5 A P – H A

Poles

1	SPST SPDT
2	DPDT

Circuits

1	OFF	(ON)
5	ON	(ON)
( ) = Momentary		

PC Terminals

P	Straight
B	Straight with Bracket
B1	Straight with Inline Bracket (SP only)
H	Right Angle with Bracket
V	Vertical with Bracket
V1	Vertical with Inline Bracket (SP only)

Plungers

A	.213″ (5.4mm) Long
*B	.183″ (4.65mm) Long
*C	.080″ (2.03mm) Long (cannot be used with cap)
* Available in single pole only	

Caps

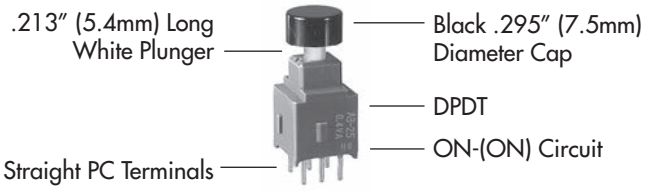
F	.201″ (5.1mm) Diameter
H	.295″ (7.5mm) Diameter

Cap Colors

A	Black
B	White
C	Red

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

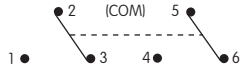
AB25AP-HA



POLES & CIRCUITS

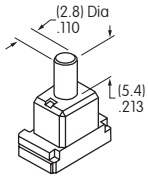
Pole	Model	Plunger Position ( ) = Momentary: Normal (Slot)	Plunger Position: Down	Connected Terminals: Normal (Slot)	Connected Terminals: Down	Throw & Schematics
SP	**AB11**	OFF	(ON)	OPEN	3-1	SPST
SP	**AB15**	ON	(ON)	2-3	2-1	SPDT
DP	**AB25**	ON	(ON)	2-3 5-6	2-1 5-4	DPDT

Note: Terminal numbers are not actually on the switch.

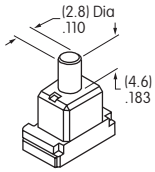


PLUNGERS

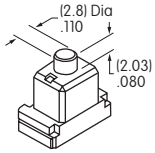
A **.213" (5.4mm) Long**



B **.183" (4.6mm) Long (on SP only)**



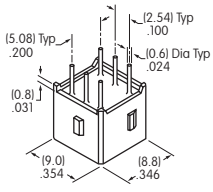
C **.080" (2.03mm) Long (on SP only)**



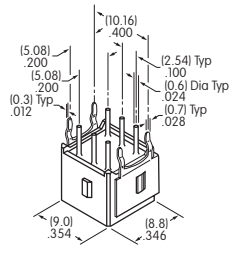
Standard Plunger Color: White Contact factory for red or black options.

PC TERMINALS

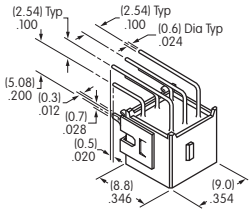
P **Straight**



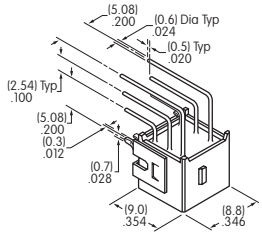
B **Straight with Bracket**



H **Right Angle with Bracket**



V **Vertical with Bracket**



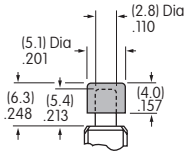
Use of a support bracket is recommended to increase PCB mounting strength and stability.
B1 & V1 terminal dimensions appear on the pushbutton drawings which follow.

SLIP-ON CAPS

F **AT475**
.201" (5.1mm) Diameter Cap

Material: Polyamide

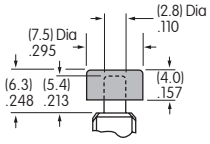
For use with plungers A & B only.



H **AT496**
.295" (7.5mm) Diameter Cap

Material: Polyamide

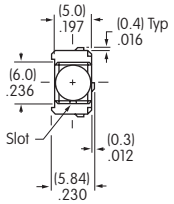
For use with plungers A & B only.

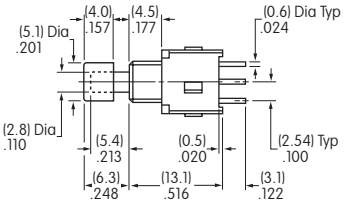


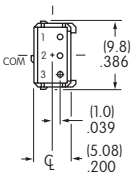
Colors Available: **A** Black **B** White **C** Red

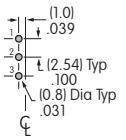
TYPICAL SWITCH DIMENSIONS

Straight PC — Single Pole





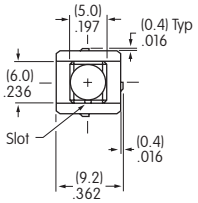


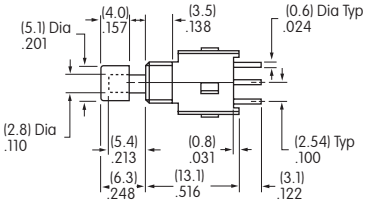


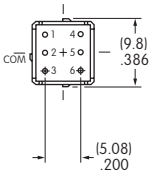
AB15AP-FA

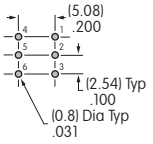
AB11 model does not have terminal 2.

Straight PC — Double Pole



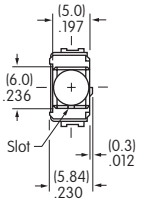


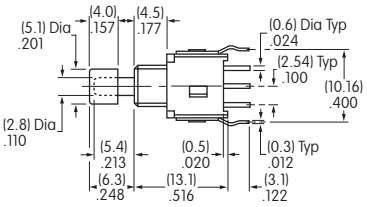


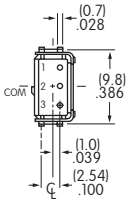


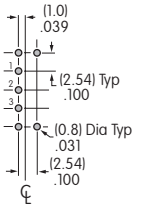
AB25AP-FA

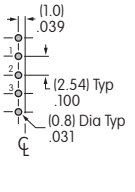
Straight PC • Bracket — Single Pole







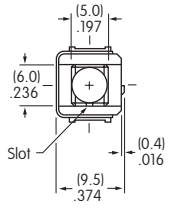


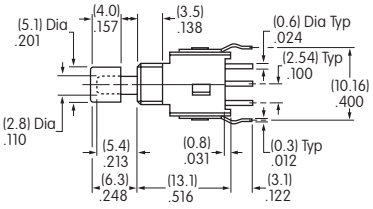


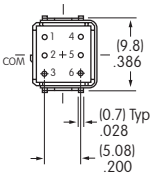
AB15AB-FA

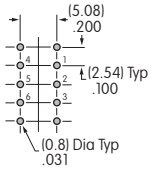
B Terminals B1 Terminals

Straight PC • Bracket — Double Pole



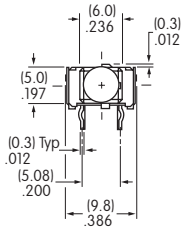


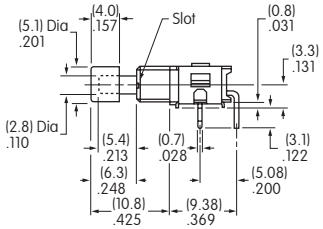


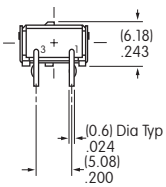


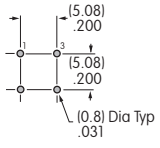
AB25AB-FA

Right Angle PC — Single Pole (Single Throw)





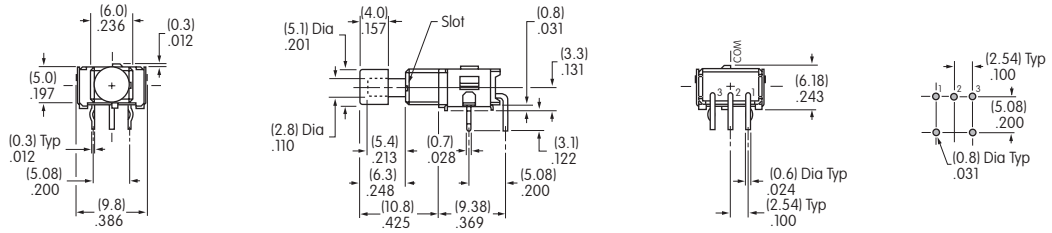




AB11AH-FA

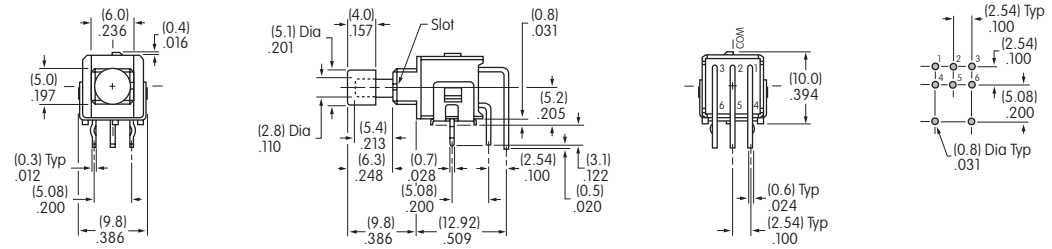
TYPICAL SWITCH DIMENSIONS

Single Pole (Double Throw) — Right Angle PC



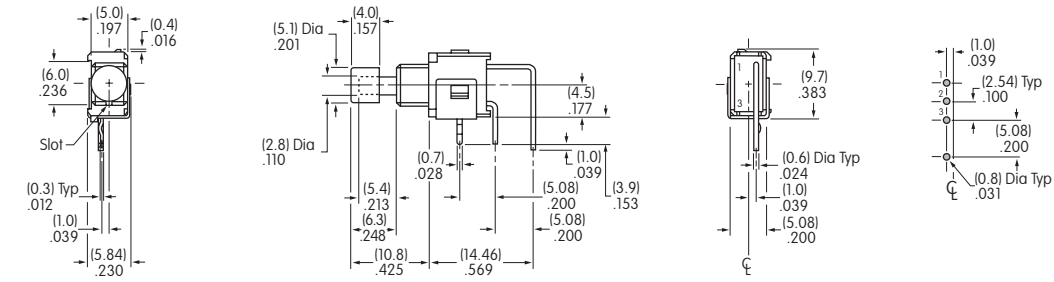
AB15AH-FA

Double Pole — Right Angle PC



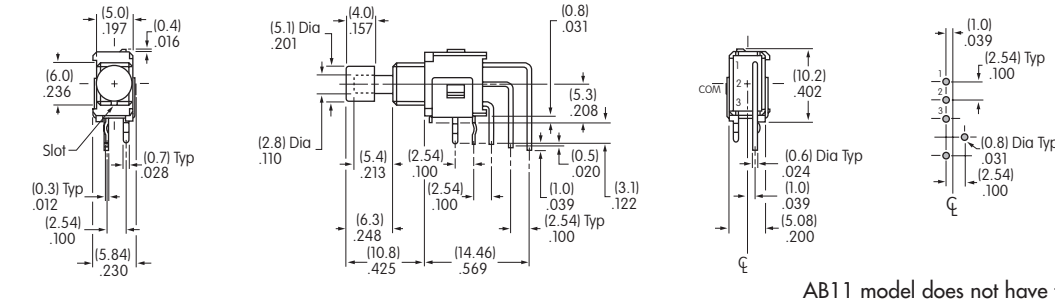
AB25AH-FA

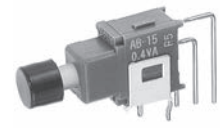
Single Pole — Vertical PC • Inline Bracket



AB11 model does not have terminal 2. **AB11AV1-FA**

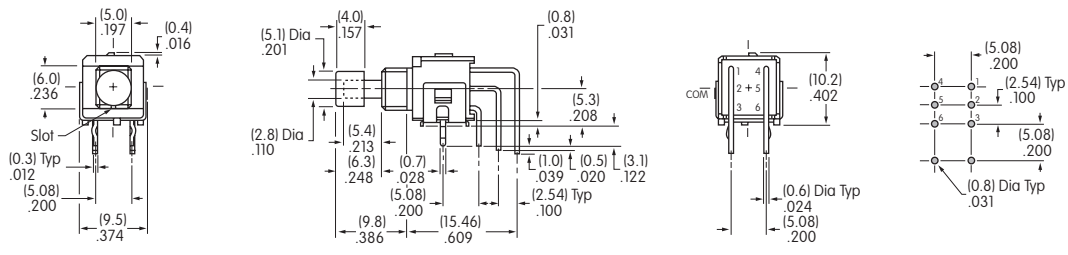
Single Pole — Vertical PC

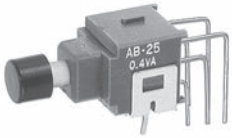




AB11 model does not have terminal 2. **AB15AV-FA**

Double Pole — Vertical PC





AB25AV-FA

General Specifications

Electrical Capacity (Resistive Load)

Logic Level: 0.4VA maximum @ 28V AC/DC maximum
(Applicable Range 0.1mA ~ 0.1A @ 20mV ~ 28V)
Note: Find additional explanation of operating range in Supplement section.

Other Ratings

Contact Resistance: 50 milliohms maximum
Insulation Resistance: 500 megohms minimum @ 500V DC
Dielectric Strength: 500V AC minimum for 1 minute minimum
Mechanical Life: 50,000 operations minimum (momentary)
25,000 operations minimum (alternate action)
Electrical Life: 50,000 operations minimum (momentary)
25,000 operations minimum (alternate action)
Nominal Operating Force: 2.55N (momentary); 2.94N (alternate action)
Contact Timing: Nonshorting
Travel: Momentary: Pretravel .028" (0.7mm); Overtravel .016" (0.4mm); Total Travel .043" (1.1mm)
Alternate: Pretravel .039" (1.0mm); Overtravel .039" (1.0mm); Total Travel .079" (2.0mm)

Materials & Finishes

Plunger: Polyacetal
Bushing: Carbon blended polyamide
Case Housing: Glass fiber reinforced polyamide
Support Bracket: Tin plated phosphor bronze
Movable Contact: Phosphor bronze with gold plating
Stationary Contacts: Copper alloy with gold plating
Terminals: Copper alloy with gold plating

Environmental Data

Operating Temp Range: –30°C through +85°C (–22°F through +185°F)
Humidity: 90 ~ 95% humidity for 96 hours @ 40°C (104°F)
Vibration: 10 ~ 55Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in 1 minute; 3 right angled directions for 2 hours
Shock: 50G (490m/s^2) acceleration (tested in 6 right angled directions, with 5 shocks in each direction)

Installation

Cap Installation Force: 49.03N (11.2 lbf) maximum downward force on actuator;
actuator must be in UP position to remove cap from alternate action models

PCB Processing

Soldering: Wave Soldering Recommended: See Profile A in Supplement section.
Manual Soldering: See Profile B in Supplement section.
Cleaning: Automated cleaning. See Cleaning specifications in Supplement section.

Standards & Certifications

Flammability Standards: UL94V-0 available
The BB Series pushbuttons have not been tested for UL recognition or CSA certification.
These switches are designed for use in a low-voltage, low-current, logic-level circuit.
When used as intended in a logic-level circuit, the results do not produce hazardous energy.

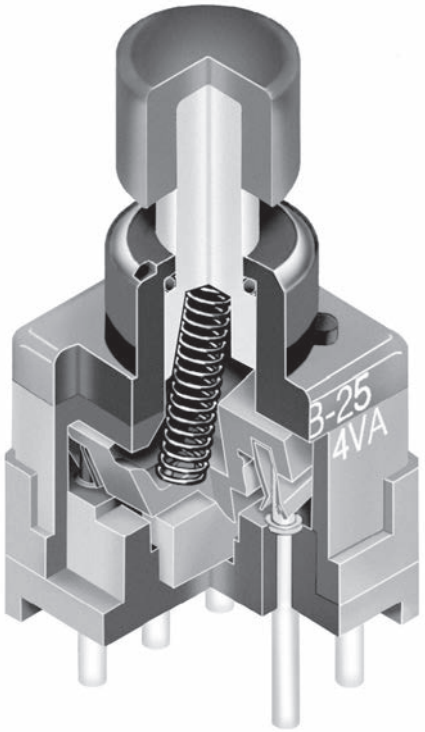
Distinctive Characteristics

Subminiature size (1/3 size of Series M switches) saves space on PC boards.

Specifically developed for logic-level applications.

Available in momentary and maintained circuits.

Industry's smallest alternate action (maintained) pushbutton with latchdown feature providing visible, audible, and tactile feedback.



Antistatic superstructure, consisting of the carbon impregnated bushing and the support bracket, prevents static discharge to the contacts. Static electricity from an operator's touch travels from the actuator through the bushing and bracket to the PC board.

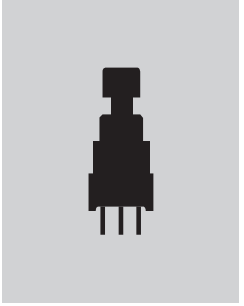
Award-winning STC contact mechanism with benefits unavailable in conventional mechanisms: smoother, positive detent actuation, increased contact stability and unparalleled logic-level reliability. (Additional STC details in Terms & Acronyms; see Supplement section.)

Smooth, 6mm diameter bushing simplifies panel layout.

Totally sealed body construction prevents contact contamination and allows time- and money-saving soldering and cleaning.

.100" x .100" (2.54mm x 2.54mm) terminal spacing conforms to standard PC board grids.

Actual Size



TYPICAL SWITCH ORDERING EXAMPLE

BB [1] [5] [A] [H] — [F] [A]

Poles

1	SPDT
2	DPDT

Circuits

5	ON		(ON)
( ) = Momentary			
6	ON		ON

Alternate Action has Latchdown.
BB16 has a Double Pole case.

PC Terminals

P	Straight
*B	Straight with Bracket
*H	Right Angle with Bracket
*V	Vertical with Bracket
W	Straight Long

* Bracketed models are ESD protected

Plunger

A	.213″ (5.4mm) Long

Caps

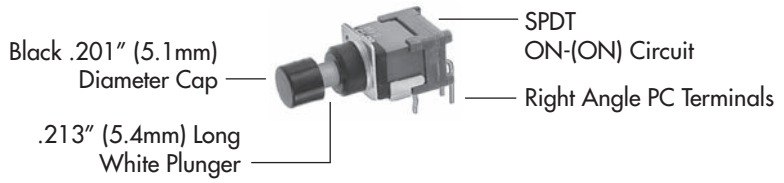
F	.201″ (5.1mm) Diameter
H	.295″ (7.5mm) Diameter

Cap Colors

A	Black
B	White
C	Red

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

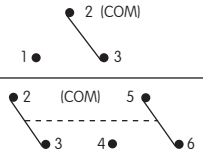
BB15AH-FA



POLES & CIRCUITS

Pole	Model	Plunger Position ( ) = Momentary: Normal (Slot)	Plunger Position ( ) = Momentary: Down	Connected Terminals: Normal (Slot)	Connected Terminals: Down	Throw & Schematics
SP	**BB15** **BB16**	ON ON	(ON) ON	2-3	2-1	SPDT
DP	**BB25** **BB26**	ON ON	(ON) ON	2-3 5-6	2-1 5-4	DPDT

Note: Terminal numbers are not actually on the switch.



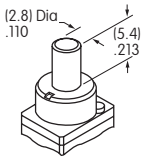
PLUNGERS

A **.213" (5.4mm) Long**

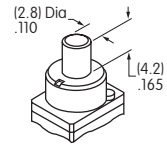
Standard Plunger Color: White

Contact factory for other colors and lengths.

Normal Position



Latchdown Position



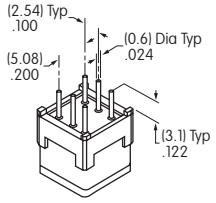
PC TERMINALS

Use of a support bracket is recommended to increase PCB mounting strength and stability.

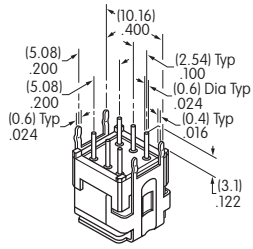
Both single pole and double pole alternate action models have double pole bases.

See Typical Switch Dimensions for details.

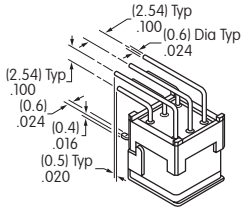
P **Straight**



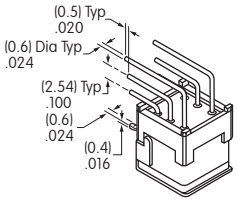
B **Straight with Bracket**



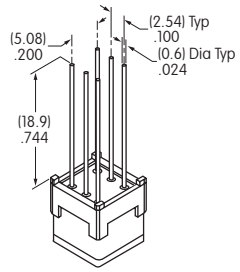
H **Right Angle with Bracket**



V **Vertical with Bracket**



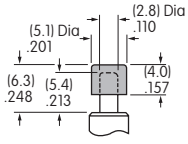
W **Straight Long**



SLIP-ON CAPS

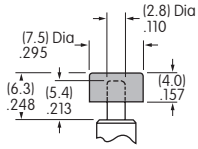
F **AT475**
.201" (5.1mm) Diameter Cap

Material: Polyamide



H **AT496**
.295" (7.5mm) Diameter Cap

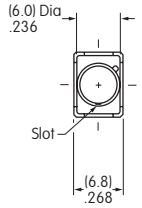
Material: Polyamide

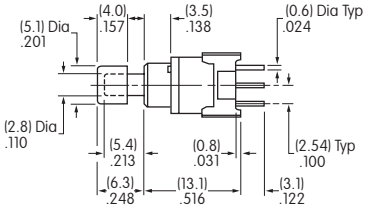


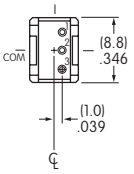
Colors Available: **A** Black **B** White **C** Red

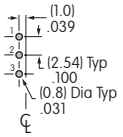
TYPICAL SWITCH DIMENSIONS

Straight PC — Single Pole





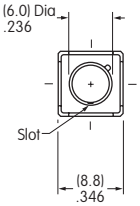


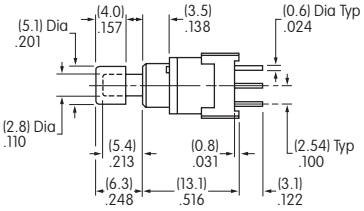


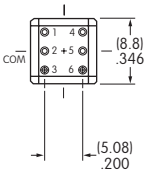
BB15AP-FA

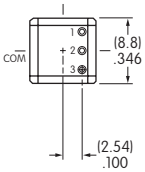
Momentary

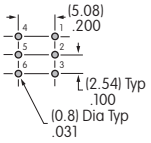
Straight PC — Double Pole — BB16AP

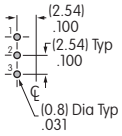










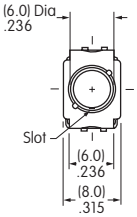


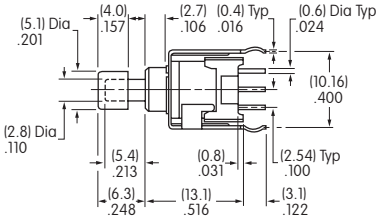
BB25AP-FA

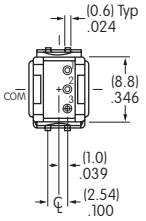
Momentary & Alternate

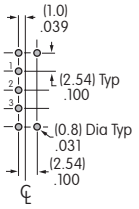
Alternate

Straight PC • Bracket — Single Pole





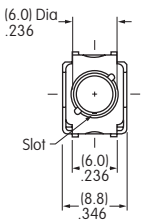


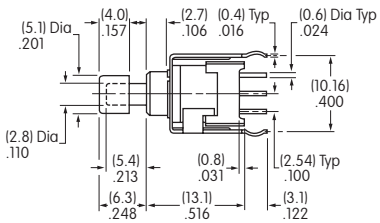


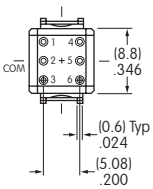
BB15AB-FA

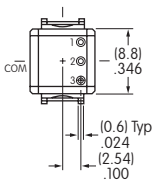
Momentary

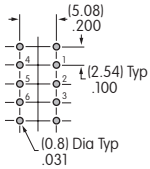
Straight PC • Bracket — Double Pole — BB16AB

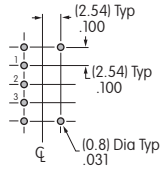












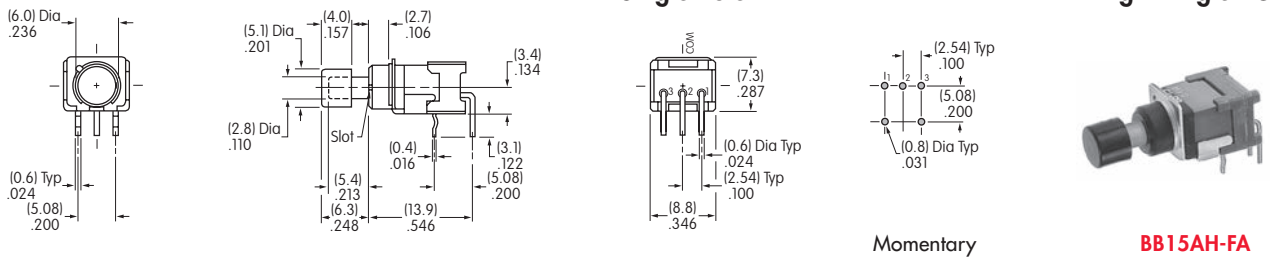
BB25AB-FA

Momentary & Alternate

Alternate

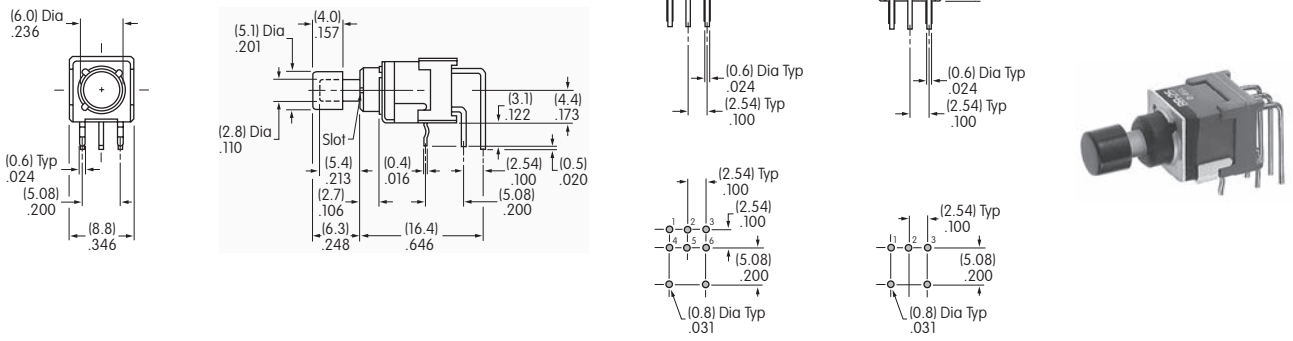
TYPICAL SWITCH DIMENSIONS

Single Pole — Right Angle PC



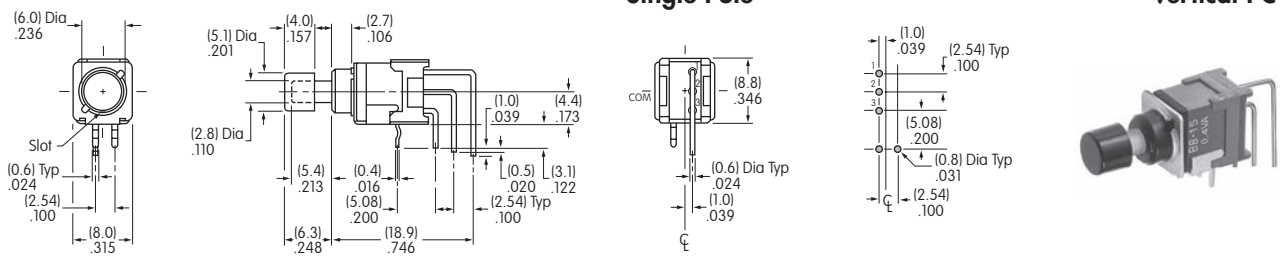
Momentary — **BB15AH-FA**

Double Pole — BB16AH — Right Angle PC



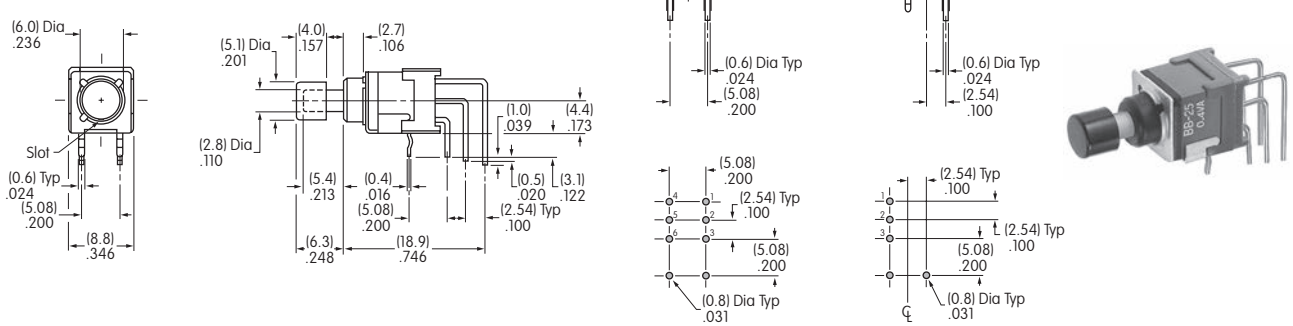
Momentary & Alternate — Alternate — **BB25AH-FA**

Single Pole — Vertical PC



Momentary — **BB15AV-FA**

Double Pole — BB16AV — Vertical PC



Momentary & Alternate — Alternate — **BB25AV-FA**

General Specifications

Electrical Capacity (Resistive Load)

Logic Level: 0.4VA maximum @ 28V AC/DC maximum
(Applicable Range 0.1mA ~ 0.1A @ 20mV ~ 28V)
Note: Find additional explanation of operating range in Supplement section.

Other Ratings

Contact Resistance: 50 milliohms maximum
Insulation Resistance: 1,000 megohms minimum @ 500V DC
Dielectric Strength: 1,000V AC minimum between contacts for 1 minute minimum;
1,500V AC minimum between contacts & case for 1 minute minimum
Mechanical Life: 200,000 operations minimum
Electrical Life: 100,000 operations minimum
Nominal Operating Force: Single Pole: 1.96N
Double Pole: 2.94N
Travel: Pretravel .020" (0.5mm); Overtravel .020" (0.5mm); Total Travel .039" (1.0mm)

Materials & Finishes

Plunger: Brass with nickel plating
Bushing: Brass with nickel plating
Frame: Stainless steel
Case: Glass fiber reinforced polyamide
Movable Contacts: Copper with gold plating
Stationary Contacts: Phosphor bronze with gold plating
Terminals: Brass with gold plating

Environmental Data

Operating Temp Range: –10°C through +70°C (+14°F through +158°F)
Humidity: 90 ~ 95% humidity for 96 hours @ 40°C (104°F)
Vibration: 10 ~ 55Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in 1 minute; 3 right angled directions for 2 hours
Shock: 50G (490m/s^2) acceleration (tested in 6 right angled directions, with 5 shocks in each direction)

Installation

Mounting Torque: 1.47Nm (13.0 lb•in) for double nut; 0.68Nm (6.0 lb•in) for single nut
Cap Installation Force: 78.5N (17.65 lbf) maximum downward force on actuator

PCB Processing

Soldering: Wave Soldering Recommended. See Profile A in Supplement section.
Manual Soldering: See Profile B in Supplement section.
Cleaning: These devices are not process sealed. Hand clean locally using alcohol based solution.

Standards & Certifications

The DB Series pushbuttons have not been tested for UL recognition or CSA certification.
These switches are designed for use in low-voltage, low-current, logic-level circuit.
When used as intended in a logic-level circuit, the results do not produce hazardous energy.

Distinctive Characteristics

Both PCB and panel mounting options available.

Choice of cap sizes in .315" (8.0mm) and .394" (10.0mm) diameter cap design for simple, snap-on installation.

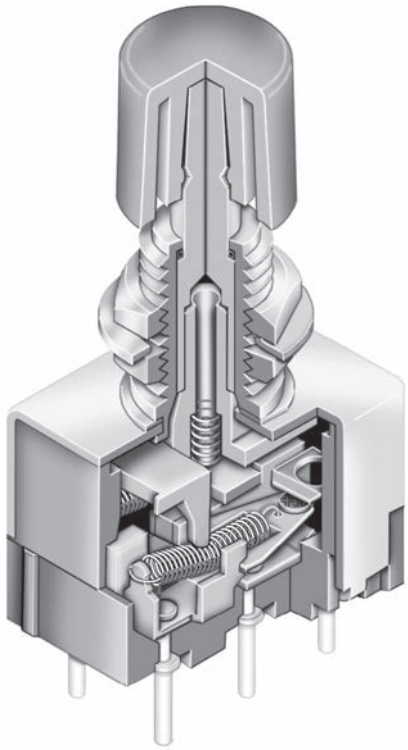
High torque bushing prevents rotation and separation from metal frame during installation.

Stainless steel frame resists corrosion.

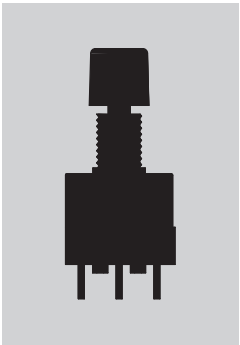
Snap action contacts give smooth actuation, short stroke, light touch, and audible feedback. This mechanism also provides long mechanical life.

Molded-in terminals prevent entry of solder flux, dust, and other contaminants.

.100" x .100" (2.54mm x 2.54mm) terminal spacing conforms to standard PC board grid spacing. Round terminals for easier through-hole mounting on PC boards.



Actual Size



TYPICAL SWITCH ORDERING EXAMPLE

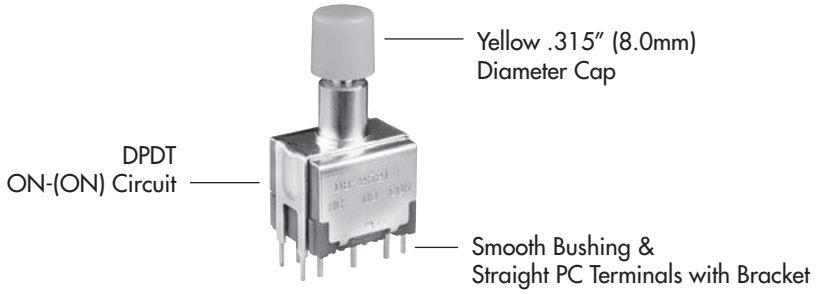
DB25 **21** **B**

Poles & Circuits			
11	SPDT	ON	(ON)
21	DPDT	ON	(ON)
( ) = Momentary			

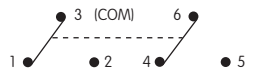
PC Terminals	
Threaded Bushing	
P	Straight
Smooth Bushing	
B	Straight with Bracket
H	Right Angle with Bracket
V	Vertical with Bracket

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

DB2521B with AT443E Cap

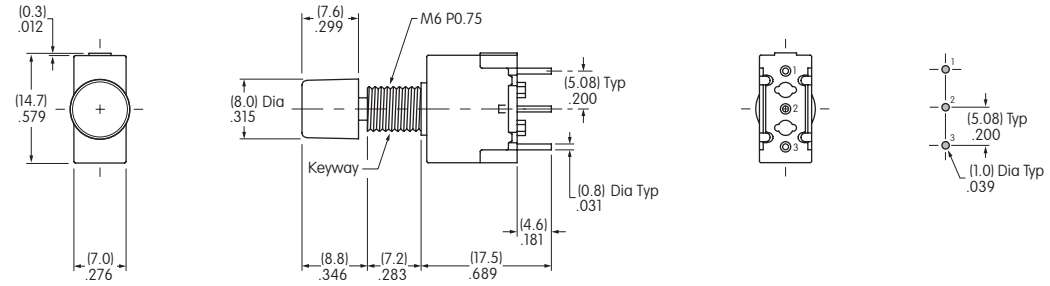


POLES & CIRCUITS

Pole	Model	Plunger Position ( ) = Momentary: Normal	Plunger Position ( ) = Momentary: Down	Connected Terminals: Normal	Connected Terminals: Down	Throw & Switch Schematics
		Keyway		Keyway		Note: Terminal numbers are not actually on the switch.
SP	**DB2511**	ON	(ON)	3-1	3-2	SPDT
DP	**DB2521**	ON	(ON)	3-1 6-4	3-2 6-5	DPDT 

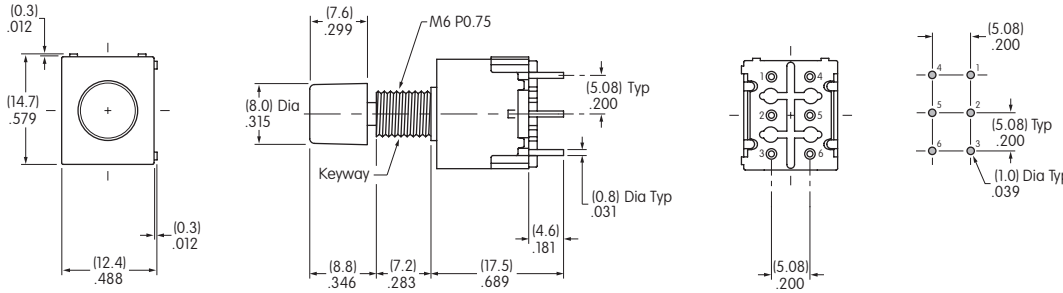
TYPICAL SWITCH DIMENSIONS

Single Pole — Straight PC



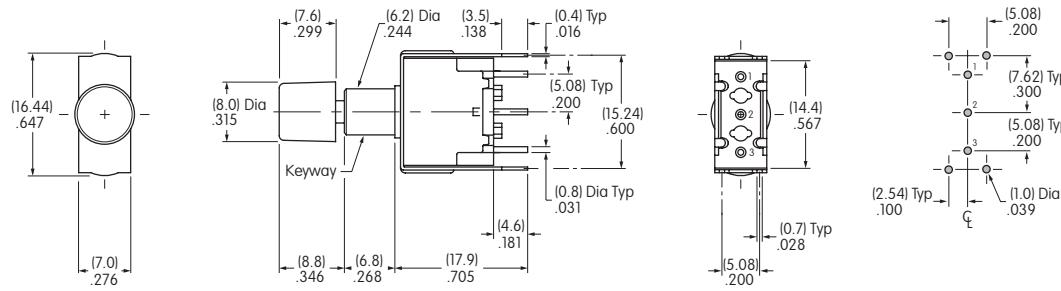
DB2511P with AT443C

Double Pole — Straight PC



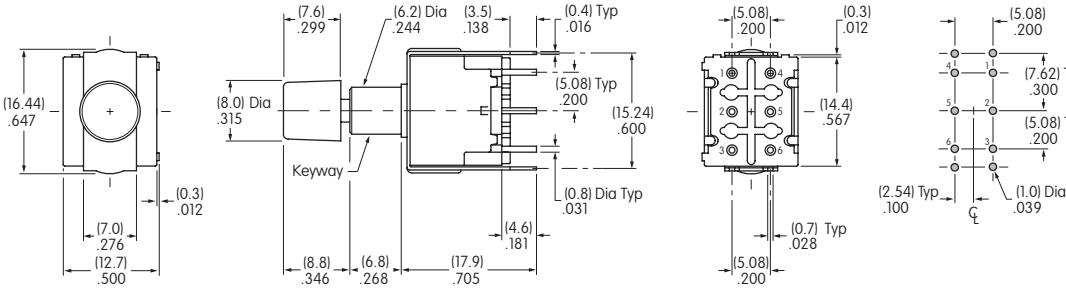
DB2521P with AT442A

Single Pole — Straight PC with Bracket



DB2511B with AT442C

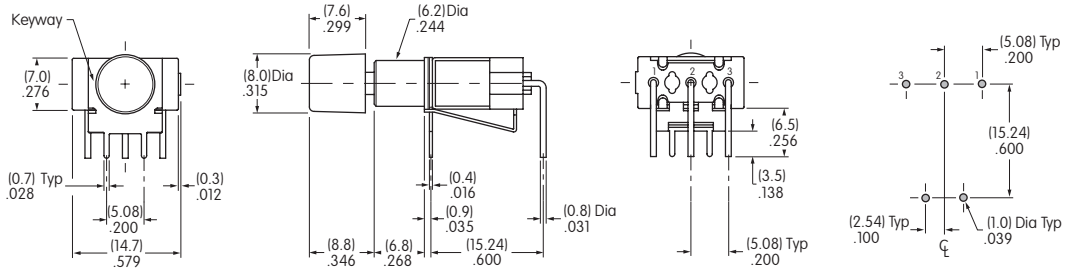
Double Pole — Straight PC with Bracket



DB2521B with AT443E

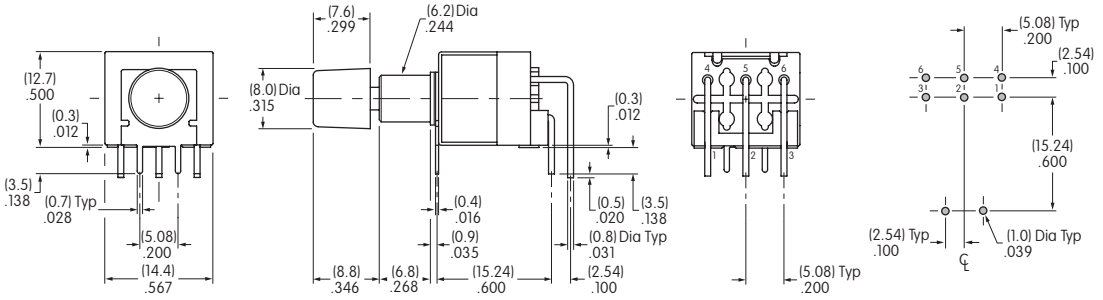
TYPICAL SWITCH DIMENSIONS

Right Angle PC with Bracket — Single Pole



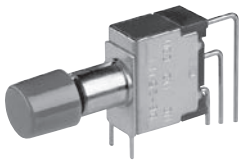
DB2511H with AT442B

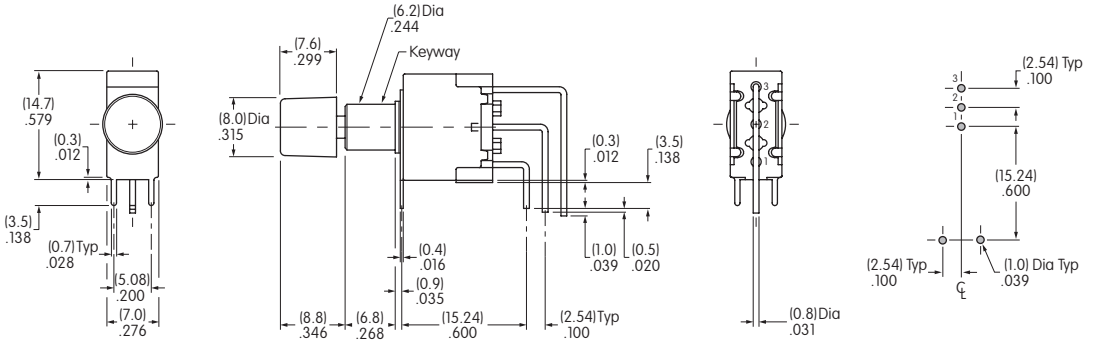
Right Angle PC with Bracket — Double Pole



DB2521H with AT442A

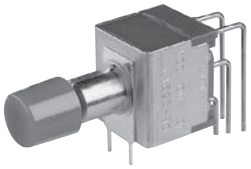
Vertical PC with Bracket — Single Pole

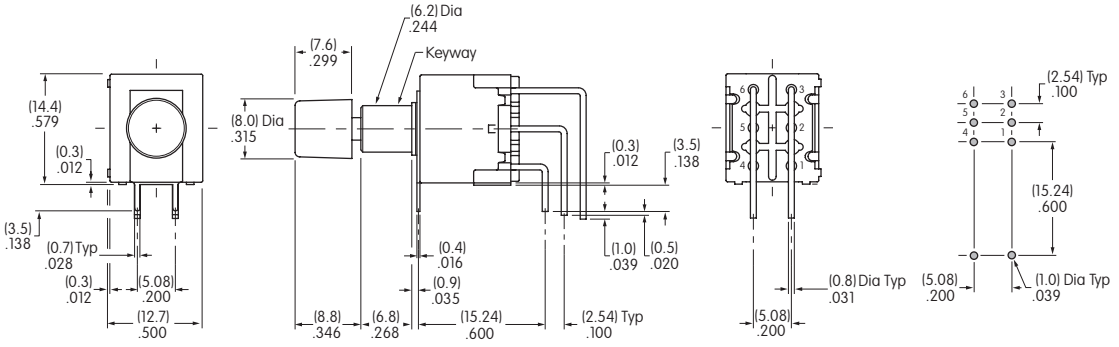




DB2511V with AT443C

Vertical PC with Bracket — Double Pole





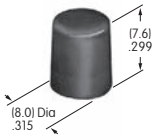
DB2521V with AT443C

OPTIONAL CAPS & COLORS

AT443
.315" (8.0mm) Diameter Snap-on Cap

Cap Colors Available:

A	Black	E	Yellow
B	White	F	Green
C	Red	G	Blue



Cap Material: Polycarbonate Finish: Glossy

AT442
.394" (10.0mm) Diameter Snap-on Cap

Cap Colors Available:

A	Black	E	Yellow
B	White	F	Green
C	Red	G	Blue

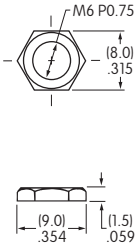
Cap Material: Polycarbonate Finish: Glossy

HARDWARE

Standard Hardware

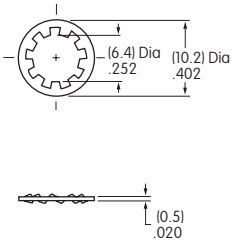
AT513M
Metric Hexagon Nut

Material:
Brass with
Nickel Plating



AT509
Lockwasher

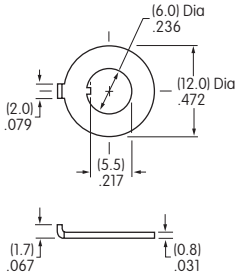
Material:
Steel with
Zinc/Chromate



Optional Hardware

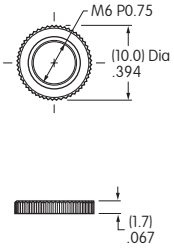
AT507M
Metric Locking Ring

Material:
Steel with
Zinc/Chromate



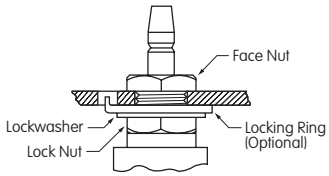
AT501M
Metric Knurled Face Nut

Material:
Brass with
Chrome Plating



INSTALLATION/ASSEMBLY

2 AT513M Metric Hexagon Nuts
1 AT509 Internal Tooth Lockwasher

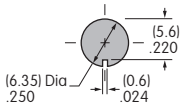


Optional Hardware:
AT507M Metric Locking Ring

Note: Cap must be snapped on after the switch is mounted into the panel.

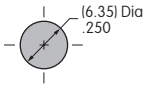
PANEL CUTOUTS & THICKNESSES

With Standard Hardware



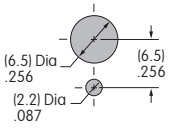
Maximum Effective Panel Thickness:
.118" (3.0mm)

Without Bottom Hex Nut



Maximum Effective Panel Thickness:
.185" (4.7mm)

With Standard Hardware & Optional Locking Ring



Maximum Effective Panel Thickness:
.087" (2.2mm)

General Specifications

Electrical Capacity (Resistive Load)

Power Level (silver): 3A @ 125V AC for silver contacts
Logic Level (gold): 0.4VA maximum @ 28V AC/DC maximum for gold contacts
(Applicable Range 0.1mA ~ 0.1A @ 20mV ~ 28V)
Note: Find additional explanation of operating range in Supplement section.

Other Ratings

Contact Resistance: 10 milliohms maximum for silver; 20 milliohms maximum for gold
Insulation Resistance: 1,000 megohms minimum @ 500V DC
Dielectric Strength: 1,000V AC minimum between contacts for 1 minute minimum;
1,500V AC minimum between contacts and case for 1 minute minimum
Mechanical Life: 100,000 operations minimum
Electrical Life: 25,000 operations minimum for silver;
50,000 operations minimum for gold
Nominal Operating Force: Single Pole: 2.35N for Momentary and 2.65N for Alternate Action
Double Pole: 2.94N for Momentary and 3.63N for Alternate Action
Travel: Momentary: Pretravel .047" (1.2mm); Overtravel .016" (0.4mm); Total Travel .063" (1.6mm)
Alternate: Pretravel .071" (1.8mm); Overtravel .016" (0.4mm); Total Travel .087" (2.2mm)

Materials & Finishes

Plunger: Brass with nickel plating
Bushing: Brass with nickel plating
Frame: Stainless steel
Case: Melamine phenolic resin (UL94V-0)
Movable Contacts: Copper with silver or gold plating
Stationary Contacts: Silver & copper with silver or gold plating
Terminals: Copper with silver or gold plating

Environmental Data

Operating Temp Range: –10°C through +70°C (+14°F through +158°F)
Humidity: 90 ~ 95% humidity for 96 hours @ 40°C (104°F)
Vibration: 10 ~ 55Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in 1 minute; 3 right angled directions for 2 hours
Shock: 50G (490m/s^2) acceleration (tested in 6 right angled directions, with 5 shocks in each direction)

Installation

Mounting Torque: 1.47Nm (13.0 lb•in) for double nut; 0.68Nm (6.0 lb•in) for single nut
Cap Installation Force: 78.5N (17.65 lbf) maximum downward force on actuator
Soldering Time & Temp: Wave Solder (Straight PC): See Profile B in Supplement section.
Manual Soldering: See Profile B in Supplement section.
Cleaning: These devices are not process sealed. Hand clean locally using alcohol based solution.

Standards & Certifications

Flammability Standards: UL94V-0 case
UL: **File No. E44145 - Recognized only when ordered with marking on switch.**
Add "/U" or "/CUL" before first dash in part number to order UL recognized switch.
All single and double pole models recognized at 3A @ 125V AC.
CSA: **File No. 023535_0_000 - Certified only when ordered with marking on switch.**
Add "/C" before first dash in part number to order CSA certified switch.
Single pole solder lug and PC models certified at 3A @ 125V AC; double pole PC models certified at 3A @ 125V AC.

Distinctive Characteristics

Power and logic level capabilities available to suit varying applications.

Bushing and snap-in mount versions available; snap-in models offer many style and color choices to enhance front panel appearance.

Light touch actuation.

High torque bushing prevents rotation and separation from metal frame during installation.

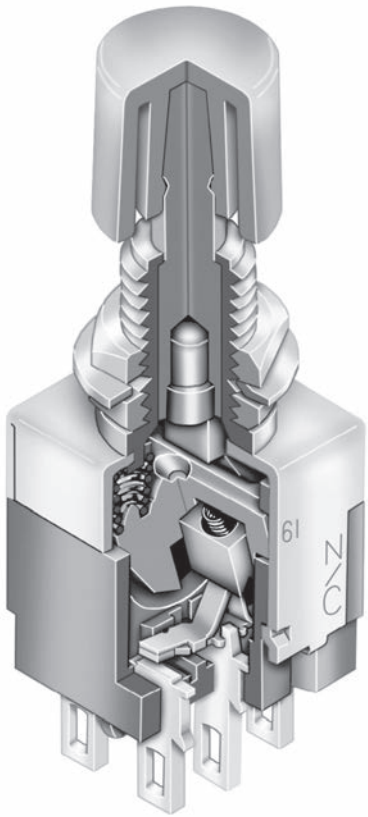
Stainless steel frame resists corrosion.

Case of heat resistant resin meets UL 94V-0 flammability rating.

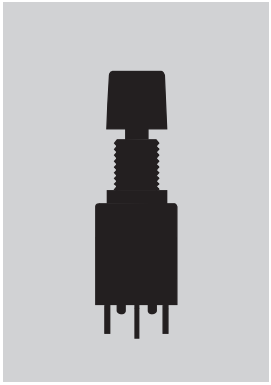
Higher insulating barriers protect against crossover in double pole devices.

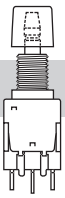
1,500V dielectric strength between contacts and case is accomplished by clinching the frame away from the terminals.

Epoxy sealed terminals prevent entry of solder flux and other contaminants.

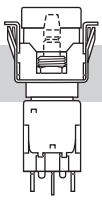


Actual Size





Bushing Mount Page C26



Snap-in Mount Page C30

TYPICAL SWITCH ORDERING EXAMPLE

EB20 [65] [ ] — [B] [F]

Poles & Circuits

11	SPDT	ON	(ON)
65	SPDT	ON	ON
61	DPDT	ON	(ON)
85	DPDT	ON	ON

( ) = Momentary

Caps

B	.315" (8.0mm) Dia.
C	.394" (10.0mm) Dia.

Contacts, Ratings, & Terminals

No Code	Silver Contacts; Solder Lug Terminals 3A @ 125V AC
G	Gold Contacts; Solder Lug Terminals 0.4VA max @ 28V AC/DC max
P	Silver Contacts; Straight PC Terminals; 3A @ 125V AC
PG	Gold Contacts; Straight PC Terminals 0.4VA max @ 28V AC/DC max

Colors

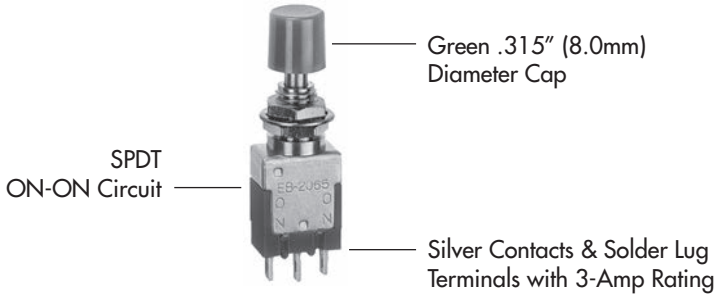
A	Black
B	White
C	Red
E	Yellow
F	Green
G	Blue
H	Gray

IMPORTANT:

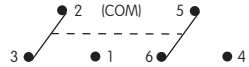
Switches are supplied without UL, cULus & CSA marking unless specified.
UL, cULus & CSA recognized only when ordered with marking on the switch.
Specific models, ratings, & ordering instructions are noted on the General Specifications page.

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

EB2065-BF



POLES & CIRCUITS

Pole	Model	Plunger Position ( ) = Momentary: Normal (Keyway)	Plunger Position ( ) = Momentary: Down	Connected Terminals: Normal (Keyway)	Connected Terminals: Down	Throw & Switch Schematics
SP	**EB2011** **EB2065**	ON ON	(ON) ON	2-3	2-1	SPDT
DP	**EB2061** **EB2085**	ON ON	(ON) ON	2-3 5-6	2-1 5-4	DPDT 

Note: Terminal numbers are not actually on the switch.

CONTACT MATERIALS, RATINGS, & TERMINALS

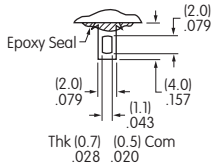
No Code — **Solder Lug, Silver Contacts**

Power Level — **3A @ 125V AC**

G — **Solder Lug, Gold Contacts**

Logic Level — **0.4VA max @ 28V AC/DC max**

Complete explanation of operating range in Supplement section.



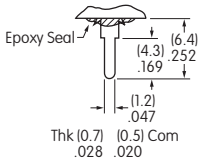
P — **Straight PC, Silver Contacts**

Power Level — **3A @ 125V AC**

PG — **Straight PC, Gold Contacts**

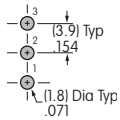
Logic Level — **0.4VA max @ 28V AC/DC max**

Complete explanation of operating range in Supplement section.

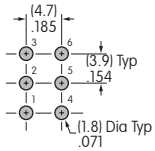


PCB Footprints

Single Pole



Double Pole



CAPS & COLORS

B **AT443**
.315" (8.0mm) Diameter Snap-on Cap

Cap Colors Available:

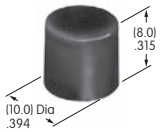
A	Black	F	Green
B	White	G	Blue
C	Red	H	Gray
E	Yellow		

Cap Material: Polycarbonate Finish: Glossy

C **AT442**
.394" (10.0mm) Diameter Snap-on Cap

Cap Colors Available:

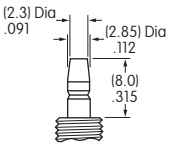
A	Black	F	Green
B	White	G	Blue
C	Red	H	Gray
E	Yellow		



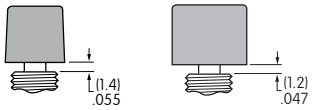
Cap Material: Polycarbonate Finish: Glossy

Plunger Extension

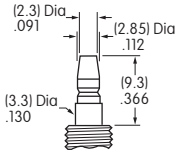
Due to a difference in plunger lengths on the momentary and alternate action models, cap distance from top of bushing varies.



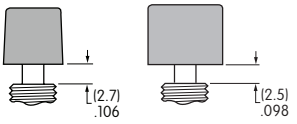
Momentary Plunger Length



Momentary Cap Location



Alternate Plunger Length

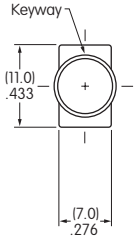


Alternate Cap Location

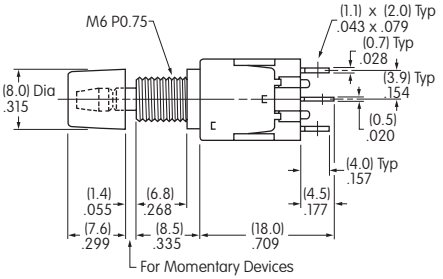
TYPICAL SWITCH DIMENSIONS

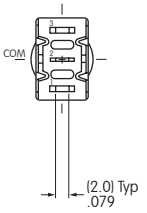
Solder Lug

EB2011-BA



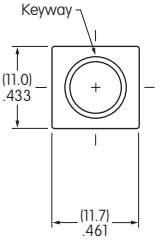
Single Pole



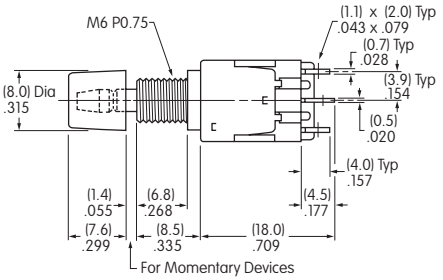


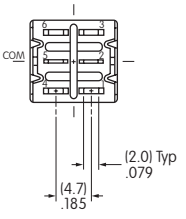
Solder Lug

EB2061-BA



Double Pole

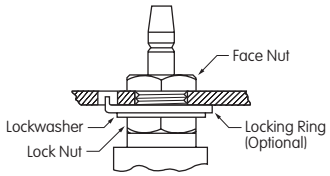




HARDWARE

Installation/Assembly

2 AT513M Metric Hexagon Nuts
1 AT509 Internal Tooth Lockwasher



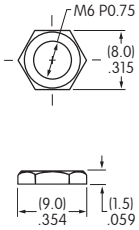
Optional Hardware:
AT507M Metric Locking Ring

Note: Cap must be snapped on after the switch is mounted into the panel.

Standard Hardware

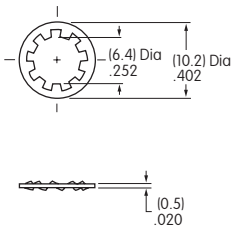
AT513M
Metric Hexagon Nut

Material:
Brass with
Nickel Plating



AT509
Lockwasher

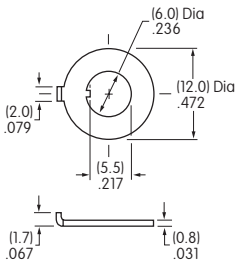
Material:
Steel with
Zinc/Chromate



Optional Hardware

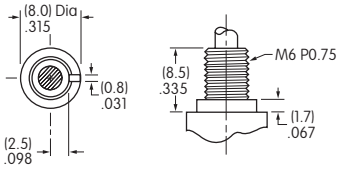
AT507M
Metric Locking Ring

Material:
Steel with
Zinc/Chromate

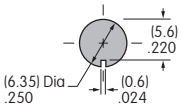


PANEL CUTOUTS & THICKNESSES

Metric Bushing

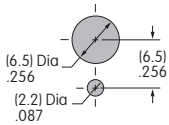


With Standard Hardware



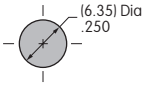
Maximum Effective
Panel Thickness:
.118" (3.0mm)

With Standard Hardware & Optional Locking Ring



Maximum Effective
Panel Thickness:
.055" (1.4mm)

Without Bottom Hex Nut



Maximum Effective
Panel Thickness:
.185" (4.7mm)

See Accessories & Hardware section for optional Conical Nuts:
AT512M used with cap AT443 and AT512CM used with cap AT442.

TYPICAL SWITCH

EB20 [11] [ ] — [B] — [J23]

Poles & Circuits

11	SPDT	ON	(ON)
65	SPDT	ON	ON
61	DPDT	ON	(ON)
85	DPDT	ON	ON

( ) = Momentary

Contacts, Ratings, & Terminals

No Code	Silver Contacts; Solder Lug Terminals 3A @ 125V AC
G	Gold Contacts; Solder Lug Terminals 0.4VA max @ 28V AC/DC max
P	Silver Contacts; Straight PC Terminals; 3A @ 125V AC
PG	Gold Contacts; Straight PC Terminals 0.4VA max @ 28V AC/DC max

Cap Colors

A	Black
B	White
C	Red
E	Yellow
F	Green
G	Blue
H	Gray

Cap Extensions & Bezel Types

Low Rise		High Rise		
Momentary	Alternate	Momentary	Alternate	Description
J20	**J30**	**J40**	**J50**	Without Bezel
J21	**J31**	**J41**	**J51**	Bezel without LED
J22	**J32**	**J42**	**J52**	Bezel with 1 Round LED
J23	**J33**	**J43**	**J53**	Bezel with 2 Round LEDs
J24	**J34**	**J44**	**J54**	Bezel with 2 Rectangular LEDs

IMPORTANT:

Switches are supplied without UL, cULus & CSA marking unless specified.
UL, cULus & CSA recognized only when ordered with marking on the switch.
Specific models, ratings, & ordering instructions are noted on the General Specifications page.

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE WITHOUT BEZEL

EB2011-A-J40

ORDERING EXAMPLES

Bezel Colors

Bezel without LEDs			
A	Black	**F**	Green
B	White	**G**	Blue
C	Red	**H**	Gray
E	Yellow		

Bezel with 1 Round LED	
A	Black

Bezel with 2 Round or Rectangular LEDs	
A	Black

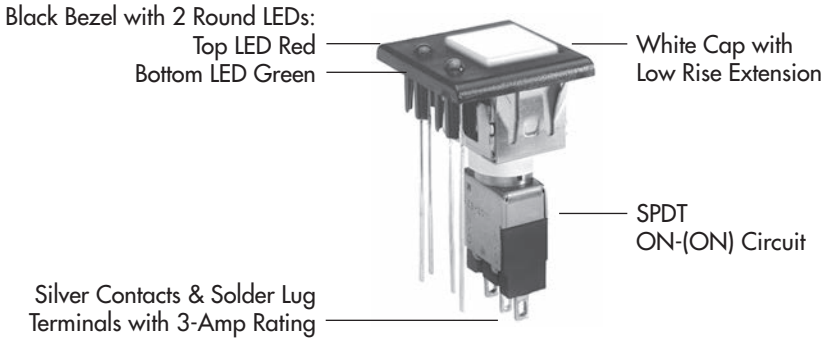
Led Colors

1 LED	
C	Red
F	Green

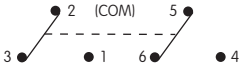
2 LEDs			
Top LED		Bottom LED	
C	Red	**C**	Red
E	Yellow	**E**	Yellow
F	Green	**F**	Green

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE WITH BEZEL

EB2011-B-J23ACF



POLES & CIRCUITS

Pole	Model	Plunger Position ( ) = Momentary: Normal	Plunger Position ( ) = Momentary: Down	Connected Terminals: Normal	Connected Terminals: Down	Throw & Switch Schematics
						Note: Terminal numbers are not actually on the switch.
SP	**EB2011** **EB2065**	ON ON	(ON) ON	2-3	2-1	SPDT
DP	**EB2061** **EB2085**	ON ON	(ON) ON	2-3 5-6	2-1 5-4	DPDT 

CONTACT MATERIALS, RATINGS, & TERMINALS

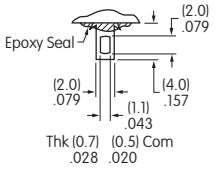
No Code — **Solder Lug, Silver Contacts**

Power Level — **3A @ 125V AC**

G — **Solder Lug, Gold Contacts**

Logic Level — **0.4VA maximum @ 28V AC/DC maximum**

Complete explanation of operating range in Supplement section.



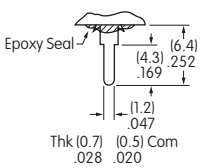
P — **Straight PC, Silver Contacts**

Power Level — **3A @ 125V AC**

PG — **Straight PC, Gold Contacts**

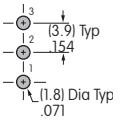
Logic Level — **0.4VA maximum @ 28V AC/DC maximum**

Complete explanation of operating range in Supplement section.

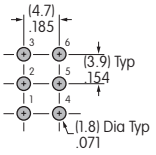


PCB Footprints

Single Pole



Double Pole



CAP COLORS

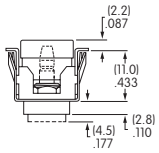
Factory Assembled on the Switch:
Square snap-on cap AT465, snap-in mounter AT529, and optional bezels which follow.

A	Black	B	White	C	Red	E	Yellow
F	Green	G	Blue	H	Gray		

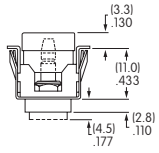
CAP EXTENSIONS & BEZEL TYPES

Cap Extension without Bezel

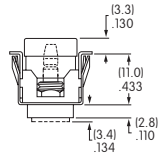
J20 Low Rise Momentary



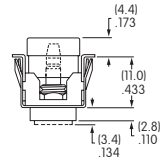
J30 Low Rise Alternate

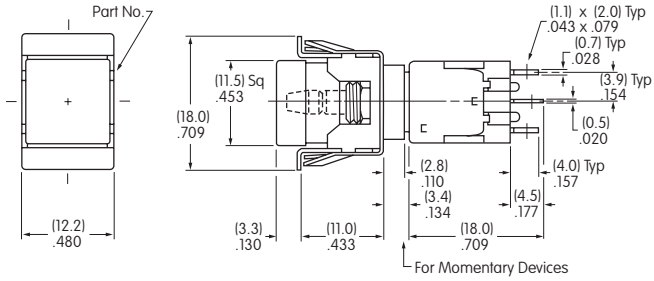


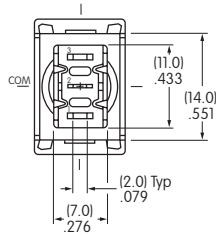
J40 High Rise Momentary

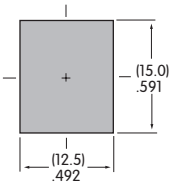


J50 High Rise Alternate







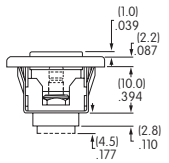


Maximum Panel Thickness
.039" ~ .157" (1.0mm ~ 4.0mm)
Cutout applies to SP & DP

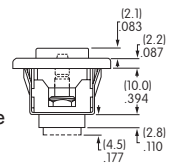
High Rise | Single Pole | **EB2011-A-J40**

Cap Extension with Bezel

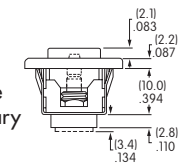
J21 Low Rise Momentary



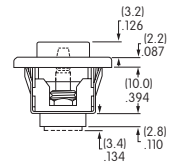
J31 Low Rise Alternate



J41 High Rise Momentary



J51 High Rise Alternate

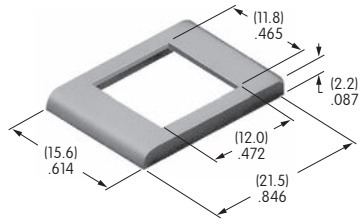


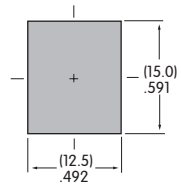
AT207 Bezel without LED

A	Black	E	Yellow
B	White	F	Green
C	Red	G	Blue
		H	Gray

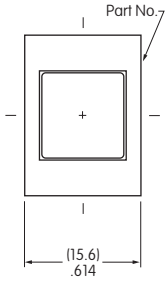
Material: Polycarbonate

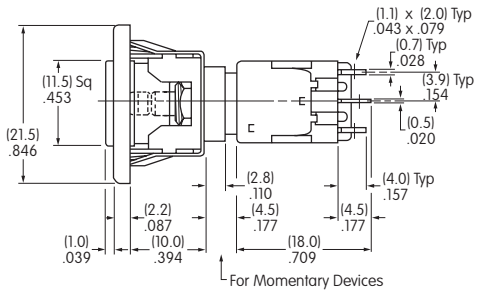
Finish: Glossy

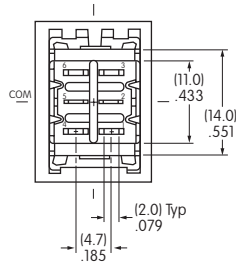




Maximum Panel Thickness
.039" ~ .126" (1.0mm ~ 3.2mm)
Cutout applies to SP & DP





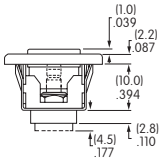


Low Rise | Double Pole | **EB2061-B-J21A**

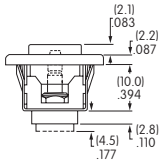
CAP EXTENSIONS & BEZEL TYPES

Cap Extension with Bezel

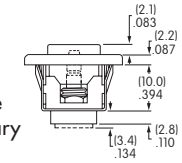
J22 Low Rise Momentary



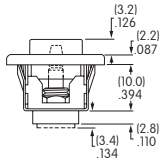
J32 Low Rise Alternate



J42 High Rise Momentary



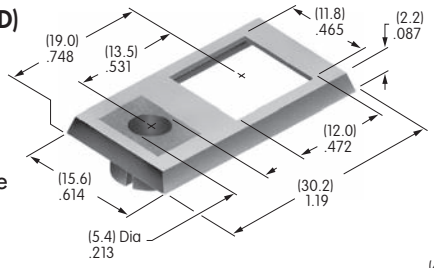
J52 High Rise Alternate



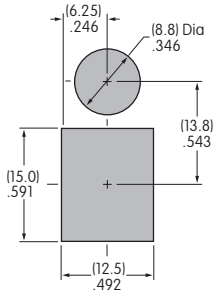
AT208 Bezel with 1 Round LED (AT070 LED)

A Black

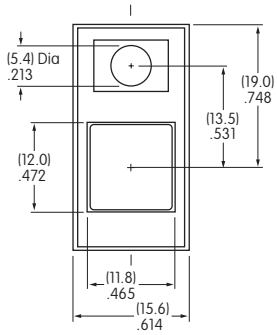
Material: Polycarbonate
Finish: Glossy

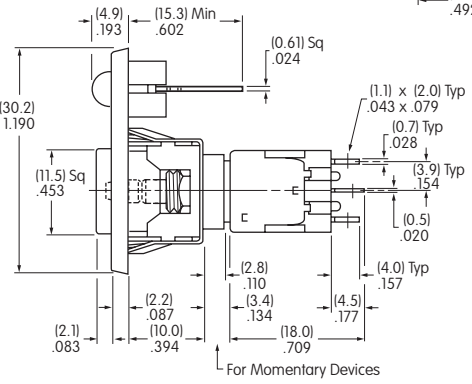


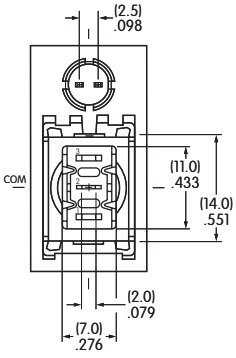
Maximum Panel Thickness
.039" ~ .126"
(1.0mm ~ 3.2mm)
Cutout applies to SP & DP



LED colors and specifications on next to last page of this EB section.







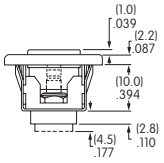
EB2011-B-J42AC

High Rise

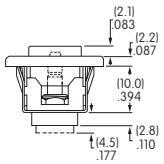
Single Pole

Cap Extension with Bezel

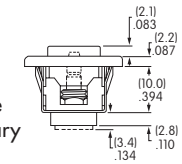
J23 Low Rise Momentary



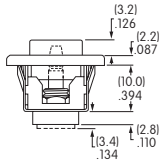
J33 Low Rise Alternate



J43 High Rise Momentary



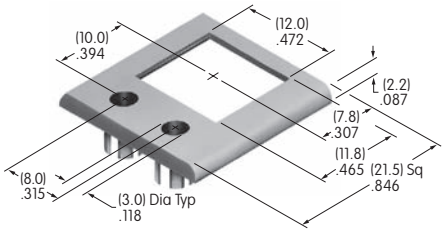
J53 High Rise Alternate

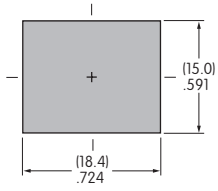


AT212 Bezel with 2 Round LEDs (AT617 LEDs)

A Black

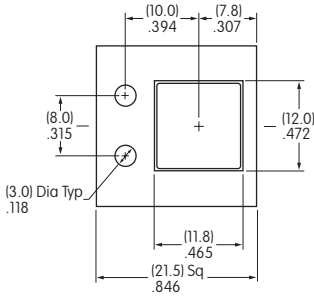
Material: Polycarbonate
Finish: Glossy

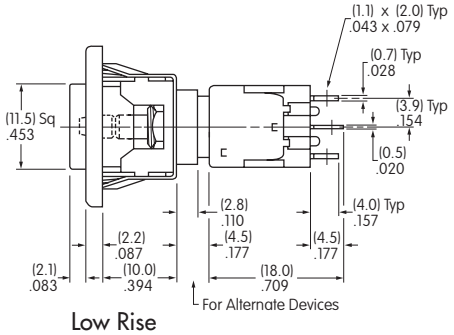


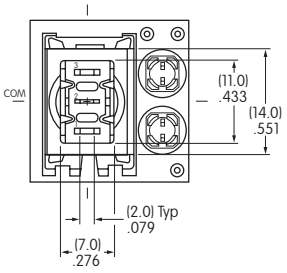


Maximum Panel Thickness
.039" ~ .126" (1.0mm ~ 3.2mm)
Cutout applies to SP & DP

LED colors and specifications on next to last page of this EB section.







EB2065-B-J33ACF

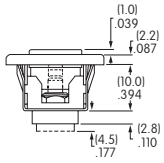
Low Rise

Single Pole

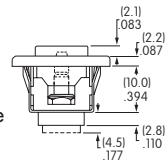
CAP EXTENSIONS & BEZEL TYPES

Cap Extension with Bezel

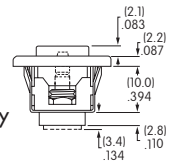
J24 Low Rise Momentary



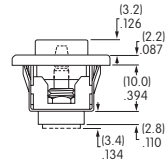
J34 Low Rise Alternate



J44 High Rise Momentary



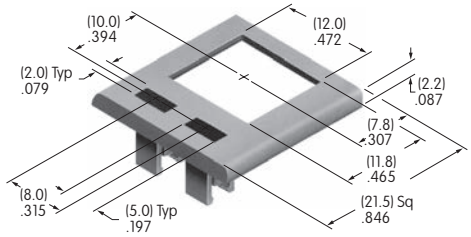
J54 High Rise Alternate

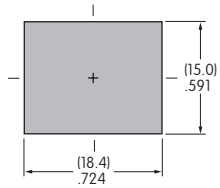


AT213 Bezel with 2 Rectangular LEDs (AT618 LEDs)

A Black

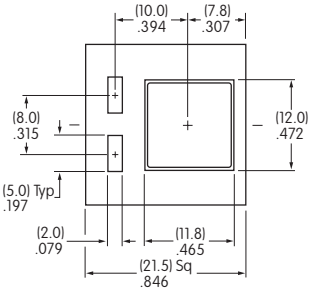
Material: Polycarbonate
Finish: Glossy

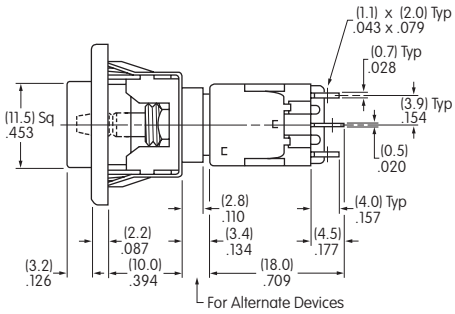




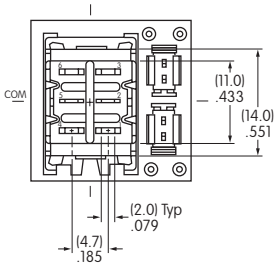
Maximum Panel Thickness
.039" ~ .126" (1.0mm ~ 3.2mm)
Cutout applies to SP & DP

LED colors and specifications on next page of this EB section.





High Rise



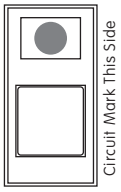
Double Pole

EB2085-B-J54ACF

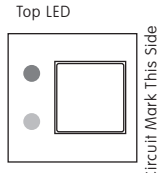
LED COLORS & SPECIFICATIONS

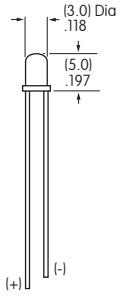
Bezel Orientation on Switch

AT070 LED
For Bezel AT208
with 1 LED

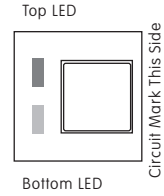


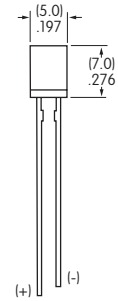
AT617 LED
For Bezel AT212
with 2 Round LEDs





AT618 LED
For Bezel AT213
with 2 Rectangular LEDs





Note: Lead lengths may differ from manufacturing lot to lot. The longer lead is the anode (+).

		AT070		AT617			AT618		
		C	F	C	E	F	C	E	F
	Color	Red	Green	Red	Yellow	Green	Red	Yellow	Green
Maximum Forward Current	I_{FM}	25mA	30mA	30mA	30mA	25mA	25mA	30mA	25mA
Typical Forward Current	I_F	20mA	20mA	20mA	20mA	20mA	20mA	20mA	20mA
Forward Voltage	V_F	2.8V	2.1V	2.0V	2.1V	2.2V	2.25V	2.1V	2.2V
Maximum Reverse Voltage	V_{RM}	4V	5V	5V	5V	5V	5V	5V	5V
Current Reduction Rate Above 25°C	ΔI_F	0.33 mA/°C	0.40 mA/°C	0.40 mA/°C	0.40 mA/°C	0.33 mA/°C	0.33 mA/°C	0.40 mA/°C	0.33 mA/°C
Ambient Temperature Range (when used with a bezel)		−10° ~ +70°C		−15° ~ +70°C			−25° ~ +50°C		

The electrical specifications shown are determined at a basic temperature of 25°C.
LED circuit is independent of switch operation. LED is colored in OFF state.

If the source voltage is greater than the rated voltage of the LED, a ballast resistor must be connected in series with the lamp.
The ballast resistor calculation and more lamp detail are shown in the Supplement section.

LEGENDS

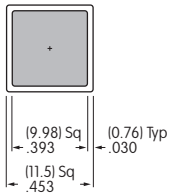
NKK Switches can provide custom legends for caps. Contact factory for more information.

Recommended Print Method:

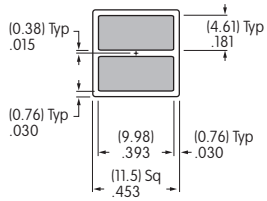
Screen Print or Pad Print

Epoxy based ink is recommended.

Suggested Printable Area for Cap



AT465



AT465

Shaded areas are printable areas.

General Specifications

Electrical Capacity (Resistive Load)

	FB Series	SB Series
Power Level:	500mA @ 125V AC for silver	3A @ 125V AC or 2A @ 250V AC or
Logic Level:	0.4VA max. @ 28V AC/DC max. for gold (Applicable Range 0.1mA ~ 0.1A @ 20mV ~ 28V) Note: Find additional explanation in Supplement section.	2A @ 30V DC for silver 0.4VA max. @ 28V AC/DC max. for gold (Applicable Range 0.1mA ~ 0.1A @ 20mV ~ 28V) Note: Find explanation of operating range in Supplement section.

Other Ratings

Contact Resistance:	30 milliohms maximum for silver; 30 milliohms maximum for gold	10 milliohms maximum for silver; 20 milliohms maximum for gold
Insulation Resistance:	100 megohms minimum @ 500V DC	200 megohms minimum @ 500V DC
Dielectric Strength:	1,000V AC minimum between contacts & between contacts & case for 1 minute minimum	1,000V AC minimum between contacts & between contacts & case for 1 minute minimum
Mechanical Life:	50,000 operations minimum	30,000 operations minimum
Electrical Life:	50,000 operations minimum	10,000 operations minimum
Nominal Operating Force:	2.16N	4.90N
Travel:	Pretravel .043" (1.1mm) Overtravel .022" (0.57mm) Total Travel .065" (1.67mm)	Normally Open Total Travel .088" (2.24mm) Normally Closed Total Travel .088" (2.24mm)

Materials & Finishes

Plunger:	Polyacetal	Phenolic resin
Bushing:	Brass with nickel plating	Brass with nickel plating
Case:	Phenolic resin	Phenolic resin
Movable Contactor:	Copper with silver or gold plating	Copper with silver or gold plating
Stationary Contacts:	Phosphor bronze with silver or gold plating	Copper with silver or gold plating
Terminals:	Phosphor bronze with silver or gold plating	Copper with silver or gold plating

Environmental & Installation Data

Operating Temp Range:	–10°C through +70°C (+14°F through +158°F)	–10°C through +70°C (+14°F through +158°F)
Soldering Time & Temperature:	Manual Soldering: See Profile A in Supplement section.	Manual Soldering: See Profile A in Supplement section.

Standards & Certifications

UL:	**File No. E44145 - Recognized only when ordered with marking on switch.** Add "/U" or "/CUL" before dash in part number to order UL recognized switch. Models rated 0.5A @ 125V AC Single pole; Momentary action circuit with solder lug terminations.	**File No. E44145 - Recognized only when ordered with marking on switch.** Add "/U" or "/CUL" before dash in part number to order UL recognized switch. Models rated 3A @ 125V AC & 2A @ 250V AC. Single pole: Momentary action circuit with solder lug terminations.
CSA:		**File No. 023535_0_000 - Certified only when ordered with marking on switch.** Add "/C" before dash in part number to order CSA certified switch. SB series rated 3A @ 125V AC & 2A @ 250V AC. Single pole: Momentary action circuit with solder lug terminations.

Distinctive Characteristics

Optional caps in different colors to vary appearance as needed.

Low operating force for ease of actuation.

Rear panel bushing mount with compact behind panel dimension.

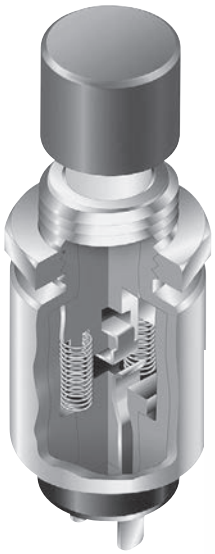
Internal antijamming feature to protect the contacts from damage due to excessive force on the plunger.

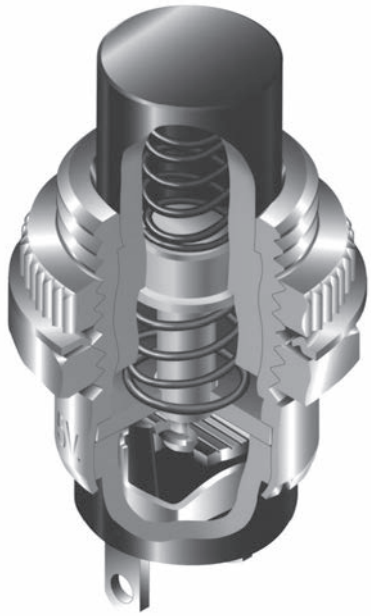
Self-cleaning contacts make FB models highly reliable.

Low cost device of rugged one-piece bushing and housing construction.

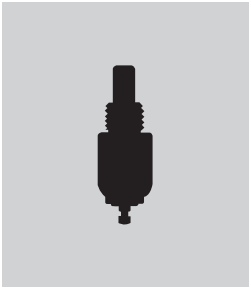
Reliability of construction with an internal guide to maintain contact alignment.

Epoxy sealed terminals.

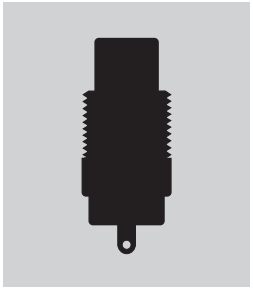




Actual Size FB



Actual Size SB



FB Bushing Mount Page C40

SB Bushing Mount Page C42

Series FB

.5 Amp Momentary Pushbuttons

TYPICAL SWITCH ORDERING EXAMPLE

FB | 15AN | EP | 2 | — | F | A

Pole & Circuit

15AN	SPST	OFF	(ON)

( ) = Momentary

Contact Materials & Ratings

2	Silver Contacts 500mA @ 125V AC
4	Gold Contacts 0.4VA max. @ 28V AC/DC max.

Cap Colors

A	Black
B	White
C	Red

Terminals

EP	Epoxy Sealed PC/Turret
P	No Epoxy PC/Turret

Caps

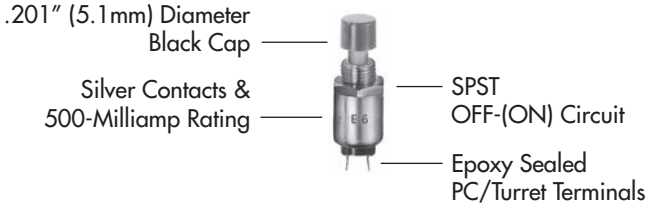
F	.201" (5.1mm) Dia.
H	.295" (7.5mm) Dia.

IMPORTANT:

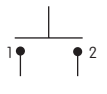
Switches are supplied without UL & cULus marking unless specified.
UL & cULus recognized only when ordered with marking on the switch.
Specific models, ratings, & ordering instructions are noted on the General Specifications page.

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

FB15ANEP2-FA



POLE & CIRCUIT

		Plunger Position ( ) = Momentary		Connected Terminals		Throw & Switch Schematics
Pole	**Model**	**Normal**	**Down**	**Normal**	**Down**	Note: Terminal numbers are not actually on the switch.
SP	**FB15AN**	OFF	(ON)	OPEN	1-2	SPST 

TERMINALS

EP Epoxy Sealed PC/Turret Terminals

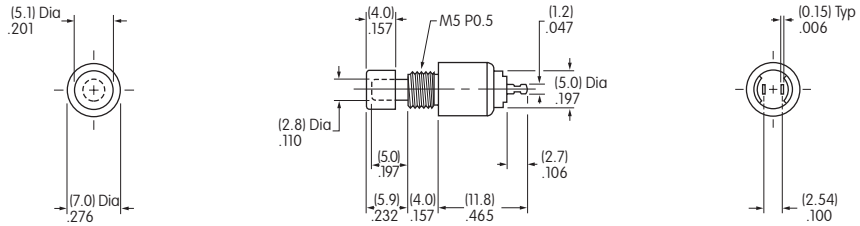
P No Epoxy PC/Turret Terminals

CONTACT MATERIALS & RATINGS

2	Silver Contacts	Power Level	500mA @ 125V AC
4	Gold Contacts	Logic Level	0.4VA maximum @ 28V AC/DC maximum

Complete explanation of operating range in Supplement section.

TYPICAL SWITCH DIMENSIONS



PC/Turret

Plunger is white polyacetal.

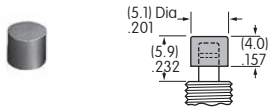
FB15ANEP2-FA

SLIP-ON CAPS & COLORS

F **AT475**
.201" (5.1mm) Diameter

Material: Polyamide

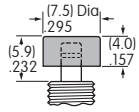
Finish: Glossy



H **AT496**
.295" (7.5mm) Diameter

Material: Polyamide

Finish: Glossy

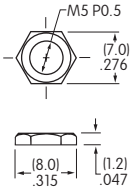


Colors Available: **A** Black **B** White **C** Red

STANDARD HARDWARE & PANEL CUTOUT

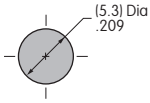
AT536 Hex Nut

Material:
Brass with nickel plating



Panel Thickness:

.110" (2.8mm) maximum



TYPICAL SWITCH ORDERING EXAMPLE

SB40 | 11NO | M | ☐ | ☐ — ☐

Pole & Circuits

Normally Open			
11NO	SPST	OFF	(ON)
Normally Closed			
11NC	SPST	ON	(OFF)

( ) = Momentary

Plunger Colors

No Code	Black
C	Red

Contact Materials & Ratings

No Code	Silver Contacts 3A @ 125V AC or 2A @ 250V DC
G	Gold Contacts 0.4VA max. @ 28V AC/DC max.

Bushings

M	Metric Threaded M12 P1
H	Inch Threaded 15/32-32 NS

Slip-On Cap & Colors

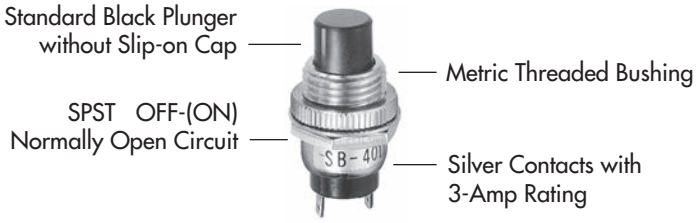
No Code	Without Cap
2A	Black
2B	White
2C	Red
2E	Yellow
2F	Green
2G	Blue

IMPORTANT:

Switches are supplied without UL, cULus & CSA marking unless specified. **UL, cULus & CSA recognized only when ordered with marking on the switch.** Specific models, ratings, & ordering instructions are noted on the General Specifications page.

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

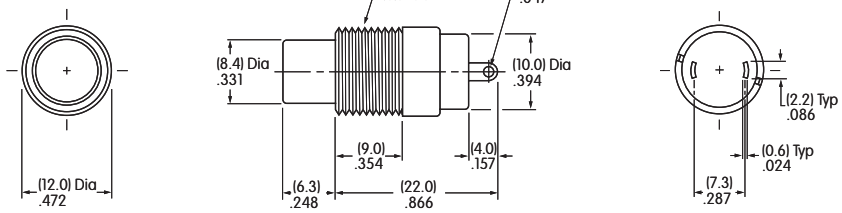
SB4011NOM



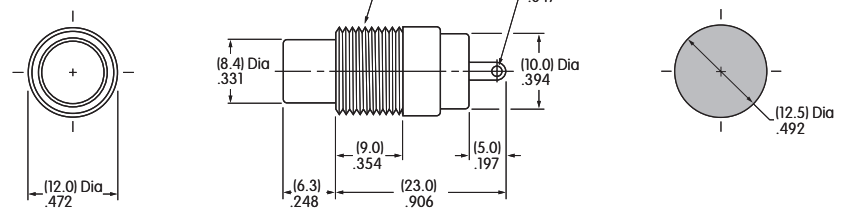
POLE & CIRCUITS

Pole	Model	Plunger Position ( ) = Momentary: Normal	Plunger Position ( ) = Momentary: Down	Connected Terminals: Normal	Connected Terminals: Down	Throw & Switch Schematics
SP	**SB4011NO**	OFF	(ON)	OPEN	1-2	Note: Terminal numbers are not actually on the switch.
	SB4011NC	ON	(OFF)	1-2	OPEN	SPST NO 1 2 NC 1 2

TYPICAL SWITCH DIMENSIONS



SB4011NOM



SB4011NCM

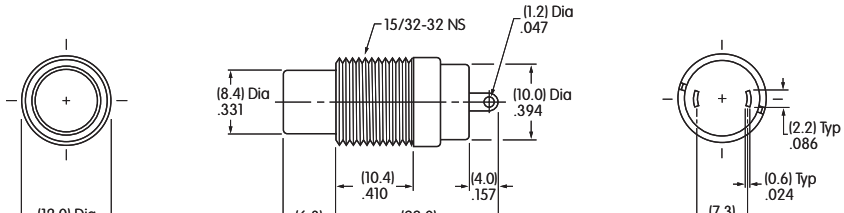
Panel Thickness:
.157" (4.0mm)

Metric Bushing

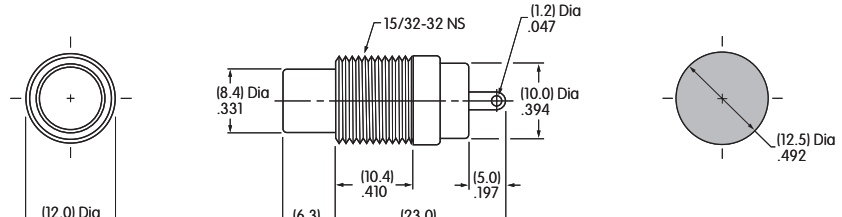
SB4011NOM

Hardware provided:
1 AT504 Knurled Face Nut
1 AT508 Lockwasher
1 AT527M Hex Mounting Nut

Details in Hardware & Accessories section.



SB4011NOH



SB4011NCH

Panel Thickness:
.157" (4.0mm)

Inch Bushing

SB4011NCH

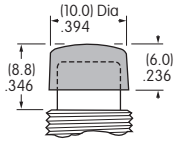
Hardware provided:
2 AT503H Hex Mounting Nuts
1 AT508 Lockwasher

Details in Hardware & Accessories section.

SLIP-ON CAP & COLORS

AT422
.394" (10.0mm) Diameter Cap

Material: Polyethylene
Finish: Matte



2A	Black	2C	Red	2F	Green
2B	White	2E	Yellow	2G	Blue

General Specifications

Electrical Capacity (Resistive Load)

Logic Level: 0.4VA maximum @ 28V AC/DC maximum
(Applicable Range 0.1mA ~ 0.1A @ 20mV ~ 28V)
Note: Find additional explanation of operating range in Supplement section.

Other Ratings

Contact Resistance: 80 milliohms maximum
Insulation Resistance: 500 megohms minimum @ 500V DC
Dielectric Strength: 500V AC minimum for 1 minute minimum
Mechanical Life: 50,000 operations minimum
Electrical Life: 50,000 operations minimum
Nominal Operating Force: 1.70N
Travel: Pretravel .035" (0.9mm); Overtravel .008" (0.2mm); Total Travel .043" (1.1mm)

Materials & Finishes

Actuator: Polyacetal
Case: Glass fiber reinforced polyamide
Sealing Rings: Nitrile butadiene rubber
Movable Contacts: Phosphor bronze with gold plating
Stationary Contacts: Phosphor bronze with gold plating
Base: Glass fiber reinforced polyamide
Mounting Bracket: Phosphor bronze with tin plating
Terminals: Phosphor bronze with gold plating

Environmental Data

Operating Temp Range: –30°C through +85°C (–22°F through +185°F)
Humidity: 90 ~ 95% humidity for 96 hours @ 40°C (104°F)
Vibration: 10 ~ 55Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in 1 minute; 3 right angled directions for 2 hours
Shock: 50G (490m/s^2) acceleration (tested in 6 right angled directions, with 5 shocks in each direction)

Installation

Cap Installation Force: 39.1N (8.8 lbf) maximum downward force on actuator

PCB Processing

Soldering: Wave Soldering Recommended: See Profile A in Supplement section.
Manual Soldering: See Profile A in Supplement section.
Cleaning: Automated cleaning. See Cleaning specifications in Supplement section.

Standards & Certifications

The GB Series pushbuttons have not been tested for UL recognition or CSA certification.
These switches are designed for use in a low-voltage, low-current, logic-level circuit.
When used as intended in a logic-level circuit, the results do not produce hazardous energy.

Distinctive Characteristics

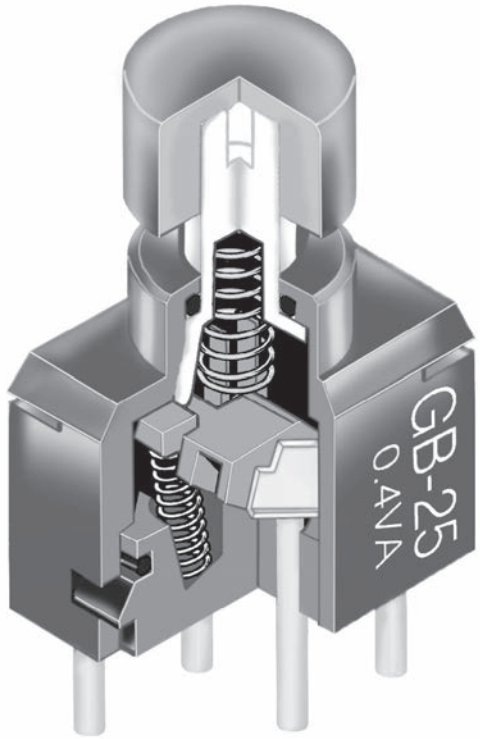
Ultra-miniature size allows high density mounting, and extremely light weight of 0.25 gram makes these switches ideal for handheld equipment.

Totally sealed body construction prevents contact contamination and allows time- and money-saving automated soldering and cleaning.

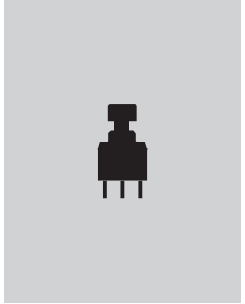
Award-winning STC contact mechanism with benefits unavailable in conventional mechanisms: smoother, positive detent actuation, increased contact stability and unparalleled logic-level reliability. (Additional STC details in Terms & Acronyms; see Supplement section.)

.100" x .100" (2.54mm x 2.54mm) terminal spacing conforms to standard PC board grid-spacing. Round terminals facilitate easier through-hole mounting on PC boards.

Matching indicators available.



Actual Size



Series GB

Process Sealed Ultra-Miniature Pushbuttons

TYPICAL SWITCH ORDERING EXAMPLE

GB 1 5 A H — X C

Poles

1	SPDT
2	DPDT

Circuits

5	ON	(ON)

( ) = Momentary

Plunger

A	.130″ (3.3mm) Long

PC Terminals

P	Straight
H	Right Angle
V	Vertical

Slip-on Cap

X	.157″ (4.0mm) Diameter

Cap Colors

A	Black
B	White
C	Red

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

GB15AH-XC

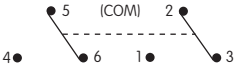
.130″ (3.3mm) Long Plunger with
.157″ (4.0mm) Diameter Red Cap

SPDT
ON-(ON) Circuit
Right Angle PC Terminals

POLES & CIRCUITS

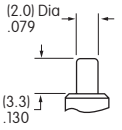
Pole	Model	Plunger Position ( ) = Momentary: Normal (Slot)	Plunger Position: Down	Connected Terminals: Normal (Slot)	Connected Terminals: Down	Throw & Schematics
SP	**GB15**	ON	(ON)	5-6	5-4	SPDT
DP	**GB25**	ON	(ON)	5-6 2-3	5-4 2-1	DPDT

Note: Terminal numbers are not actually on the switch.



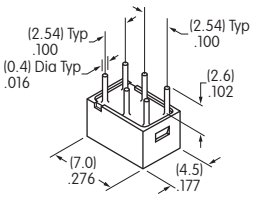
PLUNGER

A **.130″ (3.3mm) Long Plunger**

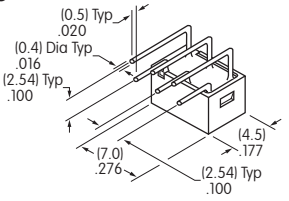


PC TERMINALS

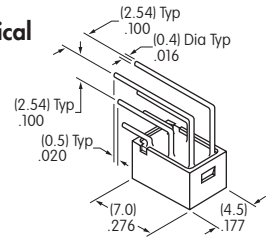
P **Straight**



H **Right Angle**



V **Vertical**



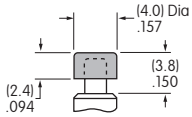
SLIP-ON CAP & COLORS

X **AT4063**
.157" (4.0mm) Diameter Slip-on Cap

Material: Polyamide

Finish: Glossy

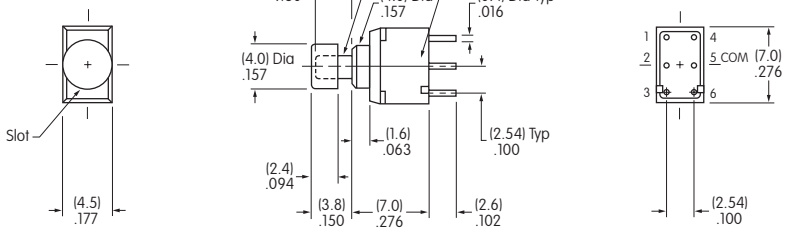
Actual Size



Cap Colors Available: **A** Black **B** White **C** Red

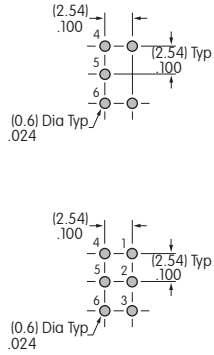
TYPICAL SWITCH DIMENSIONS

Single & Double Pole



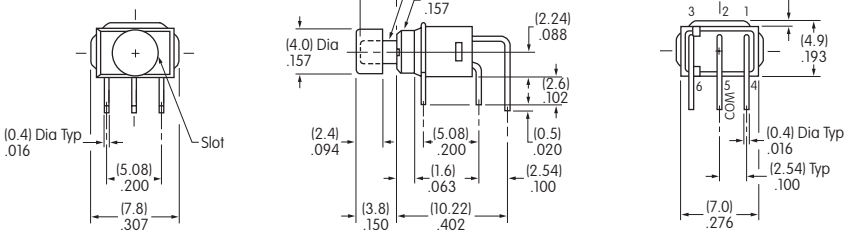
On single pole switches terminals 1 & 3 are support pins.

Straight PC

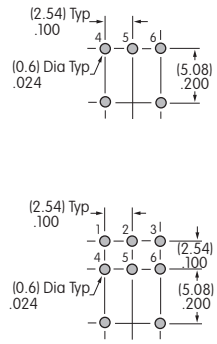


GB25AP-XC

Single & Double Pole

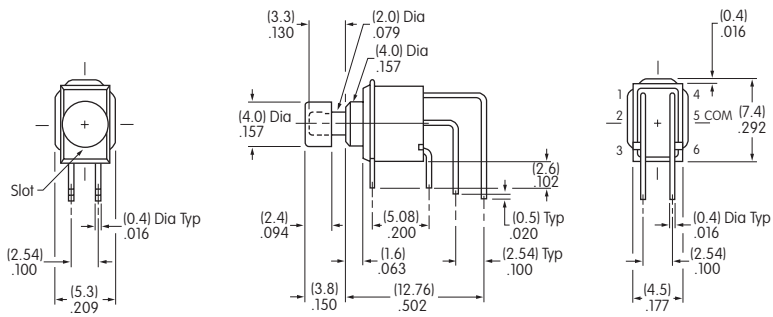


Right Angle PC

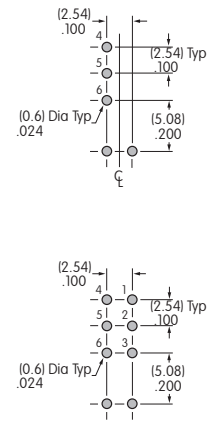


GB25AH-XC

Single & Double Pole



Vertical PC



GB25AV-XC

General Specifications

Electrical Capacity (Resistive Load)

Logic Level: 0.4VA maximum @ 28V AC/DC maximum
(Applicable Range 0.1mA ~ 0.1A @ 20mV ~ 28V)
Note: Find additional explanation of operating range in Supplement section.

Other Ratings

Contact Resistance: 80 milliohms maximum
Insulation Resistance: 500 megohms minimum @ 500V DC
Dielectric Strength: 500V AC minimum for 1 minute minimum
Mechanical Life: 50,000 operations minimum
Electrical Life: 50,000 operations minimum
Nominal Operating Force: 1.0N
Travel: Pretravel .020" (0.5mm); Overtravel .023 (0.6mm); Total Travel .043" (1.1mm)

Materials & Finishes

Actuator: Glass fiber reinforced polyamide (UL94V-0)
Case: Glass fiber reinforced polyamide (UL94V-0)
Movable Contacts: Phosphor bronze with gold plating
Stationary Contacts: Brass with gold plating
Base: Glass fiber reinforced polyamide (UL94V-0)
Mounting Bracket: Phosphor bronze with tin plating
Terminals: Brass with gold plating

Environmental Data

Operating Temperature Range: –25°C through +70°C (–13°F through +158°F)
Humidity: 90 ~ 95% humidity for 240 hours @ 40°C (104°F)
Vibration: 10 ~ 55Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in 1 minute; 3 right angled directions for 2 hours
Shock: 50G (490m/s^2) acceleration (tested in 6 right angled directions, with 5 shocks in each direction)

PCB Processing

Soldering: Wave Soldering Recommended: See Profile A in Supplement section.
Manual Soldering: See Profile A in Supplement section.
Cleaning: These devices are not process sealed. Hand clean locally using alcohol based solution.

Standards & Certifications

Flammability Standards: UL94V-0 actuator, case, & base
The GB2 Series pushbuttons have not been tested for UL recognition or CSA certification.
These switches are designed for use in a low-voltage, low-current, logic-level circuit.
When used as intended in a logic-level circuit, the results do not produce hazardous energy.

Distinctive Characteristics

Unique, off-center actuator allows high density setup and easy actuation while avoiding accidental operation in compact environments.

Side-by-side, block mounting can be achieved by use of bracket AT546 on straight PC mounting types.

Off-Momentary On Circuit.

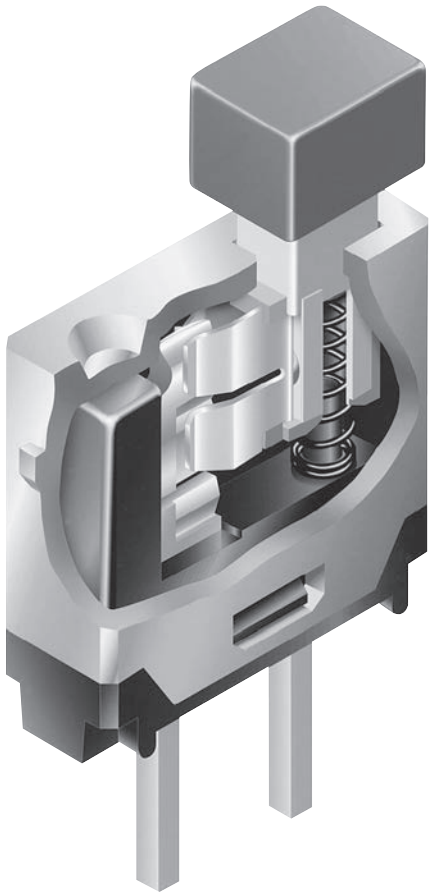
Black, white, and red snap-on caps available.

Extremely thin size allows high density PCB mounting and makes these switches ideal for handheld equipment.

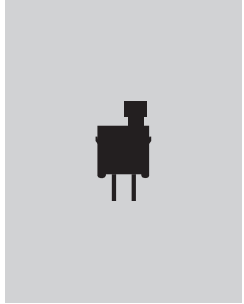
Award-winning STC contact mechanism with benefits unavailable in conventional mechanisms: smoother, positive detent actuation, increased contact stability and unparalleled logic-level reliability. (Additional STC details in Terms & Acronyms; see Supplement section.)

Molded-in, epoxy sealed terminals lock out flux and other contaminants.

.100″ x .100″ (2.54mm x 2.54mm) terminal spacing conforms to standard PC board grid spacing for straight and angle mounting.



Actual Size



Series GB2

Ultra-Thin Pushbuttons

TYPICAL SWITCH ORDERING EXAMPLE

GB2 [1] [5] [A] [B] — [ ]

Pole

1	SPST

Circuit

5	OFF	(ON)
( ) = Momentary		

Plunger

A	Standard

PC Terminals

P	Straight
B	Straight with Bracket
H	Right Angle 1 Switch
2H	Right Angle 2 Switches

Cap Colors

With P, B, or H Terminals for Single Switches

A	Black
B	White
C	Red

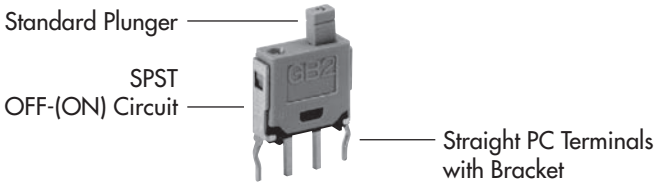
With Terminal Code 2H for 2 Right Angle Switches

Upper		*Lower
A	Black	A
B	White	B
C	Red	C

* Nearest to PC Board

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

GB215AB



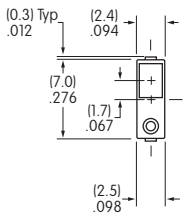
POLE & CIRCUIT

Pole	Model	Plunger Position ( ) = Momentary: Normal	Plunger Position ( ) = Momentary: Down	Connected Terminals: Normal	Connected Terminals: Down	Throw & Schematics
SP	**GB215**	OFF	(ON)	OPEN	1-2 1-2 3-4	Note: Terminal numbers are not actually on the switch. SPST SPST with 2 switches

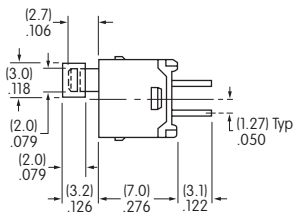
TYPICAL SWITCH DIMENSIONS

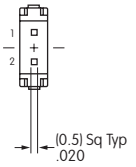
Straight PC

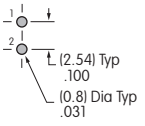
GB215AP



Single Pole



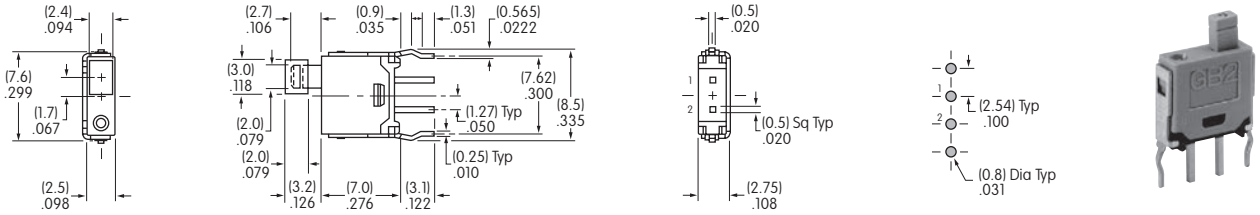




TYPICAL SWITCH DIMENSIONS

Single Pole

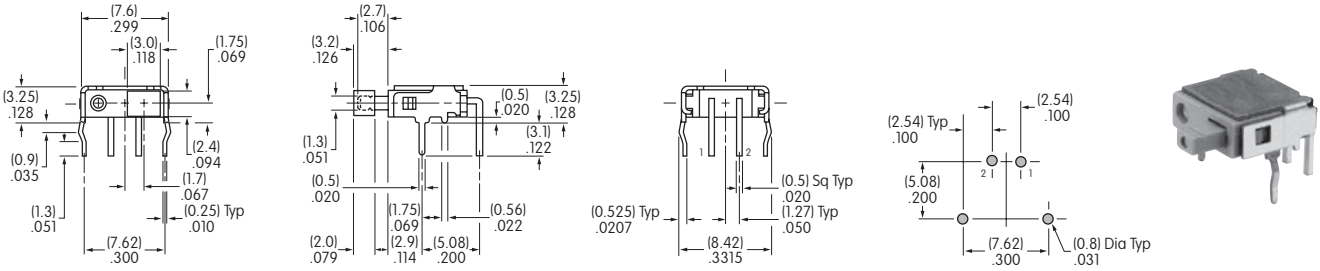
Straight PC with Bracket



GB215AB

Single Pole with 1 Switch

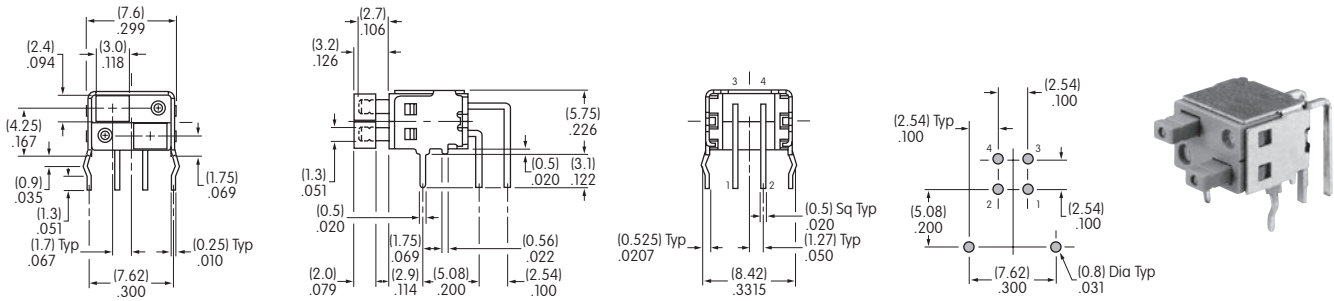
Right Angle PC



GB215AH

Single Pole with 2 Switches

Right Angle PC



GB215A2H

SNAP-ON CAP & MOUNTING BRACKET

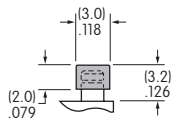
A **AT4137 Rectangular Snap-on Cap**
Black

B **AT4137 Rectangular Snap-on Cap**
White

C **AT4137 Rectangular Snap-on Cap**
Red

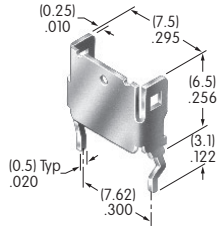
Material: PBT
Finish: Glossy

Actual Size



AT546
Mounting Bracket
for Block Mounting

Material:
Phosphor Bronze
with Tin Plating



General Specifications

Electrical Capacity (Resistive Load)

Logic Level: 0.4VA maximum @ 28V AC/DC maximum
(Applicable Range 0.1mA ~ 0.1A @ 20mV ~ 28V)
Note: Find additional explanation of operating range in Supplement section.

Other Ratings

Contact Resistance: 80 milliohms maximum
Insulation Resistance: 500 megohms minimum @ 500V DC
Dielectric Strength: 500V AC minimum for 1 minute minimum
Mechanical Life: 50,000 operations minimum
Electrical Life: 50,000 operations minimum
Nominal Operating Force: 2.0N
Travel: Pretravel: .024" (0.6mm); Overtravel: .019" (0.5mm); Total Travel: .043" (1.1mm)

Materials & Finishes

Actuator: Polyphenylene sulfide (UL94V-0)
Case: Polyphenylene sulfide (UL94V-0)
Sealing Rings: Nitrile butadiene rubber
Movable Contacts: Phosphor bronze with gold plating
Stationary Contacts: Phosphor bronze with gold plating
Base: Polyphenylene sulfide (UL94V-0)
Terminals: Phosphor bronze with gold plating

Environmental Data

Operating Temperature Range: –30°C through +85°C (–22°F through +185°F)
Humidity: 90 ~ 95% humidity for 96 hours @ 40°C (104°F)
Vibration: 10 ~ 500Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in 1 minute; 3 right angled directions for 2 hours
Shock: 50G (490m/s^2) acceleration (tested in 6 right angled directions, with 5 shocks in each direction)

Installation

Mounting: It is recommended that the body of models for upright mounting without bracket be fastened to a panel or similar support for protection of solder joints from mechanical stress.
Coplanarity: See specifications in Terms & Acronyms in Supplement section.

Processing

Soldering: Reflow Soldering Recommended. See Profile B in Supplement section.
Manual Soldering: See Profile B in Supplement section.
Cleaning: Automated cleaning. See Cleaning specifications in Supplement section.

Standards & Certifications

Flammability Standard: UL94V-0 actuator, case & base
The G3B Series pushbuttons have not been tested for UL recognition or CSA certification.
These switches are designed for use in a low-voltage, low-current, logic-level circuit.
When used as intended in a logic-level circuit, the results do not produce hazardous energy.

Distinctive Characteristics

Ultra-miniature size allows high density mounting, and extremely light weight of 0.6 gram makes these switches ideal for handheld equipment.

Tape-reel and stick-tube packaging allow rapid automated placement of surface mount devices. Tape-reel packaging meets EIA-481-D Standard.

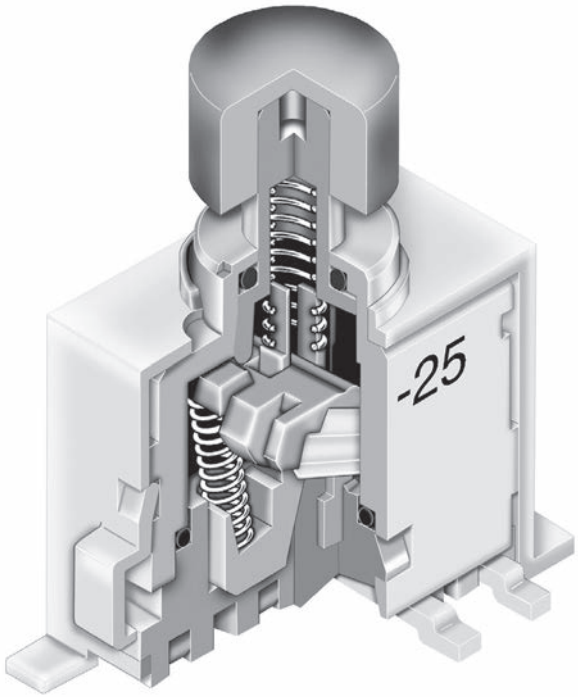
Heat resistant resin used for housing, base, and plunger allows vapor phase and infrared convection reflow soldering.

Combination of design features achieves total seal and allows automated processing techniques, including flux cleaning procedures: one-piece bushing and housing, rubber seals surrounding actuator and base, epoxy at joint of case and base, and molded-in, epoxy-sealed terminals.

Award-winning STC contact mechanism with benefits unavailable in conventional mechanisms: smoother, positive detent actuation, increased contact stability and unparalleled logic-level reliability. (Additional STC details in Terms & Acronyms; see Supplement section.)

Gull-wing terminals provide mechanical stability during soldering and simplified solder joint inspection.

Coplanarity: all considered surfaces must lie between two parallel planes that area maximum distance apart of .0059" (0.15mm). (Additional coplanarity details in Terms and Acronyms in the Supplement section.)



Actual Size

Series G3B

Ultra-Miniature Process Sealed SMT Pushbuttons

TYPICAL SWITCH ORDERING EXAMPLE

G3B [1] [5] [A] [B] — [ ] — [ ] [ ]

Poles

1	SPDT
2	DPDT

Circuits

5	ON	(ON)

( ) = Momentary

Plunger

A	.130″ (3.3mm) Long

Terminals

P	Gull Wing for Upright Mount
B	Gull Wing for Upright with Bracket
H	Gull Wing for Right Angle

Packaging

No Code	Partitioned Tray for Upright & Right Angle - Any Quantity
R	Tape-Reel for Right Angle Only 500 Pieces/Reel
S	Stick-Tube for Upright Mount 50 Pieces/Stick

Packaging details at end of G3B Series

Optional Caps

X	Slip-on Cap .157″ (4.0mm) Diameter (For installation after processing only)
Y	Process Compatible Cap .157″ (4.0mm) Diameter (Combines with R or S packaging only)

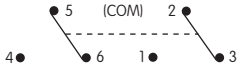
Colors

A	Black
B	White
C	Red

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

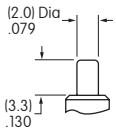
G3B15AB

POLES & CIRCUITS

Pole	Model	Plunger Position ( ) = Momentary: Normal	Plunger Position ( ) = Momentary: Down	Connected Terminals: Normal	Connected Terminals: Down	Throw & Schematics
		Slot		Slot		Note: Terminal numbers are not actually on the switch.
SP	**G3B15**	ON	(ON)	5-6	5-4	SPDT
DP	**G3B25**	ON	(ON)	5-6 2-3	5-4 2-1	DPDT 

PLUNGER & OPTIONAL CAPS

A **.130" (3.3mm) Long Plunger**



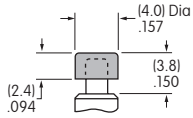
X **AT4063 Slip-on Cap .157" (4.0mm) Diameter**

Available with bulk packaging only. Cap must be installed after processing.

Material: Polyamide

Finish: Glossy

Actual Size



Y **Process Compatible Cap .157" (4.0mm) Diameter**

Factory assembled. Available with tape-reel or stick-tube packaging only.

Caution: Pulling force specification for this cap is not warranted after reflow processing.

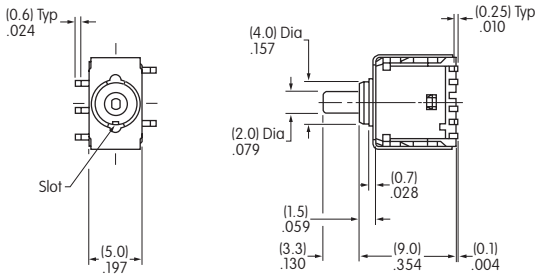
Material: Polyamide

Finish: Glossy

Cap Colors Available: **A** Black **B** White **C** Red

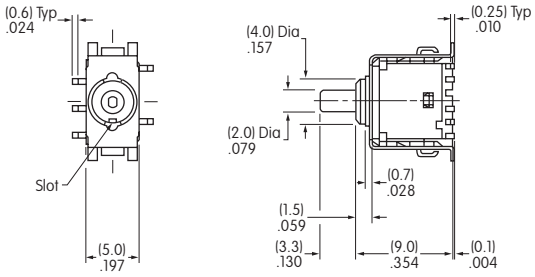
TYPICAL SWITCH DIMENSIONS

Single & Double Pole — Upright Mounting



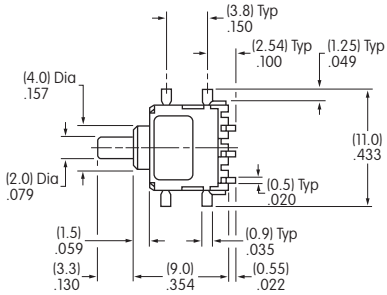
G3B25AP

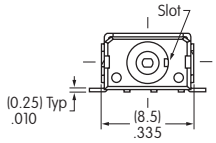
Single & Double Pole — Upright Mounting with Bracket

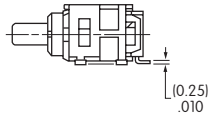


G3B15AB

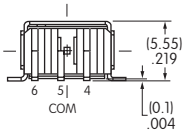
Right Angle Mounting



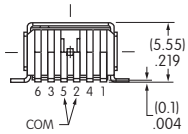




Single Pole



Double Pole



G3B15AH

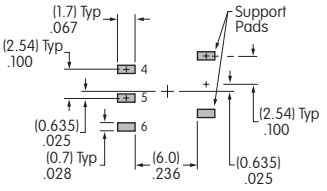
Pad Layouts for Surface Mount Terminals

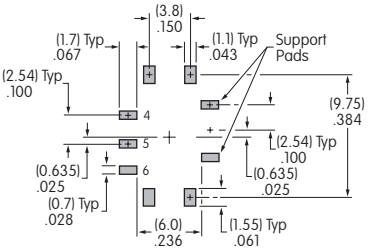
Upright Mounting

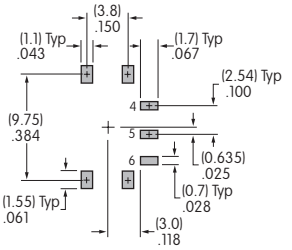
Upright Mounting with Bracket

Right Angle Mounting

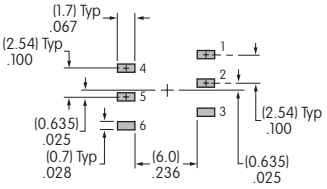
Single Pole Double Throw

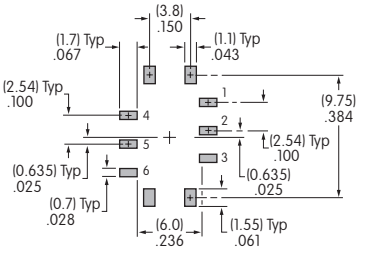


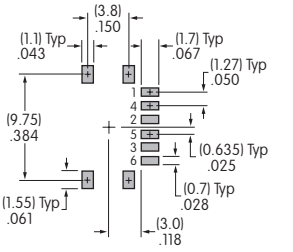




Double Pole Double Throw







PACKAGING

No Code

Partitioned Tray for Upright & Right Angle

Any quantity

If the G3 upright models are ordered in less than 50-piece increments or the right angle models in less than 500-piece increments, the switches are packaged in a partitioned tray.
No code is required.

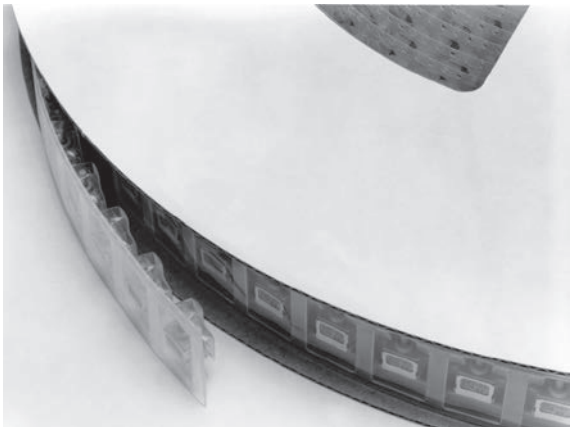
R

Tape-Reel for Right Angle

500 pieces per reel

Switches must be ordered in 500-piece increments when tape-reel packaging is selected.

This packaging meets EIA-481-D Standard for "16mm and 24mm Embossed Carrier Taping of Surface Mount Components for Automatic Handling."

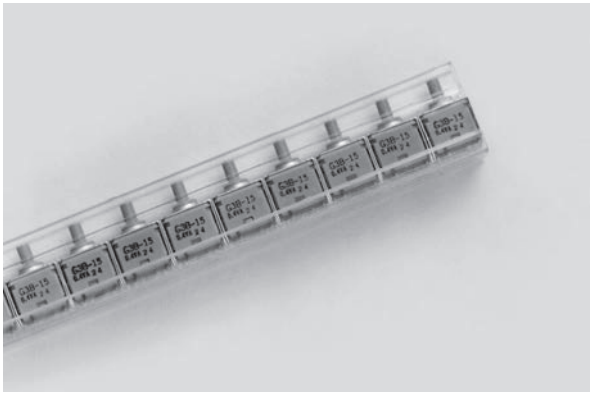


PACKAGING (CONTINUED)

S **Stick-Tube for Upright Mount**

50 pieces per stick

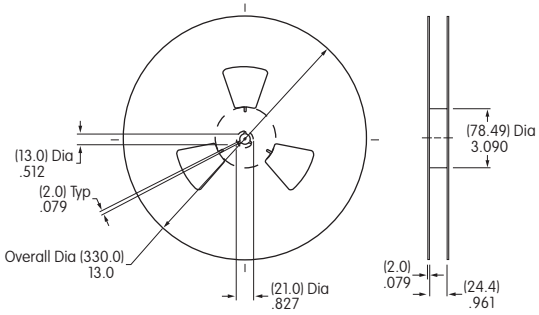
Switches must be ordered in 50-piece increments when stick-tube packaging is selected.



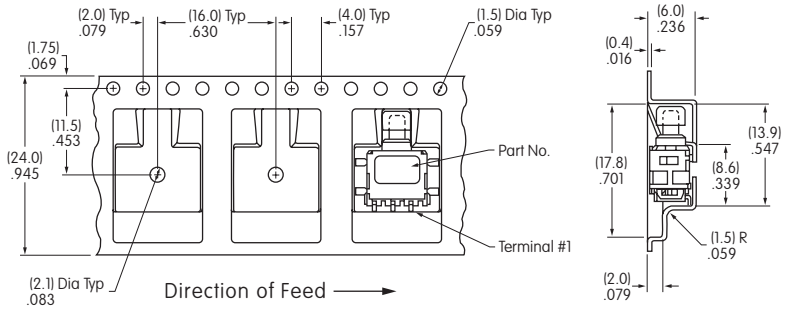
Tape-Reel Packaging for Right Angle Mount

Each tape-reel of 550 pockets contains 500 switches.

Minimum Leader Length: 7.87″ (200mm) Minimum Trailer Length: 1.97″ (50mm)



Reel Dimensions



Tape Dimensions

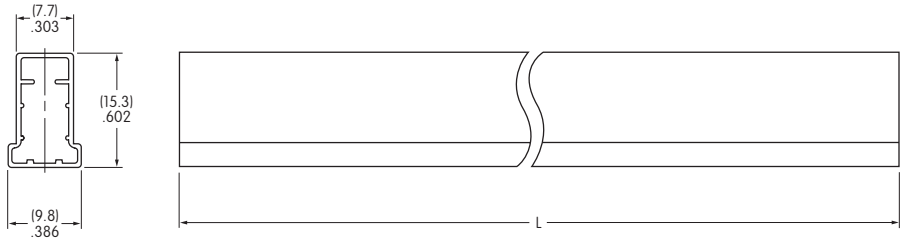
Stick-Tube Packaging for Upright Mount

Each stick-tube contains 50 switches.

L = Length

G3B Upright (code P)
18.31″ (465mm)

G3B Upright with Bracket (code B)
21.26″ (540mm)



Stick-Tube Dimensions

General Specifications

Electrical Capacity (Resistive Load)

Power Level: 10A @ 125/250V AC for JPM models & 16A @ 125/250V AC for JPL models

Other Ratings

Contact Resistance: 20 milliohms maximum
Insulation Resistance: 1,000 megohms minimum @ 500V DC
Dielectric Strength: 2,000V AC minimum between contacts for 1 minute minimum;
4,000V AC minimum between contacts & case for 1 minute minimum
Mechanical Life: 25,000 operations minimum
Electrical Life: 25,000 operations minimum
Nominal Operating Force: JPM Single Pole 3.53N & Double Pole 6.47N
JPL Single Pole 4.51N & Double Pole 9.02 N
Contact Timing: Nonshorting (break before make)
Latchdown: Normal position - flush with barrier; latchdown position - .079" (2.0mm) below normal
Travel: Pretravel .059" (1.5mm); Overtravel .071" (1.8mm); Total Travel .130" (3.3mm)

Materials & Finishes

Housing/Frame & Barrier: Polyamide (UL94V-0)
Interior Seal: Polyphenylene sulfide (UL94V-0)
Case/Base: Melamine (UL94V-0)
Movable Contacts: Silver alloy
Stationary Contacts: Silver alloy plus copper
Terminals: Brass with silver plating

Environmental Data

Operating Temp Range: –10°C through +70°C (+14°F through +158°F)
Humidity: 90 ~ 95% humidity for 96 hours @ 40°C (104°F)
Vibration: 10 ~ 55Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in 1 minute; 3 right angled directions for 2 hours
Shock: 50G (490m/s^2) acceleration (tested in 6 right angled directions, with 5 shocks in each direction)
Process Seal: Dust resistant inner seal

Installation

Soldering Time & Temp: Manual Soldering: See Profile A in Supplement section.

Standards & Certifications

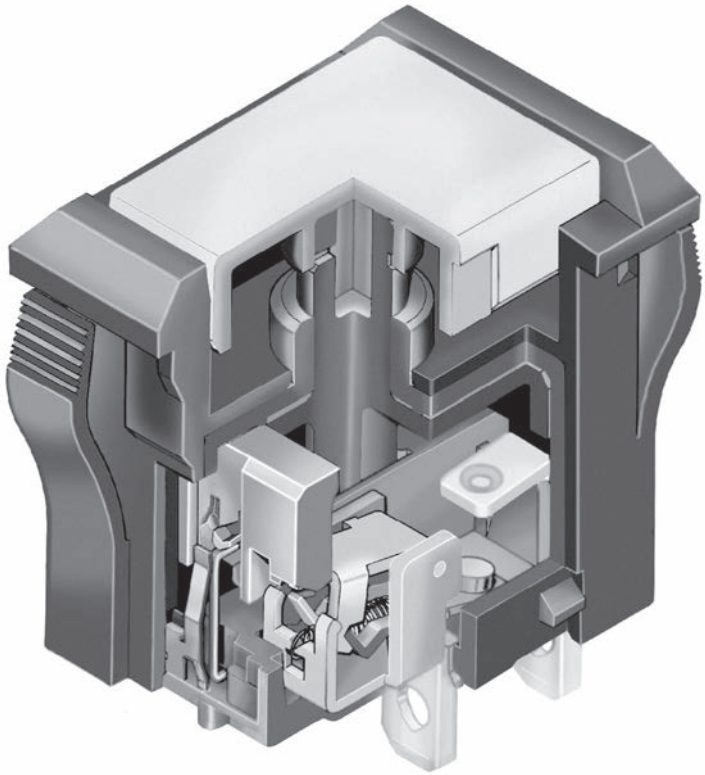
Flammability Standards: UL94V-0 for housing/frame, barrier, interior seal, & case/base
TV Ratings for UL: JPM (TV-5) Overload Test @ 125V AC for 50 operations:
Steady State Current (rms) 7.5A; Minimum Inrush Current (peak) 111A
JPM (TV-5) Endurance Test @ 125V AC for 25,000 operations:
Steady State Current (rms) 5A; Minimum Inrush Current (peak) 78A
JPL (TV-8) Overload Test @ 125V AC for 50 operations:
Steady State Current (rms) 12A; Minimum Inrush Current (peak) 163A
JPL (TV-8) Endurance Test @ 125V AC for 25,000 operations:
Steady State Current (rms) 8A; Minimum Inrush Current (peak) 117A
UL: **File No. E44145 - Recognized only when ordered with marking on switch.**
Add "/U" or "/CUL" before dash in part number to order UL recognized switch.
All JPM models certified at 10A @ 125V AC, TV5 & JPL models at 16A @ 125V AC, TV8.

VDE: **License No. 40028887 - Approved only when ordered with marking on switch.**
Add "/V" before dash in part number to order VDE approved switch.
All JPM models approved at steady state 5A, inrush 80A, resistive 10A, & motor load 6A all at 250V AC.
License No. 40039784
All JPL models approved at steady state 8A, inrush 128A, resistive 16A, & motor load 8A all at 250V AC.

Distinctive Characteristics

Industry's first molded pushbutton with TV rating. Designed to handle large inrush current. JPM models certified for TV-5 rating and JPL models for TV-8 rating.

Prominent external insulating barriers increase insulation resistance and dielectric strength.



Constructed for dust resistance with interior seal of polyphenylene sulfide (PPS) between actuator and contact area.

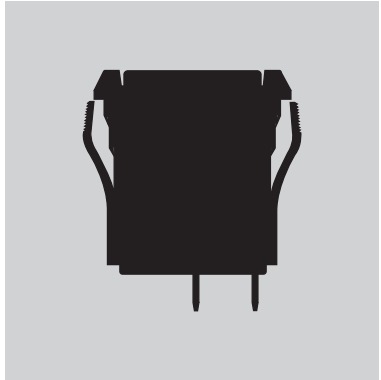
Specially designed to break light contact welds.

Snap-action contact mechanism.

Terminals are molded in and epoxy sealed to lock out flux, dust, and other contaminants.

Outer case of heat resistant resin meets UL's 94V-0 flammability standard.

Actual Size JPM



TYPICAL SWITCH ORDERING EXAMPLE

JP M 2 6 B — H

Ratings

M	TV-5 Rated 10A @ 125/250V AC
L	TV-8 Rated 16A @ 125/250V AC

Actuators

B	Flat Cap with Barrier Flange
P	Plunger with Flat Flange; cap not supplied with plunger

Poles

1	SPST
2	DPST

Circuit

6	OFF	ON
(Alternate Action with Latchdown)		

Cap Colors

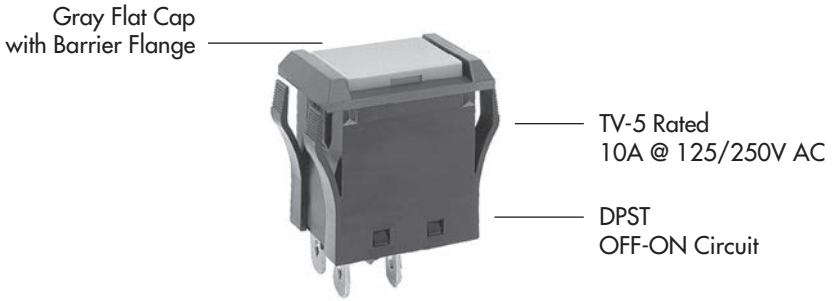
A	Black
B	Ivory
C	Red
H	Gray

IMPORTANT:

Switches are supplied without UL & VDE markings unless specified.
UL recognized only when ordered with marking on the switch.
VDE approved only when ordered with marking on the switch.
Specific models, ratings, & ordering instructions are noted on the General Specifications page.

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

JPM26B-H

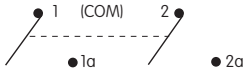


RATINGS

M	TV-5 Rated	Power Level	10A @ 125/250V AC
L	TV-8 Rated	Power Level	16A @ 125/250V AC

Note: See General Specifications page to find complete explanation of TV ratings.

POLES & CIRCUIT

		Plunger Position		Connected Terminals		Throw & Schematics
Pole	Model	Normal	Down	Normal	Down	Note: Terminal numbers are actually on the switch.
SP	JPM16 JPL16	OFF	ON	OPEN	1-1a	SPST
DP	JPM26 JPL26	OFF	ON	OPEN	1-1a 2-2a	DPST 

ACTUATORS

B Flat Cap with Barrier Flange

The barrier is an integral part of the switch. This housing is black, molded polyamide matte finish material.

Cap details below.

P Plunger with Flat Flange

The flange is an integral part of the switch. This housing is black, molded polyamide matte finish material.

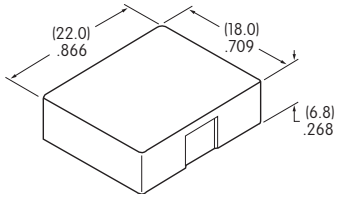
No cap supplied.

CAP COLORS

AT3021 Flat Cap for Actuator Type B with Barrier Flange

Cap Material:
Polyphenylene Oxide

Finish: Matte



The cap is flush with the barrier in normal position and .079" (2.0mm) below that in latchdown position.

The latchdown feature on this alternate action device provides visible, audible, and tactile feedback. This design gives smooth, responsive operation.

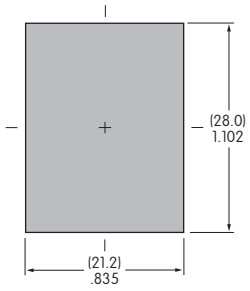
Cap Colors Available:

A Black B Ivory C Red H Gray

PANEL CUTOUT & TERMINALS

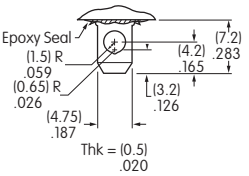
Panel Thickness Range applies to both JPM & JPL models.

.039" ~ .157"
(1.0mm ~ 4.0mm)



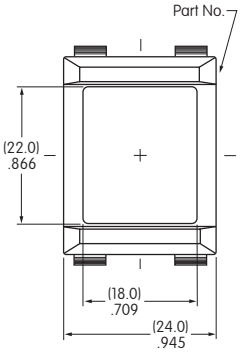
JPM & JPL Solder Lug/
.187"(4.75mm) Quick Connect Terminals

This switch assembly, when used with connectors, is not VDE approved.

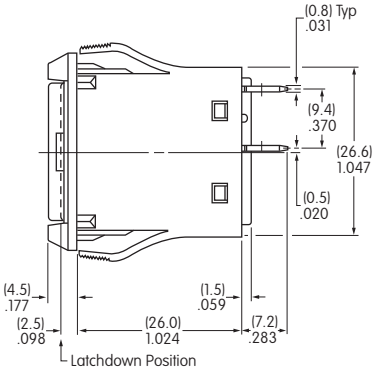


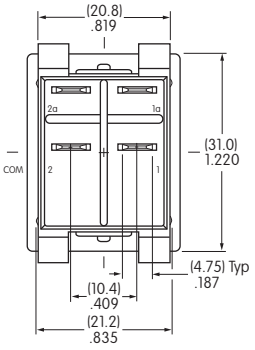
TYPICAL SWITCH DIMENSIONS

Flat Cap with Barrier Flange



JPM & JPL Single & Double Pole

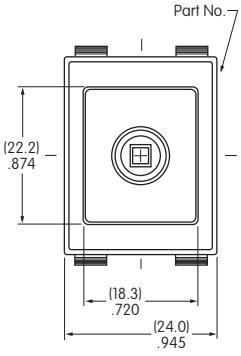




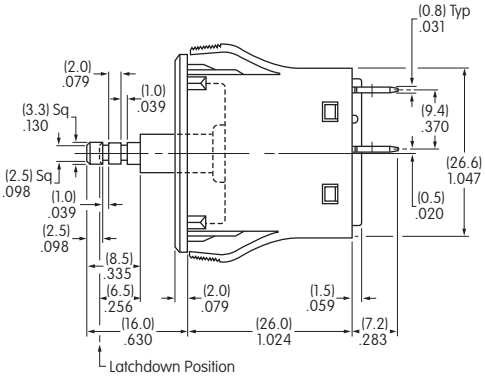
JPM26B-H

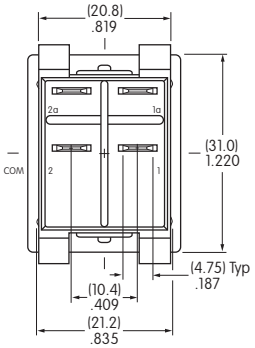
Single pole model does not have terminals 2 & 2a.

Plunger with Flat Flange



JPM & JPL Single & Double Pole





JPL16P

Single pole model does not have terminals 2 & 2a.

General Specifications

Electrical Capacity (Resistive Load)

Power Level (silver): 1A @ 125V AC or 1A @ 30V DC
Logic Level (gold): 0.4VA maximum @ 28V AC/DC maximum
(Applicable Range 0.1mA ~ 0.1A @ 20mV ~ 28V)
Logic/Power Level (gold over silver): Combines silver & gold ratings

Note: Find additional explanation of dual rating & operating range in Supplement section.

Other Ratings

Contact Resistance: 20 milliohms maximum for silver; 30 milliohms maximum for gold
Insulation Resistance: 1,000 megohms minimum @ 500V DC
Dielectric Strength: 1,000V AC minimum between contacts for 1 minute minimum;
1,500V AC minimum between contacts & case for 1 minute minimum
Mechanical Life: 200,000 operations minimum
Electrical Life: 25,000 operations minimum for silver; 100,000 operations minimum for gold
Nominal Operating Force: Single pole 2.94N & double pole 4.90N
Contact Timing: Nonshorting (break-before-make)
Travel: Pretravel .023" (0.6mm); Overtravel .016" (0.4mm); Total Travel .039" (1.0mm)

Materials & Finishes

Plunger: Brass with nickel plating
Support Bracket: Brass with tin plating
Bushing/Housing: Glass fiber reinforced polyamide (UL94V-0)
Sealing Ring: Nitrile butadiene rubber
Base: Glass fiber reinforced polyamide (UL94V-0)
Movable Contacts: Silver alloy with silver plating (code W); copper with gold plating (code G);
or silver alloy with gold plating (code A)
Stationary Contacts: Silver alloy with silver plating (code W); copper with gold plating (code G);
or silver alloy with gold plating (code A)
Terminals: Brass with silver or gold plating

Environmental Data

Operating Temp Range: –30°C through +85°C (–22°F through +185°F)
Humidity: 90 ~ 95% humidity for 96 hours @ 40°C (104°F)
Vibration: 10 ~ 55Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in 1 minute; 3 right angled directions for 2 hours
Shock: 50G (490m/s^2) acceleration (tested in 6 right angled directions, with 5 shocks in each direction)

Installation

Cap Installation Force: 49.0N (11.0 lbf) for plunger A & 79.4N (17.9 lbf) for plunger B

PCB Processing

Soldering: Wave Soldering Recommended: See Profile B in Supplement section.
Manual Soldering: See Profile B in Supplement section.
Cleaning: Automated cleaning. See Cleaning specifications in Supplement section.

Standards & Certifications

Flammability Standards: UL94V-0 rated bushing/housing & base
UL: **File No. E44145 - Recognized only when ordered with marking on switch.**
Add "/U" or "/CUL" before dash in part number to order UL recognized switch.
All models recognized at 1A @ 125V AC, 1A @ 30V DC, or 0.4A @ 28V DC.
CSA: **File No. 023535_0_000 - Certified only when ordered with marking on switch.**
Add "/C" before dash in part number to order CSA certified switch.
All models certified at 1A @ 125V AC, 1A @ 30V DC, or 0.4A @ 28V DC.

Distinctive Characteristics

Snap-acting contact mechanism gives short travel, sensitive actuation, light touch, smooth feel, audible feedback, and a longer electrical life.

Single unit construction of the bushing and top of the housing gives protection from cleaning fluids or other liquids.

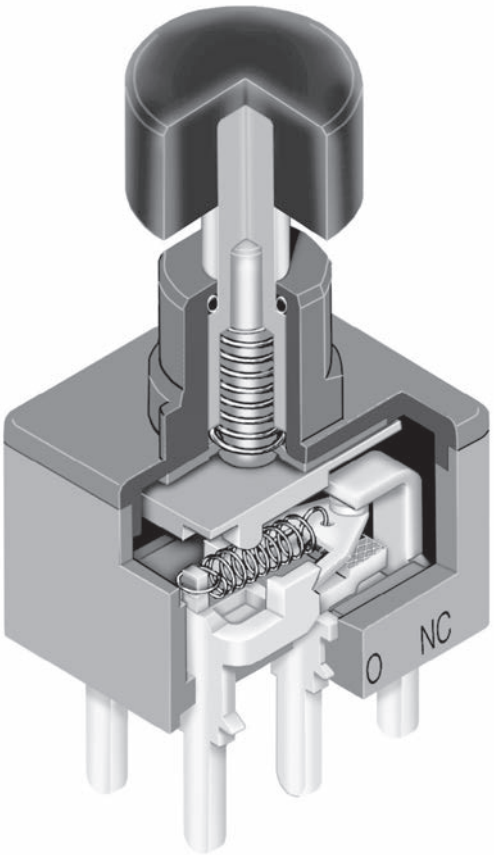
O-ring surrounding actuator at top of bushing interior prevents liquids from reaching switch mechanism.

Ultrasonic welding of upper and lower housing seals out contaminants and allows automated soldering and cleaning.

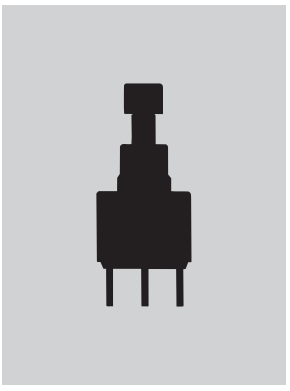
Terminals are epoxy sealed to prevent entry of flux, solvents, and other contaminants.

Bracketed models have crimped bracket legs to ensure secure PC mounting and prevent dislodging during automated soldering.

Logic level and power capabilities are available to suit varying applications.



Actual Size



TYPICAL SWITCH ORDERING EXAMPLE

M2B | 15 | A | A5 | G | 30 — F | C

Poles & Circuits

15	SPDT	ON	(ON)
25	DPDT	ON	(ON)

( ) = Momentary

Plungers

A	.282″ (7.16mm) Long for cap codes F & H
B	.307″ (7.8mm) Long for cap codes B & C

Bushing

A5	.250″ (6.35mm) Double Flatted

Contact Materials & Ratings

W	Silver; Rated 1A @ 125V AC & 1A @ 30V DC
G	Gold; Rated 0.4VA maximum @ 28V AC/DC maximum
A	Gold over Silver; Rated 1A @ 125V AC & 0.4VA max @ 28V AC/DC max

PC Terminals

03	Straight
13	Straight with .460″ (11.7mm) Bracket
30	.150″ (3.81mm) Right Angle
40	.150″ (3.81mm) Vertical

Snap-on Caps

For Plunger A	
F	.201″ (5.1mm) Diameter
H	.295″ (7.5mm) Diameter
For Plunger B	
B	.315″ (8.0mm) Diameter
C	.394″ (10.0mm) Diameter

Cap Colors

A	Black
B	White
C	Red
* E	Yellow
* F	Green
* G	Blue
* H	Gray

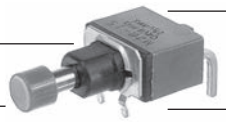
* For cap codes B & C only

IMPORTANT:

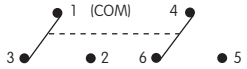
Switches are supplied without UL, cULus & CSA marking unless specified. **UL, cULus & CSA recognized only when ordered with marking on the switch.** Specific models, ratings, & ordering instructions are noted on the General Specifications page.

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

M2B15AA5G30-FC



POLES & CIRCUITS

		Plunger Position ( ) = Momentary		Connected Terminals		Throw & Schematics
Pole	Model	Normal	Down	Normal	Down	
SP	**M2B15**	ON	(ON)	1-3	1-2	SPDT
DP	**M2B25**	ON	(ON)	1-3 4-6	1-2 4-5	DPDT 

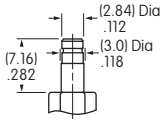
Note: Terminal numbers are not actually on the switch.

PLUNGERS

A **.282" (7.16mm) Long**

For cap codes F & H

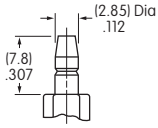
Material:
Chrome over brass



B **.307" (7.8mm) Long**

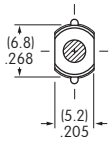
For cap codes B & C

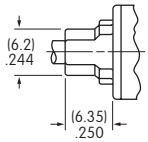
Material:
Chrome over brass



BUSHING

A5 **.250" (6.35mm) Double Flatted**





CONTACT MATERIALS & RATINGS

W	**Silver over Silver**	**Power Level**	**1A @ 125V AC & 1A @ 30V DC**
G	**Gold over Brass or Copper**	**Logic Level**	**0.4VA maximum @ 28V AC/DC maximum**

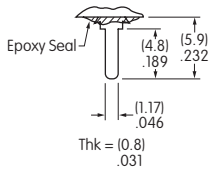
Complete explanation of operating range in Supplement section.

A	**Gold over Silver**	**Power Level or Logic Level**	**1A @ 125V AC or 0.4VA maximum @ 28V AC/DC maximum**

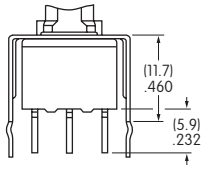
Note: This dual rated option is suitable when two or more identical switches are used in logic and in power circuits within the same application. See Supplement section for complete explanation of dual rating and operating range.

PC TERMINALS

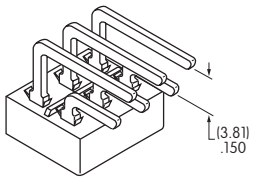
03 **Straight**



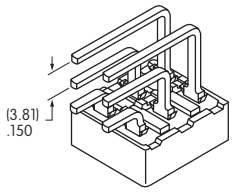
13 **Straight with .460" (11.7mm) Bracket**



30 **.150" (3.81mm) Right Angle**



40 **.150" (3.81mm) Vertical**



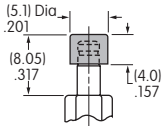
SNAP-ON CAPS

For Plunger Type A

F **AT475**
.201" (5.1mm) Diameter

Material: Polyamide

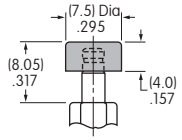
Colors Available:
A, B, C



H **AT496**
.295" (7.5mm) Diameter

Material: Polyamide

Colors Available:
A, B, C

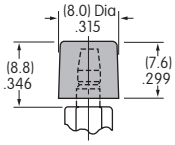


For Plunger Type B

B **AT443**
.315" (8.0mm) Diameter

Material: Polycarbonate

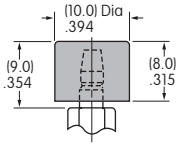
Colors Available:
A, B, C, E, F, G, H



C **AT442**
.394" (10.0mm) Diameter

Material: Polycarbonate

Colors Available:
A, B, C, E, F, G, H



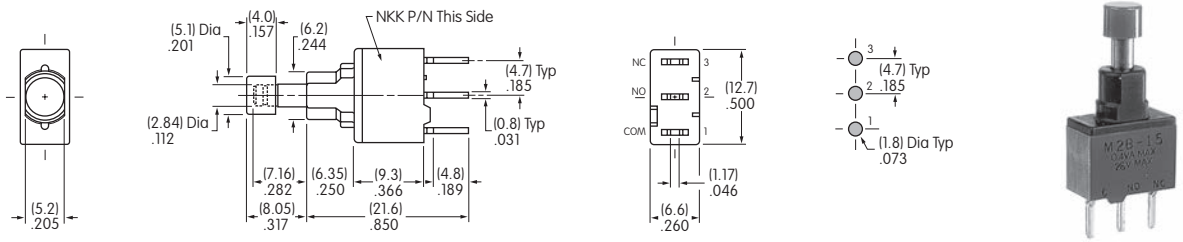
Cap Colors Codes:

A	Black	**B**	White	**C**	Red	**E**	Yellow	**F**	Green	**G**	Blue	**H**	Gray

TYPICAL SWITCH DIMENSIONS

Single Pole

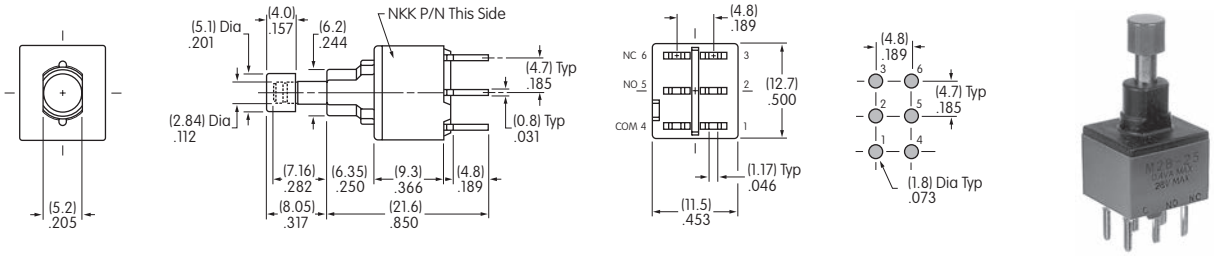
Straight PC



M2B15AA5G03-FC

Double Pole

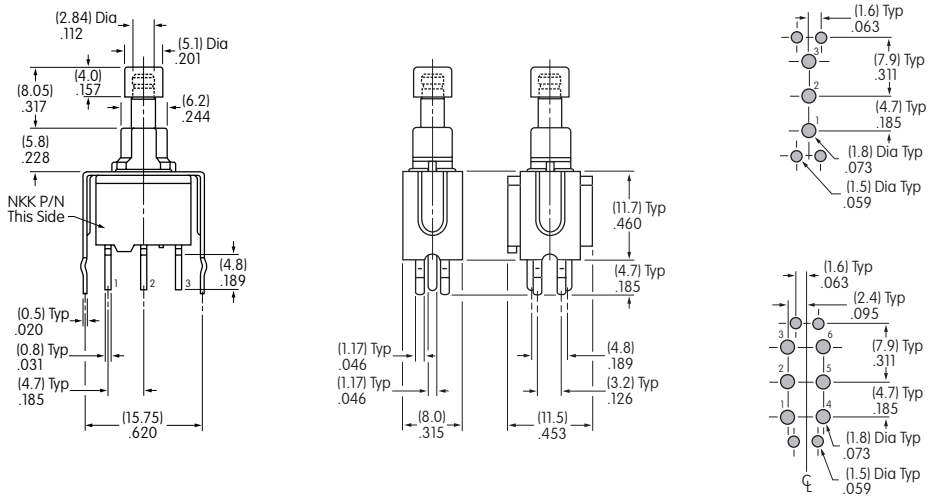
Straight PC



M2B25AA5G03-FC

Single & Double Pole

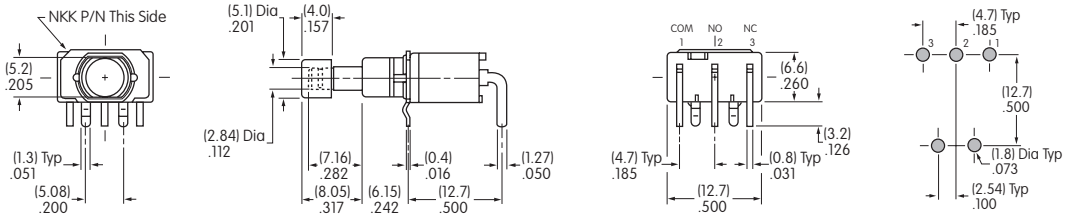
Straight PC • Bracket



M2B15AA5G13-FC

TYPICAL SWITCH DIMENSIONS

Right Angle PC — Single Pole



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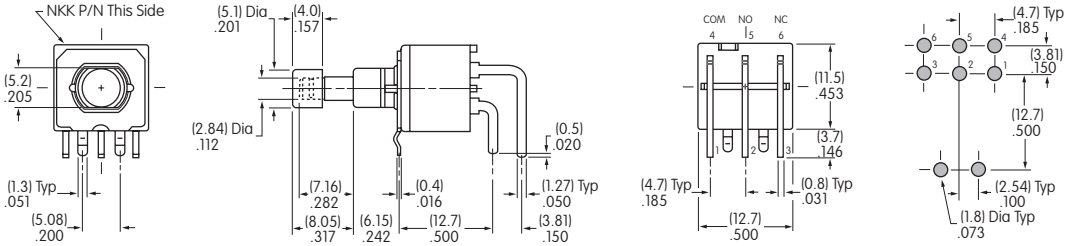
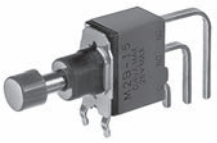
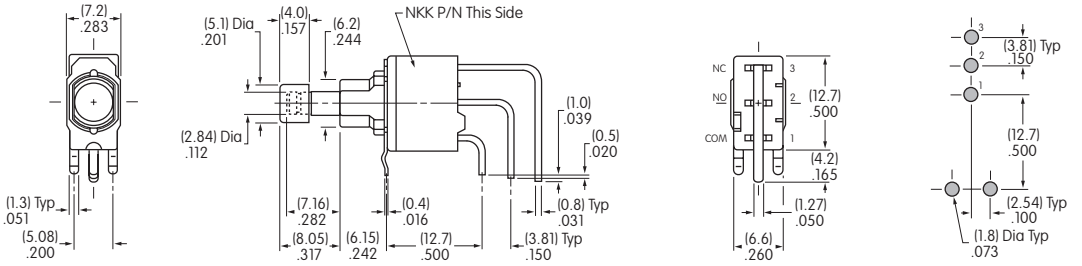
Right Angle PC — Double Pole



M2B25AA5G30-FC

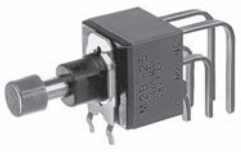
Vertical PC — Single Pole

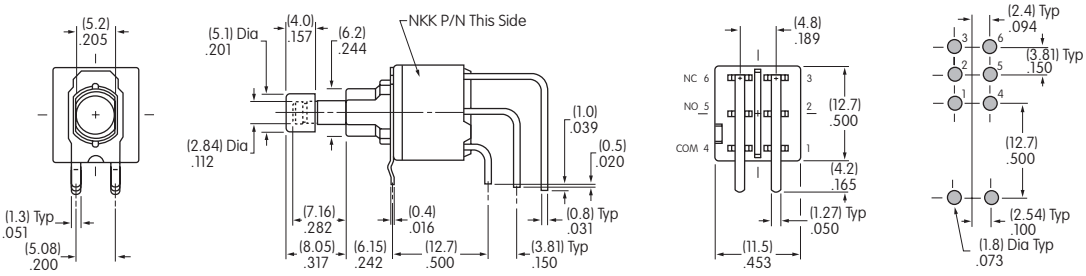




M2B15AA5G40-FC

Vertical PC — Double Pole





M2B25AA5G40-FC

General Specifications

Electrical Capacity (Resistive Load)

Power Level (silver): 6A @ 125V AC & 3A @ 250V AC or 3A @ 30V DC
Logic Level (gold): 0.4VA maximum @ 28V AC/DC maximum (Applicable Range 0.1mA ~ 0.1A @ 20mV ~ 28V)
Logic/Power Level: (gold over silver) Combines silver & gold ratings

Note: Find additional explanation dual rating & operating range in Supplement section.

Other Ratings

Contact Resistance: 10 milliohms maximum for silver; 20 milliohms maximum for gold
Insulation Resistance: 1,000 megohms minimum @ 500V DC
Dielectric Strength: 1,000V AC minimum between contacts for 1 minute minimum;
1,500V AC minimum between contacts & case for 1 minute minimum
Mechanical Life: 50,000 operations minimum for splashproof models; 100,000 for all other models
Electrical Life: 25,000 operations minimum for silver; 50,000 operations minimum for gold
50,000 operations minimum for silver at 3A @ 125V AC
Nominal Operating Force: Momentary Action: 1-pole 9.32N; 2-pole 16.18N; 4-pole 25.54N;
Alternate Action: 1-pole 4.41N; 2-pole 7.06N; 4-pole 11.77N
Contact Timing: Slow make, slow break

	Screw-on Cap (Mom.)	Screw-on Cap (Alt.)	Snap-on Cap (Mom. & Alt.)
Plunger Travel:			
Pretravel:	.028" (0.71mm)	.110" (2.80mm)	.125" (3.19mm)
Overtravel:	.043" (1.09mm)	.043" (1.10mm)	.050" (1.26mm)
Total Travel	.071" (1.80mm)	.153" (3.90mm)	.175" (4.45mm)

Materials & Finishes

Plunger: Brass w/nickel plating; polyacetal w/B1 bushing
Frame: Stainless steel
Bushing: Brass with nickel plating
Case: Diallyl phthalate resin (UL94V-0)
Movable Contactor: Phosphor bronze with silver or gold plating
Movable Contacts: Silver alloy (code W); copper with gold plating (code G); or silver alloy with gold plating (code A)
Stationary Contacts: Silver with silver plating (code W); copper or brass with gold plating (code G); or silver with gold plating (code A)
Terminals: Copper or brass with silver plating; copper or brass with gold plating

Environmental Data

Operating Temp Range: –30°C through +85°C (–22°F through +185°F)
Humidity: 90 ~ 95% humidity for 96 hours @ 40°C (104°F)
Vibration: 10 ~ 55Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in 1 minute; 3 right angled directions for 2 hours
Shock: 50G (490m/s^2) acceleration (tested in 6 right angled directions, with 5 shocks in each direction)
Sealing: B3 & D3 bushing options equivalent to IP67

Installation

Mounting Torque: 1.5Nm (13.0 lb•in) for double nut; .7Nm (6.0 lb•in) for single nut
Cap Installation Force: 80.0N (18.0 lbf) maximum downward force on actuator
Soldering Time & Temp: Wave Soldering (PC version): See Profile A in Supplement section.
Manual Soldering: See Profile A in Supplement section.
Process Seal: These devices are not process sealed. Hand clean locally using alcohol based solution.

Standards & Certifications

Flammability Standards: UL94V-0 case
UL: **File No. E44145 - Recognized only when ordered with marking on switch.**
Add "/U" or "/CUL" before dash in part number to order UL recognized switch.
All models recognized at 6A @ 125V AC or 3A @ 250V AC or 0.4VA max. @ 28V DC max.
CSA: **File No. 023535_0_000 - Certified only when ordered with marking on switch.**
Add "/C" before dash in part number to order CSA certified switch.
All models certified at 6A @ 125V AC or 3A @ 250V AC or 0.4VA max. @ 28V max.

Distinctive Characteristics

Guide interlocked with actuator block prevents window locking and maintains correct plunger alignment to assure contact stability.

Employs an over-center actuator mechanism, which diminishes sparking and increases operating life in AC circuits.

High torque bushing construction prevents rotation or separation from frame during installation.

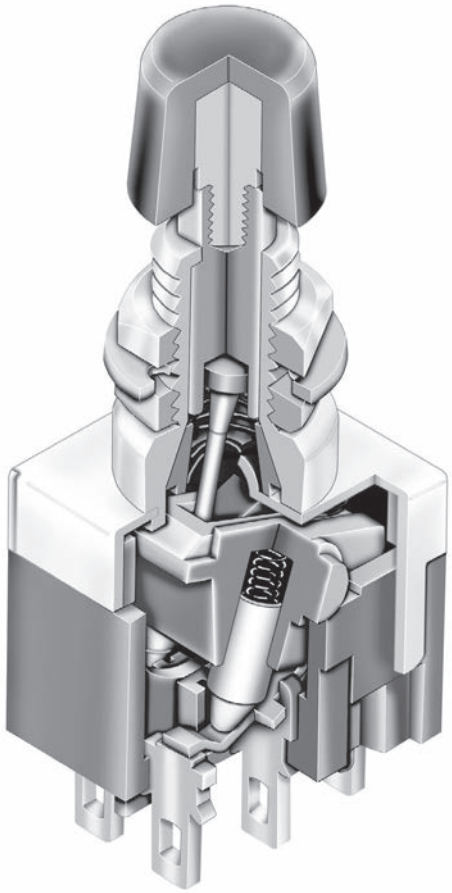
Splashproof option (D3 and B3 bushing codes) features an o-ring within the bushing and one under the face nut to protect from splashed, sprayed, or spilled liquids.

High insulating barriers, formed in the molded diallyl phthalate case, increase isolation of circuits in multipole devices.

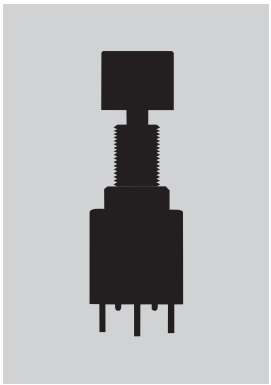
Prominent external insulating barriers increase insulation resistance and dielectric strength.

Epoxy sealed terminals prevent entry of solder flux and other contaminants.

Clinching of the frame to the case well above the base and terminals provides 1,500V dielectric strength.



Actual Size



Bushing Mount Page C74

Bracket PC Mount Page C80

Large Bushing Page C87

Series MB2000

Bushing Mount Miniature Pushbuttons

TYPICAL SWITCH ORDERING EXAMPLE

MB 2011 S S1 W 01 — C A

Poles & Circuits

2011	SPDT	ON	(ON)
2065	SPDT	ON	ON
2061	DPDT	ON	(ON)
2085	DPDT	ON	ON
2181	4PDT	ON	(ON)
2185	4PDT	ON	ON

( ) = Momentary

Contact Materials & Ratings

W	Silver Rated 6A @ 125V AC & 3A @ 250V AC
G	Gold Rated 0.4VA max @ 28V AC/DC max
A	Gold over Silver Rated 6A @ 125V AC & 0.4VA max @ 28V AC/DC max

Caps

B	.315″ (8.0mm) Diameter
C	.394″ (10.0mm) Diameter

Cap Colors

A	Black
B	White
C	Red
E	Yellow
F	Green
G	Blue
H	Gray

Plunger Types

S	Plunger for Screw-on Caps
L	Plunger for Snap-on Caps

Bushings

S1	.335″ (8.5mm) Threaded with Keyway
S2	.335″ (8.5mm) Smooth with Keyway
S4	.335″ (8.5mm) Metric Threaded with Keyway
D1	.335″ (8.5mm) Threaded with D-Flat
D3	.335″ (8.5mm) Threaded Splashproof without Keyway

Terminals

01	Solder Lug
02	Quick Connect
03	.250″ (6.35mm) Straight PC
05	.425″ (10.8mm) Wirewrap
06	.750″ (19.05mm) Wirewrap
07	.964″ (24.5mm) Wirewrap
08	1.062″ (27.0mm) Wirewrap

IMPORTANT:

Switches are supplied without UL, cULus & CSA marking unless specified. **UL, cULus & CSA recognized only when ordered with marking on the switch.** Specific models, ratings, & ordering instructions are noted on the General Specifications page.

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

MB2011SS1W01-CA

Black .394″ (10.0mm) Diameter Cap

SPDT ON-(ON) Circuit

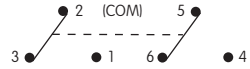
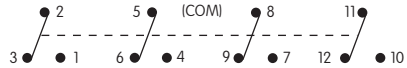
Silver Contacts with 6-Amp Rating

Plunger for Screw-on Caps

.335″ (8.5mm) Threaded Bushing with Keyway

Solder Lug Terminals

POLES & CIRCUITS

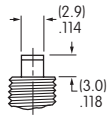
Pole	Model	Plunger Position ( ) = Momentary: Normal (Keyway)	Plunger Position ( ) = Momentary: Down	Connected Terminals: Normal (Keyway)	Connected Terminals: Down	Throw & Switch Schematics
SP	**MB2011**	ON	(ON)	2-3	2-1	SPDT
	MB2065	ON	ON			
DP	**MB2061**	ON	(ON)	2-3 5-6	2-1 5-4	DPDT 
	MB2085	ON	ON			
4P	**MB2181**	ON	(ON)	2-3 5-6 8-9 11-12	2-1 5-4 8-7 11-10	4PDT 
	MB2185	ON	ON			

Note: Terminal numbers are not actually on the switch.

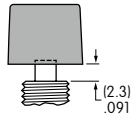
PLUNGER TYPES

On alternate action models, after transferring circuit, the plunger returns to its original position and does not latch down.

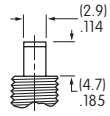
S **Plunger for Screw-on Caps**



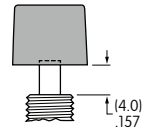
Momentary Plunger Length



Momentary Cap Location

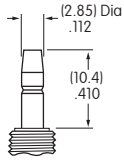


Alternate Plunger Length

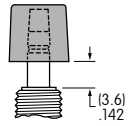


Alternate Cap Location

L **Plunger for Snap-on Caps**



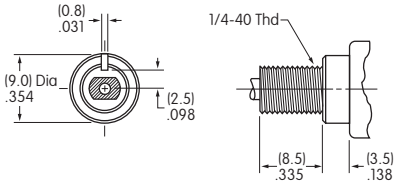
Momentary & Alternate Plunger Length



Momentary & Alternate Cap Location

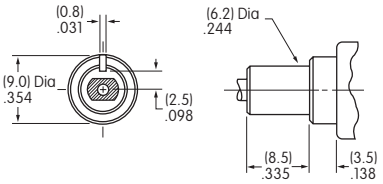
BUSHINGS

S1 **.335" (8.5mm) Threaded with Keyway**

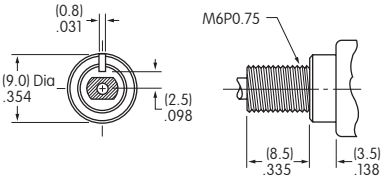


Maximum Panel Thickness with Standard Hardware: .154" (3.9mm)

S2 **.335" (8.5mm) Smooth with Keyway**

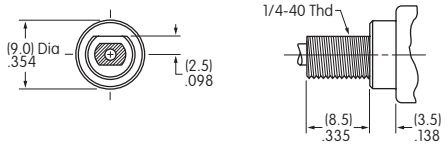


S4 **.335" (8.5mm) Metric Threaded with Keyway**



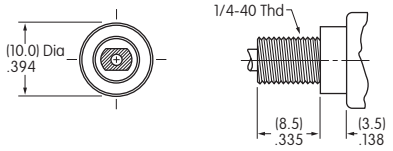
Maximum Panel Thickness with Standard Hardware: .154" (3.9mm)

D1 **.335" (8.5mm) Threaded with D Flat**



Maximum Panel Thickness with Standard Hardware: .154" (3.9mm)

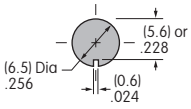
D3 **.335" (8.5mm) Threaded Splashproof without Keyway**



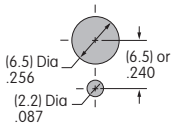
Maximum Panel Thickness with Standard Hardware: .240" (6.1mm)

Panel Cutouts

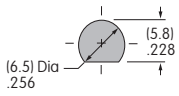
For S1, S2, or S4 Bushing with Keyway



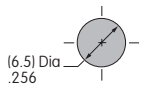
For S1 or S4 Bushing with Optional Locking Ring



For D1 Bushing with D Flat



For D3 Bushing without Keyway



Standard hardware for bushings S1, S4, & D1 includes 2 hex nuts & 1 lockwasher; D3 bushing has 1 hex nut & 1 o-ring. Standard & optional hardware are illustrated following the Typical Switch Dimension drawings.

CONTACT MATERIALS & RATINGS

W	**Silver over Silver**	**Power Level**	**6A @ 125V AC & 3A @ 250V AC**
G	**Gold over Brass or Copper**	**Logic Level**	**0.4VA maximum @ 28V AC/DC maximum**

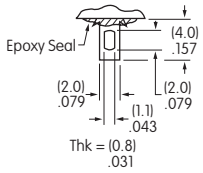
Note: Complete explanation of operating range in Supplement section.

A	**Gold over Silver**	**Power Level or Logic Level**	**6A @ 125V AC & 3A @ 250V AC or 0.4VA maximum @ 28V AC/DC maximum**

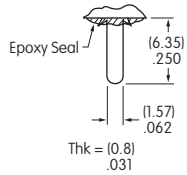
Note: This dual rated option is suitable when two or more identical switches are used in logic and in power circuits within the same application. See Supplement section for complete explanation of dual rating and operating range.

TERMINALS

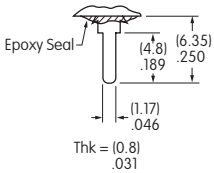
01 **Solder Lug**

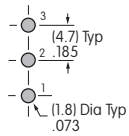


02 **.062" (1.57mm) Wide Quick Connect**

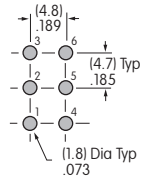


03 **.250" (6.35mm) Straight PC**

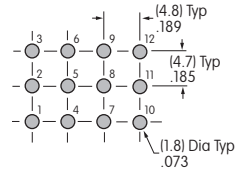




Single Pole



Double Pole



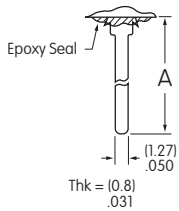
Four Pole

05 **.425" (10.8mm) Wirewrap or Extended PC**

06 **.750" (19.05mm) Wirewrap or Extended PC**

07 **.964" (24.5mm) Wirewrap or Extended PC**

08 **1.062" (27.0mm) Wirewrap or Extended PC**



If using as extended PC terminal, refer to the above footprints.

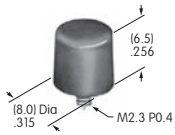
Dimension A = terminal lengths as shown beside the terminal codes at the left.

CAPS & CAP COLORS

B **AT413**
.315" (8.0mm) Diameter
Screw-on Cap

For use with Plunger Code S

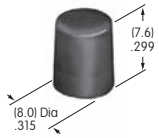
Cap Material: PBT
Finish: Glossy



AT443
.315" (8.0mm) Diameter
Snap-on Cap

For use with Plunger Code L

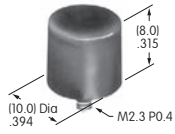
Cap Material: Polycarbonate
Finish: Glossy



C **AT407**
.394" (10.0mm) Diameter
Screw-on Cap

For use with Plunger Code S

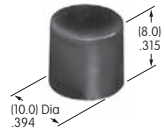
Cap Material: PBT
Finish: Glossy



AT442
.394" (10.0mm) Diameter
Snap-on Cap

For use with Plunger Code L

Cap Material: Polycarbonate
Finish: Glossy

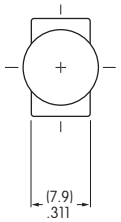


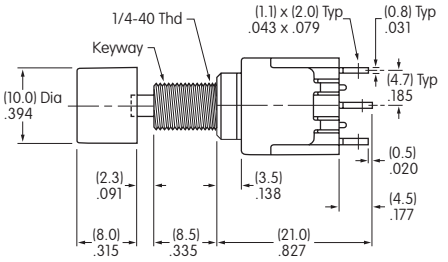
Cap Colors Available: **A** Black **B** White **C** Red **E** Yellow **F** Green **G** Blue **H** Gray

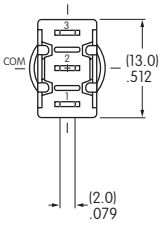
TYPICAL SWITCH DIMENSIONS

Solder Lug

Single Pole



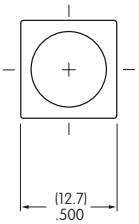


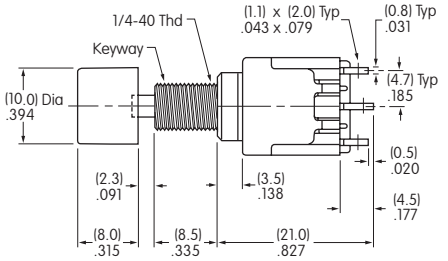


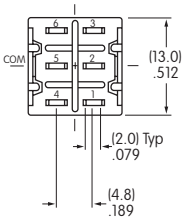
MB2011SS1W01-CA

Solder Lug

Double Pole



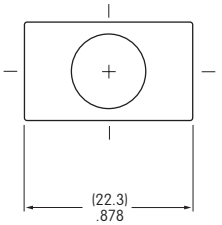


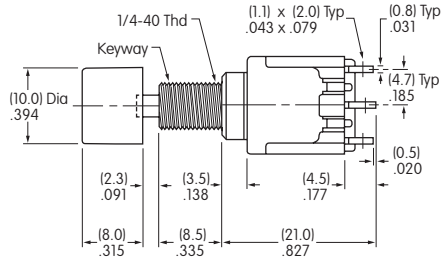


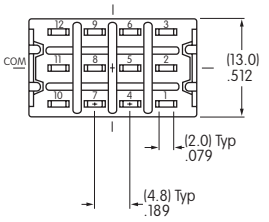
MB2061SS1W01-CA

Solder Lug

Four Pole







MB2181SS1W01-CA

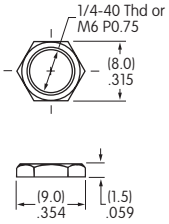
HARDWARE

Standard Hardware

AT513H for Inch
AT513M for Metric
Hexagon Nut

2 included with each switch
(1 with splashproof models)

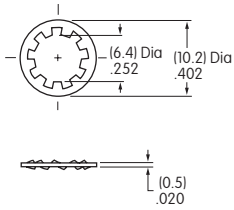
Material:
Brass with Nickel plating



AT509
Lockwasher

1 included with each switch
(not with splashproof models)

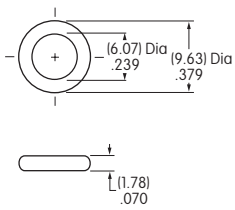
Material:
Steel with Zinc/Chromate



AT516
O-ring for
Splashproof Bushing

1 included with
each splashproof model

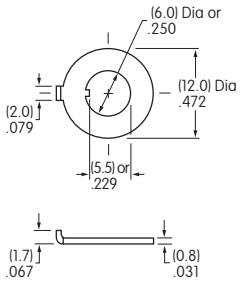
Material:
Nitrile butadiene rubber



Optional Hardware

AT507H for Inch
AT507M for Metric
Locking Ring

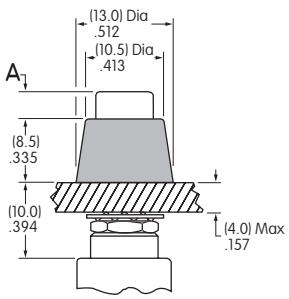
Material:
Steel with Zinc/Chromate



Optional Mounting Collars/Conical Nuts

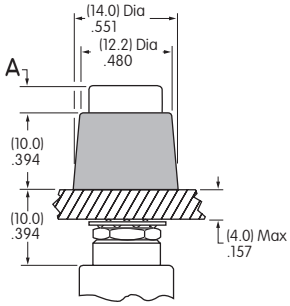
AT512H for Inch
AT512M for Metric
Conical Nut

Used with .315″ (8.0mm)
Diameter Cap (cap code B)
Material:
Brass with chrome plating



AT512CH for Inch
AT512CM for Metric
Conical nut

Used with .394″ (10.0mm)
Diameter Cap (cap code C)
Material:
Brass with chrome plating



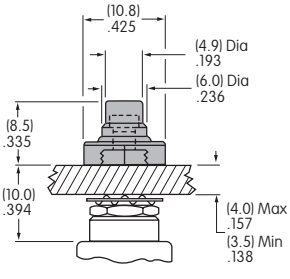
Dimension A = Cap Height

.091″ (2.3mm) for Momentary with Plunger Code S
.157″ (4.0mm) for Alternate with Plunger Code S
.142″ (3.6mm) for Momentary & Alternate with Plunger Code L

Optional Splashproof Boots for S Plunger

AT4041H for Inch
AT4041M for Metric
Boot for Momentary

Material:
Silicone rubber

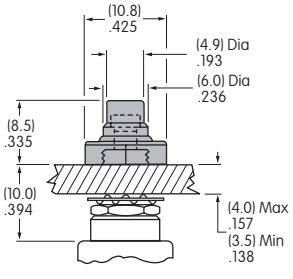


Operating Life 100,000

Boots for momentary devices are accompanied by a threaded adaptor which extends the length of the plunger.

AT4042H for Inch
AT4042M for Metric
Boot for Alternate

Material:
Silicone rubber



Operating Life 30,000

Series MB2000

Bracket PC Mount Miniature Pushbuttons

TYPICAL SWITCH ORDERING EXAMPLE

MB 2011 S S2 G 13 — C A

Poles & Circuits

2011	SPDT	ON	(ON)
2065	SPDT	ON	ON
2061	DPDT	ON	(ON)
2085	DPDT	ON	ON
2181	4PDT	ON	(ON)
2185	4PDT	ON	ON

( ) = Momentary

4-pole not for use with right angle terminals

Contact Materials & Ratings

W	Silver Rated 6A @ 125V AC & 3A @ 250V AC
G	Gold Rated 0.4VA max @ 28V AC/DC max
A	Gold over Silver Rated 6A @ 125V AC & 0.4VA max @ 28V AC/DC max

Caps

B	.315" (8.0mm) Diameter
C	.394" (10.0mm) Diameter

Cap Colors

A	Black
B	White
C	Red
E	Yellow
F	Green
G	Blue
H	Gray

Plunger Type

S	Plunger for Screw-on Caps

Bushings

S2	.335" (8.5mm) Smooth with Keyway
S1	.335" (8.5mm) Threaded with Keyway
A2	.200" (5.08mm) Smooth with Keyway Only Available in Part Numbers MB2011SA2G31 & MB2011SA2W31

Terminals

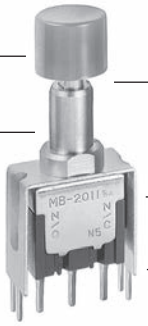
13	.250" (6.35mm) Straight PC with Bracket
40	.150" (3.81mm) Vertical PC
45	.100" (2.54mm) Vertical PC
30	Right Angle PC with .646" (16.4mm) Support to Terminals Available in 1- & 2-pole only
31	Right Angle PC with .500" (12.7mm) Support to Terminals Available in 1-pole only

IMPORTANT:

Switches are supplied without UL, cULus & CSA marking unless specified. **UL, cULus & CSA recognized only when ordered with marking on the switch.** Specific models, ratings, & ordering instructions are noted on the General Specifications page.

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

MB2011SS2G13-CA



Black .394" (10.0mm) Diameter Cap

.335" (8.5mm) Smooth Bushing with Keyway

Gold Contacts with 0.4VA Rating

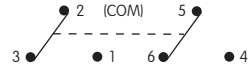
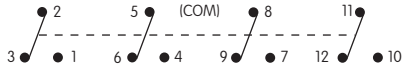
Plunger for Screw-on Caps

SPDT ON-(ON) Circuit

.250" (6.35mm) Straight PC Terminals with Bracket

Series MB2000

POLES & CIRCUITS

Pole	Model	Plunger Position ( ) = Momentary: Normal (Keyway)	Plunger Position: Down	Connected Terminals: Normal (Keyway)	Connected Terminals: Down	Throw & Switch Schematics
SP	**MB2011** **MB2065**	ON ON	(ON) ON	2-3	2-1	SPDT
DP	**MB2061** **MB2085**	ON ON	(ON) ON	2-3 5-6	2-1 5-4	DPDT 
4P	**MB2181** **MB2185**	ON ON	(ON) ON	2-3 5-6 8-9 11-12	2-1 5-4 8-7 11-10	4PDT 

Note: Terminal numbers are not actually on the switch.

PLUNGER TYPE

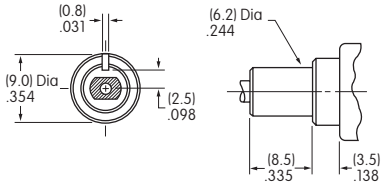
On alternate action models, after transferring circuit, the plunger returns to its original position and does not latch down.

S **Plunger for Screw-on Caps**

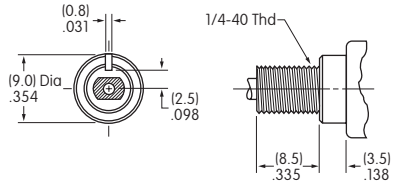
Momentary Plunger Length | Momentary Cap Location | Alternate Plunger Length | Alternate Cap Location

BUSHINGS

S2 **.335" (8.5mm) Smooth with Keyway**

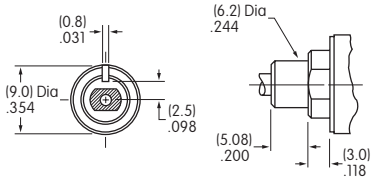


S1 **.335" (8.5mm) Threaded with Keyway**



Standard hardware: 2 hex nuts (AT513H) & 1 lockwasher (AT509)
Optional hardware: Locking ring (AT507)

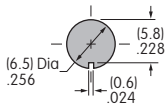
A2 **.200" (5.08mm) Smooth with Keyway**



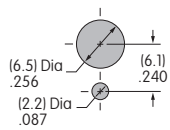
Only available in part numbers MB2011SA2W31 & MB2011SA2G31

Panel Cutouts

For S2, S1, or A2 Bushing with Keyway



With Optional Locking Ring



Maximum Panel Thickness with Standard Hardware: .154" (3.9mm)

Series MB2000

Bracket PC Mount Miniature Pushbuttons

CONTACT MATERIALS & RATINGS

W	**Silver over Silver**	**Power Level**	**6A @ 125V AC & 3A @ 250V AC**
G	**Gold over Brass or Copper**	**Logic Level**	**0.4VA maximum @ 28V AC/DC maximum**

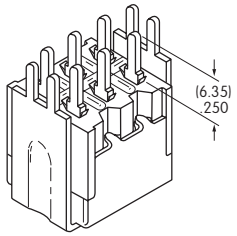
Note: Complete explanation of operating range in Supplement section.

A	**Gold over Silver**	**Power Level or Logic Level**	**6A @ 125V AC & 3A @ 250V AC or 0.4VA maximum @ 28V AC/DC maximum**

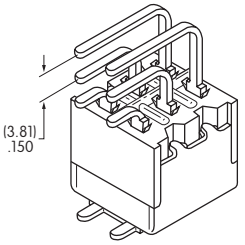
Note: This dual rated option is suitable when two or more identical switches are used in logic and in power circuits within the same application. See Supplement section for complete explanation of dual rating and operating range.

TERMINALS

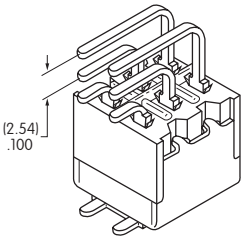
13 **.250" (6.35mm) Straight PC with Bracket**



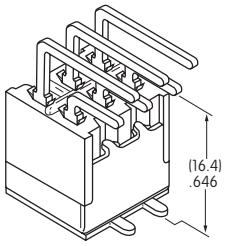
40 **.150" (3.81mm) Vertical PC**



45 **.100" (2.54mm) Vertical PC**

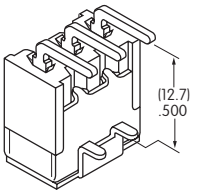


30 **Right Angle PC with .646" (16.4mm) Support to Terminal**



Only Available in 1 & 2 Pole

31 **Right Angle PC with .500" (12.7mm) Support to Terminal**

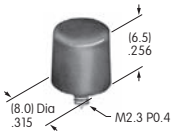


Note: Full dimensioned drawings appear on the following pages.

CAPS & CAP COLORS

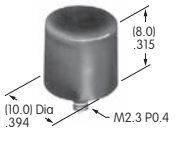
B **AT413**
.315" (8.0mm) Diameter
Screw-on Cap

Cap Material: PBT
Finish: Glossy



C **AT407**
.394" (10.0mm) Diameter
Screw-on Cap

Cap Material: PBT
Finish: Glossy

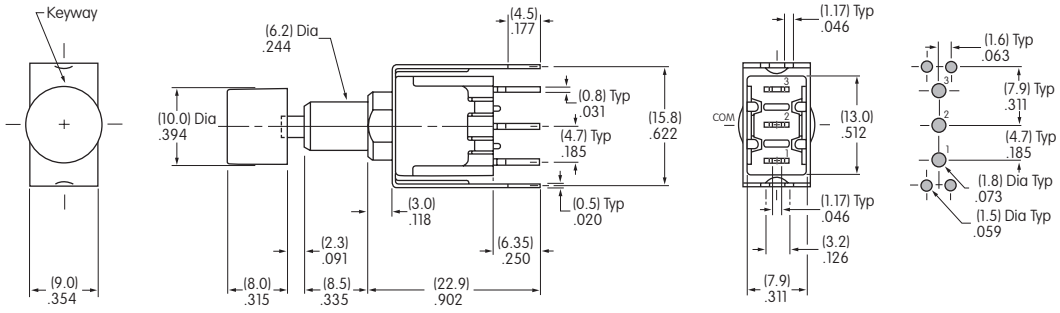


Cap Colors Available: **A** Black **B** White **C** Red **E** Yellow **F** Green **G** Blue **H** Gray

TYPICAL SWITCH DIMENSIONS

Single Pole

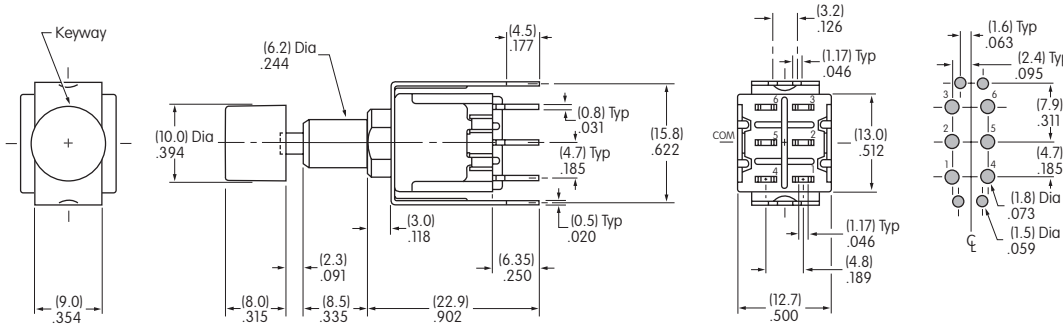
Straight PC with Bracket



MB2011SS2G13-CA

Double Pole

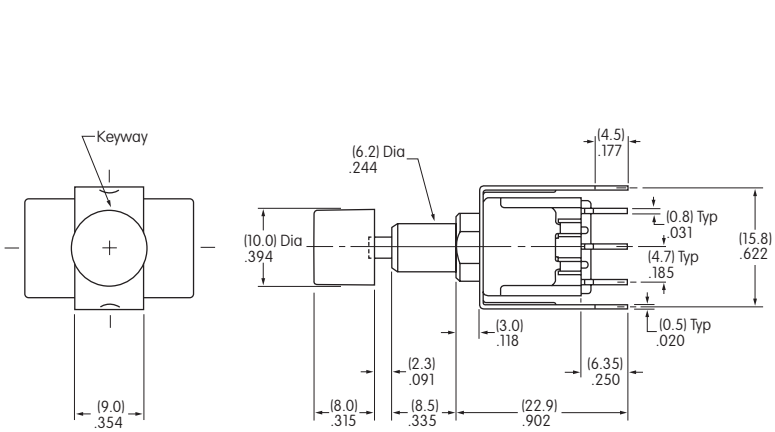
Straight PC with Bracket



MB2061SS2G13-CA

Four Pole

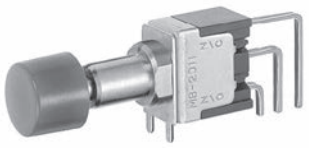
Straight PC with Bracket

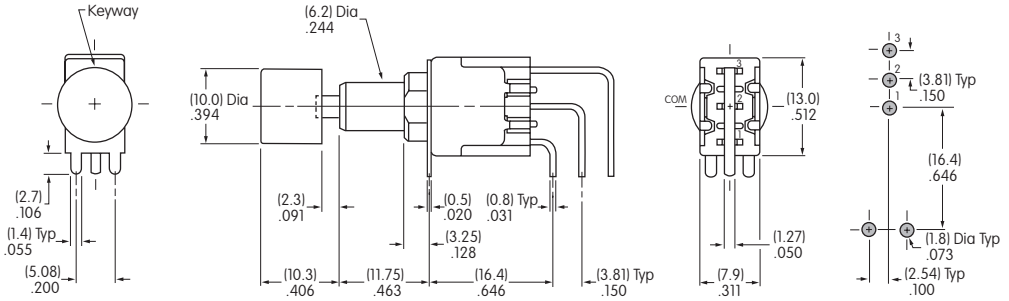


MB2181SS2G13-CA

TYPICAL SWITCH DIMENSIONS

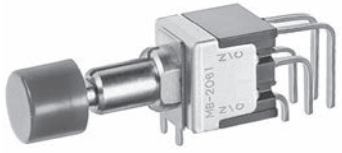
.150" (3.81mm) Vertical PC — Single Pole

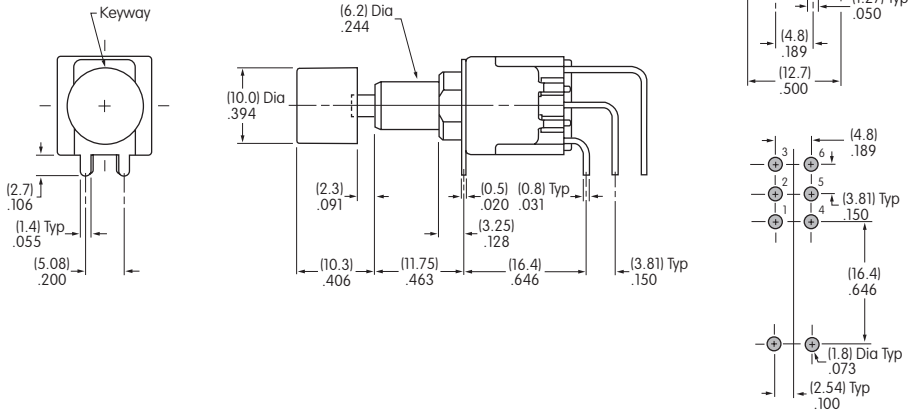




MB2011SS2G40-CA

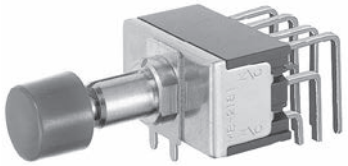
.150" (3.81mm) Vertical PC — Double Pole

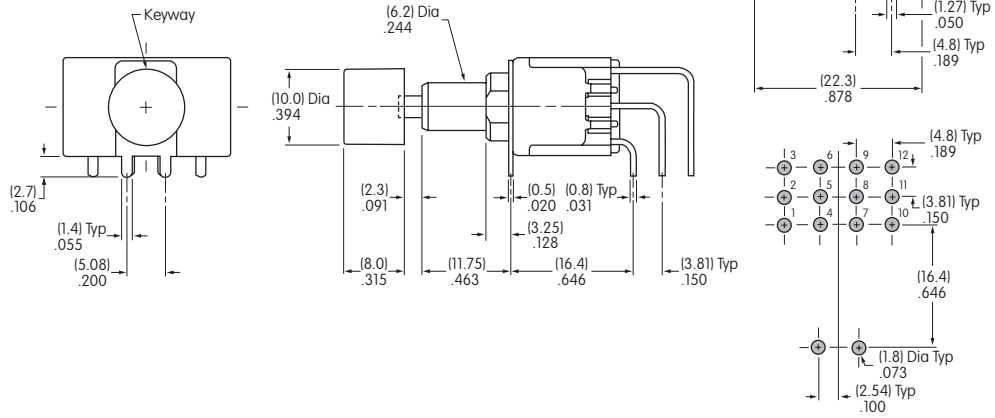




MB2061SS2G40-CA

.150" (3.81mm) Vertical PC — Four Pole

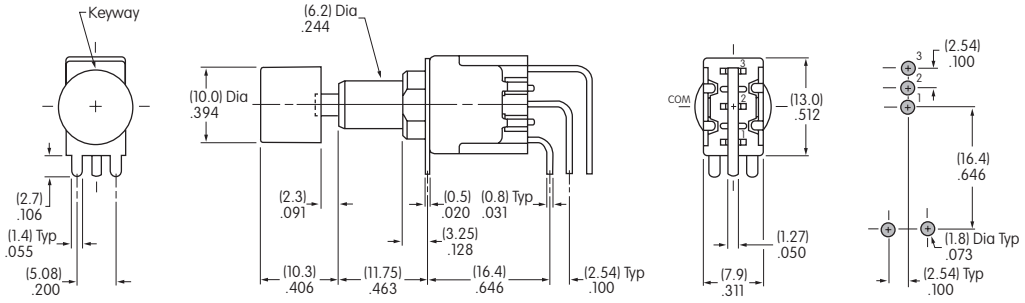


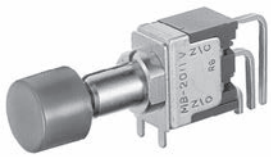


MB2181SS2G40-CA

TYPICAL SWITCH DIMENSIONS

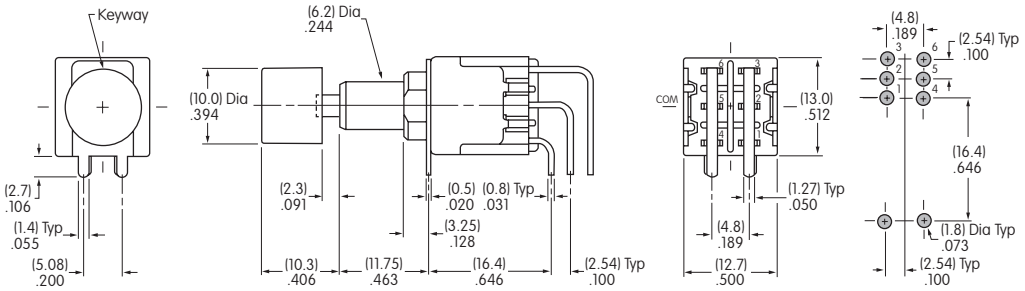
Single Pole .100" (2.54mm) Vertical PC

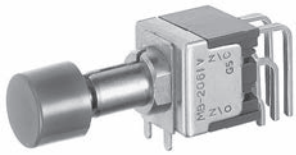




MB2011SS2G45-CA

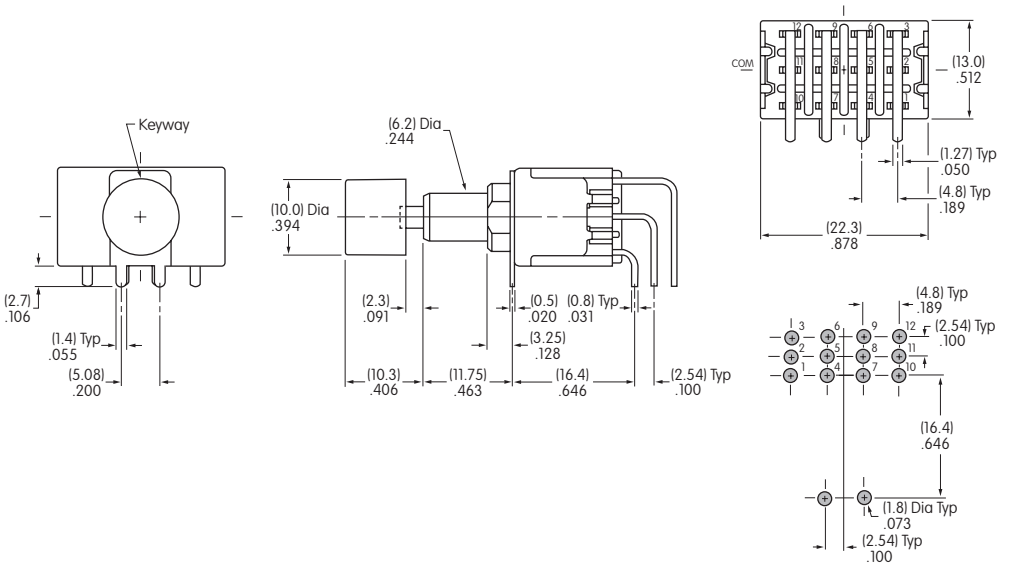
Double Pole .100" (2.54mm) Vertical PC





MB2061SS2G45-CA

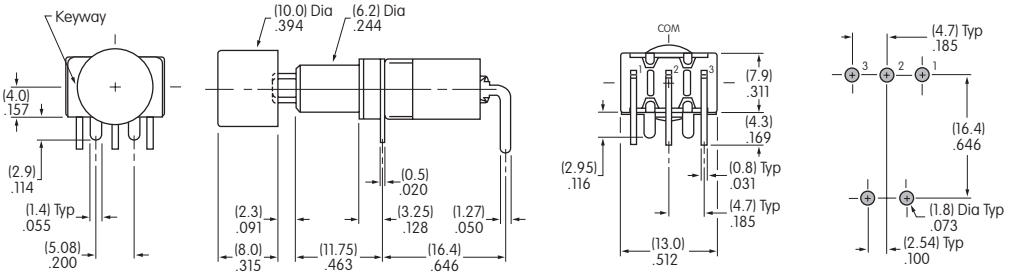
Four Pole .100" (2.54mm) Vertical PC



MB2181SS2G45-CA

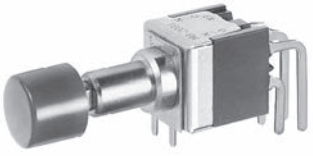
TYPICAL SWITCH DIMENSIONS

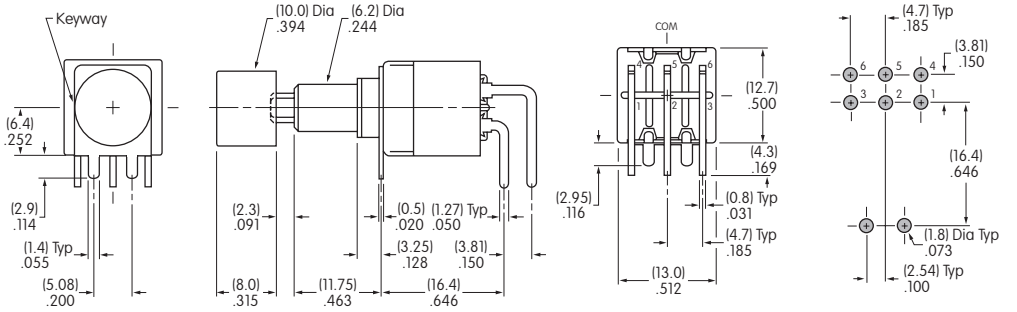
Right Angle PC — Single Pole



MB2011SS2G30-CA

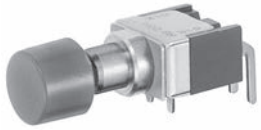
Right Angle PC — Double Pole

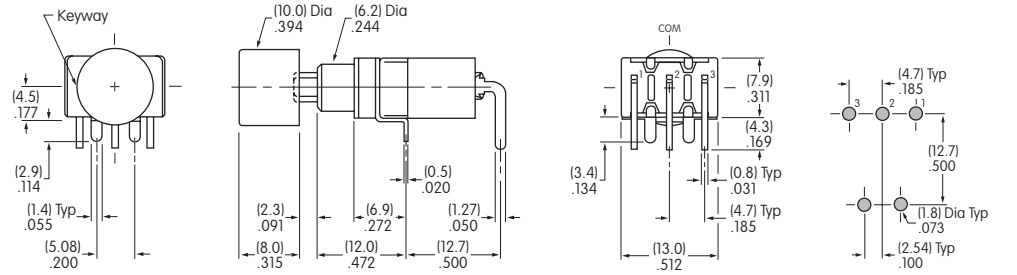




MB2061SS2G30-CA

Right Angle PC with .500" (12.7mm) Support to Terminal — Single Pole





MB2011SA2G31-CA

TYPICAL SWITCH ORDERING EXAMPLE

MB 2011 S B1 W 01 – D A

Poles & Circuits

2011	SPDT	ON	(ON)
2065	SPDT	ON	ON
2061	DPDT	ON	(ON)
2085	DPDT	ON	ON
2181	4PDT	ON	(ON)
2185	4PDT	ON	ON

( ) = Momentary

Plunger Type

S	Plunger for Screw-on Caps

Bushings

B1	.472" (12.0mm) Threaded with Keyway
B3	.472" (12.0mm) Threaded w/Splashproof

Contact Materials & Ratings

W	Silver Rated 6A @ 125V AC & 3A @ 250V AC
G	Gold Rated 0.4VA max @ 28V AC/DC max

Terminals

01	Solder Lug
02	Quick Connect
03	.250" (6.35mm) Straight PC
05	.425" (10.8mm) Wirewrap
06	.750" (19.05mm) Wirewrap
07	.964" (24.5mm) Wirewrap
08	1.062" (27.0mm) Wirewrap

Caps

B	.315" (8.0mm) Diameter
C	.394" (10.0mm) Diameter
D	.520" (13.2mm) Diameter
E	.748" (19.0mm) Diameter

Cap Colors

A	Black
B	White
C	Red
***D**	Amber
***E**	Yellow
F	Green
***G**	Blue
***H**	Gray

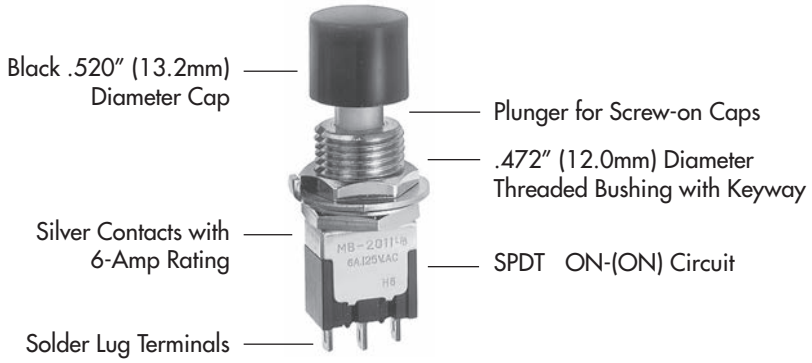
* Not available with cap code E

IMPORTANT:

Switches are supplied without UL, cULus & CSA marking unless specified. **UL, cULus & CSA recognized only when ordered with marking on the switch.** Specific models, ratings, & ordering instructions are noted on the General Specifications page.

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

MB2011SB1W01-DA



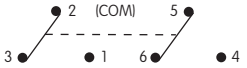
Series MB2000

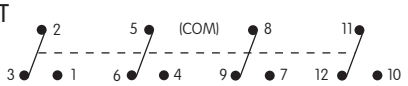
Large Bushing Miniature Pushbuttons

POLES & CIRCUITS

Pole	Model	Plunger Position ( ) = Momentary: Normal (Keyway)	Plunger Position ( ) = Momentary: Down	Connected Terminals: Normal (Keyway)	Connected Terminals: Down	Throw & Switch Schematics
SP	**MB2011**	ON	(ON)	2-3	2-1	SPDT
	MB2065	ON	ON			
DP	**MB2061**	ON	(ON)	2-3 5-6	2-1 5-4	DPDT
	MB2085	ON	ON			
4P	**MB2181**	ON	(ON)	2-3 5-6 8-9 11-12	2-1 5-4 8-7 11-10	4PDT
	MB2185	ON	ON			

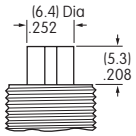
Note: Terminal numbers are not actually on the switch.



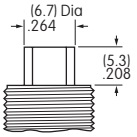


PLUNGER TYPE

S **Plunger for Screw-on Caps**
Plunger is plastic for B1 bushing.



Plunger is metal for B3 bushing.

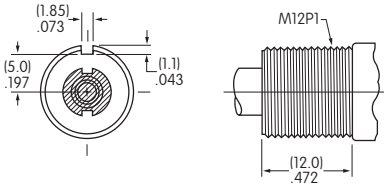


On alternate action models, after transferring circuit, the plunger returns to its original position, and does not latch down.

BUSHINGS

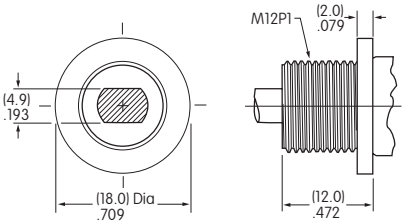
B1 **.472" (12.0mm) Diameter Threaded with Keyway**

Maximum Panel Thickness with Standard Hardware: .217" (5.5mm)



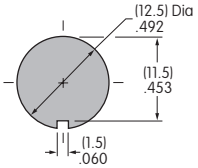
B3 **.472" (12.0mm) Diameter Threaded Splashproof**

Maximum Panel Thickness with Standard Hardware: .217" (5.5mm)

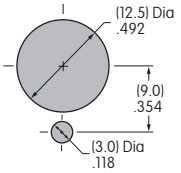


Panel Cutouts

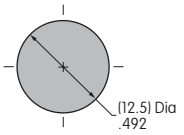
For B1 Bushing with Keyway



For B1 Bushing with Locking Ring



For B3 Bushing without Keyway



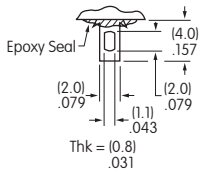
CONTACT MATERIALS & RATINGS

W	**Silver over Silver**	**Power Level**	**6A @ 125V AC & 3A @ 250V AC**
G	**Gold over Brass or Copper**	**Logic Level**	**0.4VA maximum @ 28V AC/DC maximum**

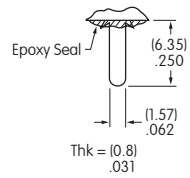
Note: Complete explanation of operating range in Supplement section.

TERMINALS

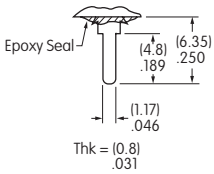
01 **Solder Lug**

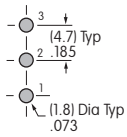


02 **.062" (1.57mm) Wide Quick Connect**

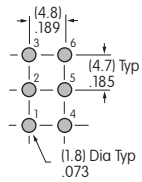


03 **.250" (6.35mm) Straight PC**

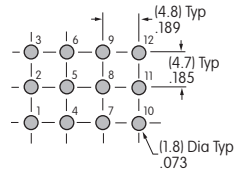




Single Pole



Double Pole



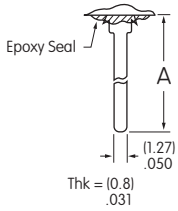
Four Pole

05 **.425" (10.8mm) Wirewrap or Extended PC**

06 **.750" (19.05mm) Wirewrap or Extended PC**

07 **.964" (24.5mm) Wirewrap or Extended PC**

08 **1.062" (27.0mm) Wirewrap or Extended PC**



If using as extended PC terminal, refer to the above footprints.

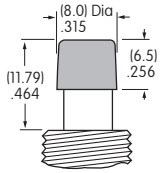
Dimension A = terminal lengths as shown beside the terminal codes at the left.

CAPS & CAP COLORS

B **AT078 .315" (8.0mm) Diameter Screw-on Cap**

Material: Polystyrene
Finish: Glossy

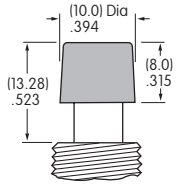
Colors Available:
A B C E F G H



C **AT079 .394" (10.0mm) Diameter Screw-on Cap**

Material: Polystyrene
Finish: Glossy

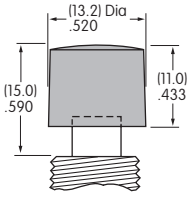
Colors Available:
A B C E F G H



D **AT414 .520" (13.2mm) Diameter Screw-on Cap**

Material: PBT
Finish: Glossy

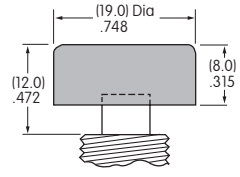
Colors Available:
A B C D E F G H



E **AT412 .748" (19.0mm) Diameter Screw-on Cap**

Material: Polystyrene
Finish: Glossy

Colors Available:
A B C F

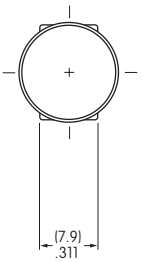


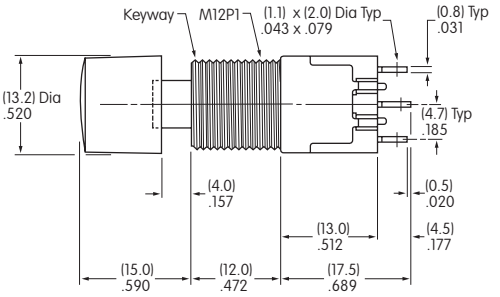
Cap Color Codes: **A** Black **B** White **C** Red **D** Amber **E** Yellow **F** Green **G** Blue **H** Gray

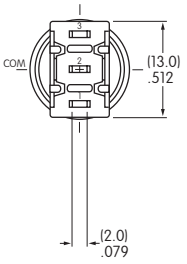
TYPICAL SWITCH DIMENSIONS

Solder Lug

Single Pole



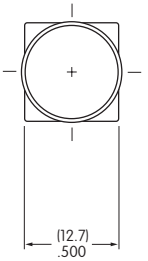


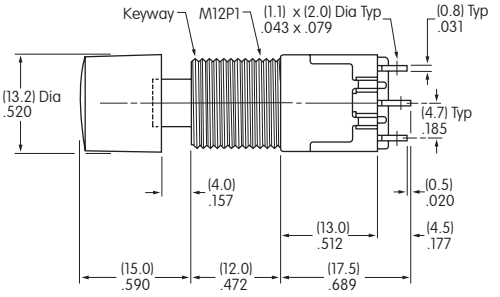


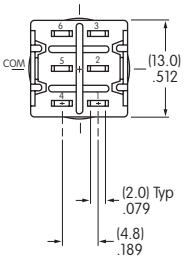
MB2011SB1W01-DA

Solder Lug

Double Pole



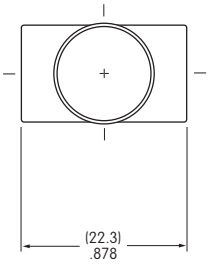


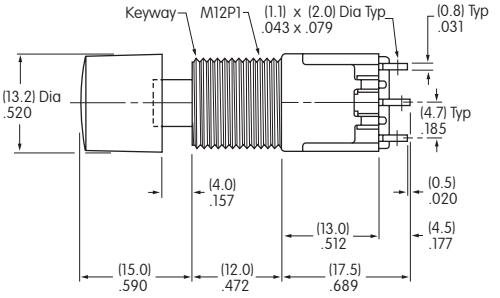


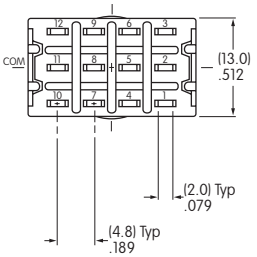
MB2061SB1W01-DA

Solder Lug

Four Pole







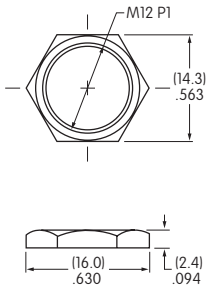
MB2181SB1W01-DA

HARDWARE

Standard Hardware for B1 Bushing

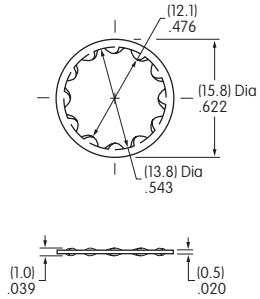
AT503M
Hex Face Nut

Material:
Brass with Chrome plating



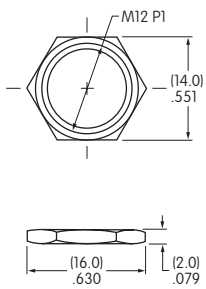
AT508
Lockwasher

Material:
Steel with Zinc/Chromate



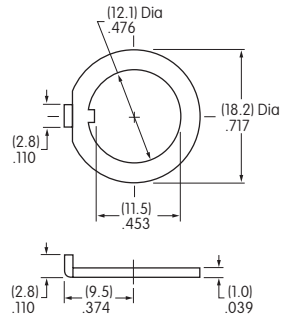
AT527M
Hex Nut

Material:
Steel with Nickel plating



AT506M
Locking Ring

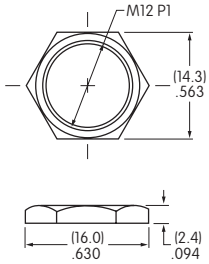
Material:
Steel with Zinc/Chromate



Standard Hardware for B3 Bushing

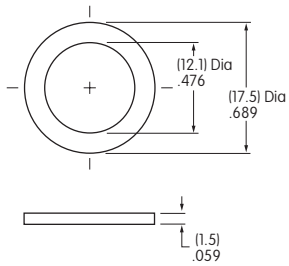
AT503M
Hex Face Nut

Material:
Brass with Chrome plating



AT401P
O-ring

Material:
Nitrile butadiene rubber

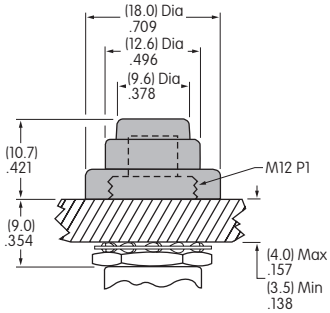


Optional Splashproof Boot for B1 Bushing

AT4043
Splashproof Boot

Material: Silicone Rubber
Operating Life: 10,000 for momentary
30,000 for alternate action

When using a splashproof boot, no cap is required.



CUSTOM ASSEMBLY ORDERING EXAMPLE

The MB2000 pushbutton series offers flexibility to accommodate a variety of applications. Using a basic large bushing model, different accessories can be assembled onto the switch to achieve the mounting variations shown on the following two pages.

These switches have:
- 12mm diameter threaded bushing with keyway
- Silver contacts
- 6-Amp rating
- Solder lug terminals

Other 12mm bushing options can be used; see details in preceding Large Bushing Ordering tables.

MB2011 SB1W01 — 4 C — A

Poles & Circuits			
2011	SPDT	ON	(ON)
2065	SPDT	ON	ON
2061	DPDT	ON	(ON)
2085	DPDT	ON	ON
4-pole available			
( ) = Momentary			

Mounter Shapes For Shroud	
4	Round
5	Rectangular

Cap Colors For Shroud	
A	Black
B	White
C	Red
F	Green
G	Blue
H	Gray

Cap Colors For Snap-In	
A	Black
B	White
C	Red
F	Green

Mounter Colors For Shroud	
A	Black
B	White
H	Gray

Round Shroud
MB2011SB1W01-4C-A

Rectangular Shroud
MB2011SB1W01-5C-A

See custom assemblies on following pages.

MOUNTER SHAPES FOR SHROUDS

4 **AT455 Round**

Material: Polycarbonate

Colors: A B H

5 **AT453 Rectangular**

Material: Polycarbonate

Colors: A B H

CAPS & CAP COLORS FOR SHROUDS

AT454 Round Insert Cap

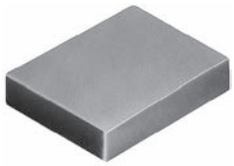
Material: Polycarbonate

Colors: A B C F G H

AT452 Rectangular Insert Cap

Material: Polycarbonate

Colors: A B C F G H



AT080 Screw Adaptor for Insert Caps

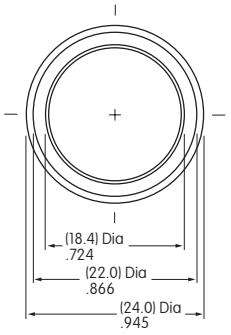
Material: Brass

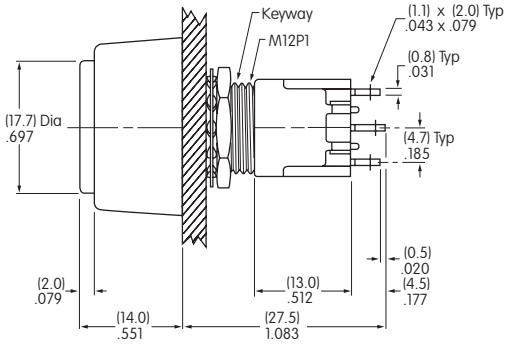
Color Codes:

A Black B White C Red F Green G Blue H Gray

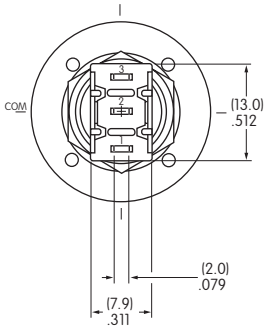
CUSTOM ASSEMBLY WITH ROUND SHROUD

MB2011SB1W01-4C-A

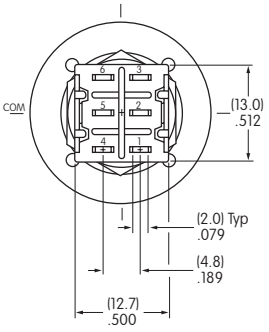


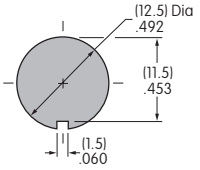


Single Pole



Double Pole

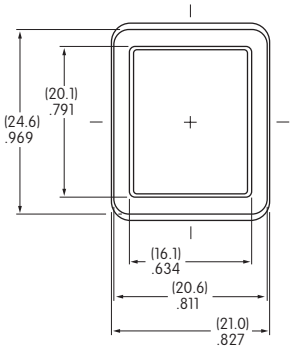


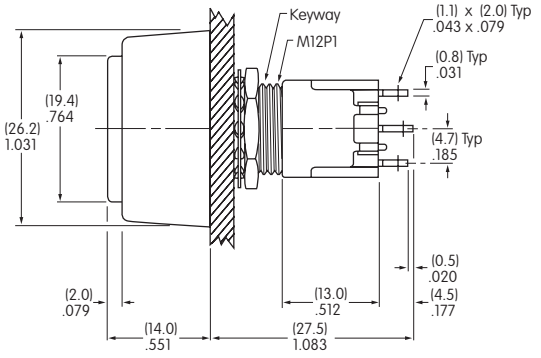


Effective Panel Thickness:
.217″ (5.5mm) maximum

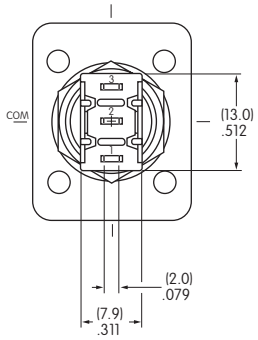
CUSTOM ASSEMBLY WITH RECTANGULAR SHROUD

MB2011SB1W01-5C-A





Single Pole



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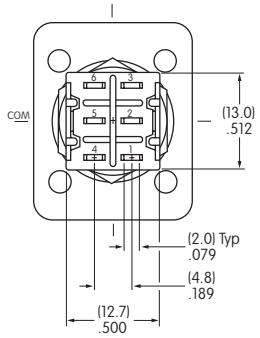
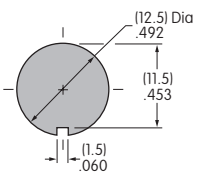




Effective Panel Thickness:
.217″ (5.5mm) maximum

General Specifications

Electrical Capacity (Resistive Load)

Power Level (silver):	3A @ 125V AC
Logic Level (gold):	0.4VA maximum @ 28V AC/DC maximum (Applicable Range 0.1mA ~ 0.1A @ 20mV ~ 28V)
Logic/Power Level:	Combines silver & gold ratings
(gold over silver)	Note: Find additional explanation of dual rating & operating range in Supplement section.

Other Ratings

Contact Resistance:	20 milliohms maximum for silver; 30 milliohms maximum for gold
Insulation Resistance:	1,000 megohms minimum @ 500V DC
Dielectric Strength:	1,000V AC minimum between contacts for 1 minute minimum; 1,500V AC minimum between contacts & case for 1 minute minimum
Mechanical Life:	200,000 operations minimum
Electrical Life:	25,000 operations minimum for silver; 100,000 operations minimum for gold
Nominal Operating Force:	Single pole 2.45N; double pole 3.92N
Travel	Pretravel .024" (0.6mm); Overtravel .016" (0.4mm); Total Travel .039" (1.0mm)

Materials & Finishes

Plunger:	Brass with nickel plating
Bushing:	Brass with nickel plating
Frame:	Stainless steel
Case:	Polybutylene terephthalate (PBT) (UL94V-0)
Base:	Diallyl phthalate resin (UL94V-0)
Movable Contactor:	Phosphor bronze with silver or gold plating
Movable Contacts:	Silver alloy (code W); copper with gold plating (code G); or silver alloy with gold plating (code A)
Stationary Contacts:	Silver alloy with silver plating (code W); copper or brass with gold plating (code G); or silver with gold plating (code A)
Terminals:	Copper or brass with silver plating; copper or brass with gold plating

Environmental Data

Operating Temp Range:	–30°C through +85°C (–22°F through +185°F)
Humidity:	90 ~ 95% humidity for 96 hours @ 40°C (104°F)
Vibration:	10 ~ 55Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in 1 minute; 3 right angled directions for 2 hours
Shock:	50G (490m/s^2) acceleration (tested in 6 right angled directions, with 3 shocks in each direction)

Installation

Mounting Torque:	1.5Nm (13.0 lb•in) for double nut; 0.7Nm (6.0 lb•in) for single nut
Cap Installation Force:	80.0N (18.0 lbf) maximum downward force on actuator
Soldering:	Wave Soldering (PC version): See Profile B in Supplement section. Manual Soldering: See Profile B in Supplement section.
Cleaning:	These devices are not process sealed. Hand clean locally using alcohol based solution. See Cleaning Specifications in Supplement section.

Standards & Certifications

Flammability Standards:	UL94V-0 case & base
UL:	**File No. E44145 - Recognized only when ordered with marking on switch.** Add "/U" or "/CUL" before dash in part number to order UL recognized switch. All single and double pole models recognized at 3A @ 125V AC or 0.4VA max. @ 28V DC max.
CSA:	**File No. 023535_0_000 - Certified only when ordered with marking on switch.** Add "/C" before dash in part number to order CSA certified switch. Single pole models with PC, solder lug, or Wirewrap terminals & double pole with PC or Wirewrap terminals certified at 3A @ 125V AC or 0.4VA @ 28V maximum.

Distinctive Characteristics

Snap-acting mechanism gives smooth actuation, short stroke, light touch, and audible feedback. This mechanism also provides long mechanical life.

High torque bushing construction prevents rotation or separation from frame during installation.

Antijamming design protects contacts from damage due to excessive downward force on the actuator.

Compatible companions with M series toggles. Body, bushing, and footprint dimensions ideal for mounting MB2400 pushbuttons and M toggles next to one another.

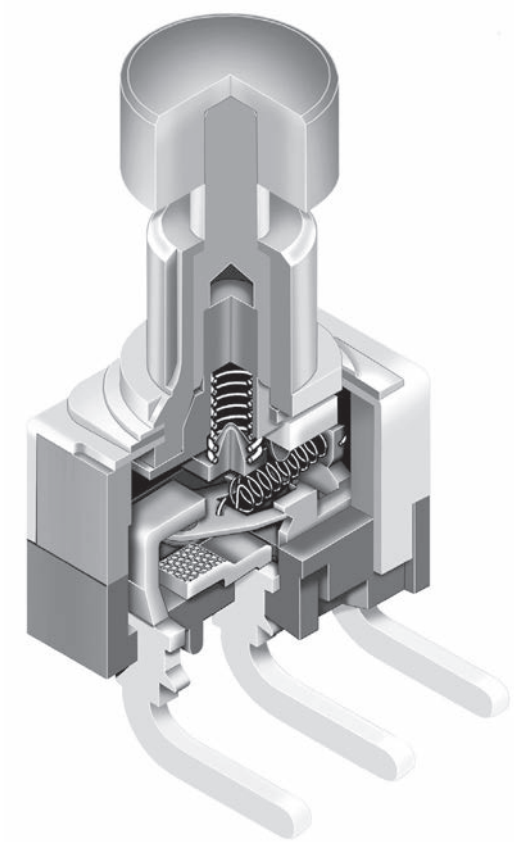
Stainless steel frame resists corrosion.

Longer center solder lug terminal simplifies wiring and soldering.

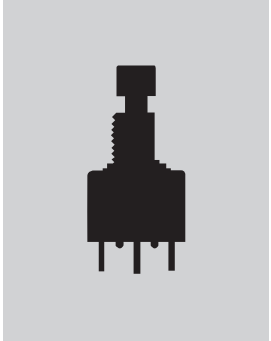
Silver contacts of specially composed alloy for hardness.

Epoxy sealed terminals prevent entry of solder flux and other contaminants.

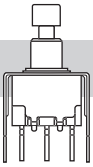
Prominent external insulating barriers increase insulation resistance and dielectric strength.



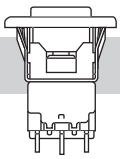
Actual Size



Bushing Mount Page C98



Bracket PC Mount Page C102



Snap-in Mount Page C108

Series MB2400

Snap-Action Bushing Mount Pushbuttons

TYPICAL SWITCH ORDERING EXAMPLE

MB24 | 11 | E1 | W | 01 — F | A

Poles & Circuits

11	SPDT	ON	(ON)
61	DPDT	ON	(ON)

( ) = Momentary

Bushings

E1	.285″ (7.24mm) Threaded with D Flat
E2	.285″ (7.24mm) Smooth with D Flat
A1	.280″ (7.1mm) Threaded with Keyway
A2	.280″ (7.1mm) Smooth with Keyway
S1	.350″ (8.9mm) Threaded with Keyway
S2	.350″ (8.9mm) Smooth with Keyway

Contact Materials & Ratings

W	Silver Rated 3A @ 125V AC
G	Gold Rated 0.4VA max @ 28V AC/DC max
A	Gold over Silver Rated 3A @ 125V AC & 0.4VA max @ 28V AC/DC max

Terminals

01	Solder Lug
03	.250″ (6.35mm) Straight PC
05	.425″ (10.8mm) Wirewrap
06	.750″ (19.05mm) Wirewrap
07	.964″ (24.5mm) Wirewrap

Caps

F	.201″ (5.1mm) Diameter
H	.295″ (7.5mm) Diameter

Cap Colors

A	Black
B	White
C	Red

IMPORTANT:

Switches are supplied without UL, cULus & CSA marking unless specified. **UL, cULus & CSA recognized only when ordered with marking on the switch.** Specific models, ratings, & ordering instructions are noted on the General Specifications page.

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

MB2411E1W01-FA

Black .201″ (5.1mm) Diameter Cap

SPDT ON-(ON) Circuit

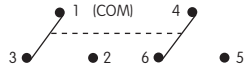
Silver Contacts with 3-Amp Rating

.285″ (7.24mm) Threaded Bushing with D Flat

Solder Lug Terminals

Series MB2400

POLES & CIRCUITS

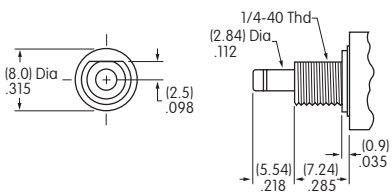
Pole	Model	Plunger Position ( ) = Momentary: Normal (Keyway)	Plunger Position: Down	Connected Terminals: Normal (Keyway)	Connected Terminals: Down	Throw & Switch Schematics
SP	**MB2411**	ON	(ON)	1-3	1-2	SPDT
DP	**MB2461**	ON	(ON)	1-3 4-6	1-2 4-5	DPDT 

Note: Terminal numbers are not actually on the switch.

BUSHINGS

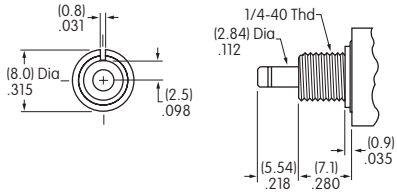
Note: Plunger selection is not required for MB2400 pushbuttons. The plunger can be used with or without a cap.

E1 **.285" (7.24mm) Threaded with D Flat**



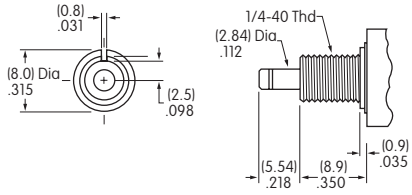
Maximum Panel Thickness with Standard Hardware: .068" (1.74mm)

A1 **.280" (7.1mm) Threaded with Keyway**



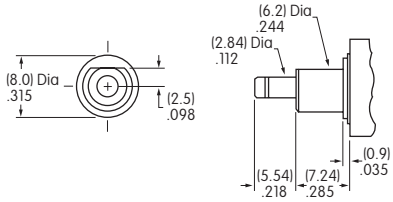
Maximum Panel Thickness with Standard Hardware: .068" (1.74mm)

S1 **.350" (8.9mm) Threaded with Keyway**

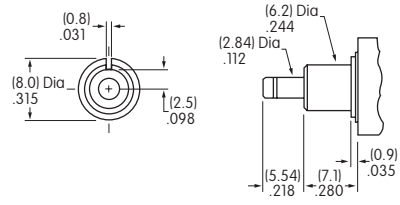


Maximum Panel Thickness with Standard Hardware: .134" (3.40mm)

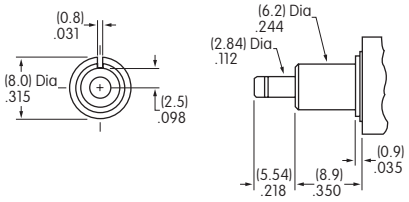
E2 **.285" (7.24mm) Smooth with D Flat**



A2 **.280" (7.1mm) Smooth with Keyway**

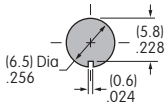


S2 **.350" (8.9mm) Smooth with Keyway**

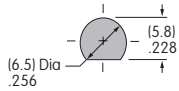


Panel Cutouts

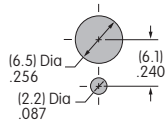
For A1, A2, S1, or S2 Bushing with Keyway



For E1 or E2 Bushing with D Flat



With Optional Locking Ring



Standard hardware includes 2 hex nuts & 1 lockwasher.
Hardware is illustrated following the Typical Switch Dimension drawings.

Series MB2400

Snap-Action Bushing Mount Pushbuttons

CONTACT MATERIALS & RATINGS

W	**Silver over Silver**	**Power Level**	**3A @ 125V AC**
G	**Gold over Brass or Copper**	**Logic Level**	**0.4VA maximum @ 28V AC/DC maximum**

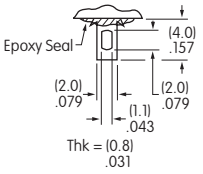
Note: Complete explanation of operating range in Supplement section.

A	**Gold over Silver**	**Power Level or Logic Level**	**3A @ 125V AC or 0.4VA maximum @ 28V AC/DC maximum**

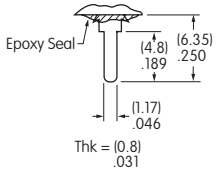
Note: This dual rated option is suitable when two or more identical switches are used in logic and in power circuits within the same application. See Supplement section for complete explanation of dual rating and operating range.

TERMINALS

01 **Solder Lug**



03 **.250" (6.35mm) Straight PC**

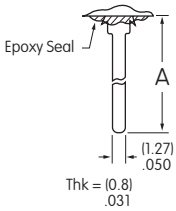


Wirewrap or Extended PC

05 **.425" (10.8mm)**

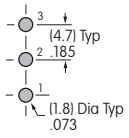
06 **.750" (19.05mm)**

07 **.964" (24.5mm)**

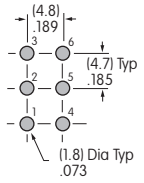


Refer to footprints if using as extended PC terminal.

Dimension A = terminal lengths as shown beside the code boxes at left.



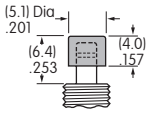
Single Pole



Double Pole

CAPS & CAP COLORS

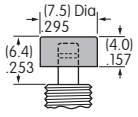
F **AT475 .201" (5.1mm) Diameter Cap**



Material: Polyamide

Finish: Glossy

H **AT496 .295" (7.5mm) Diameter Cap**



Material: Polyamide

Finish: Glossy

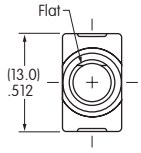
Cap Colors Available: **A** Black **B** White **C** Red

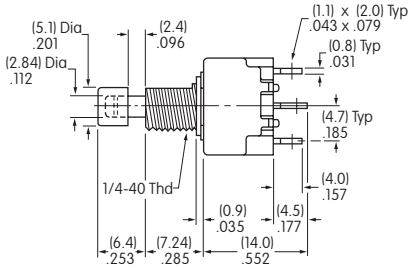
Series MB2400

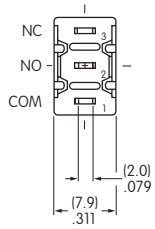
TYPICAL SWITCH DIMENSIONS

Single Pole

Solder Lug



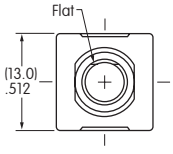


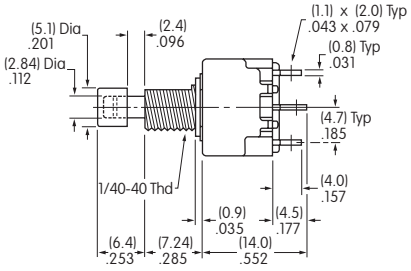


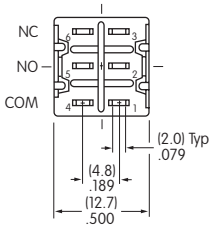
MB2411E1W01-FA

Double Pole

Solder Lug







MB2461E1W01-FA

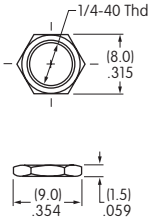
HARDWARE

Standard Hardware

AT513H Inch Threaded Hexagon Nut

2 included with each switch

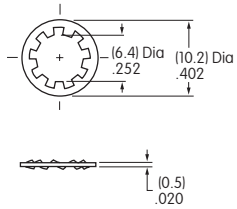
Material:
Brass with Nickel Plating



AT509 Lockwasher

1 included with each switch

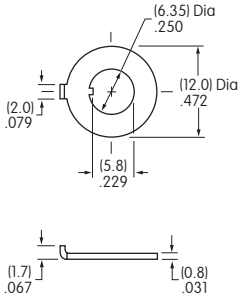
Material:
Steel with Zinc/Chromate



Optional Hardware

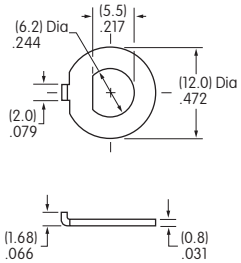
AT507H Locking Ring for A1 or S1 Bushing

Material:
Steel with Zinc/Chromate



AT515 Locking Ring for E1 Bushing

Material:
Steel with Zinc/Chromate



Series MB2400

Snap-Action Bracket PC Mount Pushbuttons

TYPICAL SWITCH ORDERING EXAMPLE

MB24 | 11 | A2 | G | 40 | — | F | A

Poles & Circuits

11	SPDT	ON	(ON)
61	DPDT	ON	(ON)

( ) = Momentary

Bushings

A2	.280″ (7.1mm) Smooth with Keyway
A1	.280″ (7.1mm) Threaded with Keyway
E2	.285″ (7.24mm) Smooth with D Flat
E1	.285″ (7.24mm) Threaded with D Flat
S2	.350″ (8.9mm) Smooth with Keyway
S1	.350″ (8.9mm) Threaded with Keyway

Contact Materials & Ratings

W	Silver Rated 3A @ 125V AC
G	Gold Rated 0.4VA max @ 28V AC/DC max
A	Gold over Silver Rated 3A @ 125V AC & 0.4VA max @ 28V AC/DC max

Caps

F	.201″ (5.1mm) Dia.
H	.295″ (7.5mm) Dia.

Cap Colors

A	Black
B	White
C	Red

Terminals

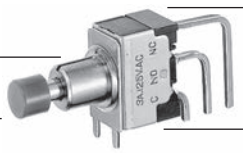
With Bracket	
13	.250″ (6.35mm) Straight PC with .465″ (11.8mm) Bracket
15	.425″ (10.8mm) Straight PC with .630″ (16.0mm) Bracket
17	.964″ (24.5mm) Straight PC with 1.150″ (29.2mm) Bracket
With Reinforced Bracket	
23	.250″ (6.35mm) Straight PC with .465″ (11.8mm) Bracket
25	.425″ (10.8mm) Straight PC with .630″ (16.0mm) Bracket
26	.750″ (19.05mm) Straight PC with .953″ (24.2mm) Bracket
With Terminal Support	
30	Right Angle PC
40	Vertical PC

IMPORTANT:

Switches are supplied without UL, cULus & CSA marking unless specified. **UL, cULus & CSA recognized only when ordered with marking on the switch.** Specific models, ratings, & ordering instructions are noted on the General Specifications page.

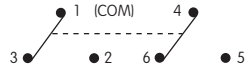
DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

MB2411A2G40-FA



Series MB2400

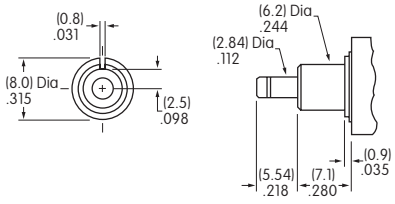
POLES & CIRCUITS

Pole	Model	Plunger Position ( ) = Momentary: Normal	Plunger Position: Down	Connected Terminals: Normal	Connected Terminals: Down	Throw & Switch Schematics
		Keyway		Keyway		Note: Terminal numbers are not actually on the switch.
SP	**MB2411**	ON	(ON)	1-3	1-2	SPDT
DP	**MB2461**	ON	(ON)	1-3 4-6	1-2 4-5	DPDT 

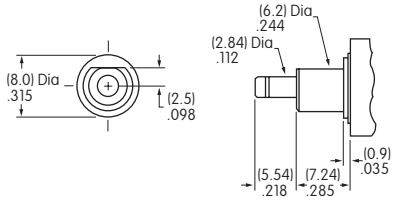
BUSHINGS

Note: Plunger selection is not required for MB2400 pushbuttons.
The plunger can be used with or without a cap.

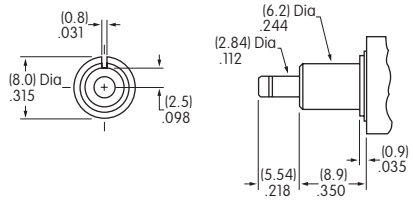
A2 .280" (7.1mm) Smooth with Keyway



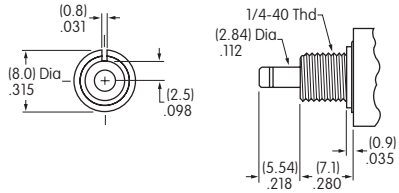
E2 .285" (7.24mm) Smooth with D Flat



S2 .350" (8.9mm) Smooth with Keyway

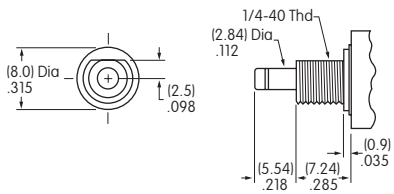


A1 .280" (7.1mm) Threaded with Keyway



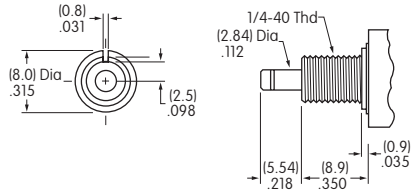
Maximum Panel Thickness with Standard Hardware: .068" (1.74mm)

E1 .285" (7.24mm) Threaded with D Flat



Maximum Panel Thickness with Standard Hardware: .068" (1.74mm)

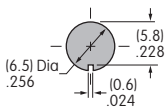
S1 .350" (8.9mm) Threaded with Keyway



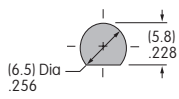
Maximum Panel Thickness with Standard Hardware: .134" (3.40mm)

Panel Cutouts

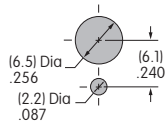
For A1, A2, S1, or S2 Bushing with Keyway



For E1 or E2 Bushing with D Flat



With Optional Locking Ring



Standard hardware includes 2 hex nuts & 1 lockwasher.
Hardware is illustrated following the Typical Switch Dimension drawings.

Series MB2400

Snap-Action Bracket PC Mount Pushbuttons

CONTACT MATERIALS & RATINGS

W	Silver over Silver	Power Level	3A @ 125V AC
G	Gold over Brass or Copper	Logic Level	0.4VA maximum @ 28V AC/DC maximum

Note: Complete explanation of operating range in Supplement section.

A	Gold over Silver	Power Level or Logic Level	3A @ 125V AC or 0.4VA maximum @ 28V AC/DC maximum

Note: This dual rated option is suitable when two or more identical switches are used in logic and in power circuits within the same application. See Supplement section for complete explanation of dual rating and operating range.

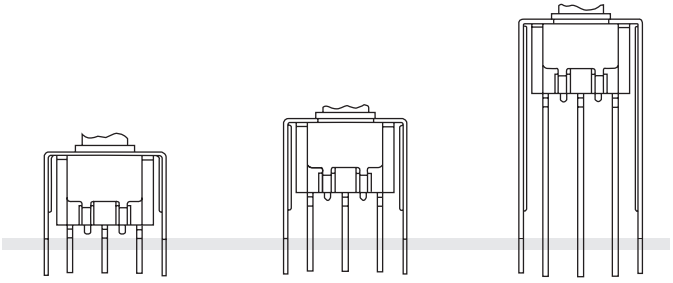
TERMINALS

Straight PC Mount with Bracket

13 .250" (6.35mm) Terminal with .465" (11.8mm) Bracket

15 .425" (10.8mm) Terminal with .630" (16.0mm) Bracket

17 .964" (24.5mm) Terminal with 1.150" (29.2mm) Bracket

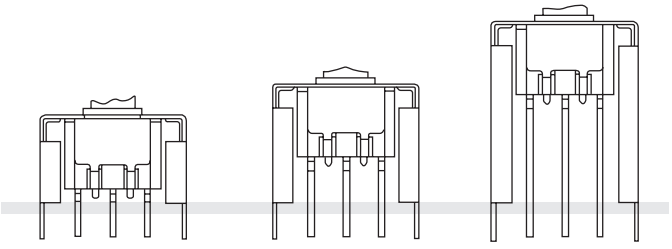


Straight PC Mount with Reinforced Bracket

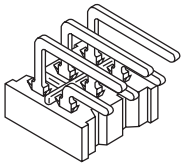
23 .250" (6.35mm) Terminal with .465" (11.8mm) Bracket

25 .425" (10.8mm) Terminal with .630" (16.0mm) Bracket

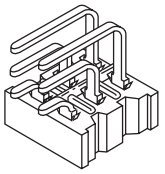
26 .750" (19.05mm) Terminal with .953" (24.2mm) Bracket



30 Right Angle PC



40 Vertical PC



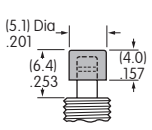
PCB footprints are on the following Typical Switch Dimension pages.

CAPS & CAP COLORS

F AT475 .201" (5.1mm) Diameter Cap

Material: Polyamide

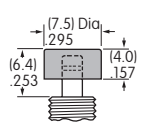
Finish: Glossy



H AT496 .295" (7.5mm) Diameter Cap

Material: Polyamide

Finish: Glossy

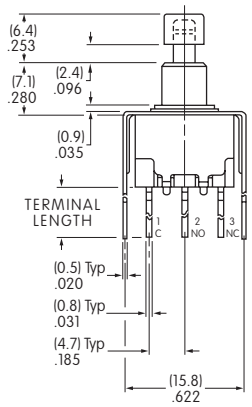


Cap Colors Available: A Black B White C Red

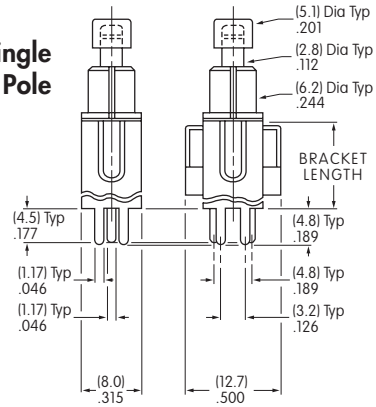
Series MB2400

TYPICAL SWITCH DIMENSIONS

Straight PC • Bracket

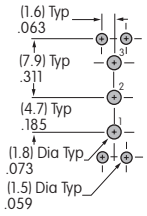


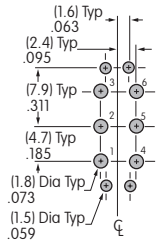
Single Pole



Double Pole

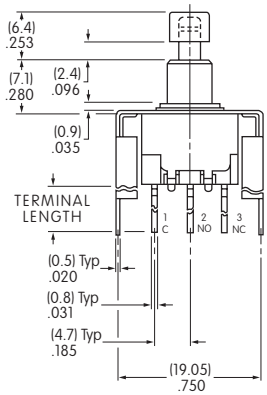
MB2411A2G13-FA



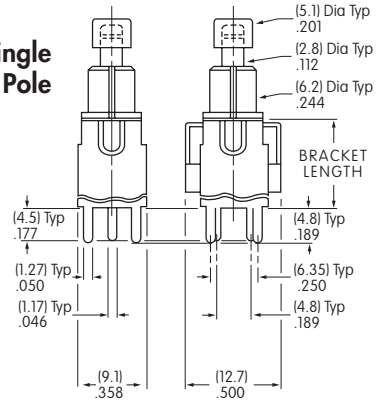


Terminal Code:	Terminal Length:	Bracket Length:
13	.250 (6.35mm)	.465 (11.8mm)
15	.425 (10.8mm)	.630 (16.0mm)
17	.964 (24.5mm)	1.150 (29.2mm)

Straight PC • Reinforced Bracket

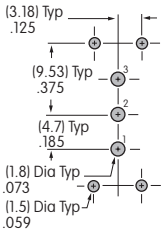


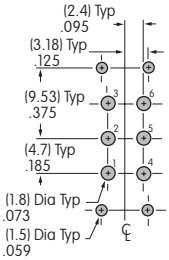
Single Pole



Double Pole

MB2411A2G23-FA

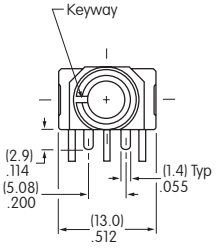


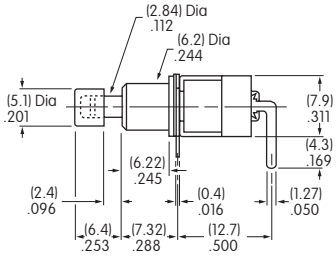


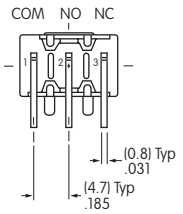
Terminal Code:	Terminal Length:	Bracket Length:
23	.250 (6.35mm)	.465 (11.8mm)
25	.425 (10.8mm)	.630 (16.0mm)
26	.750 (19.05mm)	.953 (24.2mm)

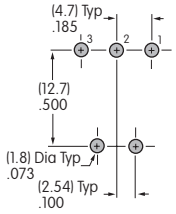
TYPICAL SWITCH DIMENSIONS

Right Angle PC — Single Pole



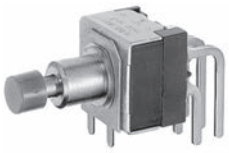


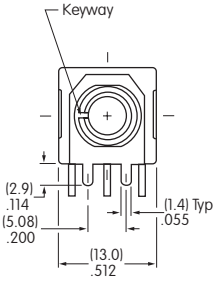


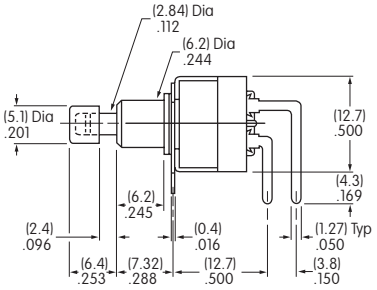


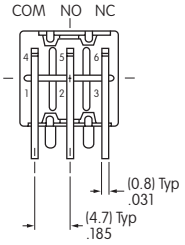
MB2411A2G30-FA

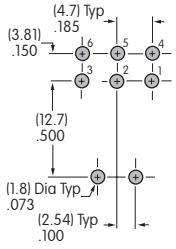
Right Angle PC — Double Pole





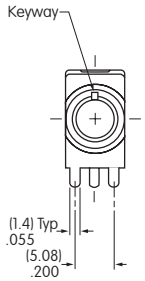


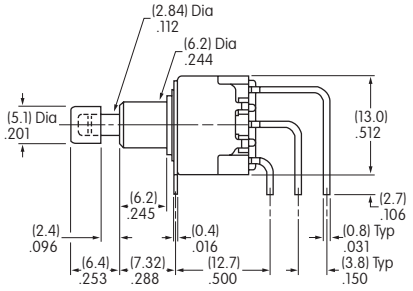


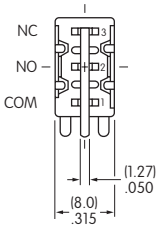


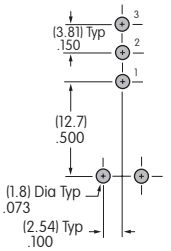
MB2461A2G30-FA

Vertical PC — Single Pole



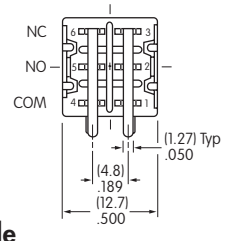


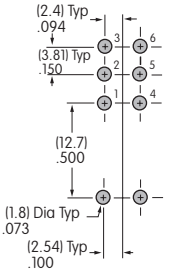




MB2411A2G40-FA

Double Pole





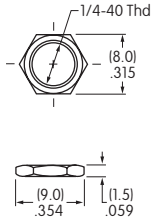
HARDWARE

Standard Hardware

AT513H Inch Threaded Hexagon Nut

2 included with each switch

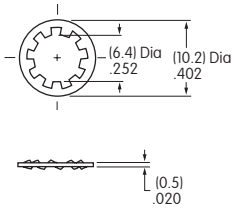
Material:
Brass with Nickel Plating



AT509 Lockwasher

1 included with each switch

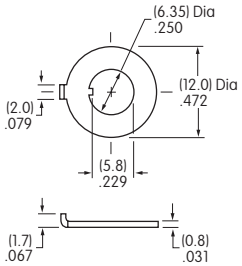
Material:
Steel with Zinc/Chromate



Optional Hardware

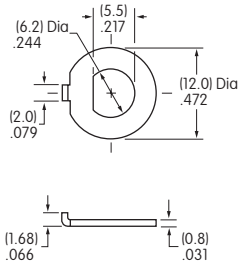
AT507H Locking Ring for A1 or S1 Bushing

Material:
Steel with Zinc/Chromate



AT515 Locking Ring for E1 Bushing

Material:
Steel with Zinc/Chromate



Series MB2400

Snap-Action Snap-in Mount Pushbuttons

TYPICAL SWITCH

MB24 | 11 | J | W | 01 | — | C | —

Poles & Circuits

11	SPDT	ON	(ON)
61	DPDT	ON	(ON)

( ) = Momentary

Contact Materials & Ratings

W	Silver Rated 3A @ 125V AC
G	Gold Rated 0.4VA max @ 28V AC/DC max
A	Gold over Silver Rated 3A @ 125V AC & 0.4VA max @ 28V AC/DC max

Cap & Cap Colors

A	Black
B	White
C	Red
E	Yellow
F	Green
G	Blue
H	Gray

Mounting Frame

J	Snap-in Frame

Terminals

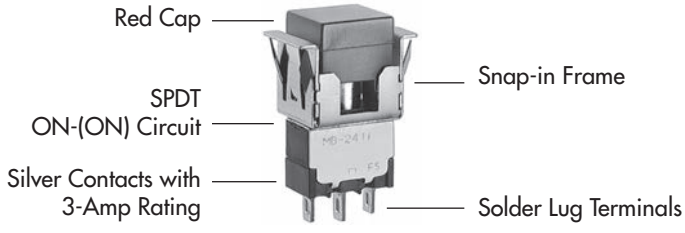
01	Solder Lug
03	.250" (6.35mm) Straight PC
05	.425" (10.8mm) Wirewrap
06	.750" (19.05mm) Wirewrap
07	.964" (24.5mm) Wirewrap

IMPORTANT:

Switches are supplied without UL, cULus & CSA marking unless specified. **UL, cULus & CSA recognized only when ordered with marking on the switch.** Specific models, ratings, & ordering instructions are noted on the General Specifications page.

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

MB2411JW01-C



ORDERING EXAMPLE

3 A — C F

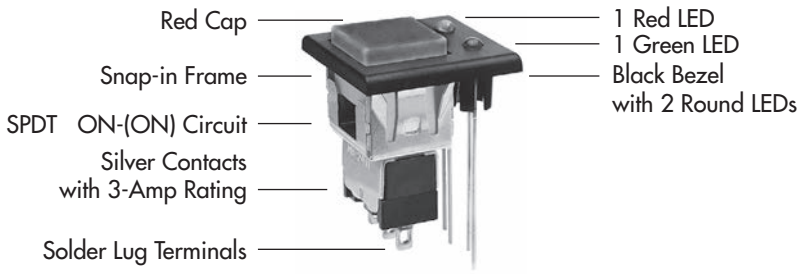
Optional Bezels	
1	Bezel without LEDs
*2	Bezel with 1 Round LED
*3	Bezel with 2 Round LEDs
*4	Bezel with 2 Rectangular LEDs
*Available in Black color only	

Bezel Colors	
A	Black
B	White
C	Red
E	Yellow
F	Green
G	Blue
H	Gray

LED Colors			
1 LED			
C	Red		
F	Green		
2 LEDs			
Top LED		Bottom LED	
C	Red	C	Red
E	Yellow	E	Yellow
F	Green	F	Green

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

MB2411JW01-C-3A-CF



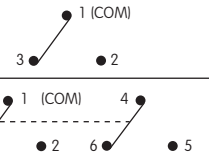
Series MB2400

Snap-Action Snap-in Mount Pushbuttons

POLES & CIRCUITS

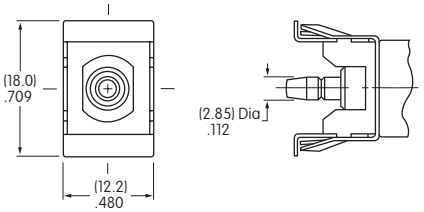
Pole	Model	Plunger Position ( ) = Momentary: Normal	Plunger Position ( ) = Momentary: Down	Connected Terminals: Normal	Connected Terminals: Down	Throw & Switch Schematics
SP	**MB2411**	ON	(ON)	1-3	1-2	SPDT
DP	**MB2461**	ON	(ON)	1-3 4-6	1-2 4-5	DPDT

Note: Terminal numbers are not actually on the switch.

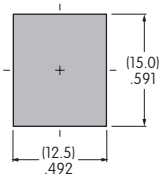


MOUNTING FRAME

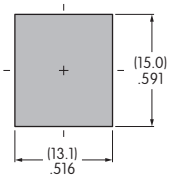
J **Snap-in Frame**



Panel Cutout for Single Pole without Bezel



Panel Cutout for Double Pole without Bezel



Panel Thickness without Bezel: .039″ ~ .157″ (1.0mm ~ 4.0mm)
Panel Thickness with Bezel: .039″ ~ .126″ (1.0mm ~ 3.2mm)

CONTACT MATERIALS & RATINGS

W **Silver over Silver** — **Power Level** — **3A @ 125V AC**

G **Gold over Brass or Copper** — **Logic Level** — **0.4VA maximum @ 28V AC/DC maximum**

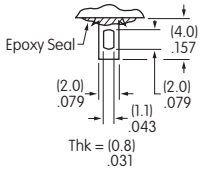
Note: Complete explanation of operating range in Supplement section.

A **Gold over Silver** — **Power Level or Logic Level** — **3A @ 125V AC or 0.4VA maximum @ 28V AC/DC maximum**

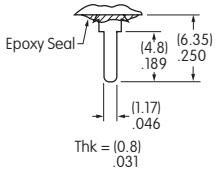
Note: This dual rated option is suitable when two or more identical switches are used in logic and in power circuits within the same application. See Supplement section for complete explanation of dual rating and operating range.

TERMINALS

01 **Solder Lug**



03 **.250″ (6.35mm) Straight PC**

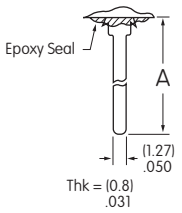


Wirewrap or Extended PC

05 **.425″ (10.8mm)**

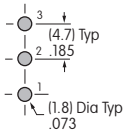
06 **.750″ (19.05mm)**

07 **.964″ (24.5mm)**

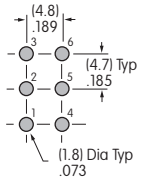


Refer to footprints if using as extended PC terminal.

Dimension A = terminal lengths as shown beside the code boxes at left.



Single Pole



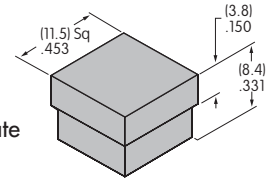
Double Pole

Series MB2400

CAP & CAP COLORS

AT465
.453" (11.5mm)
Square Cap

Material: Polycarbonate
Finish: Glossy



Contact factory for matte finish.

Legend details at end of this section.

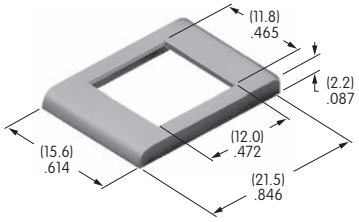
A	Black	B	White	C	Red	E	Yellow
F	Green	G	Blue	H	Gray		

OPTIONAL SNAP-IN BEZELS & BEZEL COLORS

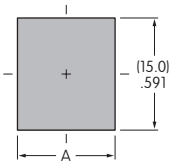
1 AT207 Bezel

Material: Polycarbonate
Finish: Glossy

Contact factory for matte finish.



A	Black	B	White	C	Red	E	Yellow
F	Green	G	Blue	H	Gray		

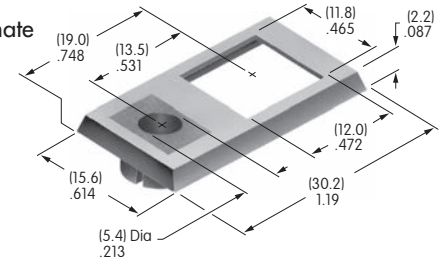


	Single Pole	Double Pole
A	(12.5)mm .492"	(13.1)mm .516"

2 AT208 Bezel for AT070 LED

Material: Polycarbonate
Finish: Glossy

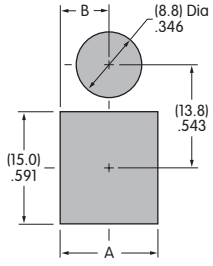
Contact factory for matte finish.



A Black

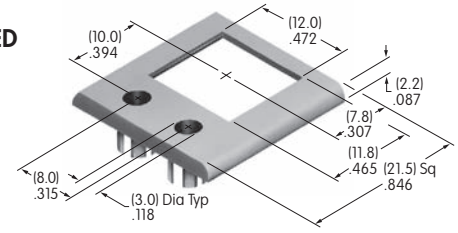
LED colors & specifications on next page.

	Single Pole	Double Pole
A	(12.5)mm .492"	(13.1)mm .516"
B	(6.25)mm .246"	(6.55)mm .258"



3 AT212 Bezel for AT617 LED

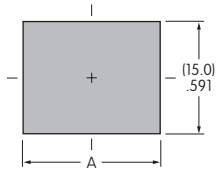
Material: Polycarbonate
Finish: Semi-glossy



A Black

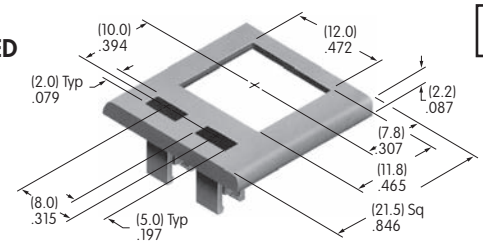
LED colors & specifications on next page.

	Single Pole	Double Pole
A	(18.4)mm .724"	(18.7)mm .736"



4 AT213 Bezel for AT618 LED

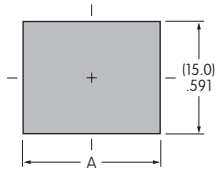
Material: Polycarbonate
Finish: Semi-glossy



A Black

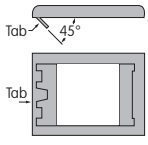
LED colors & specifications on next page.

	Single Pole	Double Pole
A	(18.4)mm .724"	(18.7)mm .736"

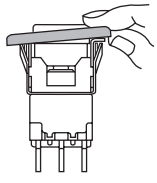


Bezel Assembly

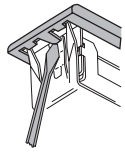
1. Pry out tab on bezel to a 45° angle.



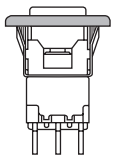
2. Insert switch frame under tab and snap on the bezel.



3. Push tab back into place.



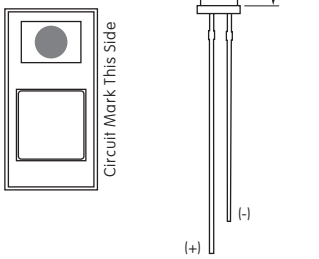
4. Snap assembled bezel and switch into panel.



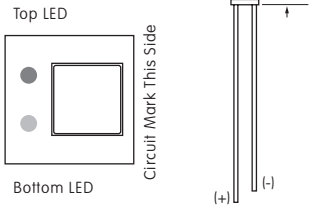
LED COLORS & SPECIFICATIONS

Bezel Orientation on Switch

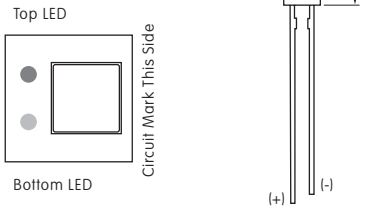
AT070 LED
For Bezel AT208
with 1 LED



AT617 LED
For Bezel AT212
with 2 Round LEDs



AT618 LED
For Bezel AT213
with 2 Rectangular LEDs



Note: Lead lengths may differ from manufacturing lot to lot. The longer lead is the anode (+).

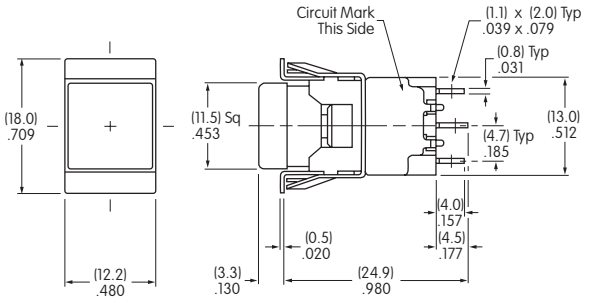
		AT070		AT617			AT618		
(+) (-)		C	F	C	E	F	C	E	F
	Color	Red	Green	Red	Yellow	Green	Red	Yellow	Green
Maximum Forward Current	I_{FM}	25mA	50mA	30mA	30mA	25mA	25mA	30mA	25mA
Typical Forward Current	I_F	20mA	30mA	20mA	20mA	20mA	20mA	20mA	20mA
Forward Voltage	V_F	2.8V	2.1V	2.0V	2.1V	2.2V	2.25V	2.1V	2.2V
Maximum Reverse Voltage	V_{RM}	4V	5V	5V	5V	5V	5V	5V	5V
Current Reduction Rate Above 25°C	ΔI_F	0.33 mA/°C	0.40 mA/°C	0.40 mA/°C	0.40 mA/°C	0.33 mA/°C	0.33 mA/°C	0.40 mA/°C	0.33 mA/°C
Ambient Temperature Range (when used with a bezel)		−10° ~ +70°C		−15° ~ +70°C			−25° ~ +70°C		

The electrical specifications shown are determined at a basic temperature of 25°C.
LED circuit is independent of switch operation. LED is colored in OFF state.

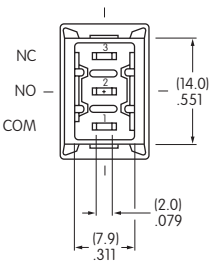
If the source voltage is greater than the rated voltage of the LED, a ballast resistor must be connected in series with the LED.
The ballast resistor calculation and more lamp detail are shown in the Supplement section.

TYPICAL SWITCH DIMENSIONS

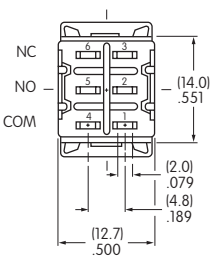
Solder Lug



Single Pole



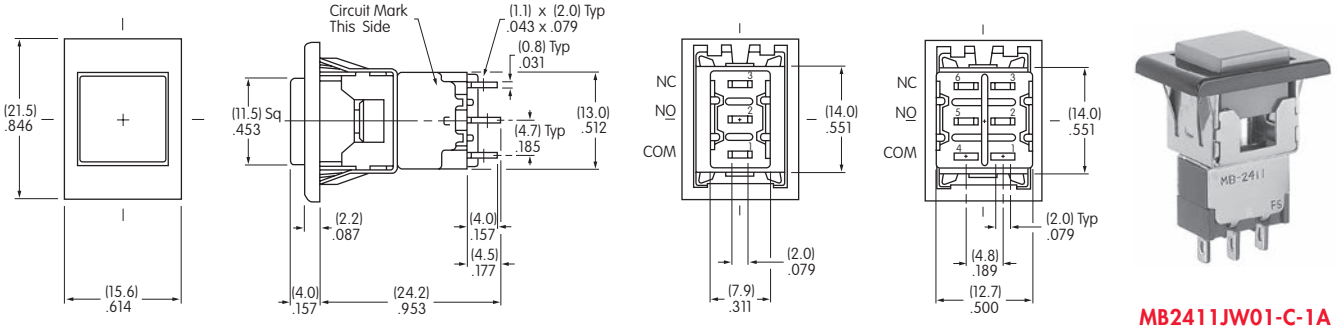
Double Pole



MB2411JW01-C

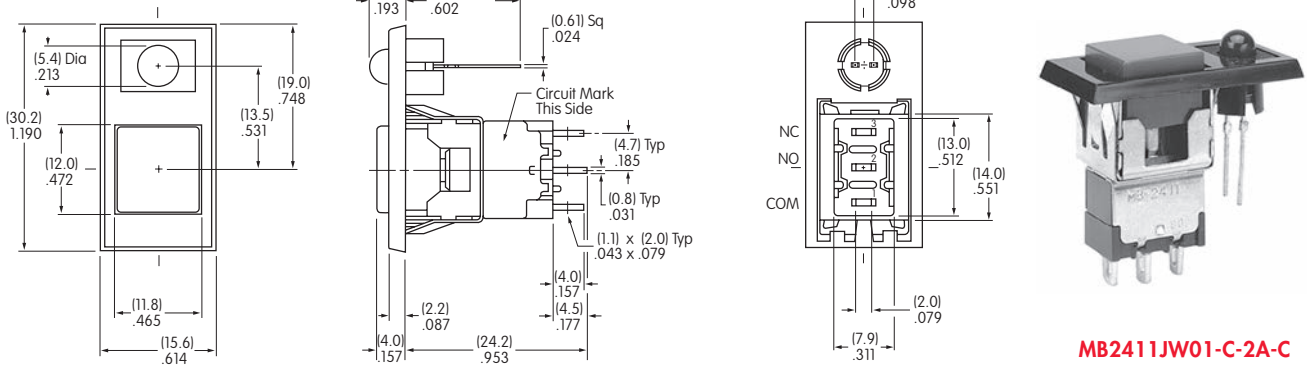
TYPICAL SWITCH DIMENSIONS

Single & Double Pole — Solder Lug • AT207 Bezel



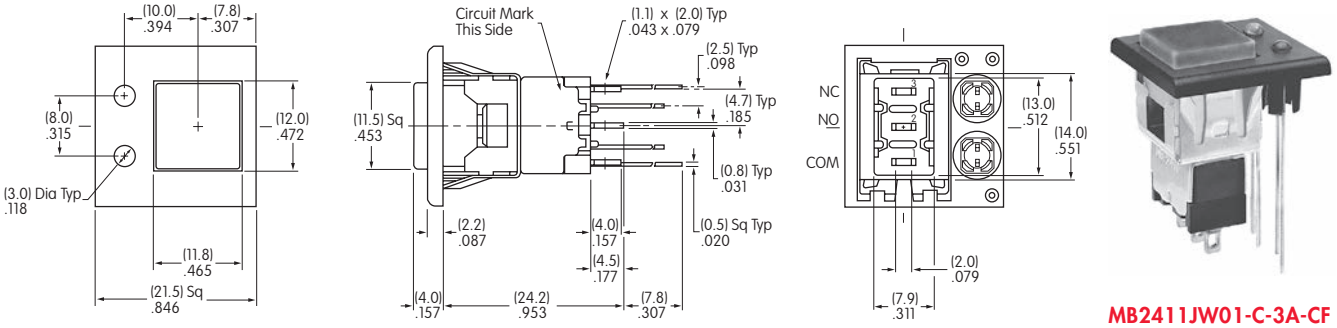
MB2411JW01-C-1A

Single Pole — Solder Lug • AT208 Bezel



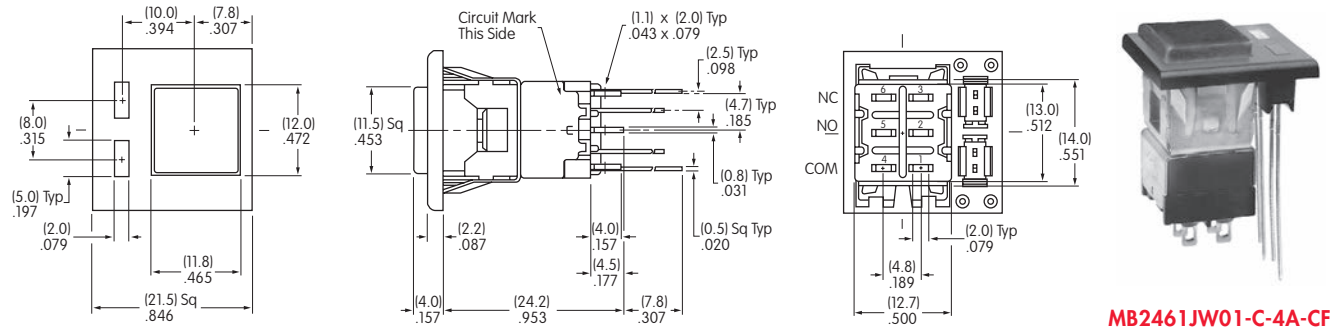
MB2411JW01-C-2A-C

Single Pole — Solder Lug • AT212 Bezel



MB2411JW01-C-3A-CF

Double Pole — Solder Lug • AT213 Bezel

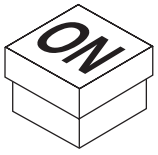


MB2461JW01-C-4A-CF

LEGENDS

NKK Switches can provide custom legends for caps. Contact factory for more information.

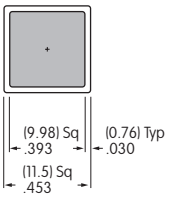
Suggested Printable Area for Cap



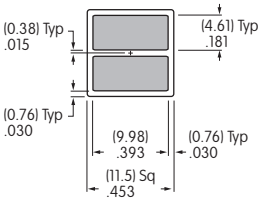
Recommended Print Method:

Screen Print or Pad Print

Epoxy based ink is recommended.



AT465



AT465

Shaded areas are printable areas.

General Specifications

Electrical Capacity (Resistive Load)

Power Level (code W): 3A @ 125V AC
Logic Level (code G): 0.4VA maximum @ 28V AC/DC maximum
(Applicable Range 0.1mA ~ 0.1A @ 20mV ~ 28V)
Logic/Power Level (code A): Combines W & G ratings
Note: See Supplement section to find explanation of operating range.

Other Ratings

Contact Resistance: 20 milliohms maximum for silver; 30 milliohms maximum for gold
Insulation Resistance: 1,000 megohms minimum @ 500V DC
Dielectric Strength: 1,000V AC minimum between contacts for 1minute minimum;
1,500V AC minimum between contacts & case for 1minute minimum
Mechanical Life: 200,000 operations minimum
Electrical Life: 25,000 operations minimum for silver; 100,000 operations minimum for gold
Nominal Operating Force: Single pole 2.45N; double pole 3.92N
Travel: Pretravel .024" (0.6mm); Overtravel .016" (0.4mm); Total Travel .039" (1.0mm)

Materials & Finishes

Plunger: Brass with nickel plating
Bushing: Brass with nickel plating
Mounting & Body Frames: Stainless steel
Support Bracket: Brass with tin plating
Case: Polybutylene terephthalate (PBT) (UL94V-0)
Base: Diallyl phthalate resin
Movable Contactor: Phosphor bronze with silver or gold plating
Movable Contacts: Silver alloy (code W); copper with gold plating (code G)
Stationary Contacts: Silver with silver plating (code W); copper or brass with gold plating (code G)
Terminals: Copper with silver plating; copper or brass with gold plating

Environmental Data

Operating Temp Range: –30°C through +85°C (–22°F through +185°F)
Humidity: 90 ~ 95% humidity for 100 hours @ 40°C (104°F)
Vibration: 10 ~ 55Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in 1 minute; 3 right angled directions for 2 hours
Shock: 50G (490m/s^2) acceleration (tested in 6 right angled directions, with 5 shocks in each direction)

Installation

Mounting Torque: 1.5Nm (13 lb•in) for double nut; 0.7Nm (6 lb•in) for single nut
Cap Installation Force: 80N (18 lbf) maximum downward force on actuator

Processing

Soldering: Wave Soldering Recommended: See Profile B in Supplement section.
Manual Soldering: See Profile B in Supplement section.
Cleaning: These devices are not process sealed. Hand clean locally using alcohol based solution.

Standards & Certifications

Flammability Standards: UL94V-0 Case
UL : **File No. E44145 - Recognized only when ordered with marking on switch.**
Add "/U" or "/CUL" before dash in part number to order UL recognized switch.
All single & double pole models recognized at 3A @ 125V AC or 0.4VA max. @ 28V AC/DC max.
CSA: **File No. 023535_0_000 - Certified only when ordered with marking on switch.**
Add "/C" before dash in part number to order CSA certified switch.
Single pole & double pole models certified at 3A @ 125V AC or 0.4VA max. @ 28V AC/DC max.

Distinctive Characteristics

Short stroke and light touch.

Antijamming design protects contacts from damage due to excessive downward force on the actuator.

High torque bushing construction prevents rotation or separation from frame during installation.

Stainless steel frame resists corrosion.

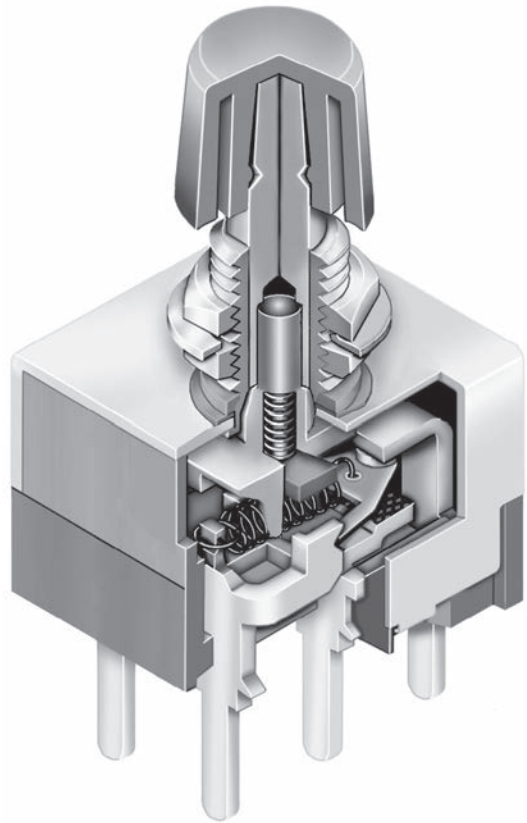
Longer center solder lug terminal simplifies wiring and soldering.

Patented silver contacts of specially composed alloy for hardness.

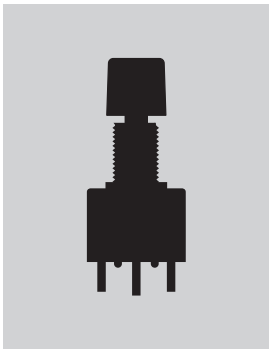
Epoxy sealed terminals prevent entry of solder flux and other contaminants.

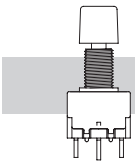
Snap-acting mechanism gives smooth actuation and audible feedback.

Prominent external insulating barriers increase insulation resistance and dielectric strength.

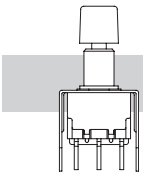


Actual Size

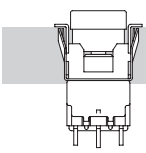




Bushing Mount Page C118



Bracket PC Mount Page C121



Snap-in Mount Page C124

Series MB2500

Snap-Action Bushing Mount Pushbuttons

TYPICAL SWITCH ORDERING EXAMPLE

MB25 | 11 | S4 | W | 01 | – | B | C

Poles & Circuits

11	SPDT	ON	(ON)
21	DPDT	ON	(ON)

( ) = Momentary

Contact Materials & Ratings

W	Silver Rated 3A @ 125V AC
G	Gold Rated 0.4VA max @ 28V AC/DC max

Caps

B	.315″ (8.0mm) Diameter
C	.394″ (10.0mm) Diameter

Bushing

S4	.315″ (8.0mm) Threaded with Keyway

Terminals

01	Solder Lug
03	.250″ (6.35mm) Straight PC

Cap Colors

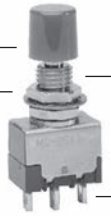
A	Black
B	White
C	Red
E	Yellow
F	Green
G	Blue

IMPORTANT:

Switches are supplied without UL, cULus & CSA marking unless specified. **UL, cULus & CSA recognized only when ordered with marking on the switch.** Specific models, ratings, & ordering instructions are noted on the General Specifications page.

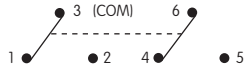
DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

MB2511S4W01-BC



Series MB2500

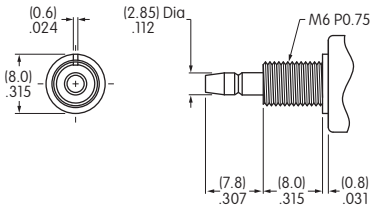
POLES & CIRCUITS

Pole	Model	Plunger Position ( ) = Momentary: Normal (Keyway)	Plunger Position: Down	Connected Terminals: Normal (Keyway)	Connected Terminals: Down	Throw & Switch Schematics
SP	**MB2511**	ON	(ON)	3-1	3-2	SPDT
DP	**MB2521**	ON	(ON)	3-1 6-4	3-2 6-5	DPDT 

Note: Terminal numbers are not actually on the switch.

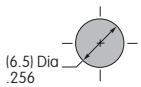
BUSHING

S4 **.315" (8.0mm) Threaded with Keyway**

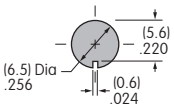


Panel Cutouts

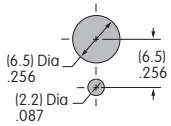
Without Keyway



With Keyway



With Optional Locking Ring



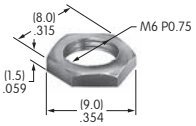
Maximum Panel Thickness with Standard Hardware: .134" (3.4mm)

Standard Hardware

AT513M Threaded Hex Nut

2 included with each switch

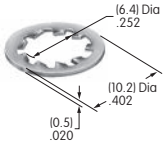
Brass with nickel plating



AT509 Lockwasher

1 included with each switch

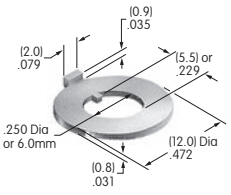
Steel with zinc/chromate



Optional Hardware

AT507M Locking Ring

Steel with zinc/chromate



CONTACT MATERIALS & RATINGS

W	**Silver over Silver**	**Power Level**	**3A @ 125V AC**
G	**Gold over Brass or Copper**	**Logic Level**	**0.4VA maximum @ 28V AC/DC maximum**

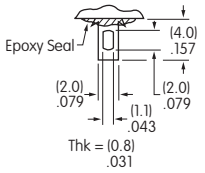
Note: Complete explanation of operating range in Supplement section.

Series MB2500

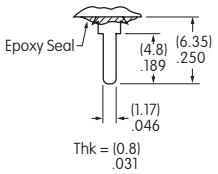
Snap-Action Bushing Mount Pushbuttons

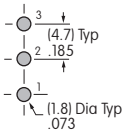
TERMINALS

01 **Solder Lug**

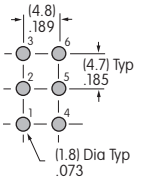


03 **.250" (6.35mm) Straight PC**





Single Pole



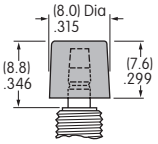
Double Pole

CAPS & CAP COLORS

B **AT443**
.315" (8.0mm) Diameter Cap

Material: Polycarbonate

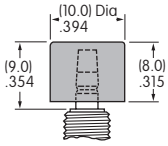
Finish: Glossy



C **AT442**
.394" (10.0mm) Diameter Cap

Material: Polycarbonate

Finish: Glossy

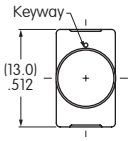


Cap Colors Available:

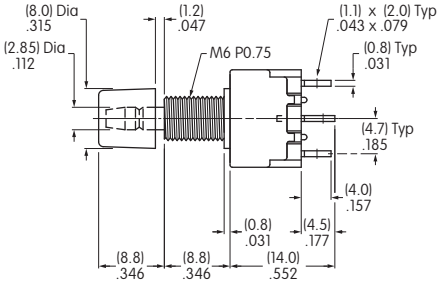
A Black **B** White **C** Red **E** Yellow **F** Green **G** Blue

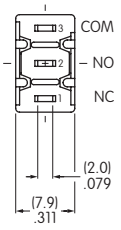
TYPICAL SWITCH DIMENSIONS

Solder Lug



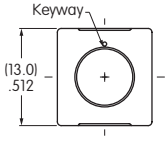
Single Pole



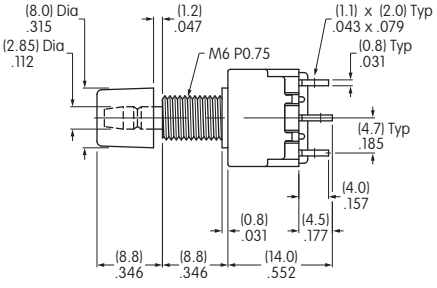


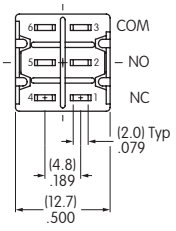
MB2511S4W01-BC

Solder Lug



Double Pole





MB2521S4W01-BC

Series MB2500

TYPICAL SWITCH ORDERING EXAMPLE

MB25 | 11 | S2 | G | 13 | — | B | C

Poles & Circuits

11	SPDT	ON	(ON)
21	DPDT	ON	(ON)

( ) = Momentary

Contact Materials & Ratings

W	Silver Rated 3A @ 125V AC
G	Gold Rated 0.4VA max @ 28V AC/DC max

Caps

B	.315″ (8.0mm) Diameter
C	.394″ (10.0mm) Diameter

Bushing

S2	.300″ (7.6mm) Smooth with Keyway

Terminals

13	.250″ (6.35mm) Straight PC with Bracket
30	Right Angle (Single Pole only)
45	Vertical PC

Cap Colors

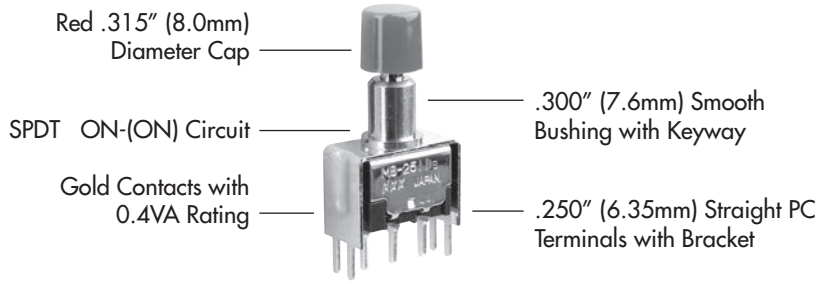
A	Black
B	White
C	Red
E	Yellow
F	Green
G	Blue

IMPORTANT:

Switches are supplied without UL, cULus & CSA marking unless specified. **UL, cULus & CSA recognized only when ordered with marking on the switch.** Specific models, ratings, & ordering instructions are noted on the General Specifications page.

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

MB2511S2G13-BC



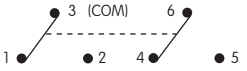
Series MB2500

Snap-Action Bracket PC Mount Pushbuttons

POLES & CIRCUITS

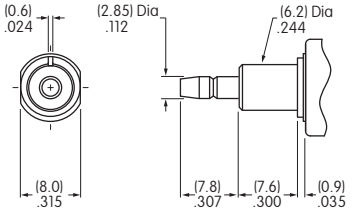
Pole	Model	Plunger Position ( ) = Momentary: Normal (Keyway)	Plunger Position ( ) = Momentary: Down	Connected Terminals: Normal (Keyway)	Connected Terminals: Down	Throw & Switch Schematics
SP	**MB2511**	ON	(ON)	3-1	3-2	SPDT
DP	**MB2521**	ON	(ON)	3-1 6-4	3-2 6-5	DPDT

Note: Terminal numbers are not actually on the switch.

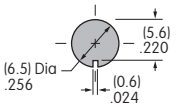


BUSHING

S2 **.300" (7.6mm) Smooth with Keyway**



Panel Cutout



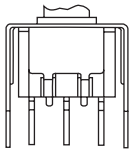
CONTACT MATERIALS & RATINGS

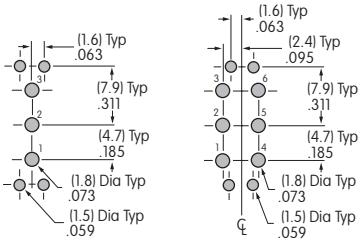
W	**Silver over Silver**	**Power Level**	**3A @ 125V AC**
G	**Gold over Brass or Copper**	**Logic Level**	**0.4VA maximum @ 28V AC/DC maximum**

Note: Complete explanation of operating range in Supplement section.

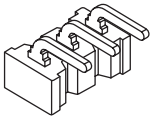
TERMINALS

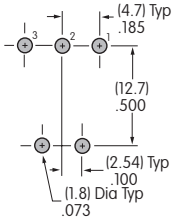
13 **.250" (6.35mm) Terminal with .465" (11.8mm) Bracket**



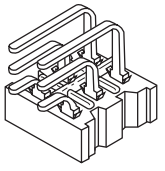


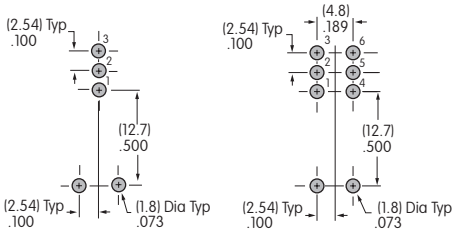
30 **Right Angle PC** Single Pole only





45 **Vertical PC**





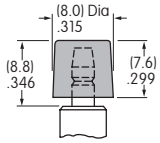
Series MB2500

CAPS & CAP COLORS

B **AT443**
.315" (8.0mm) Diameter Cap

Material: Polycarbonate

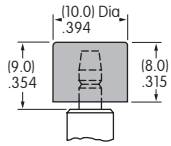
Finish: Glossy



C **AT442**
.394" (10.0mm) Diameter Cap

Material: Polycarbonate

Finish: Glossy

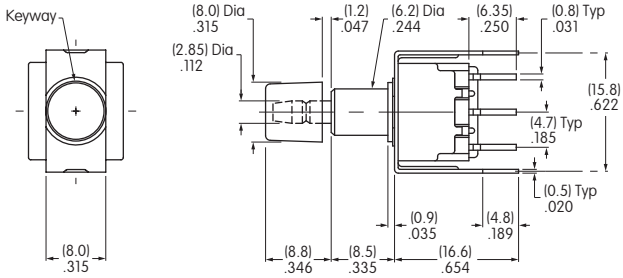


Cap Colors Available:

A Black **B** White **C** Red **E** Yellow **F** Green **G** Blue

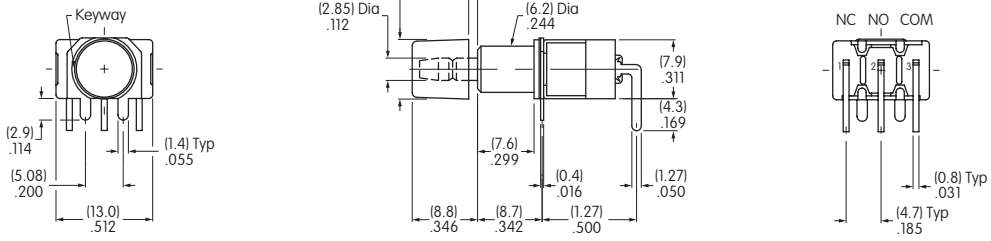
TYPICAL SWITCH DIMENSIONS

Single Pole · Double Pole · Straight PC • Bracket



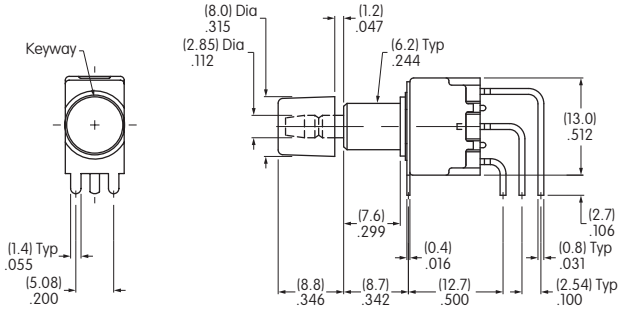
MB2511S2G13-BC

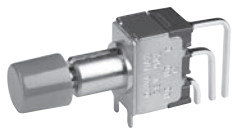
Single Pole · Right Angle PC



MB2511S2G30-BC

Single Pole · Double Pole · Vertical PC





MB2511S2G45-BC

TYPICAL SWITCH ORDERING EXAMPLE

MB25 | 11 | J | W | 01 — A

Poles & Circuits

11	SPDT	ON	(ON)
21	DPDT	ON	(ON)

( ) = Momentary

Contact Materials & Ratings

W	Silver Rated 3A @ 125V AC
G	Gold Rated 0.4VA max @ 28V AC/DC max

Cap & Cap Colors

A	Black
B	White
C	Red
E	Yellow
F	Green
G	Blue
H	Gray

Mounting Frame

J	Snap-in Frame

Terminals

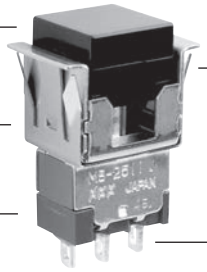
01	Solder Lug

IMPORTANT:

Switches are supplied without UL, cULus & CSA marking unless specified. **UL, cULus & CSA recognized only when ordered with marking on the switch.** Specific models, ratings, & ordering instructions are noted on the General Specifications page.

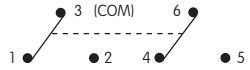
DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

MB2511JW01-A



Series MB2500

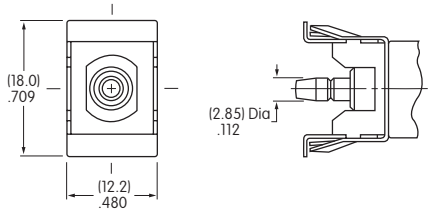
POLES & CIRCUITS

Pole	Model	Plunger Position ( ) = Momentary: Normal	Plunger Position ( ) = Momentary: Down	Connected Terminals: Normal	Connected Terminals: Down	Throw & Switch Schematics
SP	**MB2511**	ON	(ON)	3-1	3-2	SPDT
DP	**MB2521**	ON	(ON)	3-1 6-4	3-2 6-5	DPDT 

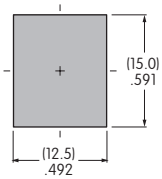
Note: Terminal numbers are not actually on the switch.

MOUNTING FRAME

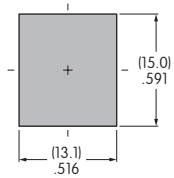
J **Snap-in Frame**



Panel Cutout for Single Pole without Bezel



Panel Cutout for Double Pole without Bezel



Panel Thickness without Bezel: .039" ~ .157" (1.0mm ~ 4.0mm)
Panel Thickness with Bezel: .039" ~ .126" (1.0mm ~ 3.2mm)

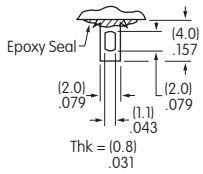
CONTACT MATERIALS & RATINGS

W	**Silver over Silver**	**Power Level**	**3A @ 125V AC**
G	**Gold over Brass or Copper**	**Logic Level**	**0.4VA maximum @ 28V AC/DC maximum**

Note: Complete explanation of operating range in Supplement section.

TERMINALS

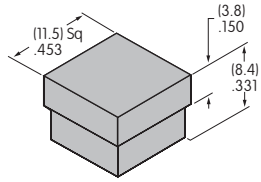
01 **Solder Lug**



CAP & CAP COLORS

AT465
.453" (11.5mm) Square Cap

Material: Polycarbonate
Finish: Glossy

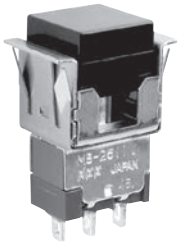


Contact factory for matte finish.

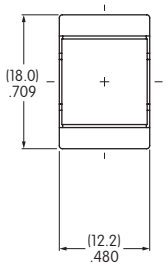
Cap Colors Available: **A** Black **B** White **C** Red **E** Yellow **F** Green **G** Blue **H** Gray

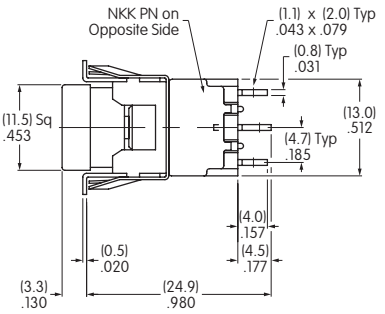
TYPICAL SWITCH DIMENSIONS

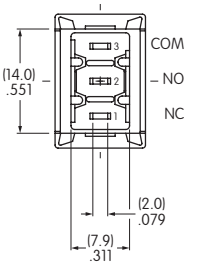
Solder Lug — Single Pole



MB2511JW01-A

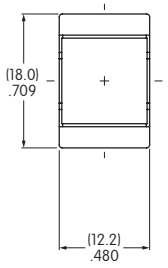


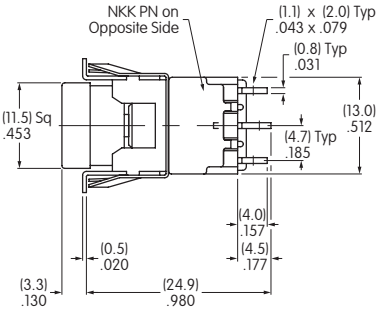


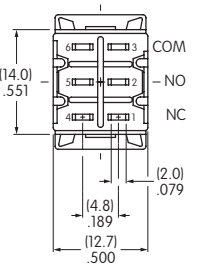


Solder Lug — Double Pole

MB2521JW01-C







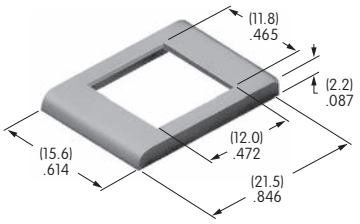
OPTIONAL SNAP-IN BEZELS & BEZEL COLORS

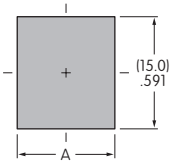
AT207 Bezel

Material: Polycarbonate
Finish: Glossy

Colors:
Black, White, Red, Yellow, Green, Blue, Gray

Contact factory for matte finish.





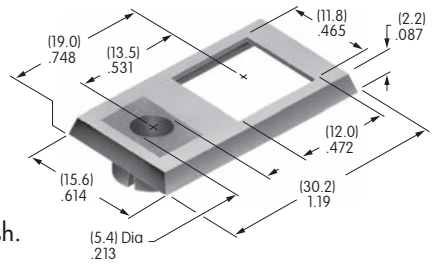
	Single Pole	Double Pole
A	(12.5mm) .492″	(13.1mm) .516″

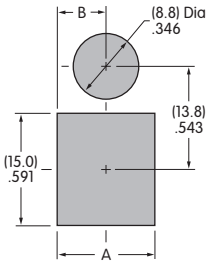
AT208 Bezel for AT070 LED

Material: Polycarbonate
Finish: Glossy

Color: Black

Contact factory for matte finish.



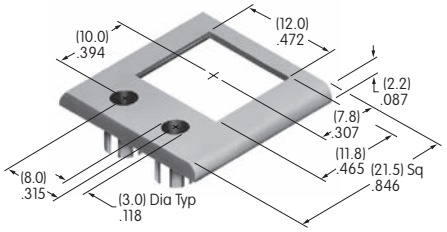


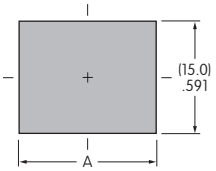
	Single Pole	Double Pole
A	(12.5mm) .492″	(13.1mm) .516″
B	(6.25mm) .246″	(6.55mm) .258″

AT212 Bezel for AT617 LED

Material: Polycarbonate
Finish: Semi-glossy

Color: Black





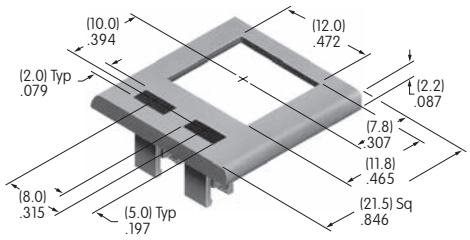
	Single Pole	Double Pole
A	(18.4mm) .724″	(18.7mm) .736″

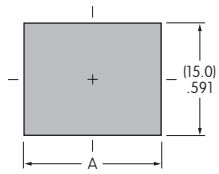
OPTIONAL SNAP-IN BEZELS & BEZEL COLORS

AT213 Bezel for AT618 LED

Material:
Polycarbonate
Finish:
Semi-glossy

Color:
Black

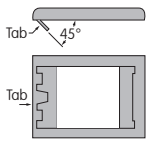




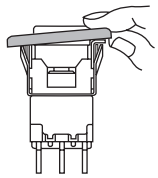
	Single Pole	Double Pole
A	(18.4mm) .724″	(18.7mm) .736″

Bezel Assembly

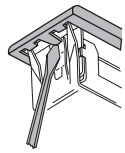
1. Pry out tab on bezel to a 45° angle.



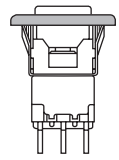
2. Insert switch frame under tab and snap on the bezel.



3. Push tab back into place.



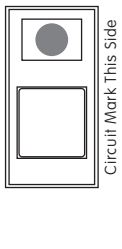
4. Snap assembled bezel and switch into panel.

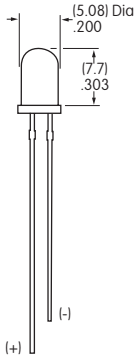


LED COLORS & SPECIFICATIONS

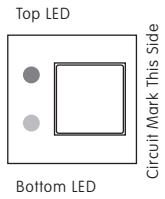
Bezel Orientation on Switch

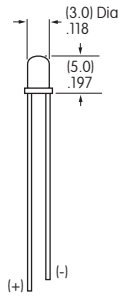
AT070 LED
For Bezel AT208
with 1 LED



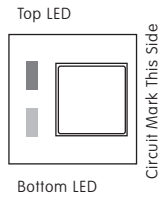


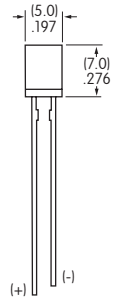
AT617 LED
For Bezel AT212
with 2 Round LEDs





AT618 LED
For Bezel AT213
with 2 Rectangular LEDs





Note: Lead lengths may differ from manufacturing lot to lot. The longer lead is the anode (+).

		AT070		AT617			AT618		
(+) (-)		C	F	C	E	F	C	E	F
	Color	Red	Green	Red	Yellow	Green	Red	Yellow	Green
Maximum Forward Current	I_{FM}	25mA	50mA	30mA	30mA	25mA	25mA	30mA	25mA
Typical Forward Current	I_F	20mA	30mA	20mA	20mA	20mA	20mA	20mA	20mA
Forward Voltage	V_F	2.8V	2.1V	2.0V	2.1V	2.2V	2.25V	2.1V	2.2V
Maximum Reverse Voltage	V_{RM}	4V	5V	5V	5V	5V	5V	5V	5V
Current Reduction Rate Above 25°C	ΔI_F	0.33 mA/°C	0.40 mA/°C	0.40 mA/°C	0.40 mA/°C	0.33 mA/°C	0.33 mA/°C	0.40 mA/°C	0.33 mA/°C
Ambient Temperature Range (when used with a bezel)		−10° ~ +70°C		−15° ~ +70°C			−25° ~ +70°C		

The electrical specifications shown are determined at a basic temperature of 25°C.
LED circuit is independent of switch operation. LED is colored in OFF state.

If the source voltage is greater than the rated voltage of the LED, a ballast resistor must be connected in series with the LED.
The ballast resistor calculation and more lamp detail are shown in the Supplement section.

GENERAL SPECIFICATIONS FOR SB25, SB60s, SB221s, SB265

Electrical Capacity (Resistive Load)

Power Level: Shown in the following tables

Other Ratings

Contact Resistance: 10 milliohms maximum
Insulation Resistance: 200 megohms minimum @ 500V DC for SB221s, SB25, & SB265;
1,000 megohms minimum @ 500V DC for SB60s.
Dielectric Strength: 1,500V AC minimum for SB265 & SB25 for 1 minute minimum;
2,000V AC minimum between contacts for SB221s & SB60s for 1 minute minimum;
1,500V AC minimum between contacts & case for SB221s & SB60s for 1 minute minimum
Mechanical Life: 50,000 operations minimum for SB221s;
30,000 operations minimum for SB25, SB60s, SB265
Electrical Life: 10,000 operations minimum
Total Travel: SB221s .116" (2.95mm); SB60s .094" (2.4mm); SB265 .213" (5.4mm);
SB25 .195" (4.95mm)
Operating Temp Range: –10°C through +70°C (+14°F through +158°F)

Materials & Finishes

Cap: Polybutylene terephthalate (PBT) (AT414)
Plunger: Polyacetal or brass with nickel plating
Bushing: Brass with nickel plating
Case: Phenolic resin or melamine phenolic resin
Case Cover: Steel with zinc plating
Movable & Stationary Contacts: Copper with silver plating for SB221s; silver alloy with silver plating for SB25, SB60s, & SB265
Terminals: Copper with tin plating for SB25 & SB60s; copper with silver plating for SB265

Installation

Soldering Time & Temp: Manual Soldering (Solder Lug): See Profile A in Supplement section.

Standards & Certifications

UL: **File No. E44145 - Recognized only when ordered with marking on switch.**
Add "/U" or "/CUL" to end of part number to order UL recognized switch.
UL or cULus recognition designated beside part numbers on following pages.
See Supplement section to find UL or cULus rating details.
CSA: **File No. 023535_0_000 - Certified only when ordered with marking on switch.**
Add "/C" to end of part number to order CSA certified switch.
CSA certification designated beside part numbers on following pages.
See Supplement section to find CSA rating details.

SINGLE POLE WITH SOLDER LUG OR SCREW LUG

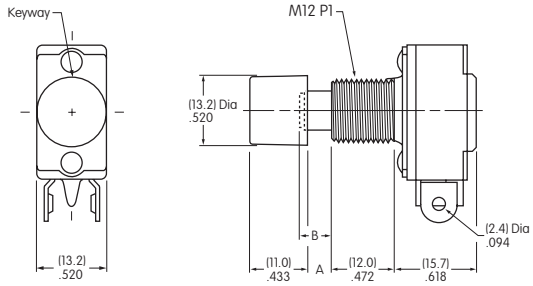
* UL, cULus & CSA recognized only when ordered with marking on switch (see General Specs)				Pushbutton Position/Connected Terminals ( ) = Momentary				Electrical Capacity (Resistive)	
Model	*Approvals			Pole & Throw	Normal	Keyway	Down	AC 125V	AC 250V
SB221NO	—	—	✓	SPST	OFF	–	(ON) 1-4	3A	1.5A
SB221NC	✓	✓	✓	SPST	ON	1-4	(OFF) —	3A	1.5A
SB221TNO	—	—	✓	SPST	OFF	–	(ON) 1-4	3A	1.5A
SB221TNC	✓	✓	✓	SPST	ON	1-4	(OFF) —	3A	1.5A

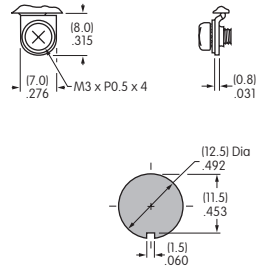
Suffix T = Screw Lug

Throw & Schematic: SPST SB221NO SPST SB221NC

Note: Terminal numbers are actually on the switch.

Notes: Standard Hardware: AT504M Knurled Nut, AT508 Lockwasher, AT527M Hex Backup Nut. See Accessories & Hardware section.





SB221NO
Supplied with AT414 Black Cap

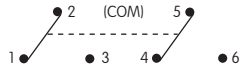
Dimension A: .185" (4.7mm) for NO model & .150" (3.8mm) for NC model.
Dimension B Plunger Extension: .197" (5.0mm) for NO model & .161" (4.1mm) for NC model.

Panel Thickness .193" (4.9mm)

DOUBLE POLE WITH SOLDER LUG

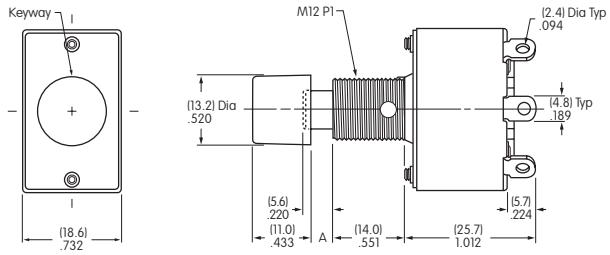
* UL & cULus recognized only when ordered with marking on switch (see General Specs)				Pushbutton Position/Connected Terminals ( ) = Momentary					Electrical Capacity (Resistive)	
Model	*Approvals			Pole & Throw	Normal	Keyway	Down		AC 125V	AC 250V
SB61A	✓	✓	—		ON	2-3 5-6	(ON)	2-1 5-4	10A	5A
SB61B	—	—	—	DPDT	ON	2-3 5-6	(ON)	2-1 5-4	3A	1.5A
SB63A	—	—	—	DPDT	ON	2-3 5-6	(ON) or Lockdown ON	2-1 5-4	10A	5A

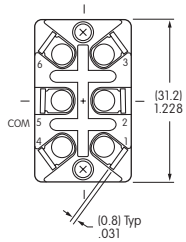
Lockdown for SB63A is achieved by actuating and then turning the button clockwise.

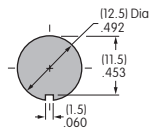
Throw & Schematic: DPDT 

Note: Terminal numbers are actually on the switch.

Notes: Standard Hardware: AT504M Knurled Nut, AT508 Lockwasher, AT527M Hex Backup Nut. See Accessories & Hardware section.







SB61A
Supplied with AT414 Black Cap

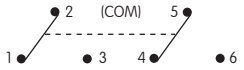
Dimension A: .169" (4.3mm) for SB61 model and .130" (3.3mm) for SB63 model.

Panel Thickness .193" (4.9mm)

DOUBLE POLE WITH SOLDER LUG

* UL, cULus & CSA recognized only when ordered with marking on switch (see General Specs)			Pushbutton Position/Connected Terminals ( ) = Momentary		Electrical Capacity (Resistive)	
Model	*Approvals	Pole & Throw	Normal (Keyway)	Down	AC 125V	AC 250V
SB25	✓ ✓ ✓	DPDT	ON 2-3 5-6	ON 2-1 5-4	15A	9A

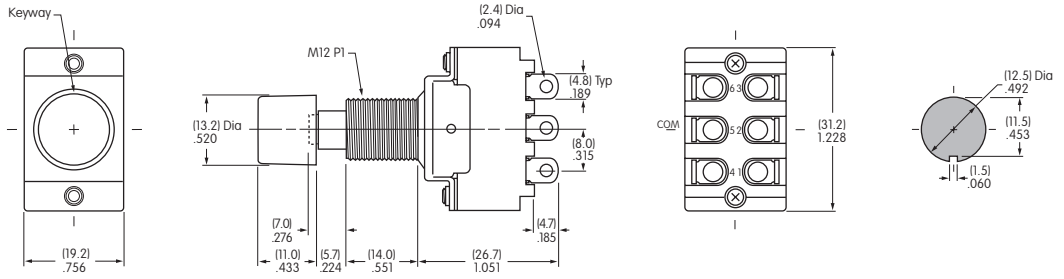
Throw & Schematic: DPDT



Note: Terminal numbers are actually on the switch.

Notes: Standard Hardware: AT504M Knurled Nut, AT508 Lockwasher, AT527M Hex Backup Nut. See Accessories & Hardware section.

SB25
Supplied with
AT414 Black Cap



Panel Thickness
.193" (4.9mm)

SINGLE POLE WITH SOLDER LUG

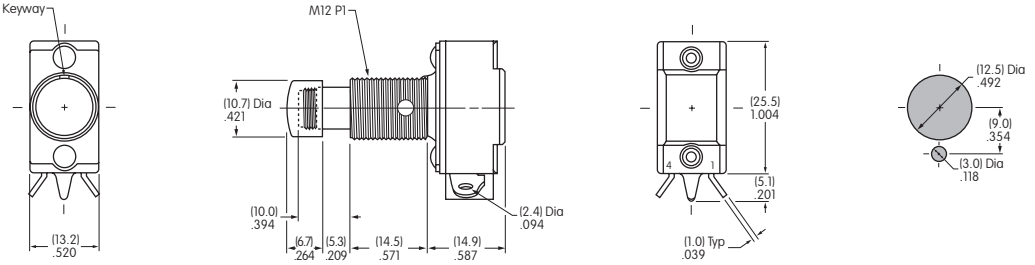
* UL, cULus & CSA recognized only when ordered with marking on switch (see General Specs)			Pushbutton Position/Connected Terminals ( ) = Momentary		Electrical Capacity (Resistive)	
Model	*Approvals	Pole & Throw	Normal (Keyway)	Down	AC 125V	AC 250V
SB265	✓ ✓ ✓	SPST	ON 1-4	OFF —	6A	3A

Throw & Schematic: SPST

Note: Terminal numbers are actually on the switch.

Notes: Standard Hardware: AT504M Knurled Nut, AT508 Lockwasher, AT527M Hex Backup Nut. See Accessories & Hardware section.

SB265
Supplied with Chrome
Plated Brass Cap



Panel Thickness
.291" (7.4mm)

GENERAL SPECIFICATIONS

Electrical Capacity

Resistive Load: 15A & ½HP @ 125 or 250V AC for high capacity models
Lamp Load: 5A @ 125V AC

Other Ratings

Contact Resistance: 15 milliohms maximum
Insulation Resistance: 100 megohms minimum @ 500V DC
Dielectric Strength: 1,000V AC minimum between contacts for 1 minute minimum;
1,500V AC minimum between contacts & case for 1 minute minimum
Mechanical Life: 1,000,000 operations minimum
Electrical Life: 50,000 operations minimum
Travel: Pretravel .047" (1.19mm); Overtravel .040" (1.01mm); Differential .011" (0.27mm)
Operating Temp Range: –40°C through +85°C (–40°F through +185°F)

Materials & Finishes

Caps & Shrouds: Polycarbonate with glossy finish or PBT
Plunger: Polyacetal or brass with nickel plating
Bushing: Steel with zinc plating or glass fiber reinforced polyamide
Case: Polyester
Movable & Stationary Contacts: Silver alloy
Terminals: Brass with silver plating

Standards & Certifications

UL: Internal snap switch is UL recognized.
CSA: Internal snap switch is CSA certified.

TYPICAL SWITCH ORDERING EXAMPLE

SCB | 2 | 5 | P | 15 | A | — | 4 | CA

Poles

1	SPDT
2	DPDT

Circuits

5	ON	(ON)
6	ON	ON
( ) = Momentary		

Bushings

P	Plastic (with momentary only)
S	Steel

Rating

15	15A

Terminals

A	.187" (4.75mm) Quick Connect
* B	.250" (6.35mm) Quick Connect
Note:	Contact factory for availability of screw lug and solder lug models.
* Available in Americas only	

Caps & Shrouds

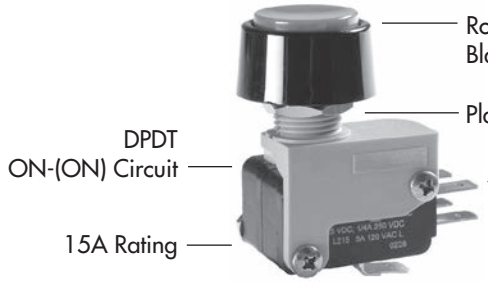
For Momentary	
3	.520" (13.2mm) Diameter Cap
For Momentary & Alternate Action	
4	Round Cap & Shroud (AT454 & AT455)
5	Rectangular Cap & Shroud (AT452 & AT453)

Colors

Caps		Shrouds
A	Black	A
B	White	B
C	Red	–
F	Green	–
G	Blue	–
H	Gray	H

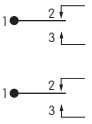
DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

SCB25P15A-4CA



Note: Standard hardware is provided with caps. See Bushing detail for more information.

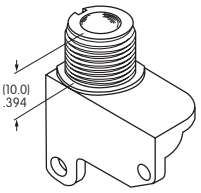
POLES & CIRCUITS

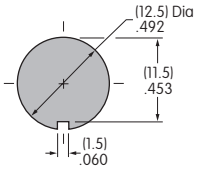
Pole	Model	Plunger Position ( ) = Momentary: Normal (Keyway)	Plunger Position ( ) = Momentary: Down	Connected Terminals: Normal (Keyway)	Connected Terminals: Down	Throw & Schematics
SP	**SCB15** **SCB16**	ON ON	(ON) ON	1-2	1-3	SPDT
DP	**SCB25** **SCB26**	ON ON	(ON) ON	1-2 1-2	1-3 1-3	SP with 2 switches 

Note: Terminal numbers are actually on the switch.

BUSHINGS

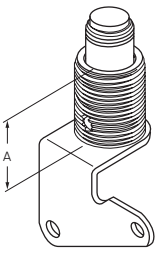
P **Plastic**
(for Momentary only)





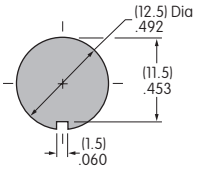
Maximum Effective Panel Thickness:
.165" (4.2mm) without Shroud
.157" (4.0mm) with Shroud

S **Steel**



"A" =
11.2mm
Momentary

15.5mm
Alternate Action



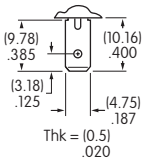
Maximum Effective Panel Thickness:
Momentary: .177" (4.5mm) without Shroud
.157" (4.0mm) with Shroud
Alternate Action: .354" (9.0mm)

Standard Hardware Provided with Caps

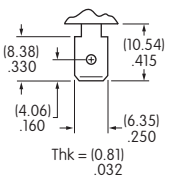
Cap Option 3: AT504M Knurled Face Nut, AT508 Lockwasher, AT527M Hex Mounting Nut
Cap Options 4 & 5: AT508 Lockwasher & AT527M Hex Mounting Nut

TERMINALS

A **.187" (4.75mm) Quick Connect**

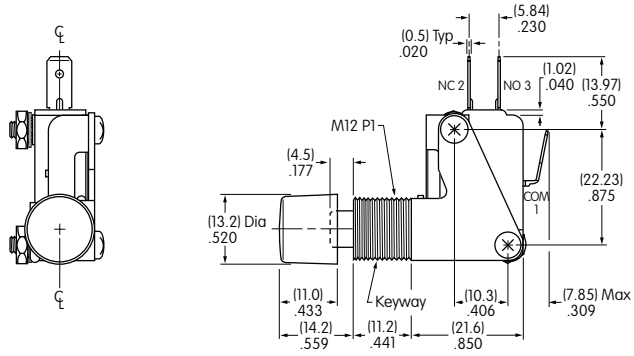


B **.250" (6.35mm) Quick Connect**



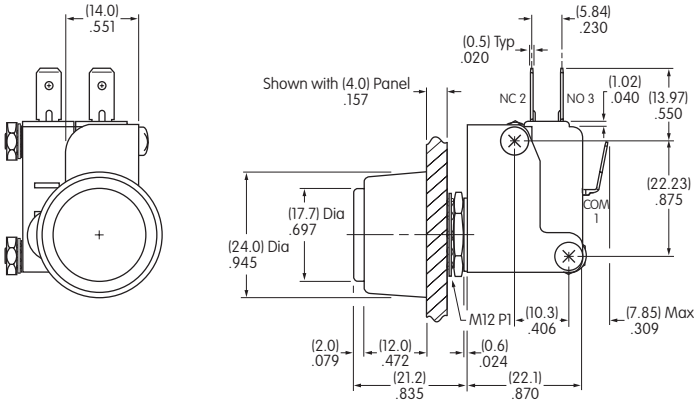
TYPICAL SWITCH DIMENSIONS

.520" (13.2mm) Dia. Cap • .187" (4.75mm) Quick Connect



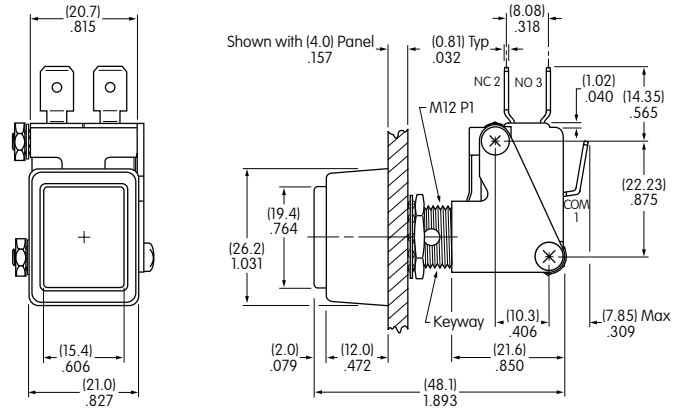
SCB15S15A-3C

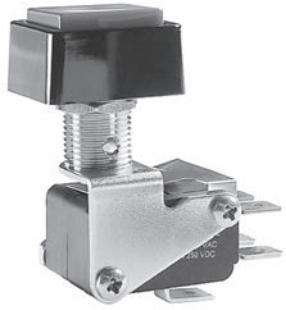
Round Cap & Shroud • .187" (4.75mm) Quick Connect



SCB25P15A-4CA

Rectangular Cap & Shroud • .250" (6.35mm) Quick Connect





SCB26S15B-5CA

General Specifications

Electrical Capacity (Resistive Load)

Power Level: 6A @ 125V AC & 3A @ 250V AC or 6A @ 30V DC

Other Ratings

Contact Resistance: 10 milliohms maximum for solder lug & screw terminal models
30 milliohms maximum for wire lead terminal models
Insulation Resistance: 200 megohms minimum @ 500V DC
Dielectric Strength: 1,500V AC minimum for 1 minute minimum
Mechanical Life: 30,000 operations minimum
Electrical Life: 15,000 operations minimum
Contact Timing: Break before make
Total Travel: Alternate Action .177" (4.5mm); Momentary Action .110" (2.8mm)

Materials & Finishes

Plunger: Brass with nickel plating
Bushing & Outer Case: Fiberglass reinforced polyamide (UL94V-0 outer case)
Inner Case: Melamine
Inner Sealing Ring: Silicone rubber
Outer Sealing Ring: Nitrile butadiene rubber
Movable Contactor: Copper with silver plating
Movable Contacts: Silver alloy with silver plating
Stationary Contacts: Silver alloy with silver plating
Terminals: Brass with tin plating
Wire Lead Covers: Heat resistant polyvinyl chloride (Leads are AWG 16.)

Environmental Data

Operating Temp Range: –30°C through +70°C (–22°F through +158°F)
Humidity: 90 ~ 95% humidity for 96 hours @ 40°C (104°F)
Vibration: 10 ~ 55Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in 1 minute; 3 right angled directions for 2 hours
Shock: 50G (490m/s^2) acceleration (tested in 6 right angled directions, with 5 shocks in each direction)

Installation

Mounting Torque: 1.5Nm (13 lb•in)
Soldering Time & Temp: Manual Soldering: See Profile A in Supplement section.

Standards & Certifications

Flammability Standards: UL94V-0 outer case
Wiring Material Standards: UL AWM 1015 Recognized at Flammability VW-1;
Temperature Range –20°C ~ +105°C; Maximum Load 600V; AWG 16
CSA TEW 105 Certified at Temperature Range –20°C ~ +105° C;
Maximum Load 600V

Distinctive Characteristics

Single unit construction of the bushing and case gives added protection from environmental elements.

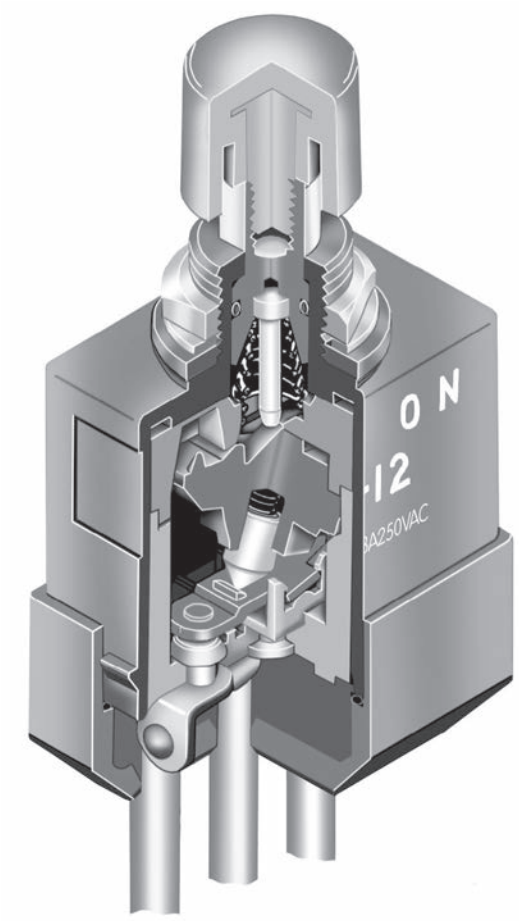
Specially designed contact mechanism for breaking light welds.

Minimal contact bounce is achieved with specially designed interlocked switching mechanism.

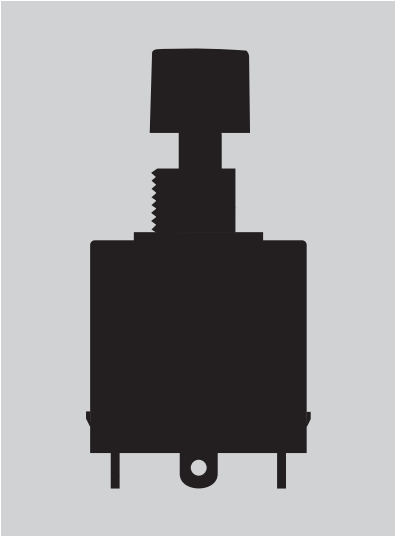
Outer housing of heat resistant resin meets UL 94V-0 flammability standard and provides high arc and tracking resistance.

Solder lug and screw terminal models meet IP67 of IEC60529 Standards at front panel (dust tight and water protected for temporary immersion). Behind panel standard is IP60 (dust tight but not water protected).

Wire lead models conform fully to IP67 of IEC60529 Standards at front and behind panel (dust tight and water protected for temporary immersion). These models are epoxy sealed at the switch base and covered by an outer case for further protection from dust and water (not operable under water).



Actual Size



Series WB

Environmentally Sealed Pushbuttons

TYPICAL SWITCH ORDERING EXAMPLE

WB 1 2 S — D A

Poles	
1	SPDT

Circuits		
2	ON	ON
5	ON	(ON)
( ) = Momentary		

Terminals	
S	Solder Lug
T	Screw Lug
L	Wire Lead

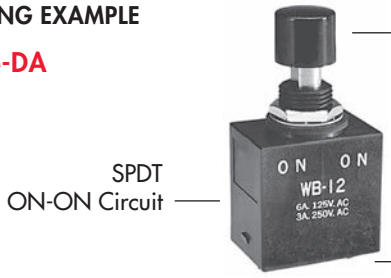
Caps	
D	.520″ (13.2mm) Dia.
E	.748″ (19.0mm) Dia.

Cap Colors	
A	Black
B	White
C	Red
* D	Amber
* E	Yellow
F	Green
* G	Blue
* H	Gray

* Not available with cap code E

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

WB12S-DA



POLES & CIRCUITS

Pole	Model	Actuator Position ( ) = Momentary: Normal (Flat)	Actuator Position ( ) = Momentary: Down	Connected Terminals: Normal (Flat)	Connected Terminals: Down	Throw & Schematics
SP	**WB12**	ON	ON	1-1b	1-1a	Note: Terminal numbers are not actually on wire lead models.
SP	**WB15**	ON	(ON)	1-1b	1-1a	SPDT

STANDARD WIRE COLOR SCHEME

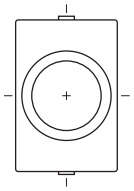
Wire leads are covered with heat resistant vinyl in accordance to UL 1015 and CSA TEW 105 Standards for Appliance Wiring Material (AWM).

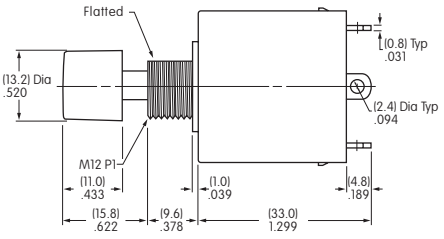
Terminal Numbers & Wire Colors			
Models	**1a**	**1**	**1b**
WB12L, WB15L	White	Black	Red

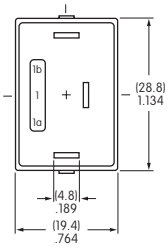
TYPICAL SWITCH DIMENSIONS

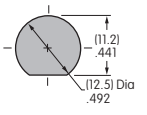
Solder Lug

WB15S-DA





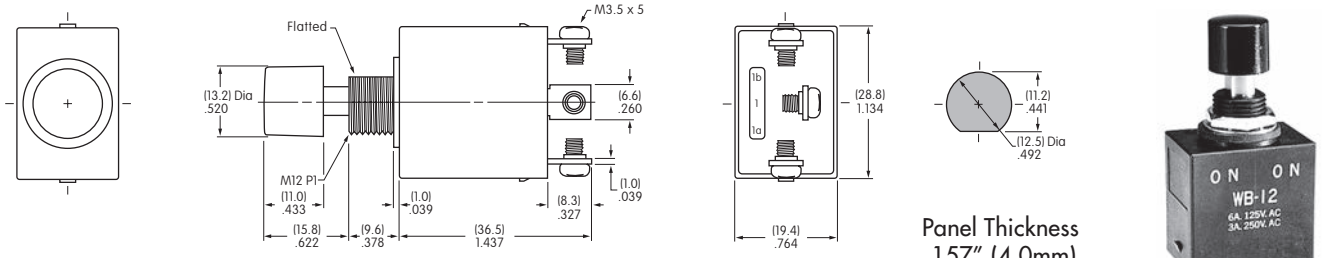




Panel Thickness
.157″ (4.0mm)

TYPICAL SWITCH DIMENSIONS

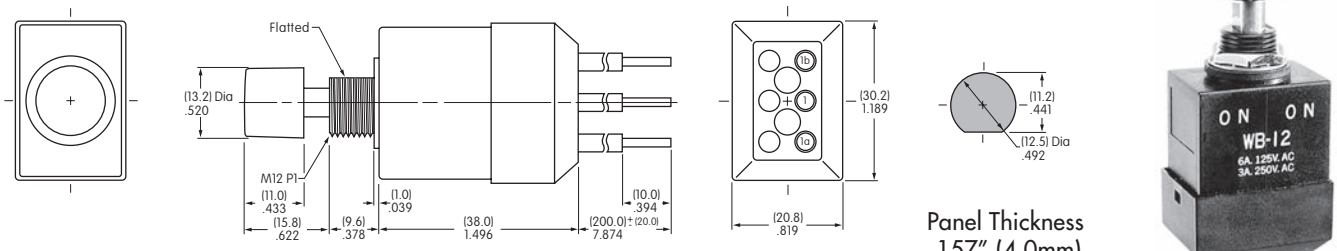
Screw Lug



Panel Thickness
.157" (4.0mm)

WB12T-DA

Wire Lead



Panel Thickness
.157" (4.0mm)

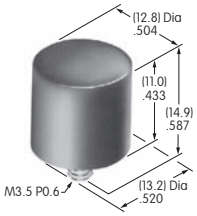
WB12L-DA

CAPS & CAP COLORS

D **AT414**
.520" (13.2mm) Diameter

Colors Available:
A B C D E F G H

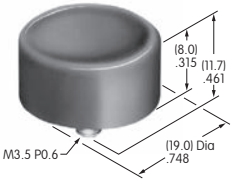
Material: PBT Finish: Glossy



E **AT412**
.748" (19.0mm) Diameter

Colors Available:
A B C F

Material: Polystyrene Finish: Glossy

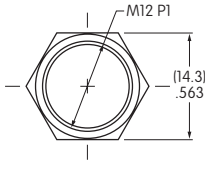


Cap Color Codes: **A** Black **B** White **C** Red **D** Amber **E** Yellow **F** Green **G** Blue **H** Gray

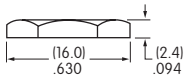
STANDARD HARDWARE

AT503M
Hex Face Nut

Material:
Brass with
chrome plating

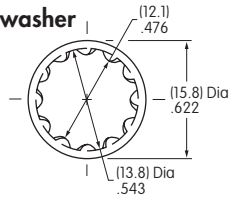


1 supplied with each switch



AT508
Internal Tooth Lockwasher

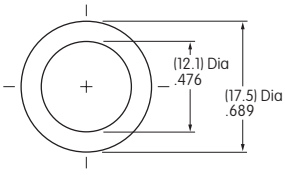
Material:
Steel with
zinc/chromate



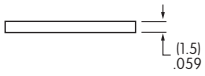
1 supplied with each switch

AT401P
O-ring

Material:
Nitrile
butadiene
rubber



1 supplied with each switch



Notes

NKK SWITCHES

Illuminated Pushbuttons

Contents Illuminated Pushbuttons

FP01 Series D4
Photo Interrupter
3 Million Actuations
6-pin Connector
Snap-in Mount

GB Series D8
Ultra-miniature Fully Illuminated Plunger
0.4VA Logic Level
Process Sealed; Straight, Right Angle & Vertical PC

HB Series Illum & Nonillum D12
0.1A Power Level; Full Face & Spot Illumination
Solder Lug
Rear Panel Threaded Mounting

HB2 Series D18
Audio/Video Quiet Actuation; 0.4VA Logic Level
Bicolor LED
PCB Mounting

KB Series Illum & Nonillum D22
1A Power Level & 0.4VA Logic Level
Full Face & Spot Illumination
Solder Lug; Bushing & Snap-in Mount

KP Series D36
Audio/Video with Silent & Audible Options
100mA Low Level
Bicolor & RGB LEDs; Alternating Legends
Rectangular Cap Assembly & Home Keys
PCB Mounting

LB Series Illum & Nonillum D48
Snap-in Mount
3A Power Level & 0.4VA Logic Level
Full Face & Spot Illumination; Super Bright & Bright LEDs
Solder Lug/Quick Connect

Contents

LB Series Illum & Nonillum D59

Panel Seal
3A Power Level & 0.4VA Logic Level
Full Face & Spot Illumination; Super Bright & Bright LEDs
Solder Lug/Quick Connect

LP01 Series D68

Secured Cap Design; 3A Power Level
Full Face Illumination
Solder Lug/Quick Connect

NP01 Series Illum & Nonillum.... D74

Soft Touch, Smooth Actuation
0.4VA Logic Level
Bicolor Alternating Legends
PCB Mounting

UB Series Illum & Nonillum D80

5A Power Level & 0.4VA Logic Level
Full Face & Spot Illumination; Bicolor Alternating Legends
Solder Lug & Straight PC
PCB & Snap-in Mount

UB2 Series Illum & Nonillum D92

5A Power Level & 0.4VA Logic Level
Variety of Illumination Effects; Alternating Legends
Bright, Super Bright, & Bicolor LEDs
Solder Lug & Straight PC; PCB & Snap-in Mount

YB Series Illum & Nonillum D104

3A Power Level & 0.4VA Logic Level
Full Face & Spot Illumination
Incandescent & Multi-element LEDs
Solder Lug/Quick Connect & Straight PC
Bushing & Snap-in Mount

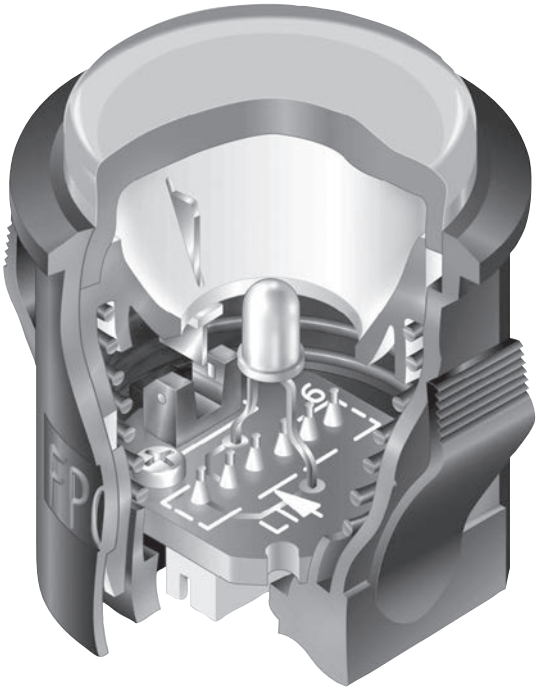
YB2 Series Illum & Nonillum D118

22mm Flush Mount Panel Seal
3A Power Level & 0.4VA Logic Level
Cap Option with Illumination Ring
Solder Lug/Quick Connect

Distinctive Characteristics

Brilliant illumination for highly visible status indication with LEDs and caps in red, green, or amber; subdued illumination for low light requirements with white cap over red, green, or amber LEDs.

Photo interrupter, rather than contacts, ensures high reliability and long life of 3 million operations minimum.



Rugged construction and smooth actuation allow repeated, rapid actuation force anywhere on cap surface.

Snap-in mounting for easy installation.

Connector socket with 6 pins for simple connection.

Well suited for gaming and vending machines, as well as equipment exposed to corrosive gases used in environments such as chemical or steel manufacturing plants.

Actual Size

TYPICAL SWITCH ORDERING EXAMPLE

FP01 [1] [5] [C] [A] [C1] [F] [F] – [ ]

Photo Transistor

1	Single

Shape

C	Round

Receptacle

C1	6-pin Socket

See Connector.

LEDs

C	Red
D	Amber
F	Green

Photo Interrupter

5	Unshaded	(Shaded)

(Momentary Operating Function)

Housing

A	Black

Actuator Colors

B	White
C	Red
D	Amber
F	Green

Connector

C2	Assembled Connector with Wire Leads
* C3	Unassembled Connector and Pins
No Code	No Connector

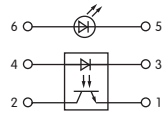
* Available in Americas only

Contact factory for custom options

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

FP0115CAC1FF

ACTUATOR & INTERRUPTER

		Actuator Position		Photo Interrupter		Schematics
Model	1	Normal	Down	Unshaded	Shaded	LED connector pins are 5 & 6; interrupter connector pins are 3-4 & 1-2.
				5	Normally Unshaded with Momentary Shaded status	
FP0115	Single Photo Transistor	When shaded, the photo transistor momentarily activates electrical function which signals the external device to change its state.				

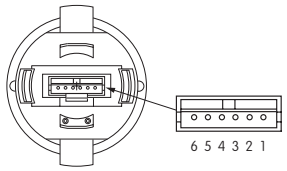
HOUSING SHAPE & COLOR

C Round Shape

A Black Housing

RECEPTACLE

C1 6-pin Socket



SWITCH SPECIFICATIONS

	Actuator Up	Actuator Down
Status of Photo Interrupter:	Unshaded	Shaded
Collector Current I_C:	0.8mA minimum	10µA maximum
Status of Photo Transistor:	On	Off
Output Condition of Photo Transistor:	I_F = 20mA & V_{CE} = 5V	

MECHANICAL SPECIFICATIONS

Total Travel:	.079" (2.0mm)
Operating Force:	0.75 N (.169 lbf)
Mechanical Life:	3,000,000 operations minimum
Operating Temperature Range:	–25°C through +50°C (–13°F through +122°F)

MATERIALS

Actuator: Polyacetal **Housing:** Polyamide

PHOTO INTERRUPTER SPECIFICATIONS (Temperature @ 25°C)

Electrical & Optical Characteristics	Typical	Maximum	Condition
Input			
Forward Voltage V_F:	1.3V	1.6V	I_F = 50mA
Reverse Current I_R:		10µA	F_R = 5V
Transmission			
Collector-Emitter Saturation Voltage V_{CE} sat:		0.4V	I_F = 20mA & I_C = 0.1mA

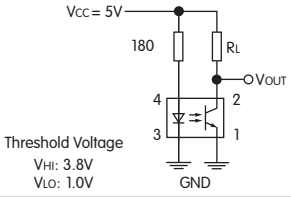
Absolute Maximum Ratings

Input LED		Output Photo Transistor	
Typical Forward Current I_F:	50mA	**Collector-Emitter Voltage V_{CEO}:**	30V
Reverse Voltage V_R:	5V	**Emitter-Collector Voltage V_{ECO}:**	4.5V
Power Dissipation P_D:	80mW	**Collector Current I_C:**	30mA
		Collector Dissipation P_C:	80mW

Circuit Design Considerations

Output of the infrared LED in the photo interrupter decreases approximately 50% after 100,000 hours.

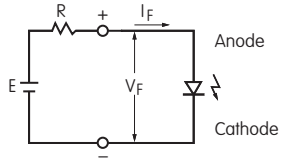
Recommended load resistance (RL) is 40k ~ 120kΩ for the illustrated circuit.



LED COLORS & SPECIFICATIONS

LEDs are an integral part of the switch and not available separately. The electrical specifications shown are determined at a basic temperature of 25°C.

If the source voltage exceeds the rated voltage, a ballast resistor is required.



$$R = \frac{E - V_F}{I_F}$$

Where: R = Resistor Value (Ohms)
E = Source Voltage (V)
V_F = Forward Voltage (V)
I_F = Forward Current (A)

Single Element LED	Color	C Red	D Amber	F Green
Maximum Forward Current	I_{FM}	30mA	25mA	25mA
Typical Forward Current	I_F	20mA	20mA	20mA
Forward Voltage	V_F	1.85V	2.0V	2.25V
Maximum Reverse Voltage	V_{RM}	5V	5V	5V
Current Reduction Rate Above 25°C	ΔI_F	0.38mA /°C	0.28mA /°C	0.40mA /°C
Ambient Temperature Range		–25° ~ +50°C		

ACTUATOR COLORS

B White

C Red

D Amber

F Green

CONNECTOR OPTIONS

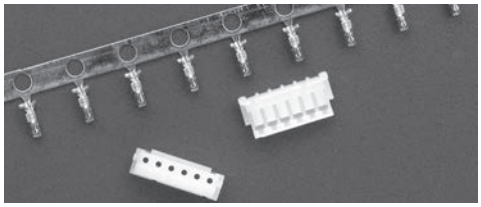
C2 **AT021**
Assembled Connector with Wire Leads

Connector body: JST model ZHR-6
Crimp connector pins: JST model SZH-002T-P0.5
Wire leads: 28-26AWG; 12-inch, unstripped;
Blue for Pin 1

C3 **AT022**
Unassembled Connector and Pins

1 connector and 8 crimp connector pins only (no wire leads provided).

Matching wire leads: 28-26AWG



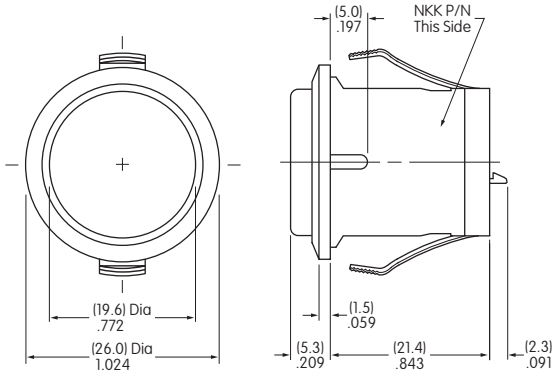
No Code

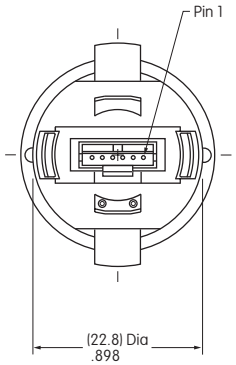
No Connector

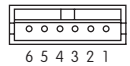
Recommended connector for assembly:
JST model number ZHR-6

Recommended crimp connector pins:
JST model SZH-002T-P0.5 for 28-26AWG wire leads or SZH-003T-P0.5 for 32-28AWG wire leads.

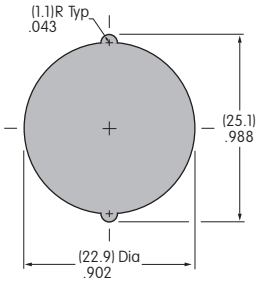
TYPICAL SWITCH DIMENSIONS







Terminal Connector Detail



Recommended Panel Thickness Range:
.098" ~ .197"
(2.5mm ~ 5.0mm)

FP0115CAC1FF

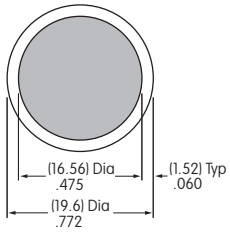
LEGENDS

NKK Switches can provide custom legends for caps. Contact factory for more information.

Suggested Printable Area for FP01 Cap

Recommended Methods:

Screen Print on cap.
Epoxy based ink is recommended.



Shaded area is printable area.

General Specifications

Electrical Capacity (Resistive Load)

Logic Level: 0.4VA maximum @ 28V AC/DC maximum
(Applicable Range 0.1mA ~ 0.1A @ 20mV ~ 28V)
Note: Find additional explanation of operating range in Supplement section.

Other Ratings

Contact Resistance: 80 milliohms maximum
Insulation Resistance: 500 megohms minimum @ 500V DC
Dielectric Strength: 500V AC minimum for 1 minute minimum
Mechanical Life: 50,000 operations minimum
Electrical Life: 50,000 operations minimum
Nominal Operating Force: 1.70N
Travel: Pretravel .035" (0.9mm); Overtravel .008" (0.2mm); Total Travel .043" (1.1mm)

Materials & Finishes

Plunger: Polyamide
Case: Glass fiber reinforced polyamide
Sealing Rings: Nitrile butadiene rubber
Movable Contact: Phosphor bronze with gold plating
Stationary Contacts: Phosphor bronze with gold plating
Base: Glass fiber reinforced polyamide
Switch Terminals: Phosphor bronze with gold plating
Lamp Terminals: Phosphor bronze with gold plating

Environmental Data

Operating Temperature Range: –25°C through +55°C (–13°F through +131°F)
Humidity: 90 ~ 95% humidity for 240 hours @ 40°C (104°F)
Vibration: 10 ~ 500Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in 15 minutes; 3 right angled directions for 2 hours
Shock: 50G (490m/s^2) acceleration (tested in 6 right angled directions, with 5 shocks in each direction)

PCB Processing

Soldering: Wave Soldering recommended. See Profile A in Supplement section.
Manual Soldering: See Profile A in Supplement section.
Cleaning: Automated alcohol based cleaning recommended, 5 minutes maximum. Do not use high-purity alcohol (50% alcohol or more) or organic solvent. High alcohol solution can damage clear plastic. See Cleaning specifications in Supplement section.

Standards & Certifications

The GB Series illuminated pushbuttons have not been tested for UL recognition or CSA certification.
These switches are designed for use in a low-voltage, low-current, logic-level circuit.
When used as intended in a logic-level circuit, the results do not produce hazardous energy.

Distinctive Characteristics

Fully illuminated plunger for highly visible status indication with single color LED in red, green, or amber.

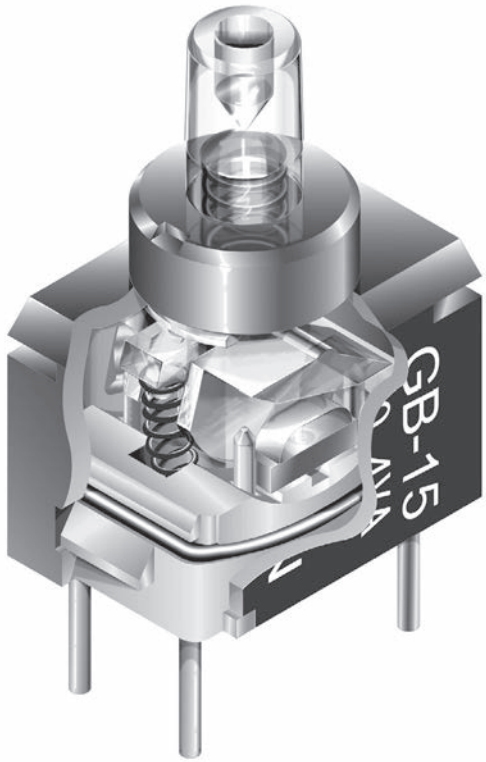
Ultra-miniature size allows high density mounting, and extremely light weight makes these switches ideal for handheld equipment.

Totally sealed body construction prevents contact contamination and allows time- and money-saving automated soldering and cleaning. Insert-molded terminals lock out flux, solvents, and other contaminants.

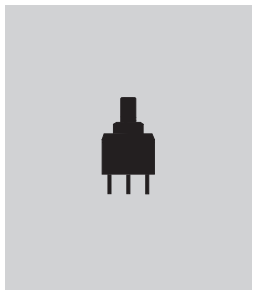
Award-winning STC contact mechanism with benefits unavailable in conventional mechanisms: smooth, positive detent actuation, increased contact stability, and unparalleled logic-level reliability. (Additional STC details in Terms & Acronyms; see Supplement section.)

.100" x .100" (2.54mm x 2.54mm) terminal spacing conforms to standard PC board grid spacing. Round terminals facilitate easier through-hole mounting on PC boards.

Nonilluminated pushbuttons available and shown in the Pushbutton section.



Actual Size



Series GB

Ultra-Miniature Fully Illuminated Plungers

TYPICAL SWITCH ORDERING EXAMPLE

GB | 1 | 5 | J | H | F

Pole	
1	SPDT

Circuit		
5	ON	(ON)
( ) = Momentary		

Actuator	
J	Clear

PC Terminals	
P	Straight
H	Right Angle
V	Vertical

LEDs	
C	Red
D	Amber
F	Green

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

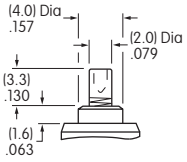
GB15JHF

POLE & CIRCUIT

Pole	Model	Plunger Position ( ) = Momentary: Normal	Plunger Position ( ) = Momentary: Down	Connected Terminals: Normal	Connected Terminals: Down	Throw & Switch/Lamp Schematics
						Note: Terminal numbers are not actually on the switch. LED circuit is isolated and requires an external power source.
SP	**GB15**	ON	(ON)	5-6	5-4	SPDT

ACTUATOR

J **Clear Plunger**



LED COLORS & SPECIFICATIONS

LEDs are an integral part of the switch and not available separately.

The electrical specifications shown are determined at a basic temperature of 25°C.

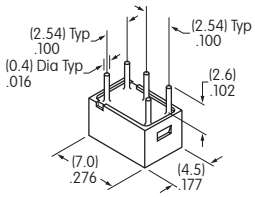
If the source voltage exceeds the rated voltage, a ballast resistor is required.

The resistor value can be calculated by using the formula in the Supplement section.

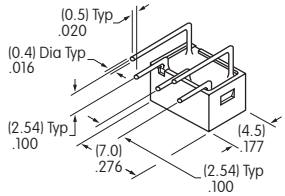
Colors		C Red	D Amber	F Green
Maximum Forward Current	I_{FM}	30mA	30mA	30mA
Typical Forward Current	I_F	20mA	20mA	20mA
Forward Voltage	V_F	1.95V	2.0V	2.1V
Maximum Reverse Voltage	V_{RM}	5V	5V	5V
Current Reduction Rate Above 25°C	ΔI_F	0.40mA/°C	0.40mA/°C	0.40mA/°C
Ambient Temperature Range		−25° ~ +55°C		

PC TERMINALS

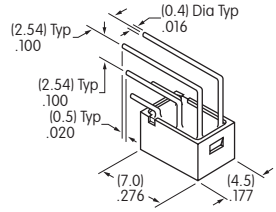
P Straight



H Right Angle

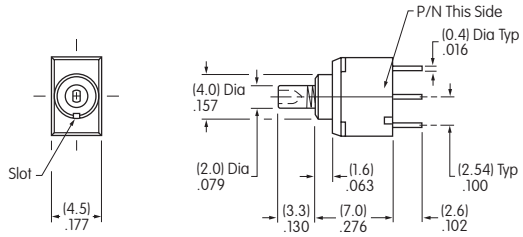


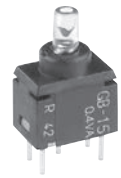
V Vertical



TYPICAL SWITCH DIMENSIONS

Straight PC

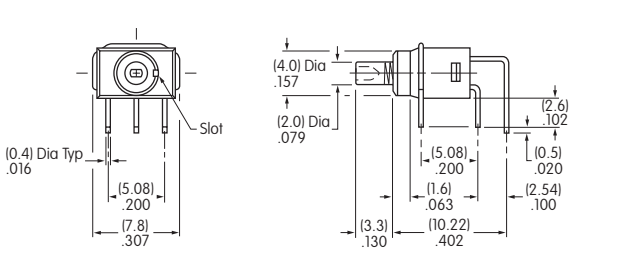




Terminals 1 & 3 are lamp terminals.

GB15JPD

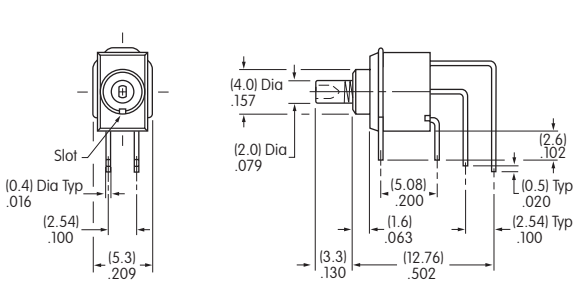
Right Angle PC



Terminals 1 & 3 are lamp terminals.

GB15JHF

Vertical PC



Terminals 1 & 3 are lamp terminals.

GB15JVC

General Specifications

Electrical Capacity (Resistive Load)

Power Level (silver): 0.1A maximum @ 30V AC/DC

Other Ratings

Contact Resistance: 50 milliohms maximum
Insulation Resistance: 100 megohms minimum @ 500V DC
Dielectric Strength: 500V AC minimum for 1 minute minimum
Mechanical Life: 100,000 operations minimum
Electrical Life: 50,000 operations minimum
Nominal Operating Force: 3.43N
Contact Timing: Nonshorting (break before make)
Travel: Pretravel .087" (2.2mm); Overtravel .031" (0.8mm); Total Travel .118" (3.0mm)

Materials & Finishes

Housing: Glass fiber reinforced polyamide
Base: Glass fiber reinforced polyamide
Movable Contact: Phosphor bronze with silver plating
Stationary Contacts: Phosphor bronze with silver plating
Common Terminal: Phosphor bronze with silver plating
End Terminals: Phosphor bronze with silver plating
Lamp Terminals: Phosphor bronze with silver plating

Environmental Data

Operating Temperature Range: –25°C through +50°C (–13°F through +122°F) for Illuminated
–25°C through +70°C (–13°F through +158°F) for Nonilluminated
Humidity: 90 ~ 95% humidity for 96 hours @ 40°C (104°F)
Vibration: 10 ~ 55Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in 1 minute; 3 right angled directions for 2 hours
Shock: 50G (490m/s^2) acceleration (tested in 6 right angled directions, with 5 shocks in each direction)

Installation

Mounting Torque: 0.49Nm (4.34 lb•in) maximum for round mounting nut
Cap Installation Force: 9.8N (2.2 lbf) maximum downward force on cap
Soldering Time & Temperature: Manual Soldering: See Profile A in Supplement section.

Standards & Certifications

UL: **File No. E44145 - Recognized only when ordered with marking on switch.**
Add "/U" or "/CUL" before first dash in part number to order UL recognized switch.
All models recognized at 0.1A @ 30V AC/DC.

Distinctive Characteristics

Full face and spot illumination available. Front panel relamping.

Choice of super bright LEDs in white, green, and blue in addition to bright red, amber, and green LEDs.

Compact front panel design with 9mm square or round bezel options.

Rear panel threaded mounting. Behind panel depth of less than one inch. 8mm body diameter fits common size panel cutout.

Latchdown feature gives indication of circuit status. Audible and tactile feedback with smooth and responsive operation.

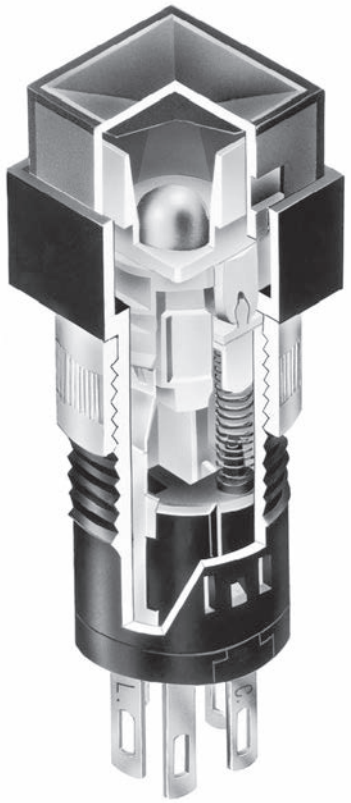
Dual, sliding contacts with self-cleaning action provide contact stability, high reliability, and increased operating life.

Solder lug terminals have spacing of .100" (2.54mm) for choice of mounting.

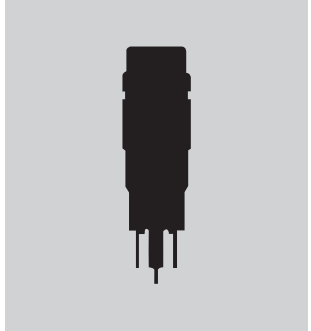
Longer normally closed terminal facilitates wiring and soldering.

Molded-in terminals lock out flux, dust, and other contaminants.

Matching indicators available.



Actual Size



TYPICAL SWITCH ORDERING EXAMPLE

HB | 1 | 5 | S | K | W01 | — | 6G | — | JB

Pole

1	SPDT

Shapes

S	Square
C	Round

Contacts & Terminals

W01	Silver Contacts and Solder Lug Terminals 0.1A @ 30V AC/DC

Circuits

5	ON	(ON)
( ) = Momentary		
6	ON	ON
Alternate Action with Latchdown		

Housing

K	Black only

LEDs

Bright

5C	Red
5D	Amber
5F	Green

Super Bright

6B	White
6F	Green
6G	Blue

Nonilluminated

No Code	Nonilluminated

Cap Types & Colors

LED Cap: Lens/Diffuser Color

AB	Black Cap/White Window for Spot Illuminated (Square only)
CB	Red/White
DB	Amber/White
FB	Green/White
JB	Clear/White

LED Cap: Lens/Diffuser Color

JB	Clear/White

Nonilluminated Cap Colors

A	Black (Square Only)
B	White
C	Red
E	Yellow
F	Green
G	Blue

IMPORTANT:

Switches are supplied without UL & cULus marking unless specified. **UL & cULus recognized only when ordered with marking on the switch.** Specific models, ratings, & ordering instructions are noted on the General Specifications page.

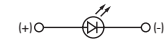
DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

HB15SKW01-6G-JB

POLES & CIRCUITS

Pole	Model	Plunger Position ( ) = Momentary: Normal	Plunger Position ( ) = Momentary: Down	Connected Terminals: Normal	Connected Terminals: Down	Throw & Switch/Lamp Schematics
SP	**HB15** ***HB16**	ON ON	(ON) ON	1-3	1-2	SPDT

Notes: Switch is marked with NO, NC, C, L. LED circuit is isolated and requires external power source.

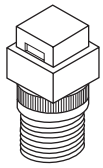


* When in latchdown position for the alternate circuit, cap position is .051" (1.3mm) above the built-in bezel.

SHAPES & PANEL CUTOUT

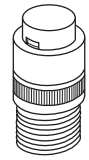
S **.354" (9.0mm) Square**

The bezel is an integral part of the switch body.



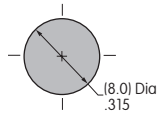
C **.354" (9.0mm) Round**

The bezel is an integral part of the switch body.



Panel Cutout & Mounting

Recommended Panel Thickness:
.020 ~ .197" (0.5 ~ 5.0mm)



Overtightening the mounting nut AT073 may damage the switch housing.

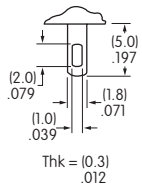
HOUSING

K **Housing available in black only.**

CONTACT MATERIALS, RATINGS, & TERMINALS

W01 **Silver Contacts** **Power Level** **0.1A maximum @ 30V AC/DC**

Solder Lug



PCB Mounting

Solder lug terminals are spaced .100" x .200" (2.54mm x 5.08mm). This enables PCB mounting which can be accomplished by elongating PC board holes to .080" (2.03mm).

LED COLORS & SPECIFICATIONS

The electrical specifications shown are determined at a basic temperature of 25°C.
LED circuit is isolated and requires external power source. Single element LED is colored in OFF state.
If the source voltage exceeds the rated voltage, a ballast resistor is required.
The resistor value can be calculated by using the formula in the Supplement section.

Bright
AT633

Super Bright
AT624G
Blue
AT629B
White
AT630F
Green

T-1 Bi-pin

Note for Super Bright:

ATTENTION
ELECTROSTATIC
SENSITIVE DEVICES

		Bright			Super Bright			
		5C	5D	5F	6B	6F	6G	
	Color	Red	Amber	Green	White	Green	Blue	Unit
Maximum Forward Current	I_{FM}	30	30	30	30	30	30	mA
Typical Forward Current	I_F	20	20	20	20	20	20	mA
Forward Voltage	V_F	1.95	2.0	2.1	3.3	3.3	3.3	V
Maximum Reverse Voltage	V_{RM}	5	5	5	7	7	7	V
Current Reduction Rate Above 25°C	ΔI_F	0.42	0.42	0.42	0.40	0.40	0.40	mA/°C
Ambient Temperature Range		−25° ~ +50°C			−25° ~ +50°C			

No Code **No Lamp**

CAP TYPES & COLORS

Color Codes: **A** Black **B** White **C** Red **D** Amber **E** Yellow **F** Green **G** Blue **J** Clear

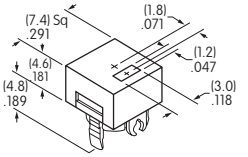
Cap Colors Available:

AB **Black Cap with Translucent White Window for LED Display**

Colored Cap for Bright LEDs

Square only
Material: Polycarbonate
Finish: Matte

AT4052
Spot Illuminated



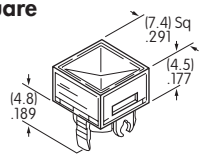
Lens/Diffuser Colors Available:

CB **Red/White**

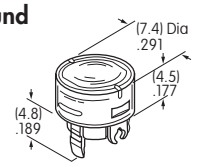
DB **Amber/White**

FB **Green/White**

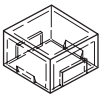
AT4166
Square



AT4167
Round



Material: Polycarbonate Finish: Glossy



Transparent Colored Lens

Translucent White Diffuser

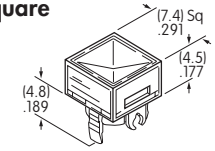
Colored LED AT633

White Cap for Bright & Super Bright LEDs

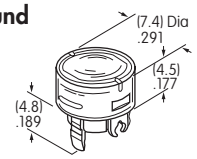
JB **Clear Lens/ White Diffuser**

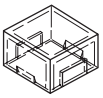
Material: Polycarbonate
Finish: Glossy

AT4031
Square



AT4032
Round





Transparent Clear Lens

Translucent White Diffuser

Colored LEDs AT624, AT629, AT630, or AT633

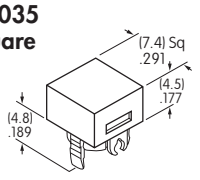
Nonilluminated Caps

Cap Colors Available:

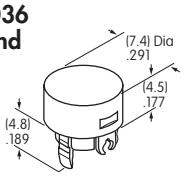
A **Black** (Square Only)
B **White**
C **Red**
E **Yellow**
F **Green**
G **Blue**

Material: Polycarbonate Finish: Glossy

AT4035
Square

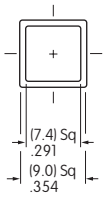


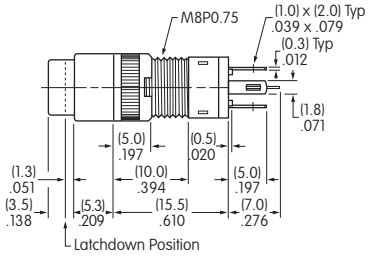
AT4036
Round

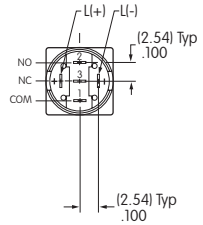


TYPICAL SWITCH DIMENSIONS

Single Pole — Square

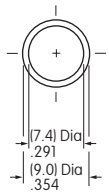


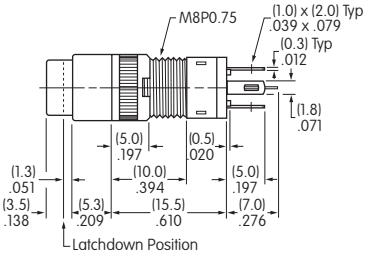


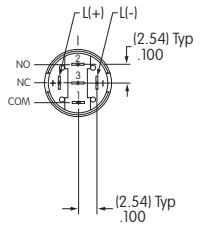


HB15SKW01-5C-CB

Single Pole — Round





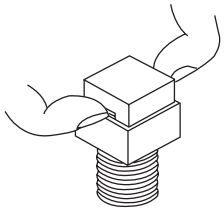


HB16CKW01-5C-CB

ASSEMBLY INSTRUCTIONS

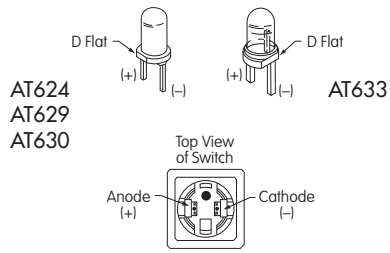
Cap Removal

1. Have cap in extended position (not latchdown) for alternate action models.
2. Use the grip slots on the sides of the cap and pull it out of the switch.



LED Polarity & Orientation in Lamp Socket

For AT624, AT629, AT630: Insert the LED with the D flat opposite the black dot molded inside the switch lamp socket. For AT633: Insert the LED with the Black Dot on the terminal to the right.

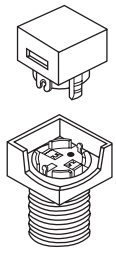


ATTENTION ELECTROSTATIC SENSITIVE DEVICES

Super Bright LEDs AT624, AT629, & AT630 are electrostatic sensitive.

Cap Replacement

1. Match the prongs on the cap base with the projections in the switch, at the same time aligning the spring clips on the cap with the indentations in the switch.
2. Press firmly in place.



AT111 Lamping Tool

Lamping Tool AT111 may be used to remove and replace LED.

AT110 Socket Wrench

Socket Wrench AT110 may be used to tighten the mounting nut.

General Specifications

Electrical Capacity (Resistive Load)

Logic Level (gold): 0.4VA maximum @ 28V AC/DC maximum
(Applicable Range 0.1mA ~ 0.1A @ 20mV ~ 28V)
Note: Find additional explanation of operating range in Supplement section.

Other Ratings

Contact Resistance: 80 milliohms maximum
Insulation Resistance: 500 megohms minimum @ 500V DC
Dielectric Strength: 500V AC minimum for 1 minute minimum
Mechanical Life: 100,000 operations minimum for momentary;
Electrical Life: 100,000 operations minimum
Nominal Operating Force: 1.8N
Travel: Pretravel .051" (1.3mm); Overtravel .020" (0.5mm); Total Travel .071" (1.8mm)

Materials & Finishes

Housing: Glass fiber reinforced polyamide
Base: Glass fiber reinforced polyamide
Movable Contact: Phosphor bronze with gold plating
Switch Terminals: Phosphor bronze with gold plating
Lamp Terminals: Steel with silver plating

Environmental Data

Operating Temperature Range: –25°C through +50°C (–13°F through +122°F)
Humidity: 90 ~ 95% humidity for 240 hours @ 40°C (104°F)
Vibration: 10 ~ 55Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in 1 minute; 3 right angled directions for 2 hours
Shock: 50G (490m/s^2) acceleration (tested in 6 right angled directions, with 5 shocks in each direction)

Installation

Cap Installation Force: 15.0N (3.37 lbf) maximum downward force on cap

PCB Processing

Soldering: Wave Soldering: See Profile A in Supplement section.
Manual Soldering: See Profile B in Supplement section.
Cleaning: These devices are not process sealed. Hand clean locally using alcohol based solution.

Standards & Certifications

The HB2 pushbuttons have not been tested for UL recognition or CSA certification.
These switches are designed for use in a low-voltage, low-current, logic-level circuit.
When used as intended in a logic-level circuit, the results do not produce hazardous energy.

Distinctive Characteristics

Quiet actuation combined with crisp tactile feedback suited for broadcast equipment.

Full face illumination with choice of red/green or red/yellow bicolor LEDs, as well as simultaneous bicolor illumination which produces amber.

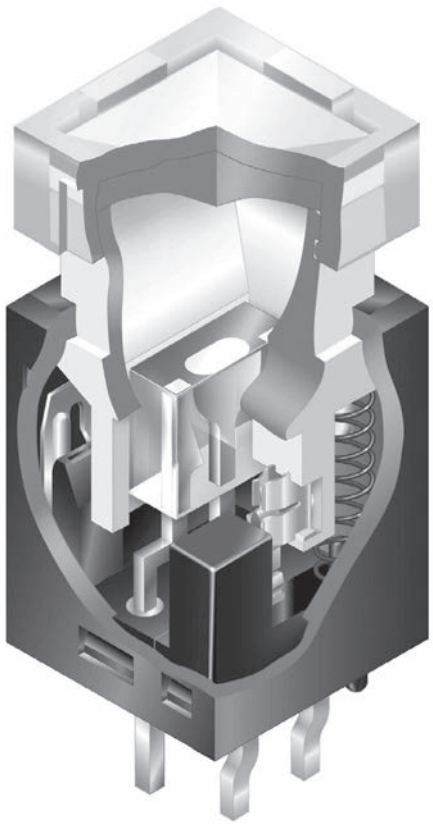
Option of legends on caps or film insert.

Compact design with short body .669" (17.0mm) from PCB to top of cap and .295" (7.5mm) square cap.

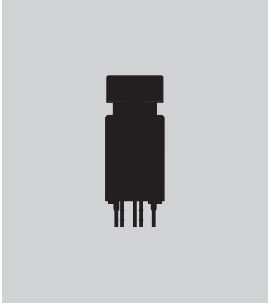
Sliding Twin Crossbar (STC) mechanism provides unequalled logic-level reliability, contact stability, smooth positive detent actuation, and long life.

Crimped power terminals ensure secure PCB mounting and prevent dislodging during soldering.

Suitable applications include broadcast, telecommunication, and medical equipment, as well as measuring instruments, etc.



Actual Size



Series HB2

Subminiature Audio/Video Pushbuttons

TYPICAL SWITCH ORDERING EXAMPLE

HB2 | 1 | 5 | S | K | G03 | CF | — | JB

Pole
1	SPST

Circuit
5	OFF	(ON)

( ) = Momentary

Shape
S	Square

Housing
K	Black

Contacts & Terminals
G03	Gold Contacts and PC Terminals, Rated 0.4VA @ 28V AC/DC

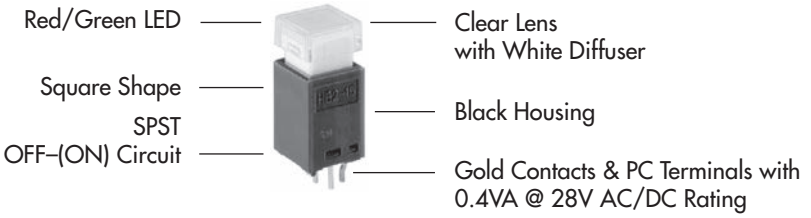
LEDs
CE	Red/Yellow
CF	Red/Green

Amber can be achieved by simultaneous illumination of LEDs.

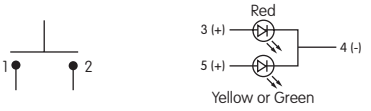
Cap Colors
JB	Clear Lens/ White Diffuser

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

HB215SKG03CF-JB



POLE & CIRCUIT

Pole	Model	Plunger Position ( ) = Momentary: Normal	Plunger Position ( ) = Momentary: Down	Connected Terminals: Normal	Connected Terminals: Down	Throw & Switch/Lamp Schematics
						Notes: Switch terminals are not marked on the switch. Red LED terminal is marked with "R". Lamp circuit is isolated and requires external power source.
SP	**HB215**	OFF	(ON)	OPEN	1-2	SPST 

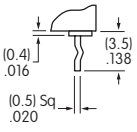
HOUSING SHAPE & COLOR

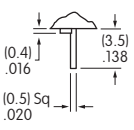
S **.307" (7.8mm) Square Body**

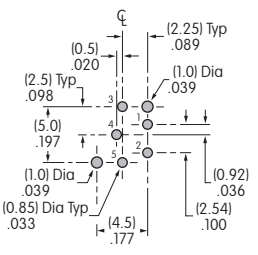
K **Black Housing**

CONTACT MATERIALS, RATINGS & TERMINALS

G03 **Gold Contacts** **Logic Level** **0.4VA maximum @ 28V AC/DC maximum**

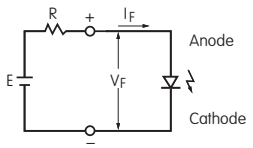
Switch Terminal 

Lamp Terminal 

PCB Footprint 

Series HB2

BICOLOR LEDS & SPECIFICATIONS



$$R = \frac{E - V_F}{I_F}$$

Where: R = Resistor Value (Ohms)
E = Source Voltage (V)
V_F = Forward Voltage (V)
I_F = Forward Current (A)

LED is an integral part of the switch.		CE		CF	
Color		Red/Yellow		Red/Green	
		Red	Yellow	Red	Green
Maximum Forward Current	I_{FM}	* 30mA	* 30mA	* 30mA	* 30mA
Typical Forward Current	I_F	20mA	20mA	20mA	20mA
Forward Voltage	V_F	2.0V	2.1V	2.0V	2.1V
Maximum Reverse Voltage	V_{RM}	4V	4V	4V	4V
Current Reduction Rate Above 25°C	ΔI_F	0.33mA/°C	0.33mA/°C	0.33mA/°C	0.33mA/°C
Ambient Temperature Range		–25° ~ +50°C			

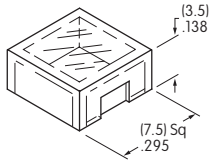
The electrical specifications shown are determined at a basic temperature of 25°C. LED circuit is isolated and requires an external power source. If the source voltage exceeds the rated voltage, a ballast resistor is required. The resistor value can be calculated by using the formula in the Supplement section.

* Value applies to single color illumination for either Red or Yellow or Red or Green. When both colors are illuminated simultaneously, the sum of the currents should not exceed the smallest value of the maximum forward current.

CAP COLORS

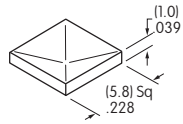
J **Clear Transparent Lens**

AT3081
Square Lens



B **White Translucent Diffuser**

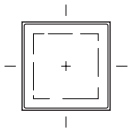
AT3082
Square Diffuser

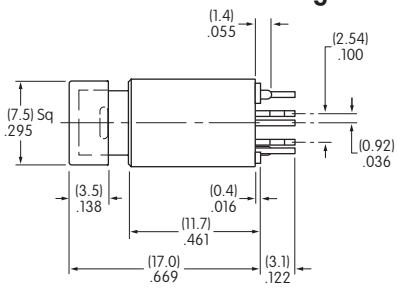


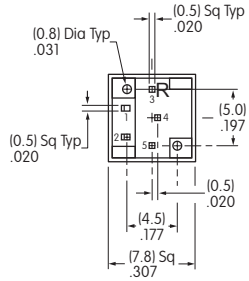
Lens & Diffuser Material: Polycarbonate Lens Finish: Glossy Diffuser Finish: Frosted

TYPICAL SWITCH DIMENSIONS

Single Pole





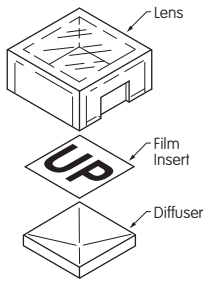


Square

HB215SKG03CF-JB

LEGENDS

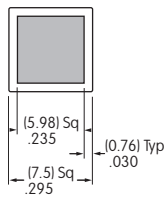
NKK Switches can provide custom legends for caps. Contact factory for more information.



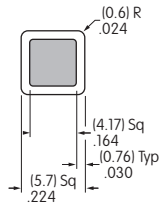
Suggested Printable Area for HB2 Lens & Film Insert

Recommended Methods: Screen Print or Pad Print on Lens; Laser Print on Film Insert.
Epoxy based ink is recommended. Film Insert: Clear Polyester, 4 mil max. thickness

Lens



Film Insert



Shaded areas are printable areas.

General Specifications

Electrical Capacity (Resistive Load)

Power Level (silver): 1A @ 125/250V AC or 1A @ 30V DC
Logic Level (gold): 0.4VA maximum @ 28V AC/DC maximum (Applicable Range 0.1mA ~ 0.1A @ 20mV ~ 28V)
Note: Find additional explanation of operating range in Supplement section.

Other Ratings

Contact Resistance: 50 milliohms maximum
Insulation Resistance: 1,000 megohms minimum @ 500V DC
Dielectric Strength: For Silver: 1,000V AC minimum between contacts for 1 minute minimum & 1,500V AC minimum between contacts & case for 1 minute minimum; For Gold: 750V AC minimum between contacts for 1 minute minimum & 1,500V AC minimum between contacts & case for 1 minute minimum
Mechanical Life: 100,000 operations minimum
Electrical Life: 50,000 operations minimum for silver; 100,000 operations minimum for gold
Nominal Operating Force: Single pole 0.98 ~ 2.45N for maintained & 0.98 ~ 1.96N for momentary; Double pole 1.47 ~ 3.43N for maintained & 1.47 ~ 2.94N for momentary
Contact Timing: Nonshorting (break-before-make)
Travel: Pretravel .087" (2.2mm); Overtravel .031" (0.8mm); Total Travel .118" (3.0mm)

Materials & Finishes

Housing: Polyamide (UL94V-0)
Movable Contactor: Silver for power circuit; copper with gold plating for logic level circuit
Stationary Contacts: Silver for power circuit; copper with gold plating for logic level circuit
Housing Base: Polyamide (UL94V-0)
Terminal Base: Polyester
Common Terminals: Phosphor bronze with silver flash plating for power circuit; Phosphor bronze with gold flash plating for logic level circuit
End Terminals: Brass with silver flash plating for power circuit; Brass with gold flash plating for logic level circuit
Lamp Terminals: Phosphor bronze with nickel flash plating

Environmental Data

Operating Temperature Range: –25°C through +50°C (–13°F through +122°F) for Illuminated
–25°C through +70°C (–13°F through +158°F) for Nonilluminated
Humidity: 90 ~ 95% humidity for 96 hours @ 40°C (104°F)
Vibration: 10 ~ 55Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in 1 minute; 3 right angled directions for 2 hours
Shock: 50G (490m/s^2) acceleration (tested in 6 right angled directions, with 3 shocks in each direction)

Installation

Mounting Torque: 0.78Nm (6.9 lb•in) maximum
Cap Installation Force: 4.51N (1.0 lbf) maximum downward force on cap
Soldering Time & Temperature: Manual Soldering: See Profile A in Supplement section.

Standards & Certifications

Flammability Standards: UL94V-0 housing & housing base
UL: **File No. E44145 - Recognized only when ordered with marking on switch.**
Add "/U" or "/CUL" before first dash in part number to order UL recognized switch.
Single & double pole models recognized at 1A @ 125/250V AC, 1A @ 30V DC, & 0.4VA @ 28V DC.
CSA: **File No. 023535_0_000 - Certified only when ordered with marking on switch.**
Add "/C" before first dash in part number to order CSA certified switch.
Single & double pole models recognized at 1A @ 125/250V AC, 1A @ 30V DC, & 0.4VA @ 28V DC.

Distinctive Characteristics

Bright illumination with numerous color variations. Spot illumination available. Square, rectangular, and round shaped caps.

Front panel relamping.

Choice of bright or super bright LEDs in red, amber, green, white, and blue.

Latchdown feature gives indication of circuit status. Audible and tactile feedback with smooth and responsive operation.

Snap-action mechanism for long life.

Stainless steel frame on snap-in models has a specially designed projection, which prevents rotation and correctly orients switch in panel.

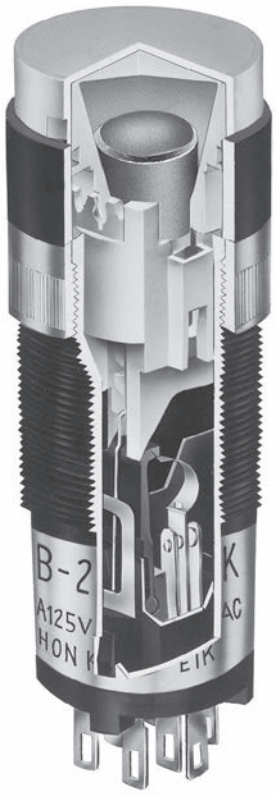
12mm body diameter.

Molded-in terminals lock out flux, dust, and other contaminants.

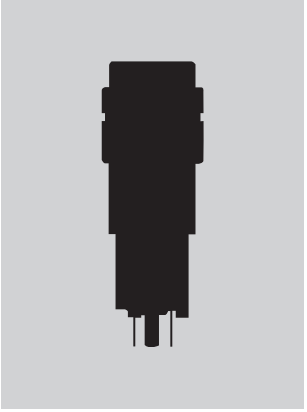
8mm panel thickness capability. Rear panel bushing or snap-in mounting.

Optional PCB adaptors in straight and right angle types.

Matching indicators available.



Actual Size



TYPICAL SWITCH

KB | 1 | 5 | C | K | W01 | ☐

Poles

1	SPDT
2	DPDT

Circuits

5	ON	(ON)
( ) = Momentary		
6	ON	ON
Alternate Action with Latchdown		

Shapes

Bushing Mounting	
S	Square
C	Round
R	Rectangular
Snap-in Mounting	
K	Square
M	Round
N	Rectangular

Housing

K	Black only

Contacts & Terminals

W01	Silver Contacts and Solder Lug Terminals 1A @ 125/250V AC
G01	Gold Contacts and Solder Lug Terminals 0.4VA @ 28V AC/DC

Barrier Type

No Code	No Barrier
B	With Barrier

IMPORTANT:

Switches are supplied without UL, cULus & CSA marking unless specified. **UL, cULus & CSA recognized only when ordered with marking on the switch.** Specific models, ratings, & ordering instructions are noted on the General Specifications page.

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

KB15CKW01-12-FF

ORDERING EXAMPLE

— 12 — FF

Lamps

Incandescent Lamp Used with Solid Cap	
05	5-volt
12	12-volt
No Code	Nonilluminated

Incandescent or Neon Used with Insert Cap	
05	5-volt
12	12-volt
01	110-volt Neon
No Code	Nonilluminated

Bright LED Used with Cap for LED			
Colors		Resistor	
5C	Red	No Code	No Resistor
5D	Amber	05	5-volt
		12	12-volt
5F	Green	24	24-volt

Super Bright LED Used with Cap for LED	
6B	White
6F	Green
6G	Blue

Cap Types & Colors

Solid Cap: Lens/Filter Colors			
A	Black/None (Nonilluminated Only. Available in Square and Round Only.)		
BB	White/White	FB	Green/White
CB	Red/White	FF	Green/Green
CC	Red/Red	GB	Blue/White
EB	Yellow/White	GG	Blue/Blue

Insert Cap: Lens/Filter Colors	
JB	Clear/White
JC	Clear/Red
JE	Clear/Yellow
* JF	Clear/Green
* JG	Clear/Blue
* JF & JG not suitable with neon.	

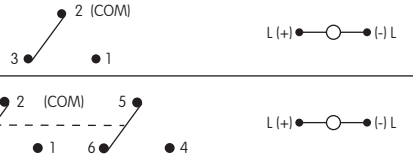
LED Cap: Lens/Diffuser Colors	
AB	Square Spot Illuminated Black Cap/White Window
JB	Clear/White
JC	Clear/Red
JD	Clear/Amber
JF	Clear/Green

LED Cap: Lens/Diffuser Colors	
JB	Clear/White

POLES & CIRCUITS

Pole	Model	Plunger Position ( ) = Momentary: Normal	Plunger Position ( ) = Momentary: Down	Connected Terminals: Normal	Connected Terminals: Down	Throw & Switch/Lamp Schematics
SP	**KB15** ***KB16**	ON ON	(ON) ON	2-3	2-1	SPDT
DP	**KB25** ***KB26**	ON ON	(ON) ON	2-3 5-6	2-1 5-4	DPDT

Notes: Switch is marked with "+" and "–". Lamp circuit is isolated and requires external power source.

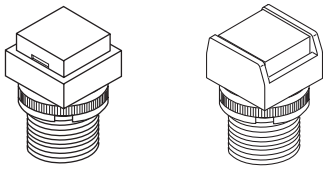


* When in latchdown position for the alternate circuit, cap position is .055" (1.4mm) above the built-in bezel.

MOUNTING TYPES & SHAPES

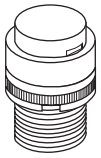
Bushing Mounting

S **.551" (14.0mm) Square**

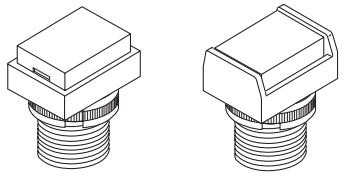


No barrier | With barrier

C **.551" (14.0mm) Round**



R **.551" x .728" (14.0mm x 18.5mm) Rectangular**

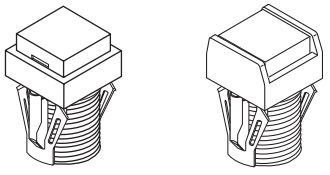


No barrier | With barrier

Bezel or barrier is an integral part of the switch body. One mounting nut AT057 supplied with each switch.

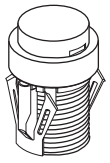
Snap-in Mounting

K **.551" (14.0mm) Square**

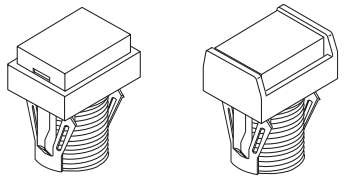


No barrier | With barrier

M **.551" (14.0mm) Round**



N **.551" x .728" (14.0mm x 18.5mm) Rectangular**



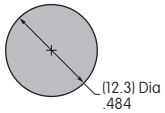
No barrier | With barrier

Bezel or barrier is an integral part of the switch body.

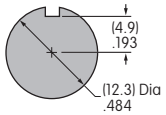
Panel Cutouts

Bushing Mounting

Without Keyway



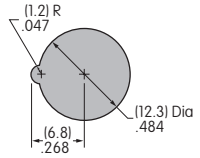
Panel Thickness:
.020" ~ .315"
(0.5 ~ 8.0mm)



With Keyway

Snap-in Mounting

Panel Thickness:
.039" ~ .138"
(1.0 ~ 3.5mm)



Panel thicknesses, when using optional accessories, are shown with the accessories at the end of this KB section.

HOUSING

K **Housing available in black only.** Bezel or barrier is an integral part of the switch body.

CONTACT MATERIALS, RATINGS & TERMINALS

W **Silver Contacts**

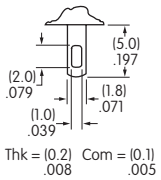
G **Gold Contacts**

Power Level
1A @ 125V AC & 250V AC

Logic Level
0.4VA maximum @ 28V AC/DC

Complete explanation of operating range in Supplement section.

01 **Solder Lug**

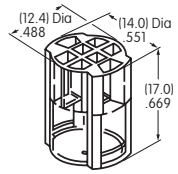


AT055 Crossover Guard

A partitioned plastic guard is supplied with each switch to provide insulation between terminals.

Installation steps:

1. Identify wire-to-terminal connections.
2. Thread wires through the guard.
3. Solder the connections.
4. Push the guard fully onto the switch body.



BARRIER TYPE

No Code **No Barrier**
Built-in bezel

B **With Barrier**
Built-in barrier only available for Square and Rectangular

LAMP COLORS & SPECIFICATIONS

The electrical specifications shown are determined at a basic temperature of 25°C.
LED circuit is isolated and requires external power source. Polarity marks are on the bottom of the switch.
If the source voltage exceeds the rated voltage, a ballast resistor is required.
The resistor value can be calculated by using the formula in the Supplement section.
Ambient Temperature Range for lamps below: −25°C ~ +50°C.

Incandescent & Neon Lamps

AT611 Incandescent

T-1 Bi-pin

AT615 Neon

		05	**12**	**01**
Voltage	V	5V AC	12V AC	110V AC
Current	I	115mA	60mA	1.5mA
Endurance	Hours	7,000 average		10,000

Recommended Resistors for Neon:
33K ohms for 110V AC;
100K ohms for 220V AC

No Code **No Lamp**

Bright LED with Resistor

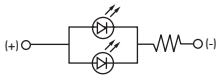
AT634

LEDs are colored in OFF state.

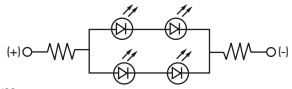
T-1¼ Bi-pin

		Red	Amber	Green	Resistor Codes		
Color Codes:		**5C**	**5D**	**5F**	**05**	**12**	**24**
Maximum Forward Current	I_{FM}				—	—	—
Typical Forward Current	I_F				25mA	20mA	10mA
Forward Voltage	V_F				5V	12V	24V
Maximum Reverse Voltage	V_{RM}				4V	8V	16V
Current Reduction Rate Above 25°C	ΔI_F				—	—	—

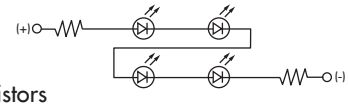
AT634
5-volt
2-element
with 1 Resistor



AT634
12-volt
4-element
with 2 Resistors



AT634
24-volt
4-element
with 2 Resistors



LAMP COLORS & SPECIFICATIONS

Bright LED without Resistor

AT635

LEDs are colored in OFF state.

T-1½ Bi-pin

Color Codes		Red 5C	Amber 5D	Green 5F	No Code: No Resistor Red	No Resistor Amber	No Resistor Green
Maximum Forward Current	I_{FM}				30mA	30mA	30mA
Typical Forward Current	I_F				20mA	20mA	20mA
Forward Voltage	V_F				1.9V	2.0V	2.1V
Maximum Reverse Voltage	V_{RM}				5V	5V	5V
Current Reduction Rate Above 25°C	ΔI_F				0.42mA/°C		
Ambient Temperature Range					−25° ~ +50°C		

Super Bright Single Element LED

AT625G Blue

AT631B White

AT632F Green

T-1 Bi-pin

ATTENTION ELECTROSTATIC SENSITIVE DEVICES

Color		6B White	6F Green	6G Blue
Maximum Forward Current	I_{FM}	30mA	30mA	30mA
Typical Forward Current	I_F	20mA	20mA	20mA
Forward Voltage	V_F	3.3V	3.3V	3.3V
Maximum Reverse Voltage	V_{RM}	7V	7V	7V
Current Reduction Rate Above 25°C	ΔI_F	0.40mA/°C	0.40mA/°C	0.40mA/°C
Ambient Temperature Range		−25° ~ +50°C		

CAP TYPES & COLOR COMBINATIONS

Color Codes: **A** Black **B** White **C** Red **E** Yellow **F** Green **G** Blue **J** Clear

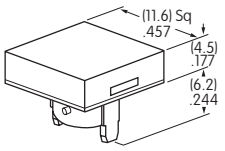
Solid Cap for Incandescent Lamp & Nonilluminated

Lens/Filter Colors Available:

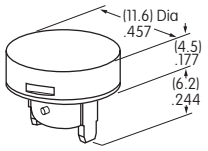
A Nonilluminated Only; Square & Round Only

BB **FB** **CB** **FF** **CC** **GB** **EB** **GG**

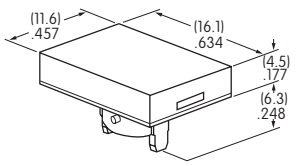
AT485 Square



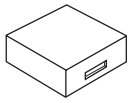
AT486 Round



AT4021 Rectangular



Material: Polycarbonate Finish: Glossy



Translucent Colored Lens

Translucent Colored Filter

Lamp AT611

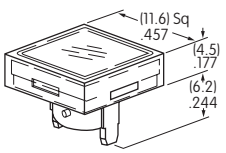
Insert Cap for Incandescent or Neon Lamp & Nonilluminated

Lens/Filter Colors Available:

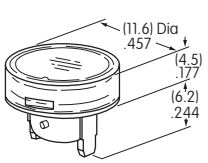
JB **JF** **JC** **JG** **JE**

JF and JG not suitable with neon lamp.

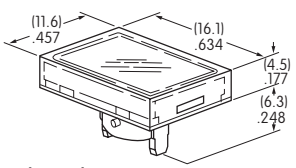
AT487 Square



AT488 Round



AT4022 Rectangular



Material: Polycarbonate Finish: Glossy

Transparent Clear Lens

Translucent Colored Filter

Lamp AT611

Lamp AT615

CAP TYPES & COLOR COMBINATIONS

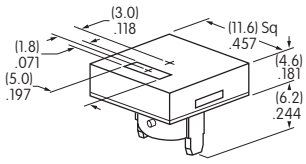
Color Codes: **A** Black **B** White **C** Red **D** Amber **E** Yellow **F** Green **G** Blue **J** Clear

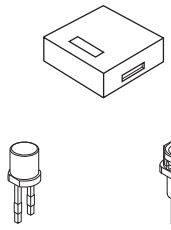
Spot Illuminated Cap for Bright LED without Resistor or with Resistor

Cap/Window Colors Available:

AB **Opaque Black Cap with Translucent White Window for Spot Illumination**

AT4051
Square





Bright LED AT635 | Bright LED AT634

Material: Polycarbonate Finish: Matte

Cap for Bright LED without Resistor or LED with Resistor

Lens/Diffuser Colors Available: (AT4133, 4132, 4134 white diffusers; AT4158, 4160, 4159 colored diffusers)

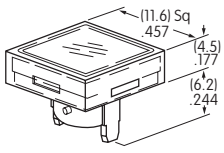
JB **AT4133** **Square** | **AT4132** **Round** | **AT4134** **Rectangular**

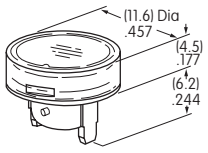
Transparent Clear Lens

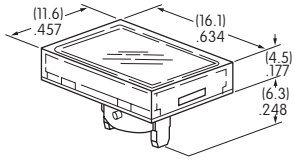
JC **AT4158** | **AT4160** | **AT4159**

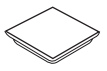
JD

JF









Translucent Diffuser

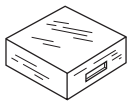
Bright LED AT635 | Bright LED AT634

Material: Polycarbonate Finish: Glossy

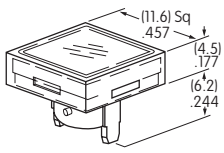
Cap for Super Bright LED

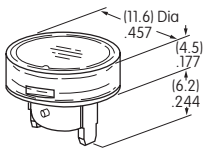
Lens/Diffuser Colors Available:

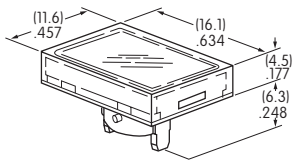
JB **AT4133** **Square** | **AT4132** **Round** | **AT4134** **Rectangular**



Translucent Clear Lens







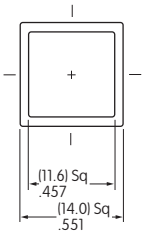
Translucent White Diffuser

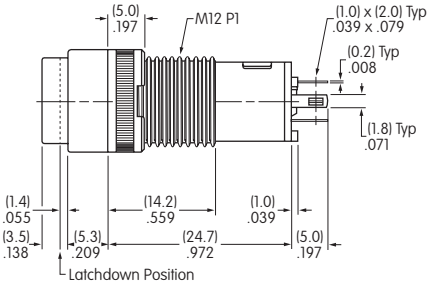
Super Bright LEDs
AT625
AT631 AT632

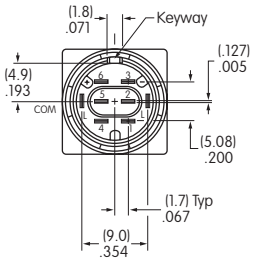
Material: Polycarbonate Finish: Glossy

TYPICAL SWITCH DIMENSIONS

Square • Bushing Mount — Single & Double Pole



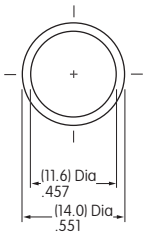


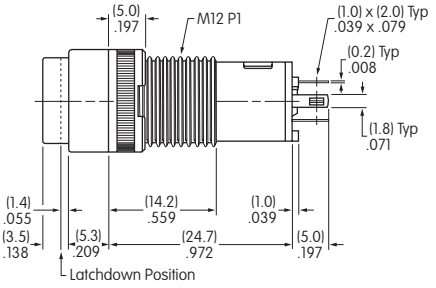


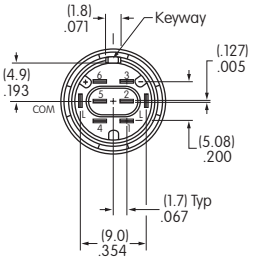
KB15SKW01-05-GG

Single pole models do not have terminals 4, 5, & 6.

Round • Bushing Mount — Single & Double Pole



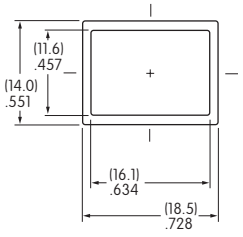


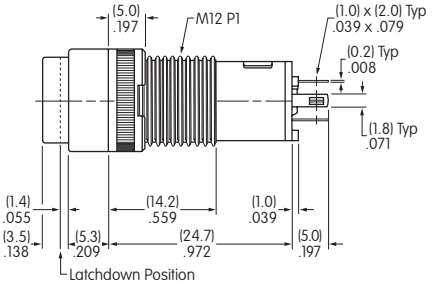


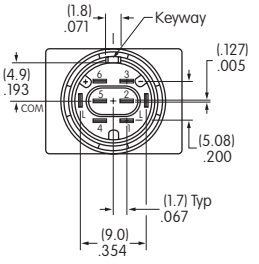
KB25CKW01-05-GG

Single pole models do not have terminals 4, 5, & 6.

Rectangular • Bushing Mount — Single & Double Pole





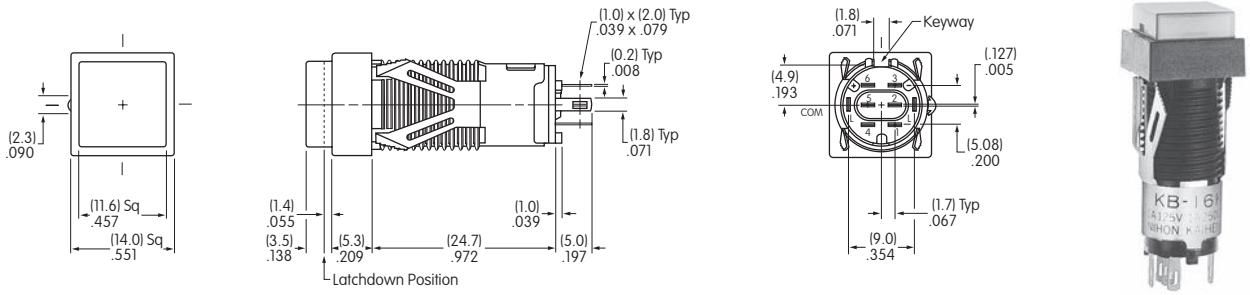


KB15RKW01-05-GG

Single pole models do not have terminals 4, 5, & 6.

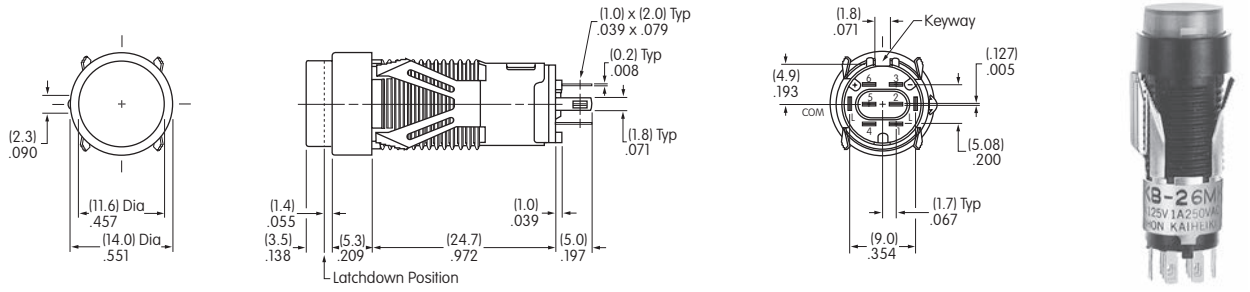
TYPICAL SWITCH DIMENSIONS

Single & Double Pole — Square • Snap-in Mount



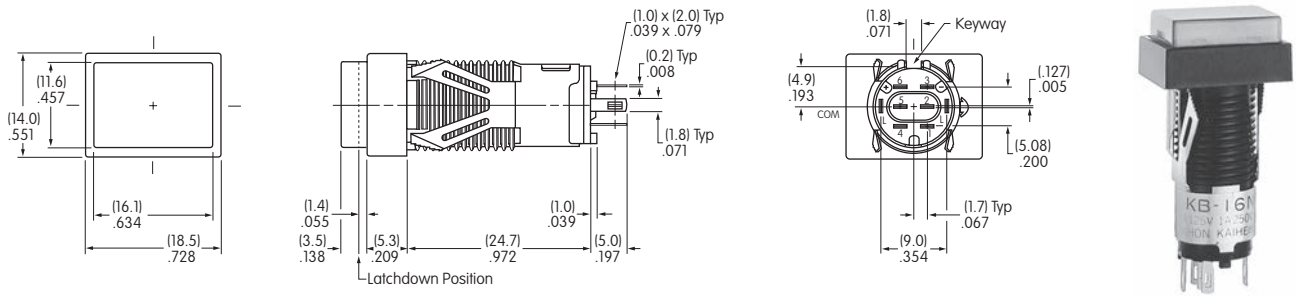
Single pole models do not have terminals 4, 5, & 6. **KB16KKW01-05-CB**

Single & Double Pole — Round • Snap-in Mount



Single pole models do not have terminals 4, 5, & 6. **KB26MKW01-05-CB**

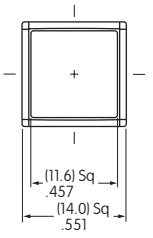
Single & Double Pole — Rectangular • Snap-in Mount

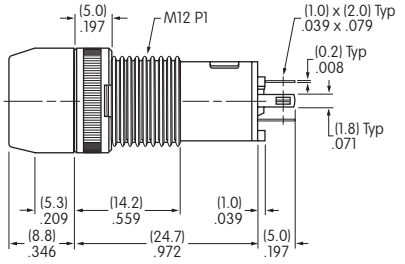


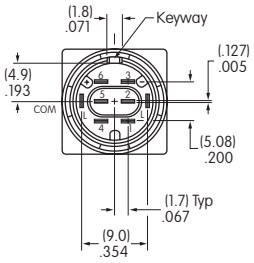
Single pole models do not have terminals 4, 5, & 6. **KB16NKW01-05-CB**

TYPICAL SWITCH DIMENSIONS

Square • Barrier • Bushing Mount — Single & Double Pole



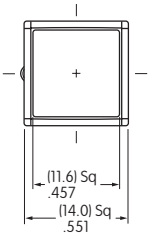


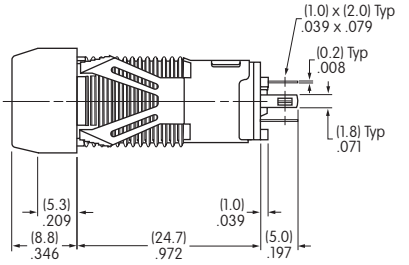


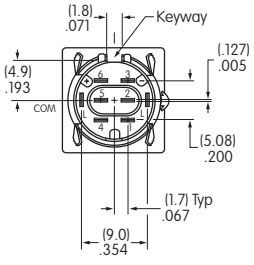
KB15SKW01B-6G-JB

Single pole models do not have terminals 4, 5, & 6.

Square • Barrier • Snap-in Mount — Single & Double Pole



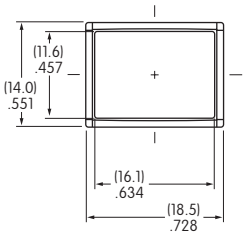


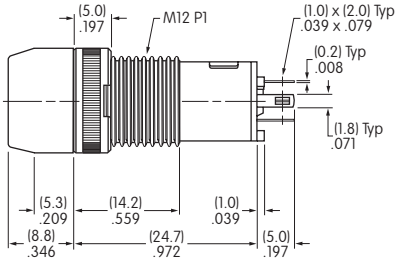


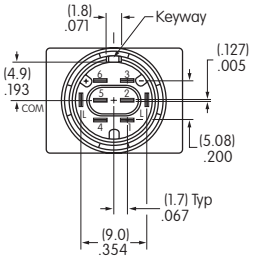
KB15KKW01B-5C-JC

Single pole models do not have terminals 4, 5, & 6.

Rectangular • Barrier • Bushing Mount — Single & Double Pole



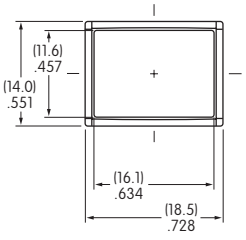


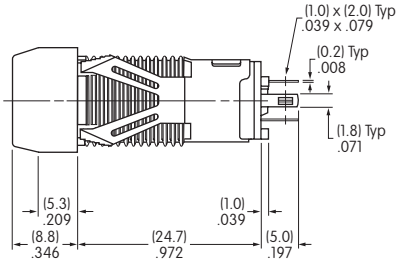


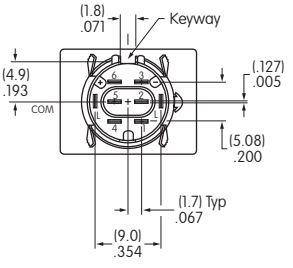
KB15RKW01B-5F-JF

Single pole models do not have terminals 4, 5, & 6.

Rectangular • Barrier • Snap-in Mount — Single & Double Pole







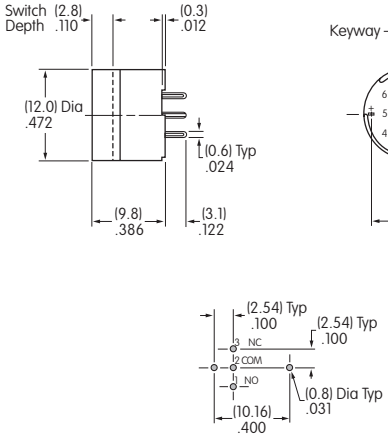
KB15NKW01B-5D-JD

Single pole models do not have terminals 4, 5, & 6.

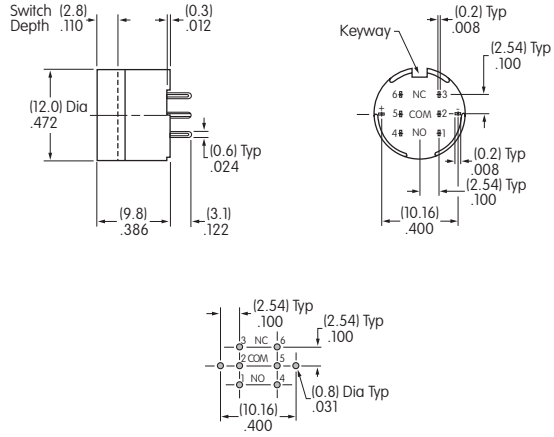
OPTIONAL ACCESSORIES

PCB Adaptors

AT701
Single Pole
Straight PC
Terminals



AT702
Double Pole
Straight PC
Terminals

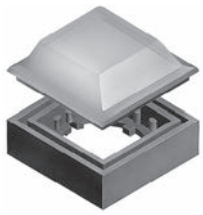


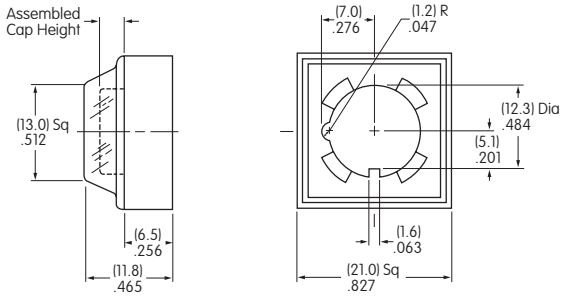
Material: Glass fiber reinforced polyamide Note: Order adaptors separately

Dust Covers

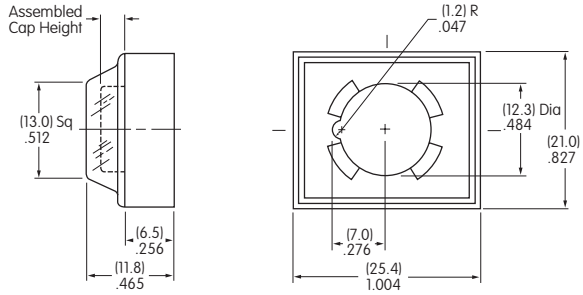
Panel Thickness Range: .020 ~ .268" (0.5 ~ 6.8mm) for Bushing Mounting; .020 ~ .079" (0.5 ~ 2.0mm) for Snap-in Mounting
Dust Covers reduce the depth of switch behind panel by .047" (1.2mm).

AT495
For Square & Round
(not for Barrier type)





AT4025
For Rectangular
(not for Barrier type)

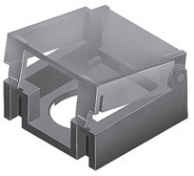


Material: Lid: PVC PVC loses pliability below 0°C (32°F). Base: Polyamide

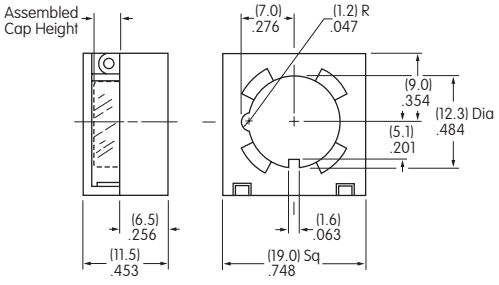
OPTIONAL ACCESSORIES

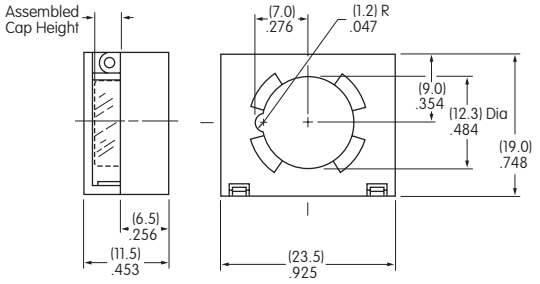
Protective Guards

AT494
For Square & Round
(not for Barrier type)



AT4024
For Rectangular
(not for Barrier type)





Panel Thickness Range:

.020" ~ .268"
(0.5 ~ 6.8mm)
for Bushing Mounting

.020" ~ .091"
(0.5 ~ 2.3mm)
for Snap-in Mounting

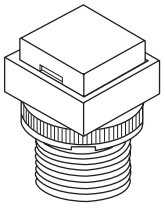
Protective Guards reduce the depth of switch behind panel by .047" (1.2mm).

Material: Cover: Polycarbonate Base: Polyamide

ASSEMBLY INSTRUCTIONS

Cap Removal & Installation

For alternate action models cap must be in UP position for cap removal. Indentations on opposite sides of the cap provide an easy way to lift the cap out of the holder, using either the finger nails, or cap extractor AT109.



LED Polarity & Orientation in Lamp Socket

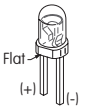
Super Bright LEDs AT625, AT631, & AT632 are electrostatic sensitive.

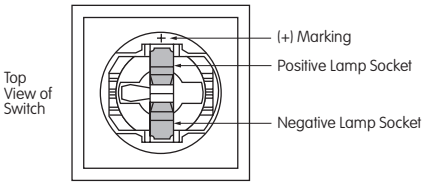
ATTENTION
ELECTROSTATIC SENSITIVE DEVICES

LED AT635

LED AT634

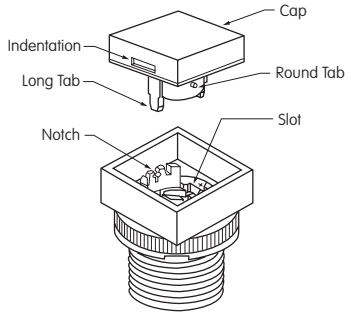
LEDs AT625 AT631 AT632





Cap Replacement

Note that the cap has a pair of round tabs and a pair of long tabs which should be used for correctly replacing the cap in its holder. Using the long tabs as guides, slide the cap with the long tabs moving into the slots on opposite sides of the cap holder. Then, the round tabs will snap into notches on the other two sides of the holder.

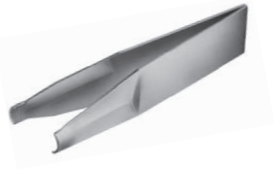


AT108 Socket Wrench for Bushing Mounting

Overtightening the mounting nut may damage the switch housing.

AT109 Cap Extractor

AT111 Lamping Tool

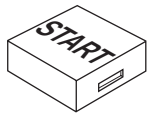


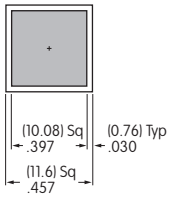
LEGENDS

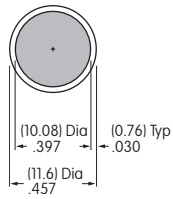
NKK Switches can provide custom legends for caps. Contact factory for more information.

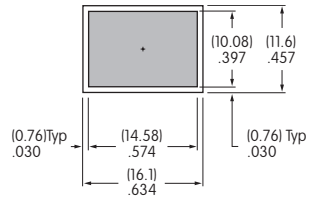
Suggested Printable Area for KB Lens

Recommended Methods: Screen Print or Pad Print on Lens.
Epoxy based ink is recommended.



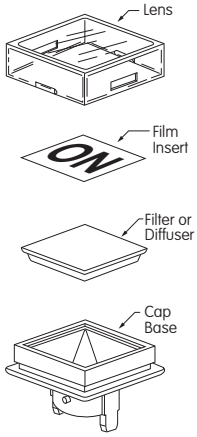






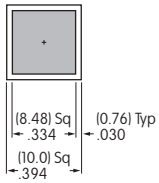
Shaded areas are printable areas.

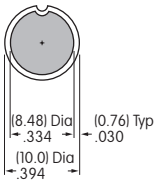
Suggested Printable Area for Film Insert

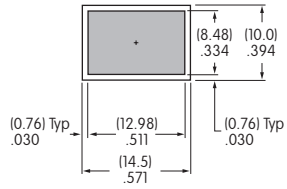


Recommended Print Method: Laser Print

Film Insert: Clear Polyester, 4 mil max. thickness







Shaded areas are printable areas.

General Specifications

Electrical Capacity (Resistive Load)

Low Level: 100mA maximum @ 12V DC

Other Ratings

Contact Resistance: 200 milliohms maximum
Insulation Resistance: 100 megohms minimum @ 250V DC
Dielectric Strength: 1,000V AC minimum between contacts for 1 minute minimum
1,500V AC minimum between contacts & case for 1 minute minimum
Mechanical Life: 5,000,000 operations minimum;
1,000,000 operations minimum for custom Rectangular Switch/Cap Assembly (at center of cap)
Electrical Life: 5,000,000 operations minimum
Nominal Operating Force: **KP01:** 1.9N maximum for Tactile & Nontactile models (at center of cap)
KP02: 1.6N maximum for Tactile, Nontactile & Tactile/Audible models (at center of cap)
Travel: **KP01:** Pretravel .122" (3.1mm); Overtravel .055" (1.4mm); Total Travel .177" (4.5mm)
KP02: Pretravel .091" (2.3mm); Overtravel .047" (1.2mm); Total Travel .138" (3.5mm)

Materials & Finishes

Plunger/Upper Housing: Polyacetal
Lower Housing: Glass fiber reinforced PBT (UL94V-0)
Movable Contact: Stainless steel with gold plating
Stationary Contacts: Gold over copper alloy
Switch Terminals: Brass with tin plating

Environmental Data

Operating Temperature Range: –25°C through +50°C (–13°F through +122°F)
Humidity: 90-95% humidity for 240 hours @ 40°C (104°F)
Vibration: 10 ~ 55Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in 1 minute; 3 right angled directions for 2 hours
Shock: 51G (500m/s²) acceleration (tested in 6 right angled directions, with 5 shocks in each direction)

Installation

Cap Installation Force : 50.0N maximum downward force on actuator

PCB Processing

Soldering: Wave Soldering. See Profile A in Supplement section.
Manual Soldering. See Profile A in Supplement section.
Cleaning: These devices are not process sealed. Hand clean locally using alcohol based solution.

Standards & Certifications

Flammability Standards: UL94V-0 lower housing

The KP Series pushbuttons have not been tested for UL recognition or CSA certification.
These switches are designed for use in a low-voltage, low-current, logic-level circuit.
When used as intended in a logic-level circuit, the results do not produce hazardous energy.

Distinctive Characteristics

KP series offers a complete switch solution for all broadcast panel needs, including home keys and the rectangular switch/cap assembly.

Distinct, long total travel of .177" (4.5mm) for KP01 or shorter stroke of .138" (3.5mm) for KP02.

Available with super bright red/green or amber/blue bicolor LED or RGB LED. The RGB LED full color spectrum in a switch package provides unlimited color combinations.

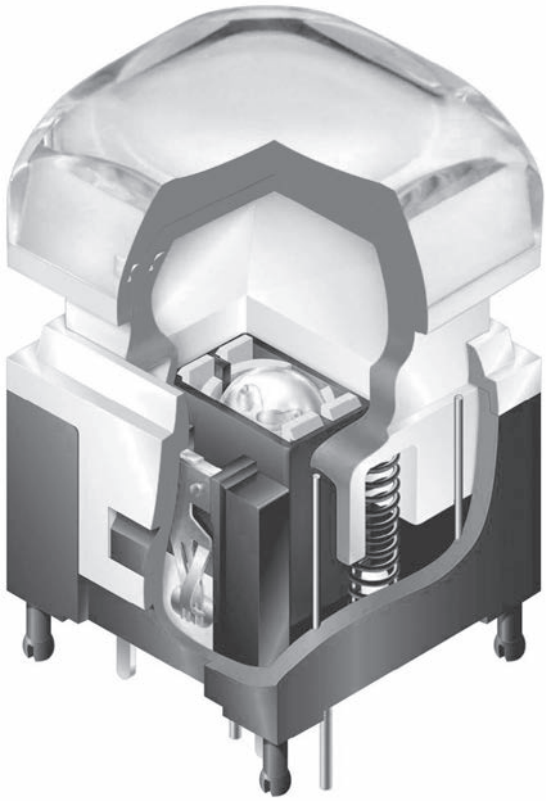
Unique actuation guide gives positive indication of circuit transfer as well as smooth and silent operation.

Choices of tactile, nontactile or tactile/audible actuation.

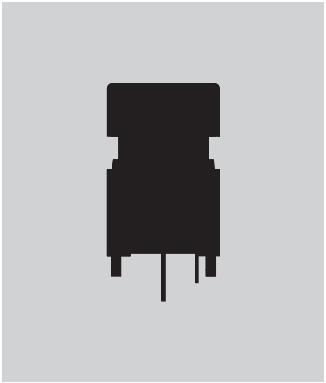
Compact design with height of .906" (23.0mm) from PC board to top of cap. (Same height as programmable SmartSwitch™.)

Flat, sculptured or home key square caps in three common sizes for design flexibility in audio/video applications.

Twin contacts with gold plating assure high reliability and long life of 5,000,000 operations minimum.



Actual Size



TYPICAL SWITCH

KP 01 15A N B K G03

Housing

K	Black only

Pole & Circuit

15A	SPST	OFF	(ON)

( ) = Momentary
Normally Open Contacts

Plungers

A	9.2mm Plunger for 12.0mm Cap
B	11.6mm Plunger for 15.0mm & 17.4mm Caps

Contacts & Terminals

G03	Gold Contacts and Straight PC Terminals; 100mA @ 12V DC

Travel & Force

01	Stroke: 4.5mm (.177″) Actuation Force: 1.9N
02	Stroke: 3.5mm (.138″) Actuation Force: 1.6N

Actuation

01

C	Tactile
N	Nontactile

02

C	Tactile
N	Nontactile
S	Tactile/Audible

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

KP0115ANBKG036CF-2SJB

11.6mm Plunger and
15.0mm Sculptured Cap
Clear Lens and White Diffuser

SPST
OFF-Momentary ON Circuit
Normally Open Contacts

Super Bright
Red/Green Bicolor LED

Nontactile Actuation

Black Housing

Gold Contacts with 100mA Rating

Straight PC Terminals

ORDERING EXAMPLE

6CF — 2 S JB 11

LEDs	
6CF	Super Bright Red/Green Bicolor
6DG	Super Bright Amber/Blue Bicolor
RGB	Red/Green/Blue
* See Note	

Cap Types	
F	Flat
S	Sculptured
T	Home Key

Cap Colors	
JB	Clear Lens & White Diffuser

Bicolor Alternating Legend Caps	
JCF	Red/Green
JDG	Amber/Blue

Cap Sizes	
1	12.0mm Square
2	15.0mm Square
3	17.4mm Square
** See Note	

Alternating Legends		
11	ON (pos)	OFF (pos)
12	ON (neg)	OFF (neg)
13	START	STOP
14	OPEN	CLOSE
Contact factory for custom options.		

Notes

* RGB LED Page D44

** Rectangular Cap Page D45

Part Numbers for Alternating Legends

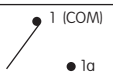
Color	Cap Size	Flat Cap	Sculptured Cap	Home Key Cap
		Part Number	Part Number	Part Number
Red/Green	12mm Square	AT3093JCF11 ~ AT3093JCF14	AT3090JCF11 ~ AT3090JCF14	AT3096JCF11 ~ AT3096JCF14
	15mm Square	AT3094JCF11 ~ AT3094JCF14	AT3091JCF11 ~ AT3091JCF14	AT3097JCF11 ~ AT3097JCF14
	17.4mm Square	AT3095JCF11 ~ AT3095JCF14	AT3092JCF11 ~ AT3092JCF14	AT3098JCF11 ~ AT3098JCF14
Amber/Blue	12mm Square	AT3093JDG11 ~ AT3093JDG14	AT3090JDG11 ~ AT3090JDG14	AT3096JDG11 ~ AT3096JDG14
	15mm Square	AT3094JDG11 ~ AT3094JDG14	AT3091JDG11 ~ AT3091JDG14	AT3097JDG11 ~ AT3097JDG14
	17.4mm Square	AT3095JDG11 ~ AT3095JDG14	AT3092JDG11 ~ AT3092JDG14	AT3098JDG11 ~ AT3098JDG14

Refer to Ordering Table for Alternating Legend that corresponds with last 2 digits of part number.

Series KP

Miniature Audio/Video Pushbuttons

POLE & CIRCUIT

Pole	Model	Plunger Position ( ) = Momentary: Normal	Plunger Position ( ) = Momentary: Down	Connected Terminals: Normal	Connected Terminals: Down	Throw & Switch Schematic
SP	KP0115A KP0215A	OFF	(ON)	Normally Open	1-1a	SPST 

Note: Switch terminals "1" & "1a" are actually marked on the switch.

ACTUATION

C **Tactile**
KP01 or KP02

N **Nontactile**
KP01 or KP02

S **Tactile/Audible**
KP02 only

HOUSING

K **Black only**

CONTACTS, TERMINALS, & RATING

G03 **Gold Contacts** | **Straight PC Terminals** | **100mA @ 12V DC**

SUPER BRIGHT BICOLOR LED SPECIFICATIONS

The electrical specifications shown are determined at a basic temperature of 25°C.

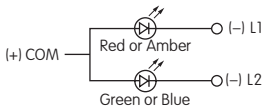
ATTENTION
ELECTROSTATIC SENSITIVE DEVICES

LEDs are an integral part of the switch and are not available separately.

LED circuit is isolated and requires an external power source.

If the source voltage exceeds the rated voltage, a ballast resistor is required.

The resistor value can be calculated by using the formula in the Supplement section.



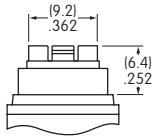
Colors		6CF Red	6CF Green	6DG Amber	6DG Blue	Unit
Minimum Luminous Intensity	I_V	230	220	204	113	mcd
Standard Luminous Intensity	I_V	290	270	340	188	mcd
Maximum Forward Current	I_{FM}	30 25 for Amber	25 22 for Amber	30	25	mA
Typical Forward Current	I_F	15	5	20	20	mA
Forward Voltage	V_F	2.0	3.1	2.1	3.2	V
Power Peak Dissipation	P_D	72	88	75	100	mW
Maximum Reverse Voltage	V_{RM}	5	7	4	4	V
Wavelength at Peak Emission	λ	620 ~ 630	528 ~ 538	583 ~ 595	464 ~ 476	nm
Current Reduction Rate Above 25°C	ΔI_F	0.40	0.36	0.40	0.33	mA/°C
Ambient Temperature Range		–25 ~ +50		–25 ~ +50		°C

Amber can be achieved by simultaneous illumination of Red & Green.
Purple can be achieved by simultaneous illumination of Amber & Blue.

PLUNGERS

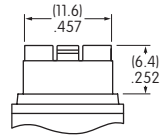
A **9.2mm Plunger for 12.0mm Cap**

9.2mm Plunger is designed with a narrower neck to hold the 12.0mm Cap.



B **11.6mm Plunger for 15.0mm & 17.4mm Caps**

11.6mm Plunger is designed with a wider neck to hold both the 15.0mm and 17.4mm Caps.

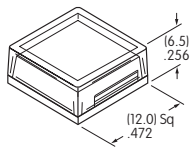


CAP TYPES & COLORS

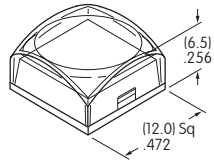
Caps for Bicolor and RGB

1 **12.0mm Square** Used on A Plunger

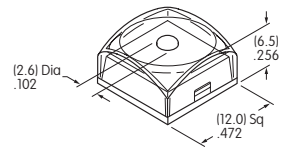
F **AT3083 Flat Cap**



S **AT3078 Sculptured Cap**

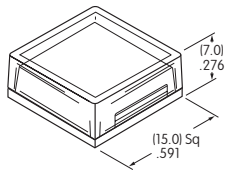


T **AT3086 Home Key Cap**

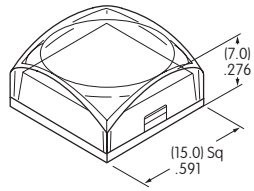


2 **15.0mm Square** Used on B Plunger

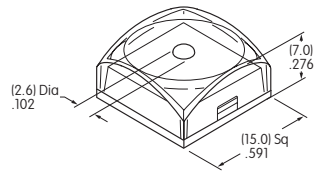
F **AT3084 Flat Cap**



S **AT3079 Sculptured Cap**

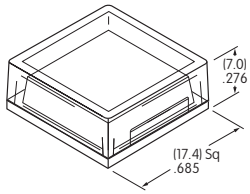


T **AT3087 Home Key Cap**

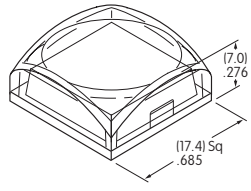


3 **17.4mm Square** Used on B Plunger

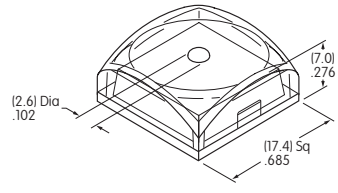
F **AT3085 Flat Cap**



S **AT3080 Sculptured Cap**



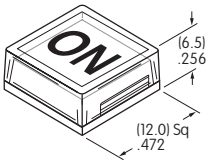
T **AT3088 Home Key Cap**



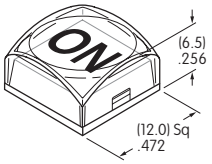
Caps for Alternating Legends

1 **12.0mm Square** Used on A Plunger

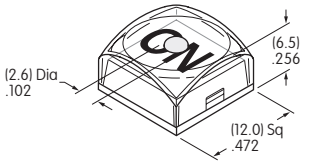
F **AT3093 Flat Cap**



S **AT3090 Sculptured Cap**

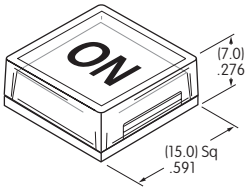


T **AT3096 Home Key Cap**

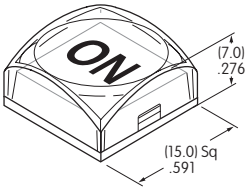


2 **15.0mm Square** Used on B Plunger

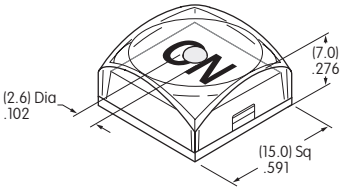
F **AT3094 Flat Cap**



S **AT3091 Sculptured Cap**

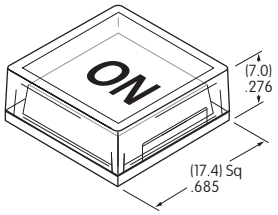


T **AT3097 Home Key Cap**

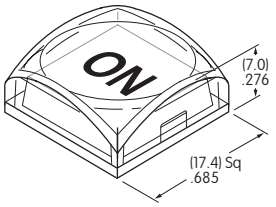


3 **17.4mm Square** Used on B Plunger

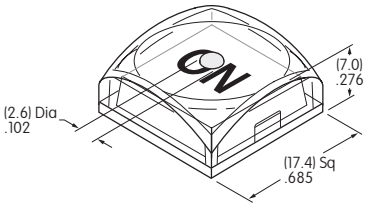
F **AT3095 Flat Cap**



S **AT3092 Sculptured Cap**



T **AT3098 Home Key Cap**

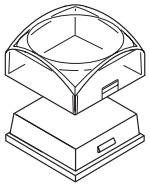


JB

Lens & Diffuser Colors Available:

Clear/White

Materials & Finishes: Lens - Polycarbonate with glossy finish
Diffuser - Polycarbonate with textured finish
Optional Protective Guard AT4170 available; contact factory.



Clear Lens

White Diffuser

Standard Alternating Legend Pairs

11 ON / OFF — Green/Red or Blue/Amber

12 ON / OFF — Green/Red or Blue/Amber

13 START / STOP — Green/Red or Blue/Amber

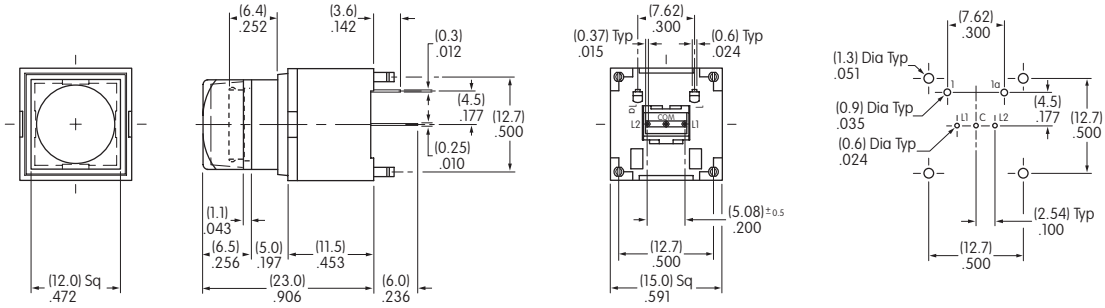
14 OPEN / CLOSE — Green/Red or Blue/Amber

Cap illumination is alternating Green/Red or Blue/Amber; legend text is black.
Contact factory for other Alternating Legends.

Legend illustrations are approximate representations of the actual characters on the filters.

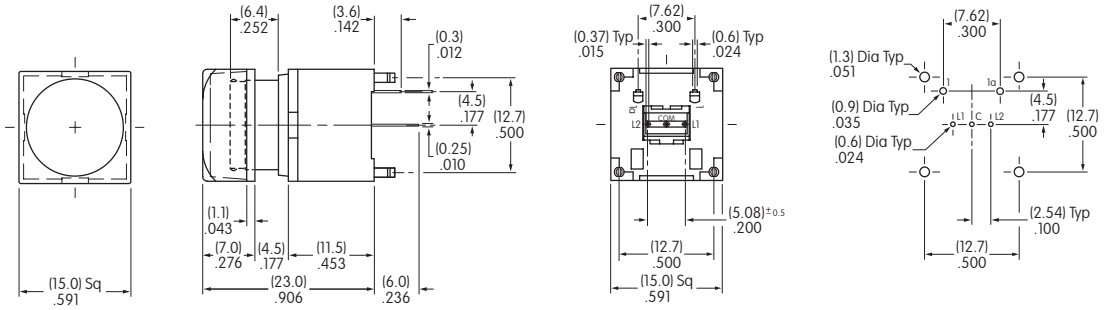
TYPICAL SWITCH DIMENSIONS

12.0mm Square Cap



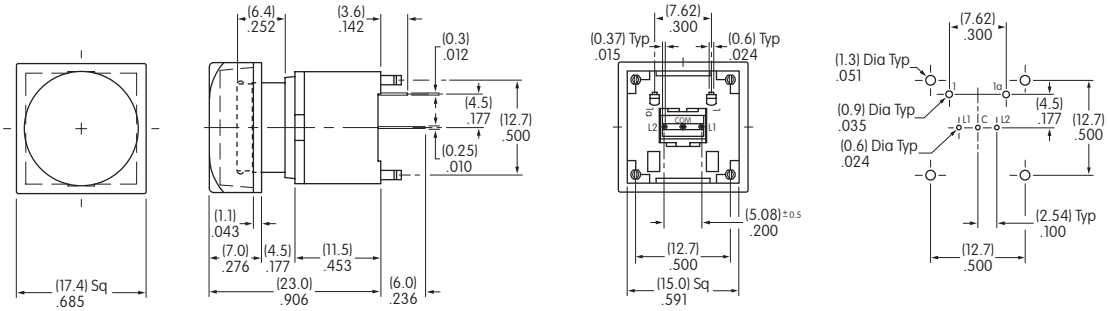
KP0115ACAKG036CF-1SJB

15.0mm Square Cap



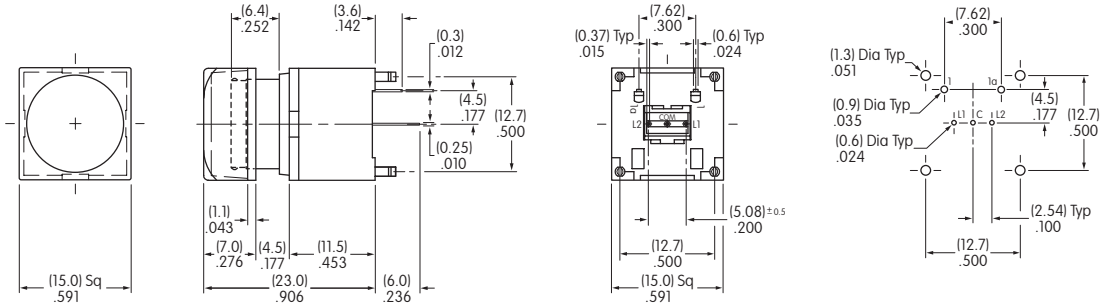
KP0115ANBKG036CF-2SJB

17.4mm Square Cap



KP0115ANBKG036CF-3SJB

Bicolor Alternating Legend • 15.0mm Square Cap



KP0115ANBKG036DG-2SJDG

RGB

LED SPECIFICATIONS

The electrical specifications shown are determined at a basic temperature of 25°C.

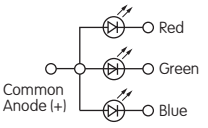
LEDs are an integral part of the switch and are not available separately.

LED circuit is isolated and requires an external power source.

If the source voltage exceeds the rated voltage, a ballast resistor is required.

The resistor value can be calculated by using the formula in the Supplement Section.

Note: For applications that require white illumination, contact factory.

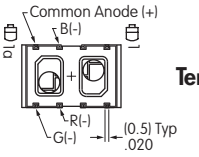


ATTENTION ELECTROSTATIC SENSITIVE DEVICES

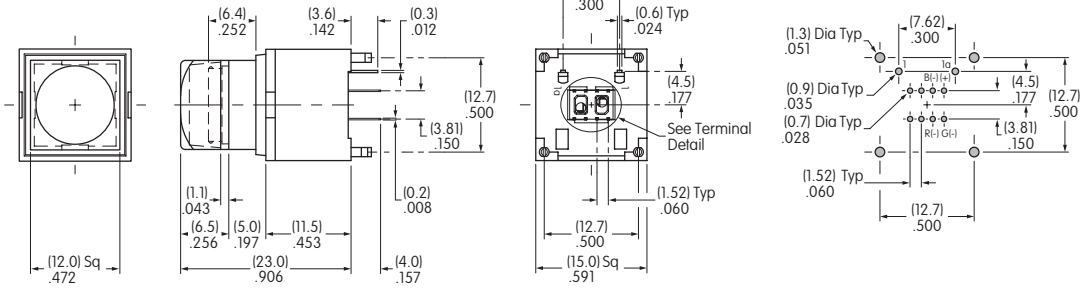
Color		RGB			
		Red	Green	Blue	Unit
Maximum Forward Current	I_{FM}	30	30	30	mA
Typical Forward Current	I_F	20	14	9	mA
Forward Voltage	V_F	2.0	2.9	2.9	V
Power Peak Dissipation	P_D	60	80	80	mW
Maximum Reverse Voltage	V_{RM}	5	5	5	V
Dominant Wavelength	λ_d	621.5	522.5	472.5	nm
Current Reduction Rate Above 25°C	Δ_{IF}	0.50	0.50	0.50	mA/°C
Ambient Temperature Range		−25 ~ +50			°C

TYPICAL SWITCH DIMENSIONS

12.0mm Square Cap with RGB LED

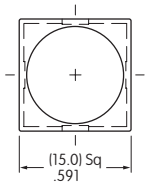


Terminal Detail

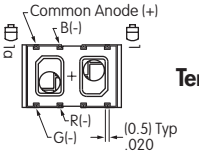


KP0115ACAKG03RGB-1SJB

15.0mm & 17.4mm Square Caps with RGB LED

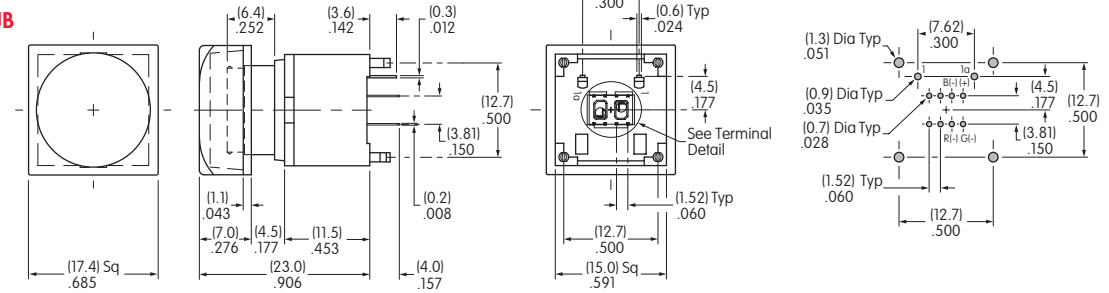


15.0mm Cap



Terminal Detail

KP0115ANBKG03RGB-2SJB

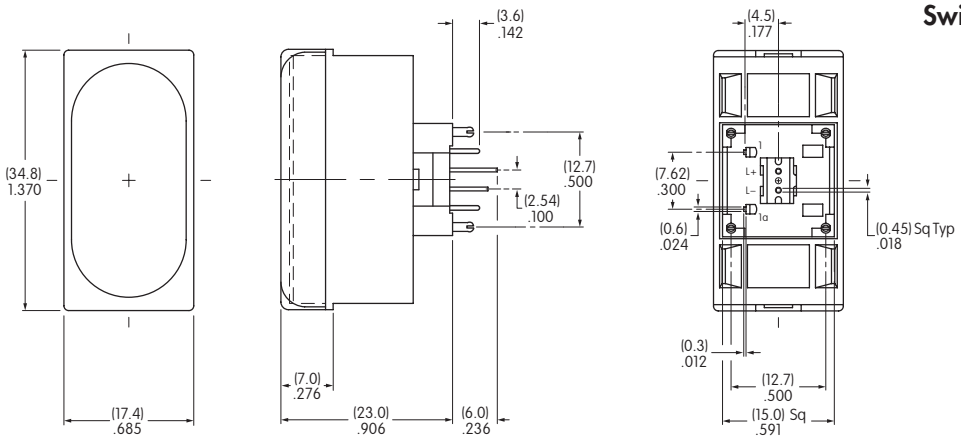


KP0115ANBKG03RGB-3SJB

17.4mm Cap

RECTANGULAR CAP ASSEMBLY

CAP ASSEMBLY DIMENSIONS



Switch/Rectangular Cap Assembly

KP0115ACBKG03CJB for Tactile
KP0115ANBKG03CJB for Nontactile

See below for complete assembly of switch, LEDs and LED holders.

LED SPECIFICATIONS

The electrical specifications shown are determined at a basic temperature of 25°C.

Center LED is an integral part of the switch. LEDs are not sold separately.

LED circuits are isolated and require an external power source.

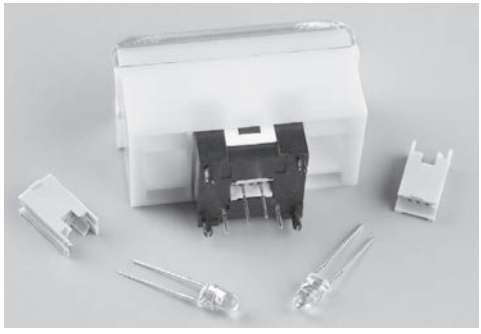
If the source voltage exceeds the rated voltage, a ballast resistor is required.

The resistor value can be calculated by using the formula in the Supplement Section.

(+) (-)	Color	Red	Unit
Maximum Forward Current	I_{FM}	30	mA
Typical Forward Current	I_F	20	mA
Forward Voltage	V_F	2.0	V
Maximum Reverse Voltage	V_{RM}	4	V
Dominant Wavelength	λ_d	623	nm
Current Reduction Rate Above 25°C	ΔI_F	0.32	mA/°C
Ambient Temperature Range		–25 ~ +50	°C

Contact factory for other LED colors.

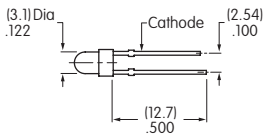
ASSEMBLY & INSTALLATION INSTRUCTIONS



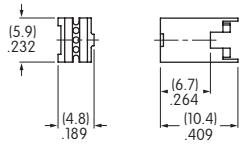
Switch/Rectangular Cap assembly has 3 LEDs to achieve bright and even illumination.

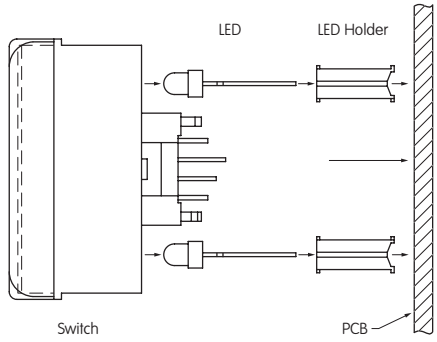
One LED (in center of switch bottom) is an integral part of the switch; the other 2 LEDs and 2 LED Holders are packaged separately.

LED

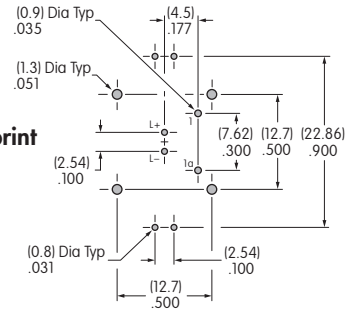


LED Holder





Footprint

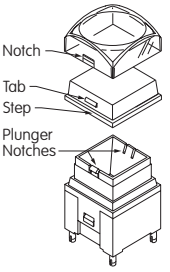


1. Install LED into LED Holder (quantity 2).
2. Solder LEDs and LED Holders into PCB.
3. Solder switch into PCB making sure that the two outer LEDs and LED Holders clear the bottom side opening of the cap.

ASSEMBLY INSTRUCTIONS FOR SQUARE CAPS

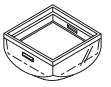
ATTENTION
ELECTROSTATIC
SENSITIVE DEVICES

Cap Orientation



As shown in the accompanying illustration, the cap and plunger are designed with tabs and notches to assure proper orientation of the cap on the switch.

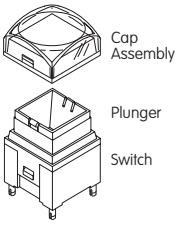
Removal of Cap Assembly & Separation of Lens & Diffuser



Holding the switch tightly, pull the cap off the switch. Once the cap assembly is released from the plunger, the lens and diffuser can be separated.

Pry up the lens with fingernail or flat tip screwdriver inserted at the step on the diffuser.

Installation or Replacement of Cap



After aligning notches with tabs, join the lens and diffuser. Hold the switch tightly without touching the terminals. Firmly press the cap onto the plunger by applying pressure from one side to the other until both are snapped together.

LEGENDS

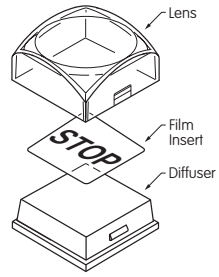
NKK Switches can provide custom legends for caps. Contact factory for more information.

Suggested Printable Areas for KP Lens

Recommended Methods:

Laser Etch on clear lens, Screen Print, or Pad Print on lens.
Laser Print on film insert.
Epoxy based ink is recommended.

Printing on Diffuser is not advisable.

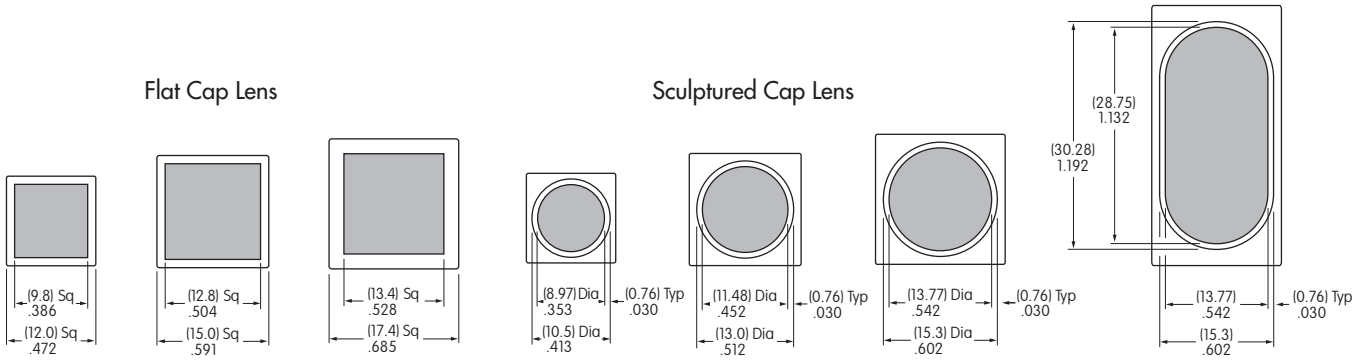


Shaded areas are suggested printable areas for Lens.

Flat Cap Lens

Sculptured Cap Lens

Rectangular Cap Lens



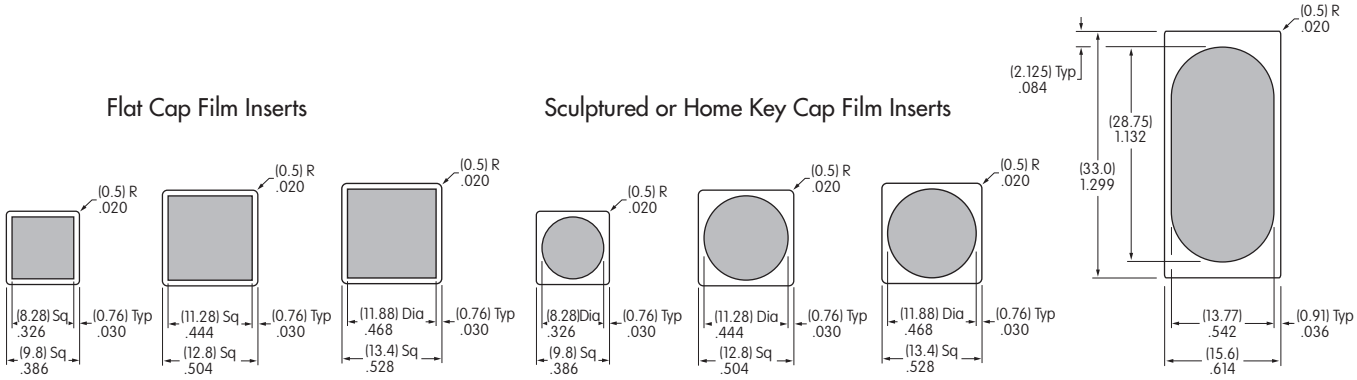
Suggested Printable Areas for KP Film Insert

Shaded areas are suggested printable areas for Film Insert.

Flat Cap Film Inserts

Sculptured or Home Key Cap Film Inserts

Rectangular Film Insert



Film Insert Material and Thickness: Clear Polyester; 4 mil (100μ) maximum thickness

General Specifications

Electrical Capacity (Resistive Load)

Power Level (silver): 3A @ 125V AC or 3A @ 250V AC or 3A @ 30V DC
Logic Level (gold): 0.4VA maximum @ 28V AC/DC maximum
(Applicable Range 0.1mA ~ 0.1A @ 20mV ~ 28V)
Note: Find additional explanation of operating range in Supplement section.

Other Ratings

Contact Resistance: 50 milliohms maximum for silver; 100 milliohms maximum for gold
Insulation Resistance: 200 megohms minimum @ 500V DC
Dielectric Strength: 1,000V AC minimum between contacts for 1 minute minimum;
1,500V AC minimum between contacts & case for 1 minute minimum
Mechanical Life: 1,000,000 operations minimum for momentary circuit
200,000 operations minimum for maintained circuit
Electrical Life: 100,000 operations minimum
Nominal Operating Force: 4.41N
Contact Timing: Nonshorting (break-before-make)
Travel: Pretravel .059" (1.5mm); Overtravel .059" (1.5mm); Total Travel .118" (3.0mm)

Materials & Finishes

Housing: Glass fiber reinforced polyamide (UL94V-0)
Snap-in Frame: Stainless steel
Movable Contact: Silver alloy or copper with gold plating
Stationary Contacts: Silver alloy or copper with gold plating
Base: Liquid crystal polymer (UL94V-0)
Switch Terminals: Phosphor bronze with silver or gold plating
Lamp Terminals: Brass with silver plating

Environmental Data

Operating Temperature Range: –25°C through +50°C (–13°F through +122°F) for Illuminated
–25°C through +70°C (–13°F through +158°F) for Nonilluminated
Note: When used with a polyvinyl chloride splash cover, the lowest limit is 0°C (32°F)
Humidity: 90 ~ 95% humidity for 96 hours @ 40°C (104°F)
Vibration: 10 ~ 55Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in 1 minute; 3 right angled directions for 2 hours
Shock: 50G (490m/s^2) acceleration (tested in 6 right angled directions, with 5 shocks in each direction)
Sealing: Not available for snap-in; see next section for panel seal.

Installation

Cap Installation Force: 3.92N maximum downward force on cap
Quick Connect Force: 52.95N maximum downward force on connector
Soldering Time & Temperature: Manual Soldering: See Profile A in Supplement section.

Standards & Certifications

Flammability Standards: UL94V-0 housing & base
UL: **File No. E44145 - Recognized only when ordered with marking on switch.**
Add "/U" or "/CUL" before first dash in part number to order UL recognized switch.
All models recognized at 3A @ 125V or 250V AC or 0.4VA @ 28V AC/DC maximum.
CSA: **File No. 023535_0_000 - Certified only when ordered with marking on switch.**
Add "/C" before first dash in part number to order CSA certified switch.
All models certified at 3A @ 125V or 250V AC or 0.4VA @ 28V AC/DC maximum.

Distinctive Characteristics

Carefully designed light diffusion and filtering system produces bright, full surface illumination with front panel relamping.

Spot illumination available in single and bicolor LEDs.

Choice of super bright LEDs in white, green, and blue in addition to standard or bright red, amber, and green LEDs.

Stainless steel clips provide secure mounting with a wide range of panel thicknesses.

Latchdown feature gives indication of circuit status. Audible and tactile feedback with smooth and responsive operation.

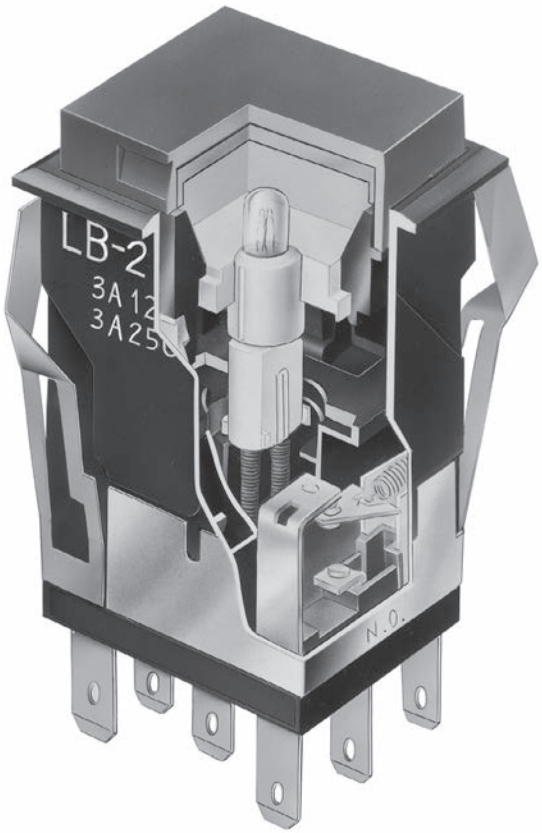
Snap-action contact mechanism gives long electrical life and sensitivity of actuation.

Combination solder lug and .110" quick connect terminals are epoxy sealed to prevent entry of flux, dust, and other contaminants.

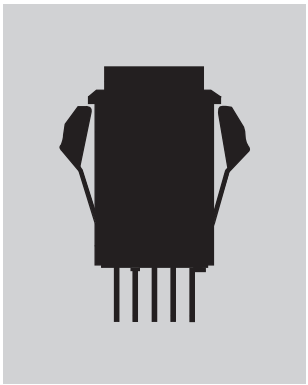
Panel sealed model meets IP65 of IEC60529 specifications (similar to NEMA 4 & 13).

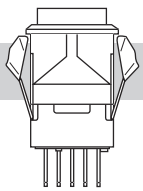
Compact switch design minimizes behind panel depth.

Matching indicators available.

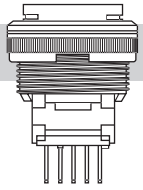


Actual Size





Snap-in Mount Page D48



Panel Seal Page D59

Series LB

Standard Size Snap-in Pushbuttons

TYPICAL SWITCH

LB | 1 | 5 | S | K | W01

Poles

1	SPDT
2	DPDT

Circuits

5	ON	(ON)
( ) = Momentary		
6	ON	ON
Alternate Action with Latchdown		

Shapes

S	Square
C	Round
R	Rectangular

Housing

K	Black
G	Gray

Contacts & Terminals

W01	Silver Contacts Rated 3A @ 125/250V AC Solder Lug/Quick Connect Terminals
G01	Gold Contacts Rated 0.4VA @ 28V AC/DC Solder Lug/Quick Connect Terminals

IMPORTANT:

Switches are supplied without UL, cULus and CSA marking unless specified. **UL, cULus & CSA recognized only when ordered with marking on the switch.** Specific models, ratings, and ordering instructions are noted on the General Specifications page.

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

LB15SKW01-5C12-JC

Red, 12-volt, Bright LED with Resistor
Clear Cap with Red Diffuser
SPDT ON-(ON) Circuit
Square Shape
Silver Contacts
Rated 3A @ 125/250V AC;
Solder Lug/Quick Connect Terminals
Black Housing

ORDERING EXAMPLE

— 5C 12 — JC

Lamps

Incandescent Lamp Used with Solid Cap

05	5-volt
12	12-volt
No Code	Nonilluminated

Incandescent or Neon Used with Insert Cap

01	110-volt Neon
05	5-volt Incandescent
12	12-volt Incandescent
No Code	Nonilluminated

Bright LED Used with LED Cap

Colors		Resistor	
5C	Red	**No Code**	No Resistor
5D	Amber	**05**	5-volt
		12	12-volt
5F	Green	**24**	24-volt

Super Bright LED Used with LED Cap

6B	White
6F	Green
6G	Blue

LED in Spot Illuminated Cap

1C	Red Single Color
1D	Amber Single Color
1F	Green Single Color
CF	Red/Green Bicolor

Nonilluminated

No Code	Nonilluminated

Cap Types & Colors

Solid Cap: Lens/Filter Colors

BJ	White/Clear
CJ	Red/Clear
EJ	Yellow/Clear
FJ	Green/Clear
GJ	Blue/Clear

Insert Cap: Lens/Filter Colors

JB	Clear/White
JC	Clear/Red
JE	Clear/Yellow
***JF**	Clear/Green
***JG**	Clear/Blue

*JF & JG not suitable with neon.

LED Cap: Lens/Diffuser Colors

JB	Clear/White
JC	Clear/Red
JD	Clear/Amber
JF	Clear/Green

LED Cap: Lens/Diffuser Colors

JB	Clear/White

Spot Illuminated Cap Colors

A	Black	Available in Square and Round only.
B	White	
C	Red	
F	Green	

Nonilluminated Cap Colors

A	Black	**F**	Green
B	White	**G**	Blue
C	Red	**H**	Gray
E	Yellow		

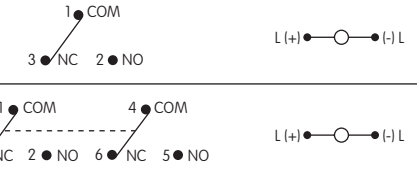
Series LB

Standard Size Snap-in Pushbuttons

POLES & CIRCUITS

Pole	Model	Plunger Position ( ) = Momentary: Normal	Plunger Position ( ) = Momentary: Down	Connected Terminals: Normal	Connected Terminals: Down	Throw & Switch/Lamp Schematics
SP	**LB15** ***LB16**	ON ON	(ON) ON	1-3	1-2	SPDT
DP	**LB25** ***LB26**	ON ON	(ON) ON	1-3 4-6	1-2 4-5	DPDT

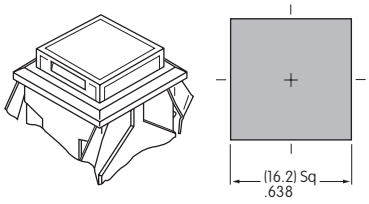
Notes: Switch is marked with NC, NO, COM, L+, L–. Lamp circuit is isolated and requires an external power source.



* When in latchdown position for the alternate circuit, cap position is .039" (1.0mm) above the built-in bezel.

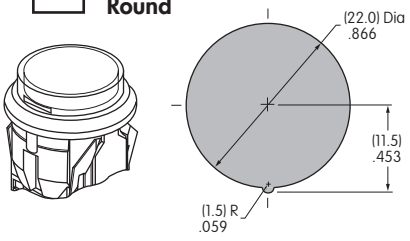
SHAPES & PANEL CUTOUTS

S **.622" (15.8mm) Square**

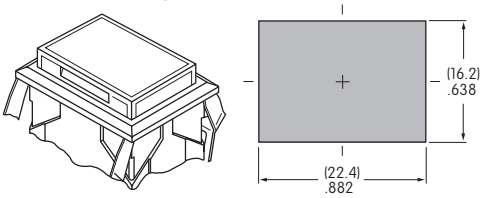


Cutout for 1 switch:
.638" x .638" (16.2mm x 16.2mm)
Cutout for 1 switch with barriers:
.638" x .815" (16.2mm x 20.7mm)

C **.854" (21.7mm) Round**



R **.622" x .866" (15.8mm x 22.0mm) Rectangular**



Cutout for 1 switch:
.638" x .882" (16.2mm x 22.4mm)
Cutout for 1 switch with barriers:
.638" x 1.059" (16.2mm x 26.9mm)

Panel Thickness for Switches & Barriers: .039" ~ .157" (1.0 ~ 4.0mm)
Panel Thickness for Protective Guards & Splash Covers: .039" ~ .138" (1.0 ~ 3.5mm)

HOUSING

Housing Colors Available: **K** Black **G** Gray

CONTACT MATERIALS, RATINGS & TERMINALS

W01 **Silver Contacts**

G01 **Gold Contacts**

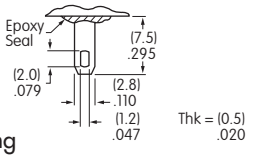
Power Level
3A @ 125V AC & 250V AC

Logic Level
0.4VA max. @ 28V AC/DC max.

Complete explanation of operating range in Supplement section.

Solder Lug/Quick Connect

Optional PCB adaptors AT711 & AT712 available; illustrated in "Optional Accessories" immediately following "Typical Switch Dimensions."



INCANDESCENT & NEON LAMP CODES & SPECIFICATIONS

AT607 & AT607N

T-1 Bi-pin

AT607 Incandescent 5-volt or 12-volt; AT607N Neon 110-volt	**05**	**12**	**01** *
Voltage V	5V AC	12V AC	110V AC
Current I	115mA	60mA	1.5mA
Endurance Avg. Hours	10,000		10,000
Ambient Temp. Range	–25°C ~ +50°C		

The electrical specifications shown are determined at a basic temperature of 25°C. Lamp circuit is isolated and requires external power source.

* Recommended Resistors for Neon:
33K ohms for 110V AC;
100K ohms for 220V AC

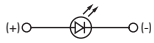
LED COLORS & SPECIFICATIONS

The electrical specifications shown are determined at a basic temperature of 25°C.
LED circuit is isolated and requires external power source. Polarity marks are on the switch.
If the source voltage exceeds the rated voltage, a ballast resistor is required.
The resistor value can be calculated by using the formula in the Supplement section.
Additional lamp detail is shown in the Accessories & Hardware section.

Bright LED without Resistor

AT635

LEDs are colored in OFF state.



T-1½ Bi-pin

Color Codes	Red 5C	Amber 5D	Green 5F	No Code: No Resistor
				Red / Amber / Green
Maximum Forward Current I_{FM}				30mA / 30mA / 30mA
Typical Forward Current I_F				20mA / 20mA / 20mA
Forward Voltage V_F				1.9V / 2.0V / 2.1V
Maximum Reverse Voltage V_{RM}				5V / 5V / 5V
Current Reduction Rate Above 25°C ΔI_F				0.42mA/°C
Ambient Temperature Range				−25° ~ +50°C

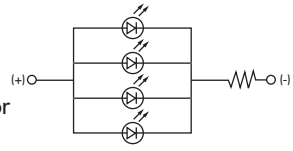
Bright LED with Resistor

AT627 with Resistor

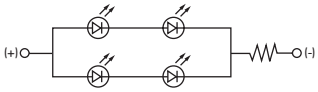
T-1 Bi-pin

Color Codes:	Red 5C	Amber 5D	Green 5F	Resistor Codes 05	12	24
Maximum Forward Current I_{FM}				—	—	—
Typical Forward Current I_F				52mA	26mA	13mA
Forward Voltage V_F				5V	12V	24V
Maximum Reverse Voltage V_{RM}				4V	8V	16V
Current Reduction Rate Above 25°C ΔI_F				0.50mA/°C		
Ambient Temperature Range				−25° ~ +50°C		

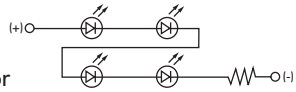
AT627 5-volt 4-element with Resistor



AT627 12-volt 4-element with Resistor



AT627 24-volt 4-element with Resistor



Super Bright Single Element LED

AT625G Blue
AT631B White
AT632F Green

T-1 Bi-pin

ATTENTION ELECTROSTATIC SENSITIVE DEVICES	Color	6B White	6F Green	6G Blue
Maximum Forward Current	I_{FM}	30mA	30mA	30mA
Typical Forward Current	I_F	20mA	20mA	20mA
Forward Voltage	V_F	3.3V	3.3V	3.3V
Maximum Reverse Voltage	V_{RM}	7V	7V	7V
Current Reduction Rate Above 25°C	ΔI_F	0.40mA/°C	0.40mA/°C	0.40mA/°C
Ambient Temperature Range		−25° ~ +50°C		

No Code **No Lamp**

CAP TYPES & COLOR COMBINATIONS

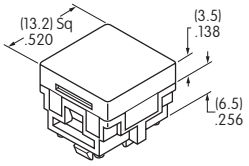
Color Codes: **B** White **C** Red **D** Amber **E** Yellow **F** Green **G** Blue **J** Clear

Solid Cap for Incandescent Lamp & Nonilluminated

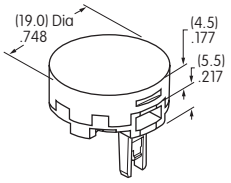
Lens/Filter Colors Available:

BJ FJ
CJ GJ
EJ

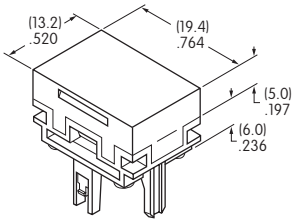
AT476 Square

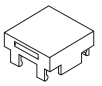


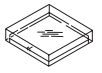
AT4012 Round



AT4026 Rectangular




Translucent Colored Lens


Transparent Clear Filter

Lamp AT607

Material: Polycarbonate Finish: Glossy

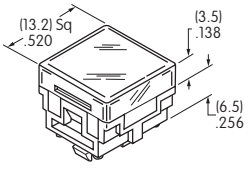
Insert Cap for Incandescent or Neon Lamp & Nonilluminated

Lens/Filter Colors Available:

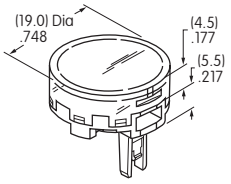
JB JF
JC JG
JE

JF and JG not suitable with neon lamp.

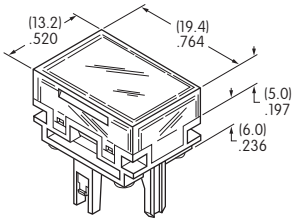
AT477 Square



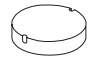
AT4013 Round



AT4027 Rectangular



Transparent Clear Lens


Translucent Colored Filter

Lamp AT607 or 607N

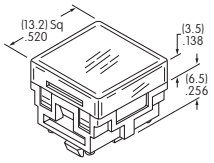
Material: Polycarbonate Finish: Glossy

Cap for Bright LED without Resistor

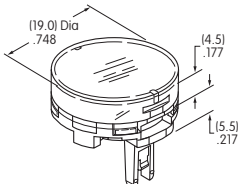
Lens/Diffuser Colors Available:

JB
JC
JD
JF

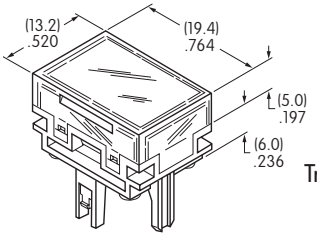
AT4176 Square

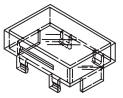


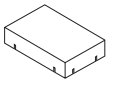
AT4178 Round



AT4177 Rectangular




Transparent Clear Lens


Translucent Colored Diffuser

Bright LED AT635

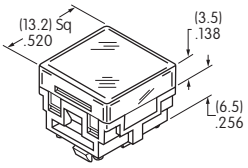
Material: Polycarbonate Finish: Glossy

Cap for Bright LED with Resistor

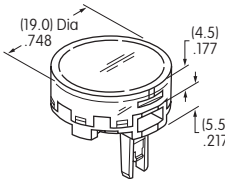
Lens/Diffuser Colors Available:

JB
JC
JD
JF

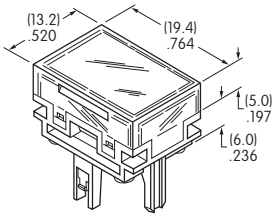
AT4162 Square

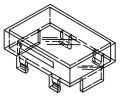


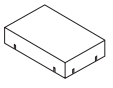
AT4164 Round



AT4163 Rectangular




Transparent Clear Lens


Translucent Colored Diffuser

Bright LED AT627

Material: Polycarbonate Finish: Glossy

CAP TYPES & COLOR COMBINATIONS

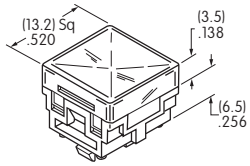
Color Codes: **A** Black **B** White **C** Red **D** Amber **E** Yellow **F** Green **G** Blue **H** Gray **J** Clear

Cap for Super Bright LEDs

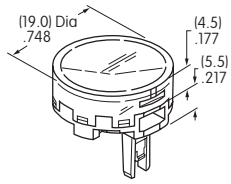
JB **Clear Lens White Diffuser**

Material: Polycarbonate
Finish: Glossy

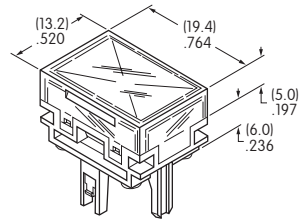
AT4129 Square

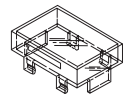


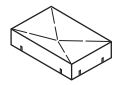
AT4128 Round



AT4130 Rectangular




Transparent Clear Lens


Translucent White Diffuser

LEDs AT625 AT631 AT632

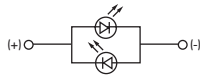
Spot Illuminated Cap with LED

The electrical specifications shown are determined at a basic temperature of 25°C. LED circuit is isolated and requires an external power source. Single color LEDs are colored in OFF state; bicolor LEDs are translucent white in OFF state. Polarity marks are on the switch. If the source voltage exceeds the rated voltage, a ballast resistor is required. The resistor value can be calculated by using the formula in the Supplement section. Additional lamp detail is shown in the Accessories & Hardware section.

LED Specifications

LED factory assembled in Spot Illuminated Caps

Not Available Separately

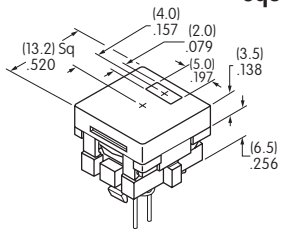
	Single Color LED with 1 Element	Bicolor LED with 2 Elements	Single Color			Bicolor
			**1C** Red	**1D** Amber	**1F** Green	**CF** Red/Green
Maximum Forward Current		I_{FM}	25mA	30mA	25mA	30/25mA
Typical Forward Current		I_F	20mA	20mA	20mA	20mA
Forward Voltage		V_F	2.25V	2.1V	2.2V	2.0/2.2V
Maximum Reverse Voltage		V_{RM}	5V	5V	5V	—
Current Reduction Rate Above 25°C		ΔI_F	0.33mA/°C	0.40mA/°C	0.33mA/°C	0.43/0.38mA/°C
Ambient Temperature Range			−25° ~ +70°C			

Cap Colors Available:

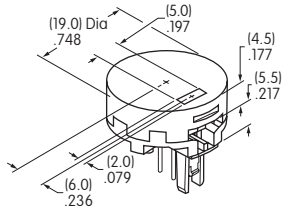
A **C**
B **F**

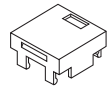
Material: Polycarbonate
Finish: Glossy

AT480 Square



AT4016 Round




Cap with Window

Factory Assembled LED; Not Available Separately

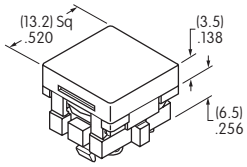
When ordering spot illuminated cap separately, LED color must be specified.
Examples: AT480CA (red LED, black cap); AT4016CFB (red/green bicolored LED, white cap)

Cap for Nonilluminated

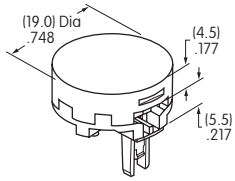
Cap Colors Available:

A **E** **H**
B **F**
C **G**

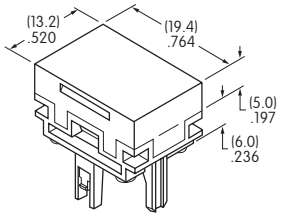
AT484 Square

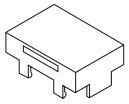


AT4017 Round



AT4030 Rectangular




Cap

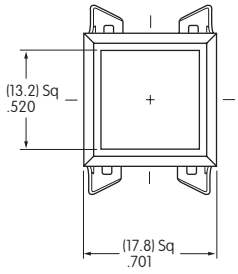
No Lamp

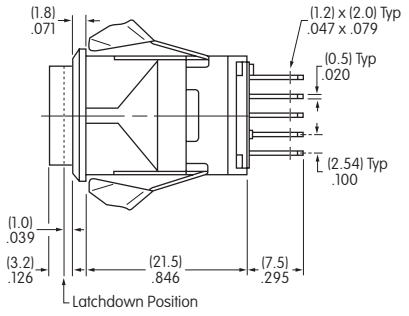
Material: Polycarbonate Finish: Glossy

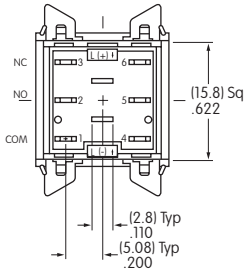
TYPICAL SWITCH DIMENSIONS

Square

Single & Double Pole





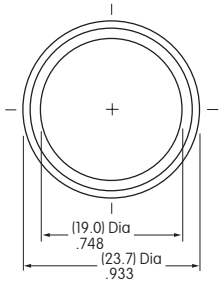


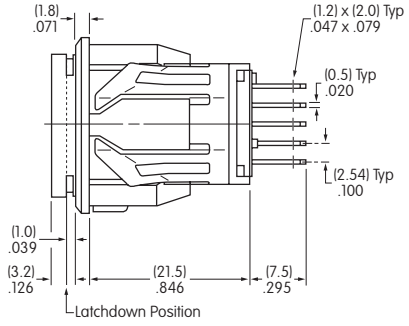
LB15SKW01-12-CJ

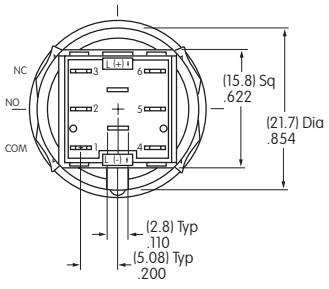
Single pole models do not have terminals 4, 5, & 6.

Round

Single & Double Pole





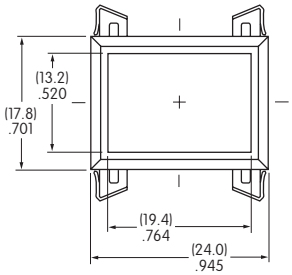


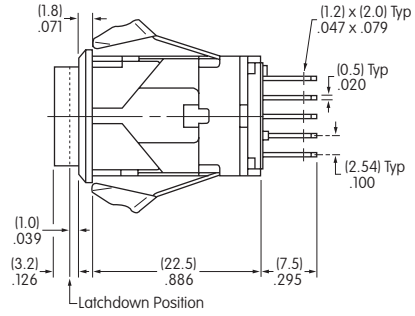
LB16CKW01-12-CJ

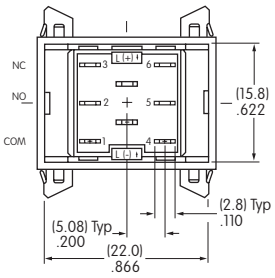
Single pole models do not have terminals 4, 5, & 6.

Rectangular

Single & Double Pole







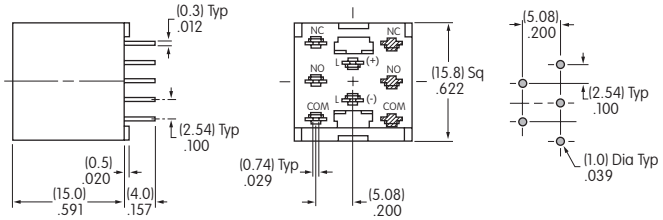
LB26RGW01-12-CJ

Single pole models do not have terminals 4, 5, & 6.

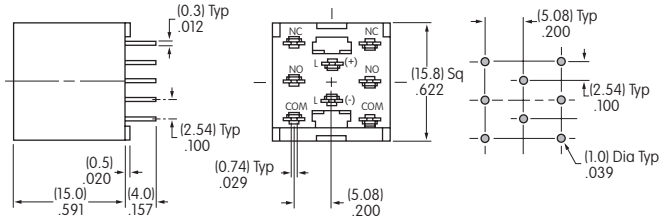
OPTIONAL ACCESSORIES

PCB Adaptors

AT711 Single Pole • Straight PC Terminals



AT712 Double Pole • Straight PC Terminals



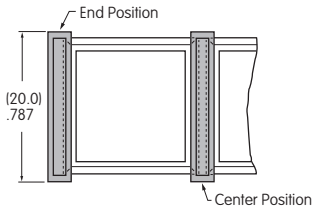
Note: Order adaptors separately.

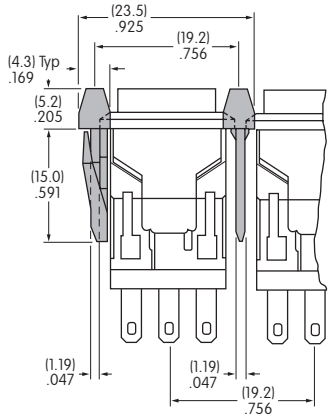
OPTIONAL ACCESSORIES

Barriers

AT497
End

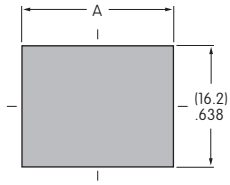
AT498
Center





Material: Polyamide

Cutouts for More Than 1 Switch

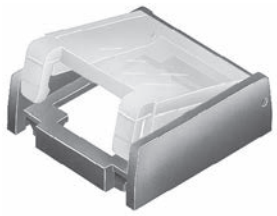


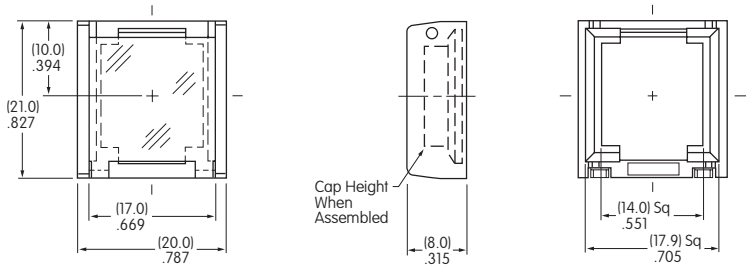
Square
A = .752″ (19.1mm) x Number of Switches + .051″ (1.3mm)
Rectangular
A = .996″ (25.3mm) x Number of Switches + .051″ (1.3mm)

Protective Guard

AT499
Square
Protective Guard

Opens 90°
Closes manually





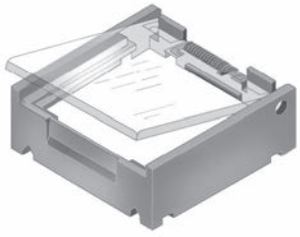
Material: Polyamide

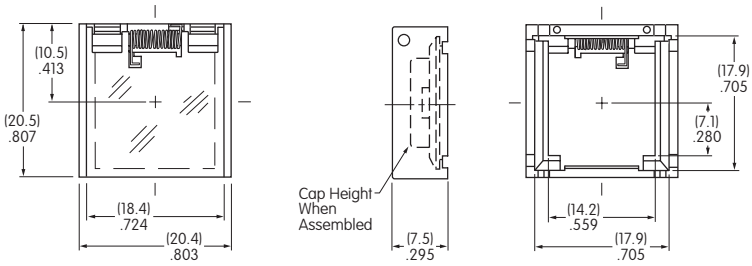
Protective Guards reduce depth of switch behind panel by .020″ (0.5mm).

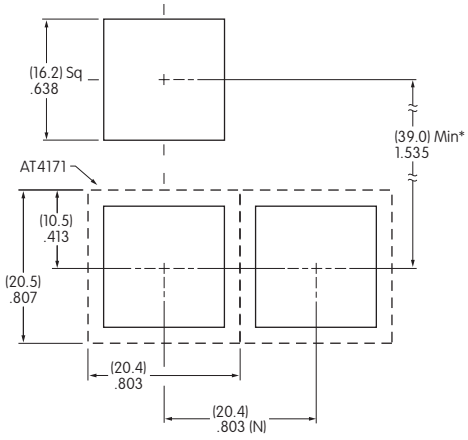
Spring Loaded Protective Guard

AT4171
Square
Protective Guard

Opens 180°
Closes automatically

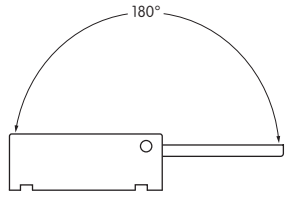






(N) = Number of switches * Minimum dimension allows opening of cover to 180°

Materials:
Cover: Clear Polycarbonate
Base: Black GFR Polyamide
Coil Spring: Stainless Steel



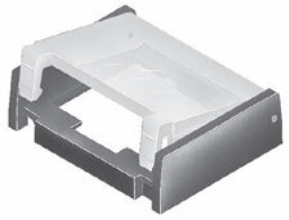
Recommended Panel Thickness:
.039″ ~ .106″ (1.0mm ~ 2.7mm)

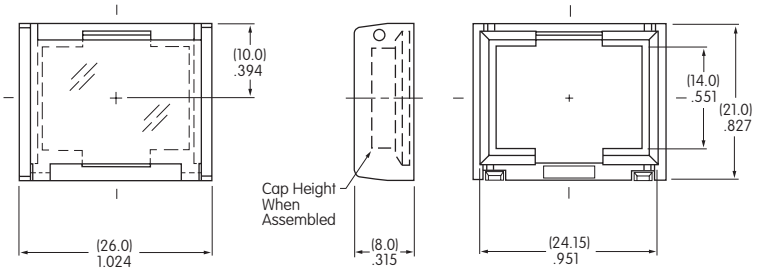
OPTIONAL ACCESSORIES

Protective Guard

AT4057
Rectangular
Protective Guard

Opens 90°
Closes manually



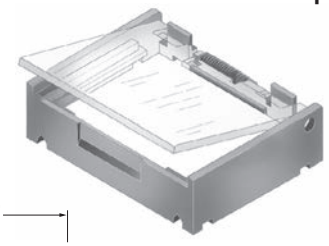


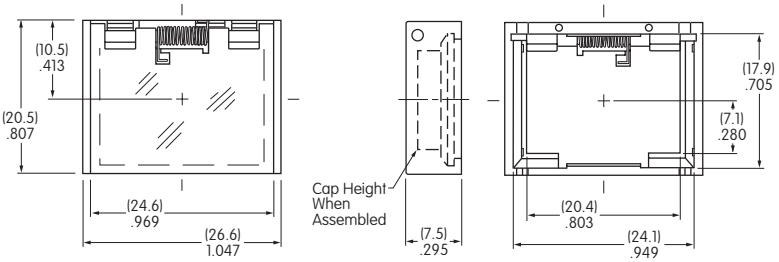
Material: Polyamide

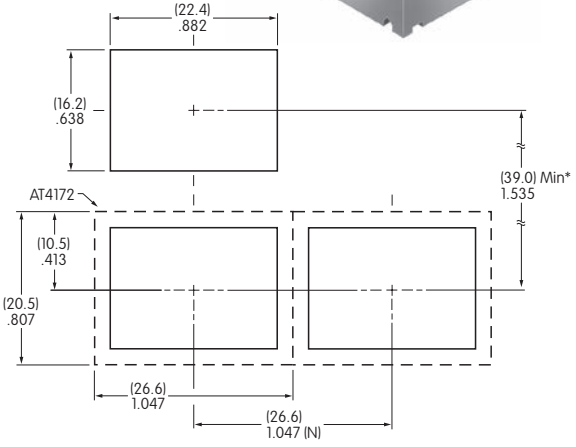
Protective Guards reduce depth of switch behind panel by .020" (0.5mm).

Spring Loaded Protective Guard

AT4172
Rectangular
Protective Guard





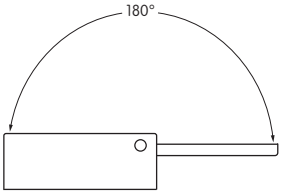


(N) = Number of switches * Minimum dimension allows opening of cover to 180°

Opens 180°
Closes automatically

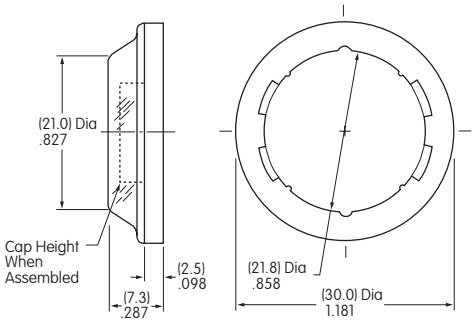
Materials:
Cover: Clear Polycarbonate
Base: Black GFR Polyamide
Coil Spring: Stainless Steel

Recommended Panel Thickness:
.039" ~ .106" (1.0mm ~ 2.7mm)

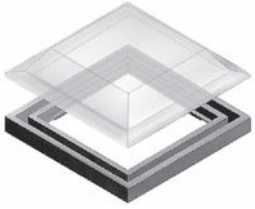


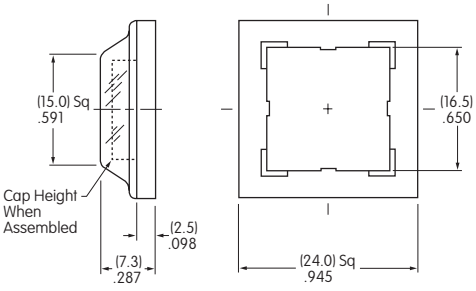
Dust Covers

AT4002
Round

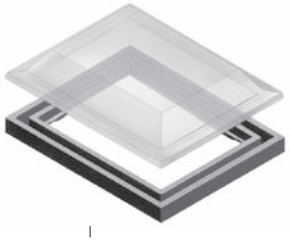


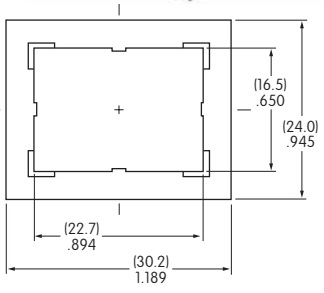
AT4001
Square





AT4011
Rectangular





Materials: PVC with polyethylene gasket; PVC loses pliability below 0°C (32°F). Dust Covers reduce depth of switch behind panel by .020" (0.5mm).

General Specifications

Electrical Capacity (Resistive Load)

Power Level (silver): 3A @ 125V AC or 3A @ 250V AC or 3A @ 30V DC
Logic Level (gold): 0.4VA maximum @ 28V AC/DC maximum
(Applicable Range 0.1mA ~ 0.1A @ 20mV ~ 28V)

Note: Find additional explanation of operating range in Supplement section.

Other Ratings

Contact Resistance: 50 milliohms maximum for silver; 100 milliohms maximum for gold
Insulation Resistance: 200 megohms minimum @ 500V DC
Dielectric Strength: 1,000V AC minimum between contacts for 1 minute minimum;
1,500V AC minimum between contacts & case for 1 minute minimum
Mechanical Life: 1,000,000 operations minimum for momentary circuit
200,000 operations minimum for maintained circuit
Electrical Life: 100,000 operations minimum
Nominal Operating Force: 5.39N
Contact Timing: Nonshorting (break-before-make)
Travel: Pretravel .059" (1.5mm); Overtravel .059" (1.5mm); Total Travel .118" (3.0mm)

Materials & Finishes

Housing: Glass fiber reinforced polyamide (UL94V-0)
O-ring: Nitrile butadiene rubber
Inner Seal: Silicone rubber
Movable Contact: Silver alloy or copper with gold plating
Stationary Contacts: Silver alloy or copper with gold plating
Base: Liquid crystal polymer (UL94V-0)
Switch Terminals: Phosphor bronze with silver or gold plating
Lamp Terminals: Brass with silver plating

Environmental Data

Operating Temperature Range: –25°C through +50°C (–13°F through +122°F) for Illuminated
–25°C through +70°C (–13°F through +158°F) for Nonilluminated
Note: When used with a polyvinyl chloride splash cover, the lowest limit is 0°C (32°F)
Humidity: 90 ~ 95% humidity for 96 hours @ 40°C (104°F)
Vibration: 10 ~ 55Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in 1 minute; 3 right angled directions for 2 hours
Shock: 50G (490m/s^2) acceleration (tested in 6 right angled directions, with 5 shocks in each direction)

Sealing: IP65 of IEC60529 standard (similar to NEMA 4 & 13)

Installation

Mounting Torque: 1.96Nm (17.35 lb•in) maximum
Cap Installation Force: 3.92N maximum downward force on cap
Quick Connect Force: 52.95N maximum downward force on connector
Soldering Time & Temperature: Manual Soldering: See Profile A in Supplement section.

Standards & Certifications

Flammability Standards: UL94V-0 housing & base
UL: **File No. E44145 - Recognized only when ordered with marking on switch.**
Add "/U" or "/CUL" before first dash in part number to order UL recognized switch.
All models recognized at 3A @ 125V or 250V AC or 0.4VA @ 28V AC/DC maximum.
CSA: **File No. 023535_0_000 - Certified only when ordered with marking on switch.**
Add "/C" before first dash in part number to order CSA certified switch.
All models certified at 3A @ 125V or 250V AC or 0.4VA @ 28V AC/DC maximum.

Series LB

Standard Size Panel Seal Pushbuttons

TYPICAL SWITCH

LB | 1 | 6 | W | K | W01

Poles

1	SPDT
2	DPDT

Circuits

5	ON	(ON)
( ) = Momentary		
6	ON	ON
Alternate Action with Latchdown		

Shape

W	Round

Housing

K	Black
G	Gray

Contacts & Terminals

W01	Silver Contacts Rated 3A @ 125/250V AC Solder Lug/Quick Connect Terminals
G01	Gold Contacts Rated 0.4VA @ 28V AC/DC Solder Lug/Quick Connect Terminals

IMPORTANT:

Switches are supplied without UL, cULus & CSA marking unless specified. **UL, cULus & CSA recognized only when ordered with marking on the switch.** Specific models, ratings, & ordering instructions are noted on the General Specifications page.

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

LB16WKW01-5C12-JC

Red, 12-volt, Bright LED with Resistor

Round Shape

Black Housing

Clear Cap with Red Diffuser

SPDT ON-ON Circuit

Silver Contacts
Rated 3A @ 125/250V AC;
Solder Lug/Quick Connect Terminals

ORDERING EXAMPLE

— 5C | 12 — JC

Lamps

Incandescent Lamp Used with Solid Cap	
05	5-volt
12	12-volt
No Code	Nonilluminated

Incandescent or Neon Used with Insert Cap	
01	110-volt Neon
05	5-volt Incandescent
12	12-volt Incandescent
No Code	Nonilluminated

Bright LED Used with LED Cap			
Colors		**Resistor**	
5C	Red	**No Code**	No Resistor
5D	Amber	**05**	5-volt
		12	12-volt
5F	Green	**24**	24-volt

Super Bright LED Used with LED Cap	
6B	White
6F	Green
6G	Blue

Cap Types & Colors

Solid Cap: Lens/Filter Colors	
BJ	White/Clear
CJ	Red/Clear
EJ	Yellow/Clear
FJ	Green/Clear
GJ	Blue/Clear

Insert Cap: Lens/Filter Colors	
JB	Clear/White
JC	Clear/Red
JE	Clear/Yellow
***JF**	Clear/Green
***JG**	Clear/Blue

*JF & JG not suitable with neon.

LED Cap: Lens/Diffuser Colors	
JB	Clear/White
JC	Clear/Red
JD	Clear/Amber
JF	Clear/Green

LED Cap: Lens/Diffuser Colors	
JB	Clear/White

Series LB

Standard Size Panel Seal Pushbuttons

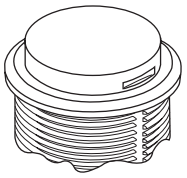
POLES & CIRCUITS

Pole	Model	Plunger Position ( ) = Momentary: Normal	Plunger Position ( ) = Momentary: Down	Connected Terminals: Normal	Connected Terminals: Down	Throw & Switch/Lamp Schematics
						Notes: Switch is marked with NC, NO, COM, L+, L–. Lamp circuit is isolated and requires external power source.
SP	**LB15** ***LB16**	ON ON	(ON) ON	1-3	1-2	SPDT
DP	**LB25** ***LB26**	ON ON	(ON) ON	1-3 4-6	1-2 4-5	DPDT

* When in latchdown position for the alternate circuit, cap position is .039" (1.0mm) above the built-in bezel.

SHAPE & PANEL CUTOUT

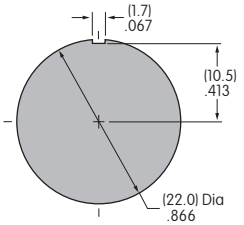
W **.866" (22.0mm) Round**



Recommended Panel Thickness:
.039" ~ .157" (1.0mm ~ 4.0mm)

Recommended Panel Thickness with Splash Cover:
.039" ~ .138" (1.0mm ~ 3.5mm)

Overtightening the mounting nut AT074 may damage the switch housing.



HOUSING

Housing Colors Available:

K Black

G Gray

CONTACT MATERIALS, RATINGS & TERMINALS

W01 **Silver Contacts**

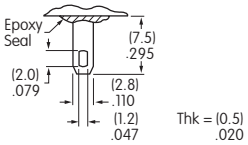
Power Level
3A @ 125V AC & 250V AC

G01 **Gold Contacts**

Logic Level
0.4VA max. @ 28V AC/DC max.

Complete explanation of operating range in Supplement section.

Solder Lug/Quick Connect



Optional PCB adaptors AT711 & AT712 available; illustrated in previous snap-in subsection.

INCANDESCENT & NEON LAMP CODES & SPECIFICATIONS

AT607 & AT607N

T-1 Bi-pin

AT607 Incandescent 5-volt or 12-volt; AT607N Neon 110-volt		**05**	**12**	**01** *
Voltage	V	5V AC	12V AC	110V AC
Current	I	115mA	60mA	1.5mA
Endurance	Avg. Hours	10,000		10,000
Ambient Temp. Range		–25°C ~ +50°C		

The electrical specifications shown are determined at a basic temperature of 25°C. Lamp circuit is isolated and requires external power source.

* Recommended Resistors for Neon:
33K ohms for 110V AC;
100K ohms for 220V AC

LED COLORS & SPECIFICATIONS

The electrical specifications shown are determined at a basic temperature of 25°C.
LED circuit is isolated and requires external power source. Polarity marks are on the switch.
If the source voltage exceeds the rated voltage, a ballast resistor is required.
The resistor value can be calculated by using the formula in the Supplement section.
Additional lamp detail is shown in the Accessories & Hardware section.

Bright LED without Resistor

AT635

LEDs are colored in OFF state.

T-1½ Bi-pin

Color Codes		Red 5C	Amber 5D	Green 5F	No Code: No Resistor Red	No Resistor Amber	No Resistor Green
Maximum Forward Current	I_{FM}				30mA	30mA	30mA
Typical Forward Current	I_F				20mA	20mA	20mA
Forward Voltage	V_F				1.9V	2.0V	2.1V
Maximum Reverse Voltage	V_{RM}				5V	5V	5V
Current Reduction Rate Above 25°C	ΔI_F				0.42mA/°C		
Ambient Temperature Range					−25° ~ +50°C		

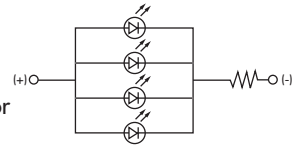
Bright LED with Resistor

AT627 with Resistor

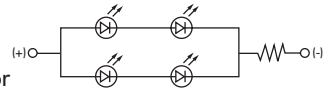
T-1 Bi-pin

Color Codes:		Red 5C	Amber 5D	Green 5F	Resistor Codes 05	12	24
Maximum Forward Current	I_{FM}				—	—	—
Typical Forward Current	I_F				52mA	26mA	13mA
Forward Voltage	V_F				5V	12V	24V
Maximum Reverse Voltage	V_{RM}				4V	8V	16V
Current Reduction Rate Above 25°C	ΔI_F				0.50mA/°C		
Ambient Temperature Range					−25° ~ +50°C		

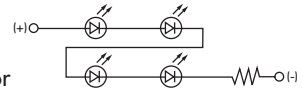
AT627 5-volt 4-element with Resistor



AT627 12-volt 4-element with Resistor



AT627 24-volt 4-element with Resistor



Super Bright Single Element LED

AT625G Blue
AT631B White
AT632F Green

T-1 Bi-pin

ATTENTION ELECTROSTATIC SENSITIVE DEVICES		6B	6F	6G
	Color	White	Green	Blue
Maximum Forward Current	I_{FM}	30mA	30mA	30mA
Typical Forward Current	I_F	20mA	20mA	20mA
Forward Voltage	V_F	3.3V	3.3V	3.3V
Maximum Reverse Voltage	V_{RM}	7V	7V	7V
Current Reduction Rate Above 25°C	ΔI_F	0.40mA/°C	0.40mA/°C	0.40mA/°C
Ambient Temperature Range		−25° ~ +50°C		

No Code **No Lamp**

CAP TYPES & COLOR COMBINATIONS

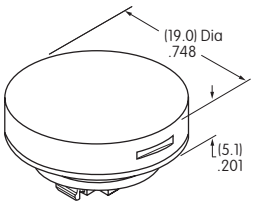
Color Codes: **B** White **C** Red **D** Amber **E** Yellow **F** Green **G** Blue **J** Clear

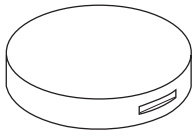
Solid Cap for Incandescent Lamp & Nonilluminated

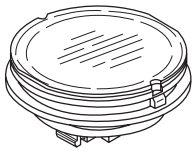
Lens/Filter Colors Available:

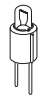
BJ FJ
CJ GJ
EJ

AT4054




Translucent Colored Lens


Transparent Clear Filter


Lamp AT607

Material: Polycarbonate Finish: Glossy

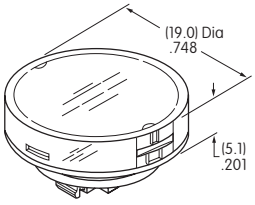
Insert Cap for Incandescent or Neon Lamp & Nonilluminated

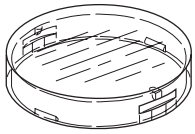
Lens/Filter Colors Available:

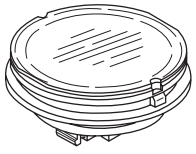
JB JF
JC JG
JE

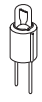
JF and JG not suitable with neon lamp.

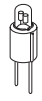
AT4055




Transparent Clear Lens


Translucent Colored Filter


Lamp AT607


Lamp AT607N

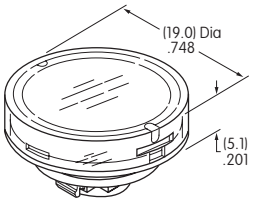
Material: Polycarbonate Finish: Glossy

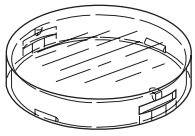
Cap for Bright LED without Resistor

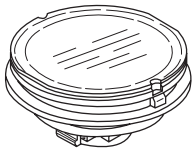
Lens/Diffuser Colors Available:

JB
JC
JD
JF

AT4179




Transparent Clear Lens


Translucent Colored Diffuser

Bright LED AT635

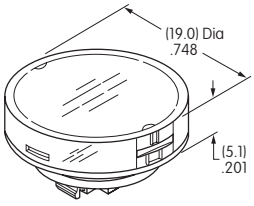
Material: Polycarbonate Finish: Glossy

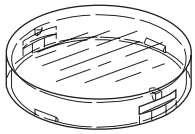
Cap for Bright LED with Resistor

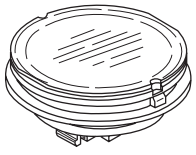
Lens/Diffuser Colors Available:

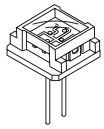
JB
JC
JD
JF

AT4165




Transparent Clear Lens


Translucent Colored Diffuser


Bright LED AT627

Material: Polycarbonate Finish: Glossy

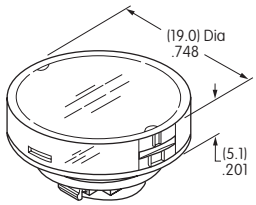
CAP TYPES & COLOR COMBINATIONS

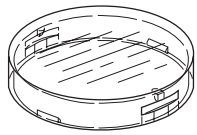
Cap for Super Bright LEDs

JB **Clear Lens**
White Diffuser

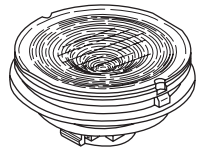
Material:
Polycarbonate
Finish: Glossy

AT4131





Transparent
Clear Lens

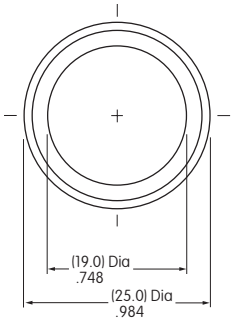


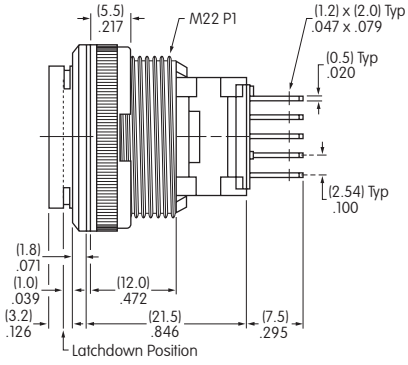
Translucent
Colored Diffuser

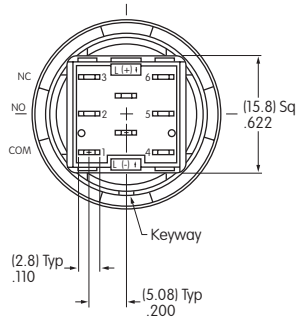
LEDs
AT625
AT631
AT632

TYPICAL SWITCH DIMENSIONS

Single & Double Pole







Single pole models do not have terminals 4, 5, & 6.

Panel Seal

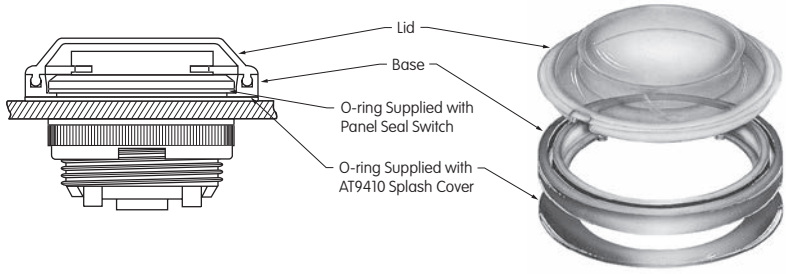
LB25WKW01-12-JC

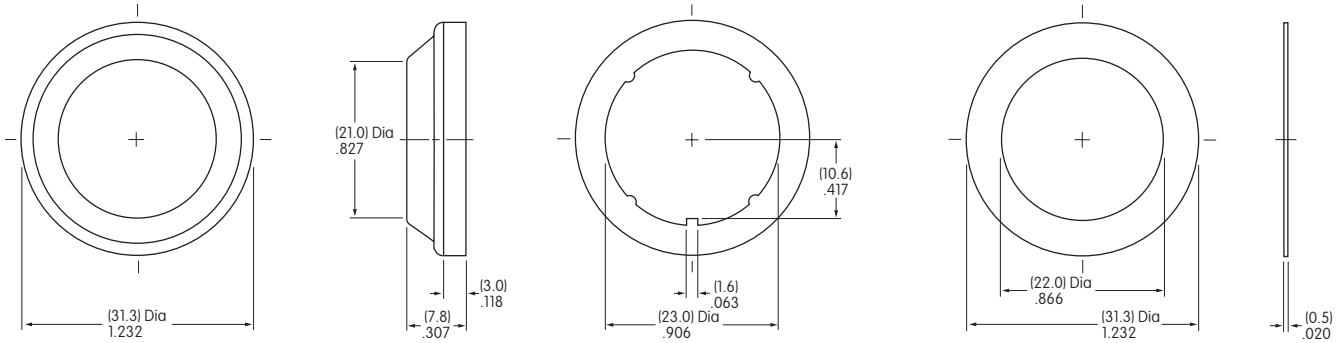
OPTIONAL ACCESSORIES

AT9410 Splash Cover for Panel Seal

Materials:
Lid: PVC (loses pliability below 0°C/32°F)
Base: Polyethylene
O-ring: NBR

Recommended Panel Thickness:
.039" ~ .138" (1.0mm ~ 3.5mm)



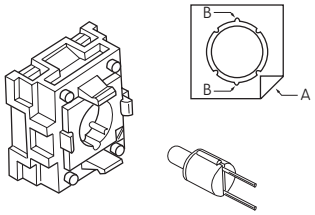


ASSEMBLY INSTRUCTIONS

Lamp Installation & LED Orientation

Incandescent & Neon Lamps AT607 & AT607N

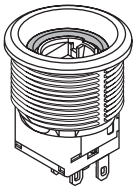
Align projections on lamp with grooves (B) in holder when inserting lamp. To correctly join the lamp holder and cap base, match the cut corners (A).



Bright LED AT627

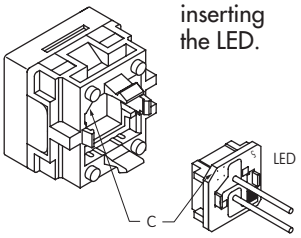
Panel Seal Models

For panel seal models, Bright LED must first be inserted into the lamp socket which is built into the switch. The cap can then be placed on the switch.



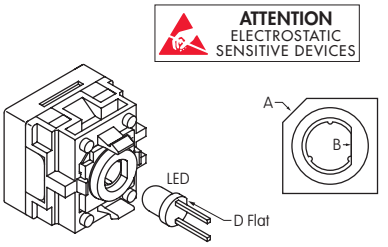
Snap-in Models

For snap-in models, Bright LED must be inserted into the cap first. Align cut corners (C) when inserting the LED.



Bright & Super Bright LEDs AT625, AT631, AT632, AT635

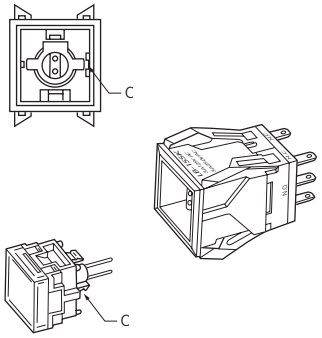
Align D-flat on LED with flat (B) in holder when inserting the LED.
To correctly join the lamp holder and cap base, match the cut corners (A).



Switch & Cap Assembly

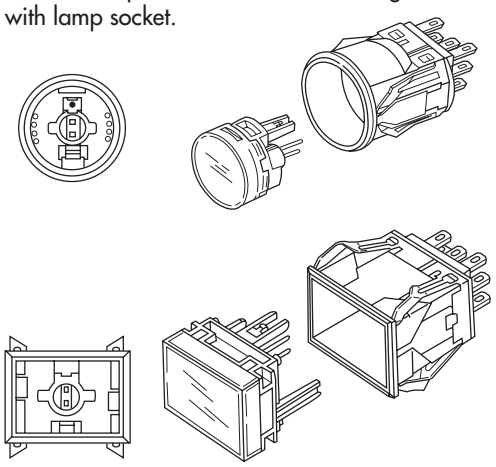
Square

Match projection (C) on cap assembly with groove (C) inside switch. Lamp terminals will then be aligned correctly with lamp socket.



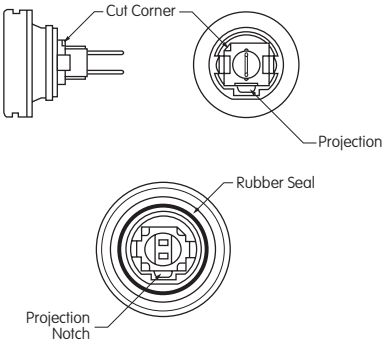
Round & Rectangular

Match clip on cap assembly with receptacle inside switch. Lamp terminals will then be aligned correctly with lamp socket.



Panel Seal

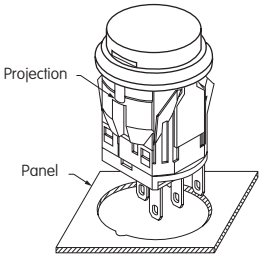
With Lamps AT607, AT607N, and LEDs AT614, AT625, AT631, AT632: Match projection on cap assembly with notch inside switch. Lamp terminals will then be aligned correctly with lamp socket.



Installation & Maintenance

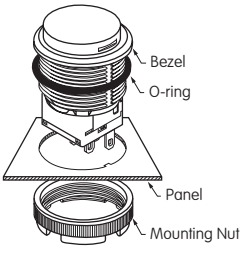
Snap-in Mount

Snap-in clip holds all switches firmly in place.
To mount round switch, match the antirotation projection on switch with guide cut in panel. Snap into panel cutout.



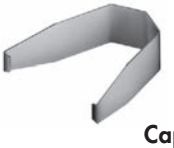
Panel Seal Bushing Mount

Insert switch from the front of the panel with the o-ring between the built-in bezel and the panel. Install mounting nut AT075 (supplied with switch) from the rear of the panel.
Overtightening mounting nut may damage the switch housing.



Lamp Replacement

Actuator must be in UP position. Pull off cap with cap extractor AT109.
Replace lamp and reassemble as shown above.



AT109
Cap Extractor

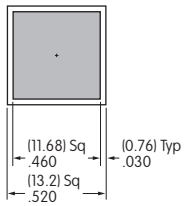
AT112
Socket Wrench

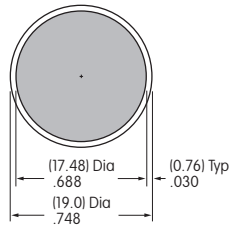
LEGENDS

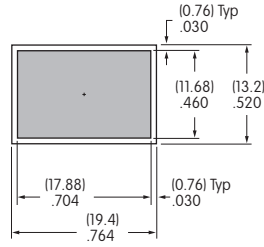
NKK Switches can provide custom legends for caps. Contact factory for more information.

Suggested Printable Area for Lens

Recommended Methods: Laser Etch on clear lens, Screen Print, or Pad Print on lens.
Epoxy based ink is recommended.



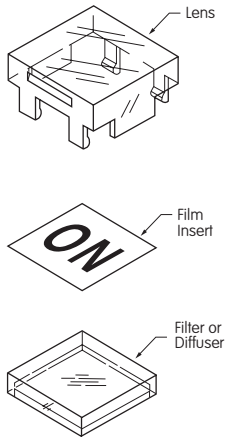




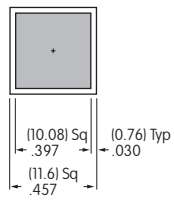
Shaded areas are printable areas.

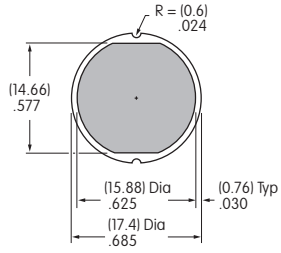
Suggested Printable Area for Film Insert

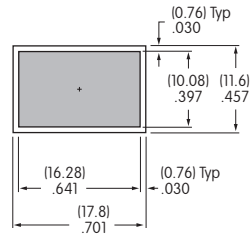
Recommended Print Method: Laser Print or Screen Print with Epoxy based ink



Film Insert: Clear Polyester, 4 mil max. thickness







Shaded areas are printable areas.

General Specifications

Electrical Capacity (Resistive Load)

Power Level (silver): 3A @ 125V AC or 3A @ 250V AC or 3A @ 30V DC

Other Ratings

Contact Resistance: 50 milliohms maximum
Insulation Resistance: 200 megohms minimum @ 500V DC
Dielectric Strength: 1,000V AC minimum between contacts for 1 minute minimum
1,500V AC minimum between contacts and case for 1 minute minimum
Mechanical Life: 500,000 operations minimum
Electrical Life: 50,000 operations minimum for 3A @ 125V/250V AC & 3A @ 30V DC
100,000 operations minimum for 1A @ 125V/250V AC & 1A @ 30V DC
Nominal Operating Force: 1.5N for Single Pole; 3.0N for Double Pole
Contact Timing: Nonshorting (break-before-make)
Travel: Total Travel .118" (3.0mm)

Materials & Finishes

Actuator: Polycarbonate
Housing: Bushing mount: Glass fiber reinforced polyamide (UL94V-0);
Snap in mount: Polybutylene terephthalate (PBT) (UL94V-0)
Base: Glass fiber reinforced polyamide (UL94V-0)
Movable Contact: Phosphor bronze & silver with silver plating
Stationary Contacts: Common terminal: Phosphor bronze with silver plating;
Contact terminals: Phosphor bronze with tin & copper plating
Lamp Terminals: Phospher bronze with tin and copper plating

Environmental Data

Operating Temperature Range: –10°C through +50°C (+14°F through +122°F) for Illuminated
–25°C through +70°C (+13°F through +158°F) for Nonilluminated
Humidity: 90 ~ 95% humidity for 240 hours @ 40°C (104°F)
Vibration: 10 ~ 55Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in 1 minute; 3 right angled directions for 2 hours
Shock: 50G (490m/s^2) acceleration (tested in 6 right angled directions, with 5 shocks in each direction)

Installation

Mounting Torque: 0.8Nm (7.08 lb•in)
Soldering Time & Temperature: Manual Soldering: See Profile A in Supplement section.
Cleaning: Hand clean locally with alcohol based solution

Standards & Certifications

Flammability Standards: UL94V-0 housing & base
UL: **File No. E44145 - Recognized only when ordered with marking on switch.**
Add "/U" or "/CUL" to end of part number to order UL recognized switch.
All single & double pole models recognized at 3A @ 125V/250V AC or 3A @ 30V DC.

Distinctive Characteristics

Environmentally friendly components and packaging materials meet RoHS Directive restricting use of hazardous materials. Suited for lead-free soldering because of heat resistant resin materials.

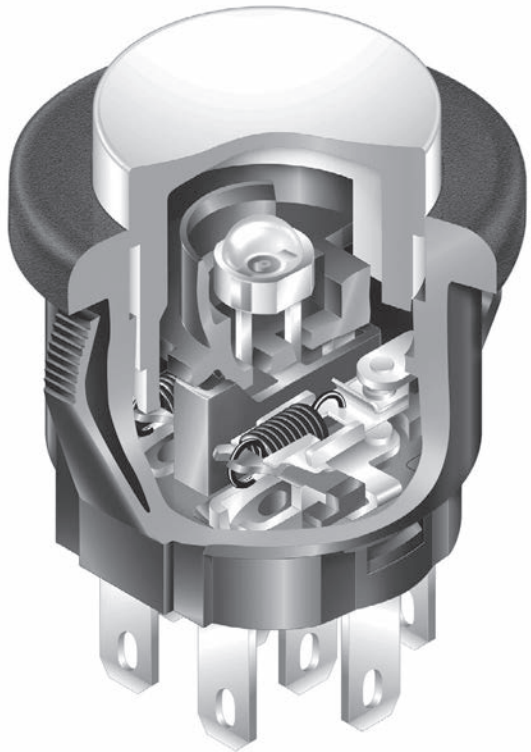
Smooth, slightly concave surface of cap designed to fit fingertip. Unique design and construction of cap prevents its removal and limits tampering.

Bright LED illumination in choice of red, green, or amber through translucent white cap.

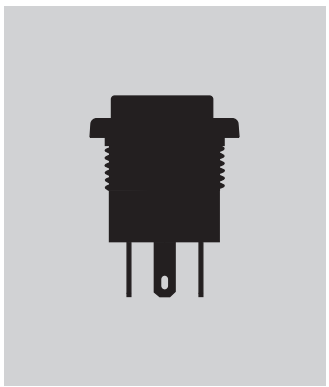
Short body of .551" (14.0mm) conserves behind-panel space.

Combination solder lug and .110" quick connect terminals.

Crisp actuation and clear circuit status provided by snap-action contact mechanism. Arc barrier between movable contacts protects against crossover.



Actual Size



Series LP01

Short Body Pushbuttons

TYPICAL SWITCH ORDERING EXAMPLE

LP01 | 1 | 5 | C | C | K | W01 | 5C | B

Poles

1	SPDT
2	DPDT

Mounting Types

C	Bushing
M	Snap-in

Contacts & Terminals

W01	Silver Rated 3A @ 125V AC/250V AC Solder Lug/ Quick Connect Terminals

Circuit

5	ON	(ON)

( ) = Momentary

Housing

K	Black

LEDs

5C	Red
5D	Amber
5F	Green

Cap Color

B	White

IMPORTANT:

Switches are supplied without UL & cULus markings unless specified. **UL & cULus recognized only when ordered with marking on switch.** Specific models, ratings, & ordering instructions are noted on the General Specifications page.

Nonilluminated

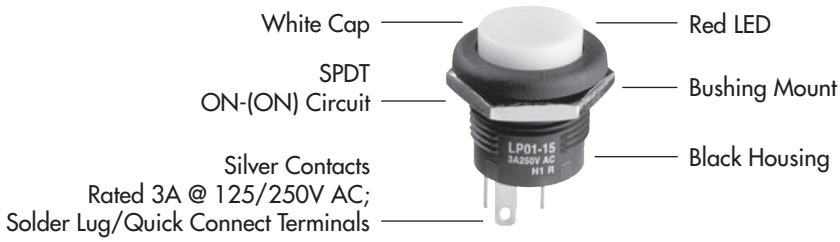
No Code	Nonilluminated

Nonilluminated Cap Colors

A	Black
C	Red
F	Green

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

LP0115CCKW015CB



POLES & CIRCUIT

Pole	Model	Plunger Position ( ) = Momentary: Normal	Plunger Position ( ) = Momentary: Down	Connected Terminals: Normal	Connected Terminals: Down	Throw & Power/Lamp Schematics
						Note: Terminal markings "COM, NO, NC, L, + and –" are actually on the switch; terminal numbers are not on the switch.
SP	**LP0115**	ON	(ON)	1-3	1-2	SPDT
DP	**LP0125**	ON	(ON)	1-3 4-6	1-2 4-5	DPDT

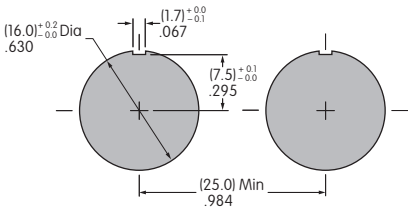
MOUNTING TYPES

C **Bushing**

.630″ (16.0mm) Diameter

This mounting option is supplied with a steel hexagon nut with nickel plating.

Recommended Panel Thickness:
.079″ ~ .256″
(2.0mm ~ 6.5mm)

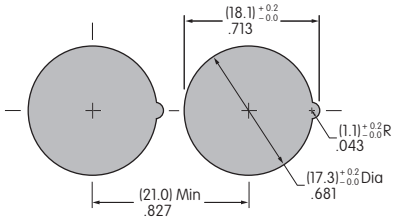


Allow .984″ (25.0mm) distance from center-to-center between switches when mounted side-by-side.

M **Snap-in**

.669″ (17.0mm) Diameter

Recommended Panel Thickness:
.039″ ~ .126″
(1.0mm ~ 3.2mm)



Allow .827″ (21.0mm) distance from center-to-center between switches when mounted side-by-side.

HOUSING

K **Black**

Housing available in black only. The one-piece body and bezel have a matte finish.

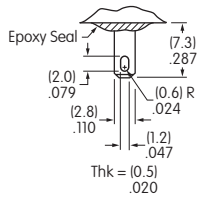
CONTACT MATERIALS, RATINGS, & TERMINALS

W01 **Silver**

Power Level

3A @ 125V AC/250V AC; 3A @ 30V DC

Solder Lug/ .110″ (2.8mm) Quick Connect



Note: If used at 1A @ 125V AC/250V AC or 1A @ 30V DC, electrical life will be 100,000 operations minimum.

LED COLORS & SPECIFICATIONS

The electrical specifications shown are determined at a basic temperature of 25°C.
LED circuit is isolated and requires external power source. Polarity marks are on the switch.
If the source voltage exceeds the rated voltage, a ballast resistor is required.
The resistor value can be calculated by using the formula in the Supplement section.

LEDs are an integral part of the switch and are not available separately.

Single Color LED with 1 Element (+) (-)	Colors	5C Red	5D Amber	5F Green
Maximum Forward Current	I_{FM}	30mA	30mA	30mA
Typical Forward Current	I_F	20mA	20mA	20mA
Forward Voltage	V_F	1.95V	2.0V	2.1V
Maximum Reverse Voltage	V_{RM}	5V	5V	5V
Current Reduction Rate Above 25°C	ΔI_F	0.41mA/°C	0.29mA/°C	0.39mA/°C
Ambient Temperature Range		−10°C ~ +50°C		

No Code **No Lamp**

CAP COLORS

Illuminated Cap

Cap Color Available:

B **White** The translucent cap is an integral part of the switch and is not available separately.

Material: Polycarbonate Finish: Matte

Nonilluminated Caps

Cap Colors Available:

A **Black** **C** **Red** **F** **Green**

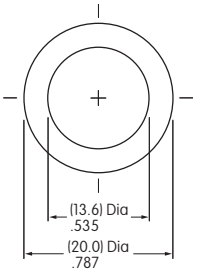
The cap is an integral part of the switch and is not available separately.

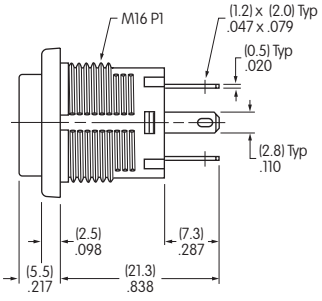
Material: Polycarbonate Finish: Matte

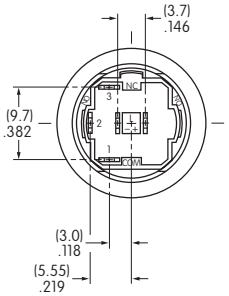
TYPICAL SWITCH DIMENSIONS

Bushing Mount • Single Pole

LP0115CCKW015CB

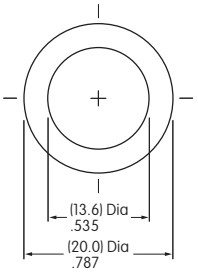


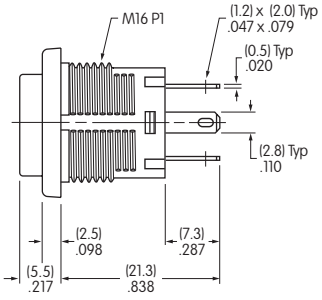


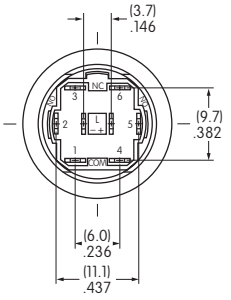


Bushing Mount • Double Pole

LP0125CCKW015CB

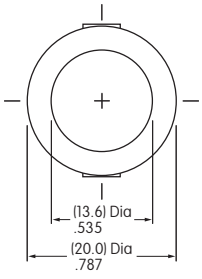


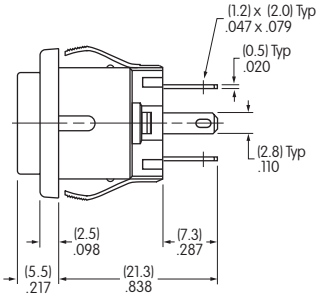


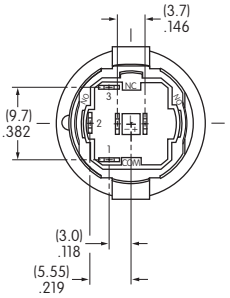


Snap-in • Single Pole

LP0115CMKW015CB

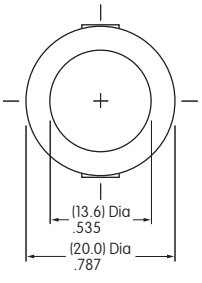


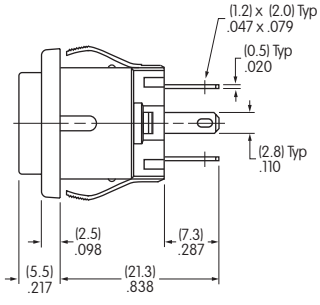


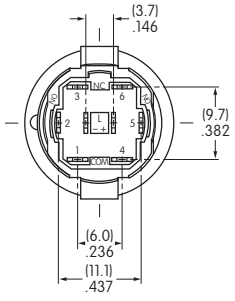


Snap-in • Double Pole

LP0125CMKW015DB



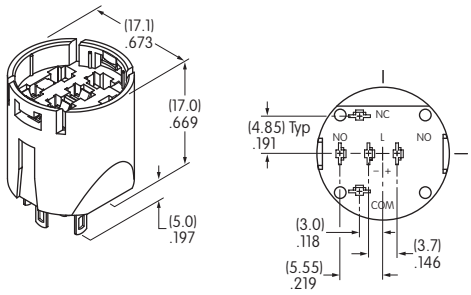




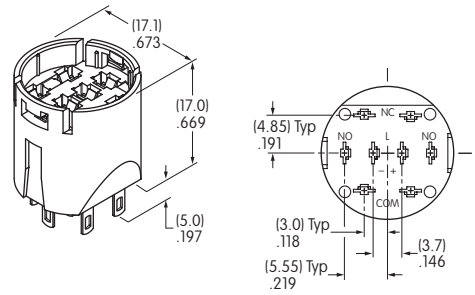
OPTIONAL ACCESSORIES

Adaptors

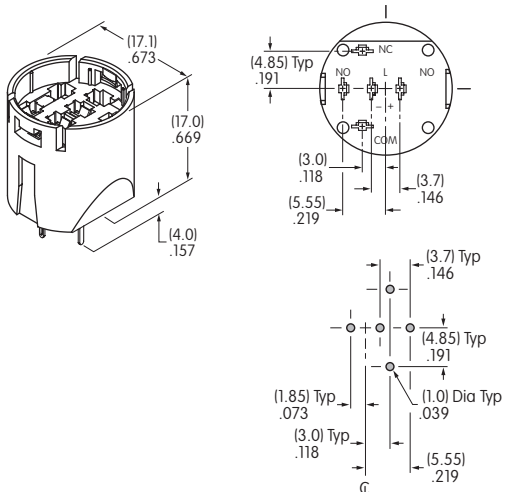
AT716
Single Pole
Solder Lug/
Quick Connect
Terminals



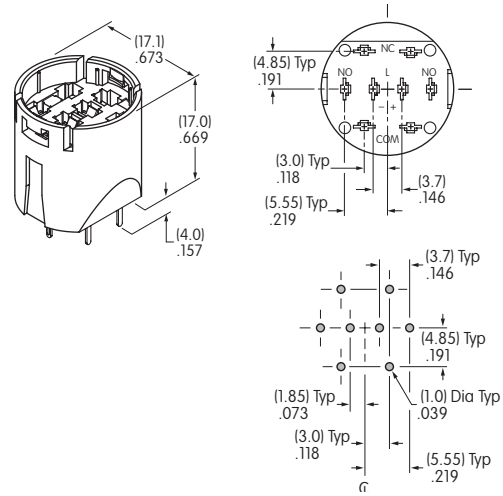
AT717
Double Pole
Solder Lug/
Quick Connect
Terminals



AT718
Single Pole
Straight PC
Terminals



AT719
Double Pole
Straight PC
Terminals



Material: Glass fiber reinforced polyamide Note: Order adaptors separately

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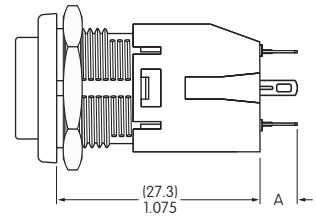
Switch Dimensions Shown with Adaptor AT716

Dimension A: Solder Lug .197" (5.0mm); Straight PC .157" (4.0mm)

Panel thickness for LP01 Bushing Mount: .079" ~ .256" (2.0mm ~ 6.5mm)



LEGENDS

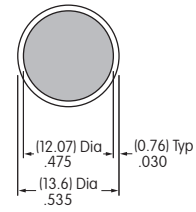
NKK Switches can provide custom legends for caps. Contact factory for more information.

Suggested Printable Area for LP01 Cap

Recommended Methods:

Pad Print or Laser Etch on cap.

Epoxy based ink is recommended.



Shaded area is printable area

General Specifications

Electrical Capacity (Resistive Load)

Logic Level: 0.4VA maximum @ 28V AC/DC maximum
(Applicable Range 0.1mA ~ 0.1A @ 20mV ~ 28V)

Other Ratings

Contact Resistance: 50 milliohms maximum
Insulation Resistance: 500 megohms minimum @ 250V DC
Dielectric Strength: 250V AC minimum between contacts for 1 minute minimum
Mechanical Life: 500,000 operations minimum
Electrical Life: 500,000 operations minimum
Nominal Operating Force: **Standard:** 1.5N ±0.5 Newtons
High: 2.5N ±0.8 Newtons
Stroke: 1.5mm (.059")

Materials & Finishes

Actuator: Silicon rubber
Case: Polycarbonate resin
Base: Glass fiber reinforced polyamide resin
Movable Contact: Silver over nickel with gold plating
Stationary Contacts: Brass with gold plating
Switch Terminals: Brass with gold plating

Environmental Data

Operating Temperature Range: –25°C through +50°C (–13°F through +122°F) for Illuminated
–25°C through +70°C (–13°F through +158°F) for Nonilluminated
Humidity: 90 ~ 95% humidity for 96 hours @ 40°C (104°F)
Vibration: 10 ~ 55Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in 1 minute; 3 right angled directions for 2 hours
Shock: 50G (490m/s^2) acceleration (tested in 6 right angled directions, with 5 shocks in each direction)

Installation

Cap Installation Force: 5.0N maximum downward force on actuator

PCB Processing

Soldering: Wave Soldering: 270°C maximum @ 6 seconds maximum
Manual Soldering: 390°C maximum @ 4 seconds maximum
Cleaning: These devices are not process sealed. Hand clean locally using alcohol based solution.

Standards & Certifications

The NP01 Series pushbuttons have not been tested for UL recognition or CSA certification.
These switches are designed for use in a low-voltage, low-current, logic-level circuit.
When used as intended in a logic-level circuit, the results do not produce hazardous energy.

Distinctive Characteristics

Soft touch actuation achieved by mechanical silicon rubber structure.

Distinct, long stroke of 1.5mm (.059″).

Entire cap is fully illuminated with single or bicolor LED.

Compact design with dimension of 12.5mm (.492″) from PC board to top of cap.

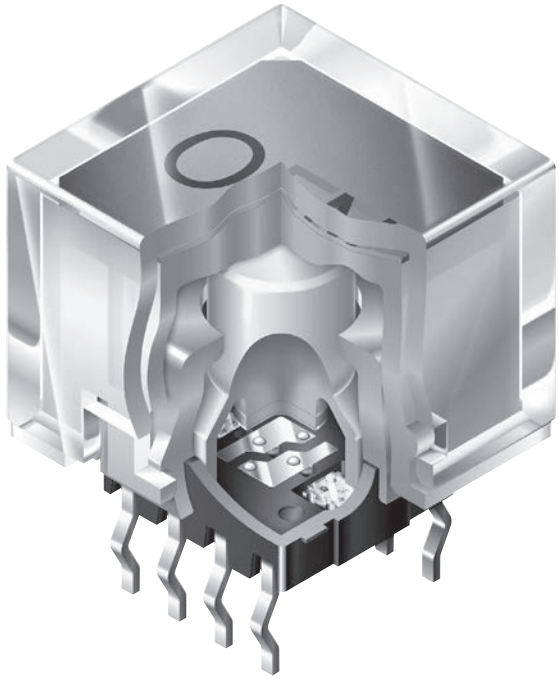
Alternating legend options with bicolor LED.

Available in both high (2.5N) or standard (1.5N) operating force.

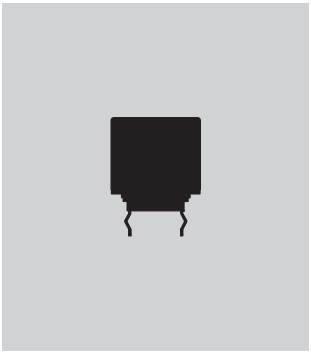
Gold plated contacts provide high reliability.

Crimped terminals ensure secure PC mounting and prevent dislodging during soldering.

Molded-in terminals prevent entry of flux, solvents, and other contaminants.



Actual Size



TYPICAL SWITCH ORDERING EXAMPLE

NP01 | 15 | H | G03 | L | F | – | JF | – | | |

Pole & Circuit

15	SPST	OFF	(ON)

( ) = Momentary Normally Open Contacts

Contacts & Terminals

G03	Gold Contacts and PC Terminals, Rated 0.4VA @ 28V AC/DC

Illumination

L	Illuminated
N	Nonilluminated

Packaging

No Code	Partitioned Tray, Any Quantity (With or without caps installed)
S	Stick-Tube 50 Pieces/Stick (For switch body only; caps packaged separately)

Operating Force

A	Standard (1.5N) (Black Switch Body)
H	High (2.5N) (Gray Switch Body)

LEDs

Single or Bicolor LED

C	Red
D	Amber
F	Green
CF	Bicolor Red/Green
DG	Bicolor Amber/Blue

Bicolor LED

CF	Red/Green
DG	Amber/Blue

Nonilluminated

N	No LED

Cap Types & Colors

Cap Lens/Diffuser Colors

JB	Clear/White (Combine with any LED)
JC	Clear/Red
JD	Clear/Amber
JF	Clear/Green

Bicolor Alternating Legend Caps

JCF	Red/Green
JDG	Amber/Blue

Solid Color Cap

A	Black
B	White
C	Red
H	Gray

Alternating Legends

11	ON (pos)	OFF (pos)
12	ON (neg)	OFF (neg)
13	START	STOP
14	OPEN	CLOSE

Contact factory for custom options.

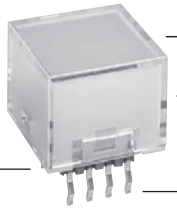
Part Numbers for Alternating Legends

Color	Part Number
Red/Green	AT3023JCF11 ~ AT3023JCF14
Amber/Blue	AT3023JDG11 ~ AT3023JDG14

Refer to Ordering Table for Alternating Legend that corresponds with last 2 digits of part number.

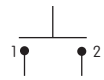
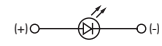
DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

NP0115HG03LF-JF

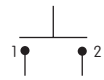


POLE & CIRCUIT

Illuminated Models

Pole	Model	Plunger Position ( ) = Momentary: Normal	Plunger Position ( ) = Momentary: Down	Connected Terminals		Throw & Switch Schematic
						Notes: Switch is marked with LC1, 1, L3, L4, L1, L2, 2, LC2. Lamp circuit is isolated and requires an external power source.
SP	**NP0115AG03L** **NP0115HG03L**	OFF	(ON)	Normally Open	1-2	SPST  

Nonilluminated Models

Pole	Model	Plunger Position ( ) = Momentary: Normal	Plunger Position ( ) = Momentary: Down	Connected Terminals		Throw & Switch Schematic
						Note: Switch is marked with LC1, 1, L3, L4, L1, L2, 2, LC2.
SP	**NP0115AG03N** **NP0115HG03N**	OFF	(ON)	Normally Open	1-2	SPST 

OPERATING FORCE

A **Standard Nominal Operating Force**
1.5 ±0.5N
Switch base is Black

H **High Nominal Operating Force**
2.5 ±0.8N
Switch base is Gray

CONTACTS, TERMINALS, & RATING

G03 **Gold Contacts** | **Straight PC Terminals** | **0.4VA maximum @ 28V AC/DC maximum**

ILLUMINATION

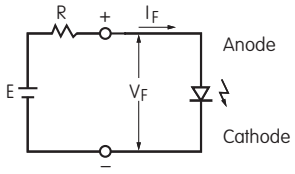
L **Illuminated**

N **Nonilluminated**

LED COLORS & SPECIFICATIONS

LEDs are an integral part of the switch and not available separately. The electrical specifications shown are determined at a basic temperature of 25°C.

If the source voltage exceeds the forward voltage, a ballast resistor is required. Specifications in parentheses ( ) below for Bicolor LED denote simultaneous illumination of Red and Green.



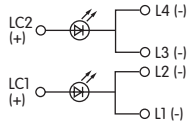
$$R = \frac{E - V_F}{I_F}$$

Where: R = Resistor Value (Ohms)
E = Source Voltage (V)
V_F = Forward Voltage (V)
I_F = Forward Current (A)

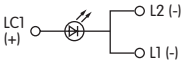
ATTENTION ELECTROSTATIC SENSITIVE DEVICES

		Single Color LED			Bicolor LED			
	Color	C Red	D Amber	F Green	CF Red	CF Green	DG Amber	DG Blue
Maximum Forward Current	I_{FM}	30mA	30mA	25mA	30 (25)mA	25 (25)mA	30mA	30mA
Typical Forward Current	I_F	20mA	20mA	16mA	20 (20)mA	16 (5)mA	20mA	20mA
Forward Voltage	V_F	1.95V	2.0V	3.3V	1.95V	3.3V	2.0V	3.2V
Maximum Reverse Voltage	V_{RM}	5V	5V	5V	5V	5V	5V	5V
Current Reduction Rate	ΔI_F	0.41mA/°C above 25°C	0.38mA/°C above 25°C	0.33mA/°C above 25°C	0.40mA/°C above 25°C	0.33mA/°C above 25°C	0.40mA/°C above 25°C	0.40mA/°C above 25°C
Ambient Temperature Range		–25° ~ +50°C			–25° ~ +50°C			

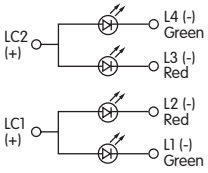
Amber LED



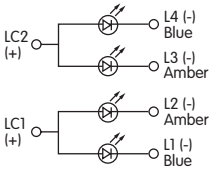
Red or Green LEDs



Red/Green Bicolor LED



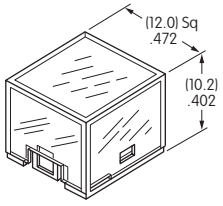
Amber/Blue Bicolor LED



CAP TYPES & COLORS

AT3022
12mm Square Cap

Material:
Polycarbonate Resin

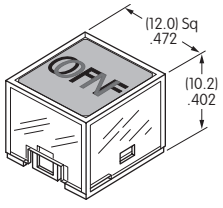


Cap for Single or Bicolor LED

- JB — Clear Lens/White Diffuser
- JC — Clear Lens/Red Diffuser
- JD — Clear Lens/Amber Diffuser
- JF — Clear Lens/Green Diffuser

AT3023
12mm Square Cap

Material:
Polycarbonate Resin



Alternating Legend Cap for Bicolor LED

- JCF — Red/Green
- JDG — Amber/Blue

Clear Lens
Alternating Legend Filter

Standard Alternating Legend Pairs

11	12	13	14
ON / OFF	ON / OFF	START / STOP	OPEN / CLOSE
Green/Red or Blue/Amber	Green/Red or Blue/Amber	Green/Red or Blue/Amber	Green/Red or Blue/Amber

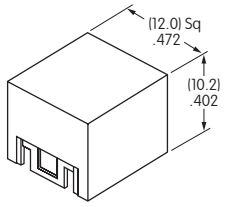
Cap illumination is alternating Green/Red or Blue/Amber; legend text is black.
Contact factory for other Alternating Legends.
Legend illustrations are approximate representations of the actual characters on the filters.

CAP TYPES & COLORS (CONTINUED)

Solid Color Cap for Nonilluminated

AT3024
12mm Square Cap

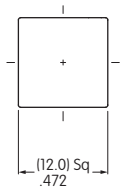
Material:
Polycarbonate Resin

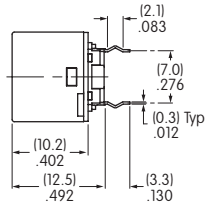


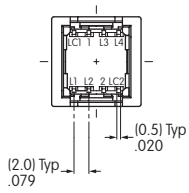
A	Black	C	Red
B	White	H	Gray

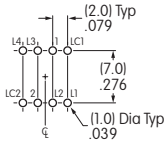
TYPICAL SWITCH DIMENSIONS

Illuminated • Straight PC









NP0115HG03LF-JF

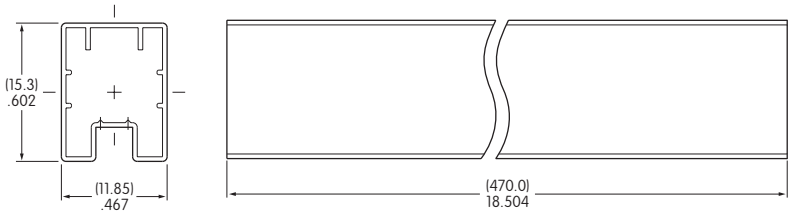
PACKAGING

No Code

Partitioned Tray
Any quantity. No code is required. Switches may be packaged with or without caps installed.

S

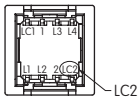
Stick-Tube Packaging
50 pieces per stick
Switches must be ordered in 50-piece increments when stick-tube packaging is selected. This packaging is for the switch body only. Caps will be packaged separately.



LEGEND ORIENTATION

Top View

Bottom View

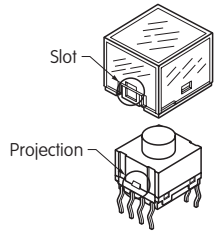


Orient cap with legend as shown here, and "LC2" at lower right of switch body.
Orders for switches with legends will be assembled as illustrated.

PRECAUTIONS FOR HANDLING & STORAGE

1. NP01 Pushbuttons are electrostatically sensitive. To prevent damage to LED, devices must be properly isolated from static electricity.
2. Once the cap is installed onto the switch body, it cannot be removed.
3. When assembling cap, align projection on switch body to slot on inside of cap. (Refer to illustration at right.)
4. * Legends may be printed on the lens with laser etch, screen print or pad print methods. Epoxy based ink is recommended.
5. Do not use excessive force during installation on PC board or for cap installation.

* NKK Switches can provide custom legends for caps. Contact factory for more information.



General Specifications

Electrical Capacity (Resistive Load)

Power Level (silver): 5A @ 125/250V AC or 5A @ 30V DC
Logic Level (gold): 0.4VA maximum @ 28V AC/DC maximum
(Applicable Range 0.1mA ~ 0.1A @ 20mV ~ 28V)
Note: Find additional explanation of operating range in Supplement section.

Other Ratings

Contact Resistance: 50 milliohms maximum for silver; 100 milliohms maximum for gold
Insulation Resistance: 200 megohms minimum @ 500V DC
Dielectric Strength: 1,000V AC minimum between contacts for 1 minute minimum;
1,500V AC minimum between contacts & case for 1 minute minimum
Mechanical Life: 1,000,000 operations minimum for momentary;
200,000 operations minimum for alternate action
Electrical Life: 10,000 operations minimum for silver;
100,000 operations minimum for silver with resistive load of 3A @ 125V AC
200,000 operations minimum for gold
Nominal Operating Force: Single Pole: 1.9N for Square & 1.9N for Rectangular
Double Pole: 2.55N for Square & 3.1N for Rectangular
Contact Timing: Break before make
Travel: Pretravel .067" (1.7mm); Overtravel .024" (0.6mm); Total Travel .091" (2.3mm)

Materials & Finishes

Housing/Bezel: Glass fiber reinforced polyamide (UL94V-0)
Snap-in Frame: Stainless steel
Movable Contactor: Phosphor bronze
Movable Contacts: Silver alloy or copper with gold plating
Stationary Contacts: Silver alloy or copper with gold plating
Switch Terminals: Phosphor bronze with silver or gold plating
Lamp Terminals: Brass with silver plating
Base: Glass fiber reinforced liquid crystal polymer (UL94V-0)

Environmental Data

Operating Temperature Range: –25°C through +50°C (–13°F through +122°F) for Illuminated
–20°C through +70°C (–4°F through +158°F) for Nonilluminated
Humidity: 90 ~ 95% humidity for 96 hours @ 40°C (104°F)
Vibration: 10 ~ 55Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in 1 minute; 3 right angled directions for 2 hours
Shock: 50G (490m/s^2) acceleration (tested in 6 right angled directions, with 5 shocks in each direction)

Installation

Cap Installation Force: 7.55N (1.70 lbf) maximum downward force on cap
Soldering Time & Temp: Wave Soldering (PC version): See Profile A in Supplement section.
Manual Soldering: See Profile A in Supplement section.
Cleaning: These devices are not process sealed. Hand clean locally using alcohol based solution.

Standards & Certifications

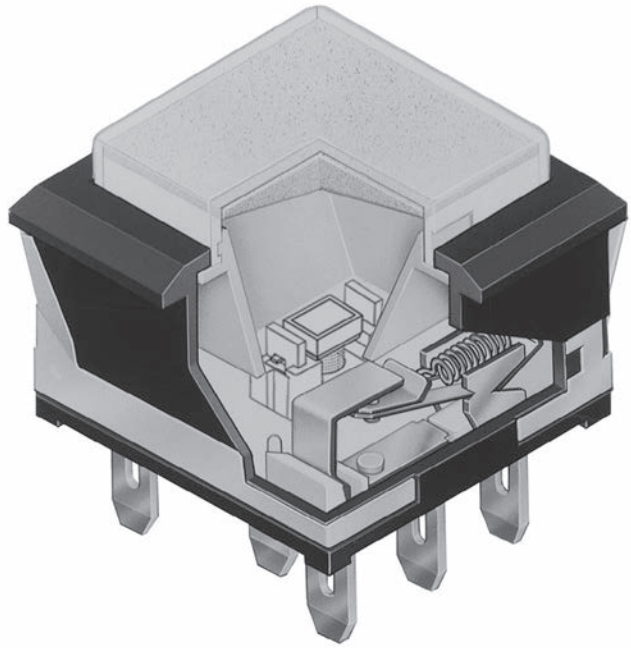
Flammability Standards: UL94V-0 housing/bezel & base
UL: **File No. E44145 - Recognized only when ordered with marking on switch.**
Add "/U" or "/CUL" before dash in part number to order UL recognized switch.
UL recognized only when ordered switch body with cap assembled.
All single & double pole models recognized at 5A @ 125/250V AC or 0.014A @ 28V DC.
CSA: **File No. 023535_0_000 - Certified only when ordered with marking on switch.**
Add "/C" before dash in part number to order CSA certified switch.
All single & double pole models certified at 5A @ 125/250V AC or 5A @ 30V DC or 0.4VA maximum @ 28V AC/DC maximum.

Distinctive Characteristics

Red/green and amber/blue bicolors with alternating standard or custom legends. Super bright LED provides brilliant uniform illumination.

Bright or super bright LEDs (an integral part of the switch) of red, amber, green, blue, or white, in full face or spot illumination plus square or rectangular models.

Combination of PCB mountability and short body allows use in compact applications.



Small behind panel dimension for snap-in mounting in tight spaces.

Snap-acting contact mechanism provides sensitive actuation with audible feedback; quick-make, quick-break characteristic limits arcing and prolongs electrical life.

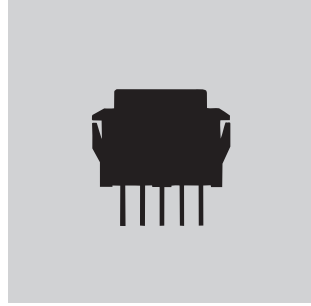
Latchdown mechanism, independent of switching mechanism, gives visible and tactile indication of circuit status.

Terminals are epoxy sealed to lock out flux, solvents, and other contaminants.

Momentary and alternate action circuits available in the same space-saving body size.

Matching indicators available.

Actual Size



Series UB

Low Profile Pushbuttons

TYPICAL SWITCH

UB | 1 | 5 | SK | G | 03

Poles

1	SPDT
2	DPDT

Circuits

5	ON	(ON)

( ) = Momentary

6	ON	ON

Alternate Action with Latchdown

Mounting Types

PCB Mounting	
SK	Square
RK	Rectangular
*** Snap-in Mounting**	
KK	Square
NK	Rectangular
NBK	Rectangular with Side Barriers

* Standard with Solder Lug terminals

Contacts & Ratings

W	Silver Rated 5A @ 125/250V AC
G	Gold Rated 0.4VA max @ 28V AC/DC max

Terminals

01	Solder Lug (for Snap-in Mounting)
03	Straight PC

IMPORTANT:

Switches are supplied without UL, cULus & CSA marking unless specified. **UL, cULus & CSA recognized only when ordered with marking on the switch.** Specific models, ratings, & ordering instructions are noted on General Specifications page.

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

UB15SKG035C-CC

Gold Contacts with 0.4VA Rating

Square with PCB Mounting

Red, Bright LED & Red Lens with Red Diffuser

SPDT ON-(ON) Circuit

Straight PC Terminals

ORDERING EXAMPLE

5C — CC —

LEDS

Bright LED

5C	Red
5D	Amber
5F	Green

Super Bright LED

6B	White
6F	Green
6G	Blue

Super Bright Bicolor LED

6CF	Red/Green
6DG	Amber/Blue

Nonilluminated

N	Nonilluminated

Cap Types & Colors

Full Face Illuminated Cap for Bright LED

Lens/Diffuser Colors

CB	Red/White	**FF**	Green/Green
CC	Red/Red	***FJ**	Green/Clear
***CJ**	Red/Clear	**JB**	Clear/White
DB	Amber/White	**JC**	Clear/Red
DD	Amber/Amber	**JD**	Clear/Amber
***DJ**	Amber/Clear	**JF**	Clear/Green
FB	Green/White	***JJ**	Clear/Clear
AB	Square & Rectangular Spot Illuminated Black Cap with White Window		

* Not available with Rectangular cap

Full Face Illuminated Cap for Super Bright LED

JB	Clear Lens/White Diffuser
AB	Spot Illuminated Black Cap with White Window

Alternating Legend Cap/Diffuser

JCF	Red/Green
JDG	Amber/Blue

Nonilluminated Cap Colors

A	Black	**E**	Yellow
B	White	**F**	Green
C	Red	**G**	Blue

— [ ]

Alternating Legends

11	ON (pos)	OFF (pos)
12	ON (neg)	OFF (neg)
13	START	STOP
14	OPEN	CLOSE

Part Numbers for Alternating Legends

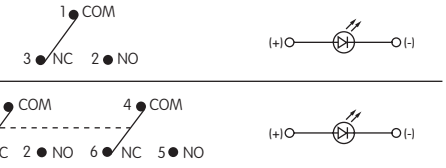
Square Alternating Legends				Rectangular Alternating Legends			
Color	Part Number	Color	Part Number	Color	Part Number	Color	Part Number
Red/Green	AT9450CF11	Amber/Blue	AT9450DG11	Red/Green	AT9451CF11	Amber/Blue	AT9451DG11
	AT9450CF12		AT9450DG12		AT9451CF12		AT9451DG12
	AT9450CF13		AT9450DG13		AT9451CF13		AT9451DG13
	AT9450CF14		AT9450DG14		AT9451CF14		AT9451DG14

Refer to Ordering Table for Alternating Legend that corresponds with last 2 digits of part number.

POLES & CIRCUITS

Pole	Model	Plunger Position ( ) = Momentary: Normal	Plunger Position ( ) = Momentary: Down	Connected Terminals: Normal	Connected Terminals: Down	Throw & Switch/Lamp Schematics
SP	**UB15** ***UB16**	ON ON	(ON) ON	1-3	1-2	SPDT
DP	**UB25** ***UB26**	ON ON	(ON) ON	1-3 4-6	1-2 4-5	DPDT

Notes: Switch is marked with NC, NO, COM, L+ & L–. Lamp circuit is isolated and requires an external power source.

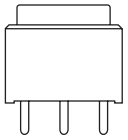


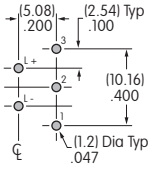
* When in latchdown position for the alternate circuit, cap position is .039" (1.0mm) above the housing.

MOUNTING TYPES & SHAPES

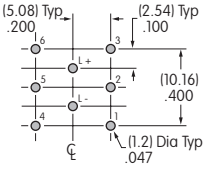
PCB Mounting

SK Square



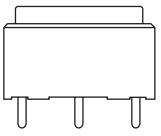


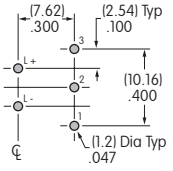
Single Pole



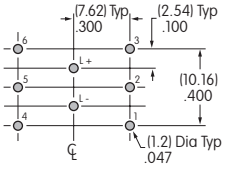
Double Pole

RK Rectangular





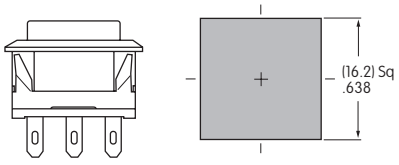
Single Pole



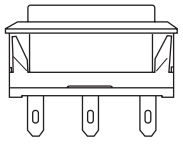
Double Pole

Snap-in Mounting (Solder Lug)

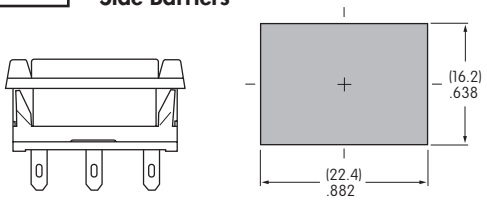
KK Square with Built-in Bezel



NK Rectangular with Built-in Bezel



NBK Rectangular with Built-in Side Barriers



Snap-in Mounting with Solder Lug terminals is the standard combination. Panel Thickness: .039 ~ .126" (1.0 ~ 3.2mm)

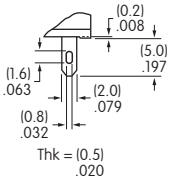
CONTACT MATERIALS & RATINGS

W	**Silver Contacts**	**Power Level**	**5A @ 125V AC & 250V AC**
G	**Gold Contacts**	**Logic Level**	**0.4VA maximum @ 28V AC/DC maximum**

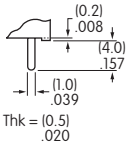
Complete explanation of operating range in Supplement section.

TERMINALS

01 Solder Lug



03 Straight PC

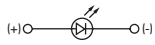


BRIGHT & SUPER BRIGHT LED COLORS & SPECIFICATIONS

The electrical specifications shown are determined at a basic temperature of 25°C. LED circuit is isolated and requires external power source. Polarity marks are on bottom of switch. If the source voltage exceeds the rated voltage, a ballast resistor is required. Resistor value can be calculated by using the formula in the Supplement section. LED is an integral part of switch and not available separately.

Super Bright LEDs are Electrostatic Sensitive

ATTENTION ELECTROSTATIC SENSITIVE DEVICES



		Bright			Super Bright			
	Color	5C Red	5D Amber	5F Green	6B White	6F Green	6G Blue	Unit
Maximum Forward Current	I_{FM}	30	30	25	30	30	30	mA
Typical Forward Current	I_F	20	20	20	20	20	20	mA
Forward Voltage	V_F	1.85	2.0	2.1	3.2	3.2	3.2	V
Maximum Reverse Voltage	V_{RM}	5	5	5	5	5	5	V
Current Reduction Rate Above 25°C	ΔI_F	0.40	0.42	0.46	0.40	0.40	.040	mA/°C
Ambient Temperature Range		−25° ~ +50°C			−25° ~ +50°C			

N **No Lamp**

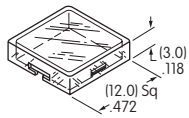
CAP TYPES & COLOR COMBINATIONS

Full Face Illuminated Cap for Bright LED

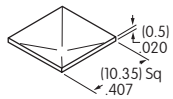
Lens/Diffuser Colors Available for Square Cap:

CB DD FJ JF
CC DJ JB JJ
CJ FB JC
DB FF JD

AT4074 Lens



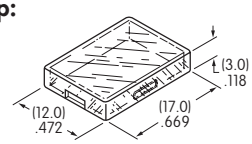
AT4075 Diffuser



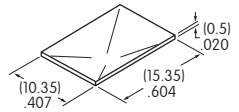
Lens/Diffuser Colors Available for Rectangular Cap:

CB FB JD
CC FF JF
DB JB
DD JC

AT4117 Lens



AT4118 Diffuser



Lens & Diffuser Material: Polycarbonate Lens Finish: Glossy Diffuser Finish: Textured

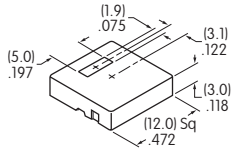
Spot Illuminated Caps for Bright & Super Bright LEDs

Cap/Window Colors Available:

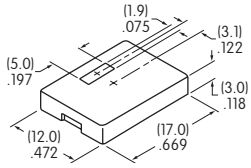
AB **Black Cap with Translucent White Window for LED Display**

Material: Polycarbonate Finish: Matte

AT4119 Square for Bright and Super Bright LED



AT4120 Rectangular for Bright and Super Bright LED

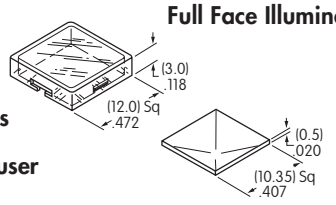


Full Face Illuminated Caps for Super Bright Bicolor LED

JB

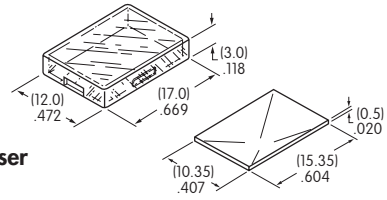
AT4074 Square Lens

AT4188 Square Diffuser



AT4117 Rectangular Lens

AT4189 Rectangular Diffuser



Lens & Diffuser Material: Polycarbonate Lens Finish: Glossy Diffuser Finish: Textured

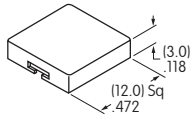
Opaque Caps for Nonilluminated

Cap Colors Available:

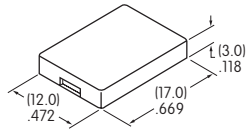
A C F
B E G

Material: Polycarbonate
Finish: Glossy

AT4073 Square



AT4116 Rectangular



Color Codes: **A** Black **B** White **C** Red **D** Amber **E** Yellow **F** Green **G** Blue **J** Clear

SUPER BRIGHT BICOLOR LEDS FOR ALTERNATING LEGENDS

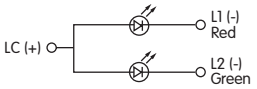
The electrical specifications shown are determined at a basic temperature of 25°C. LED circuit is isolated and requires external power source. Polarity marks are on bottom of switch. If the source voltage exceeds the rated voltage, a ballast resistor is required. Resistor value can be calculated by using the formula in the Supplement section. LED is an integral part of switch and not available separately.

Electrical Specifications for Super Bright Bicolor LEDs

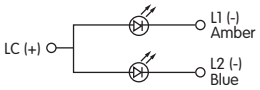
Super Bright LEDs are Electrostatic Sensitive — ATTENTION ELECTROSTATIC SENSITIVE DEVICES		6CF Red/Green		6DG Amber/Blue		
	Color	Red	Green	Amber	Blue	Unit
Maximum Forward Current	I_{FM}	* 30	* 30	* 30	* 30	mA
Typical Forward Current	I_F	20	20	20	20	mA
Forward Voltage	V_F	2.3	3.2	2.1	3.0	V
Maximum Reverse Voltage	V_{RM}	4	4	4	4	V
Current Reduction Rate Above 25°C	ΔI_F	0.33	0.33	0.33	0.33	mA/°C
Ambient Temperature Range		−25° ~ +50°		−25° ~ +50°		°C

* Value applies to single color illumination for either Red or Green or Amber or Blue. When both colors are illuminated simultaneously, the sum of the currents should not exceed the smallest value of the maximum forward current.

Super Bright Bicolor Red/Green LED with 2 elements



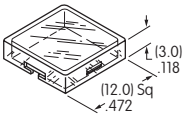
Super Bright Bicolor Amber/Blue LED with 2 elements



Alternating Legend Caps for Super Bright Bicolor LED

JCF **JDG**

AT4074 12.0mm Square Flat Cap

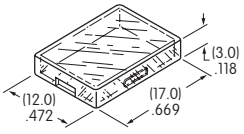


AT9450 Square Legend Insert

AT4188 Square Diffuser

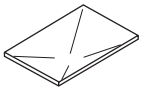
JCF **JDG**

AT4117 12.0mm x 17.0mm Rectangular Flat Cap



AT9451 Rectangular Legend Insert

AT4189 Rectangular Diffuser



Lens & Diffuser Material: Polycarbonate Legend Insert Material: Polyethylene Terephthalate (PET)

Lens Finish: Glossy Diffuser Finish: Textured

Standard Alternating Legend Pairs

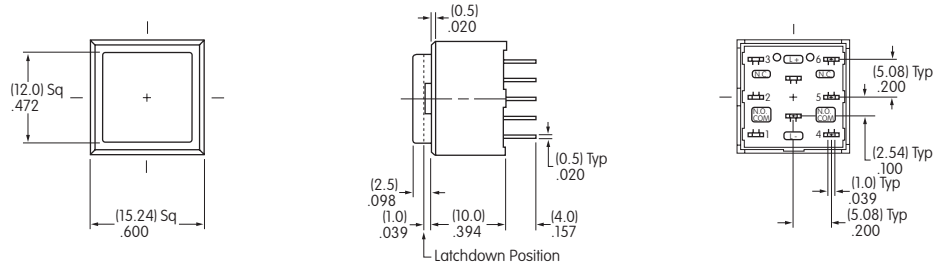
11	12	13	14
ON / OFF	ON / OFF	START / STOP	OPEN / CLOSE
Green/Red or Blue/Amber	Green/Red or Blue/Amber	Green/Red or Blue/Amber	Green/Red or Blue/Amber

Cap illumination is alternating Green/Red or Blue/Amber; legend text is black.
Contact factory for other Alternating Legends.

Legend illustrations are approximate representations of the actual characters on the filters.

TYPICAL SWITCH DIMENSIONS

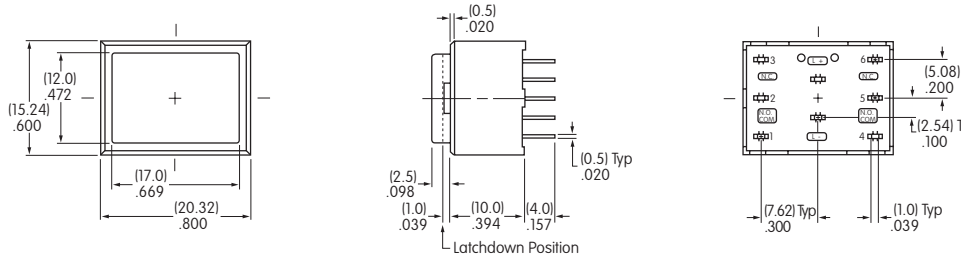
Single & Double Pole — Square • PCB Mount



Single pole models do not have terminals 4, 5, & 6.

UB15SKG035C-CB

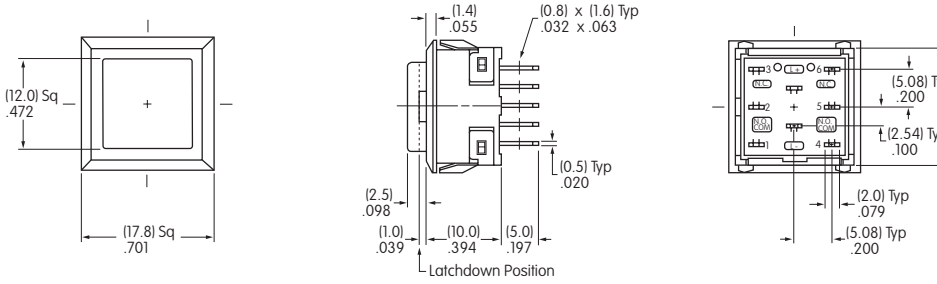
Single & Double Pole — Rectangular • PCB Mount



Single pole models do not have terminals 4, 5, & 6.

UB26RKG035D-DD

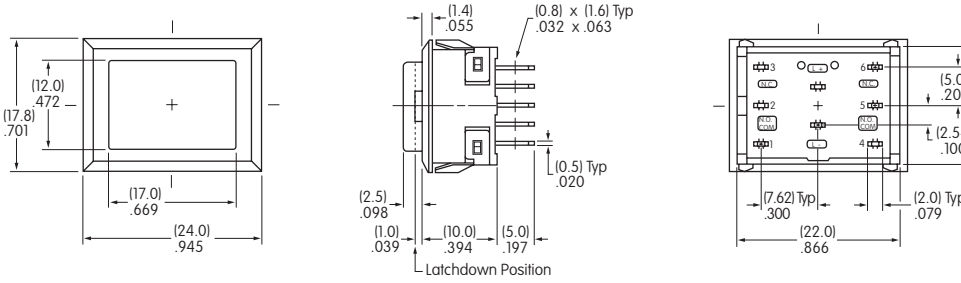
Single & Double Pole — Square • Snap-in Mount • Built-in Bezel



Single pole models do not have terminals 4, 5, & 6.

UB25KKW015C-CB

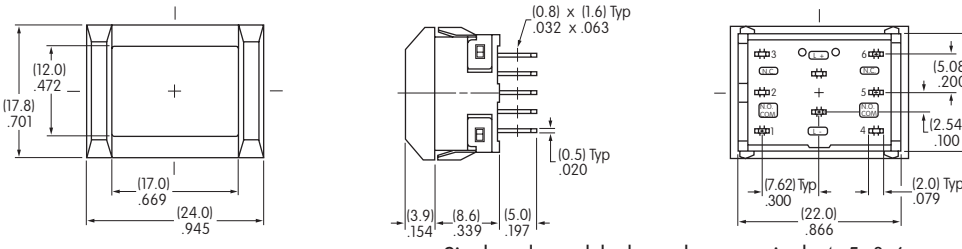
Single & Double Pole — Rectangular • Snap-in Mount • Built-in Bezel



Single pole models do not have terminals 4, 5, & 6.

UB26NKW015F-FF

Single & Double Pole — Rectangular • Snap-in Mount • Built-in Side Barriers

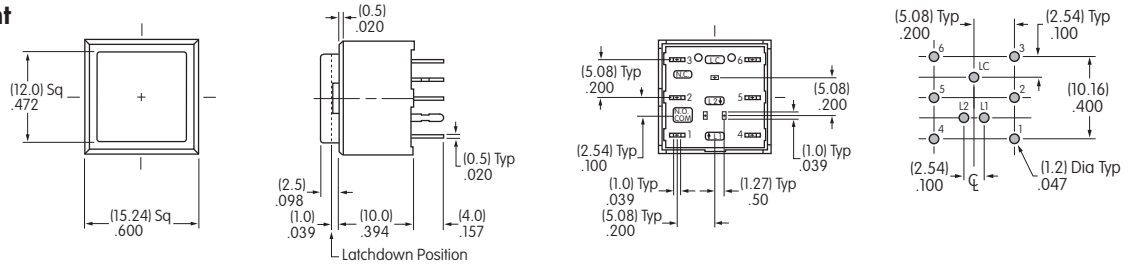


Single pole models do not have terminals 4, 5, & 6.

UB25NBKW015F-FB

TYPICAL SWITCH DIMENSIONS

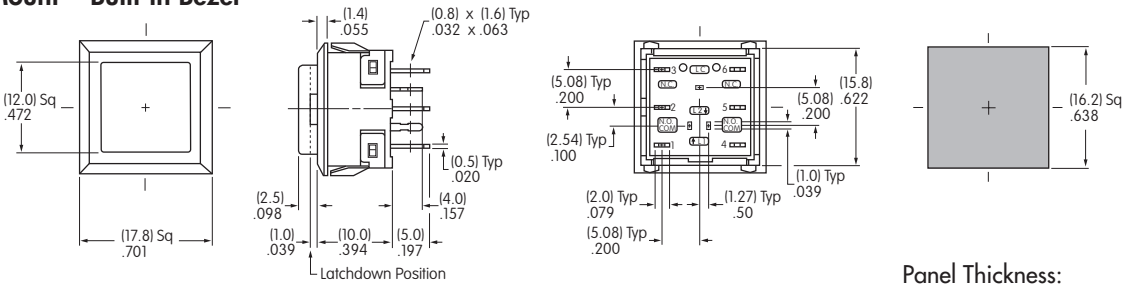
Square • PCB Mount



UB25SKG036DG-JDG11

Single pole models do not have terminals 4, 5, & 6.

Square • Snap-in Mount • Built-in Bezel

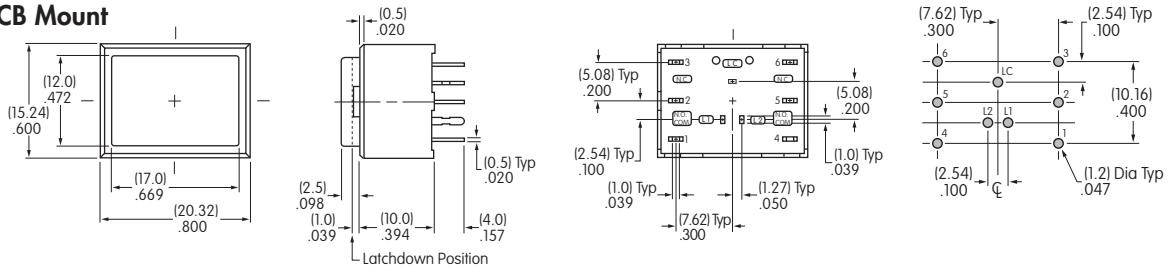


UB25KKW016DG-JDG11

Single pole models do not have terminals 4, 5, & 6.

Panel Thickness:
(1.0 ~ 3.2mm) .039 ~ .126"

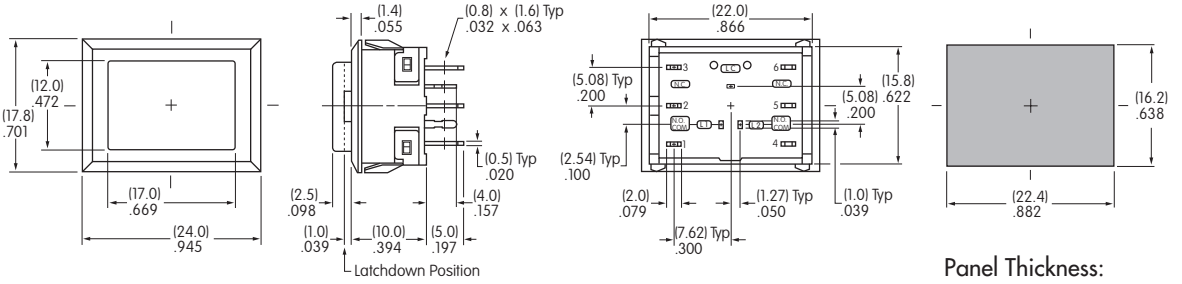
Rectangular • PCB Mount



UB25RKG036DG-JDG11

Single pole models do not have terminals 4, 5, & 6.

Rectangular • Snap-in Mount • Built-in Bezel

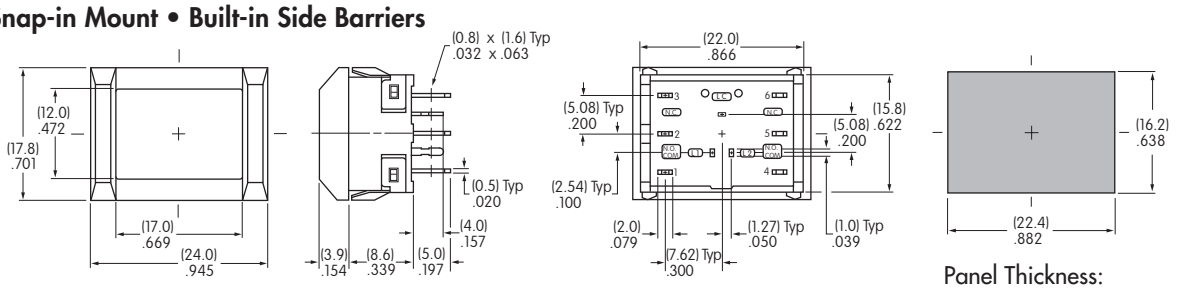


UB26NKW016DG-JDG11

Single pole models do not have terminals 4, 5, & 6.

Panel Thickness:
(1.0 ~ 3.2mm) .039 ~ .126"

Rectangular • Snap-in Mount • Built-in Side Barriers



UB26NBKW016DG-JDG11

Single pole models do not have terminals 4, 5, & 6.

Panel Thickness:
(1.0 ~ 3.2mm) .039 ~ .126"

OPTIONAL ACCESSORIES

Spring Loaded Protective Guard for Snap-in Mounting of Square PCB Model

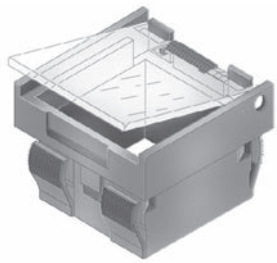
AT4173
Square Protective Guard/ Snap-in Frame

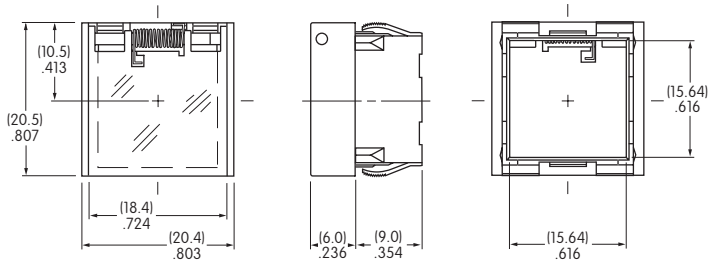
Opens 180°
Closes automatically

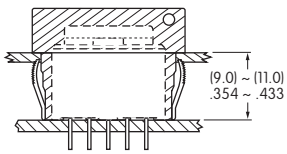
Materials:
Cover: Clear Polycarbonate
Base: Black Polyamide
Coil Spring: Stainless Steel

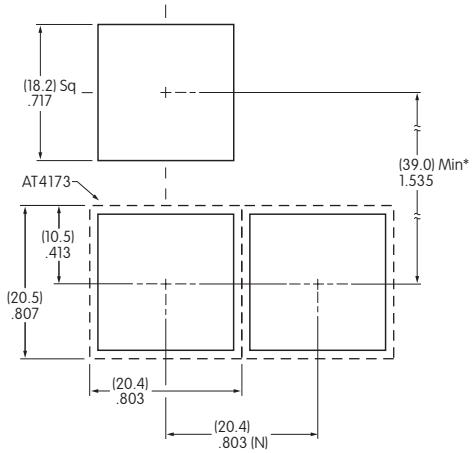
Recommended Panel Thickness:
.039" ~ .126"
(1.0mm ~ 3.2mm)

Recommended Panel-to-PCB Range:
.354" ~ .433"
(9.0mm ~ 11.0mm)

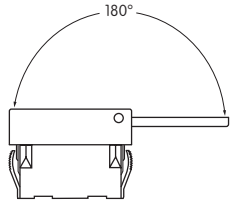






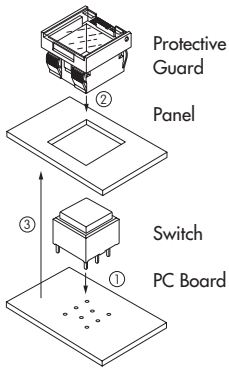


(N) = Number of switches
* Minimum dimension allows opening of cover to 180°



Installation

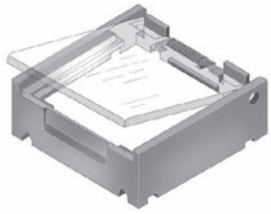
1. Install switch onto PC board.
2. Snap protective guard into panel.
3. Join the two assemblies.

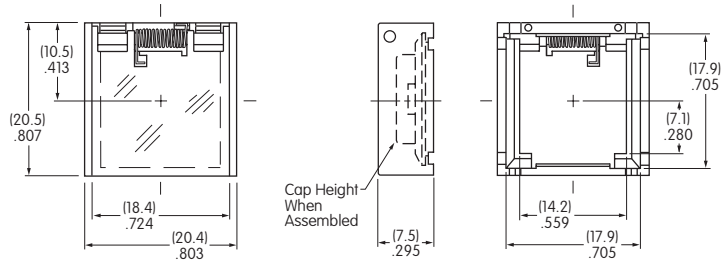


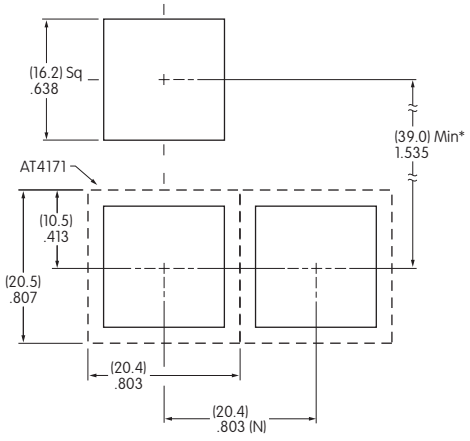
Spring Loaded Protective Guard for Square Snap-in Model

AT4171
Square Protective Guard

Opens 180°
Closes automatically



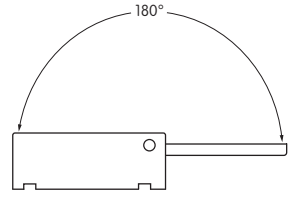




(N) = Number of switches * Minimum dimension allows opening of cover to 180°

Materials:
Cover: Clear Polycarbonate
Base: Black GFR Polyamide
Coil Spring: Stainless Steel

Recommended Panel Thickness:
.039" ~ .106" (1.0mm ~ 2.7mm)

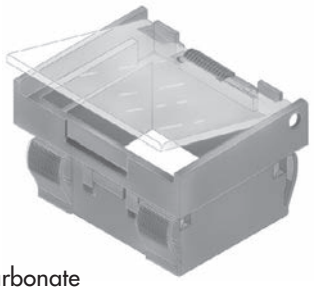


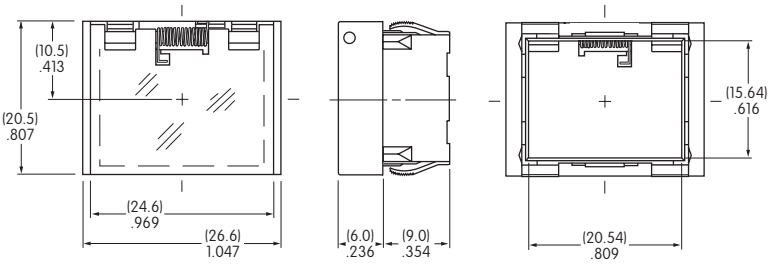
OPTIONAL ACCESSORIES

Spring Loaded Protective Guard for Snap-in Mounting of Rectangular PCB Model

AT4174
Rectangular Protective Guard/ Snap-in Frame

Opens 180°
Closes automatically

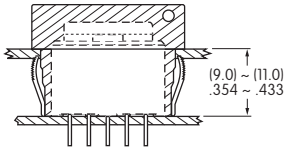


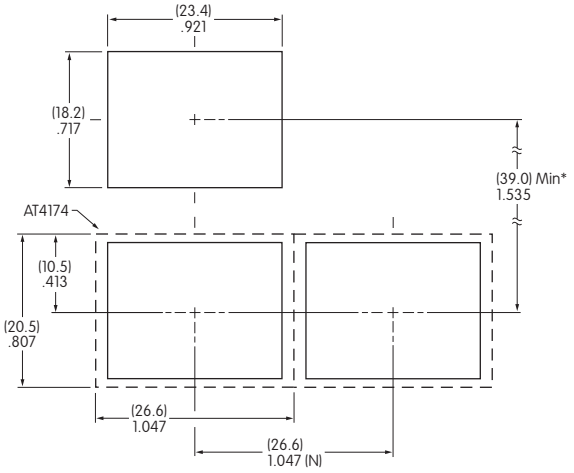


Materials:
Cover: Clear Polycarbonate
Base: Black Polyamide
Coil Spring: Stainless Steel

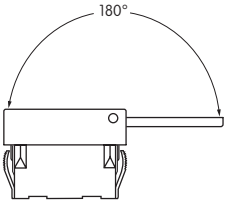
Recommended Panel Thickness:
.039" ~ .126"
(1.0mm ~ 3.2mm)

Recommended Panel-to-PCB Range:
.354" ~ .433"
(9.0mm ~ 11.0mm)



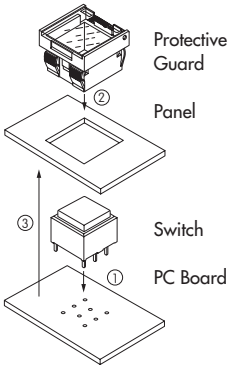


(N) = Number of switches * Minimum dimension allows opening of cover to 180°



Installation

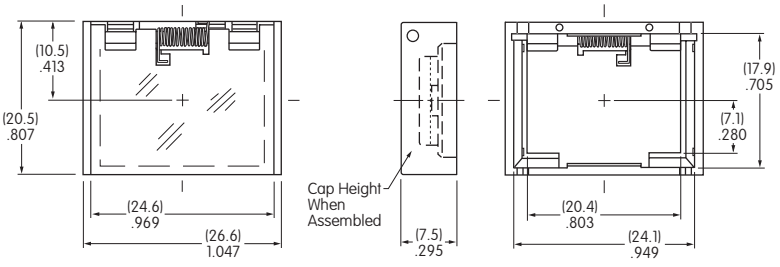
1. Install switch onto PC board.
2. Snap protective guard into panel.
3. Join the two assemblies.

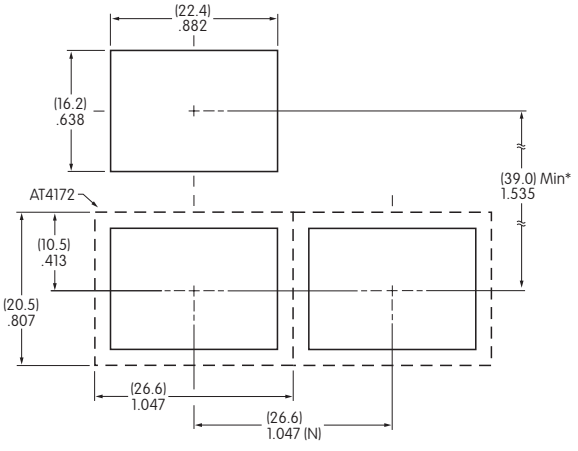


Spring Loaded Protective Guard for Rectangular Snap-in Model

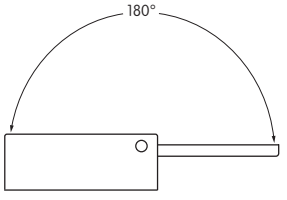
AT4172
Rectangular Protective Guard

Opens 180°
Closes automatically





(N) = Number of switches * Minimum dimension allows opening of cover to 180°

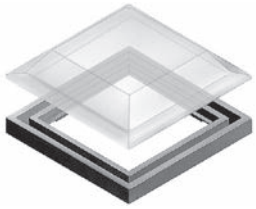


Materials:
Cover: Clear Polycarbonate
Base: Black GFR Polyamide
Coil Spring: Stainless Steel

Recommended Panel Thickness:
.039" ~ .106" (1.0mm ~ 2.7mm)

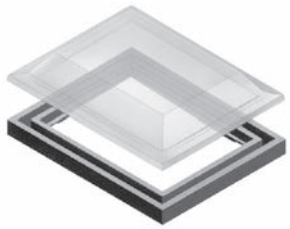
OPTIONAL ACCESSORIES

AT4001
Square



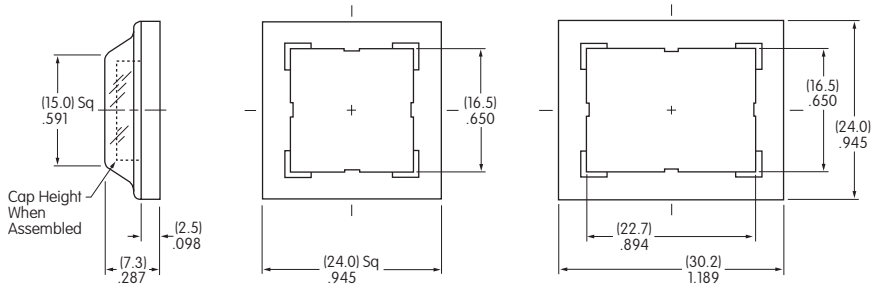
Only for use with KK mounting type

AT4011
Rectangular



Only for use with NK mounting type

Dust Covers



Materials:
PVC with polyethylene gasket
(PVC loses pliability below 0°C (32°F).)

Recommended Panel Thickness: .039″ ~ .098″ (1.0mm ~ 2.5mm)

LEGENDS

NKK Switches can provide custom legends for caps. Contact factory for more information.

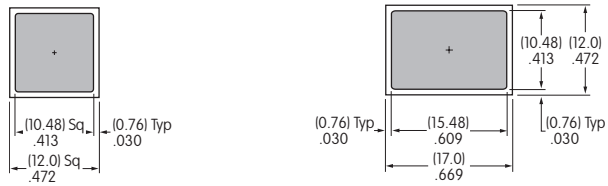
Suggested Printable Area for UB Lens & Film Insert

Recommended Methods: Laser Etch on clear lens, Screen Print or Pad Print on lens;
Laser Print on film insert.

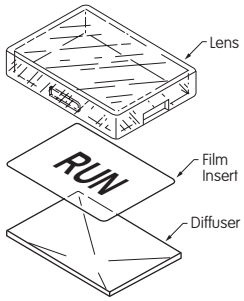
Square Cap

Shaded areas are printable areas.

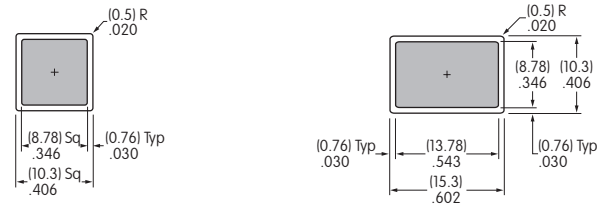
Lens



Rectangular Cap



Film Insert



Film Insert: Clear Polyester 0.15mm max. thickness

General Specifications

Electrical Capacity (Resistive Load)

Power Level (silver): 5A @ 125/250V AC or 5A @ 30V DC
Logic Level (gold): 0.4VA maximum @ 28V AC/DC maximum
(Applicable Range 0.1mA ~ 0.1A @ 20mV ~ 28V)
Note: Find additional explanation of operating range in Supplement section.

Other Ratings

Contact Resistance: 50 milliohms maximum for silver; 100 milliohms maximum for gold
Insulation Resistance: 200 megohms minimum @ 500V DC
Dielectric Strength: 1,000V AC minimum between contacts for 1 minute minimum;
1,500V AC minimum between contacts & case for 1 minute minimum
Mechanical Life: 1,000,000 operations minimum for momentary;
200,000 operations minimum for alternate action
Electrical Life: 10,000 operations minimum for silver;
200,000 operations minimum for gold
Nominal Operating Force: Single Pole: 1.90N
Double Pole: 2.55N
Contact Timing: Break before make
Travel: Pretravel .067" (1.7mm); Overtravel .024" (0.6mm); Total Travel .091" (2.3mm)

Materials & Finishes

Housing/Bezel: Glass fiber reinforced polyamide (UL94V-0)
Snap-in Frame: Stainless steel
Movable Contactor: Phosphor bronze
Movable Contacts: Silver alloy or copper with gold plating
Stationary Contacts: Silver alloy or copper with gold plating
Switch Terminals: Phosphor bronze with silver or gold plating
Lamp Terminals: Brass with tin plating
Base: Glass fiber reinforced liquid crystal polymer (UL94V-0)

Environmental Data

Operating Temperature Range: –25°C through +50°C (–13°F through +122°F) for Illuminated
–25°C through +70°C (–13°F through +158°F) for Nonilluminated
Humidity: 90 ~ 95% humidity for 240 hours @ 40°C (104°F)
Vibration: 10 ~ 55Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in 1 minute; 3 right angled directions for 2 hours
Shock: 50G (490m/s^2) acceleration (tested in 6 right angled directions, with 5 shocks in each direction)

Installation

Cap Installation Force: 15.0N maximum downward force on cap

Processing

Soldering: Wave Soldering (PC version): See Profile A in Supplement section.
Manual Soldering: See Profile A in Supplement section.
Cleaning: These devices are not process sealed. Hand clean locally using alcohol based solution.

Standards & Certifications

Flammability Standards: UL94V-0 housing/bezel & base
UL: **File No. E44145 - Recognized only when ordered with marking on switch.**
Add "/U" or "/CUL" before dash in part number to order UL recognized switch.
UL recognized only when ordered switch body with cap assembled.
All single & double pole models recognized at 5A @ 125/250V AC or 0.014A @ 28V DC.

Distinctive Characteristics

Wide selection of illumination effects is achieved with single and bicolor, 1- or 6-element LEDs in flat, beveled, or sculptured caps.

Alternating legends in choice of sculptured or flat caps, combined with super bright bicolor LED.

Combination of PCB mountability and short body allows use in compact applications.

Small behind panel dimension for snap-in mounting in tight spaces.

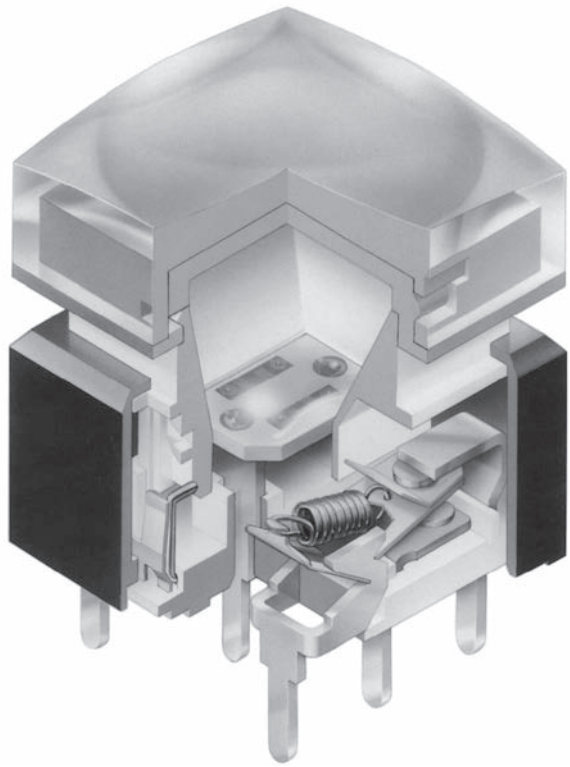
Snap-acting contact mechanism provides sensitive actuation with audible feedback; quick-make, quick-break characteristic limits arcing and prolongs electrical life.

Latchdown mechanism, independent of switching mechanism, gives outstanding stability and reliability plus visible and tactile indication of circuit status.

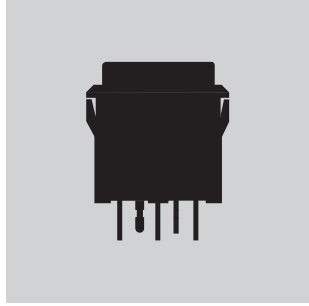
Terminals are epoxy sealed to lock out flux, solvents, and other contaminants.

Momentary and alternate action circuits available in the same space-saving body size.

Matching indicators available.



Actual Size



Series UB2

Low Profile Pushbuttons

TYPICAL SWITCH

UB2 | 1 | 5 | SK | G | 03

Poles

1	SPDT
2	DPDT

Circuits

5	ON	(ON)
( ) = Momentary		
6	ON	ON
Alternate Action with Latchdown		

Mounting Types

PCB Mounting	
SK	Square
* Snap-in Mounting	
KK	Square

* Standard with Solder Lug terminals

Terminals

01	Solder Lug (for Snap-in Mounting)
03	Straight PC

Contacts & Ratings

W	Silver Rated 5A @ 125/250V AC
G	Gold Rated 0.4VA max @ 28V AC/DC max

Part Numbers for Alternating Legends

Color	15mm Square Sculptured Cap	15mm Square Flat Cap
	Part Number	Part Number
Red/Green	AT3069JCF11 ~ AT3069JCF14	AT3070JCF11 ~ AT3070JCF14
Amber/Blue	AT3069JDG11 ~ AT3069JDG14	AT3070JDG11 ~ AT3070JDG14

Refer to Ordering Table for Alternating Legend that corresponds with last 2 digits of part number.

IMPORTANT:

Switches are supplied without UL & cULus marking unless specified. **UL & cULus recognized only when ordered with marking on switch.** Specific models, ratings, & ordering instructions are noted on the General Specifications page.

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

UB215SKG035C-1JC

Gold Contacts with 0.4VA Rating

Square with PCB Mounting

Straight PC Terminals

Red, Bright LED and Sculptured Cap with Clear Lens and Red Diffuser

SPDT ON-(ON) Circuit

ORDERING EXAMPLE

5C — 1JC [ ]

LEDS

Bright LED	
5C	Red
5D	Amber
5F	Green

Super Bright LED	
6B	White
6F	Green
6G	Blue

Super Bright Bicolor LED	
6CF	Red/Green
6DG	Amber/Blue

Nonilluminated	
N	Nonilluminated

Cap Types & Colors

Sculptured Cap Lens/Diffuser Colors	
1JB	Clear/White
1JC	Clear/Red
1JD	Clear/Amber
1JF	Clear/Green
Beveled Cap & Colors	
2B	White
2C	Red
2D	Amber
2F	Green
Flat Cap Lens/Diffuser Colors	
3JB	Clear/White
3JC	Clear/Red
3JD	Clear/Amber
3JF	Clear/Green

Sculptured Cap Lens/Diffuser Color	
1JB	Clear/White
Beveled Cap & Color	
2B	White
Flat Cap Lens/Diffuser Color	
3JB	Clear/White

Sculptured Cap Lens/Diffuser Color	
1JB	Clear/White
Beveled Cap & Color	
2B	White
Flat Cap Lens/Diffuser Color	
3JB	Clear/White
Sculptured Cap with Alternating Legend	
4JCF	Clear; Red/Green
4JDG	Clear; Amber/Blue
Flat Cap with Alternating Legend	
5JCF	Clear; Red/Green
5JDG	Clear; Amber/Blue

Sculptured Cap Lens/Insert Colors			
4JA	Clear/Black	4JD	Clear/Amber
4JB	Clear/White	4JF	Clear/Green
4JC	Clear/Red		
Beveled Cap & Colors			
5A	Black	5D	Amber
5B	White	5F	Green
5C	Red		

Alternating Legends

11	ON (pos)	OFF (pos)
12	ON (neg)	OFF (neg)
13	START	STOP
14	OPEN	CLOSE

See Part Numbers Table on Previous Page.

Contact factory for custom options.

POLES & CIRCUITS

Pole	Model	Plunger Position ( ) = Momentary: Normal	Plunger Position ( ) = Momentary: Down	Connected Terminals: Normal	Connected Terminals: Down	Throw & Switch/Lamp Schematics
SP	**UB215** ***UB216**	ON ON	(ON) ON	1-3	1-2	SPDT
DP	**UB225** ***UB226**	ON ON	(ON) ON	1-3 4-6	1-2 4-5	DPDT

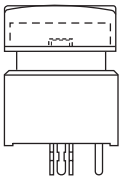
Notes: Switch is marked with NC, NO, COM, L+ & L–. Lamp circuit is isolated and requires an external power source.

* When in latchdown position for the alternate circuit, cap positions above the housing are: .059" (1.5mm) for snap-in models & .276" (7.0mm) for PCB models.

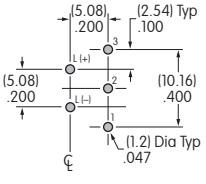
MOUNTING TYPES & SHAPES

PCB Mounting

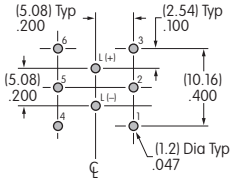
SK **Square**



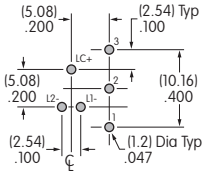
SP, Single Color LED



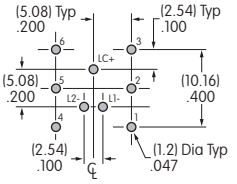
DP, Single Color LED



SP, Bicolor LED

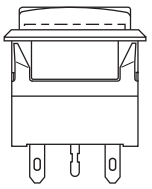


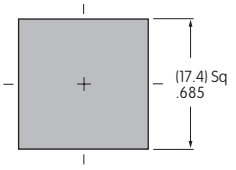
DP, Bicolor LED



Snap-in Mounting (Solder Lug)

KK **Square with Built-in Bezel**





Panel Thickness: .039 ~ .126" (1.0 ~ 3.2mm)

CONTACT MATERIALS & RATINGS

W **Silver Contacts** **Power Level** **5A @ 125V AC & 250V AC**

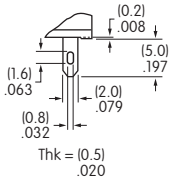
G **Gold Contacts** **Logic Level** **0.4VA maximum @ 28V AC/DC maximum**

Complete explanation of operating range in Supplement section.

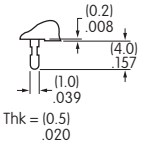
SWITCH & LAMP TERMINALS

01 **Solder Lug**

For Switch & Bright LED

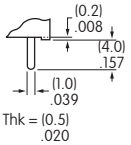


For Super Bright & Bicolor LED

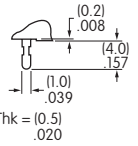


03 **Straight PC**

For Switch & Bright LED



For Super Bright & Bicolor LED



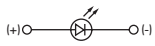
BRIGHT LED & CAPS

The electrical specifications shown are determined at a basic temperature of 25°C.
LED circuit is isolated and requires an external power source. Polarity marks are on the bottom of the switch.
If the source voltage exceeds the rated voltage, a ballast resistor is required.
The resistor value can be calculated by using the formula in the Supplement section.

The LED is an integral part of the switch and not available separately.

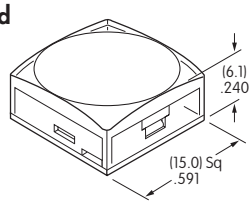
Electrical Specifications for Bright LED

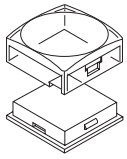
	Color	5C Red	5D Amber	5F Green	Unit
Maximum Forward Current	I_{FM}	30	30	25	mA
Typical Forward Current	I_F	20	20	20	mA
Forward Voltage	V_F	1.85	2.0	2.1	V
Maximum Reverse Voltage	V_{RM}	5	5	5	V
Current Reduction Rate Above 25°C	ΔI_F	0.40	0.42	0.46	mA/°C
Ambient Temperature Range		−25° ~ +50°			°C

Bright Single Color LED with 1 element 

Caps for Bright LED

1 AT3074 Sculptured

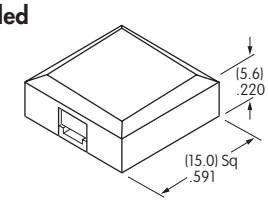


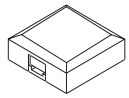


Clear Lens

Translucent Colored Diffuser

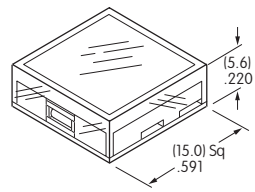
2 AT3075 Beveled

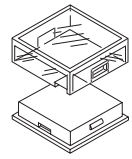




Translucent Colored Cap

3 AT3076 Flat





Clear Lens

Translucent Colored Diffuser

Lens/Diffuser Colors Available:

- JB Clear/White
- JC Clear/Red
- JD Clear/Amber
- JF Clear/Green

Cap Colors Available:

- B White
- C Red
- D Amber
- F Green

Lens/Diffuser Colors Available:

- JB Clear/White
- JC Clear/Red
- JD Clear/Amber
- JF Clear/Green

Material: Polycarbonate Finish: Glossy

SUPER BRIGHT LEDS & CAPS

The electrical specifications shown are determined at a basic temperature of 25°C. LED circuit is isolated and requires an external power source. Polarity marks are on the bottom of the switch. If the source voltage exceeds the rated voltage, a ballast resistor is required. The resistor value can be calculated by using the formula in the Supplement section. The LED is an integral part of the switch and not available separately.

Electrical Specifications for Super Bright LEDS

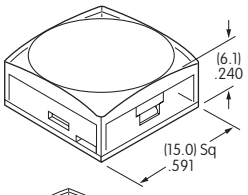
Super Bright LEDs are Electrostatic Sensitive (ATTENTION ELECTROSTATIC SENSITIVE DEVICES)	Color	6B White	6F Green	6G Blue	Unit
Maximum Forward Current	I_{FM}	20	30	30	mA
Typical Forward Current	I_F	15	20	20	mA
Forward Voltage	V_F	3.3	3.5	3.6	V
Maximum Reverse Voltage	V_{RM}	5	5	5	V
Current Reduction Rate Above 25°C	ΔI_F	0.25	0.50	0.50	mA/°C
Ambient Temperature Range		−20° ~ +50°			°C

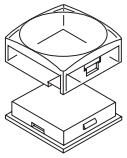
Super Bright Single Color LED with 1 element

Caps for Super Bright LED

1JB

AT3074JB Sculptured Clear Lens/ White Diffuser



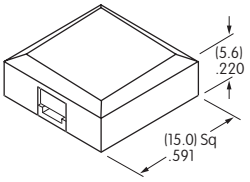


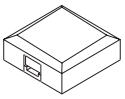
Clear Lens

Translucent White Diffuser

2B

AT3075B Beveled White Cap

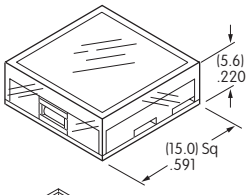


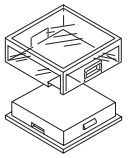


Translucent White Cap

3JB

AT3076JB Flat Clear Lens/ White Diffuser





Clear Lens

Translucent White Diffuser

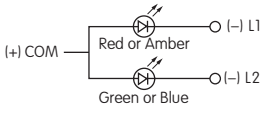
Material: Polycarbonate Finish: Glossy

SUPER BRIGHT BICOLOR LEDS & CAPS

The electrical specifications shown are determined at a basic temperature of 25°C. LED circuit is isolated and requires an external power source. Polarity marks are on the bottom of the switch. If the source voltage exceeds the rated voltage, a ballast resistor is required. The resistor value can be calculated by using the formula in the Supplement section. The LED is an integral part of the switch and not available separately.

Electrical Specifications for Super Bright Bicolor LEDs

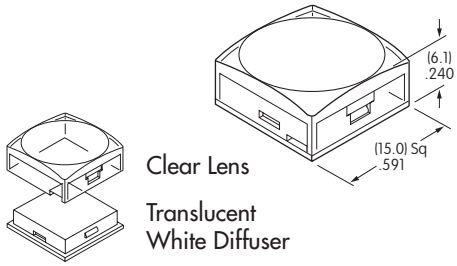
Super Bright LEDs are Electrostatic Sensitive (ATTENTION ELECTROSTATIC SENSITIVE DEVICES)	Color	6CF Red	6CF Green	6DG Amber	6DG Blue	Unit
Maximum Forward Current	I_{FM}	30 * 25 for Amber	25 * 22 for Amber	30	30	mA
Typical Forward Current	I_F	20	20	15	15	mA
Forward Voltage	V_F	2.1	3.5	2.0	2.8	V
Maximum Reverse Voltage	V_{RM}	4	4	4	4	V
Current Reduction Rate Above 25°C	ΔI_F	0.40	0.33	0.33	0.33	mA/°C
Ambient Temperature Range		−20° ~ +50°		−20° ~ +50°		°C

Super Bright Bicolor LED with 2 elements 

* Amber color is achieved by lighting red and green simultaneously, but is not suitable for Alternating Legends.

Caps for Super Bright Bicolor LED

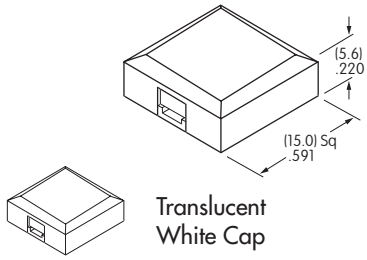
1JB **AT3074JB Sculptured Clear Lens/White Diffuser**



Clear Lens

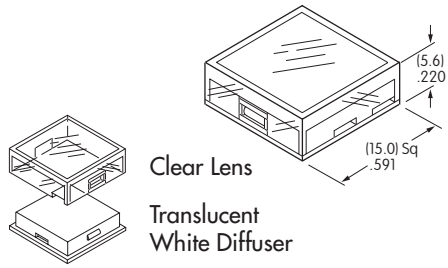
Translucent White Diffuser

2B **AT3075B Beveled White Cap**



Translucent White Cap

3JB **AT3076JB Flat Clear Lens/White Diffuser**



Clear Lens

Translucent White Diffuser

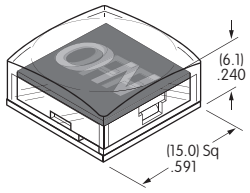
Material: Polycarbonate Finish: Glossy

Alternating Legend Caps for Super Bright Bicolor LED

AT3069J Sculptured Cap with Alternating Legend

4JCF Red/Green

4JDG Amber/Blue



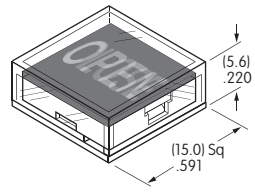
Clear Lens
Alternating Legend Filter

Material: Polycarbonate

AT3070J Flat Cap with Alternating Legend

5JCF Red/Green

5JDG Amber/Blue



Clear Lens
Alternating Legend Filter

Finish: Glossy

Standard Alternating Legend Pairs

11	ON	OFF	12	ON	OFF	13	START	STOP	14	OPEN	CLOSE
Green/Red or Blue/Amber			Green/Red or Blue/Amber			Green/Red or Blue/Amber			Green/Red or Blue/Amber		

Cap illumination is alternating Green/Red or Blue/Amber; legend text is black.
Contact factory for other Alternating Legends.
Legend illustrations are approximate representations of the actual characters on the filters.

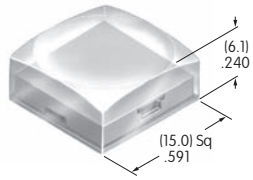
No Code **No Lamp**

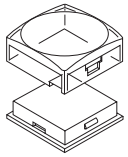
CAP TYPES & COLOR COMBINATIONS FOR NONILLUMINATED

4 **AT3073 Sculptured**

Lens/Insert Colors Available:

- **JA** Clear/Black
- **JB** Clear/White
- **JC** Clear/Red
- **JD** Clear/Amber
- **JF** Clear/Green





Clear Lens

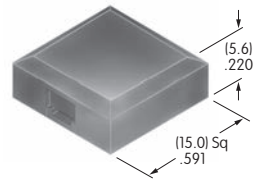
Opaque Colored Insert

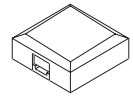
Material: Polycarbonate
Finish: Glossy

5 **AT3077 Beveled**

Cap Colors Available:

- **A** Black
- **B** White
- **C** Red
- **D** Amber
- **F** Green



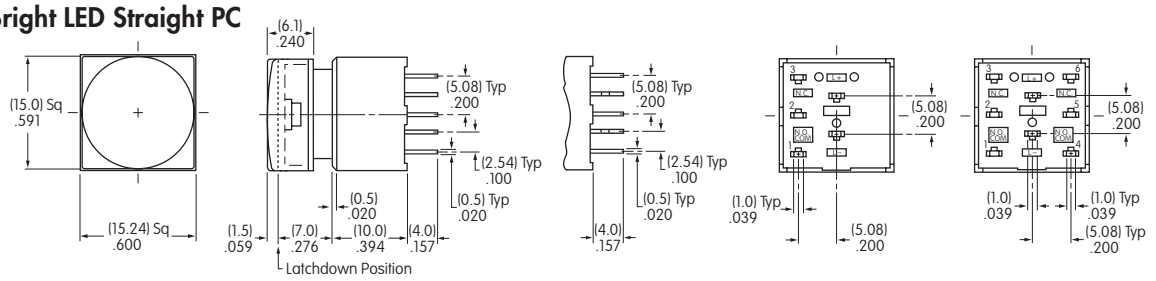


Opaque Colored Cap

Material: Polycarbonate
Finish: Glossy

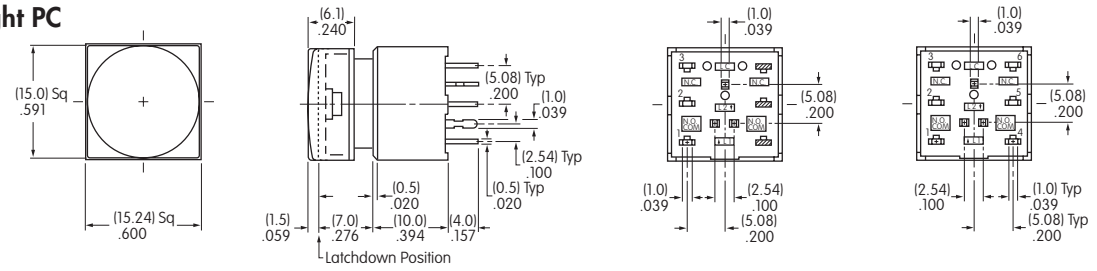
TYPICAL SWITCH DIMENSIONS

Bright & Super Bright LED Straight PC



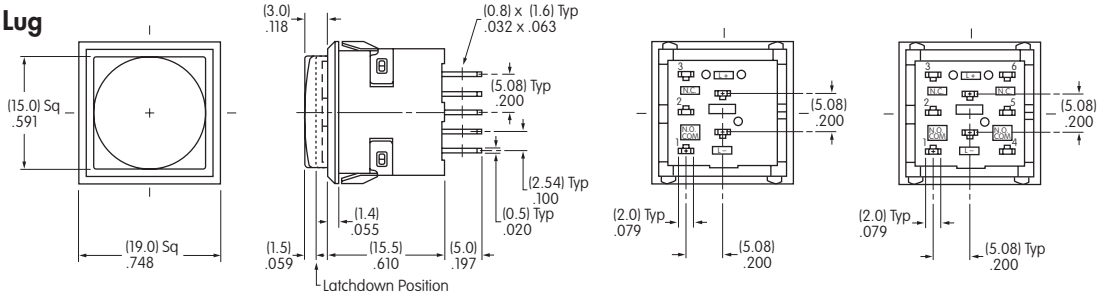
UB215SKG035C-1JC | Bright Single Color LED | Super Bright Single Color LED | Single Pole | Double Pole

Bicolor LED Straight PC



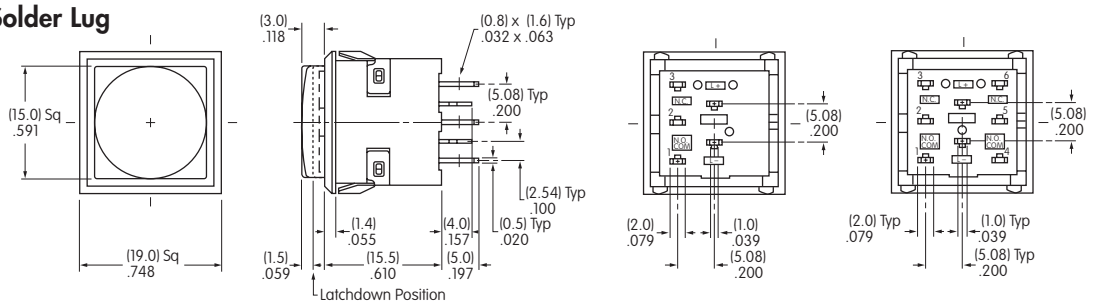
UB225SKG03CF-1JB | Bicolor LED Side View | Single Pole | Double Pole

Bright LED Solder Lug



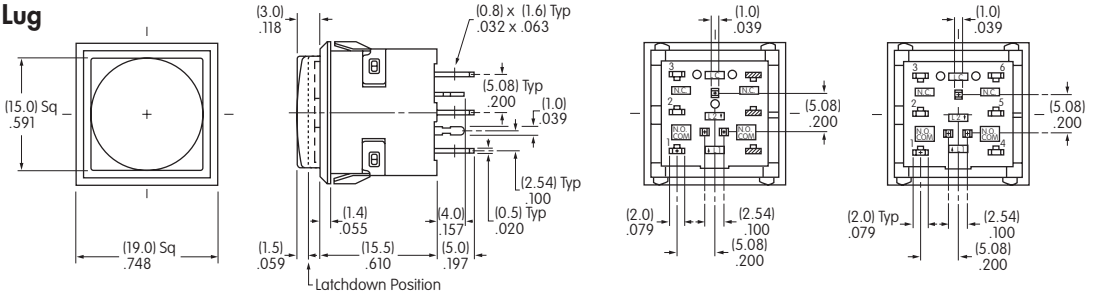
UB216KKW015F-1JF | Single Color LED Side View | Single Pole | Double Pole

Super Bright LED Solder Lug



UB226KKW016F-1JF | Single Color LED Side View | Single Pole | Double Pole

Bicolor LED Solder Lug



UB216KKW01CF-1JB | Bicolor LED Side View | Single Pole | Double Pole

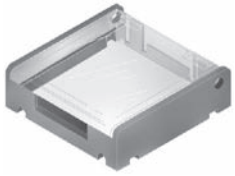
OPTIONAL ACCESSORIES

Protective Guard for Snap-in Model

AT4141

Opens 90°

Closes manually



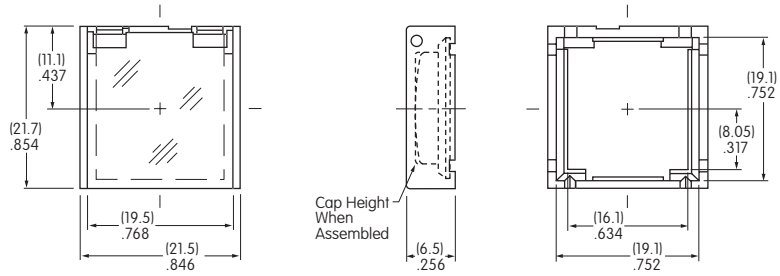
Materials:

Cover: Clear Polycarbonate

Base: Black GFR Polyamide

Recommended Panel Thickness:

.039" ~ .106" (1.0mm ~ 2.7mm)

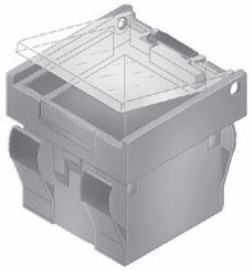


Spring Loaded Protective Guard for Snap-in Mounting of PCB Model

AT4170

Opens 180°

Closes automatically

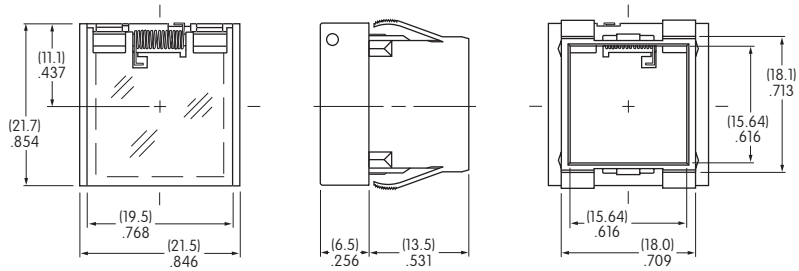


Materials:

Cover: Clear Polycarbonate

Base: Black Polyamide

Coil Spring: Stainless Steel



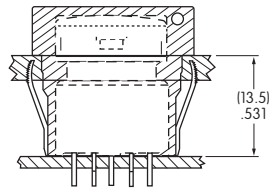
Recommended Panel Thickness:

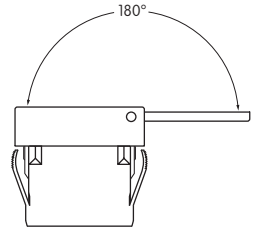
.039" ~ .126"

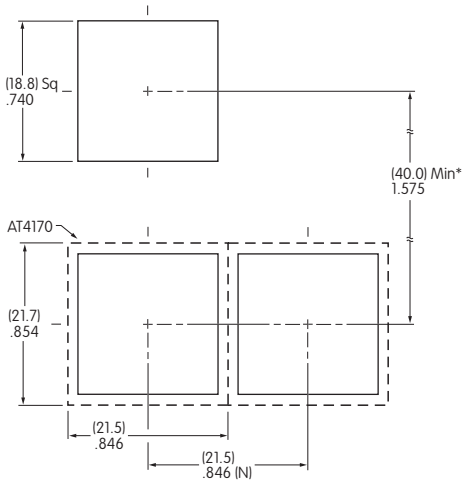
(1.0mm ~ 3.2mm)

Recommended Panel-to-PCB Range:

.531" (13.5mm)





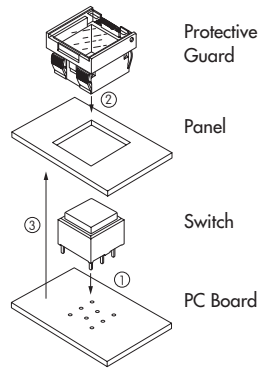


(N) = Number of switches

* Minimum dimension allows opening of cover to 180°

Installation

1. Install switch onto PC board.
2. Snap protective guard into panel.
3. Join the two assemblies.

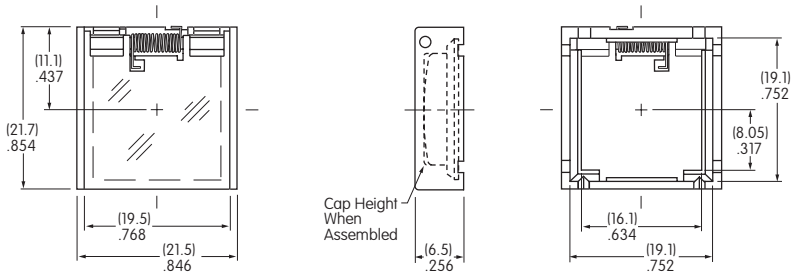


OPTIONAL ACCESSORIES

Spring Loaded Protective Guard for Snap-in Model

AT4142
Opens 180°
Closes automatically

Materials:
Cover: Clear Polycarbonate
Base: Black GFR Polyamide
Coil Spring: Stainless Steel

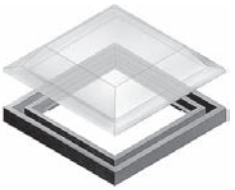


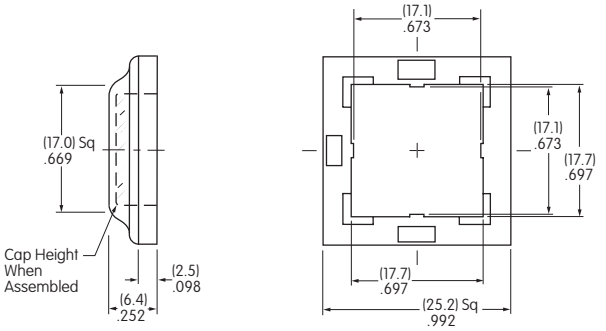
Recommended Panel Thickness:
.039″ ~ .106″ (1.0mm ~ 2.7mm)

Dust Cover

AT4145 Not for use with barriers.

Materials:
Lid: Clear PVC
Operating temperature range:
0°C ~ +70°C (32°F ~ 158°C).
Gasket: Polyethylene



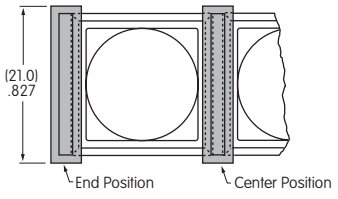


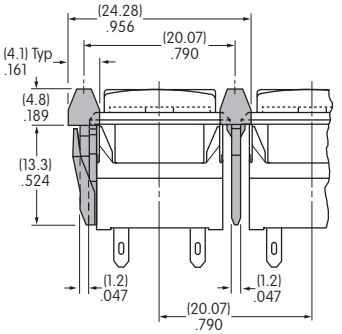
Recommended Panel Thickness
.039″ ~ .098″ (1.0mm ~ 2.5mm)

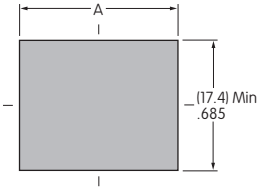
Barriers for Snap-in Mount

AT4143
End

AT4144
Center







Material: Polyamide

Cutouts for more than 1 Switch:

A = .799″ (20.3mm) x Number of Switches + .063″ (1.6mm)

LEGENDS

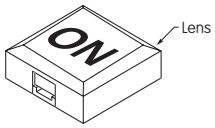
NKK Switches can provide custom legends for caps. Contact factory for more information.

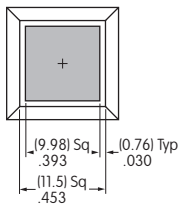
Suggested Printable Area for UB2 Lens, Film Insert or Diffuser

Recommended Methods: Laser Etch on clear lens, Screen Print or Pad Print on lens; Laser Print on film insert.

Shaded areas are printable areas.

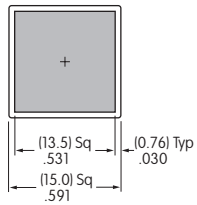
Beveled Cap



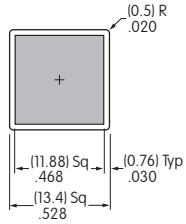


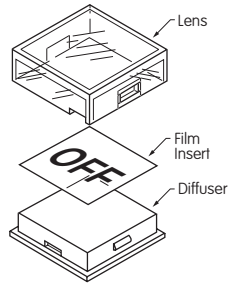
Flat Cap

Lens



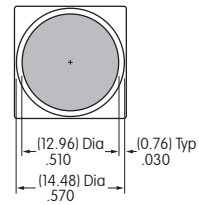
Film Insert or Diffuser



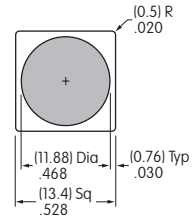


Sculptured Cap

Lens



Film Insert or Diffuser



Film Insert: Clear Polyester 4 mil maximum thickness

General Specifications

Electrical Capacity (Resistive Load)

Power Level (silver): 3A @ 125V AC or 3A @ 250V AC or 3A @ 30V DC
Logic Level (gold): 0.4VA maximum @ 28V AC/DC maximum
(Applicable Range 0.1mA ~ 0.1A @ 20mV ~ 28V)
Note: Find additional explanation of operating range in Supplement section.

Other Ratings

Contact Resistance: 50 milliohms maximum for silver; 100 milliohms maximum for gold
Insulation Resistance: 200 megohms minimum @ 500V DC
Dielectric Strength: 1,000V AC minimum between contacts for 1 minute minimum;
1,500V AC minimum between contacts & case for 1 minute minimum
Mechanical Life: 1,000,000 operations minimum for momentary circuit
200,000 operations minimum for maintained circuit
Electrical Life: 100,000 operations minimum
Nominal Operating Force: Single pole: 1.47N for nonsealed; 1.67N for sealed
Double pole: 2.75N for nonsealed; 2.94N for sealed
Contact Timing: Nonshorting (break-before-make)
Travel: Pretravel .059" (1.5mm); Overtravel .059" (1.5mm); Total Travel .118" (3.0mm)

Materials & Finishes

Housing/Bezel: Glass fiber reinforced polyamide (UL94V-0)
Snap-in Frame: Stainless steel
Base: Glass fiber reinforced polyamide (UL94V-0)
Movable Contactor: Phosphor bronze with silver or gold plating
Movable Contacts: Silver alloy with silver plating or brass with gold plating
Stationary Contacts: Silver alloy or copper with gold plating
Switch Terminals: Phosphor bronze with tin plating
Lamp Terminals: Phosphor bronze with tin plating

Environmental Data

Operating Temperature Range: –25°C through +50°C (–13°F through +122°F) for Illuminated
–25°C through +70°C (–13°F through +158°F) for Nonilluminated
Humidity: 90 ~ 95% humidity for 96 hours @ 40°C (104°F)
Vibration: 10 ~ 55Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in 1 minute; 3 right angled directions for 2 hours
Shock: 50G (490m/s^2) acceleration (tested in 6 right angled directions, with 5 shocks in each direction)
Sealing: IP65 of IEC60529 standard for panel seal models

Installation

Mounting Torque: 0.785Nm (6.95 lb•in) maximum
Quick Connect Force: 24.5N maximum downward force on connector
Soldering Time & Temperature: Manual Soldering: See Profile A in Supplement section.

Standards & Certifications

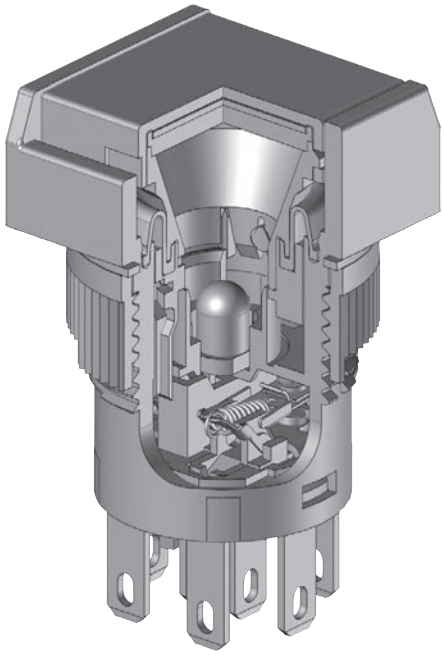
Flammability Standards: UL94V-0 housing & base
UL: **File No. E44145 - Recognized only when ordered with marking on switch.**
Add "/U" or "/CUL" before first dash in part number to order UL recognized switch.
All solder lug models recognized at 3A @ 125/250V AC or 0.4VA @ 28V AC/DC maximum.
CSA: **File No. 023535_0_000 - Certified only when ordered with marking on switch.**
Add "/C" before first dash in part number to order CSA certified switch.
All solder lug models certified at 3A @ 125/250V AC or 0.4VA @ 28V AC/DC maximum.

Distinctive Characteristics

Full face or spot illumination with incandescent lamps or multi-element LEDs, with or without resistors.

Choice of super bright LEDs in white, green, and blue as well as bright LEDs in red, amber, and green.

Combination bezel-barrier is an integral part of the switch and prevents accidental actuation.



Unique thermoplastic elastomer seal inside caps plus rolled sleeve of nitrile butadiene rubber at joining of housing and inner case, all for added protection to interior mechanism.

Dust and oil tight as well as splashproof panel seal models qualify to IP65 of IEC60529 Standards (similar to NEMA 4 and 13). Panel seal models provided with exterior o-ring.

Distinctive design of snap-action contacts for shock resistance, long life, and sensitive actuation.

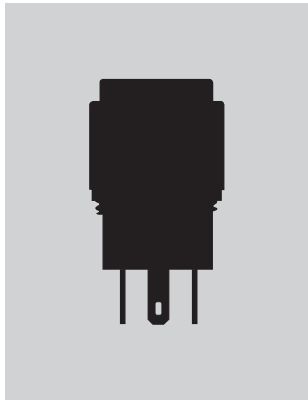
High density design to give behind panel depth of less than one inch.

Terminals are epoxy sealed to lock out flux, dust, solvents, and other contaminants.

Latchdown for indication of circuit status, plus audible, tactile feedback with smooth, responsive operation.

Matching indicators available.

Actual Size



Series YB

Short Body Pushbuttons

TYPICAL SWITCH

YB [1] [5] [ ] [C] [K] [W] [01]

Poles

1	SPDT
2	DPDT

Panel Seal

No Code	Without Panel Seal
W	With Panel Seal (Bushing Mount only)

Housing

K	Black only

Terminals

01	Solder Lug/.110" (2.8mm) Quick Connect
03	Straight PC

Circuits

5	ON	(ON)
( ) = Momentary		
6	ON	ON
Alternate Action with Latchdown		

Shapes

Bushing Mounting	
S	Square
C	Round
R	Rectangular
Snap-in Mounting	
K	Square
M	Round
N	Rectangular

Contact Materials & Ratings

W	Silver Rated 3A @ 125V AC
G	Gold Rated 0.4VA max. @ 28V AC/DC max.

IMPORTANT:

Switches are supplied without UL & cULus marking unless specified. **UL & cULus recognized only when ordered with marking on switch.** Specific models, ratings, & ordering instructions are noted on the General Specifications page.

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

YB15CKW01-6F-JB

- Green, Super Bright LED
- Round with Bushing Mounting
- Black Housing
- SPDT ON-(ON) Circuit
- Led Cap with Clear Lens and White Insert
- Without Panel Seal
- Silver Contacts with 3 Amp Rating
- Solder Lug/.110" (2.8mm) Quick Connect Terminals

ORDERING EXAMPLE

— 6 F — JB

Lamps

Incandescent Lamp	
05	5-volt
12	12-volt
No Code	Nonilluminated

LED for Spot Illuminated Cap			
LED Colors		Forward Voltage	
1C	Red	02	2-volt (no resistor)
1D	Amber	05	5-volt
1F	Green	12	12-volt
1CF	Red/Green	24	24-volt

Bright LED			
LED Colors		Resistor	
5C	Red	No Code	No Resistor
5D	Amber	05	5-volt
5F	Green	12	12-volt
		24	24-volt

Super Bright LED	
6B	White
6F	Green
6G	Blue

Bicolor LED for Full Face Illuminated			
LED Colors		Forward Voltage	
2CF	Red/Green	02	2-volt (no resistor)
		05	5-volt
		12	12-volt
		24	24-volt

Cap Types & Colors

Solid Cap: Lens/Insert Colors	
BB	White/White
CB	Red/White
EB	Yellow/White
FB	Green/White
GB	Blue/White

Spot Illuminated Cap: Lens/Insert Colors	
JA	Clear/Black
JB	Clear/White
JC	Clear/Red
JE	Clear/Yellow
JF	Clear/Green

LED Cap: Lens/Insert Colors	
JB	Clear/White
JC	Clear/Red
JD	Clear/Amber
JF	Clear/Green

LED Cap: Lens/Insert Colors	
JB	Clear/White

LED Cap: Lens/Insert Colors	
JB	Clear/White

POLES & CIRCUITS

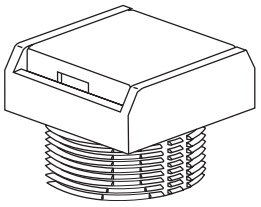
Pole	Model	Plunger Position ( ) = Momentary: Normal	Plunger Position ( ) = Momentary: Down	Connected Terminals: Normal	Connected Terminals: Down	Throw & Switch/Lamp Schematics
						Notes: Switch is marked with NC, NO, COM, L+, L–. Lamp circuit is isolated and requires external power source.
SP	**YB15** ***YB16**	ON ON	(ON) ON	1-3	1-2	SPDT
DP	**YB25** ***YB26**	ON ON	(ON) ON	1-3 4-6	1-2 4-5	DPDT

* When in latchdown position for the alternate circuit, cap position is .020" (0.5mm) above the built-in bezel.

PANEL SEAL

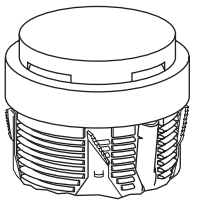
No Code **Without Panel Seal**

Bushing Mounting



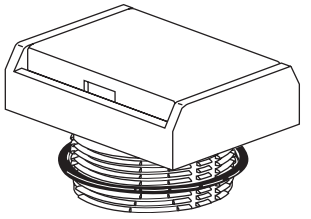
Supplied with mounting nut.

Snap-in Mounting



W **With Panel Seal**

Bushing Mounting only

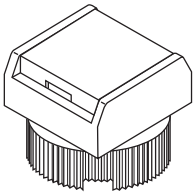


Supplied with mounting nut and o-ring AT089.

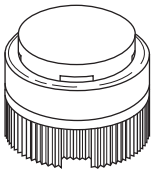
SHAPES & MOUNTING TYPES

Bushing Mounting

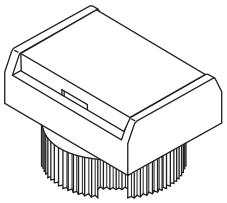
S **Square**



C **Round**

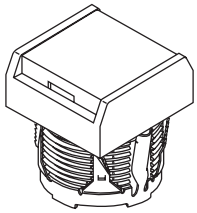


R **Rectangular**

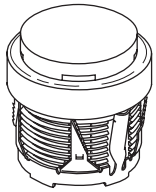


Snap-in Mounting

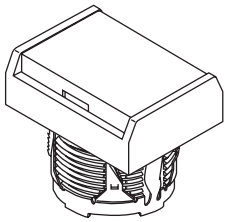
K **Square**



M **Round**



N **Rectangular**



Bezel-barrier is an integral part of the switch body.

HOUSING

K **Black**

Housing available in black only. The 1-piece body and bezel-barrier have a matte finish.

CONTACT MATERIALS & RATINGS

W **Silver Contacts**

G **Gold Contacts**

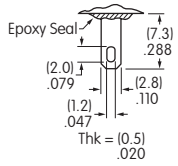
Power Level **3A @ 125/250V AC**

Logic Level **0.4VA max. @ 28V AC/DC max.**

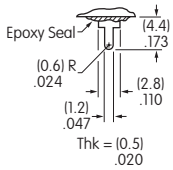
Complete explanation of operating range in Supplement section.

TERMINALS

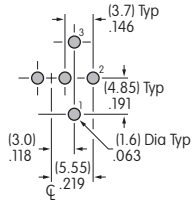
01 **Solder Lug/ .110" (2.8mm) Quick Connect**



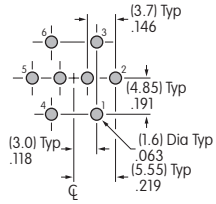
03 **Straight PC**



Single Pole



Double Pole



INCANDESCENT LAMP & SOLID CAP

Electrical specifications are determined at a basic temperature of 25°C. Lamp circuit is independent of switch operation.
For dimension drawing of lamp see the Accessories & Hardware section.

AT611

T-1 Bi-pin

		05	12
Voltage	V	5V AC	12V AC
Current	I	115mA	60mA
MSCP		.150	.150
Endurance	Hours	7,000 average	
Ambient Temperature Range		–25°C ~ +50°C	

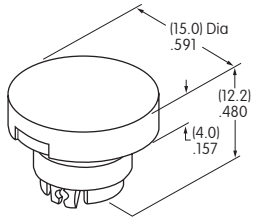
No Code **No Lamp**

Solid Cap for Incandescent Lamp & Nonilluminated

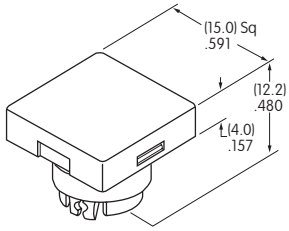
Lens/Insert Colors Available:

- **BB** White/White
- **CB** Red/White
- **EB** Yellow/White
- **FB** Green/White
- **GB** Blue/White

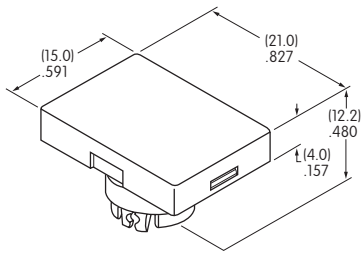
AT3002 Round



AT3001 Square

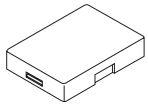


AT3003 Rectangular

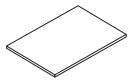


Materials:

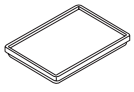
Lens & Insert: Polycarbonate Seal/Filter: Thermoplastic Elastomer



Translucent Colored Lens



Translucent White Insert



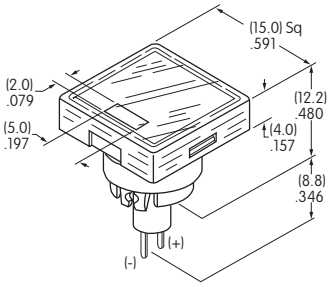
Translucent White Seal/Filter

Incandescent Lamp AT611

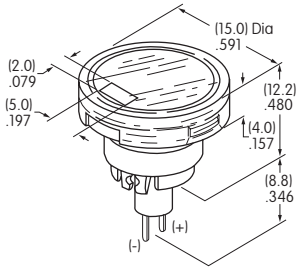
SPOT ILLUMINATED CAP WITH BUILT-IN LED

This spot-illuminated cap is factory assembled.

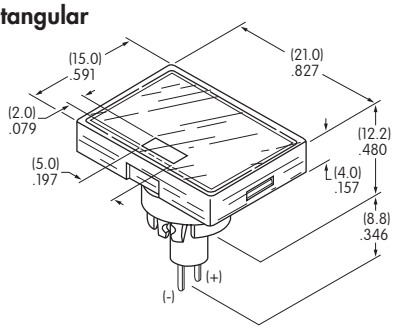
AT3010
Square



AT3011
Round



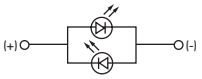
AT3012
Rectangular



Colors Available: 1C Red	1D Amber	1F Green	1CF Red/Green	02 Without Resistor	05 With Resistor	12 With Resistor	24 With Resistor	Unit
Maximum Forward Current			I_{FM}	20	15	15	12	mA
Typical Forward Current			I_F	15	12.5	12.5	10	mA
Forward Voltage			V_F	2.1	5	12	24	V
Maximum Reverse Voltage (not applicable to bicolor)			V_{RM}	5	5	5	5	V
Current Reduction Rate Above 25°C			ΔI_F	0.27	—	—	—	mA/°C
Ambient Temperature Range				−25 ~ +50				°C

Without Resistor 2-volt

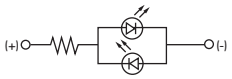
Single Color



Bicolor

With Resistor 5, 12, 24-volt

Single Color



Bicolor

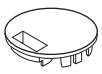
The electrical specifications shown are determined at a basic temperature of 25°C. LED circuit is isolated and requires external power source. Single color LEDs are colored in OFF state. Bicolor LED is translucent white in OFF state.

If the source voltage exceeds the rated voltage, a ballast resistor is required.
The resistor value can be calculated by using the formula in the Supplement section.

Lens/Insert Colors Available:

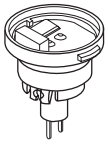
- JA **Clear/Black**
- JB **Clear/White**
- JC **Clear/Red**
- JE **Clear/Yellow**
- JF **Clear/Green**

Clear Lens



Colored Insert

Seal



Built-in LED (integral part of the cap)

Example part number when cap is ordered separate from switch:
AT3010F02JA
for a
Square Spot Illuminated Cap
with Green 2-volt LED
without resistor
Clear Lens and Black Insert

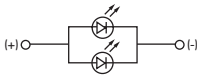
Materials:
Lens & Insert: Polycarbonate
Seal: Thermoplastic Elastomer

BRIGHT LED & LED CAPS

The electrical specifications shown are determined at a basic temperature of 25°C.
LED circuit is isolated and requires external power source.
If the source voltage exceeds the rated voltage, a ballast resistor is required.
The resistor value can be calculated by using the formula in the Supplement section.

Electrical Specifications for Bright LED without Resistor

Bright AT628



T-1 Bi-pin

Colors Available: 5C Red, 5D Amber, 5F Green — No Code No Resistor

LED Colors		Red	Amber	Green	Unit
Maximum Forward Current	I_{FM}	40	40	40	mA
Typical Forward Current	I_F	26	26	26	mA
Forward Voltage	V_F	1.9	2.0	2.0	V
Maximum Reverse Voltage	V_{RM}	4	4	4	V
Current Reduction Rate Above 25°C	ΔI_F	0.50			mA/°C
Ambient Temperature Range		−25 ~ +50			°C

Electrical Specifications for Bright LED with Resistor

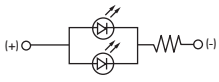
Bright AT634

T-1¼ Bi-pin

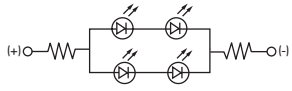
Colors Available: 5C Red, 5D Amber, 5F Green

		05	12	24	Unit
Maximum Forward Current	I_{FM}	—	—	—	mA
Typical Forward Current	I_F	25	20	10	mA
Forward Voltage	V_F	5	12	24	V
Maximum Reverse Voltage	V_{RM}	4	8	16	V
Current Reduction Rate Above 25°C	ΔI_F	——	——	——	mA/°C
Ambient Temperature Range		−25 ~ +50			°C

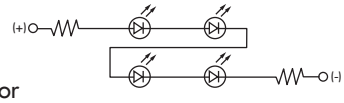
AT634 5-volt, 2-element with Resistor



AT634 12-volt, 4-element with Resistor



AT634 24-volt, 4-element with Resistor

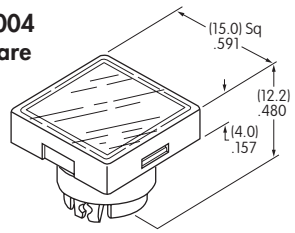


Cap for Bright LED

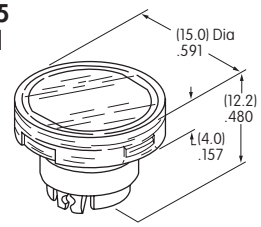
Lens/Insert Colors Available:

- JB Clear/White
- JC Clear/Red
- JD Clear/Amber
- JF Clear/Green

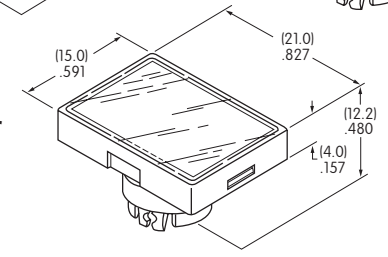
AT3004 Square

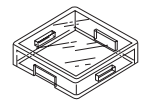


AT3005 Round

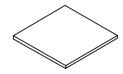


AT3006 Rectangular

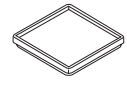




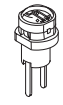
Transparent Clear Lens



Translucent Colored Insert



Translucent White Seal/Diffuser



Bright LEDs
AT628 AT634

Materials:
Lens & Insert: Polycarbonate Seal/Diffuser: Thermoplastic Elastomer

SUPER BRIGHT LED & LED CAPS

The electrical specifications shown are determined at a basic temperature of 25°C.
LED circuit is isolated and requires external power source.
If the source voltage exceeds the rated voltage, a ballast resistor is required.
The resistor value can be calculated by using the formula in the Supplement section.

Electrical Specifications for Super Bright LED

Super Bright
AT625G Blue
AT631B White
AT632F Green

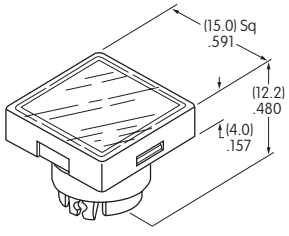
T-1 Bi-pin

ATTENTION ELECTROSTATIC SENSITIVE DEVICES

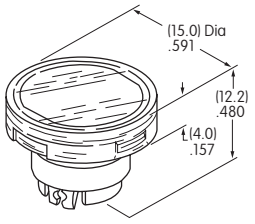
Colors:		6B White	6F Green	6G Blue	Unit
Maximum Forward Current	I_{FM}	30	30	30	mA
Typical Forward Current	I_F	20	20	20	mA
Forward Voltage	V_F	3.3	3.3	3.3	V
Maximum Reverse Voltage	V_{RM}	7	7	7	V
Current Reduction Rate Above 25°C	ΔI_F	0.40	0.40	0.40	mA/°C
Ambient Temperature Range		−25 ~ +50			°C

Cap for Super Bright LED

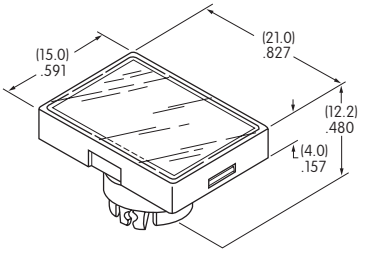
AT3014
Square



AT3015
Round

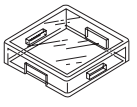


AT3016
Rectangular

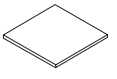


Lens/Insert
Colors Available:

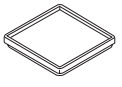
JB **Clear/White**



Transparent Clear Lens



Translucent White Insert



Translucent White Seal/Diffuser

Super Bright LEDs
AT625 AT631
AT632

Materials:
Lens & Insert: Polycarbonate Seal/Diffuser: Thermoplastic Elastomer

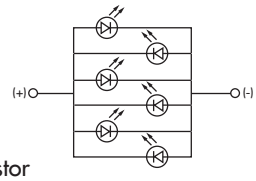
BICOLOR LED & LED CAPS

The electrical specifications shown are determined at a basic temperature of 25°C.
LED circuit is isolated and requires external power source.
If the source voltage exceeds the rated voltage, a ballast resistor is required.
The resistor value can be calculated by using the formula in the Supplement section.

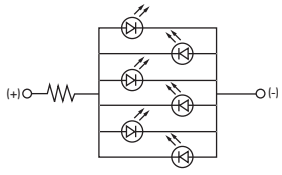
Electrical Specifications for Bicolor LED

Bicolor AT621			02	05	12	24	Unit
2CF Red/Green	Maximum Forward Current	I_{FM}	60	60	20	12	mA
	Typical Forward Current	I_F	45	45	15	10	mA
	Forward Voltage (Red/Green)	V_F	1.9 / 2.1	5	12	24	V
	Current Reduction Rate Above 25°C	ΔI_F	0.80	——	——	——	mA/°C
T-1½ Bi-pin	Ambient Temperature Range		–25 ~ +50				°C

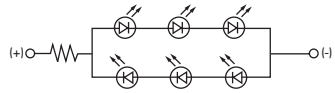
AT621
Bicolor LED
2-volt
6-element
without Resistor



AT621
Bicolor LED
5-volt
6-element
with Resistor



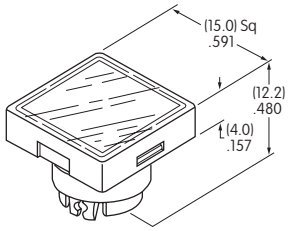
AT621
Bicolor LED
12 & 24-volt
6-element
with Resistor



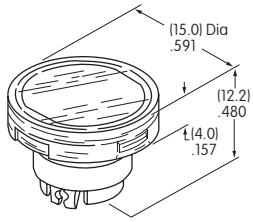
As shown for Red;
Reverse polarity for Green

LED Caps

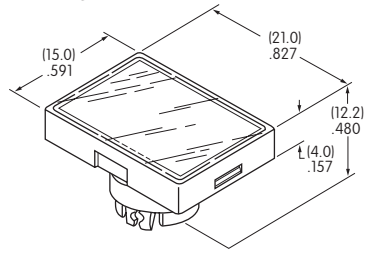
AT3004
Square



AT3005
Round

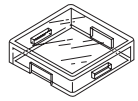


AT3006
Rectangular

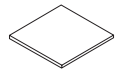


Lens/Insert Colors Available:

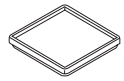
JB **Clear/White**



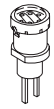
Transparent Clear Lens



Transparent White Insert



Translucent White Seal/Diffuser



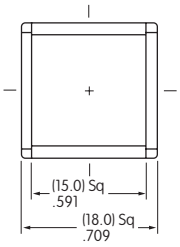
Bicolor LED AT621

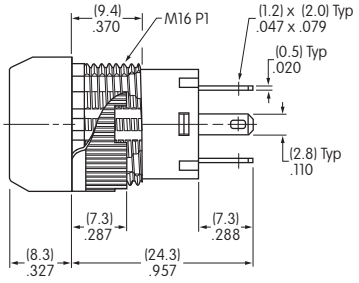
Materials:
Lens & Insert: Polycarbonate Seal/Diffuser: Thermoplastic Elastomer

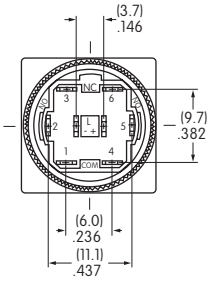
TYPICAL SWITCH DIMENSIONS

Square • Bushing Mounting

Single & Double Pole





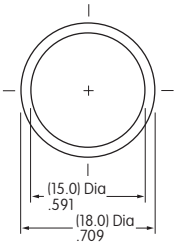


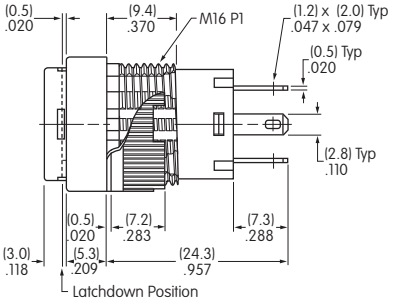
YB15SKW01-12-CB

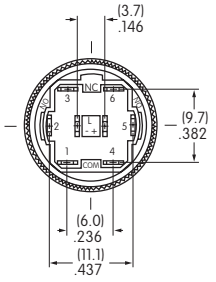
Single pole models do not have terminals 4, 5, & 6.

Round • Panel Seal

Single & Double Pole





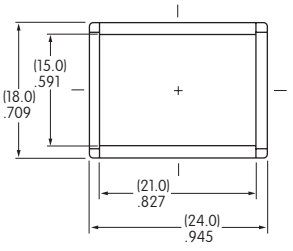


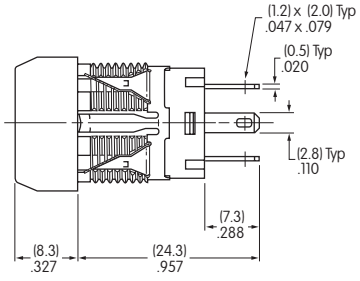
YB26WCKW01-12-EB

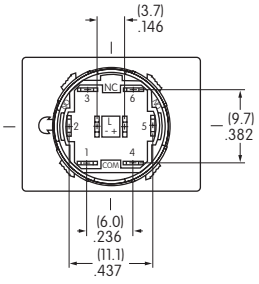
Single pole models do not have terminals 4, 5, & 6.

Rectangular • Snap-in Mounting

Single & Double Pole







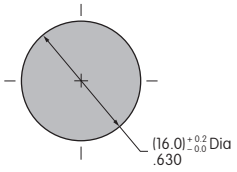
YB15NKW01-5C-JC

Single pole models do not have terminals 4, 5, & 6.

PANEL THICKNESS & CUTOUTS

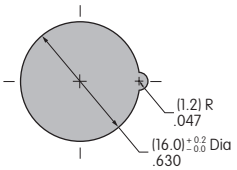
Bushing & Panel Seal Mount

Panel Thickness
.020" ~ .197"
(0.5mm ~ 5.0mm)



Snap-in Mount

Panel Thickness
.039" ~ .138"
(1.0mm ~ 3.5mm)



OPTIONAL ACCESSORIES

Dust Covers and Protective Guards reduce depth of switch behind panel by .047" (1.2mm).

Panel Thickness Range with Dust Cover or Protective Guards:

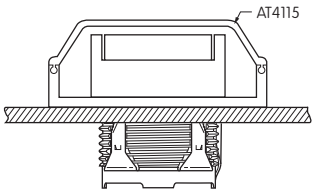
Bushing Mounting	Snap-in Mounting	Panel Seal
.020" ~ .150" (0.5mm ~ 3.8mm)	.020" ~ .091" (0.5mm ~ 2.3mm)	.020" ~ .118" (0.5mm ~ 3.0mm)

Dust/Splash Cover

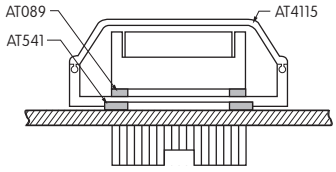
AT4115 Dust Cover for Snap-in or Bushing Mount

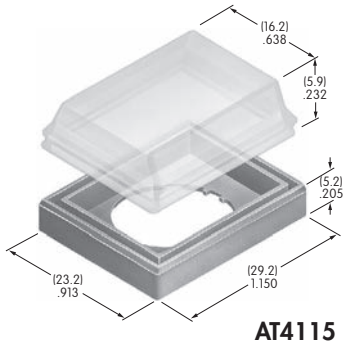
AT4115 Splash Cover and AT541 O-ring for Bushing Mount

Dust Cover



Splash Cover





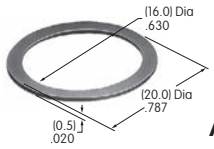
AT4115

Materials:
Lid: Polyvinyl Chloride
Base: Polyamide
O-ring: Nitrile butadiene rubber

Snap-in Mount

Panel Seal

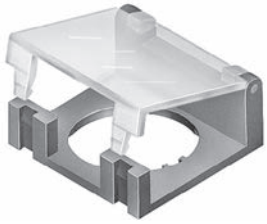
Note: AT089 o-ring supplied with panel seal model.



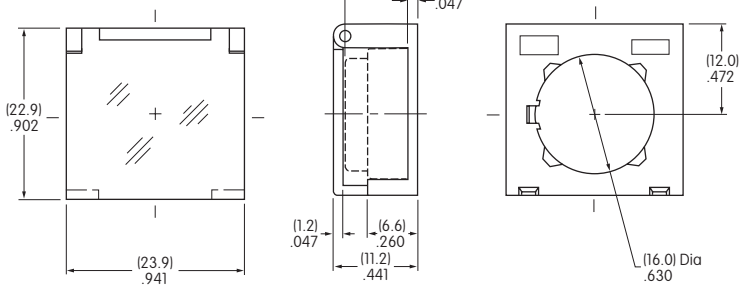
AT541

Protective Guard

AT4072 Protective Guard
Opens 90°
Closes manually

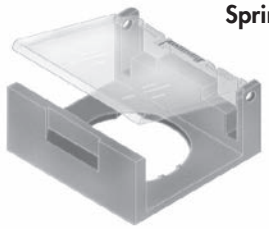


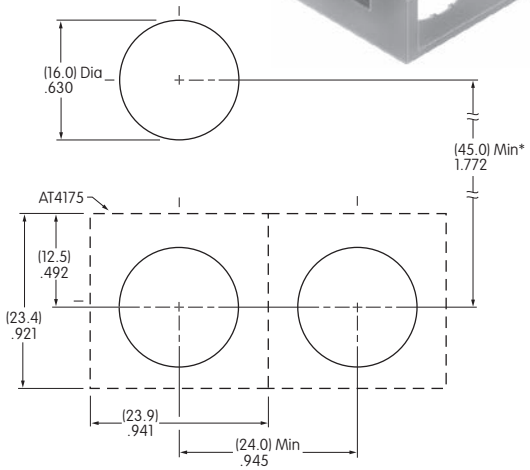
Materials:
Lid: Polycarbonate
Base: Glass Fiber Reinforced Polycarbonate

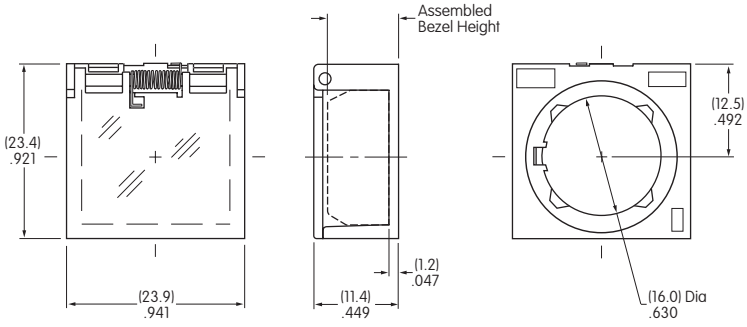


Spring Loaded Protective Guard

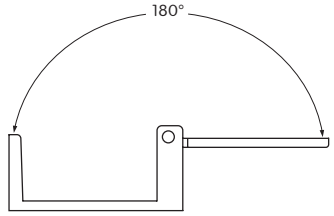
AT4175 Spring Loaded Protective Guard
Opens 180°
Closes automatically







Materials:
Lid: Polycarbonate
Base: Glass Fiber Reinforced Polyamide
Coil Spring: Stainless Steel

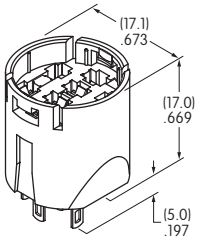


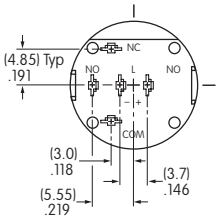
* Minimum dimension allows opening of cover to 180°

OPTIONAL ACCESSORIES

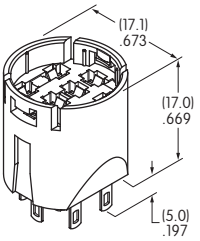
Adaptors

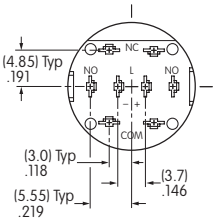
AT716
Single Pole
Solder Lug/
Quick Connect
Terminals



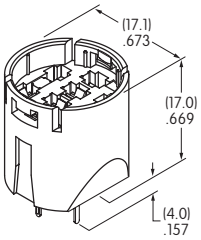


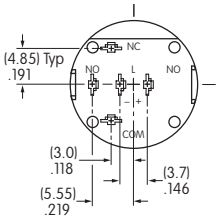
AT717
Double Pole
Solder Lug/
Quick Connect
Terminals

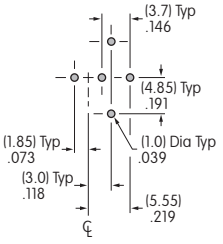




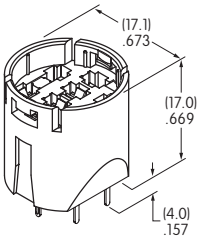
AT718
Single Pole
Straight PC
Terminals

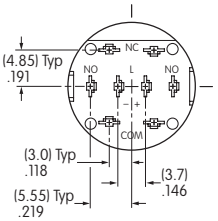


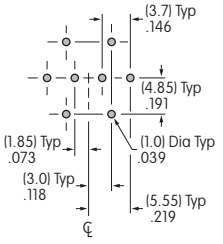




AT719
Double Pole
Straight PC
Terminals







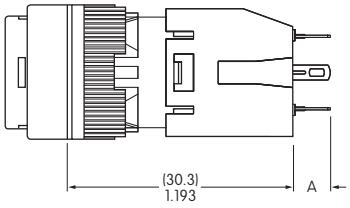
Material: Glass fiber reinforced polyamide Note: Order adaptors separately

---

Switch Dimensions Shown with Adaptor AT716

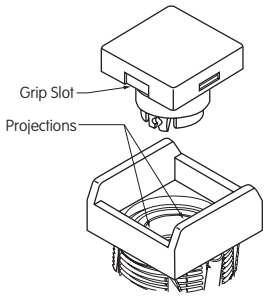
Dimension A:
Solder Lug .197" (5.0mm); Straight PC .157" (4.0mm)

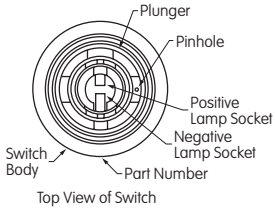
Panel thickness for YB Bushing Mount:
.020" ~ .197" (0.5mm ~ 5.0mm)



ASSEMBLY INSTRUCTIONS

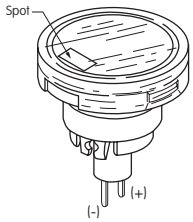
Cap Assembly





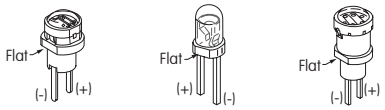
Top View of Switch

LED Polarity & Orientation in Lamp Socket



Spot Illuminated Cap with Built-in LED

ATTENTION
ELECTROSTATIC SENSITIVE DEVICES



LED AT628 AT634

LEDs AT625G AT631B AT632F

LED AT621

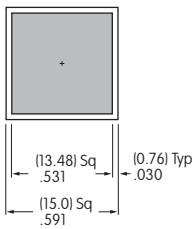
The following installation tools are available: AT106 Socket Wrench for bushing mounting (Overtightening the mounting nut AT092 may damage the switch housing.); AT109 Cap Extractor; AT111 Lamping Tool.
Further details and dimensions are shown in the Accessories and Hardware section.

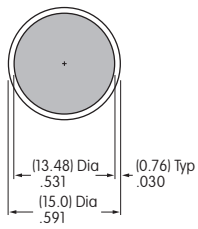
LEGENDS

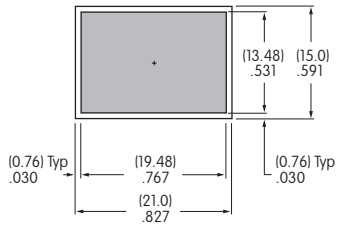
NKK Switches can provide custom legends for caps. Contact factory for more information.

Suggested Printable Area for YB Lens

Recommended Methods: Laser Etch on clear lens, Screen Print or Pad Print on Lens.
Epoxy based ink is recommended.

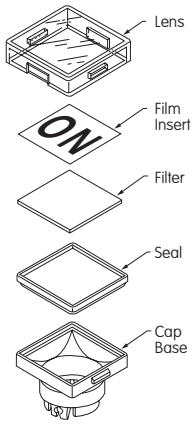




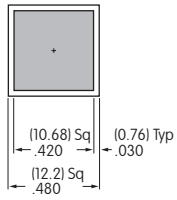


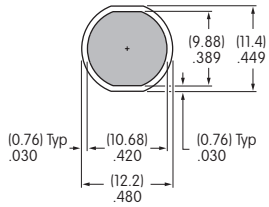
Shaded areas are printable areas.

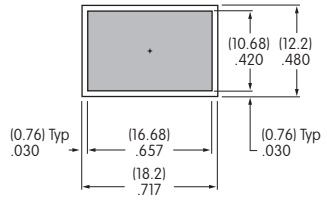
Suggested Printable Area for Film Insert



Recommended Print Method: Laser Print
Film Insert: Clear Polyester, 4 mil max. thickness







Shaded areas are printable areas.

General Specifications

Electrical Capacity (Resistive Load)

Power Level (silver): 3A @ 125V AC or 3A @ 250V AC or 3A @ 30V DC
Logic Level (gold): 0.4VA maximum @ 28V AC/DC maximum
(Applicable Range 0.1mA ~ 0.1A @ 20mV ~ 28V)

Other Ratings

Contact Resistance: 50 milliohms maximum for silver; 100 milliohms maximum for gold
Insulation Resistance: 200 megohms minimum @ 500V DC
Dielectric Strength: 1,000V AC minimum between contacts for 1 minute minimum;
1,500V AC minimum between contacts & case for 1 minute minimum
Mechanical Life: 1,000,000 operations minimum for momentary circuit
200,000 operations minimum for maintained circuit
Electrical Life: 100,000 operations minimum
Nominal Operating Force: Single pole: 1.5N
Double pole: 3.0N
Contact Timing: Nonshorting (break-before-make)
Travel: Pretravel .059" (1.5mm); Overtravel .059" (1.5mm); Total Travel .118" (3.0mm)

Materials & Finishes

Bezel: Black: Glass fiber reinforced polyamide (UL94V-0);
Chrome plated: Chrome plating over ABS resin (UL94V-2)
Housing: Glass fiber reinforced polyamide (UL94V-0)
Base: Glass fiber reinforced polyamide (UL94V-0)
Movable Contactor: Phosphor bronze with silver or gold plating
Movable Contacts: Silver alloy or copper with gold plating
Stationary Contacts: Silver alloy or copper with gold plating
Switch Terminals: Phosphor bronze with tin plating
Lamp Terminals: Phosphor bronze with tin plating

Environmental Data

Operating Temperature Range: –25°C through +50°C (–13°F through +122°F) for Illuminated
–25°C through +70°C (–13°F through +158°F) for Nonilluminated
Humidity: 90 ~ 95% humidity for 240 hours @ 40°C (104°F)
Vibration: 10 ~ 55Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in 1 minute; 3 right angled directions for 2 hours
Shock: 50G (490m/s^2) acceleration (tested in 6 right angled directions, with 5 shocks in each direction)
Sealing: IP65 of IEC60529 standard

Installation

Mounting Torque: 0.785Nm (6.95 lb•in) maximum
Soldering Time & Temperature: Manual Soldering: See Profile A in Supplement section.

Standards & Certifications

Flammability Standards: UL94V-0 housing, base & black bezel
UL: **File No. E44145 - Recognized only when ordered with marking on switch.**
Add "/CUL" before first dash in part number to order cULus marking on switch.
All solder lug models recognized at 3A @ 125/250V AC or 0.4VA @ 28V AC/DC maximum.

Distinctive Characteristics

24mm square and 25mm diameter pushbuttons with the shortest above-panel dimension (1.8mm) in the industry for splashproof design.

Meets IP65 of IEC60529 standards (similar to NEMA 4 and 13), providing dust tight and splashproof panel seal protection.

Tamper resistant 18mm square and 19mm diameter actuators.

Short body of .965" (24.5mm) conserves behind-panel space.

Distinctive long stroke and light touch actuation for clear indication of circuit status.

Choice of cap colors includes clear, brushed chrome, red, green, or yellow, for enhanced panel appearance. Metallic silver cap option has bright ring illumination (round only). Unbrushed chrome has the look of stainless steel when non-illuminated, and LED color or legends when illuminated.

Brilliant illumination with multiple LED colors.

Bezel color options in black or brushed chrome.

Brushed chrome option is lighter weight than actual metal switches due to metal plating on resin.

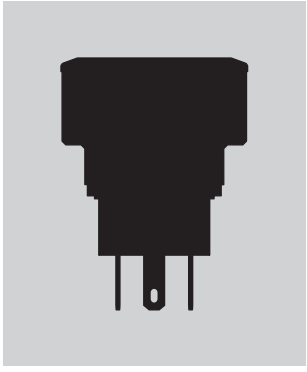
Available in momentary and alternate action with latchdown.

Crisp actuation and clear circuit status provided by snap-action contact mechanism. Arc barrier protects against crossover.

Combination solder lug and .110" quick connect terminals. Terminals are epoxy sealed to lock out flux, dust, solvents, and other contaminants, as well as to secure terminals and improve contact stability.

Custom legends on actuator or inserts.

Actual Size (Round)



Series YB2

Panel Seal Pushbuttons

TYPICAL SWITCH

YB2 | 1 | 5 | C | W | C | K | W | 01

Poles

1	SPDT
2	DPDT

Contact Point

C	Normally Open and Normally Closed

Shape

C	Round
S	Square

Terminals

01	Solder Lug/.110" (2.8mm) Quick Connect

Circuits

5	ON	(ON)
( ) = Momentary		
6	ON	ON
Alternate Action with Latchdown		

Panel Seal

W	With Panel Seal

Bezel

K	Black
P	Brushed Chrome

Contact Materials & Ratings

W	Silver Rated 3A @ 125V AC
G	Gold Rated 0.4VA maximum @ 28V AC/DC maximum

IMPORTANT:

Switches are supplied without cULus marking unless specified. **cULus recognized only when ordered with marking on the switch.** Specific models, ratings, and ordering instructions are noted on General Specifications page.

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

YB215CWCKW01-6B-JB

ORDERING EXAMPLE

— 6 B — JB —

LEDS

Bright LED

LED Colors		Resistor	
5C	Red	No Code	No Resistor (not for Green)
5D	Amber	05	5-volt
5F	Green	12	12-volt
		24	24-volt

Super Bright LED

6B	White
6F	Green
6G	Blue

Nonilluminated

N	No Lamp

Cap Types & Colors

Lens/Diffuser Colors

JB	Clear/White
JS	Metallic Silver Cap/Clear Ring (Round only)
CB	Red/White
EB	Yellow/White
FB	Green/White
HB	Unbrushed Chrome/White

LED and cap need to be the same color. Yellow cap pairs with amber LED to achieve amber illumination. Codes JB and JS (Round only) may be combined with all LED colors.

Lens/Diffuser Cap Colors

JB	Clear/White
JS	Metallic Silver Cap/Clear Ring (Round only)
HB	Unbrushed Chrome/White

Cap Color

JB	Clear/White
CB	Red/White
EB	Yellow/White
FB	Green/White
HB	Unbrushed Chrome/White
P	Brushed Chrome

— [ ]

Round or Square Cap with Legend

001	⏻
002	START
003	STANDBY
004	STOP
005	⏻

Contact factory for custom options.

Round or Square Cap with Legend

001	⏻
002	START
003	STANDBY
004	STOP
005	⏻

Contact factory for custom options.

Part Numbers for Unbrushed Chrome Caps with Legends

Round Cap for Bright LED	Round Cap for Super Bright LED	Square Cap for Bright or Super Bright LED
AT3017HB-001	AT3018HB-001	AT3025HB-001
AT3017HB-002	AT3018HB-002	AT3025HB-002
AT3017HB-003	AT3018HB-003	AT3025HB-003
AT3017HB-004	AT3018HB-004	AT3025HB-004
AT3017HB-005	AT3018HB-005	AT3025HB-005

Refer to Ordering Table for legend that corresponds with last 3 digits of part number.

Series YB2

Panel Seal Pushbuttons

POLES & CIRCUITS

Pole	Model	Plunger Position ( ) = Momentary: Normal	Plunger Position ( ) = Momentary: Down	Connected Terminals: Normal	Connected Terminals: Down	Throw & Switch/Lamp Schematics
						Notes: Switch is marked with NC, NO, COM, L+, L–. Lamp circuit is isolated and requires an external power source.
SP	**YB215** **YB216**	ON ON	(ON) ON	1-3	1-2	SPDT
DP	**YB225** **YB226**	ON ON	(ON) ON	1-3 4-6	1-2 4-5	DPDT

CONTACT POINT

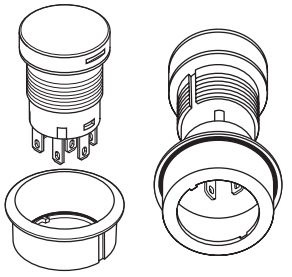
C **Normally Open and Normally Closed**

Contact points are both Normally Open and Normally Closed.

PANEL SEAL

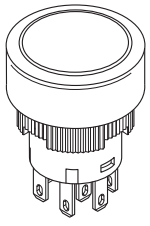
W **Panel Seal (Round and Square)**

Two o-rings provide panel seal protection meeting IP65 of IEC60529 standards.

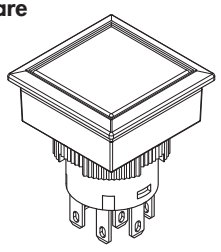


SHAPE

C **Round**



S **Square**

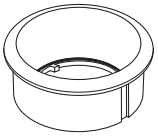


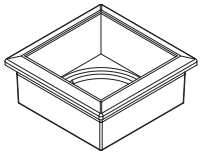
BEZEL

K **Black**

P **Brushed Chrome**

For Round or Square





CONTACT MATERIALS & RATINGS

W **Silver Contacts**

Power Level: 3A @ 125/250V AC

Switch base is black

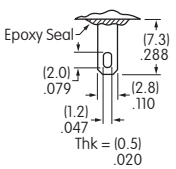
G **Gold Contacts**

Logic Level: 0.4VA max. @ 28V AC/DC max.

Switch base is ivory

TERMINALS

01 **Solder Lug/ .110" (2.8mm) Quick Connect**



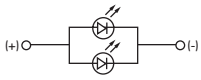
BRIGHT & SUPER BRIGHT LEDS

The electrical specifications shown are determined at a basic temperature of 25°C. LED circuit is isolated and requires an external power source. If the source voltage exceeds the rated voltage, a ballast resistor is required. Base of AT634 and AT636 is Black for 5V, Light Blue for 12V and Gray for 24V.

Electrical Specifications for Bright LED without Resistor

Bright AT628

T-1 Bi-pin



Colors Available: 5C Red, 5D Amber		No Code No Resistor		Unit
	LED Colors	Red	Amber	
Maximum Forward Current	I_{FM}	40	40	mA
Typical Forward Current	I_F	26	26	mA
Forward Voltage	V_F	1.9	2.0	V
Maximum Reverse Voltage	V_{RM}	4	4	V
Current Reduction Rate Above 25°C	ΔI_F	0.50		mA/°C
Ambient Temperature Range		–25 ~ +50		°C

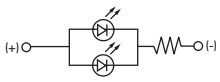
Electrical Specifications for Bright Red & Amber LED with Resistor

Bright AT634

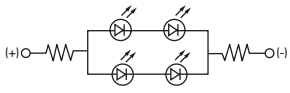
T-1¼ Bi-pin

Colors Available: 5C Red, 5D Amber		05	12	24	Unit
Maximum Forward Current	I_{FM}	—	—	—	mA
Typical Forward Current	I_F	25	20	10	mA
Forward Voltage	V_F	5	12	24	V
Maximum Reverse Voltage	V_{RM}	4	8	16	V
Current Reduction Rate Above 25°C	ΔI_F	—	—	—	mA/°C
Ambient Temperature Range		–25 ~ +50			°C

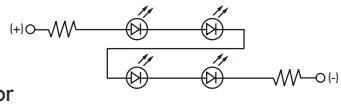
AT634 5-volt, 2-element with Resistor



AT634 12-volt, 4-element with Resistor



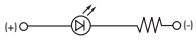
AT634 24-volt, 4-element with Resistor



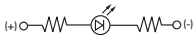
Electrical Specifications for Bright Green LED with Resistor

Bright AT636

T-1¼ Bi-pin



5V



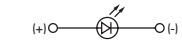
12V & 24V

Colors Available: ATTENTION ELECTROSTATIC SENSITIVE DEVICES, 5F Green		05	12	24	Unit
Maximum Forward Current	I_{FM}	—	—	—	mA
Typical Forward Current	I_F	11	9.5	8.7	mA
Forward Voltage	V_F	5	12	24	V
Maximum Reverse Voltage	V_{RM}	5	5	5	V
Current Reduction Rate Above 25°C	ΔI_F	—	—	—	mA/°C
Ambient Temperature Range		–25 ~ +50			°C

Electrical Specifications for Super Bright LED

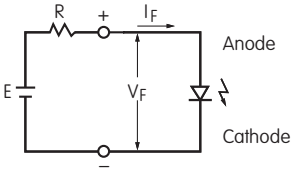
Super Bright
AT625G Blue
AT631B White
AT632F Green

T-1 Bi-pin

ATTENTION ELECTROSTATIC SENSITIVE DEVICES  Colors:		6B White	6F Green	6G Blue	Unit
Maximum Forward Current	I_{FM}	30	30	30	mA
Typical Forward Current	I_F	20	20	20	mA
Forward Voltage	V_F	3.3	3.3	3.3	V
Maximum Reverse Voltage	V_{RM}	7	7	7	V
Current Reduction Rate Above 25°C	ΔI_F	0.40	0.40	0.40	mA/°C
Ambient Temperature Range		–25 ~ +50			°C

BALLAST RESISTOR CALCULATION FOR LEDS

If the source voltage is greater than the rated voltage of a lamp or LED, a ballast resistor must be connected in series with the lamp. This circuit diagram and formula will assist in calculating the value of the required ballast resistor.



$$R = \frac{E - V_F}{I_F}$$

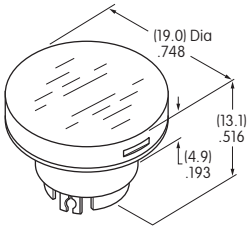
Where: R = Resistor Value (Ohms)
E = Source Voltage (V)
V_F = Forward Voltage (V)
I_F = Forward Current (A)

CAPS & CAP COLORS

AT3017 Cap for Bright LED or Nonilluminataed

Lens/Diffuser Colors Available:

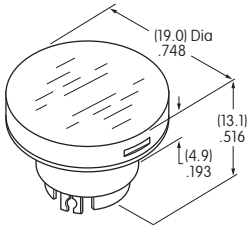
- **JB** Clear/White
- **CB** Red/White
- **EB** *Yellow/White
- **FB** Green/White
- **HB** Unbrushed Chrome/ White



AT3018 Cap for Super Bright LED

Lens/Diffuser Colors Available:

- **JB** Clear/White
- **HB** Unbrushed Chrome/ White

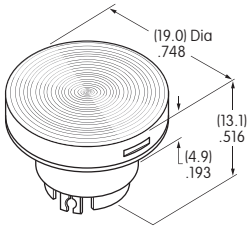


Material for Lens & Diffuser:
Polycarbonate
HB Lens: ABS Resin & Unbrushed Chrome Plating

AT3019 Cap for Nonilluminated

Cap Color Available:

- **P** Brushed Chrome

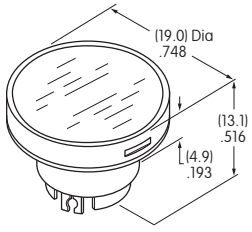


Material for Lens:
ABS Resin & Brushed Chrome Plating

AT3020 Cap with Illumination Ring for Bright or Super Bright LED

Cap Color Available:

- **JS** Metallic Silver with Clear Ring



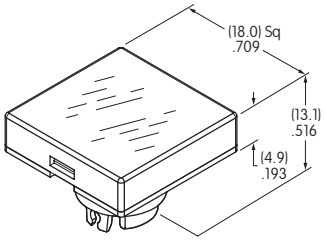
Materials
Lens: Polycarbonate
Insert: Polyester

*Yellow cap pairs with amber LED to achieve amber illumination.

AT3025 Cap for Illuminated or Nonilluminated

Lens/Diffuser Colors Available:

- **JB** Clear/White For Bright & Super Bright LEDs
- **CB** Red/White For Bright LED only
- **EB** *Yellow/White For Bright LED only
- **FB** Green/White For Bright LED only
- **HB** Unbrushed Chrome/White For Bright & Super Bright LEDs



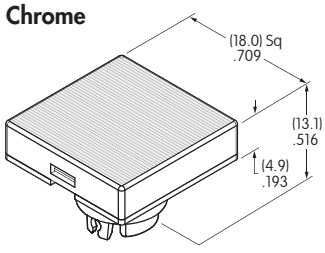
Material for Lens & Diffuser:
Polycarbonate

*Yellow cap pairs with amber LED to achieve amber illumination.

AT3027 Cap for Nonilluminated

Cap Color Available:

- **P** Brushed Chrome



Material for Lens:
ABS Resin & Brushed Chrome Plating

Standard Legends for Unbrushed Chrome Caps

001

Round or Square Cap
Bright or Super Bright LED

002

Round or Square Cap
Bright or Super Bright LED

003

Round or Square Cap
Bright or Super Bright LED

004

Round or Square Cap
Bright or Super Bright LED

005

Round or Square Cap
Bright or Super Bright LED

Images appear the color of the LED when lit.
Contact factory for other legends options.

Legend illustrations are approximate representations of the actual images on the caps.

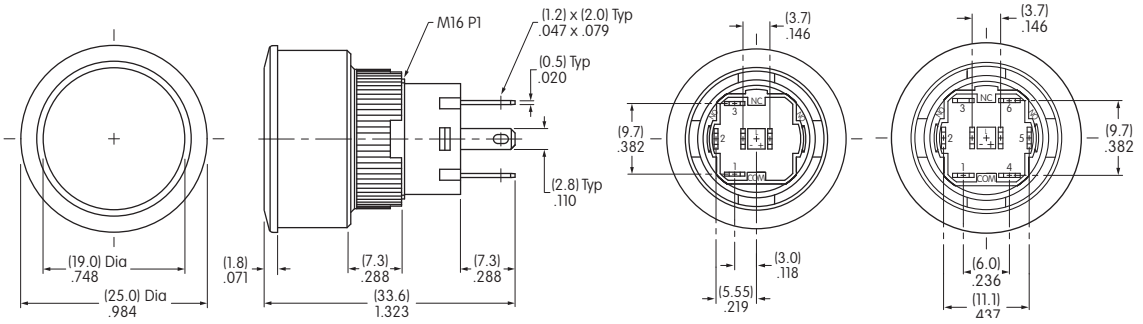
Unbrushed Chrome/White Cap with Lens/Diffuser

Without Illumination

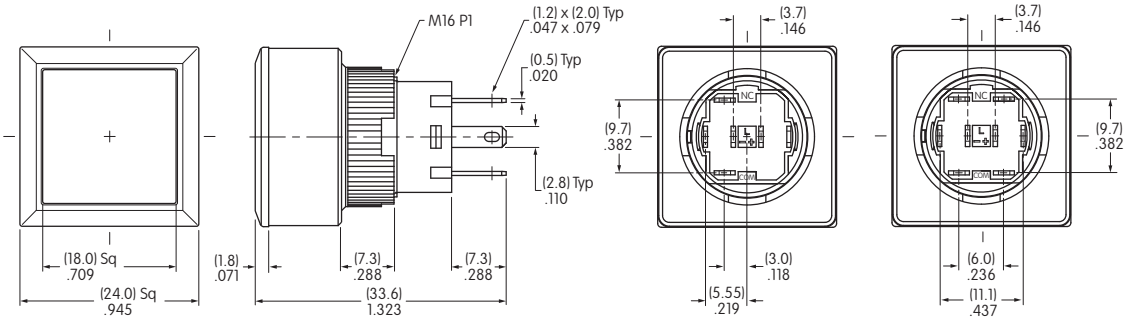
With Illumination

Depending on the design and the color of ink used, the legend may be visible when it is not illuminated.
It is recommended that the legend be clear and without ink in order to achieve the maximum visibility when the cap is illuminated.

TYPICAL SWITCH DIMENSIONS



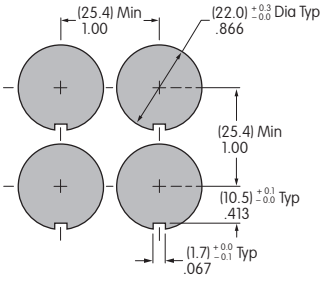
YB215CWCKW01-6B-JB



YB216CWSPW01-N-P

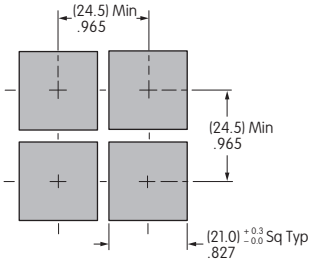
PANEL THICKNESS & CUTOUT

Recommended
Panel Thickness
.020″ ~ .197″
(0.5mm ~ 5.0mm)



Side-by-side Mounting

Recommended
Panel Thickness
.020″ ~ .197″
(0.5mm ~ 5.0mm)

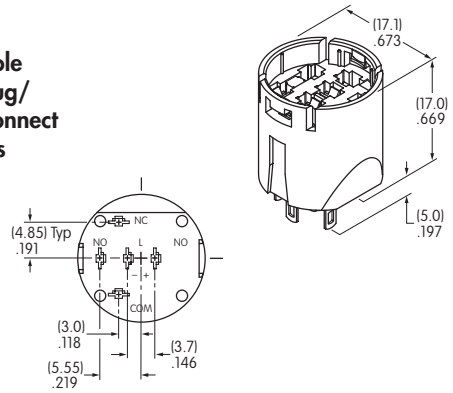


Side-by-side Mounting

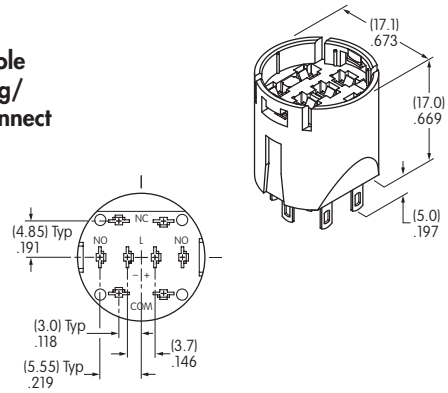
OPTIONAL ACCESSORIES

Adaptors

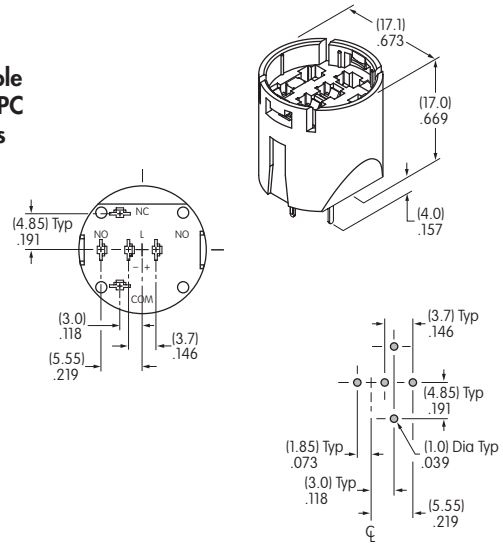
AT716
Single Pole
Solder Lug/
Quick Connect
Terminals



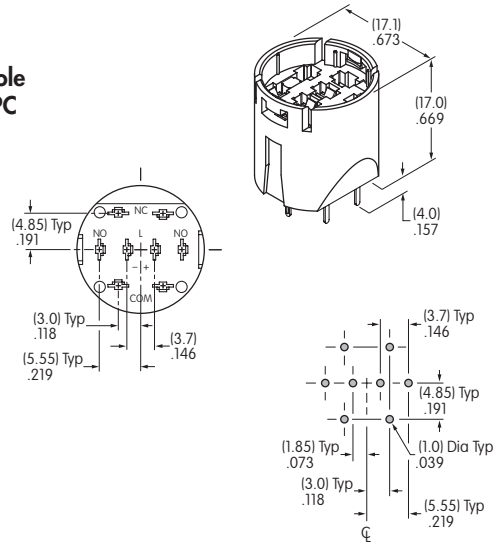
AT717
Double Pole
Solder Lug/
Quick Connect
Terminals



AT718
Single Pole
Straight PC
Terminals



AT719
Double Pole
Straight PC
Terminals



Material: Glass fiber reinforced polyamide Note: Order adaptors separately

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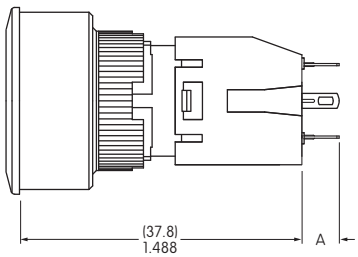
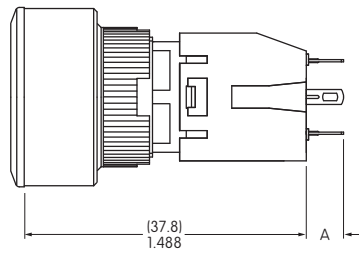
Round & Square Switch Dimensions Shown with Adaptor AT716





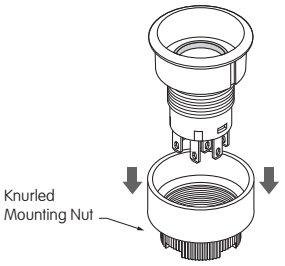
Dimension A:
Solder Lug .197″ (5.0mm); Straight PC .157″ (4.0mm)

Panel thickness for YB2 Round:
.020″ ~ .161″ (0.5mm ~ 4.1mm)

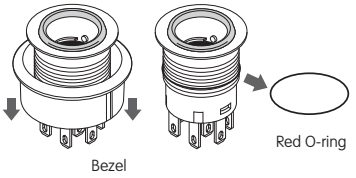
Panel thickness for YB2 Square:
.020″ ~ .126″ (0.5mm ~ 3.2mm)

ASSEMBLY INSTRUCTIONS FOR ROUND

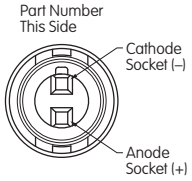
1. Remove knurled mounting nut.



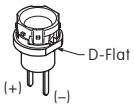
2. Remove bezel and red o-ring from housing. There are two o-rings in this assembly: one is red, one is orange.



3. Install LED.



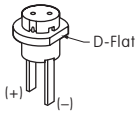
LEDs
AT634 & AT636



ATTENTION
ELECTROSTATIC
SENSITIVE DEVICES

Align D-flat on LED with Part Number on switch for appropriate polarity and insert LED into base.

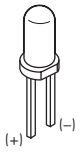
LED AT628



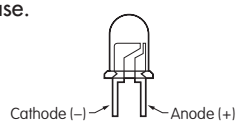
Align D-flat on LED with Part Number on switch for appropriate polarity and insert LED into base.

ATTENTION
ELECTROSTATIC
SENSITIVE DEVICES

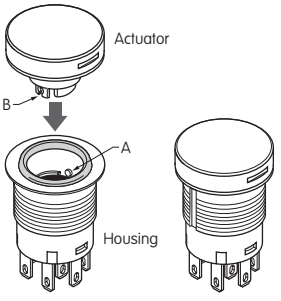
LEDs AT625G,
AT631B,
AT632F



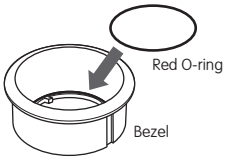
The larger metal part within the LED represents the cathode (–). Align LED for appropriate polarity and insert LED into base.



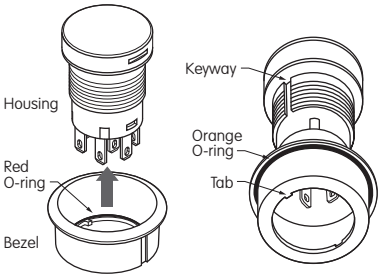
4. Align tabs (B) on both sides of actuator with the projections (A) inside of the housing and push actuator firmly down to snap in.



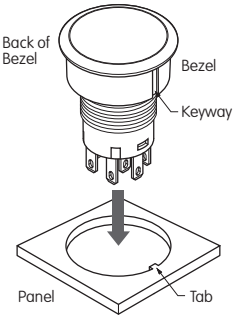
5. Install the red o-ring which was removed in step 2 at the inside bottom of the bezel.



6. Align tab inside of the bezel with keyway on housing and bring bezel back into its original position.

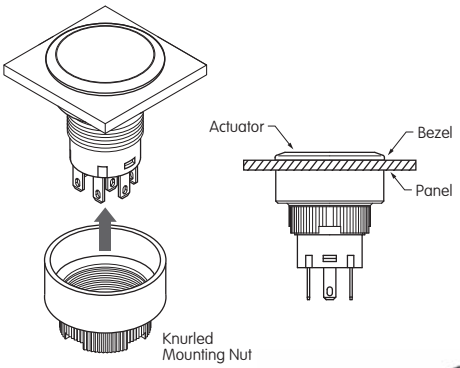


7. Before installing into panel, make sure that the orange o-ring is present at the back of the bezel. Align keyway on bezel with tab in panel and push switch all the way into the panel.



8. Attach mounting nut behind panel and tighten. Make sure that bezel and actuator fit properly and that there is no space between bezel and panel. Do not overtighten.

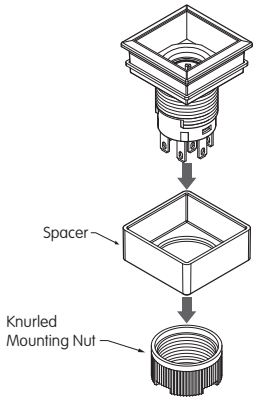
Mounting torque: 0.785Nm (6.95 lb•in) maximum.
Optional socket wrench AT106 available.



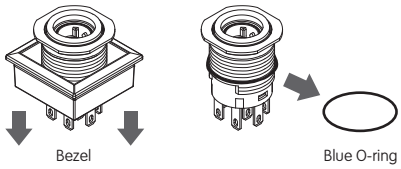
AT106 Socket Wrench

ASSEMBLY INSTRUCTIONS FOR SQUARE

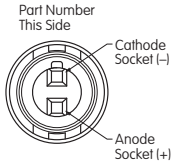
1. Remove knurled mounting nut.



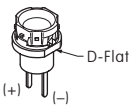
2. Remove bezel and blue o-ring from housing.



3. Install LED.



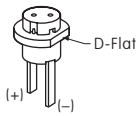
LEDs
AT634 & AT636



ATTENTION
ELECTROSTATIC
SENSITIVE DEVICES

Align D-flat on LED with Part Number on switch for appropriate polarity and insert LED into base.

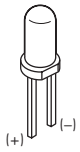
LED AT628



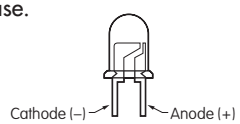
Align D-flat on LED with Part Number on switch for appropriate polarity and insert LED into base.

ATTENTION
ELECTROSTATIC
SENSITIVE DEVICES

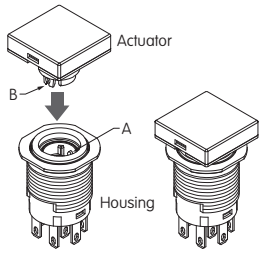
LEDs AT625G,
AT631B,
AT632F



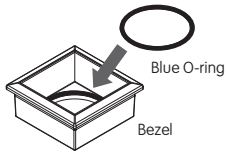
The larger metal part within the LED represents the cathode (–). Align LED for appropriate polarity and insert LED into base.



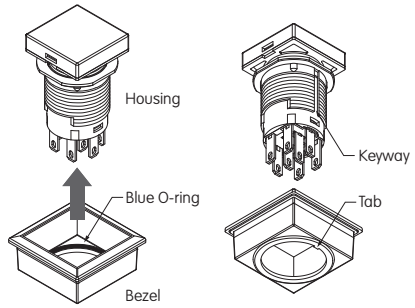
4. Align tabs (B) on both sides of actuator with the projections (A) inside of the housing and push actuator firmly down to snap in.



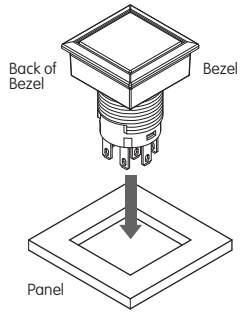
5. Install the blue o-ring which was removed in step 2 at the inside bottom of the bezel.



6. Align tab inside of the bezel with keyway on housing and bring bezel back into its original position.

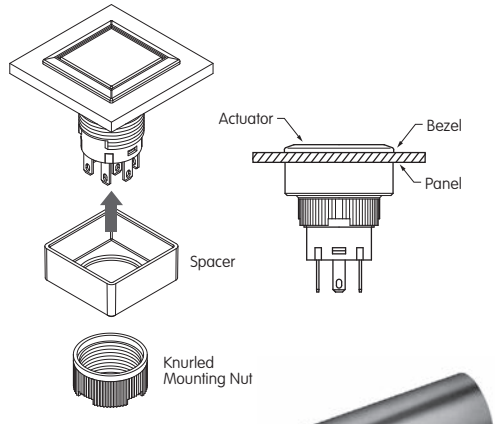


7. Before installing into panel, make sure that the square gasket is present at the back of the bezel. Align keyway on bezel with tab in panel and push switch all the way into the panel.



8. Attach mounting nut behind panel and tighten. Make sure that bezel and actuator fit properly and that there is no space between bezel and panel. Do not overtighten.

Mounting torque: 0.785Nm (6.95 lb•in) maximum.
Optional socket wrench AT106 available.



AT106 Socket Wrench

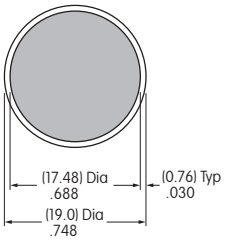
LEGENDS

NKK Switches can provide custom legends for caps. Contact factory for more information.

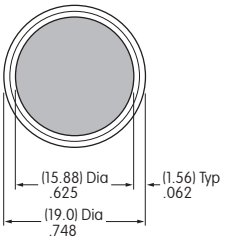
Suggested Printable Area for YB2 Caps

Recommended Methods: Laser Etch on clear cap, Screen Print or Pad Print on cap.
Epoxy based ink is recommended.

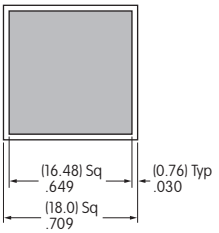
For Caps
AT3017, AT3018, and AT3019



For Cap
AT3020 (with clear ring for illumination)

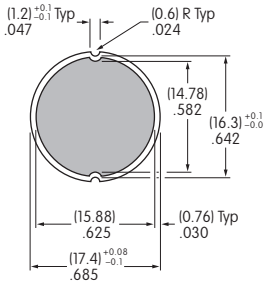


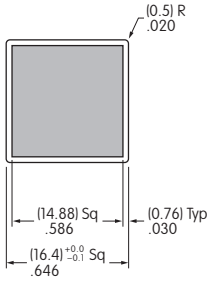
For Caps
AT3025 and AT3027



Shaded areas are printable areas.

Suggested Printable Area for Film Inserts





Recommended Method:
Screen Print; Epoxy based ink is recommended

Film Material and Thickness:
Clear Polyester, 4 mil max.

Shaded areas are printable areas.

HANDLING & PRECAUTIONS

ATTENTION
ELECTROSTATIC
SENSITIVE DEVICES

LEDs are electrostatic sensitive devices. When installing and handling LEDs, use an electrostatic protected work station to prevent LED damage.

NKK SWITCHES

SmartSwitch

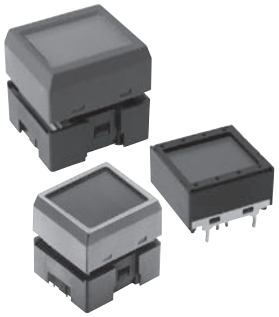
Contents SmartSwitch

OLED Pushbuttons, Display & Rocker.....E3

- Frameless OLED Switch with 96 x 64 Programmable Color Display
- OLED Switch with 64 x 48 Programmable Color Display
- OLED Display with 52 x 36 Programmable Color Display
- OLED Rocker Switch with 96 x 64 Programmable Display

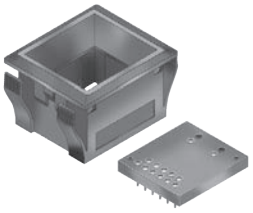
LCD 64 x 32 Pushbuttons, Display, Compact.....E21

- Switch with Programmable Display; Short Travel & RGB 64 Colors
- Switch with Programmable Display; Long Travel & RGB 64 Colors
- Display: Programmable with RGB 64 Colors & Long Life LCD
- Compact Switch with Programmable Display; RGB 64 Colors



LCD 36 x 24 Pushbuttons, Display, Compacts....E34

- Switch with Programmable Display; RGB Backlight
- Switch with Programmable Display; Red/Green Backlight
- Display: Programmable with RGB Backlight
- Compact Switch with Programmable Display; RGB Backlight
- Compact Switch with Programmable Display; Red/Green Backlight



Accessories.....E48

Enhance Your Applications

Development Tools & Support

NKK provides numerous development tools to get any SmartSwitch project started easily. Please visit out website or contact a sales representative.

OLED SWITCHES & DISPLAY

Frameless OLED Pushbutton — ISF15ACP4

96 x 64 Programmable Color Display
Video Capability; 180° Viewing Angle
High Definition, Excellent Contrast
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OLED Pushbutton — ISC15ANP4

64 x 48 Programmable Color Display
Video Capability; 180° Viewing Angle
High Definition, Excellent Contrast
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OLED Display — ISC01P

52 x 36 Programmable Color Display
Video Capability; 180° Viewing Angle
High Definition, Excellent Contrast
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OLED Rocker — IS18WWC1W

96 x 64 Programmable Display
White Monochrome OLED Display
Exceptional Contrast; 180° Viewing Angle; IP64 Rating
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For OLED Pushbuttons & Display

Handling & Storage Page E14

For OLED Rocker

Handling & Storage Page E20

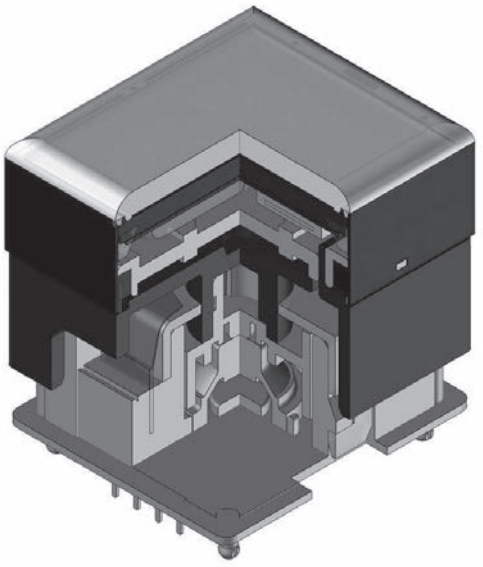
For Controlling, refer to Application Notes on website for more information.

SmartSwitch

Frameless OLED Pushbutton

DISTINCTIVE CHARACTERISTICS

- High definition, contrast and resolution of 96RGB x 64 pixels in compact screen and minimal frame
- Range of 65,536 colors in 16 bit mode
- Operating life of 50,000 hours minimum
- Maximum use of display lens with ultra-thin frame provides full screen capacity
- Multiple units easily combine to form one screen, offering flexibility in size and layout
- Smooth, silent operation with short stroke of 0.07" lends to tactile feedback unparalleled to touch panels
- Same outer dimensions of switch and footprint, enabling ease of replacement with current switches
- Operated by commands and data supplied via serial communications (SPI)
- Incorporates bitmap display function
- Low energy consumption
- Dust tight construction
- Snap-in standoff for easy, secure mounting and alignment; aids in prevention of dislodging during wave soldering



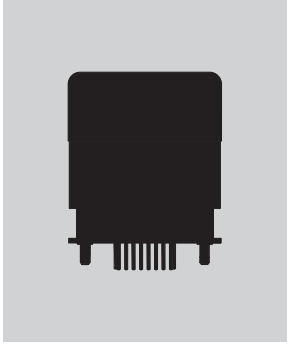
Viewing area: 21.28mm x 18.7mm (horizontal x vertical)

High reliability and long life of one million actuations minimum

Highly reliable gold plated twin contacts

Epoxy sealed straight PC terminals

Actual Size



SWITCH PART NUMBER & DESCRIPTION

ATTENTION ELECTROSTATIC SENSITIVE DEVICES

Part Number	Switch Description	OLED	Pixel Format
ISF15ACP4	SPST, Momentary ON Gold Contacts Straight PC Terminals	Color OLED Display Module 65,536 Colors	96RGB x 64 Pixels Horizontal x Vertical

SWITCH SPECIFICATIONS

Circuit	SPST normally open
Contact Position	Leave actuator: ① – ② OFF Push actuator: ① – ② ON
Electrical Capacity (Resistive Load)	100mA @ 12V DC (resistive circuit)
Contact Resistance	200 milliohms maximum @ 20mV 10mA
Insulation Resistance	100 megohms minimum @ 100V DC
Dielectric Strength	125V AC for 1 minute minimum
Mechanical Endurance	1,000,000 operations minimum
Electrical Endurance	1,000,000 operations minimum
Operating Force	2.0 ± 0.5 Newtons
Total Travel	1.8mm (0.07")

OLED SPECIFICATIONS

Characteristics of Display

Display Device	Color OLED display module
Display Mode	Passive matrix
Viewing Area	21.28mm x 18.74mm (horizontal x vertical)
Pixel Format	96RGB x 64 pixels (horizontal x vertical)
Pixel Size	0.222mm x 0.293mm (horizontal x vertical)
Interface	Serial (SPI) interface
Number of Colors	65,536 Colors (16bit: R 5bit/G 6bit/B 5bit) or 256 Colors (8bit: R 2bit/G 3bit/B 3bit)
Operating Temperature Range	–20°C ~ +70°C (–4°F ~ +158°F)
Storage Temperature Range	–30°C ~ +80°C (–22°F ~ +176°F)
Operating Life (Display)	50,000 hours @ 100cd/m² (based on 40% pixels ON; Ta = 77°F)

Absolute Maximum Ratings

Items	Symbols	Ratings
Supply Voltage for Logic/Interface	V_{DD}	–0.3V to +4.0V
Supply Voltage for Drive	V_{CC}	–0.0V to +19.0V
Input Voltage	V_I	–0.3V to V_{DD} +0.3V

Recommended Operating Conditions

Items	Symbols	Minimum	Typical	Maximum
Supply Voltage for Logic/Interface	V_{DD}	2.4V	2.8V	3.5V
Supply Voltage for Drive	V_{CC}	14.0V	15.0V	16.0V
Input High Level Voltage	V_{IH}	0.8 x V_{DD}	—	—
Input Low Level Voltage	V_{IL}	—	—	0.2 x V_{DD}

Current Consumption

(Temperature at 25°C, V_{DD} = 2.8V, V_{CC} = 15.0V)

Items	Symbols	Min	Typical	Max
All-Pixels-On Mode *Drive System Power Current	I_{CC1}	—	11.0mA	13.2mA
All-Pixels-On Mode *Logic/IF System Power Current	I_{DD1}	—	0.17mA	0.20mA
Sleep Mode **Drive System Power Current	I_{CC2}	—	—	10μA
Sleep Mode **Logic/IF System Power Current	I_{DD2}	—	—	10μA

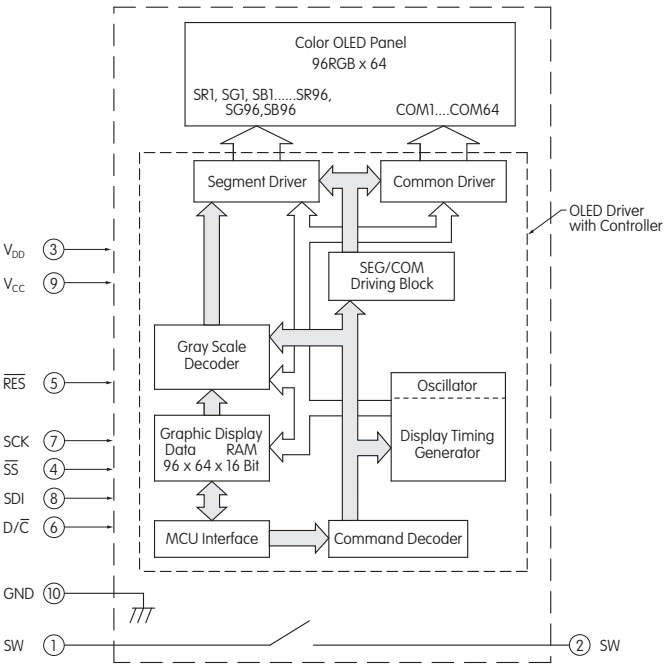
* All pixels shall be turned on with the maximum level gray scale
** All pixels shall be turned off (while chip is operating)

Optical Characteristics (Temperature at 25°C, Initial Value: 87 x 0F)

Items		Min	Typical	Max	Unit	Remarks
Luminosity		80	105	130	cd/m²	White (All pixels on)
White Color Coordinate	(x)	0.26	0.30	0.34	—	
	(y)	0.31	0.36	0.41	—	
Red Color Coordinate	(x)	0.62	0.66	0.70	—	
	(y)	0.30	0.34	0.38	—	
Green Color Coordinate	(x)	0.24	0.29	0.33	—	
	(y)	0.59	0.63	0.67	—	
Blue Color Coordinate	(x)	0.10	0.15	0.19	—	
	(y)	0.10	0.17	0.23	—	
Contrast Ratio		100	—	—	—	

BLOCK DIAGRAM & PIN CONFIGURATIONS

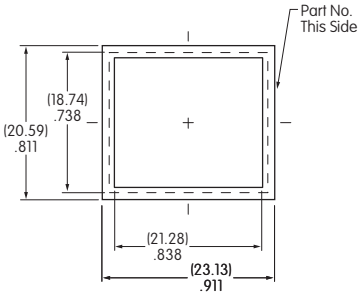
ISF15ACP4

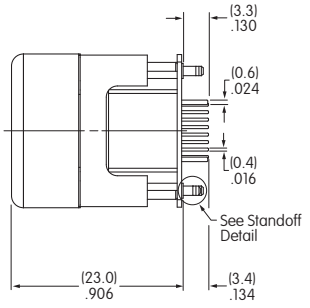


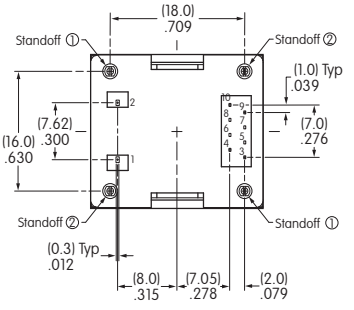
Pin No.	Symbol	Name	Function
1	**SW**	Terminal of Switch	Normally open
2	**SW**	Terminal of Switch	Normally open
3	**V_{DD}**	Power	Power source for logic circuit
4	**$\overline{SS}$**	Slave Select	Slave select for SPI. This line is active low.
5	**$\overline{RES}$**	Reset	Reset signal input. When pin is low, initialization of chip is executed.
6	**D/$\overline{C}$**	Data/Command	Data/Command Control. When pin is pulled low, data will be interpreted as Command; when pulled high, data will be interpreted as Data.
7	**SCK**	Serial Clock	Clock line for SPI that synchronizes command and data
8	**SDI**	Serial Data In	Data input line for SPI
9	**V_{CC}**	Power	Power source for drive circuit
10	**GND**	Ground	Connect to Ground

TYPICAL SWITCH DIMENSIONS

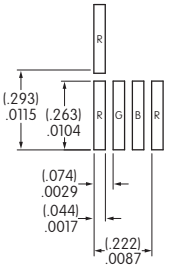
Terminal numbers are not on the switch.



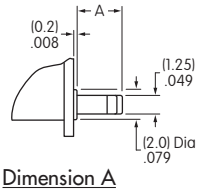




Pixel Detail



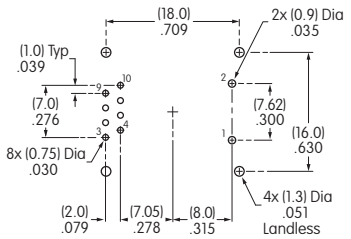
Standoff Detail



Dimension A

Standoff 1 = (2.7) .106 Standoff 2 = (2.3) .091

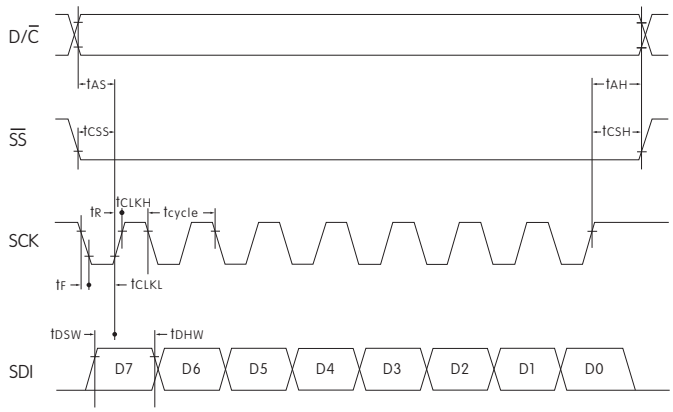
Footprint



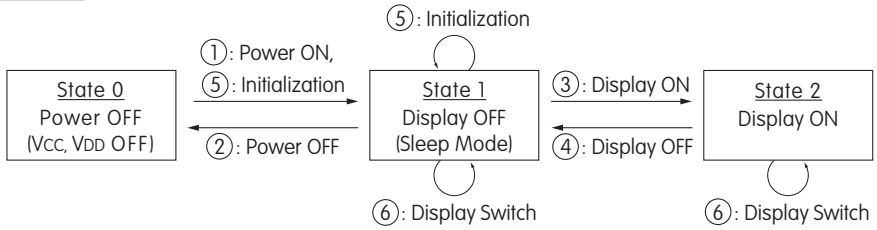
TIMING SPECIFICATIONS

AC Characteristics (Temperature at 25°C), V_{DD} = 2.4V ~ 3.5V)

Items	Symbols	Minimum	Typical	Maximum
Clock Cycle Time	tcycle	150ns	—	—
D/C̄ Setup Time	tAS	40ns	—	—
D/C̄ Hold Time	tAH	40ns	—	—
S̄S̄ Setup Time	tCSS	75ns	—	—
S̄S̄ Hold Time	tCSH	60ns	—	—
Write Data Setup Time	tDSW	40ns	—	—
Write Data Hold Time	tDHW	40ns	—	—
SCK Low Time	tCLKL	75ns	—	—
SCK High Time	tCLKH	75ns	—	—
SCK Rise Time	tR	—	—	15ns
SCK Fall Time	tF	—	—	15ns



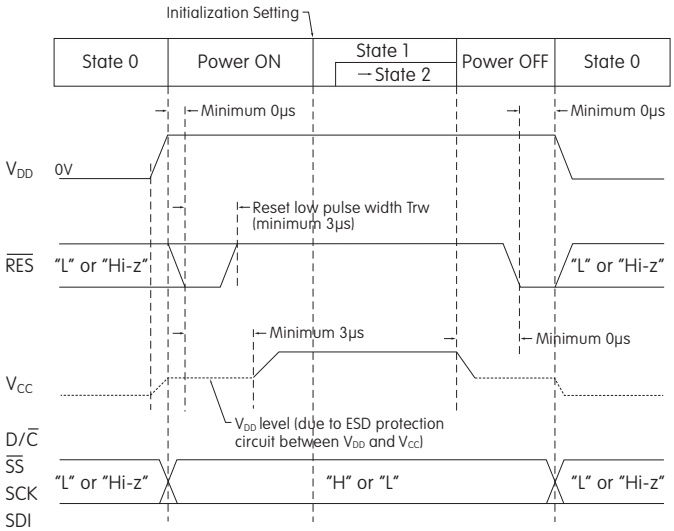
STATE TRANSITION



State Number	State	Display	Sleep	V_{CC}	V_{DD}	Changing the Display
0	Power OFF	OFF	—	OFF	OFF	Disable
1	Display OFF	OFF	ON	ON	ON	Enable
2	Display ON	ON	OFF	ON	ON	Enable

State Transition	Transition	Index
①	Power ON	Refer to "Power ON/OFF Sequence"
②	Power OFF	
③	Display ON	
④	Display OFF	
⑤	Initialization	Initialize Setting of Command/Data
⑥	Image Rewriting	Send Display Data
	Display Settings	Dimmer, Scroll, etc.

Power ON/OFF Sequence



SmartSwitch

OLED Pushbutton & Display

DISTINCTIVE CHARACTERISTICS

- Organic LED technology
- Life 30,000 hours @ 100cd/m² (based on 40% pixels on) or 60,000 hours @ 50cd/m² (based on 40% pixels on)
- Power consumption only 3.8mA (30% less than previous product)
- Range of 65,536 colors in 16 bit mode, 256 colors in 8 bit mode
- Full viewing angle of 180°
- Exceptional contrast: 50 times greater than LCD products
- Four times more enhanced resolution
- High resolution provides sharp, clear images of very small characters
- Operated by commands and data supplied via serial communications (SPI)
- Distinct, long travel of 4.5mm (same as KP01 series pushbuttons)
- Dust tight construction
- Stylish, translucent black housing design

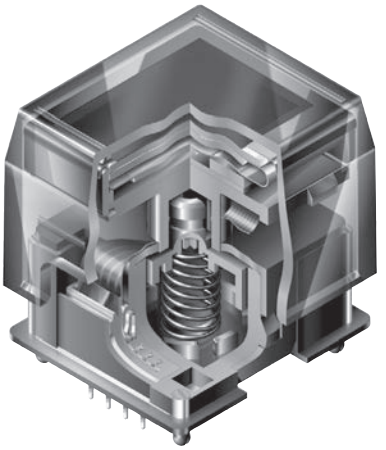
Viewing area: 15.5mm x 11.6mm (horizontal x vertical)

High reliability and long life of three million actuations minimum

High resolution of 64RGB x 48 pixels

Epoxy sealed straight PC terminals

Snap-in standoff for easy, secure mounting and alignment

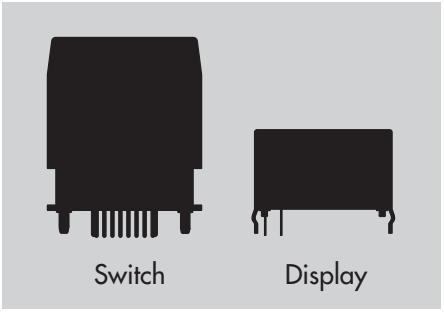


Viewing area: 12.9mm x 9.9mm (horizontal x vertical)

High resolution of 52RGB x 36 pixels

Bracket has crimped legs to ensure secure PC mounting and prevent dislodging during wave soldering

Actual Sizes



SWITCH PART NUMBER & DESCRIPTION

ATTENTION ELECTROSTATIC SENSITIVE DEVICES

Part Number	Switch Description	OLED	Pixel Format
ISC15ANP4	SPST, Momentary ON Gold Contacts Straight PC Terminals	Color OLED Display Module 65,536 Colors	64RGB x 48 Pixels Horizontal x Vertical

SWITCH SPECIFICATIONS

Circuit	SPST normally open
Contact Position	Leave actuator: ① – ② OFF Push actuator: ① – ② ON
Electrical Capacity (Resistive Load)	100mA @ 12V DC
Contact Resistance	200 milliohms maximum @ 20mV 10mA
Insulation Resistance	100 megohms minimum @ 100V DC
Dielectric Strength	125V AC for 1 minute minimum
Mechanical Endurance	3,000,000 operations minimum
Electrical Endurance	3,000,000 operations minimum
Operating Force	2.0 ± 0.5 Newtons
Total Travel	4.5mm (.177")

OLED SPECIFICATIONS

Characteristics of Display

Display Device	Color OLED display module
Display Mode	Passive matrix
Viewing Area	15.5mm x 11.6mm (horizontal x vertical)
Pixel Format	64RGB x 48 pixels (horizontal x vertical)
Pixel Size	0.21mm x 0.20mm (horizontal x vertical)
Interface	Serial (SPI) interface
Number of Colors	65,536 Colors (16bit: R 5bit/G 6bit/B 5bit) or 256 Colors (8bit: R 2bit/G 3bit/B 3bit)
Operating Temperature Range	–20°C ~ +70°C (–4°F ~ +158°F)
Storage Temperature Range	–30°C ~ +80°C (–22°F ~ +176°F)
Operating Life (Display)	30,000 hours @ 100cd/m² (based on 40% pixels ON) 60,000 hours @ 50cd/m² (based on 40% pixels ON)

Absolute Maximum Ratings

Items	Symbols	Ratings
Supply Voltage for Logic/Interface	V_{DD}	–0.3V to +4.0V
Supply Voltage for Drive	V_{CC}	–0.0V to +19.0V
Input Voltage	V_I	–0.3V to V_{DD} +0.3V

Recommended Operating Conditions

Items	Symbols	Minimum	Typical	Maximum
Supply Voltage for Logic/Interface	V_{DD}	2.4V	2.8V	3.5V
Supply Voltage for Drive	V_{CC}	15.0V	16.0V	17.0V
Input High Level Voltage	V_{IH}	0.8 x V_{DD}	—	—
Input Low Level Voltage	V_{IL}	—	—	0.2 x V_{DD}

Current Consumption

(Temperature at 25°C, V_{DD} = 2.8V, V_{CC} = 16.0V)

Items	Symbols	Min	Typical	Max
All-Pixels-On Mode *Drive System Power Current	I_{CC1}	—	3.8mA	4.6mA
All-Pixels-On Mode *Logic/IF System Power Current	I_{DD1}	—	0.16mA	0.19mA
Sleep Mode **Drive System Power Current	I_{CC2}	—	—	10μA
Sleep Mode **Logic/IF System Power Current	I_{DD2}	—	—	10μA

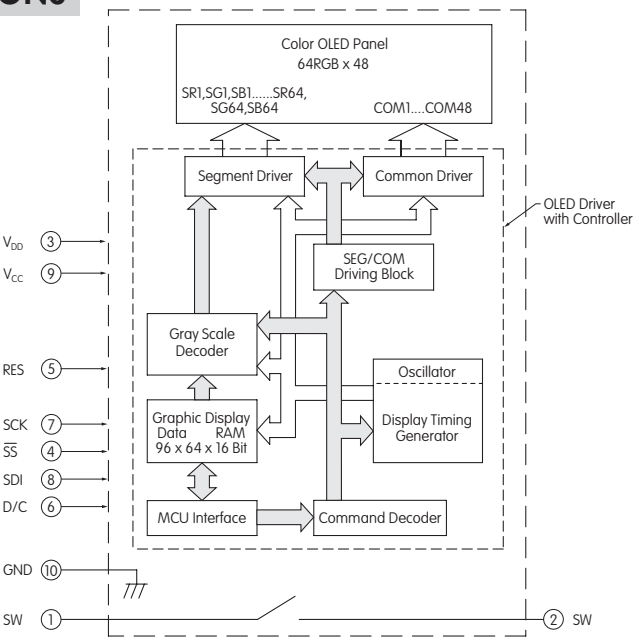
* All pixels shall be turned on with the maximum level gray scale
** All pixels shall be turned off (while chip is operating)

Optical Characteristics (Temperature at 25°C, Initial Value: 87 x 0F)

Items		Min	Typical	Max	Unit	Remarks
Luminosity		75	100	125	cd/m²	White (All pixels on)
White Color Coordinate	(x)	0.26	0.30	0.34	—	
	(y)	0.32	0.37	0.42	—	
Red Color Coordinate	(x)	0.63	0.67	0.71	—	
	(y)	0.29	0.33	0.37	—	
Green Color Coordinate	(x)	0.19	0.23	0.27	—	
	(y)	0.61	0.65	0.69	—	
Blue Color Coordinate	(x)	0.10	0.14	0.18	—	
	(y)	0.14	0.20	0.26	—	
Contrast Ratio		100	—	—	—	

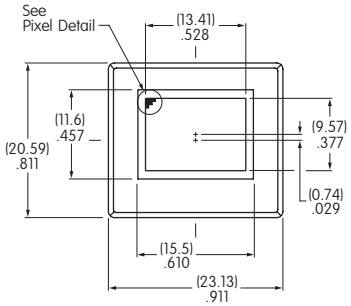
SWITCH BLOCK DIAGRAM & PIN CONFIGURATIONS

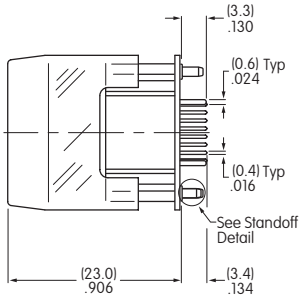
ISC15ANP4



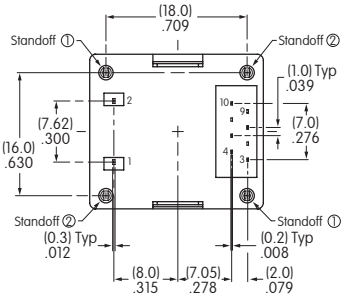
Pin No.	Symbol	Name	Function
1	SW	Terminal of Switch	Normally open
2	SW	Terminal of Switch	Normally open
3	V_{DD}	Power	Power source for logic circuit
4	$\overline{SS}$	Slave Select	Slave select for SPI. This line is active low.
5	RES	Reset	Reset signal input. When pin is low, initialization of chip is executed.
6	D/C	Data/Command	Data/Command Control. When pin is pulled low, data will be interpreted as Command; when pulled high, data will be interpreted as Data.
7	SCK	Serial Clock	Clock line for SPI that synchronizes command and data
8	SDI	Serial Data In	Data input line for SPI
9	V_{CC}	Power	Power source for drive circuit
10	GND	Ground	Connect to Ground

TYPICAL SWITCH DIMENSIONS

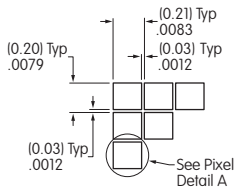




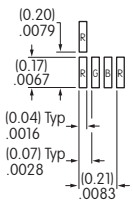
Terminal numbers are not on the switch.



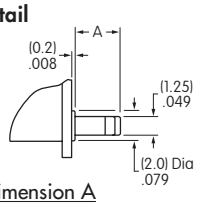
Pixel Detail



Pixel Detail A



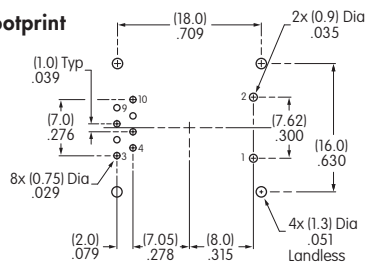
Standoff Detail



Dimension A

Standoff 1 = (2.7) .106 Standoff 2 = (2.3) .091

Footprint



DISPLAY PART NUMBER & DESCRIPTION

ATTENTION ELECTROSTATIC SENSITIVE DEVICES

Part Number	Display Description	OLED	Pixel Format
ISC01P	Straight PC Terminals	Color OLED Display Module 65,536 Colors	52RGB x 36 Pixels Horizontal x Vertical

OLED SPECIFICATIONS

Characteristics of Display

Display Device	Color OLED display module
Display Mode	Passive matrix
Viewing Area	12.9mm x 9.9mm (horizontal x vertical)
Pixel Format	52RGB x 36 pixels (horizontal x vertical)
Pixel Size	0.21mm x 0.22mm (horizontal x vertical)
Interface	Serial (SPI) interface
Number of Colors	65,536 Colors (16bit: R 5bit/G 6bit/B 5bit) or 256 Colors (8bit: R 2bit/G 3bit/B 3bit)
Operating Temperature Range	–20°C ~ +70°C (–4°F ~ +158°F)
Storage Temperature Range	–30°C ~ +80°C (–22°F ~ +176°F)
Operating Life (Display)	30,000 hours @ 100cd/m² (based on 40% pixels ON) 60,000 hours @ 50cd/m² (based on 40% pixels ON)

Absolute Maximum Ratings

Items	Symbols	Ratings
Supply Voltage for Logic/Interface	V_{DD}	–0.3V to +4.0V
Supply Voltage for Drive	V_{CC}	0.0V to +19.0V
Input Voltage	V_I	–0.3V to V_{DD} +0.3V

Recommended Operating Conditions

Items	Symbols	Minimum	Typical	Maximum
Supply Voltage for Logic/Interface	V_{DD}	2.4V	2.8V	3.5V
Supply Voltage for Drive	V_{CC}	15.0V	16.0V	17.0V
Input High Level Voltage	V_{IH}	0.8 x V_{DD}	—	—
Input Low Level Voltage	V_{IL}	—	—	0.2 x V_{DD}

Current Consumption

(Temperature at 25°C, V_{DD} = 2.8V, V_{CC} = 16.0V)

Items	Symbols	Min	Typical	Max
All-Pixels-On Mode *Drive System Power Current	I_{CC1}	—	2.4mA	2.9mA
All-Pixels-On Mode *Logic/IF System Power Current	I_{DD1}	—	0.15mA	0.18mA
Sleep Mode **Drive System Power Current	I_{CC2}	—	—	10μA
Sleep Mode **Logic/IF System Power Current	I_{DD2}	—	—	10μA

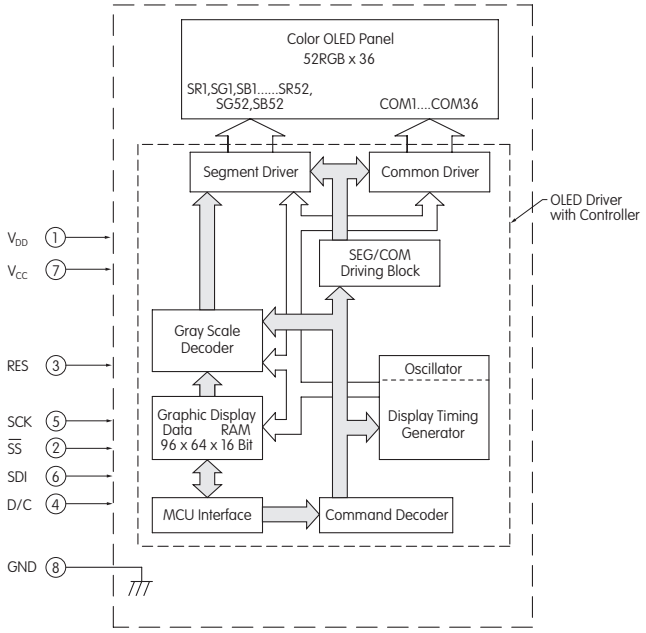
*All pixels shall be turned on with the maximum level gray scale
**All pixels shall be turned off (while chip is operating)

Optical Characteristics (Temperature at 25°C, Initial Value: 87 x 0F)

Items		Min	Typical	Max	Unit	Remarks
Luminosity		75	100	125	cd/m²	White (All pixels on)
White Color Coordinate	(x)	0.25	0.29	0.33	—	
	(y)	0.31	0.36	0.41	—	
Red Color Coordinate	(x)	0.63	0.67	0.71	—	
	(y)	0.29	0.33	0.37	—	
Green Color Coordinate	(x)	0.19	0.23	0.27	—	
	(y)	0.60	0.64	0.68	—	
Blue Color Coordinate	(x)	0.10	0.14	0.18	—	
	(y)	0.14	0.20	0.26	—	
Contrast Ratio		100	—	—	—	

DISPLAY BLOCK DIAGRAM & PIN CONFIGURATIONS

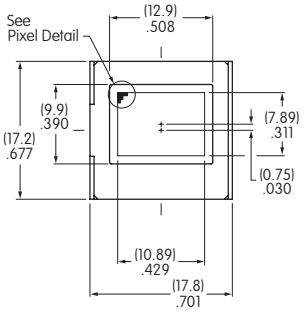
ISC01P

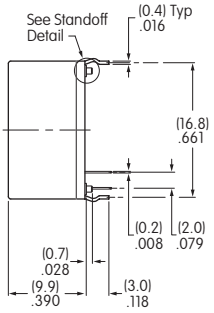


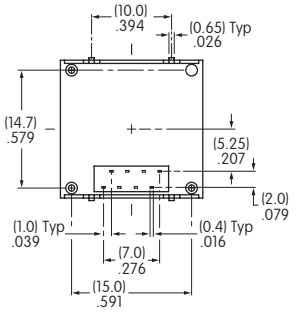
Pin No.	Symbol	Name	Function
1	V_{DD}	Power	Power source for logic circuit
2	$\overline{SS}$	Slave Select	Slave select for SPI. This line is active low.
3	RES	Reset	Reset signal input. When pin is low, initialization of chip is executed.
4	D/C	Data/Command	Data/Command Control. When pin is pulled low, data will be interpreted as Command; when pulled high, data will be interpreted as Data.
5	SCK	Serial Clock	Clock line for SPI that synchronizes command and data
6	SDI	Serial Data In	Data input line for SPI
7	V_{CC}	Power	Power source for drive circuit
8	GND	Ground	Connect to Ground

TYPICAL DISPLAY DIMENSIONS

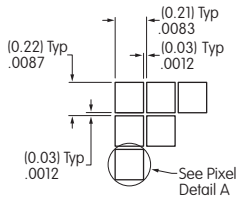
Terminal numbers are not on the switch.



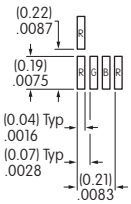




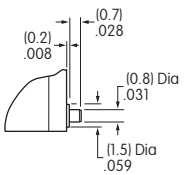
Pixel Detail



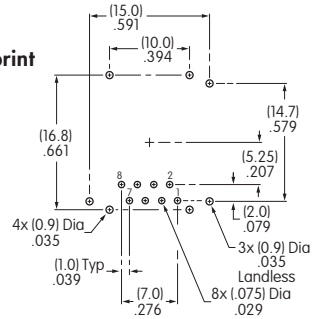
Pixel Detail A



Standoff Detail



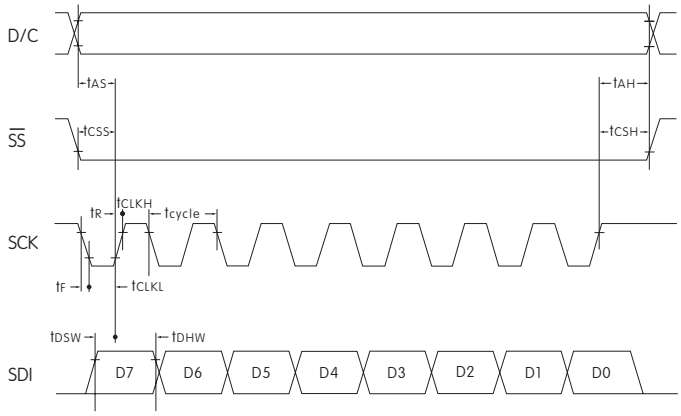
Footprint



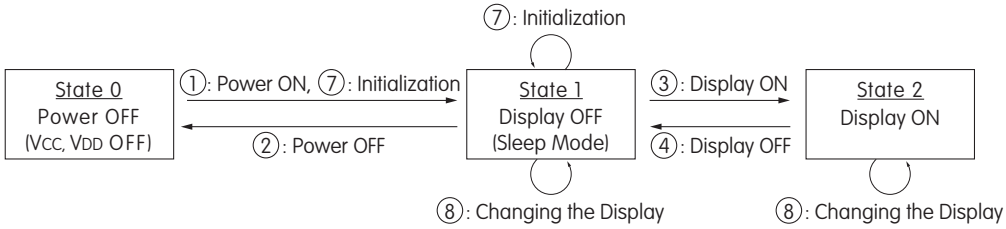
TIMING SPECIFICATIONS FOR SWITCH & DISPLAY

AC Characteristics (Temperature at 25°C), V_{DD} = 2.4V ~ 3.5V)

Items	Symbols	Minimum	Typical	Maximum
Clock Cycle Time	tcycle	150ns	—	—
D/C Setup Time	tAS	40ns	—	—
D/C Hold Time	tAH	40ns	—	—
$\overline{SS}$ Setup Time	tCSS	75ns	—	—
$\overline{SS}$ Hold Time	tCSH	60ns	—	—
Write Data Setup Time	tDSW	40ns	—	—
Write Data Hold Time	tDHW	40ns	—	—
SCK Low Time	tCLKL	75ns	—	—
SCK High Time	tCLKH	75ns	—	—
SCK Rise Time	tR	—	—	15ns
SCK Fall Time	tF	—	—	15ns



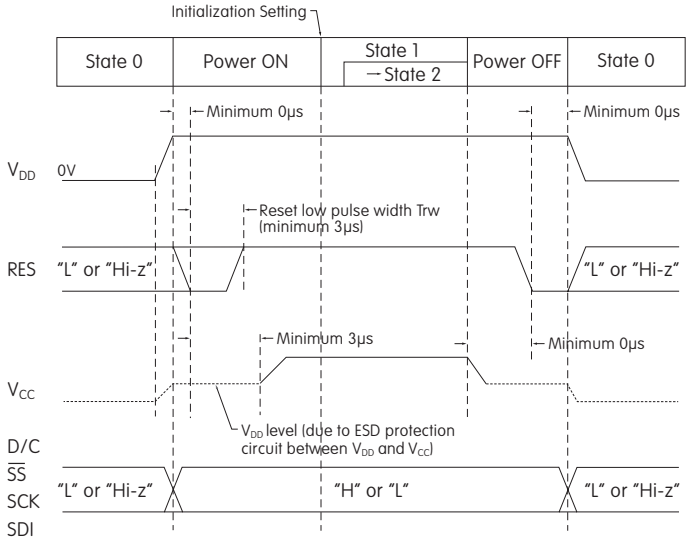
STATE TRANSITION



State Number	State	Display	Sleep	V_{CC}	V_{DD}	Changing the Display
0	Power OFF	OFF	—	OFF	OFF	Disable
1	Display OFF	OFF	ON	ON	ON	Enable
2	Display ON	ON	OFF	ON	ON	Enable

State Transition	Transition	Index
①	Power ON	Refer to "Power ON/OFF Sequence"
②	Power OFF	
③	Display ON	
④	Display OFF	
⑦	Initialization	Initialize Setting of Command/Data
⑧	Image Rewriting	Send Display Data
	Display Settings	Dimmer, Scroll, etc.

Power ON/OFF Sequence



Note: Refer to Application Notes on web site.

PRECAUTIONS FOR HANDLING & STORAGE OF OLED PUSHBUTTONS & DISPLAY

Handling

1. The IS Series OLED devices are electrostatic sensitive. To avoid damage to IC, do not touch terminals unless properly isolated from static electricity.
2. Signal input under conditions not recommended may cause damage to the OLED unit or deterioration of the display. Follow directions regarding supply sequences of power and signal voltages.
3. If the OLED panel is broken, avoid touching the contents. Wash off any contact to the skin or clothing.
4. Limit operating force to switch keytop to 100.0N maximum, as excessive pressure may damage the OLED.
5. For OLED display, it is necessary for bracket legs to be Grounded.
6. Recommended soldering time and temperature limits for OLED switch or display:

   Avoid temperatures exceeding 80°C at the OLED.
   Wave Soldering: see Profile A in Supplement section.
   Manual Soldering: see Profile A in Supplement section.
7. The IS series OLED devices are not process sealed.
8. Pixels acquire diminished brightness over time and use, and those most frequently habituated have greater reduction of brightness than those less used. To minimize this difference, operate OLED unit so that all pixels are used as consistently as possible.
9. For switch, clean cap surface with dry cloth. If further cleaning is needed, wipe with dampened cloth using neutral cleanser and dry with clean cloth. Do not use organic solvent. For display, avoid contact with any flux or detergent. If any liquids spill on display surface, immediately wipe with soft absorbent cloth.
10. Proper serial resistors and buffers for signals should be used to prevent noise problems.

Storage

1. Store in original container and away from direct sunlight.
2. Keep away from static electricity.
3. Avoid extreme temperatures, high humidity, gaseous substances, and all forms of chemical contamination.

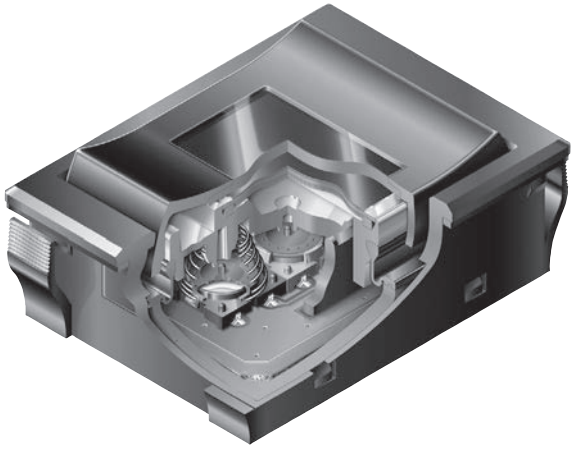
DISTINCTIVE CHARACTERISTICS

- Organic LED technology in display rocker (patent pending)
- Multifunction programmable device: select with rocker, push for activation
- Replaces multiple switches and displays with one device in a small package
- Broad display aids in navigation, both forward and reverse and up and down, in structured menus
- Wide viewing angle of 180° and large 0.92" display with exceptional contrast
- Conforms to IP64 of IEC60529 Standards on panel surface; dust tight construction of switch prevents entry of dust and improves contact reliability
- Commands and data supplied via serial communications protocol (SPI)
- Long life OLED with 52,000 hours at 30% illumination
- High reliability and long mechanical and electrical life of one million actuations minimum
- Stylish black housing design with matte finish complements any application

Monochrome OLED featuring sharp contrast and high resolution with 96 x 64 pixels

Panel mount with easy, snap-in installation

Short 14.6mm (.575") behind-panel height for compact spaces



Actual Size

SMARTSWITCH PART NUMBER & DESCRIPTION

Part Number	Description	
IS18WWC1W	**OLED Rocker Switch:** SP3T Switch Rocker (ON) (ON) (ON) Pushbutton Normally OFF	

SWITCH SPECIFICATIONS

Circuit	Single Pole Three Throw (Momentary)
Contact Position	Top: Normal OFF / Down (ON) 9-12; Center: Normal OFF / Down (ON) 10-12; Bottom: Normal OFF / Down (ON) 11-12
Electrical Capacity (Resistive Load)	3VA maximum DC
Contact Resistance	200 milliohms maximum
Insulation Resistance	500 megohms minimum @ 250V DC
Dielectric Strength	250V AC for 1 minute minimum
Electrostatic Resisting Pressure	15kV minimum
Mechanical Endurance	1,000,000 operations minimum
Electrical Endurance	1,000,000 operations minimum
Operating Force	5±2 Newtons at center of cap; 3.7±1.7 Newtons at top and bottom
Total Travel	1.3±0.5mm (.051"±.020") at center of cap; 1.8±0.6mm (.71"±.024") at top and bottom

OLED SPECIFICATIONS

Characteristics of Display

Display Device	Single color OLED display
Display Mode	Passive matrix
Pixel Format	96 x 64 pixels (horizontal x vertical)
Pixel Size	0.16mm x 0.177mm (horizontal x vertical)
Interface	Serial (SPI) interface
Color	White/Black (normally White)
Splash & Dust Proof	Conforms to IP64 of IEC60529 standards on panel surface
Operating Temperature Range	–20°C ~ +70°C (–4°F ~ +158°F)
Storage Temperature Range	–25°C ~ +80°C (–13°F ~ +176°F)
Operating Life Time (Display)	52,000 hours (30% brightness); 15,600 hours (100% brightness)

Absolute Maximum Ratings (Temperature at 25°C)

Items	Symbols	Ratings
Supply Voltage for Logic/Interface	VDDA	–0.3V to +3.6V
Supply Voltage for Drive	VAH	–0.3V to +18.0V
Input Voltage	Vin	–0.3V to VDDA +0.3V

Recommended Operating Conditions

Items	Symbols	Minimum	Typical	Maximum
Supply Voltage for Logic/Interface	VDDA	2.7V	2.8V	2.9V
Supply Voltage for Drive	VAH	14.5V	15.0V	15.5V
Input High Level Voltage	V_{IH}	0.75 x VDDA	—	VDDA
Input Low Level Voltage	V_{IL}	0.0	—	0.25V x VDDA

Current Consumption

(Temperature at 25°C, VDDA = 2.8V, VAH = 15.0V)

Items	Symbols	Min	Typical	Max
All-Pixels-On Mode *Drive System Power Current	I_{H1}	—	11.0mA	13.2mA
All-Pixels-On Mode *Logic/IF System Power Current	I_{DD1}	—	0.58mA	0.72mA
Sleep Mode **Drive System Power Current	I_{H2}	—	—	10μA
Sleep Mode **Logic/IF System Power Current	I_{DD2}	—	—	10μA

* All pixels shall be turned on with the maximum level gray scale
** All pixels shall be turned off (while chip is operating)

Optical Characteristics

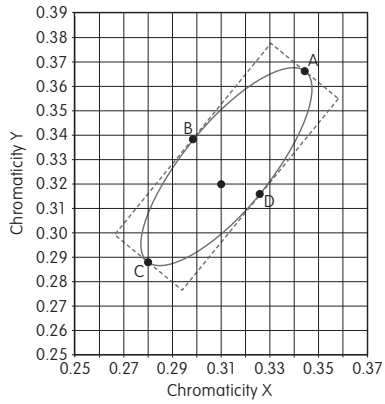
(Temperature at 25°C, Initial Value: depends on initial setting)

Items		Minimum	Typical	Maximum
Brightness		75 cd/m²	100 cd/m²	125 cd/m²
Chromaticity	(x)	*1	0.310	*1
	(y)	*1	0.320	*1
Contrast		100	—	—

* Chromaticity range is the area of the ellipse. (See Chromaticity Diagram next page) The ellipse passes through points A, B, C and D and designates the center of each side of the quadrangle.

Chromaticity Diagram

Point	Chromaticity X	Chromaticity Y
A	0.3441	0.3663
B	0.2983	0.3384
C	0.2799	0.2881
D	0.3257	0.3160



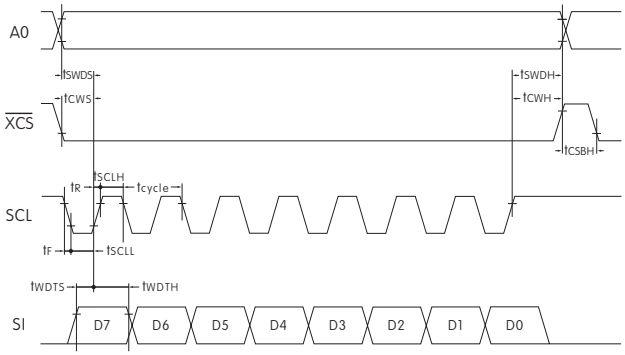
TIMING SPECIFICATIONS

AC Characteristics

(Temperature at −20°C ~ +70°C), VDDA = 2.8V, VAH = 16V

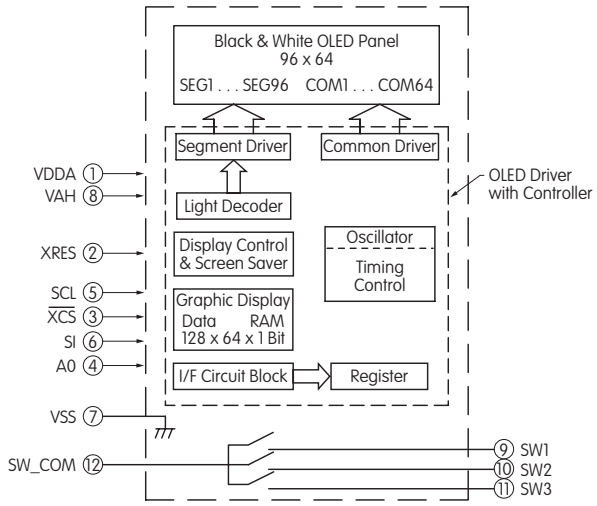
Items	Symbols	Minimum	Typical	Maximum
Clock Cycle Time	t_{cycle}	100ns	—	—
A0 Setup Time	t_{SWDS}	65ns	—	—
A0 Hold Time	t_{SWDH}	35ns	—	—
$\overline{XCS}$ Setup Time	t_{CWS}	65ns	—	—
$\overline{XCS}$ Hold Time	t_{CWH}	95ns	—	—
High Level $\overline{XCS}$ Pulse Width	t_{CSBH}	*10ns	—	—
Write Data Setup Time	t_{WDTS}	10ns	—	—
Write Data Hold Time	t_{WDTH}	20ns	—	—
SCL Low Time	t_{SCLL}	45ns	—	—
SCL High Time	t_{SCLH}	45ns	—	—
SCL Rise Time	t_r	—	—	15ns
SCL Fall Time	t_f	—	—	15ns

* Requires more than 100ns after resetting software



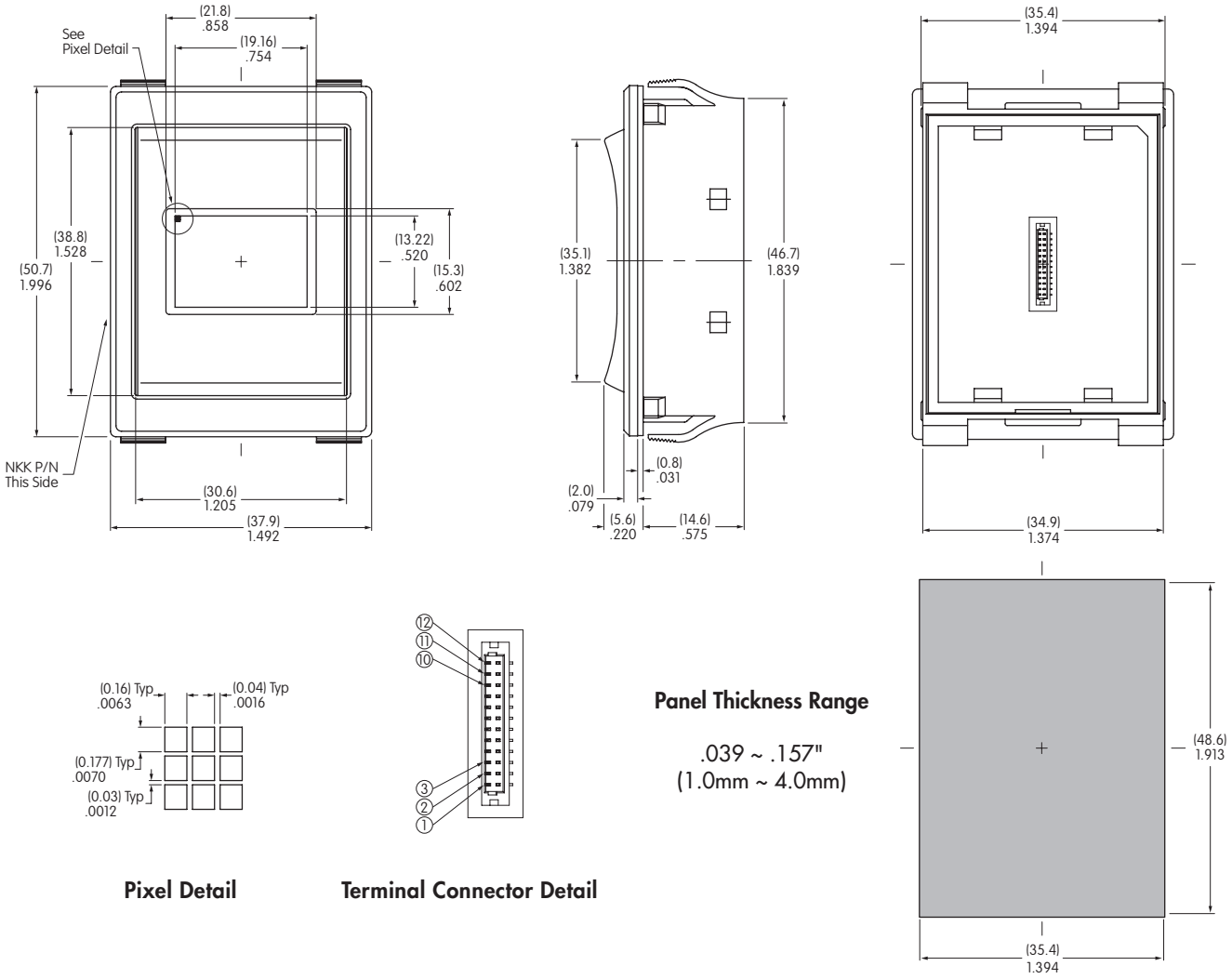
BLOCK DIAGRAM & PIN CONFIGURATIONS

IS18WWC1W



Pin No.	Symbol	Name	Function
1	VDDA	Logic Type Power Source	
2	XRES	Reset	Terminal to initialize IC built-in logic; initializes with low level
3	$\overline{XCS}$	Chip Select	Slave select for SPI. This line is active low.
4	A0	Address	Terminal to input control signals of command/parameter Set low at time of command input and high level at the time of parameter input.
5	SCL	Serial Clock	Read command/parameter at time of SCL signal standing up
6	SI	Serial Data Input	Terminal to input command/parameter by SPI
7	VSS	Ground	
8	VAH	Drive Type Power Source	
9	SW1	Switch Terminal 1	N/O
10	SW2	Switch Terminal 2	N/O
11	SW3	Switch Terminal 3	N/O
12	SW_COM	Switch Common Terminal	

SMARTSWITCH TYPICAL DIMENSIONS



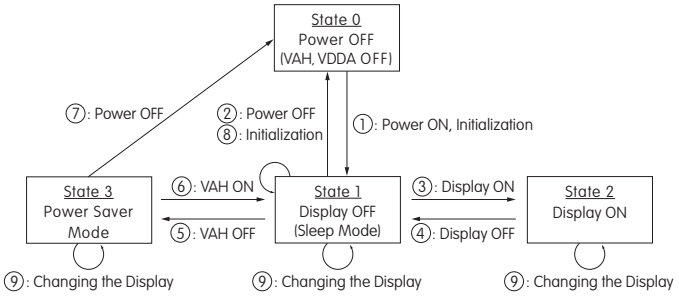
Pixel Detail

Terminal Connector Detail

Panel Thickness Range

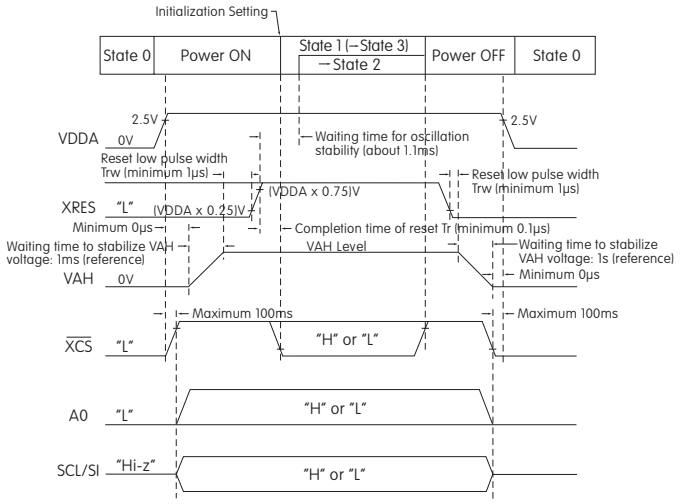
.039 ~ .157"
(1.0mm ~ 4.0mm)

STATE TRANSITION



State Number	State	Display	Sleep	VAH	VDDA	Changing the Display
0	Power OFF	OFF	—	OFF	OFF	Disable
1	Display OFF	OFF	ON	ON	ON	Enable
2	Display ON	ON	OFF	ON	ON	Enable
3	Power Saver	OFF	ON	OFF	ON	Enable

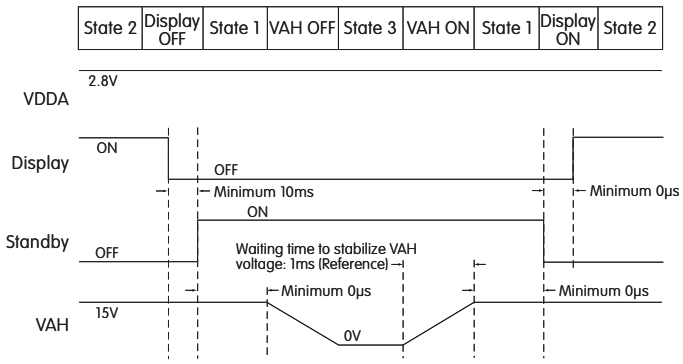
Power ON/OFF Sequence



STATE TRANSITION (CONTINUED)

State Transition	Transition		Reference or Setting Procedure
①	Power ON		Refer to "Power ON/OFF Sequence" → Refer to "Initialization Setting"
②	Power OFF		Refer to "Power ON/OFF Sequence"
③	Display ON		Refer to "Display ON/OFF Sequence"
④	Display OFF		
⑤	VAH OFF		Wait until VAH becomes stable
⑥	VAH ON		
⑦	Power OFF		Refer to "Power ON/OFF Sequence"
⑧	Initialization		Refer to "Initialization Setting"
⑨	Display Change	Image Rewriting	96 x 64 Image Data Sending
		Display Settings	Dimmer/Screen Saver/Indication 180° Reversal

Display ON/OFF Sequence



INITIALIZITION SETTING

Command Name	Command Address	Parameter (1 or 2Byte)	Remarks
Software Reset	01		
Dot Matrix Display ON/OFF	02	00	Note 1
Read/Write Operation Wetting	07	00	Note 1
Display Direction Set Command	09	00	Note 1
Reserved 1	10	03	Note 2
Reserved 2	12	63	Note 2
Reserved 3	13	00	Note 2
Dot Matrix Display Standby ON/OFF	14	00	
Reserved 4	16	00	Note 2
Reserved 5	17	00	Notes 1 & 2
Reserved 6	18	09	Note 2
Reserved 7	1A	04	Notes 1 & 2
Reserved 8	1C	00	Notes 1 & 2
Graphic Memory Writing Direction	1D	00	Note 1
Setting Column Output Range	30	005F	Note 1
Setting Row Output Range	32	003F	Note 1
X Axis Reading/Writing Start Point	34	00	Note 1
X Axis Reading/Writing End Point	35	0B	Note 1
Y Axis Reading/WritingStart Point	36	00	Note 1
Y Axis Reading/Writing End Point	37	3F	Note 1

Notes: 1. Same as default value

2. Do not change setting value

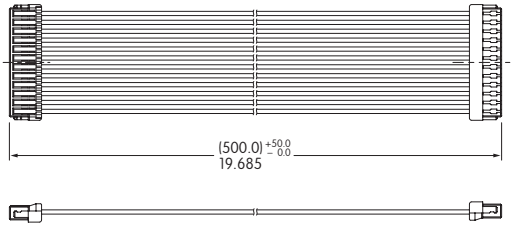
Command Name	Command Address	Parameter (1 or 2Byte)	Remarks
X Axis Reading Start Address	38	00	Note 1
Y Axis Reading Start Address	39	00	Note 1
Reserved 9	48	03	Note 2
Screen Saver Event Timer Setting Command	C3	00	Note 1
Screen Saver Event Timer Setting Command	C4	00	Note 1
One Time, Repeat or Direction Setting for Screen Saver	CC	00	Note 1
Start/Stop Setting for Screen Saver	CD	00	Note 1
System Clock Division Ratio Setting	D0	80	Note 2
Setting the STBY Pin	D2	00	Notes 1 & 2
DACA Setting	D4	00	Note 2
DACB Setting	D5	00	Note 2
DACC Setting	D6	00	Note 2
DACD Setting	D7	00	Note 2
Reserved 10	D9	00	Notes 1 & 2
Dimmer Setting	DB	0F	Note 1
Reserved 11	DD	88	Note 2
Image Writing	08	Image data	

Notes: 1. Same as default value

2. Do not change setting value

ACCESSORIES

AT715 Cable for Connection



PRECAUTIONS FOR HANDLING & STORAGE OF OLED ROCKERS

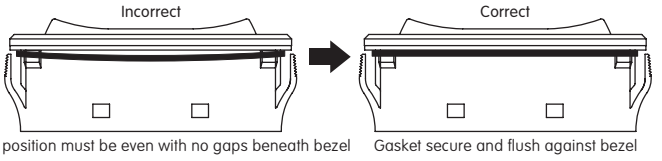
Handling

1. OLED devices are electrostatic sensitive.
2. Signal input under conditions not recommended may cause damage to the OLED unit or deterioration of the display. Follow directions regarding supply sequences of power and signal voltages.
3. If the OLED panel is broken, avoid touching the contents. Wash off in case of contact to the skin or clothing.
4. Limit operating force to 100.0N maximum, as excessive pressure may damage the display.
5. Under certain actuation conditions, one side of the rocker and the center switch can both send actuation signals.
6. Pixels acquire diminished brightness over time and use, and those most frequently habituated have greater reduction of brightness than those less used. To minimize this difference, operate OLED unit so that all pixels are used as consistently as possible.
7. Clean actuator surface with dry cloth. If further cleaning is needed, wipe with dampened cloth using neutral cleanser and dry with clean cloth. Do not use organic solvent.

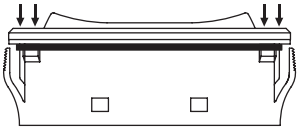
Storage

1. Store in original container and away from direct sunlight.
2. Keep away from static electricity.
3. Avoid extreme temperatures, high humidity, gaseous substances, and all forms of chemical contamination.

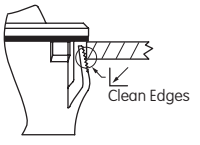
Panel Mounting



- Before snapping a switch into the panel, align the gasket evenly under the bezel of the switch.
- When mounting into a panel, apply equal pressure to sides of bezel and insert parallel to the panel.
- After mounting, be sure there are no gaps between switch and panel. Lightly push into panel.



- After installing into panel, do not apply excessive force.
- After panel installation and wiring is completed, do not apply force horizontally or vertically from behind panel.
- Behind the panel, cut area should be squared. If front of panel is painted, do not allow any paint to collect in corners of cutout to prevent level mounting.



- Avoid reinstalling a switch once it has been mounted into panel. This may cause deterioration of panel sealability.

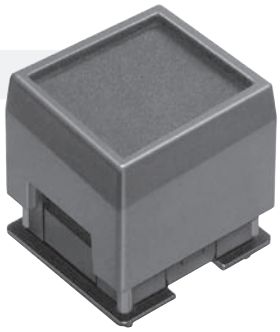
HIGH RESOLUTION LCDS

Pushbutton • Short Travel — IS15EBFP4RGB-09YN

Programmable Display; High Resolution: 64 x 32 Pixels
Backlight RGB: 64 colors; Black & White LCD
Up to 4 Lines with 10 Characters Each
Page E22

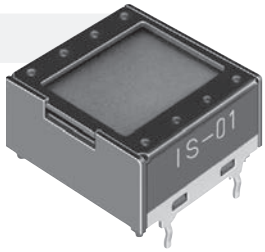
Pushbutton • Long Travel — IS15EBFP4RGB

Programmable Display; High Resolution: 64 x 32 Pixels
Backlight RGB: 64 colors; Black & White LCD
Up to 4 Lines with 10 Characters Each
Page E22



Display — IS01EBFRGB

Programmable Display; High Resolution: 64 x 32 Pixels
Backlight RGB: 64 colors; Black & White LCD
Up to 4 Lines with 10 Characters Each
Page E26



Compact Pushbutton — IS15ESBFP4RGB

Programmable Display; High Resolution: 64 x 32 Pixels
Backlight RGB: 64 colors; Black & White LCD
Up to 4 Lines with 10 Characters Each
Page E28

For All LCD 64 x 32 Switches & Displays

Timing Specifications	Page E31
Bitmap	Page E31
Commands & Data	Page E32
Handling & Storage	Page E33

SmartSwitch

Wide View LCD 64 x 32 Pushbuttons & Display

DISTINCTIVE CHARACTERISTICS

- Programmable display graphics for alphanumeric characters and animated sequences
- 64 colors of backlighting can be controlled dynamically
- Pushbutton switches or display with LCD, RGB LED backlighting
- General brightness of backlight is dynamically controlled in eight steps from dark to bright
- Operated by commands and data supplied via serial communications (SPI)
- Incorporates bitmap display function
- Dual image VRAM for quick change of displayed images
- Travel options: Short travel of 1.8mm, or long travel of 4.5mm (same as KP01 Series)
- Low energy consumption
- Dust tight construction

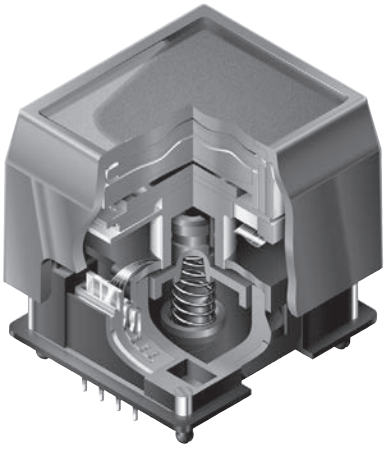
Viewing areas:
Switches - 17.0mm x 13.0mm (horizontal x vertical)
Display - 14.4mm x 11.8mm

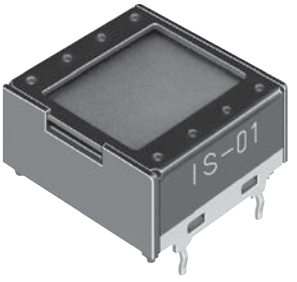
High reliability and long life of one million (short travel) or three million (long travel) actuations

High resolution of 64 x 32 pixels

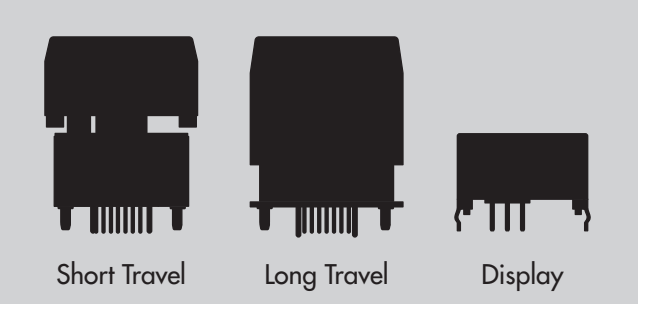
Epoxy sealed straight PC terminals

Snap-in standoff legs on the switches, or display's bracket with crimped legs, ensure secure mounting and alignment and prevent dislodging during wave soldering.



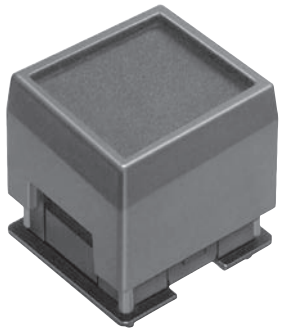


Actual Sizes of Switches & Display



IS15EBFP4RGB-09YN
RGB LED Backlight
Black and White LCD
Short Travel

IS15EBFP4RGB
RGB LED Backlight
Black and White LCD
Long Travel



SWITCH PART NUMBERS & DESCRIPTION

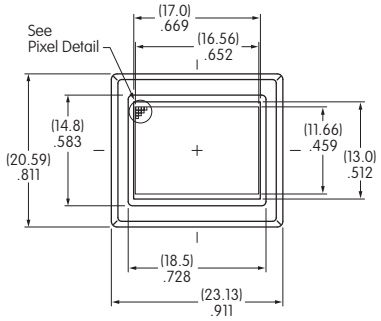
Part Numbers	Switch Description	LCD Mode	LED Color
IS15EBFP4RGB-09YN IS15EBFP4RGB	SPST Momentary ON Gold Contacts Straight PC Terminals	Black & White FSTN Positive	Red/Green/Blue

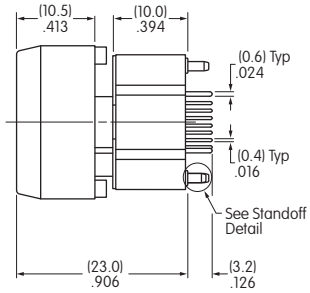
SWITCH SPECIFICATIONS

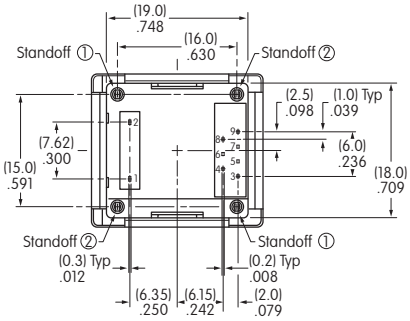
	Short Travel	Long Travel
Circuit	SPST normally open	SPST normally open
Electrical Capacity (Resistive Load)	100mA @ 12V DC	100mA @ 12V DC
Contact Resistance	200 milliohms maximum @ 20mV 10mA	200 milliohms maximum @ 20mV 10mA
Insulation Resistance	100 megohms minimum @ 100V DC	100 megohms minimum @ 100V DC
Dielectric Strength	125V AC for 1 minute minimum	125V AC for 1 minute minimum
Mechanical Endurance	1,000,000 operations minimum	3,000,000 operations minimum
Electrical Endurance	1,000,000 operations minimum	3,000,000 operations minimum
Operating Force	1.7 ± 0.5 Newtons	2.0 ± 0.5 Newtons
Total Travel	1.8mm (.071")	4.5mm (.177")

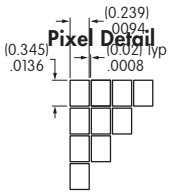
TYPICAL SWITCH DIMENSIONS FOR SHORT TRAVEL

Terminal numbers are not on the switch.

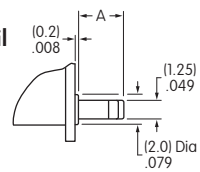








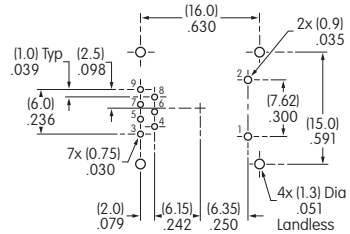
Standoff Detail



Dimension A

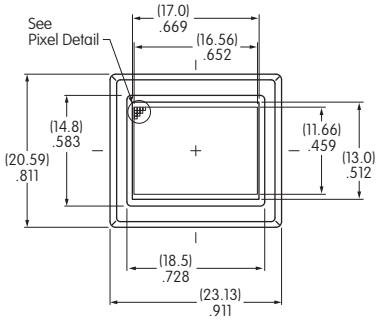
Standoff 1 = (2.7) .106 Standoff 2 = (2.3) .091

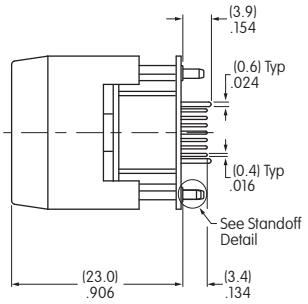
Footprint



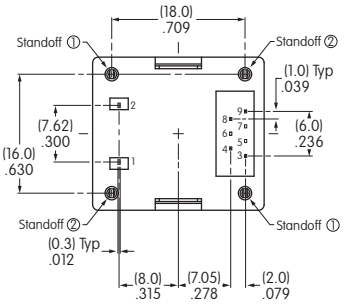
The Compact LCD 64 x 32 Pushbutton may utilize the same footprint as the Short Travel LCD 64 x 32 Pushbutton.

TYPICAL SWITCH DIMENSIONS FOR LONG TRAVEL

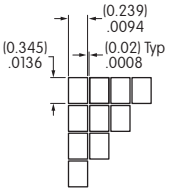




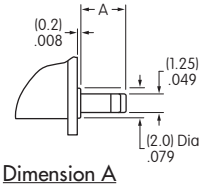
Terminal numbers are not on the switch.



Pixel Detail



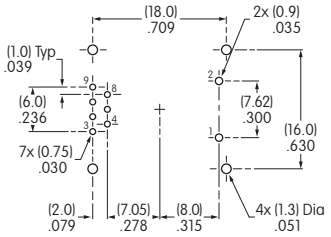
Standoff Detail



Dimension A

Standoff 1 = (2.7) .106 Standoff 2 = (2.3) .091

Footprint



The following pages for Wide View LCD 64 x 32 Pushbuttons apply to the both Short Travel and Long Travel LCD 64 x 32 Pushbuttons.

LCD SPECIFICATIONS

Characteristics of Display

Display Operation Mode	FSTN positive; background colors, black & white
Display Condition	Transflective with built-in LED backlight
Viewing Angle Direction	6 o'clock
Viewing Area	17.0mm x 13.0mm (horizontal x vertical)
Pixel Format	64 x 32 pixels (horizontal x vertical)
Pixel Size	0.239mm x 0.345mm (horizontal x vertical)
***Operating Temperature Range**	–15°C ~ +50°C (+5°F ~ +122°F)
Storage Temperature Range	–20°C ~ +60°C (–4°F ~ +140°F)
Backlight LED	**RGB:** red/green/blue

* In a low temperature environment (below 0°C), speed and contrast decrease when image changes. The non-indicator dot may become dense in a high temperature environment (about +50°C). Highest backlight brightness level should not be used for temperatures above +35°C.

Absolute Maximum Ratings (Temperature at 25°C)

Items	Symbols	Ratings
Supply Voltage	V_{DD}	–0.3V to +7.0V
Input Voltage	V_I	–0.3V to V_{DD} +0.3V
Output Voltage	V_O	–0.3V to V_{DD} +0.3V

Optical Characteristics (Temperature at 25°C)

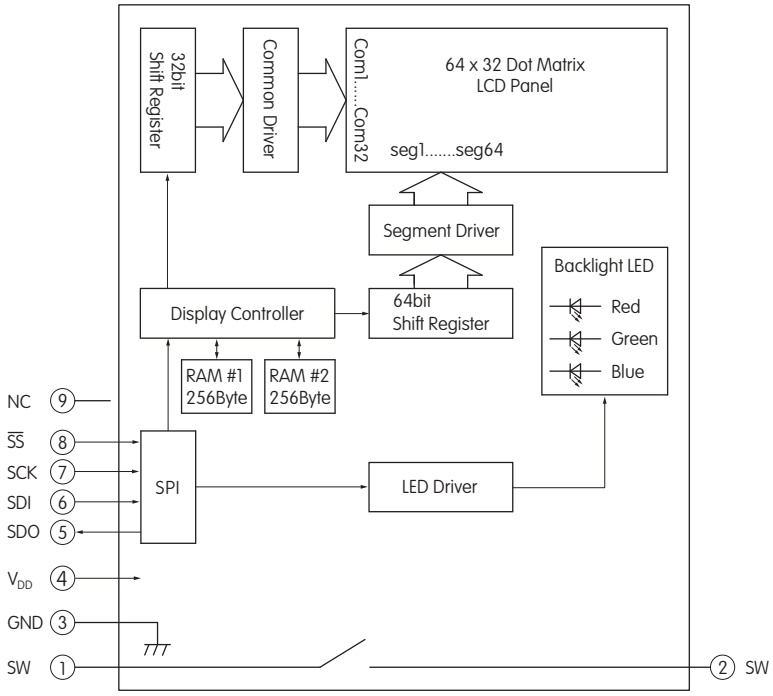
Items		Symbols	Min	Typical	Max
Contrast Ratio		Cr	—	3.0	—
Viewing Angle (Cr ≥ 1.1)	Up & Down	θ	—	90°	—
	Right & Left	ϕ	—	90°	—

Recommended Operating Conditions (Temperature at 25°C)

Items	Symbols	Minimum	Typical	Maximum
Supply Voltage	V_{DD}	4.9V	5.0V	5.1V
High Level Input Voltage	V_{IH}	0.8 V_{DD}	–	–
Low Level Input Voltage	V_{IL}	–	–	0.2V_{DD}
SPI Clock Frequency	f_{SCK}	–	–	8MHz
Current Consumption	I_{DD}	** 10mA	–	*** 60mA

** 10mA: Backlighting LED is off
*** 60mA: Backlighting LEDs (Red, Green, Blue) are maximum brightness

SWITCH BLOCK DIAGRAM & PIN CONFIGURATIONS



Pin No.	Symbol	Name	Function
①	**SW**	Terminal of Switch	Normally open
②	**SW**	Terminal of Switch	Normally open
③	**GND**	Ground	
④	**V_{DD}**	Power	Power source for logic circuit and LCD
⑤	**SDO**	Data Out	Data output line for SPI
⑥	**SDI**	Data In	Data input line for SPI
⑦	**SCK**	Serial Clock	Clock line for SPI that synchronizes commands and data
⑧	**$\overline{SS}$**	Slave Select	Chip select for SPI; line is active low
⑨	**NC**	None	No connection

DISPLAY PART NUMBER & DESCRIPTION

Part Number	Terminals	LCD Mode	LED Color
IS01EBFRGB	Straight PC	Black & White FSTN Positive	Red/Green/Blue

LCD SPECIFICATIONS

Characteristics of Display

Display Operation Mode	FSTN positive; background colors, black & white
Display Condition	Transflective with built-in LED backlight
Viewing Angle Direction	6 o'clock
Viewing Area	14.4mm x 11.8mm (horizontal x vertical)
Pixel Format	64 x 32 pixels (horizontal x vertical)
Pixel Size	0.200mm x 0.285mm (horizontal x vertical)
***Operating Temperature Range**	–15°C ~ +50°C (+5°F ~ +122°F)
Storage Temperature Range	–20°C ~ +60°C (–4°F ~ +140°F)
Backlight LED	**RGB:** red/green/blue

* In a low temperature environment (below 0°C), speed and contrast decrease when image changes. The non-indicator dot may become dense in a high temperature environment (about +50°C). Highest backlight brightness level should not be used for temperatures above +35°C.

Recommended Operating Conditions (Temperature at 25°C)

Items	Symbols	Minimum	Typical	Maximum
Supply Voltage	V_{DD}	4.9V	5.0V	5.1V
High Level Input Voltage	V_{IH}	0.8 V_{DD}	—	—
Low Level Input Voltage	V_{IL}	—	—	0.2V_{DD}
SPI Clock Frequency	f_{SCK}	—	—	8MHz
Current Consumption	I_{DD}	** 10mA	—	*** 60mA

** 10mA: Backlighting LED is off
*** 60mA: Backlighting LEDs (Red, Green, Blue) are maximum brightness

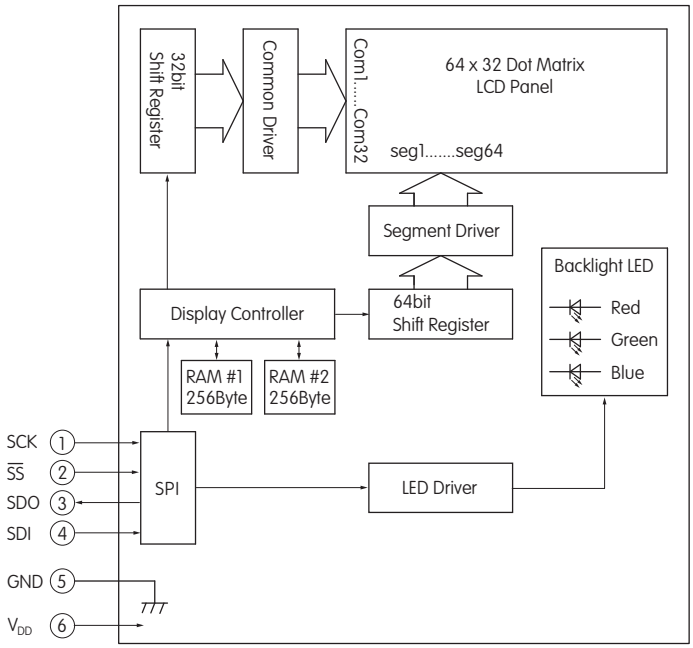
Absolute Maximum Ratings (Temperature at 25°C)

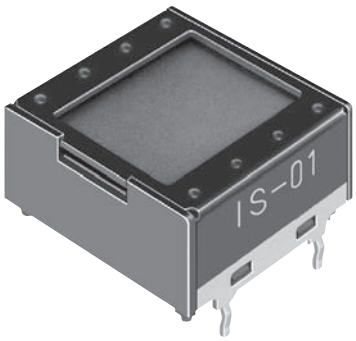
Items	Symbols	Ratings
Supply Voltage	V_{DD}	–0.3V to +7.0V
Input Voltage	V_I	–0.3V to V_{DD} +0.3V
Output Voltage	V_O	–0.3V to V_{DD} +0.3V

Optical Characteristics (Temperature at 25°C)

Items		Symbols	Minimum	Typical	Maximum
Contrast Ratio		Cr	—	3.0	—
Viewing Angle (Cr ≥ 1.1)	Up & Down	θ	—	90°	—
	Right & Left	ϕ	—	90°	—

DISPLAY BLOCK DIAGRAM & PIN CONFIGURATIONS



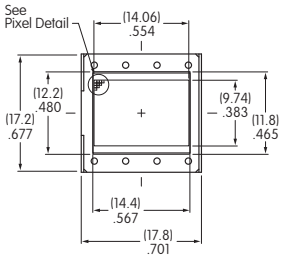


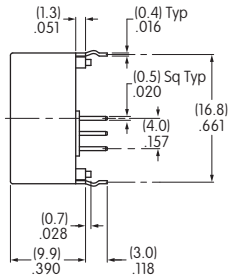
IS01EBFRGB
RGB LED Backlight
Black and White LCD

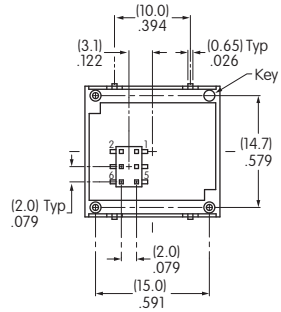
Pin No.	Symbol	Name	Function
1	**SCK**	Serial Clock	Clock line for SPI that synchronizes commands and data
2	**$\overline{SS}$**	Slave Select	Chip select for SPI; line is active low
3	**SDO**	Data Out	Data output line for SPI
4	**SDI**	Data In	Data input line for SPI
5	**GND**	Ground	
6	**V_{DD}**	Power	Power source for logic circuit and LCD

TYPICAL DISPLAY DIMENSIONS

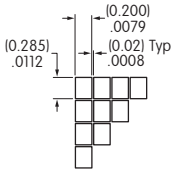
Terminal numbers are not on the device.



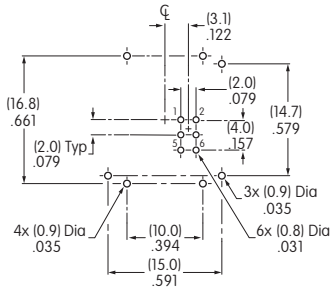




Pixel Detail



Footprint



SmartSwitch

Wide View Compact LCD 64 x 32 Pushbutton

DISTINCTIVE CHARACTERISTICS

Compact Size Combined with High Resolution

- High resolution of 64 x 32 pixels
- 64 colors of backlighting can be controlled dynamically
- Pushbutton switch with LCD, RGB LED backlighting
- General brightness of backlight is dynamically controlled in eight steps from dark to bright
- Operated by commands and data supplied via serial communications (SPI)
- Can display as many as four lines of text with ten characters each
- Incorporates bitmap display function
- Programmable display graphics for alphanumeric characters and animated sequences
- Dual image VRAM for quick change of displayed images
- Low energy consumption
- Dust tight construction

Viewing area: 14.5mm x 11.8mm (horizontal x vertical)

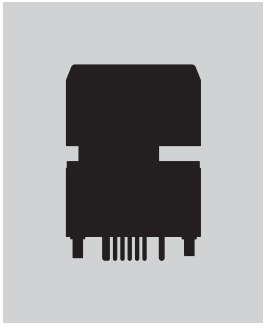
Variety of LED backlighting with 64 colors and 8 steps brightness

Dome gives crisp tactile feedback to positively indicate circuit transfer

Epoxy sealed straight PC terminals

Snap-in standoff for easy, secure mounting and alignment

Actual Size



PART NUMBER & DESCRIPTION

Part Number	Switch Description	LCD Mode	LED Color
IS15ESBFP4RGB	SPST Momentary ON Gold Contacts Straight PC Terminals	Black & White FSTN Positive	Red/Green/Blue

SWITCH SPECIFICATIONS

Circuit	SPST normally open
Electrical Capacity (Resistive Load)	100mA @ 12V DC
Contact Resistance	200 milliohms maximum @ 20mV 10mA
Insulation Resistance	100 megohms minimum @ 100V DC
Dielectric Strength	125V AC for 1 minute minimum
Mechanical Endurance	1,000,000 operations minimum
Electrical Endurance	1,000,000 operations minimum
Operating Force	1.7 ± 0.5 Newtons
Total Travel	1.8mm (.071")

Absolute Maximum Ratings (Temperature at 25°C)

Items	Symbols	Ratings
Supply Voltage	V_{DD}	–0.3V to +7.0V
Input Voltage	V_I	–0.3V to V_{DD} +0.3V
Output Voltage	V_O	–0.3V to V_{DD} +0.3V

Optical Characteristics (Temperature at 25°C)

Items		Symbols	Minimum	Typical	Maximum
Contrast Ratio		Cr	—	3.0	—
Viewing Angle (Cr ≥ 1.1)	Up & Down	θ	—	90°	—
	Right & Left	ϕ	—	90°	—

LCD SPECIFICATIONS

Characteristics of Display

Display Operation Mode	FSTN positive; background colors, black & white
Display Condition	Transflective with built-in LED backlight
Viewing Angle Direction	6 o'clock
Viewing Area	14.5mm x 11.8mm (horizontal x vertical)
Pixel Format	64 x 32 pixels (horizontal x vertical)
Pixel Size	0.200mm x 0.285mm (horizontal x vertical)
***Operating Temp Range**	–15°C ~ +50°C (+5°F ~ +122°F)
Storage Temp Range	–20°C ~ +60°C (–4°F ~ +140°F)
Backlight LED	**RGB:** red/green/blue

* In a low temperature environment (below 0°C), speed and contrast decrease when image changes. The non-indicator dot may become dense in a high temperature environment (about +50°C). Highest backlight brightness level should not be used for temperatures above +35°C.

Recommended Operating Conditions (Temperature at 25°C)

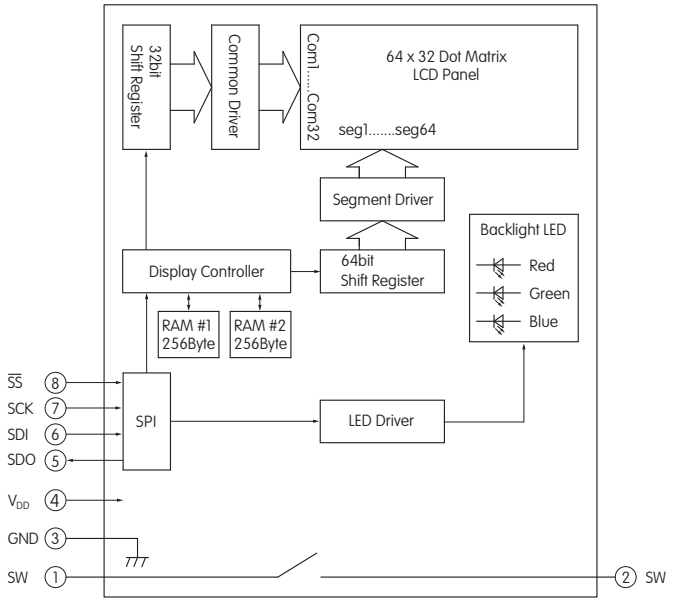
Items	Symbols	Minimum	Typical	Maximum
Supply Voltage	V_{DD}	4.9V	5.0V	5.1V
High Level Input Voltage	V_{IH}	0.8 V_{DD}	—	—
Low Level Input Voltage	V_{IL}	—	—	0.2V_{DD}
SPI Clock Frequency	f_{SCK}	—	—	8MHz
Current Consumption	I_{DD}	** 10mA	—	*** 60mA

** 10mA: Backlighting LED is off

*** 60mA: Backlighting LEDs (Red, Green, Blue) are maximum brightness

BLOCK DIAGRAM & PIN CONFIGURATIONS

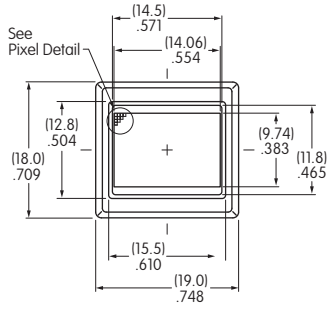
IS15ESBFP4RGB
RGB LED Backlight
Black and White LCD

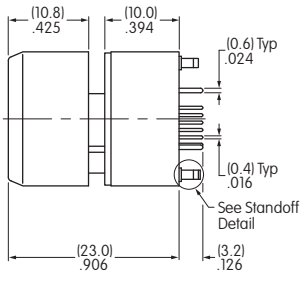


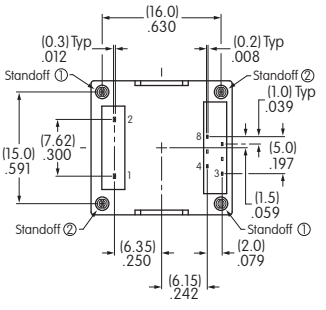
Pin No.	Symbol	Name	Function
1	**SW**	Terminal of Switch	Normally open
2	**SW**	Terminal of Switch	Normally open
3	**GND**	Ground	
4	**V_{DD}**	Power	Power source for logic circuit and LCD
5	**SDO**	Data Out	Data output line for SPI
6	**SDI**	Data In	Data input line for SPI
7	**SCK**	Serial Clock	Clock line for SPI that synchronizes commands and data
8	**$\overline{SS}$**	Slave Select	Chip select for SPI; line is active low

TYPICAL SWITCH DIMENSIONS

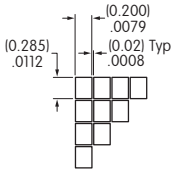
Terminal numbers are not on the switch.



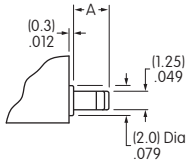




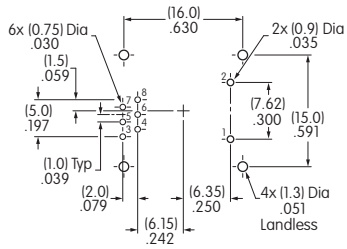
Pixel Detail



Standoff Detail



Footprint



Dimension A

Standoff 1 = (2.7) .106 Standoff 2 = (2.3) .091

The Compact LCD 64 x 32 Pushbutton may utilize the same footprint as the Short Travel LCD 64 x 32 Pushbutton.

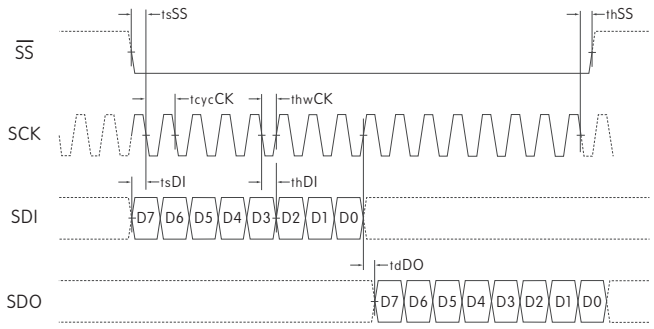
TIMING SPECIFICATIONS FOR SWITCHES & DISPLAY

SPI Characteristics (See Timing Diagram)

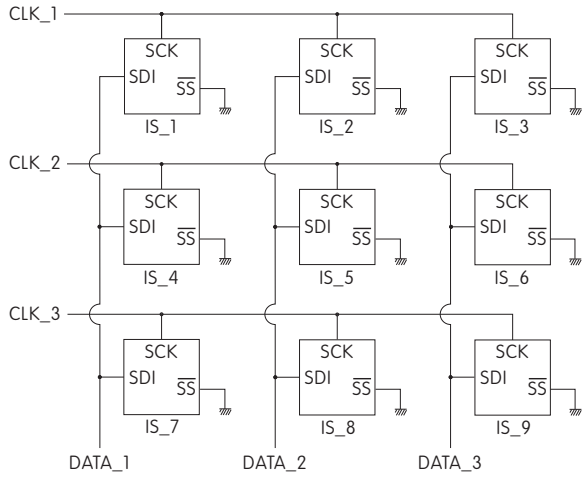
(Temperature at −15°C ~ +50°C and V_{DD} = 5.0V ± 2%)

Items	Symbols	Minimum	Maximum
SPI_$\overline{SS}$ Set Up Time	tsSS	10ns	
SPI_$\overline{SS}$ Hold Time	thSS	10ns	
SPI_CLK Cycle	tcycCK		8MHz
SPI_CLK Width	thwCK	10ns	
SPI_DI Set Up Time	tsDI	10ns	
SPI_DI Hold Time	thDI	10ns	
SPI_DO Delay Time	tdDO	10ns	

SPI Timing Chart ($\overline{SS}$ Using)

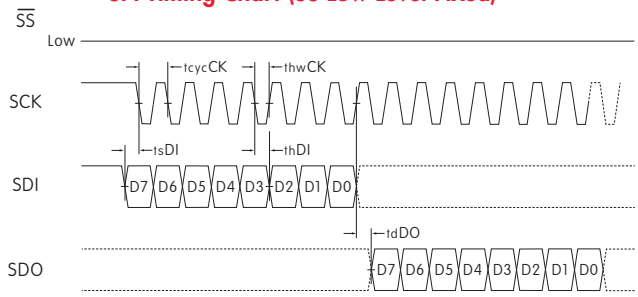


Circuit Example



It is recommended that all $\overline{SS}$ pins be connected to a controller pin instead of ground. A clock glitch during power up could cause the communication to fall out of sync. Toggling the $\overline{SS}$ line resets the communication.

SPI Timing Chart ($\overline{SS}$ Low Level Fixed)



SDI and SCK shall be kept high when idle.

BITMAP

	Segment				
Common	**1 2 3 4 5 6 7 8**	**9 • • • 16**	**• • • • •**	**49 • • • 56**	**57 58 59 60 61 62 63 64**
	Byte8	Byte7	• • •	Byte2	Byte1
COM1	D0 D1 D2 D3 D4 D5 D6 D7	D0 • • • D7	• • •	D0 • • • D7	D0 D1 D2 D3 D4 D5 D6 D7
	Byte16				Byte9
COM2	D0 D1 D2 D3 D4 D5 D6 D7				D0 D1 D2 D3 D4 D5 D6 D7
•	•				•
•	•				•
•	•				•
	Byte256	• • •		• • •	Byte249
COM32	D0 D1 D2 D3 D4 D5 D6 D7				D0 D1 D2 D3 D4 D5 D6 D7

Transferring Display Data/Displaying LCD Command and Data Sequence

Command	Data (256 Bytes)		
0 x 55	Byte1	Byte2 • • • Byte255	Byte256
0 1 0 1 0 1 0 1	D7 D6 D5 D4 D3 D2 D1 D0	D7 D6 • • • D1 D0	D7 D6 D5 D4 D3 D2 D1 D0

Notes: Display RAM has two screen areas. The first area is for the display on current LCD; the second area is for the data to be displayed next. The screens are changed when the second area is fully stored.

COMMANDS & DATA

- Transferring display data/displaying on LCD: command (1 Byte) + data (256 Bytes)
- Others: command (1 Byte) + data (1 Byte)
- Commands can be accepted only when all bits coincide; otherwise, they are not acknowledged
- Additional commands will not be received until the communication of commands (1 Byte) and data (256 or 1 Byte) is completed
- There is no time limit from the beginning to end of data receipt
- Commands may be executed consecutively (no need to wait between commands)
- Irregular commands or data are not recognized
- Initial status at power activation: LCD display off, LED off (brightness 1/20, color off)

Transferring Display Data/Displaying on LCD

Command		Data	Remarks
Hex	Binary		
0 x 55	01010101	256 Bytes (64 x 32 = 2,048 bits)	See above for details of bitmap data

LED (Backlight) Color Set

Command		Data	Remarks
Hex	Binary		
0 x 40	01000000	R R G G B B 1 1 2 bits x 3	For each of RGB: 00 = off 10 = 1/2 01 = 1/4 11 = full

LED (Backlight) Brightness Set

Command		Data	Remarks
Hex	Binary		
0 x 41	01000001	* * * 1 1 1 1 1 3 bits	For leading 3bits: 000 = 1/20 (dark) 100 = 1/3 001 = 1/10 101 = 1/2 010 = 1/7 110 = 2/3 011 = 1/5 111 = full (bright)

Reset (Returning to Initial Status at Power Activation)

Command		Data	Remarks
Hex	Binary		
0 x 5E	01011110	00000011	Returning to initial status at power activation

PRECAUTIONS FOR HANDLING & STORAGE OF LCD 64 x 32 DEVICES

Handling

1. The IS Series devices are electrostatic sensitive.
2. Limit operating force to keytop to 100.0N maximum, as excessive pressure may damage the LCD device.
3. The IS series devices are not process sealed.
4. If the LCD is accidentally broken, avoid contact with the liquid and wash off any liquid spills to the skin or clothing.
5. Clean cap surface with dry cloth. If further cleaning is needed, wipe with dampened cloth using neutral cleanser and dry with clean cloth. Do not use organic solvent.
6. Recommended soldering time and temperature limits:

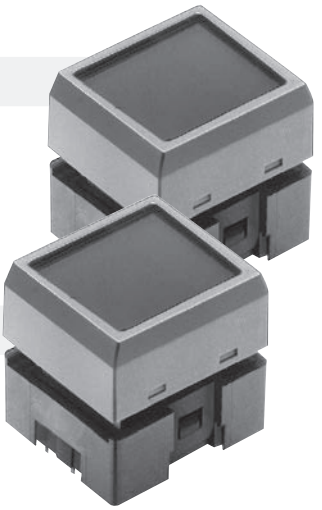
   Do not exceed 60°C at the LCD level.
   Wave Soldering: see Profile B in Supplement section.
   Manual Soldering for Switch: see Profile A in Supplement section.
   Manual Soldering for Display: see Profile B in Supplement section.
7. Excessive images may result after the same image is emitted continuously for an extended period of time.
8. The highest backlight brightness level should not be used for temperatures above +35°C.

Storage

1. Store in original container and away from direct sunlight.
2. Keep away from static electricity.
3. Avoid extreme temperatures, high humidity, gaseous substances, and all forms of chemical contamination.

SmartSwitch Wide View LCD 36 x 24 Pushbuttons, Display & Compacts

STANDARD RESOLUTION LCDS

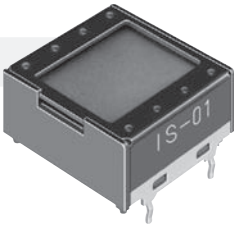


Pushbutton IS15BBFP4RGB

Programmable Display; Resolution: 36 x 24 Pixels
Backlight RGB; Black & White LCD
Up to 3 Lines with 6 Characters Each
Page E35

Pushbutton IS15BAFP4CF

Programmable Display; Resolution: 36 x 24 Pixels
Backlight Red/Green; Black & White LCD
Up to 3 Lines with 6 Characters Each
Page E35



Display IS01BBFRGB

Programmable Display; Resolution: 36 x 24 Pixels
Backlight RGB; Black & White LCD
Up to 3 Lines with 6 Characters Each
Page E39

Compact Pushbutton IS15BSBFP4RGB

Programmable Display; Resolution: 36 x 24 Pixels
Backlight RGB; Black & White LCD
Up to 3 Lines with 6 Characters Each
Page E41

Compact Pushbutton IS15BSAFP4CF

Programmable Display; Resolution: 36 x 24 Pixels
Backlight Red/Green; Black & White LCD
Up to 3 Lines with 6 Characters Each
Page E41

For All LCD 36 x 24 Switches & Displays

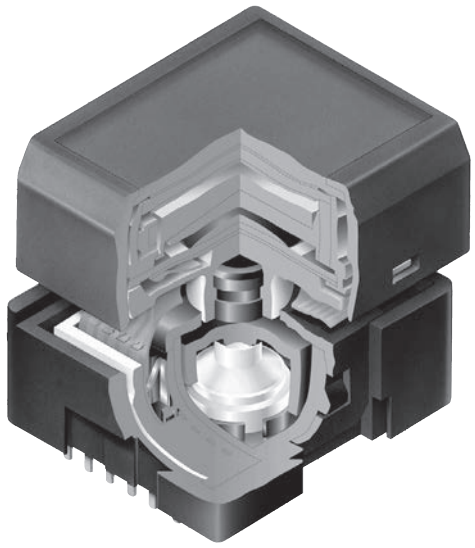
Switch Specifications Page E44
LCD Specifications Page E45 - E46
LED Characteristics Page E46
Handling & Storage Page E47

Contact factory for additional options.

DISTINCTIVE CHARACTERISTICS

Standard with Enhanced LED Illumination:

- Broad and even light diffusion
- Consistent backlighting
- Low energy consumption



Programmable LCD

Variety of LED Backlighting Colors

Rubber Dome

Epoxy Sealed Straight PC Terminals

RGB or bicolor red/green backlighting provides infinite color availability.

Programmable to display graphics, alphanumeric characters and animated sequences.

Integrated liquid crystal display provides wide viewing angle with high contrast and clarity.

Viewing area for switches 17.0mm x 13.0mm (horizontal x vertical) at 36 x 24 pixels; Display viewing area 14.4mm x 11.8mm.

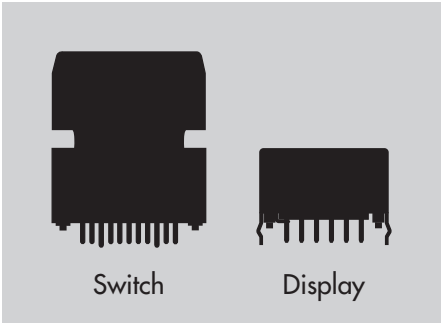
Dome gives crisp tactile feedback to positively indicate circuit transfer.

High reliability and long life of one million actuations minimum.

Epoxy sealed terminals prevent entry of solder flux and other contaminants.

Optional accessories available to enhance panel design and simplify production process.

Actual Sizes



PART NUMBERS & DESCRIPTIONS

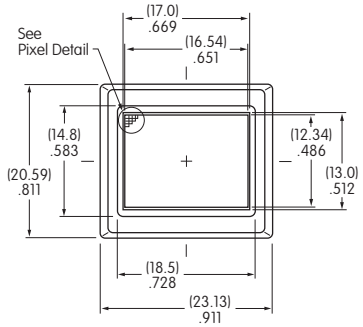
Part Number	Switch Description	LCD Mode	LED Color
IS15BBFP4RGB	SPST Momentary ON Gold Contacts Straight PC Terminals	Black & White FSTN Positive	* Red/Green/Blue
IS15BAFP4CF	SPST Momentary ON Gold Contacts Straight PC Terminals	Black & White FSTN Positive	* Red/Green

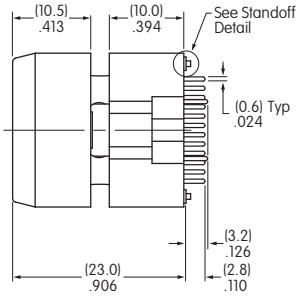
* Simultaneous illumination of LEDs achieves infinite colors.

CHARACTERISTICS OF DISPLAY

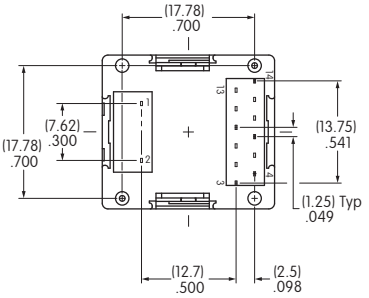
Viewing Area	17.0mm x 13.0mm (horizontal x vertical)
Pixel Size	0.440mm x 0.495mm (horizontal x vertical)
Backlight LED	**RGB:** red/green/blue **Bicolor:** red/green

TYPICAL SWITCH DIMENSIONS FOR RGB

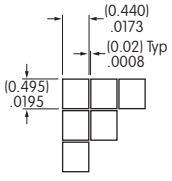




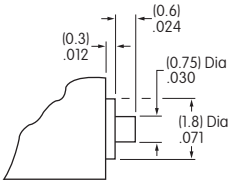
Terminal numbers are not on the switch.



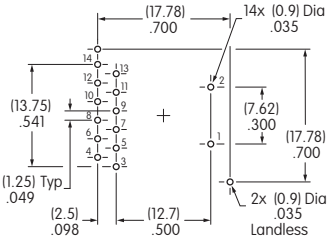
Bottom View: RGB



Pixel Detail

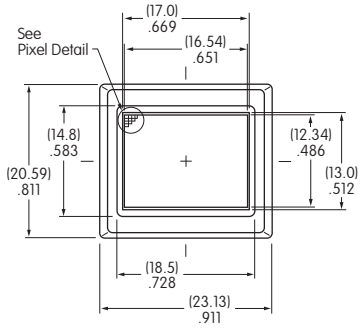


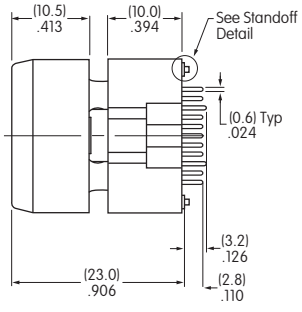
Standoff Detail



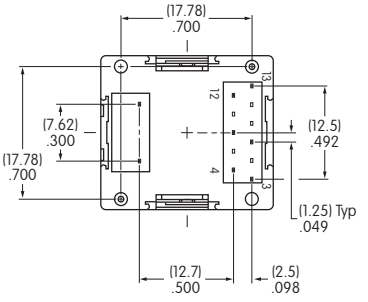
Footprint: RGB

TYPICAL SWITCH DIMENSIONS FOR BICOLOR

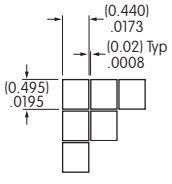




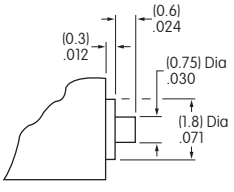
Terminal numbers are not on the switch.



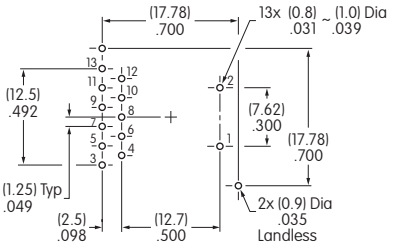
Bottom View: Bicolor Red & Green



Pixel Detail

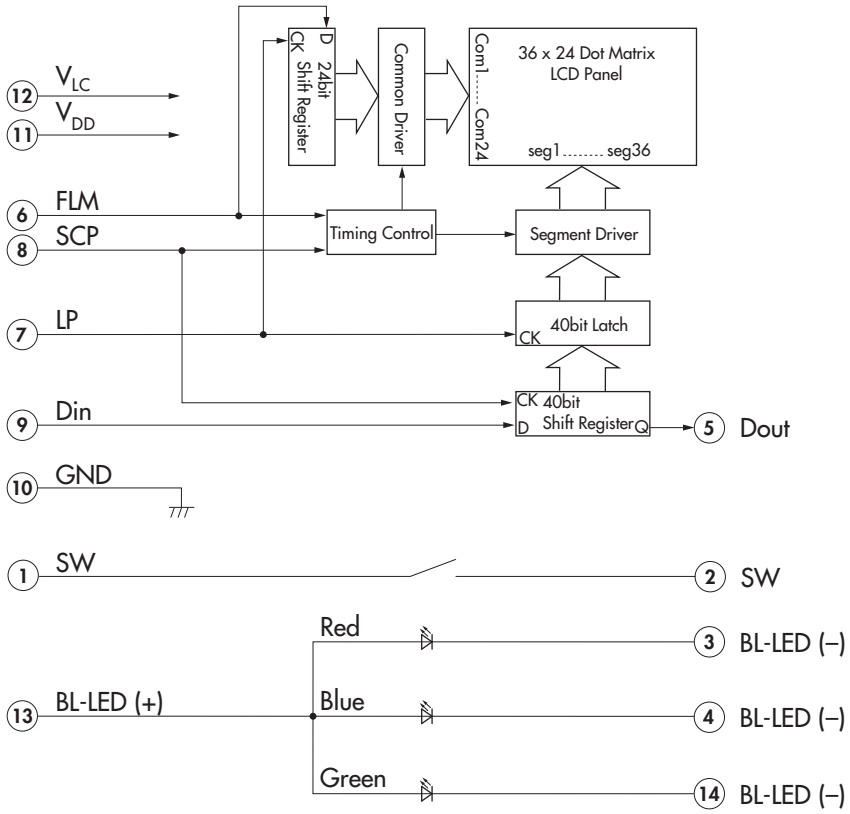


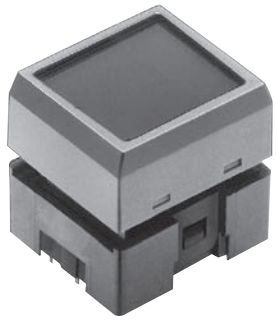
Standoff Detail



Footprint: Bicolor Red & Green

BLOCK DIAGRAM & PIN CONFIGURATIONS FOR RGB

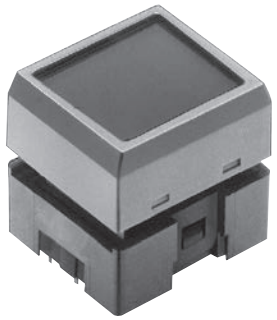




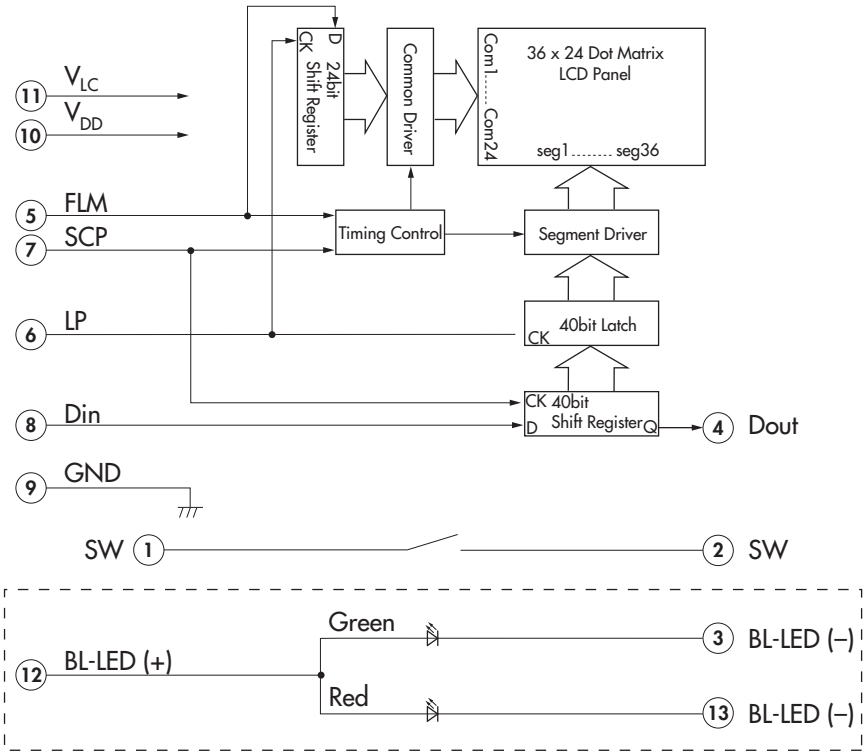
IS15BBFP4RGB
RGB LED Backlight
Black and White LCD

Pin No.	Symbol	Name	Function
1	**SW**	Terminal of Switch	Normally open
2	**SW**	Terminal of Switch	Normally open
3	**BL-LED (–)**	Terminal of Backlight LED	Cathode for red
4	**BL-LED (–)**	Terminal of Backlight LED	Cathode for blue
5	**Dout**	Data Output	Display serial output. Can be used to connect to Din of the next SMARTSWITCH. As a result, many SMARTSWITCHES can be controlled with one clock and data signal.
6	**FLM**	First Line Marker	The marking signal for the first line data of LCD display. The first line of LCD will be selected by the falling edge of LP signal during the high level (FLM).
7	**LP**	Latch Pulse	Line data latch pulse will latch content of internal 40-bit shift register at falling edge for one line of display. LP will also increment the display line by one.
8	**SCP**	Serial Clock Pulse	Clock used by 40-bit internal shift register of the switch, shifting the display data bit presented at Din at falling edge.
9	**Din**	Data Input	Display serial data bit. Note: to map the display data, because of the difference between the number of internal shift register data (40) and the single line of LCD pixels (36), the first four bits of data shifted will be dummy bits.
10	**GND**	Ground	
11	**V_{DD}**	Power	Power source for logic circuit
12	**V_{LC}**	Power	Power source for LCD drive
13	**BL-LED (+)**	Terminal of Backlight LED	Anode for common
14	**BL-LED (–)**	Terminal of Backlight LED	Cathode for green

BLOCK DIAGRAM & PIN CONFIGURATIONS FOR BICOLOR



IS15BAFP4CF
Red/Green LED Backlight
Black and White LCD



Pin No.	Symbol	Name	Function
1	**SW**	Terminal of Switch	Normally open
2	**SW**	Terminal of Switch	Normally open
3	**BL-LED (–)**	Terminal of Backlight LED	Cathode for green
4	**Dout**	Data Output	Display serial output. Can be used to connect to Din of the next SMARTSWITCH. As a result, many SMARTSWITCHES can be controlled with one clock and data signal.
5	**FLM**	First Line Marker	The marking signal for the first line data of LCD display. The first line of LCD will be selected by the falling edge of LP signal during the high level (FLM).
6	**LP**	Latch Pulse	Line data latch pulse will latch content of internal 40-bit shift register at falling edge for one line of display. LP will also increment the display line by one.
7	**SCP**	Serial Clock Pulse	Clock used by 40-bit internal shift register of the switch, shifting the display data bit presented at Din at falling edge.
8	**Din**	Data Input	Display serial data bit. Note: to map the display data, because of the difference between the number of internal shift register data (40) and the single line of LCD pixels (36), the first four bits of data shifted will be dummy bits.
9	**GND**	Ground	
10	**V_{DD}**	Power	Power source for logic circuit
11	**V_{LC}**	Power	Power source for LCD drive
12	**BL-LED (+)**	Terminal of Backlight LED	Anode for common
13	**BL-LED (–)**	Terminal of Backlight LED	Cathode for red

DISTINCTIVE CHARACTERISTICS

Standard with Enhanced Illumination:

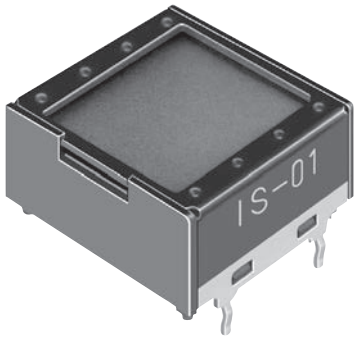
Programmable to display graphics, alphanumeric characters and animated sequences.

Standard SMARTDISPLAY™ can be used alone or in conjunction with electromechanical switches.

Integrated liquid crystal display provides wide viewing angle with high contrast and clarity.

RGB LED provides numerous color variations.

Viewing area 14.4mm x 11.8mm (horizontal x vertical) at 36 x 24 pixels.



PART NUMBER & DESCRIPTION

Part Number	Terminals	LCD Mode	LED Color
IS01BBFRGB	Straight PC	Black & White FSTN Positive	* Red/Green/Blue

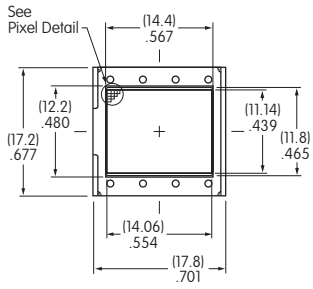
* Simultaneous illumination of LED achieves infinite colors.

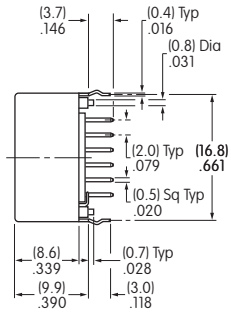
CHARACTERISTICS OF DISPLAY

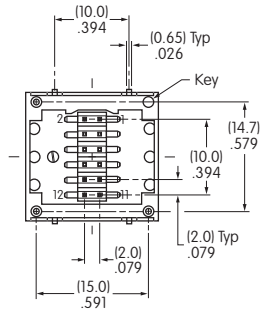
Viewing Area	14.4mm x 11.8mm (horizontal x vertical)
Pixel Size	0.371mm x 0.445mm (horizontal x vertical)
Backlight LED	**RGB:** red/green/blue

TYPICAL DISPLAY DIMENSIONS FOR RGB LED

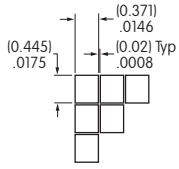
Terminal numbers are not on the device.



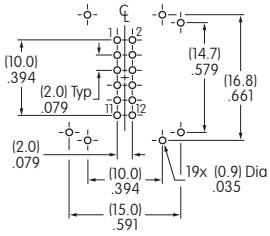




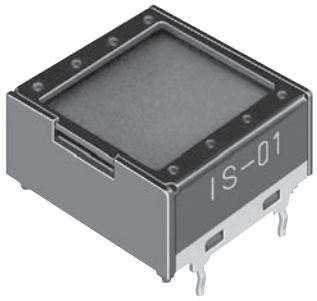
Pixel Detail



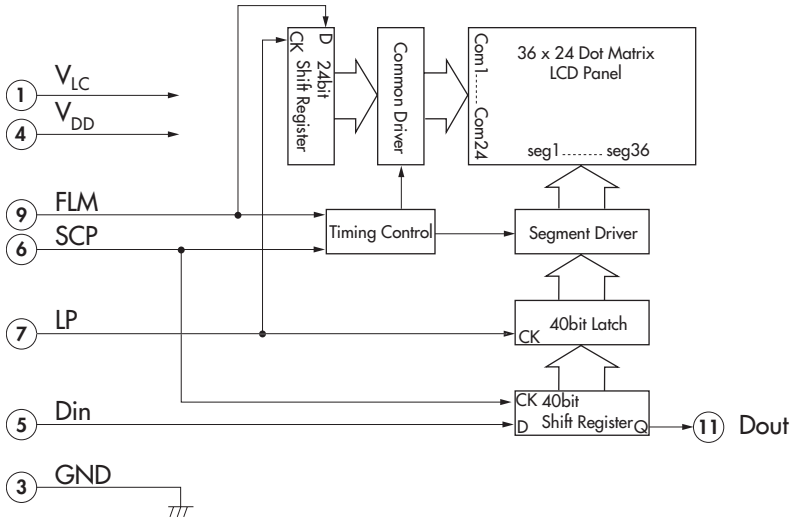
Footprint



BLOCK DIAGRAM & PIN CONFIGURATIONS FOR RGB LEDS



IS01BBFRGB
RGB LED Backlight
Black and White LCD



Pin No.	Symbol	Name	Function
1	V_{LC}	Power	Power source for LCD drive
2	**BL-LED (–)**	Terminal of Backlight LED	Cathode for green
3	**GND**	Ground	
4	V_{DD}	Power	Power source for logic circuit
5	**Din**	Data Input	Display serial data bit. Note: to map the display data, because of the difference between the number of internal shift register data (40) and the single line of LCD pixels (36), the first four bits of data shifted will be dummy bits.
6	**SCP**	Serial Clock Pulse	Clock used by 40-bit internal shift register of the switch, shifting the display data bit presented at Din at falling edge.
7	**LP**	Latch Pulse	Line data latch pulse will latch content of internal 40-bit shift register at falling edge for one line of display. LP will also increment the display line by one.
8	**BL-LED (–)**	Terminal of Backlight LED	Cathode for red
9	**FLM**	First Line Marker	The marking signal for the first line data of LCD display. The first line of LCD will be selected by the falling edge of LP signal during the high level (FLM).
10	**BL-LED (+)**	Terminal of Backlight LED	Anode for common
11	**Dout**	Data Output	Display serial output. Can be used to connect to Din of the next SMARTDISPLAY. As a result, many SMARTDISPLAYS can be controlled with one clock and data signal.
12	**BL-LED (–)**	Terminal of Backlight LED	Cathode for blue

DISTINCTIVE CHARACTERISTICS

Compact Size

- Perfect for rack mount router and other applications with space limitations.
  Compact body size: 19.0mm (.748″) x 18.0mm (.709″) compared to
  Standard body size: 23.13mm (.911″) x 20.59mm (.811″)
- Vibrant Illumination
- Low Energy Consumption

Programmable LCD

Variety of LED Backlighting Colors

Rubber Dome

Epoxy Sealed Straight PC Terminals

Snap-in standoff for easy, secure mounting and alignment

Programmable to display graphics, alphanumeric characters and animated sequences.

Integrated liquid crystal display provides wide viewing angle with high contrast and clarity.

Viewing area 14.5mm x 11.8mm (horizontal x vertical) at 36 x 24 pixels.

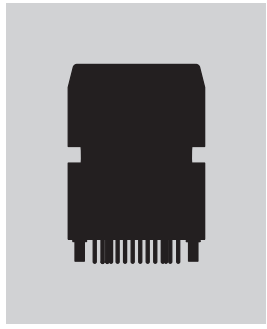
Dome gives crisp tactile feedback to positively indicate circuit transfer.

High reliability and long life of one million actuations minimum.

Epoxy sealed terminals prevent entry of solder flux and other contaminants.

Optional accessories available to simplify production process.

Actual Size



PART NUMBERS & DESCRIPTIONS

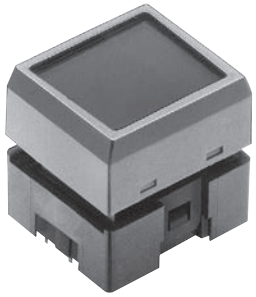
Part Number	Switch Description	LCD Mode	LED Color
IS15BSBFP4RGB	SPST Momentary ON Gold Contacts Straight PC Terminals	Black & White FSTN Positive	* Red/Green/Blue
IS15BSAFP4CF	SPST Momentary ON Gold Contacts Straight PC Terminals	Black & White FSTN Positive	* Red/Green

* Simultaneous illumination of LEDs achieves infinite colors.

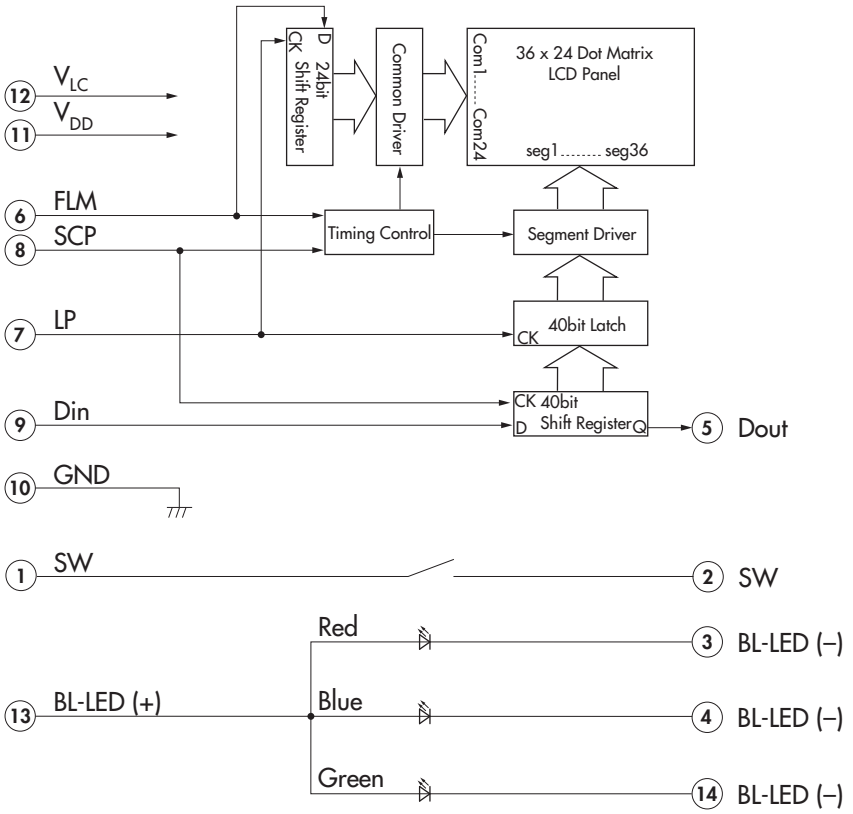
CHARACTERISTICS OF DISPLAY

Viewing Area	14.5mm x 11.8mm (horizontal x vertical)
Pixel Size	0.371mm x 0.445mm (horizontal x vertical)
Backlight LED	**RGB:** red/green/blue **Bicolor:** red/green

BLOCK DIAGRAM & PIN CONFIGURATIONS FOR RGB

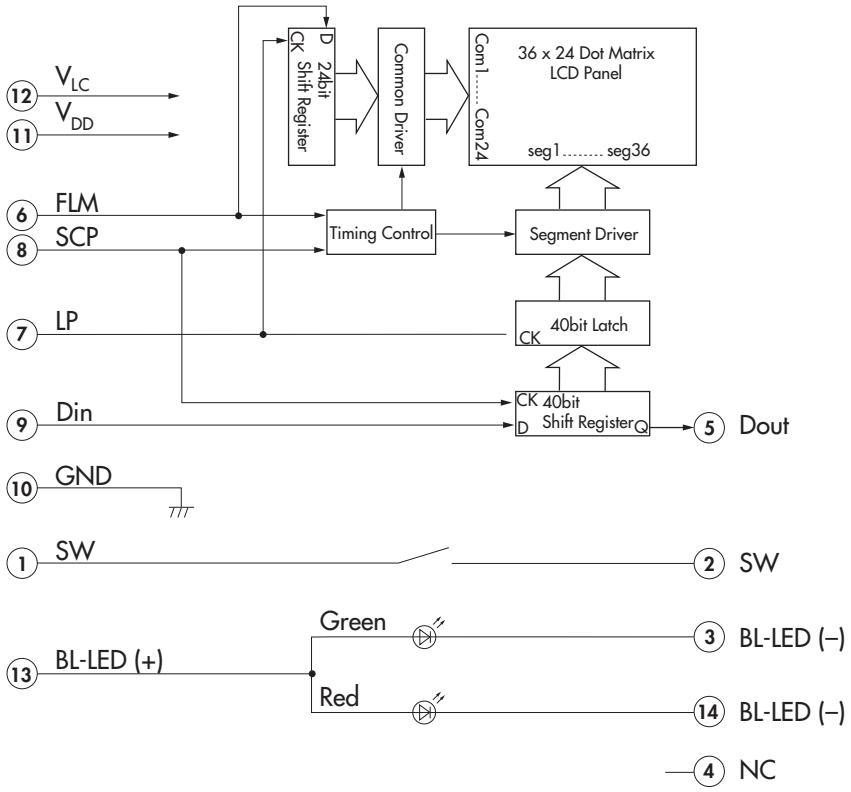


IS15BSBFP4RGB
RGB LED Backlight
Black and White LCD



Pin No.	Symbol	Name	Function
1	**SW**	Terminal of Switch	Normally open
2	**SW**	Terminal of Switch	Normally open
3	**BL-LED (–)**	Terminal of Backlight LED	Cathode for red
4	**BL-LED (–)**	Terminal of Backlight LED	Cathode for blue
5	**Dout**	Data Output	Display serial output. Can be used to connect to Din of the next SMARTSWITCH. As a result, many SMARTSWITCHES can be controlled with one clock and data signal.
6	**FLM**	First Line Marker	The marking signal for the first line data of LCD display. The first line of LCD will be selected by the falling edge of LP signal during the high level (FLM).
7	**LP**	Latch Pulse	Line data latch pulse will latch content of internal 40-bit shift register at falling edge for one line of display. LP will also increment the display line by one.
8	**SCP**	Serial Clock Pulse	Clock used by 40-bit internal shift register of the switch, shifting the display data bit presented at Din at falling edge.
9	**Din**	Data Input	Display serial data bit. Note: to map the display data, because of the difference between the number of internal shift register data (40) and the single line of LCD pixels (36), the first four bits of data shifted will be dummy bits.
10	**GND**	Ground	
11	**V_{DD}**	Power	Power source for logic circuit
12	**V_{LC}**	Power	Power source for LCD drive
13	**BL-LED (+)**	Terminal of Backlight LED	Anode for common
14	**BL-LED (–)**	Terminal of Backlight LED	Cathode for green

BLOCK DIAGRAM & PIN CONFIGURATIONS FOR BICOLOR

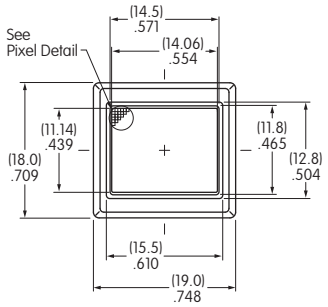


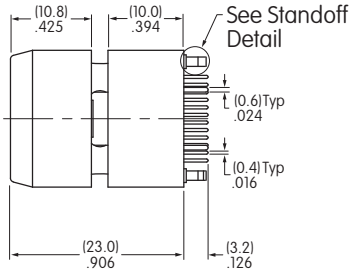
IS15BSAFP4CF
Red/Green LED Backlight
Black and White LCD

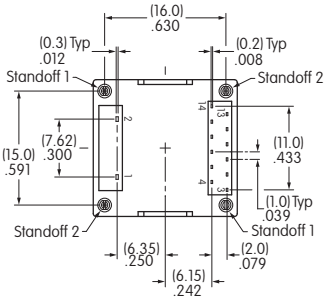
Pin No.	Symbol	Name	Function
1	**SW**	Terminal of Switch	Normally open
2	**SW**	Terminal of Switch	Normally open
3	**BL-LED (–)**	Terminal of Backlight LED	Cathode for green
4	**NC**	None	No connection
5	**Dout**	Data Output	Display serial output. Can be used to connect to Din of the next SMARTSWITCH. As a result, many SMARTSWITCHES can be controlled with one clock and data signal.
6	**FLM**	First Line Marker	The marking signal for the first line data of LCD display. The first line of LCD will be selected by the falling edge of LP signal during the high level (FLM).
7	**LP**	Latch Pulse	Line data latch pulse will latch content of internal 40-bit shift register at falling edge for one line of display. LP will also increment the display line by one.
8	**SCP**	Serial Clock Pulse	Clock used by 40-bit internal shift register of the switch, shifting the display data bit presented at Din at falling edge.
9	**Din**	Data Input	Display serial data bit. Note: to map the display data, because of the difference between the number of internal shift register data (40) and the single line of LCD pixels (36), the first four bits of data shifted will be dummy bits.
10	**GND**	Ground	
11	**V_{DD}**	Power	Power source for logic circuit
12	**V_{LC}**	Power	Power source for LCD drive
13	**BL-LED (+)**	Terminal of Backlight LED	Anode for common
14	**BL-LED (–)**	Terminal of Backlight LED	Cathode for red

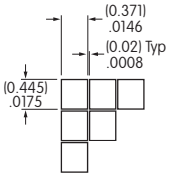
TYPICAL COMPACT SWITCH DIMENSIONS

Terminal numbers are not on the switch.

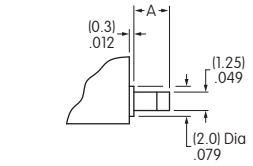








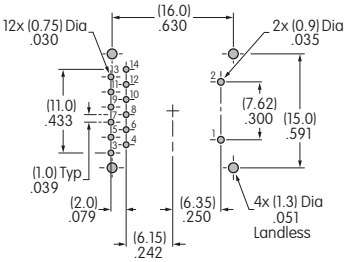
Pixel Detail



Dimension A

Standoff 1 = (2.7) .106 Standoff 1 = (2.3) .091

Standoff Detail



Footprint

SWITCH SPECIFICATIONS

Circuit	SPST normally open
Electrical Capacity (Resistive Load)	100mA @ 12V DC
Contact Resistance	200 milliohms max @ 20mV 10mA
Insulation Resistance	100 megohms min @ 100V DC
Dielectric Strength	125V AC for 1 minute minimum
Mechanical Endurance	1,000,000 operations minimum
Electrical Endurance	1,000,000 operations minimum
Operating Force	2.2 ± 0.5 Newtons
Total Travel	1.8mm (.071")
Operating Temp. Range	–20°C ~ +60°C (–4°F ~ +140°F)
Storage Temp. Range	–30°C ~ +70°C (–22 °F ~ +158°F)

Optical Characteristics (Temperature at 25°C)

Items		Symbols	Minimum	Typical	Maximum
Contrast Ratio		Cr	—	3.0	—
Viewing Angle (Cr ≥ 1.1)	Up & Down	θ	—	90°	—
	Right & Left	ϕ	—	90°	—

Absolute Maximum Ratings (Temperature at 25°C)

Items	Symbols	Ratings
Supply Voltage for Logics	V_{DD}	–0.3V to +7.0V
Supply Voltage for LCD	V_{LC}	–0.3V to +12.0V
Input Voltage	V_I	–0.3V to V_{DD} +0.3V
Output Voltage	V_O	–0.3V to V_{DD} +0.3V

LCD SPECIFICATIONS

Characteristics of Display

Display Operation Mode	FSTN positive
Display Condition	Transflective with built-in LED backlight
Viewing Angle	6 o'clock
Driving Method	1/24 duty. 1/5 bias (built-in driving circuit)
Pixel Format	36 x 24 pixels (horizontal x vertical)
Backlight LED	**RGB:** red/green/blue **Bicolor:** red/green

Recommended Operating Conditions (Temperature at 25°C)

Items	Symbols	Minimum	Typical	Maximum
Supply Voltage for Logics	V_{DD}	4.5V	5.0V	5.5V
Supply Voltage	V_{LC}	7.1	7.3V	7.5
Input Voltage	V_I	0V	—	V_{DD}
Driving Frequency	f_{FLM}	—	150Hz	—
Clock Operation Frequency	f_{SCP}	—	—	6.0MHz

DC Characteristics of LCD Drive (Temperature at –20°C to +60°C and V_{DD} = 5.0V ±10%)

Items	Symbols	Test Conditions	Minimum	Typical	Maximum	Unit
High Level Input Voltage	V_{IH}		0.7V_{DD}		V_{DD}	V
Low Level Input Voltage	V_{IL}		0		0.3V_{DD}	V
High Level Input Leakage Current	I_{LIH}	$V_I = V_{DD}$			10	µA
Low Level Input Leakage Current	I_{LIL}	V_I = 0V			10	µA
High Level Output Voltage	V_{OH}	I_{OH} = –500µA	V_{DD}–0.5			V
Low Level Output Voltage	V_{OL}	I_{OL} = 500µA			0.5	V
High Level Output Leakage Current	I_{LOH}	$V_O = V_{DD}$			10	µA
Low Level Output Leakage Current	I_{LOL}	V_O = 0V			10	µA
Supply Current	I_{DD}	f_{SCP} = 1.0MHz			500	µA
LCD Drive Current	I_{LC}	f_{LP} = 2.4kHz V_{LC} = 7.3V		500	2,000	µA

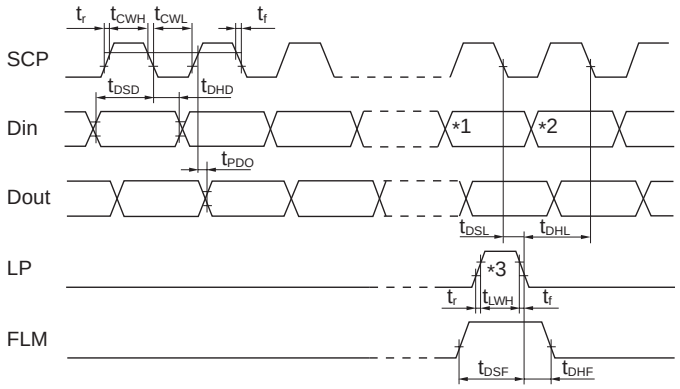
Timing Characteristics of LCD Drive IC

(Temperature at –20°C to +60°C and V_{DD} = 5.0V ±10%)

Items	Symbols	Minimum	Maximum
Clock Operation Frequency	f_{SCP}		6.0MHz
Latch Pulse Frequency	f_{LP}		50kHz
Clock High Level Pulse Width	t_{CWH}	70ns	
Clock Low Level Pulse Width	t_{CWL}	70ns	
Data Setup Time	t_{DSD}	45ns	
Data Hold Time	t_{DHD}	50ns	
Data Output Delay Time	t_{PDO}		25ns
Latch Setup Time	t_{DSL}	50ns	
Latch Hold Time	t_{DHL}	50ns	
Latch High Level Width	t_{LWH}	200ns	
FLM Setup Time	t_{DSF}	50ns	
FLM Hold Time	t_{DHF}	50ns	
SCP, LP Rise/Fall Time	t_r/t_f		15ns

Timing Diagram

*1 Last data on first line
*2 Beginning data on second line
*3 Location of LP signal on first line



LED CHARACTERISTICS

Typical Electrical Characteristics (Temperature at 25°C)

Backlight Color	Symbols	Red	Green	Blue	Red/Green	Unit
Forward Current	I_F	10	8.5	8.0	15/15	mA

ABSOLUTE MAXIMUM FOR LEDS

Electrical Characteristics (Temperature at 25°C)

Backlight Color	Symbols	Red	Green	Blue	Red/Green	Unit
Forward Current	I_F	20	20	20	20	mA
Forward Voltage	V_F	2.0 (I_F = 10mA)	2.8 (I_F = 8.5mA)	2.8 (I_F = 8.0mA)	1.9/1.9	V
Reverse Voltage	V_R	4.0	4.0	4.0	4.0	V
Current Reduction Rate Above 25°C	ΔI_F(DC)	–0.33	–0.33	–0.33	–0.26	mA/°C
*Power Dissipation (LED Overall 115mW)	P_D	40	60	60	130 maximum	mW

*For uniform light emission, Power Dissipation should not exceed the Absolute Maximum Rating, and the Forward Current should not exceed the derated Absolute Forward Current.

PRECAUTIONS FOR HANDLING & STORAGE OF LCD 36 x 24 DEVICES

Handling

1. The IS Series devices are electrostatic sensitive.
2. Limit operating force to keytop to 100.0N maximum, as excessive pressure may damage the LCD device.
3. The IS series devices are not process sealed.
4. If the LCD is accidentally broken, avoid contact with the liquid and wash off any liquid spills to the skin or clothing.
5. Clean cap surface with dry cloth. If further cleaning is needed, wipe with dampened cloth using neutral cleanser and dry with clean cloth. Do not use organic solvent.
6. Recommended soldering time and temperature limits:

   Do not exceed 70°C at the LCD level.
   Wave Soldering: see Profile B in the Supplement section.
   Manual Soldering for Switch: see Profile A in the Supplement section.
   Manual Soldering for Display: see Profile B in the Supplement section.
7. Recommendation for backlight color uniformity: Use constant current driver. For current limiting resistor method, the power source should be at least twice the backlight LED forward voltage.
8. The VLC voltage should not be applied before logic voltage. If VLC voltage is present before logic voltage, it may cause the driver logic to freeze and damage the LCD, and the driver logic may become damaged.
9. Backlight Forward Current should not exceed the derated Absolute Maximum Forward Current based on the temperature.
10. Excessive images may result after the same image is emitted continuously for an extended period of time.

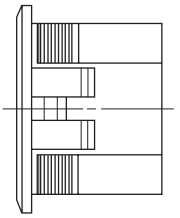
Storage

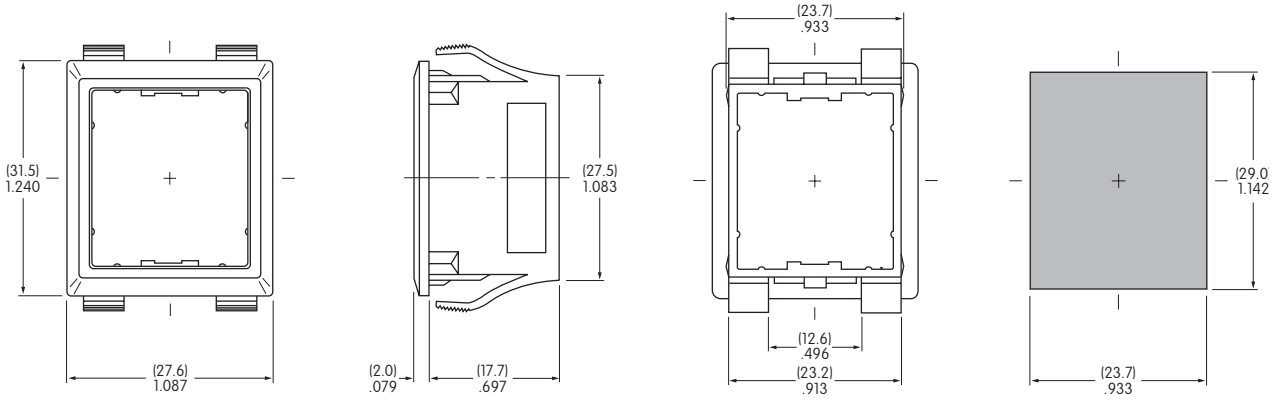
1. Store in original container and away from direct sunlight.
2. Keep away from static electricity.
3. Avoid extreme temperatures, high humidity, gaseous substances, and all forms of chemical contamination.

OPTIONAL ACCESSORIES

AT548 Panel Mount Housing

Material: Polyamide





Compatible Part Numbers for AT548

Wide View LCD 36 x 24
IS15BAFP4CF
IS15BBFP4RGB

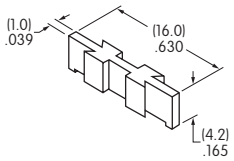
The Panel Mount Housing is available for the LCD 36 x 24 Pushbutton only.

Panel Thickness Range:
(1.5 ~ 4.0mm) .059 ~ .157″

Panel mount housing allows the LCD 36 x 24 Pushbutton to be snapped into a panel cutout for quick, secure mounting. It gives flexibility in locating the devices anywhere on the panel. It also allows using the LCD 36 x 24 Pushbutton on an existing panel.

AT542 Coupler

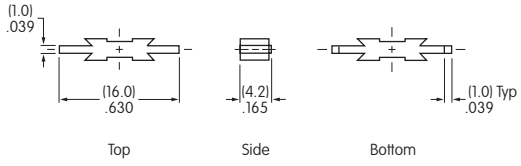
Material: PBT



Compatible Part Numbers for AT542

Wide View LCD 36 x 24
IS15BAFP4CF
IS15BBFP4RGB

This coupler is for connecting the LCD 36 x 24 Pushbutton into precise, tight groupings that maintain an even distance from PCB to top of the actuator.



The Coupler is available for the LCD 36 x 24 Pushbutton only.

OPTIONAL ACCESSORIES

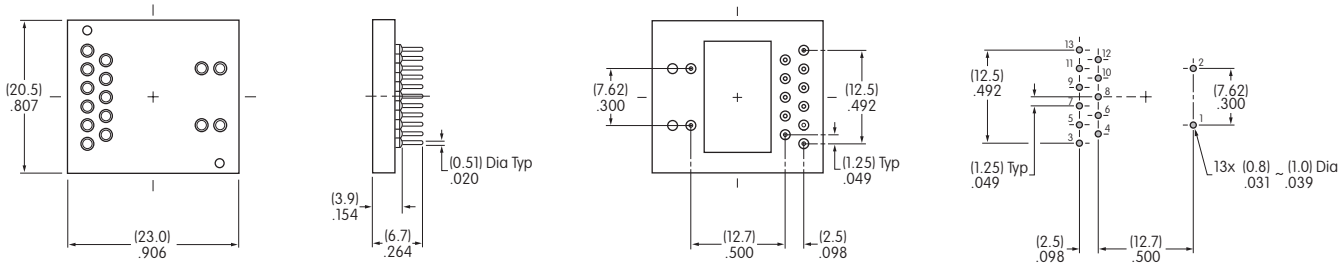
AT9704-02YC Socket for Single and Bicolor LCD 36 x 24 Pushbutton

Materials:

Base - Glass Fiber Reinforced PBT
Terminals - Brass/Beryllium Copper

- The socket permits the SmartSwitch to be plugged in after automated processing.
- Use of the socket enables easy field replacement of the device.

Compatible Part Number for AT9704-02YC
Wide View LCD 36 x 24
IS15BAFP4CF



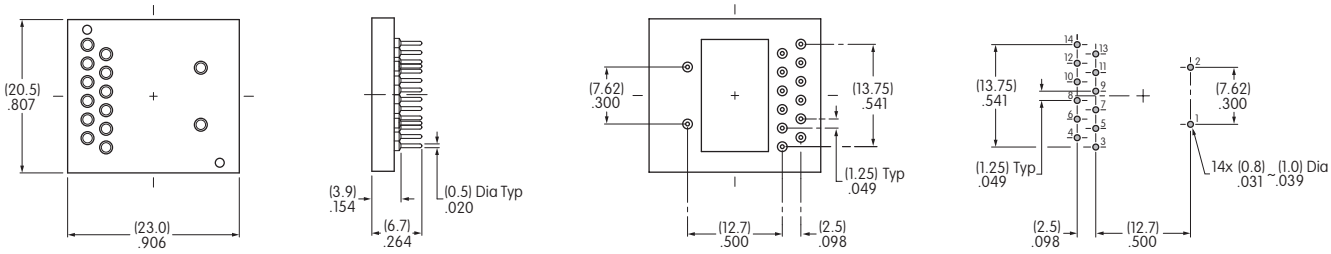
AT9704-065E Socket for RGB LCD 36 x 24 Pushbutton

Materials:

Base - Glass Fiber Reinforced PBT
Terminals - Brass/Beryllium Copper

- The socket permits the RGB SmartSwitch to be plugged in after automated processing.
- Use of the socket enables easy field replacement of the device.

Compatible Part Number for AT9704-065E
Wide View RGB LCD 36 x 24
IS15BBFP4RGB



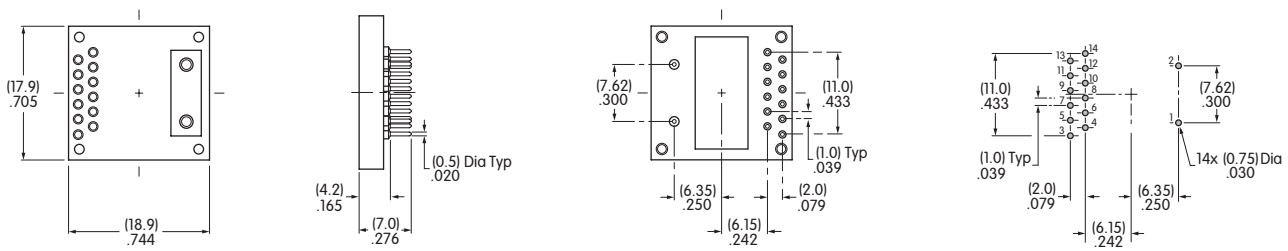
AT9704-065F Socket for Compact Pushbutton (All Models)

Materials:

Base - Glass Fiber Reinforced PBT
Terminals - Brass/Beryllium Copper

- The socket permits the Compact SmartSwitch to be plugged in after automated processing.
- Use of the socket enables easy field replacement of the device.

Compatible Part Numbers for AT9704-065F
Wide View/Short Travel LCD 64 x 32
IS15EBFP4RGB-09YN
Wide View LCD 64 x 32 Compact
IS15ESBFP4RGB
Wide View LCD 36 x 24
IS15BAFP4CF
Wide View LCD 36 x 24 Compact
IS15BSBFP4RGB



Note: AT9704-065F Socket may be used with the LCD 64 x 32 SmartSwitch by removing pins 3, 4, 11, 12, 13 and 14.

OPTIONAL ACCESSORIES

AT9704-085K Socket for LCD 64 x 32 Pushbutton

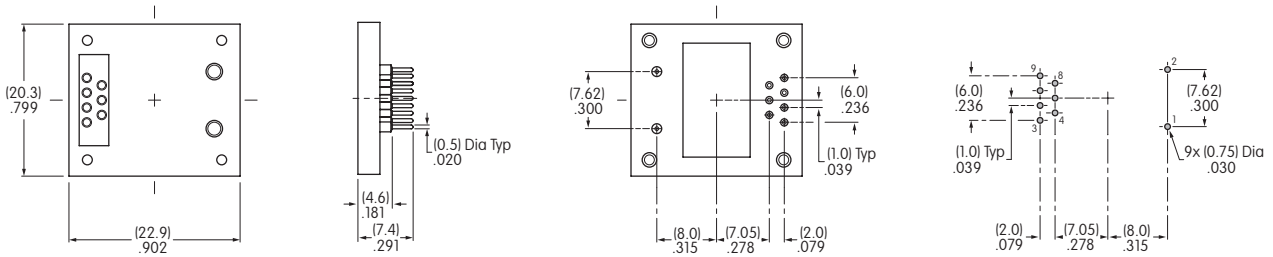
Materials:

Base - Glass Fiber Reinforced PBT
Terminals - Brass/Beryllium Copper

Compatible Part Number for AT9704-085K

Wide View LCD 64 x 32
IS15EBFP4RGB

- The socket permits the SmartSwitch to be plugged in after automated processing.
- Use of the socket enables easy field replacement of the device.



AT9704-085L Socket for OLED Pushbutton

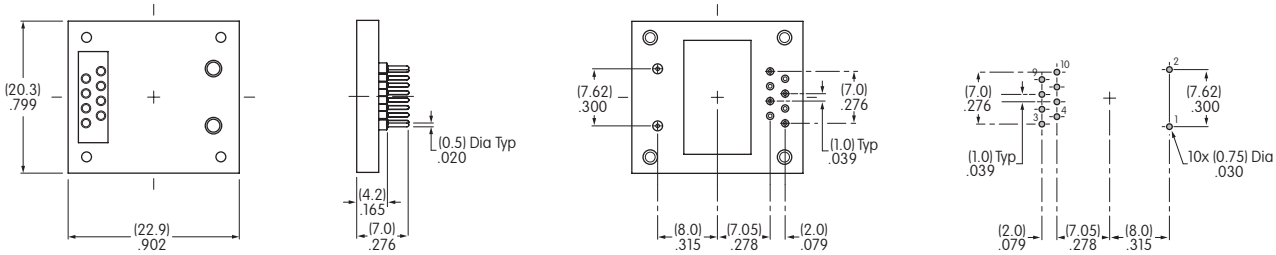
Materials:

Base - Glass Fiber Reinforced PBT
Terminals - Brass/Beryllium Copper

Compatible Part Numbers for AT9704-085L

OLED Pushbutton	Frameless OLED
ISC15ANP4	ISF15ACP4

- The socket permits the OLED SmartSwitch to be plugged in after automated processing.
- Use of the socket enables easy field replacement of the device.



AT9704-085M Socket for OLED Display

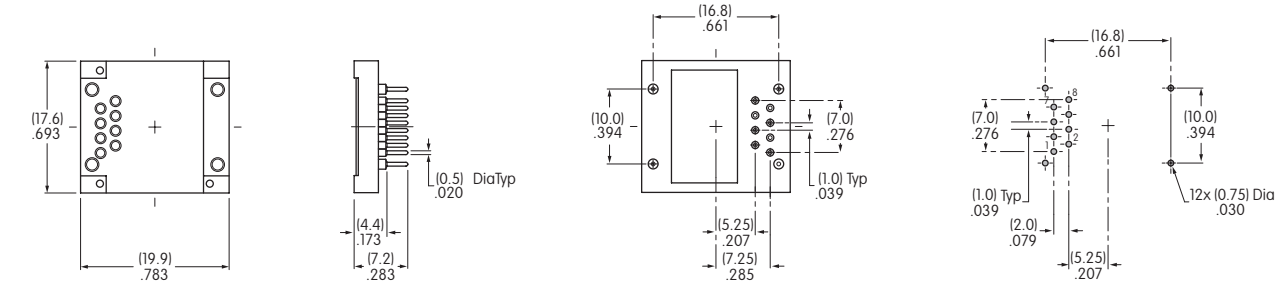
Materials:

Base - Glass Fiber Reinforced PBT
Terminals - Brass/Beryllium Copper

Compatible Part Number for AT9704-085M

OLED Display
ISC01P

- The socket permits the OLED SmartDisplay to be plugged in after automated processing.
- Use of the socket enables easy field replacement of the device.



NKK SWITCHES

Keylocks

CK Series F3

16mm & 19mm High Security
3A Power Level
Solder Lug
Bushing Mount

SK Series F9

12mm Low & Medium Security
3A & 1A Power Level
Solder Lug
Bushing Mount

SK Series F15

Antistatic Process Sealed Subminiature
0.4VA Logic Level
Straight & Right Angle PC
PCB Mount

SK Series F19

Process Sealed
0.4VA Logic Level
Straight & Right Angle PC
PCB Mount

SK Series F25

Antistatic Snap-in
0.4VA Logic Level
Solder Lug
Snap-in Mount

General Specifications

Electrical Capacity (Resistive Load)

Power Level: 3A @ 250V AC

Other Ratings

Contact Resistance: 20 milliohms maximum
Insulation Resistance: 1,000 megohms minimum @ 500V DC
Dielectric Strength: 1,000V AC minimum between contacts for 1 minute minimum;
1,500V AC minimum between contacts & case for 1 minute minimum
Mechanical Life: 30,000 cycles minimum
Electrical Life: 10,000 cycles minimum
Static Capability: Withstands 15 kilovolts minimum ESD minimum (for CKM models only)
Nominal Operating Torque: 16mm Bushing (CKM models):
.04 mNm (5.67 oz•in) for Flat Key
.08 mNm (11.33 oz•in) for Tubular Key
19mm Bushing (CKL models):
.05 mNm (7.08 oz•in) for Flat Key
.07 mNm (9.91 oz•in) for Tubular Key
Contact Timing: Break-before-make
Angle of Throw: 90° for 2-position & 45° for 3-position

Materials & Finishes

Keys for CKM: Brass with nickel plating with ABS handle
Keys for CKL: Brass with nickel plating for tubular key;
brass with chrome plating for flat key
Housing/Bushing: Glass fiber reinforced PBT for CKM models;
zinc alloy with chrome plating for CKL
Base: LCP (Liquid Crystal Polymer)
Contact Terminals: Copper with silver plating
Common Terminals: Copper with silver plating
Movable Contactor: Copper
Movable Contacts: Silver

Environmental Data

Operating Temperature Range: –25°C through +70°C (–13°F through +158°F)
Humidity: 90 ~ 95% humidity for 240 hours @ 40°C (104°F) for CKM;
90 ~ 95% humidity for 96 hours @ 40°C (104°F) for CKL
Vibration: 10 ~ 55Hz with peak-to-peak amplitude of 1.5mm for CKM or 0.7mm for CKL traversing the frequency range & returning in 1 minute; 3 right angled directions for 2 hours
Shock: 50G (490m/s^2) acceleration for CKM; 30G (294m/s^2) acceleration for CKL; (CKM & CKL tested in 6 right angled directions, with 5 shocks in each direction)

Installation

Mounting Torque: 1.5 Nm (13.28 lb•in) maximum
Soldering Time & Temperature: Manual Soldering: See Profile A in Supplement section.

Distinctive Characteristics

High insulating material for 16mm CKM models withstands over 15 kilovolts of electrostatic discharge, thus providing antistatic feature.

Rugged, die cast housing 19mm CKL models designed for higher security requirements.

Vertically rotating switching mechanism combines with self-cleaning sliding contacts for high reliability and long operating life.

16mm and 19mm diameter bushings available.

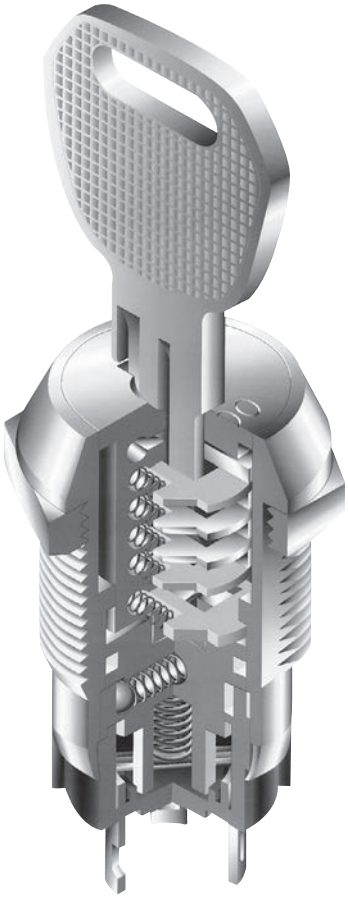
CKL and CKM on-off-on models with tubular keys have push-and-lock mechanism which allows contactor to drop and slide over stationary contacts.

Available in both flat and tubular key styles; flat key is reversible for easier setting.

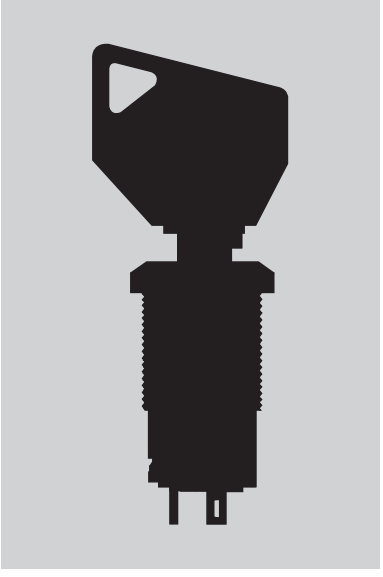
Epoxy sealed terminals prevent entry of flux and other contaminants.

Interior construction provides seal for contact area.

High dielectric strength of 1,500 volts between contacts and case.



Actual Size CKM with Tubular Key



TYPICAL SWITCH ORDERING EXAMPLE

CK | M | 1 | 2A | F | W | 01

Bushings

M	16mm Diameter
L	19mm Diameter

Poles

1	SPDT

Keys

F	Flat
T	Tubular

Terminals

01	Solder Lug

Circuits & Key-Removable Positions

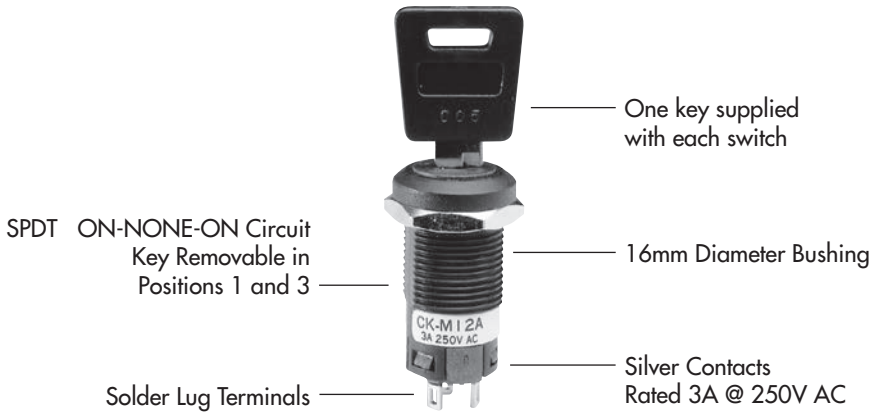
Code	Pos. 1	Pos. 2	Pos. 3	Key Removes
2A	ON	NONE	ON	Positions 1 and 3
2B	ON	NONE	ON	Position 1
3E	ON	OFF	ON	Position 2

Contact Material

W	Silver Rated 3A @ 250V AC

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

CKM12AFW01



POLES, CIRCUITS & KEY-REMOVABLE POSITIONS

Pole & Throw	Model	Key Positions Pos 1	Key Positions Pos 2	Key Positions Pos 3	Connected Terminals (Terminal numbers are on switch) Pos 1	Connected Terminals Pos 2	Connected Terminals Pos 3	Schematic	⊙ = Key Removable, • = Not Removable, ◺ = Maximum Arc
SPDT	**CKM12A CKL12A**	ON	NONE	ON	COM-1	——	COM-2	COM, 1, 2	POS 1, 3
SPDT	**CKM12B CKL12B**	ON	NONE	ON	COM-1	——	COM-2		POS 1, 3
SPDT	**CKM13E CKL13E**	ON	OFF	ON	COM-1	OPEN	COM-2	COM, OPEN, 1, 2	2, POS 1, 3

KEYS

F **Flat Key**

AT4147 for CKM 16mm
Brass with Nickel Plating key base & ABS key handle
AT4153 for CKL 19mm
Brass with Chrome Plating (crosshatch texture on handle)

One key provided with each switch (no master key available)
For ordering additional keys, indicate the same key number that is engraved on the face of your switch.

Randomly assigned key number (001 through 010 for CKM models & 001 through 025 for CKL models).

Typical Key Ordering Example: AT4153-001

T **Tubular Key**
(must be pressed inward to actuate)

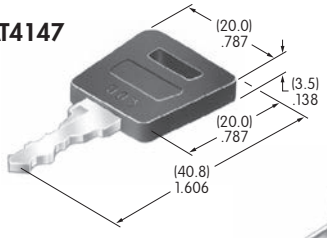
AT4146 for CKM 16mm
Brass with Nickel Plating key base & ABS key handle
AT4152 for CKL 19mm
Brass with Nickel Plating (smooth)

One key provided with each switch (no master key available)
For ordering additional keys, indicate the same key number that is engraved on the face of your switch.

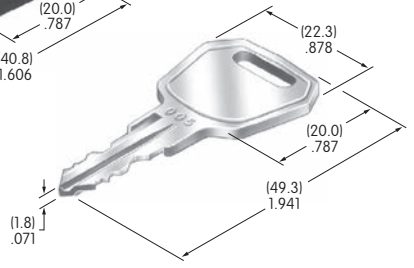
Randomly assigned key number (001 through 025 for CKM models & 001 through 050 for CKL models).

Typical Key Ordering Example: AT4146-001

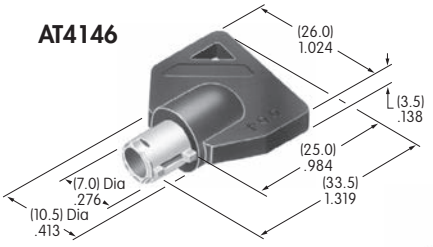
AT4147



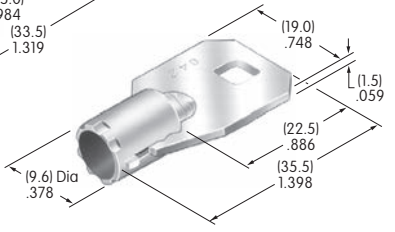
AT4153



AT4146



AT4152

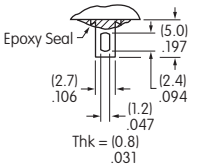


CONTACT MATERIALS, RATINGS & TERMINALS

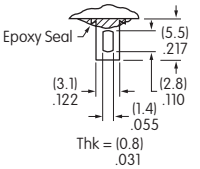
W **Silver over Silver**
Power Level 3A @ 250V AC

01 **Solder Lug Terminals**

Solder Lug Terminal for CKM



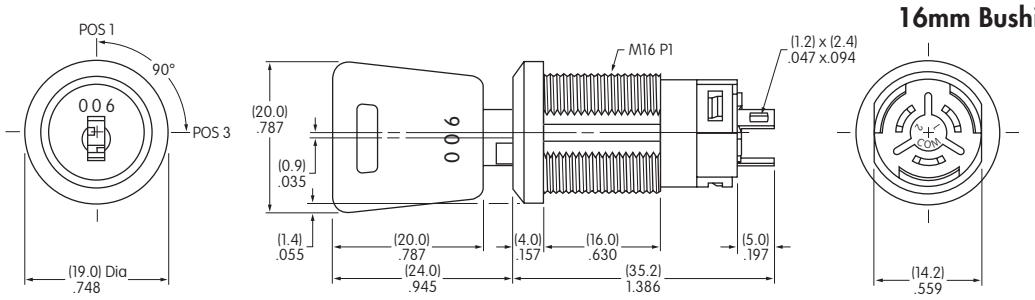
Solder Lug Terminal for CKL



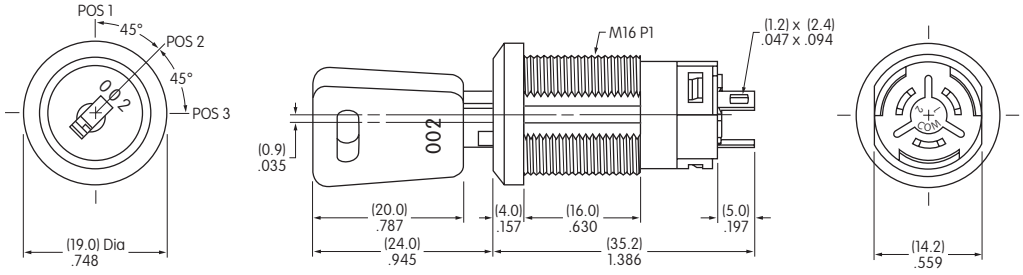
TYPICAL SWITCH DIMENSIONS

16mm Bushing • Flat Key

90° Angular Throw



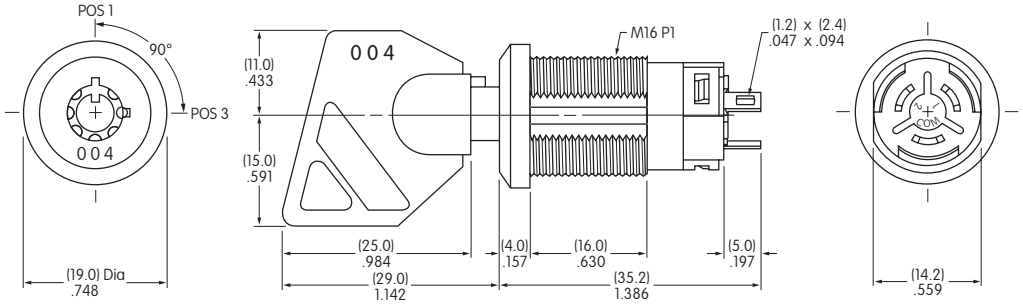
45° Angular Throw



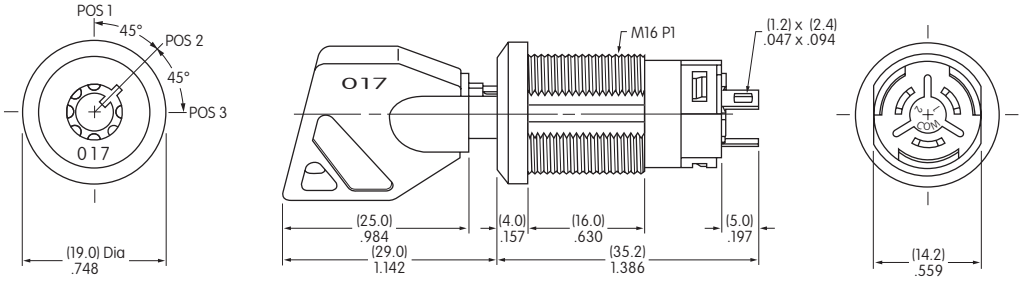
CKM12AFW01

16mm Bushing • Tubular Key

90° Angular Throw



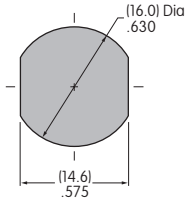
45° Angular Throw



CKM13ETW01

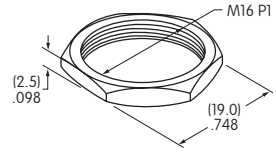
PANEL CUTOUT & STANDARD HARDWARE FOR 16MM BUSHING

Maximum Effective Panel Thickness: .469" (11.9mm)



AT016
16mm Hex Mounting Nut for CKM

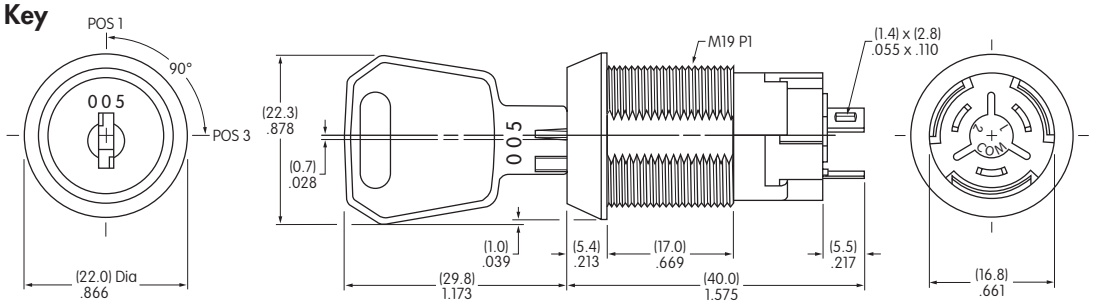
1 included with each switch
Steel with nickel plating



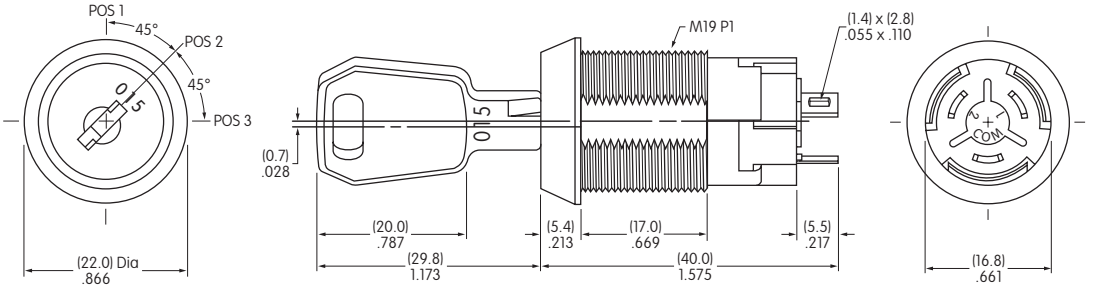
TYPICAL SWITCH DIMENSIONS

19mm Bushing • Flat Key

90° Angular Throw



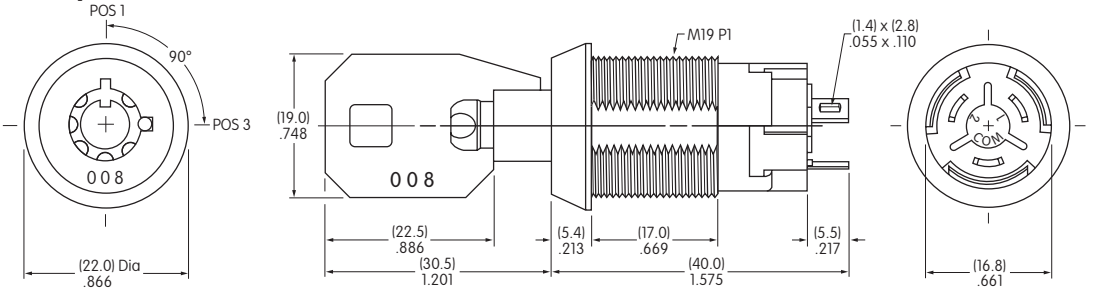
45° Angular Throw



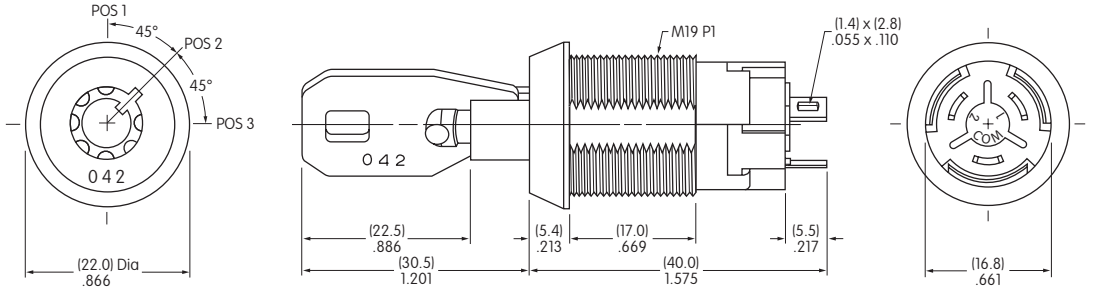
CKL12AFW01

19mm Bushing • Tubular Key

90° Angular Throw



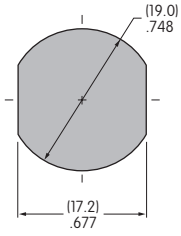
45° Angular Throw



CKL13ETW01

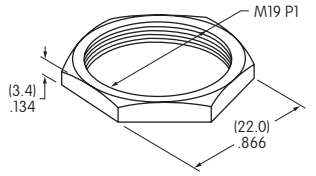
PANEL CUTOUT & STANDARD HARDWARE FOR 19MM BUSHING

Maximum Effective Panel Thickness: .496" (12.6mm)



AT019
19mm Hex Mounting Nut for CKL

1 included with each switch
Steel with nickel plating



General Specifications

Electrical Capacity (Resistive Load)

Power Level (silver): 3A @ 125V AC for low & medium security; 1A @ 250V AC for low security

Other Ratings

Contact Resistance: 10 milliohms maximum
Insulation Resistance: 1,000 megohms minimum @ 500V DC
Dielectric Strength: 1,000V AC minimum between contacts for 1 minute minimum;
1,500V AC minimum between contacts & case for 1 minute minimum
Mechanical Life: 30,000 cycles minimum
Electrical Life: 10,000 cycles minimum
Nominal Operating Torque: .026Nm (.234 lb•in) for low & medium security
Contact Timing: Break-before-make
Angle of Throw: 90° for 2-position & 45° for 3-position

Materials & Finishes

Key: Zinc alloy with chrome plating (matte) for low security models;
brass with nickel plating (shiny) for medium security models
Tumbler Barrel: Zinc alloy with chrome plating (matte) for low security models;
zinc alloy with chrome plating (shiny) for medium security models
Housing/Bushing: Zinc alloy with chrome plating (matte) for low security models;
zinc alloy with chrome plating (shiny) for medium security models
Base: Phenolic resin (thermoset)
Movable Contactor: Silver
Stationary Contacts: Silver capped copper with silver plating
Terminals: Copper or brass with silver plating

Environmental Data

Operating Temperature Range: –25°C through +70°C (–13°F through +158°F)
Humidity: 90 ~ 95% humidity for 96 hours @ 40°C (104°F)
Vibration: 10 ~ 55Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in 1 minute; 3 right angled directions for 2 hours
Shock: 50G (490m/s^2) acceleration (tested in 6 right angled directions, with 5 shocks in each direction)

Installation

Mounting Torque: 1.5Nm (13.28 lb•in) maximum
Soldering Time & Temperature: Manual Soldering: See Profile A in Supplement section.

Standards & Certifications

UL: **File No. E44145 - Recognized only when ordered with marking on switch.**
Add "/U" or "/CUL" to end of part number to order UL recognized switch.
All low security models recognized at 3A @ 125V AC or 1A @ 250V AC
& all medium security models recognized at 3A @ 125V AC
CSA: **File No. 023535_0_000 - Certified only when ordered with marking on switch.**
Add "/C" to end of part number to order CSA certified switch.
All low security models certified at 3A @ 125V AC or 1A @ 250V AC

Distinctive Characteristics

12mm diameter bushing for easy panel cutout preparation and high density mounting.

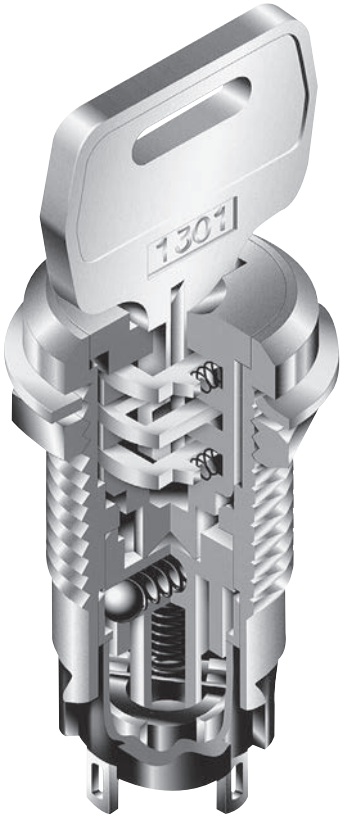
Epoxy sealed terminals prevent entry of flux and other contaminants.

Short behind panel dimension - only 1.063" (27.0mm).

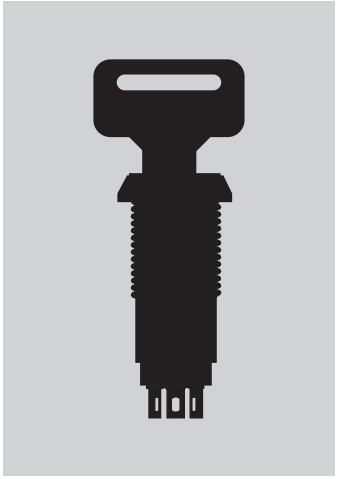
High dielectric strength of 1,500 volts between contacts and case.

Detent mechanism gives crisp, positive action for accurate switch setting.

Dust resistant interior construction protects contacts.



Actual Size



TYPICAL SWITCH ORDERING EXAMPLE

SK | 1 | 2B | A | W | 01

Poles

1	SPDT

Lock Mechanisms

A	Low Security
D	Medium Security (not combinable with code 3D circuit)

Terminals

01	Solder Lug

Circuits & Key-Removable Positions

Code	Pos. 1	Pos. 2	Pos. 3	Key Removes
2A	ON	NONE	ON	Positions 1 and 3
2B	ON	NONE	ON	Position 1
3D	ON	OFF	ON	Positions 1, 2, 3
3E	ON	OFF	ON	Position 2

Contact Material

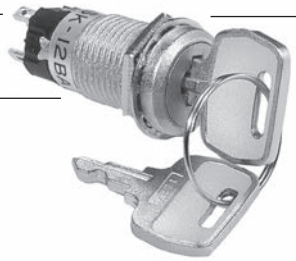
W	Silver Rated 3A @ 125V AC

IMPORTANT:

Switches are supplied without UL, cULus & CSA marking unless specified. **UL, cULus & CSA recognized only when ordered with marking on the switch.** Specific models, ratings, & ordering instructions are noted on the General Specifications page.

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

SK12BAW01



POLES, CIRCUITS & KEY-REMOVABLE POSITIONS

Pole & Throw	Model	Key Positions Pos 1	Pos 2	Pos 3	Connected Terminals (Terminal numbers are on switch) Pos 1	Pos 2	Pos 3	Schematic	⊙ = Key Removable • = Not Removable ◺ = Maximum Arc
SPDT	**SK12A**	ON	NONE	ON	COM-1	——	COM-2	COM 1 2	POS 1 3
SPDT	**SK12B**	ON	NONE	ON	COM-1	——	COM-2		POS 1 3
SPDT	***SK13D**	ON	OFF	ON	COM-1	OPEN	COM-2	COM OPEN 1 2	POS 1 2 3
SPDT	**SK13E**	ON	OFF	ON	COM-1	OPEN	COM-2		POS 1 2 3

* Available with low security only

KEY REMOVABLE

A **Positions 1 & 3**
90° Angular Throw

B **Position 1**
90° Angular Throw

D **Positions 1, 2 & 3**
45° Angular Throw

E **Position 2**
45° Angular Throw

LOCK MECHANISMS & KEYS

A Low Security Mechanism

Zinc Alloy with Chrome Plating (matte finish)

Two keys provided with each switch
(no master key available)

For ordering additional keys:
AT4081 for SK12A and SK12B, marked "1201"
AT4082 for SK13D and SK13E, marked "1301"

D Medium Security Mechanism

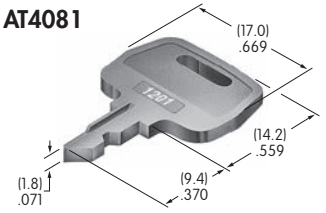
Brass with Nickel Plating (shiny finish)

One key provided with each switch
(no master key available)

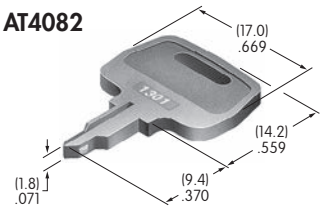
For ordering additional keys, indicate the same key number that is engraved on the face of your switch.

Key numbers (001 through 010) randomly assigned.

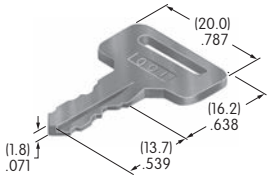
AT4081



AT4082



Typical Key Ordering Example:
AT4124-001

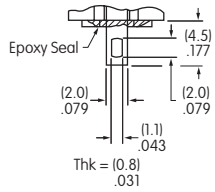


CONTACT MATERIALS, RATINGS, & TERMINALS

W Silver over Silver

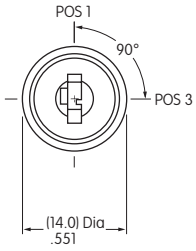
Power Level 3A @ 125V AC

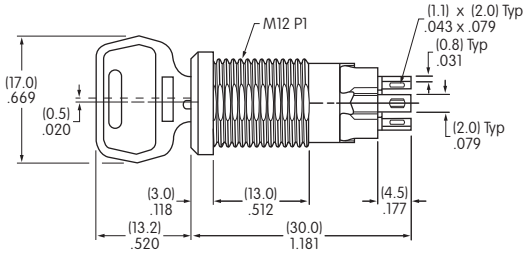
01 Solder Lug Terminals

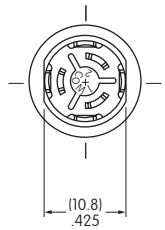


TYPICAL SWITCH DIMENSIONS

Low Security • 90° Angular Throw

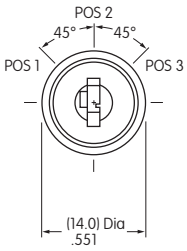


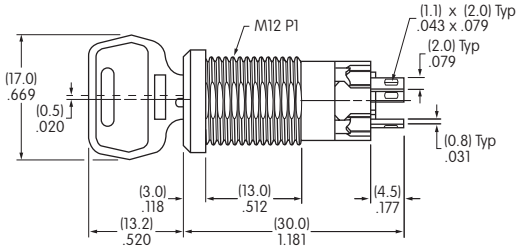


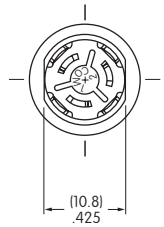


SK12BAW01

Low Security • 45° Angular Throw



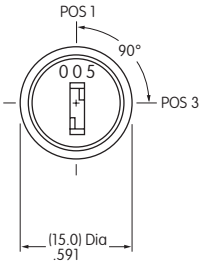


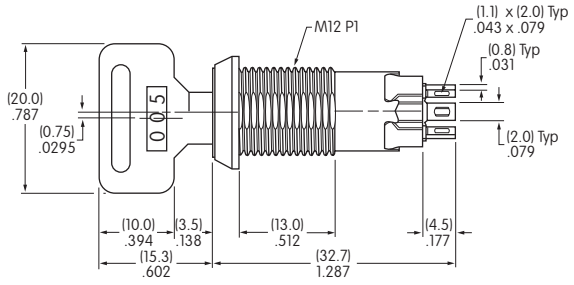


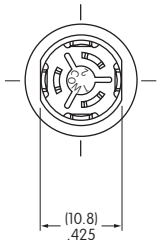
SK13EAW01

TYPICAL SWITCH DIMENSIONS

Medium Security • 90° Angular Throw

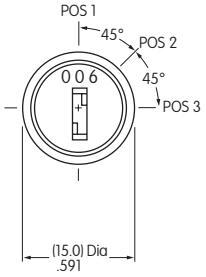


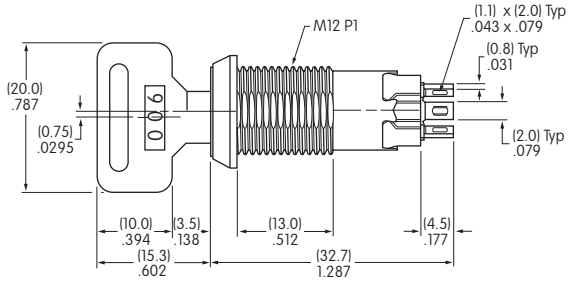


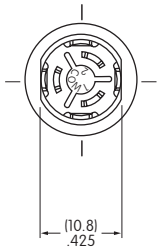


SK12ADW01

Medium Security • 45° Angular Throw

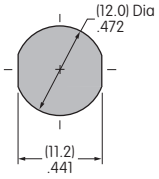






SK13EDW01

PANEL CUTOUT & THICKNESS



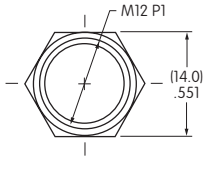
The 12mm bushing is .512" (13.0mm) long.
It allows mounting these devices in a maximum effective panel thickness of .315" (8.0mm).

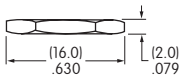
STANDARD HARDWARE

AT527M
Hex Mounting Nut

1 included with each switch

Steel with nickel plating

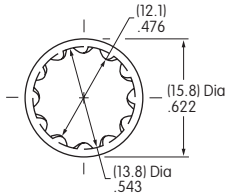




AT508
Internal Tooth Lockwasher

1 included with each switch

Steel with
zinc/chromate plating



General Specifications

Electrical Capacity (Resistive Load)

Logic Level: 0.4VA maximum @ 28V AC/DC maximum
(Applicable Range 0.1mA ~ 0.1A @ 20mV ~ 28V)
Note: Find additional explanation of operating range in Supplement section

Other Ratings

Contact Resistance: 100 milliohms maximum
Insulation Resistance: 100 megohms minimum @ 500V DC
Dielectric Strength: 500V AC minimum for 1 minute minimum
Mechanical Life: 30,000 cycles minimum
Electrical Life: 20,000 cycles minimum
Static Capability: Withstands 15 kilovolts ESD
Nominal Operating Torque: .0002Nm (.0017 lb•in)
Contact Timing: Break-before-make
Angle of Throw: 45° for 3-position & 5-position

Materials & Finishes

Key: Polyacetal
Housing/Bushing: Glass fiber reinforced polyester (PBT)
Base: Glass fiber reinforced polyamide
Rotor & Stopper: Polyacetal
Tumbler Plate: Brass
Movable Contactor: Beryllium copper with gold plating
Stationary Contacts: Phosphor bronze with gold plating
Terminals: Phosphor bronze with gold plating
Mounting Bracket: Steel with tin plating

Environmental Data

Operating Temperature Range: –25°C through +70°C (–13°F through +158°F)
Humidity: 90 ~ 95% humidity for 240 hours @ 40°C (104°F)
Vibration: 10 ~ 55Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in 1 minute; 3 right angled directions for 2 hours
Shock: 50G (490m/s^2) acceleration (tested in 6 right angled directions, with 5 shocks in each direction)

PCB Processing

Soldering: Wave Soldering Recommended. See Profile A in Supplement section.
Manual Soldering: See Profile A in Supplement section.
Cleaning: Automated cleaning. See Cleaning specifications in Supplement section.

Standards & Certifications

The SK Series devices have not been tested for UL recognition or CSA certification.
These switches are designed for use in a low-voltage, low-current, logic-level circuit.
When used as intended in a logic-level circuit, the results do not produce hazardous energy.

Distinctive Characteristics

Housing and bushing of high insulating material withstands over 15 kilovolts of electrostatic discharge, thus providing antistatic protection.

Totally sealed construction with internal o-ring, with gasket between base and housing, and with insert-molded terminals, gives protection for automated processing techniques.

Subminiature size allows high density mounting.

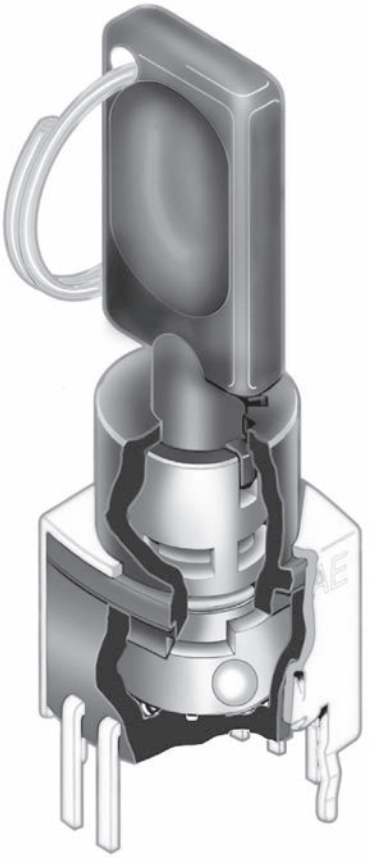
Molded-in terminals prevent entry of flux and other contaminants.

Crimped bracket legs ensure secure PCB mounting and prevent dislodging during automated wave soldering.

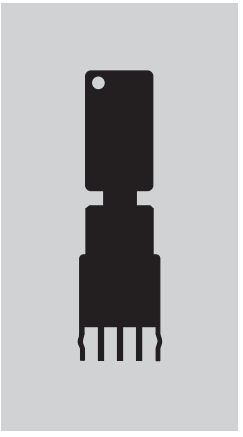
Bifurcated, self-wiping contact mechanism provides unequalled logic-level reliability and smoother, positive detent actuation.

Detent mechanism, with its spring-operated steel ball, gives distinct feel and crisp actuation for accurate switch setting.

.100" x .100" (2.54mm x 2.54mm) terminal spacing conforms to standard PC board grid spacing.



Actual Size



TYPICAL SWITCH ORDERING EXAMPLE

SK | 1 | 3 | A | E | G | 13

Poles

1	SP3T SP5T

Key Removable

A	All Positions

Bushing

E	9mm Diameter Smooth

PC Terminals

13	Straight with Bracket
30	Right Angle

Positions

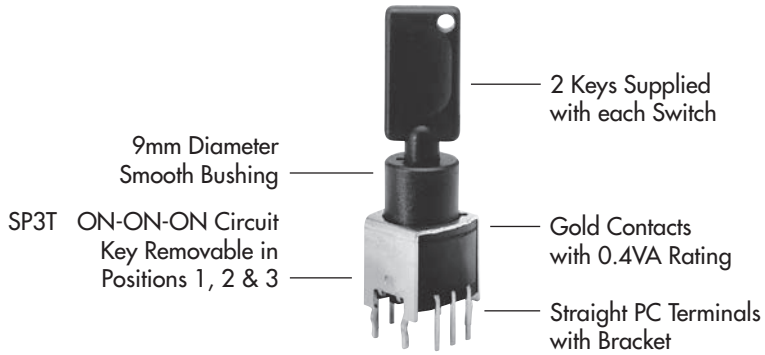
Code	Pos. 1	Pos. 2	Pos. 3	Pos. 4	Pos. 5
3	ON	ON	ON	NONE	NONE
5	ON	ON	ON	ON	ON

Contact Material

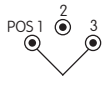
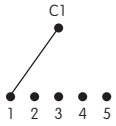
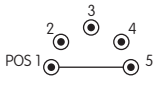
G	Gold Rated 0.4VA @ 28V AC/DC

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

SK13AEG13



POLES, CIRCUITS & KEY-REMOVABLE POSITIONS

Pole & Throw	Model	Key Positions Pos 1	Pos 2	Pos 3	Pos 4	Pos 5	Connected Terminals (Terminal numbers are not on switch) Pos 1	Pos 2	Pos 3	Pos 4	Pos 5	Schematic	⊙ = Key Removable • = Not Removable ◡ = Maximum Arc
SP3T	**SK13A**	ON	ON	ON	-----	-----	C1-2	C1-3	C1-4	-----	-----		
SP5T	**SK15A**	ON	ON	ON	ON	ON	C1-1	C1-2	C1-3	C1-4	C1-5		

KEY REMOVABLE

A All Positions
45° Angular Throw

BUSHING

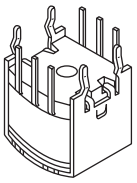
E 9mm Diameter Smooth

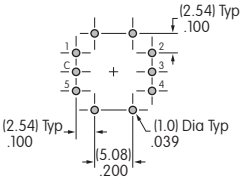
CONTACT MATERIAL & RATING

G Gold over Bronze or Copper | Logic Level | 0.4VA @ 28V AC/DC maximum

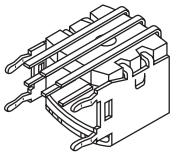
TERMINALS

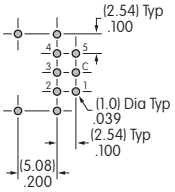
13 Straight PC with Bracket





30 Right Angle PC

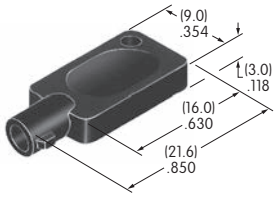




KEY

AT4094
Tubular Key

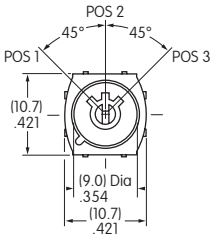
Material: Polyacetal

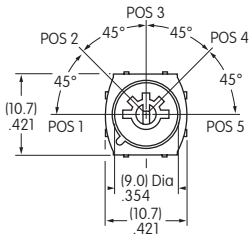


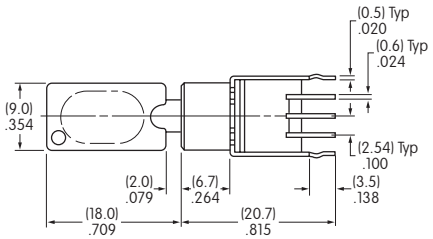
2 keys provided with each switch

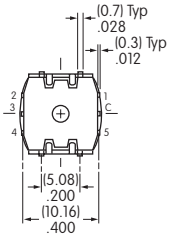
TYPICAL SWITCH DIMENSIONS

Straight PC with Bracket



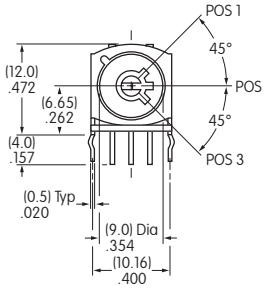


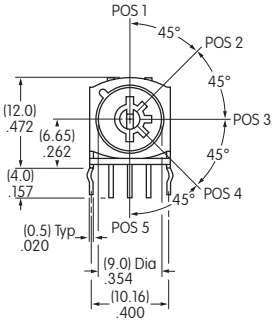


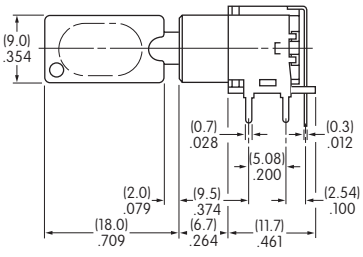


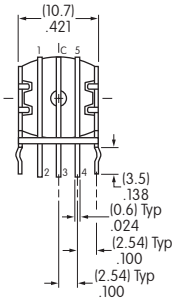
SK13AEG13 | **3 Position** | **5 Position** | On 3-position models terminals 1 & 5 are support pins.

Right Angle PC









SK15AEG30 | **3 Position** | **5 Position** | On 3-position models terminals 1 & 5 are support pins.

General Specifications

Electrical Capacity (Resistive Load)

Logic Level: 0.4VA maximum @ 28V AC/DC maximum
(Applicable Range 0.1mA ~ 0.1A @ 20mV ~ 28V)
See Supplement section to find explanation of operating range

Other Ratings

Contact Resistance: 80 milliohms maximum
Insulation Resistance: 100 megohms minimum @ 500V DC
Dielectric Strength: 500V AC minimum for 1 minute minimum
Mechanical Life: 30,000 cycles minimum
Electrical Life: 10,000 cycles minimum
Nominal Operating Torque: .026Nm (.234 lb•in) for momentary action models
.020Nm (.182 lb•in) for maintained action models
Contact Timing: Break-before-make
Angle of Throw: 90° for 2-position & 45° for 3-position

Materials & Finishes

Boot: Polyvinyl chloride
Key: Brass alloy with bright nickel plating;
brass alloy with bright nickel plating & ABS resin handle
Tumbler Barrel: Polyacetal
Bushing: Zinc alloy with nickel plating
Bracket: Steel with tin plating
Base: Glass fiber reinforced polyamide
Movable Contactor: Beryllium copper with gold plating
Stationary Contacts: Copper with gold plating
Terminals: Brass with tin plating

Environmental Data

Operating Temperature Range: –25°C through +70°C (–13°F through +158°F)
Humidity: 90 ~ 95% humidity for 240 hours @ 40°C (104°F)
Vibration: 10 ~ 55Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in 1 minute; 3 right angled directions for 2 hours
Shock: 50G (490m/s^2) acceleration (tested in 6 right angled directions, with 5 shocks in each direction)

PCB Processing

Soldering: Wave Soldering recommended: See Profile B in Supplement section.
Manual Soldering: See Profile B in Supplement section.
Cleaning: Automated cleaning. Boot must be on switch during processing.
See Cleaning specifications in Supplement section.

Standards & Certifications

These SK Series devices have not been tested for UL recognition or CSA certification.
These switches are designed for use in a low-voltage, low-current, logic-level circuit.
When used as intended in a logic-level circuit, the results do not produce hazardous energy.

Distinctive Characteristics

Sealed body construction plus disposable boot protect contacts and allow automated processing.

Molded-in terminals seal out flux, solvents, and other contaminants.

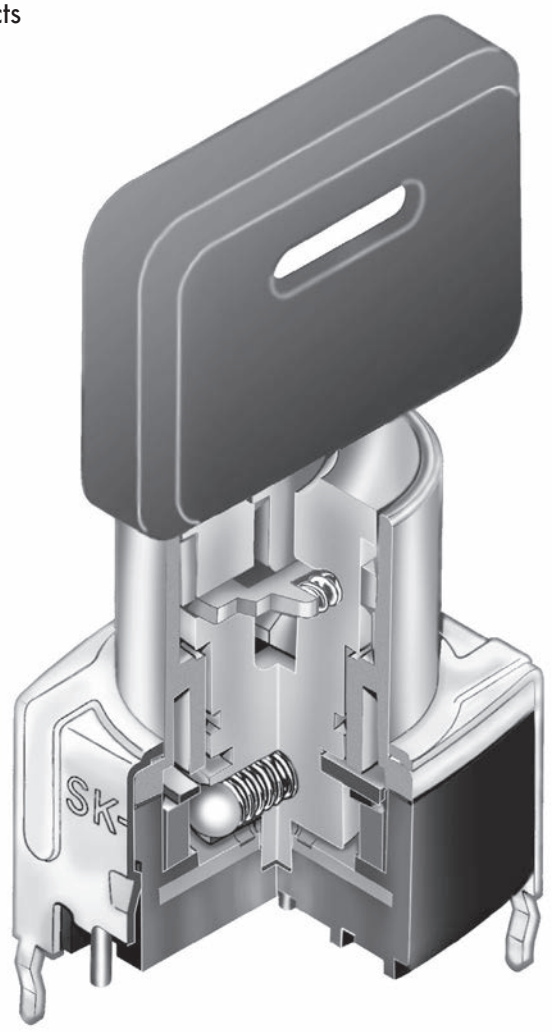
Short body size for space-saving, behind panel dimensions.

Detent mechanism, with its spring-operated steel ball, gives crisp, positive action for accurate switch setting.

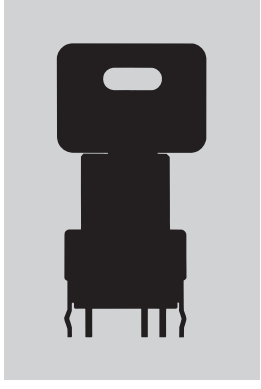
Bifurcated, self-wiping contact mechanism provides unequalled logic-level reliability and smoother, positive detent actuation.

Crimped bracket legs ensure secure PCB mounting and prevent dislodging during automated wave soldering.

.100" x .100" (2.54mm x 2.54mm) terminal spacing conforms to standard PC board grid spacing.



Actual Size



TYPICAL SWITCH ORDERING EXAMPLE

SK | 2 | 4E | G | 30

Poles

1	SPDT SP3T
2	DPDT DP3T

Contact Material

G	Gold Rated 0.4VA @ 28V AC/DC

Circuits & Key-Removable Positions

Code	Pos. 1	Pos. 2	Pos. 3	Key Removes
2A	ON	NONE	ON	Positions 1 and 3
2B	ON	NONE	ON	Position 1
5B	ON	NONE	(ON)	Position 1
***4D**	ON	ON	ON	Positions 1, 2, 3
***4E**	ON	ON	ON	Position 2

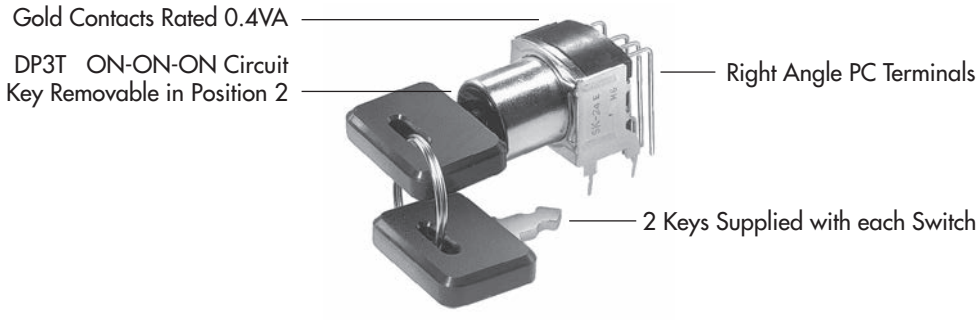
( ) = Momentary
*Can be used as ON-OFF-ON circuit

PC Terminals

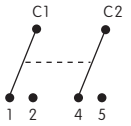
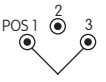
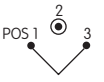
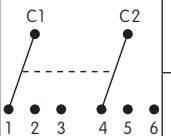
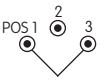
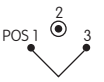
13	Straight with Bracket
30	Right Angle

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

SK24EG30



POLES, CIRCUITS & KEY-REMOVABLE POSITIONS

Pole & Throw	Model	Key Positions Pos 1	Key Positions Pos 2	Key Positions Pos 3	Connected Terminals (Terminal numbers are not on switch) Pos 1	Connected Terminals Pos 2	Connected Terminals Pos 3	Schematic	⊙ = Key Removable • = Not Removable ◺ = Maximum Arc
SPDT	**SK12A**	ON	NONE	ON	C1-1	——	C1-2		
SPDT SPDT	**SK12B** **SK15B**	ON ON	NONE NONE	ON (ON)	C1-1	——	C1-2		
DPDT	**SK22A**	ON	NONE	ON	C1-1 C2-4	——	C1-2 C2-5		
DPDT DPDT	**SK22B** **SK25B**	ON ON	NONE NONE	ON (ON)	C1-1 C2-4	——	C1-2 C2-5		
SP3T	**SK14D**	ON	ON	ON	C1-1	C1-2	C1-3		
SP3T	**SK14E**	ON	ON	ON	C1-1	C1-2	C1-3		
DP3T	**SK24D**	ON	ON	ON	C1-1 C2-4	C1-2 C2-5	C1-3 C2-6		
DP3T	**SK24E**	ON	ON	ON	C1-1 C2-4	C1-2 C2-5	C1-3 C2-6		

KEY REMOVABLE

A Positions 1 & 3
90° Angular Throw

B Position 1
90° Angular Throw

D Positions 1, 2 & 3
45° Angular Throw

E Position 2
45° Angular Throw

CONTACT MATERIAL & RATING

G Gold over Copper

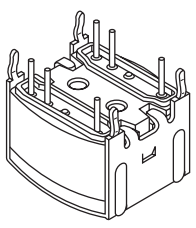
Logic Level

0.4VA maximum @ 28V AC/DC maximum

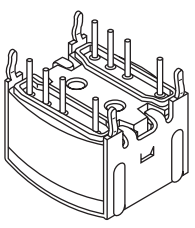
TERMINALS

13 Straight PC Terminals with Bracket

Double Throw Model

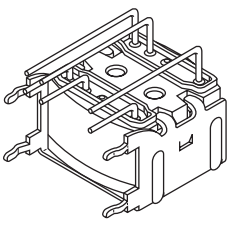


Three Throw Model

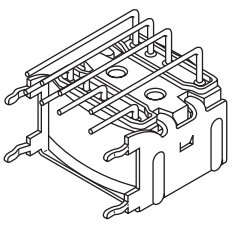


30 Right Angle PC Terminals

Double Throw Model



Three Throw Model

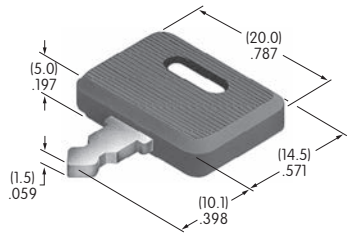


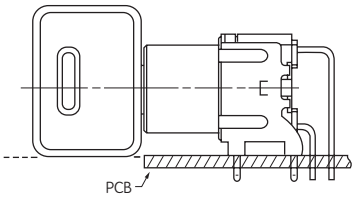
KEYS

AT4080 Standard
Antistatic Plastic Handle

Brass Alloy with Bright Nickel Plating & ABS Resin Handle

2 keys supplied with each switch



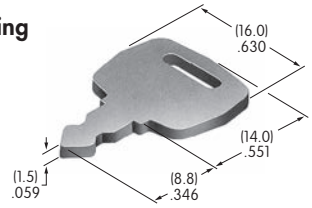


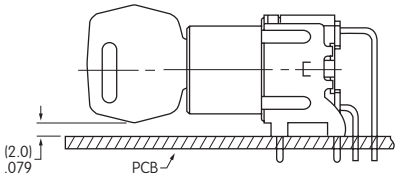
Suitable for all Straight PCB mount and for Right Angle PCB mount where clearance for key is obtainable.

AT4079 for Right Angle Mid-board Mounting
(Optional) All Metal

Brass Alloy with Bright Nickel Plating

Contact factory if metal keys needed





Disposable Boot

Each switch is supplied with a boot that provides protection from automated soldering and the cleaning process. Attach the boot without the key installed in the switch.

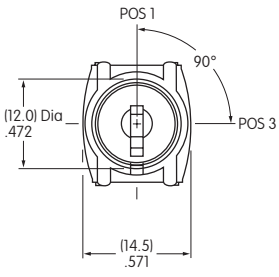
The boot is not reusable; discard after the washing procedure.

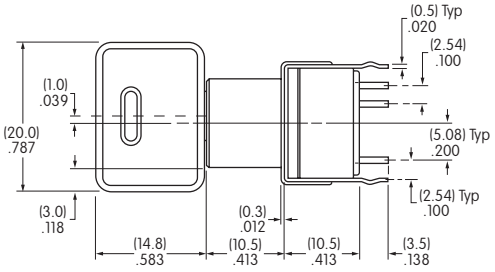
Polyvinyl Chloride

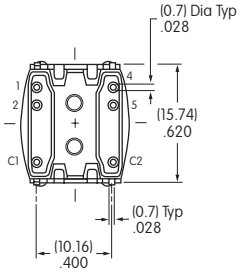
TYPICAL SWITCH DIMENSIONS

Single & Double Pole

Straight PC with Bracket • Double Throw





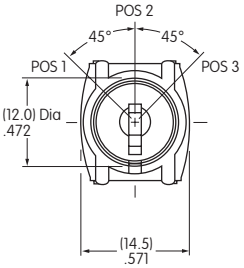


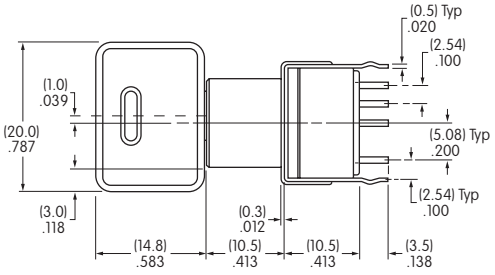
Single Pole models have only terminals 1, 2 & C1

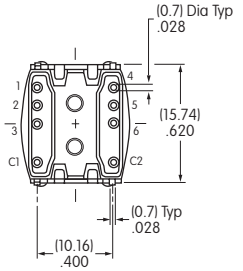
SK12AG13

Single & Double Pole

Straight PC with Bracket • Three Throw





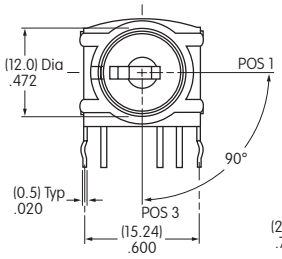


Single Pole models have only terminals 1, 2, 3 & C1

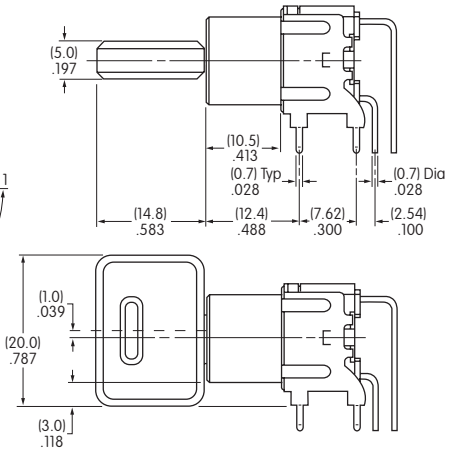
SK24DG13

TYPICAL SWITCH DIMENSIONS

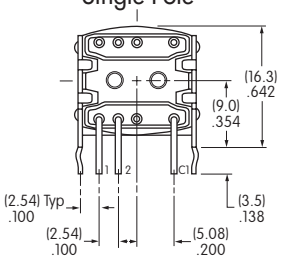
Right Angle PC Terminals Double Throw

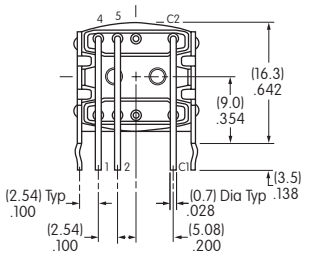


Key in Position 1



Single Pole



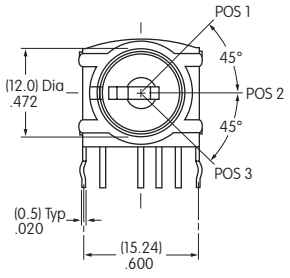


SK15BG30

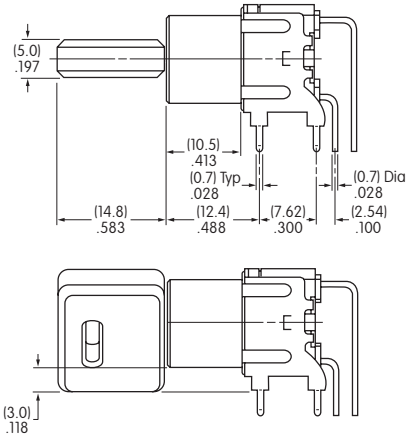
Key in Position 3

Double Pole

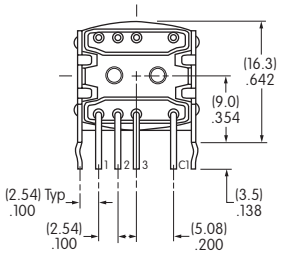
Right Angle PC Terminals Three Throw

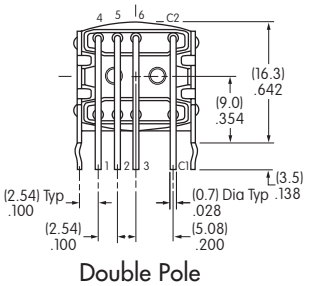


Key in Position 2



Single Pole





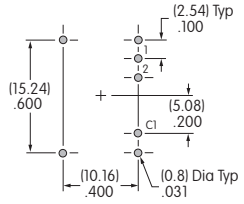
SK24EG30

Key in Position 1

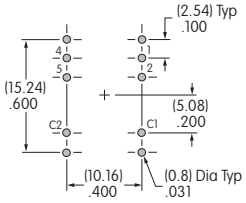
Double Pole

Straight PC Footprints

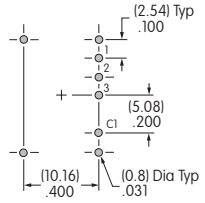
SPDT



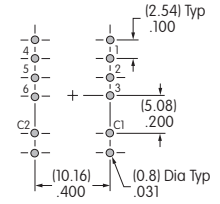
DPDT



SP3T

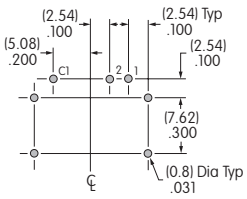


DP3T

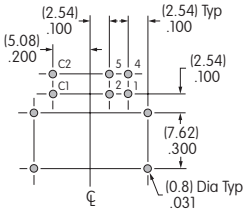


Right Angle PC Footprints

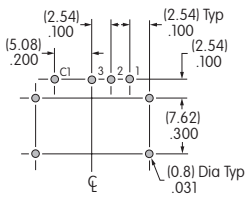
SPDT



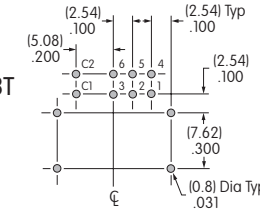
DPDT



SP3T



DP3T



General Specifications

Part Number: SK14DGMG01

Electrical Capacity (Resistive Load)

Logic Level: 0.4VA maximum @ 28V AC/DC maximum
(Applicable Range 0.1mA ~ 0.1A @ 20mV ~ 28V)

Other Ratings

Contact Resistance: 100 milliohms maximum
Insulation Resistance: 100 megohms minimum @ 500V DC
Dielectric Strength: 500V AC minimum between contacts for 1 minute minimum
Mechanical Life: 30,000 operations minimum
Electrical Life: 10,000 operations minimum
Static Capability: Withstands 15 kilovolts ESD
Nominal Operating Force: 0.02Nm (0.18 lb•in)
Contact Timing: Break-before-make
Angle of Throw: 45°

Materials & Finishes

Key: Brass alloy with bright nickel plating and ABS resin handle
Housing: Polyamide
Base: Glass fiber reinforced polyamide
Rotor: Glass fiber reinforced polyamide
Tumbler Plate: Brass
Movable Contacts: Beryllium copper with gold plating
Stationary Contacts: Brass with gold plating
Switch Terminals: Brass with gold plating

Environmental Data

Operating Temperature Range: –40°C through +85°C (–40°F through +185°F)
Humidity: 90 ~ 95% humidity for 240 hours @ 60°C (140°F)
Vibration: 10 ~ 55Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in 1 minute; 3 right angled directions for 2 hours
Shock: 50G (490m/s^2) acceleration (tested in 6 right angled directions, with 5 shocks in each direction)

PCB Processing

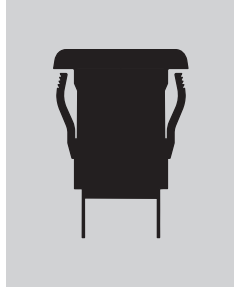
Soldering: Manual Soldering: lead-free, see profile below. Do not exceed these specifications.
Cleaning: Hand clean locally using alcohol based solution.

Solder Iron Tip Temperature	370°C
Time on Terminal	4 seconds
Cycles	2

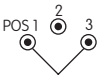
Standards & Certifications

These devices have not been tested for UL recognition or CSA certification.
These devices are designed for use in a low-voltage, low-current, logic-level circuit.
When used as intended in a logic-level circuit, the results do not produce hazardous energy.

Actual Size



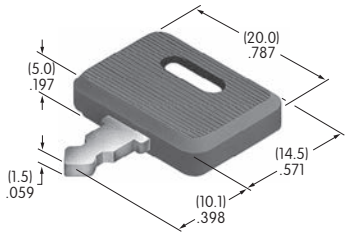
POLES, CIRCUITS & KEY-REMOVABLE POSITIONS

Pole & Throw	Key Positions Pos 1	Pos 2	Pos 3	Connected Terminals (Terminal numbers are on switch) Pos 1	Pos 2	Pos 3	Schematic	⊙ = Key Removable ◡ = Maximum Arc
SP3T	ON	ON	ON	C-1	C-2	C-3		

KEY

AT4080 Standard
Antistatic Plastic Handle

Material:
Brass Alloy with Bright Nickel Plating
& ABS Resin Handle

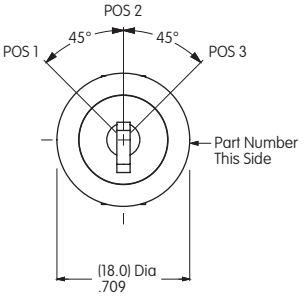


2 keys supplied with each switch

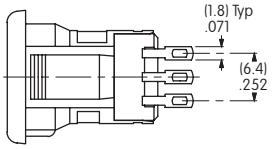
TYPICAL SWITCH DIMENSIONS

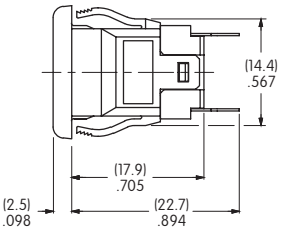
Antistatic Snap-in • Flat Key

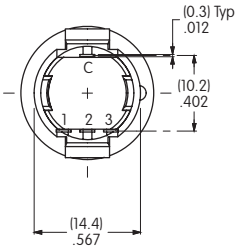
SK14DGMG01



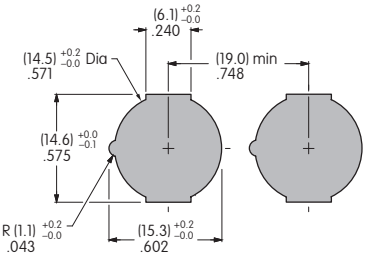
Single Pole Three Throw







PANEL CUTOUT

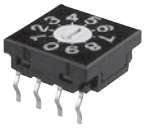


Panel Thickness Range
.039" ~ .079"
(1.0mm ~ 2.0mm)

NKK SWITCHES

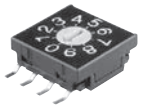
Rotaries

Contents Rotaries



FR01 Series G4

10mm Ultra-Thin DIP; 100mA @ 5V DC; 100mA @ 50V DC
Straight PC & Right Angle PC
Through-hole Mount
Decimal & Hexadecimal



FR02 Series G12

10mm Ultra-Thin DIP; 100mA @ 5V DC; 100mA @ 50V DC
Gull Wing Terminals
Upright Mount
Decimal & Hexadecimal

MR Series.....G16

0.4VA & 250mA Logic Level
Process Sealed
Straight PC
PC & Bushing Mount

MR Series.....G22

Power Rated 2A, 3A, 5A & 10A @ 125V AC
PC Turret, Turret & Solder Lug
Bushing Mount

MRB Series G28

0.4VA Logic Level
Process Sealed
Straight & Right Angle Bracketed PC

ND Series G34

8mm Process Sealed DIP; 100mA @ 5V DC
Straight & Right Angle PC
Decimal & Hexadecimal

ND3 Series.....G38

8mm Process Sealed DIP; 100mA @ 5V DC
Gull Wing Terminals
Upright & Right Angle Mount
Decimal & Hexadecimal

HS13 & HS16 Series G46

6A &12A @ 125V AC
HS13: 2-4 Positions; Nonshorting
HS16: 1-6 Poles; 2-11 Positions; Nonshorting or Shorting
Solder Lug
Bushing Mount

TS Series G46

6A @ 125V AC
1-5 Poles
2-11 Positions
Nonshorting
Screw Lug
Bushing Mount

PS Series G46

30A @ 125V AC
1-5 Poles
2-11 Positions
Nonshorting
Screw Lug
Bushing Mount

General Specifications

Electrical Capacity (Resistive Load)

Switching Rating: 100mA @ 5V DC
Nonswitching Rating: 100mA @ 50V DC

Other Ratings

Contact Resistance: 100 milliohms maximum; 30 milliohms maximum for contact point
Insulation Resistance: 1,000 megohms minimum @ 250V DC
Dielectric Strength: 250V AC minimum for 1 minute minimum
Mechanical Life: 10,000 detent operations minimum
Electrical Life: 10,000 detent operations minimum
Notes: A detent operation is one actuator position operation or stepping.
A cycle is one 360° rotation. 10,000 detent operations equal 625 cycles for hexadecimal devices or 1,000 cycles for decimal devices.
Nominal Operating Torque: Metal Shaft: 0.009Nm for decimal devices; 0.011Nm for hexadecimal devices
All other Actuator types: 0.008Nm for decimal devices; 0.01Nm for hexadecimal devices
Contact Timing: Nonshorting

Materials & Finishes

Actuators: Screwdriver and Plastic Shaft - Glass fiber reinforced polyamide (UL94V-0);
Dial - Polyoxymethylene; Metal Shaft - Brass with nickel plating
Bushing : Brass with nickel plating (for Metal Shaft model)
Outer Case: Glass fiber reinforced PBT (for Metal Shaft model)
Housing & Base: Glass fiber reinforced polyamide (UL94V-0)
Movable Contacts: Copper alloy with gold plating
Stationary Contacts: Phosphor bronze with gold plating
Terminals: Phosphor bronze with gold plating
Terminal Cover: Polyamide (Right angle model only)
Bracket: Phospher bronze with tin plating (for Metal Shaft model)

Environmental Data

Operating Temperature Range: –25°C through +85°C (–13°F through +185°F)
Humidity: 90 ~ 95% humidity for 240 hours @ 40°C (104°F)
Vibration: 10 ~ 55Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in 5 minutes; 3 right angled directions for 2 hours
Shock: 50G (490m/s^2) acceleration (tested in 6 right angled directions, with 5 shocks in each direction)

Processing

Soldering: Wave Soldering Recommended. See Profile A in Supplement section.
Manual Soldering: See Profile A in Supplement section.
Note: During soldering process, set the switch to the following position:
FR01FR10P, FR01FR16P, FR01KR10P, FR01KR16P, FR01SR10P, FR01SR16P,
FR01AR10PB, FR01AR16PB, FR01AR10HB, FR01AR16HB: 0 position;
FR01FC10P, FR01KC10P, FR01FC10H, FR01KC10H,
FR01SC10P, FR01AC10PB, FR01AC10HB: 7 position;
FR01FC16P, FR01KC16P, FR01FC16H, FR01KC16H,
FR01SC16P, FR01AC16PB, FR01AC16HB: F position
Cleaning: These devices are not process sealed. Hand clean locally using alcohol based solution.
Custom process sealed version available; contact factory.

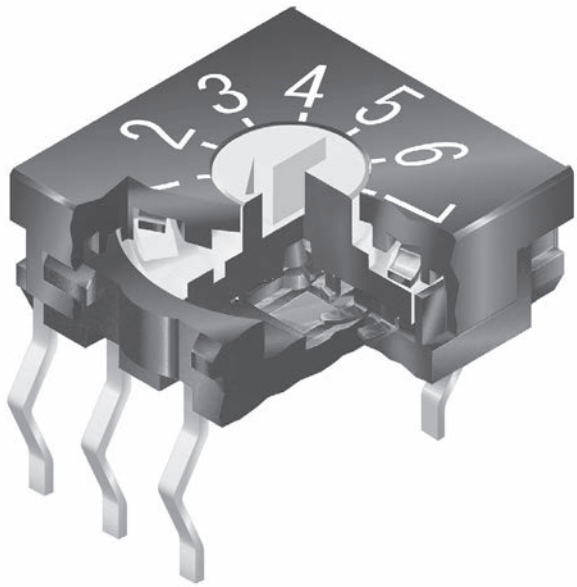
Standards & Certifications

Flammability Standards: UL94V-0 rated actuator, housing and base
The FR01 Series rotaries have not been tested for UL recognition or CSA certification.
These switches are designed for use in a low-voltage, low-current circuit.
When used as intended, the results do not produce hazardous energy.

Distinctive Characteristics

Compact dimensions and low profile allow high density mounting and close stacking of PC boards.

Highly visible legends and choice of screwdriver, shaft or dial actuators with arrow position indication provide trouble-free code setting. Knob actuator also available.



Real or complement code setting identified by color-keyed actuator.

Detent mechanism gives crisp, positive action for accurate switch setting.

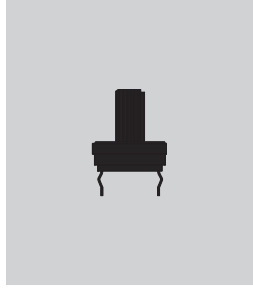
Crimped terminals ensure secure PC mounting and prevent dislodging during soldering.

Cam activated movable contact and gold contacts assure contact reliability and continuity.

Surface mount model with screwdriver actuation available and shown in the surface mount section.

Contact factory for custom models with .200" (5.08mm) terminal spacing.

Actual Size



TYPICAL SWITCH ORDERING EXAMPLE

FR | 01 | K | R | 16 | P | | — | S

Mounting

01	Through-hole

Actuation

F	Screwdriver
K	Plastic Shaft
S	Dial (for Straight Terminals only)
*A	Metal Shaft (for Optional Knobs)

*Must be used with Bracket

Circuits

R	Real Coded (Orange Actuator)
C	Complement Coded (Yellow Actuator)

Color not applicable to Actuator A

Positions

10	Decimal
16	Hexadecimal

PC Terminals

P	Straight
H	Right Angle

Bracket

No Code	No Bracket
*B	With Bracket

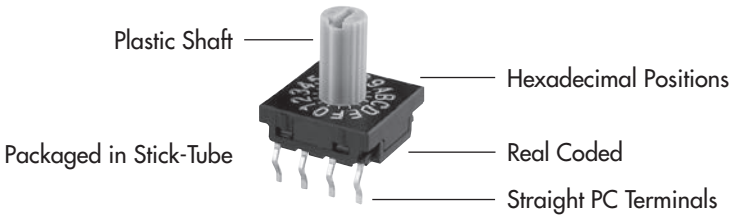
*For Actuator A only

Packaging

S	Stick-Tubes: FR01F, FR01K, FR01S 50 Pieces/Stick FR01A 25 Pieces/Stick

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

FR01KR16P-S



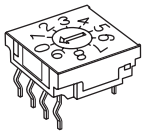
MOUNTING

01 **Through-hole**

ACTUATION

F **Screwdriver**

Adjusted with a flat tipped screwdriver

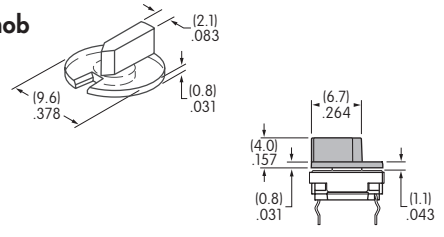


Actuators are fully rotational either clockwise or counterclockwise.
Actuator Colors: Orange for real coded devices; Yellow for complement coded devices.

AT4180
Optional Snap-on Knob

Polyamide

Black knob with transparent flange

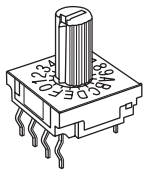


Install knob before mounting on PCB for right angle type; it should not be removed once mounted. When mounting, align slit in knob with arrowhead on actuator.

ACTUATION

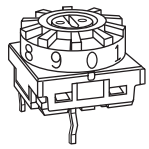
K **Plastic Shaft**

Adjusted by hand or with flat tipped screwdriver



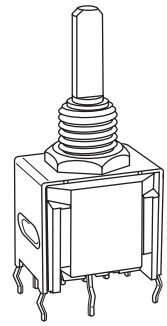
S **Dial**

Adjusted by hand or with flat tipped screwdriver



A **Metal Shaft**

Knob options illustrated below with color choices



Actuators are fully rotational and operate either clockwise or counterclockwise.
Colors for Actuators K and S: Orange for real coded devices; Yellow for complement coded devices

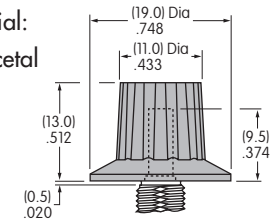
Mounting hardware is available if needed for models with Actuator A:
Hexagon Nut AT513M, Locking Ring AT515M, and Lockwasher AT509; all are shown in the Accessories and Hardware section.

OPTIONAL KNOBS FOR METAL SHAFT

AT433
Plain Black

Material:
Polyacetal

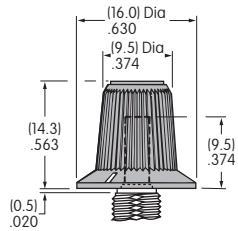
Color:
Black



AT4103 Small
Color Tipped

Polyester Base:
Black

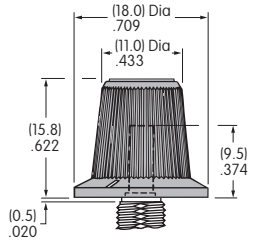
Polyamide Tip Colors:
A, B, C, E, F, G, H



AT4104 Large
Color Tipped

Polyester Base:
Black

Polyamide Tip Colors:
A, B, C, E, F, G, H



Knob Orientation: When installed with shaft flat rotated 180° from bushing flat as shown in "Typical Switch Dimensions," white line on cap points to Actuator Position 0 noted in truth tables below.

Color Codes: **A** Black **B** White **C** Red **E** Yellow **F** Green **G** Blue **H** Gray

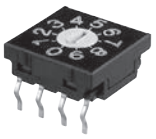
TRUTH TABLES (CIRCUITS & POSITIONS)

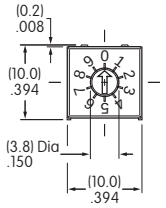
Terminal No. (Output)	Actuator Position (● = ON)	10 Decimal										16 Hexadecimal															
		0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
R **Real Coded** Model Numbers: FR01FR, FR01KR, FR01SR, FR01AR	1		●		●		●		●		●		●		●		●		●		●		●		●		●
	2			●	●			●	●					●	●			●	●			●	●			●	●
	4					●	●	●	●							●	●	●	●					●	●	●	●
	8									●	●									●	●	●	●	●	●	●	●
C **Complement Coded** Model Numbers: FR01FC, FR01KC FR01SC, FR01AC	1	●		●		●		●		●		●		●		●		●		●		●		●		●	
	2	●	●			●	●			●	●	●	●			●	●			●	●			●	●		
	4	●	●	●	●					●	●	●	●	●	●					●	●	●	●				
	8	●	●	●	●	●	●	●	●			●	●	●	●	●	●	●	●								

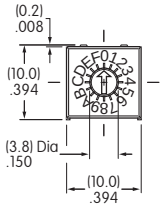
Terminal numbers are actually on the switch.
Above sequence shown for clockwise rotation.

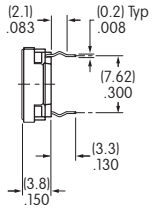
TYPICAL SWITCH DIMENSIONS

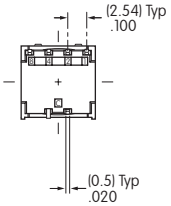
P Straight PC • Screwdriver

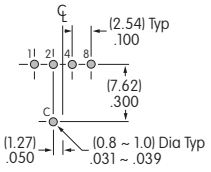






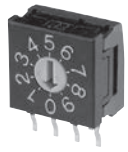


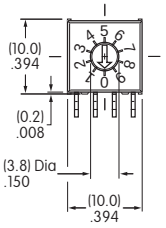


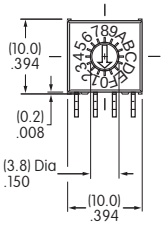


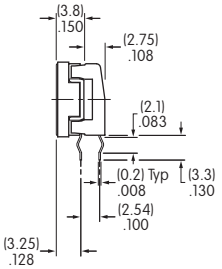
FR01FC10P Decimal Hexadecimal

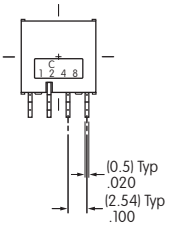
H Right Angle PC • Screwdriver

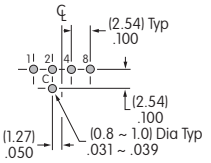






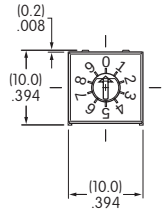


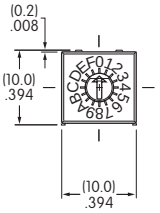


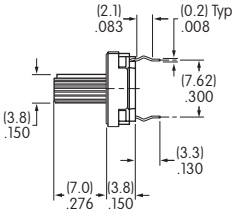


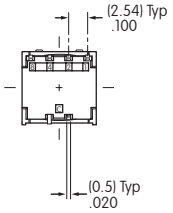
FR01FR10H Decimal Hexadecimal

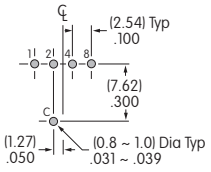
P Straight PC • Plastic Shaft





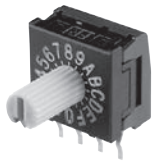


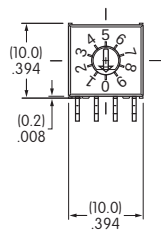


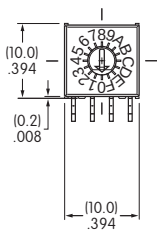


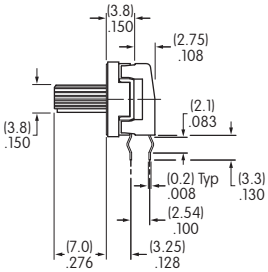
FR01KR16P Decimal Hexadecimal

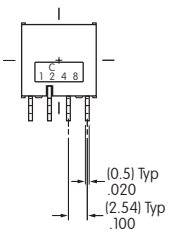
H Right Angle PC • Plastic Shaft

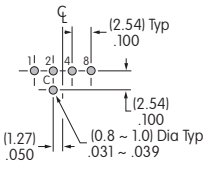








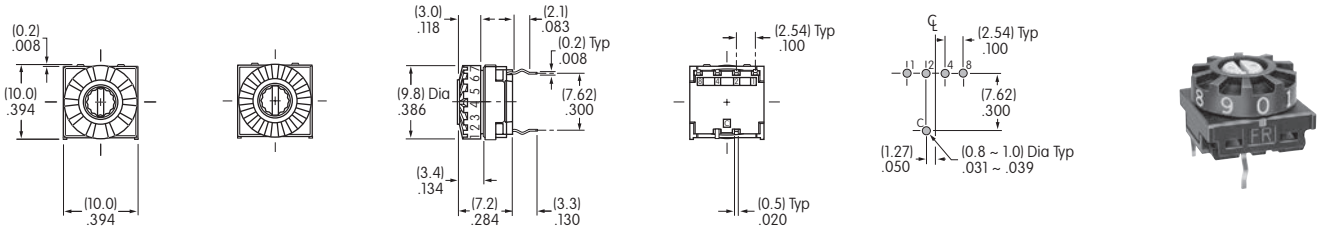




FR01KC16H Decimal Hexadecimal

TYPICAL SWITCH DIMENSIONS

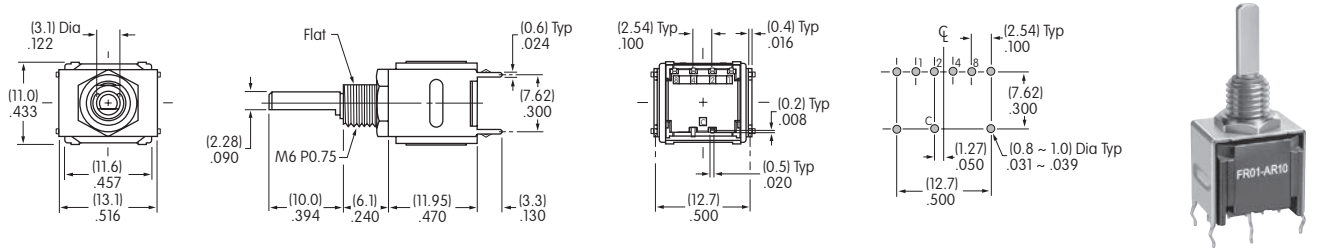
Straight PC • Dial P



Decimal Hexadecimal

FR01SR10P

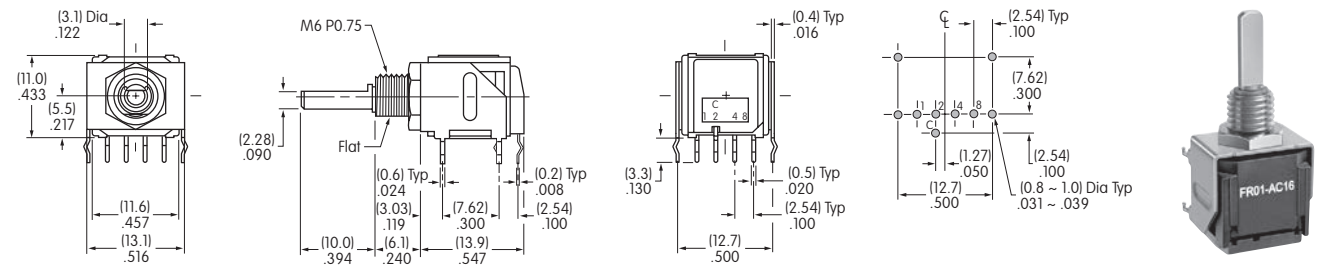
Straight PC • Metal Shaft P



Shown in Position 0 with shaft flat rotated 180° from bushing flat

FR01AR10PB

Right Angle PC • Metal Shaft H



Shown in Position 0 with shaft flat rotated 180° from bushing flat

FR01AC16HB

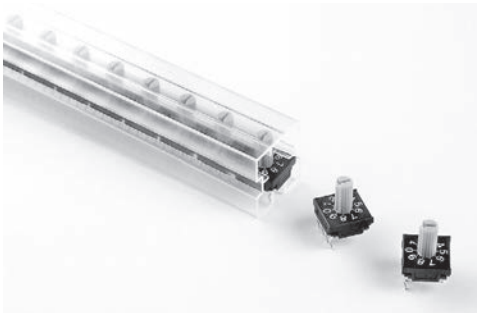
PACKAGING

S **Stick-Tube**

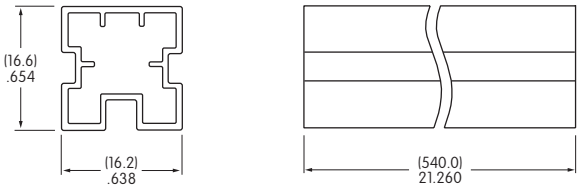
FR01F, FR01K & FR01S
Each stick-tube contains 50 switches.
Switches must be ordered in 50-piece increments.

FR01A
Each stick-tube contains 25 switches.
Switches must be ordered in 25-piece increments.

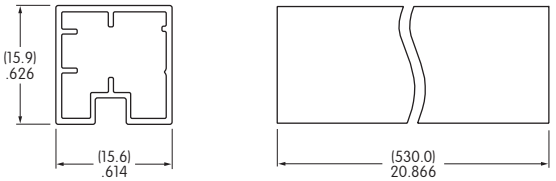
Note: Transport and storage temperatures should not exceed 50°C (122°F). Store stick tubes on flat surface.



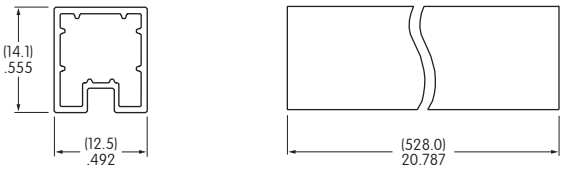
FR01F with Screwdriver Actuation & Straight PC



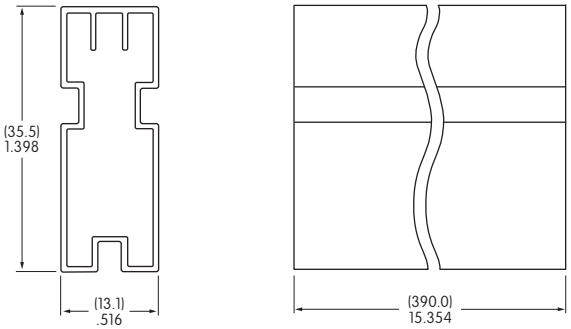
FR01K with Plastic Shaft & Right Angle PC



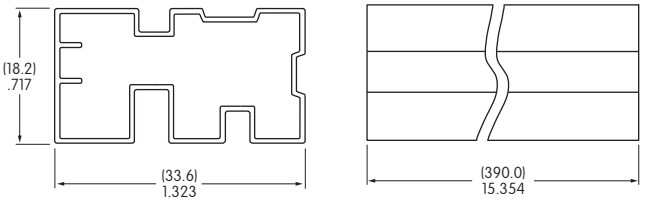
FR01S with Dial Actuation & Straight PC



FR01A with Metal Shaft & Straight PC



FR01A with Metal Shaft & Right Angle PC



General Specifications

Electrical Capacity (Resistive Load)

Switching Rating: 100mA @ 5V DC
Nonswitching Rating: 100mA @ 50V DC

Other Ratings

Contact Resistance: 100 milliohms maximum for circuit; 30 milliohms maximum for contact point
Insulation Resistance: 1,000 megohms minimum @ 250V DC
Dielectric Strength: 250V AC minimum for 1 minute minimum
Mechanical Life: 10,000 detent operations minimum
Electrical Life: 10,000 detent operations minimum
Notes: A detent operation is one actuator position operation or stepping.
A cycle is one 360° rotation. 10,000 detent operations equal
625 cycles for hexadecimal devices or 1,000 cycles for decimal devices.
Nominal Operating Torque: 0.008Nm for decimal devices; 0.01Nm for hexadecimal devices
Contact Timing: Nonshorting

Materials & Finishes

Actuator: Screwdriver and Plastic Shaft - Glass fiber reinforced polyamide (UL94V-0)
Housing & Base: Glass fiber reinforced polyamide (UL94V-0)
Leaf Spring: Stainless steel
Movable Contacts: Copper alloy with gold plating
Stationary Contacts: Phosphor bronze with gold plating
Terminals: Phosphor bronze with gold plating

Environmental Data

Operating Temperature Range: –25°C through +85°C (–13°F through +185°F)
Humidity: 90 ~ 95% humidity for 240 hours @ 40°C (104°F)
Vibration: 10 ~ 55Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in 5 minutes; 3 right angled directions for 2 hours
Shock: 50G (490m/s^2) acceleration (tested in 6 right angled directions, with 5 shocks in each direction)

Processing

Soldering: Reflow Soldering Recommended. See Profile A in Supplement section.
Manual Soldering: See Profile A in Supplement section.
Note: During soldering process, set the switch to the following position:
FR02FR10P, FR02FR16P, FR02KR10P, FR02KR16P: 0 position;
FR02FC10P, FR02KC10P: 7 position;
FR02FC16P, FR02KC16P: F position
Cleaning: These devices are not process sealed. Hand clean locally using alcohol based solution.

Standards & Certifications

Flammability Standards: UL94V-0 rated actuator, housing, & base
The FR02 Series rotaries have not been tested for UL recognition or CSA certification.
These switches are designed for use in a low-voltage, low-current circuit.
When used as intended, the results do not produce hazardous energy.

Distinctive Characteristics

Slim .150" (3.8mm) body has the lowest profile in the industry and allows close stacking of PC boards.

Highly visible legends and choice of screwdriver or shaft actuators with arrow position indication provide trouble-free code setting.

Detent mechanism gives crisp, positive action for accurate switch setting.

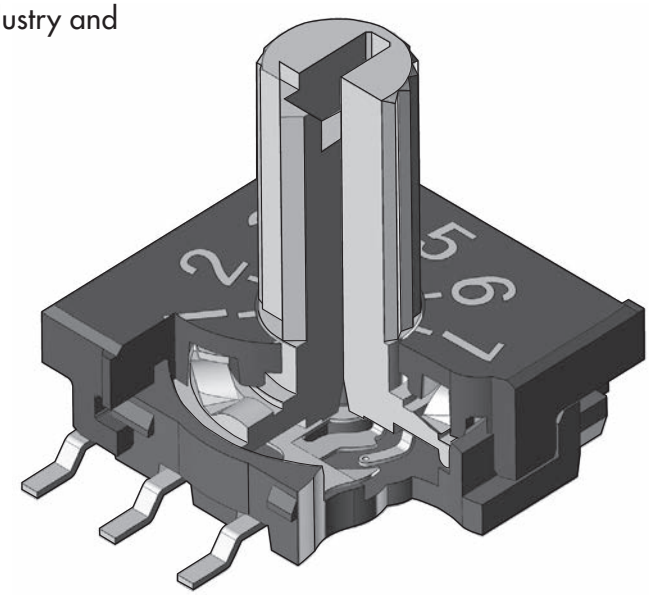
Use of heat resistant resin allows infrared convection reflow soldering.

Gull-winged terminals ensure mechanical stability during soldering and simplify solder joint inspection.

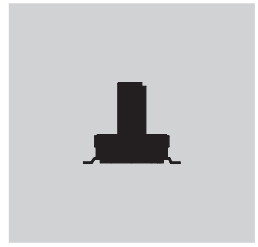
Cam activated movable contact and gold contacts assure contact reliability and continuity.

Tape-reel packaging meets EIA-481-2 Standard.

Coplanarity: all considered surfaces must lie between two parallel planes that are a maximum distance apart of .0059" (0.15mm). (Additional co-planarity details in Terms and Acronyms in the Supplement section.)



Actual Size



TRUTH TABLES (CIRCUITS & POSITIONS)

Actuator Position ● = ON

Terminal No. (Output)

		10 Decimal										16 Hexadecimal															
		0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
R Real Coded Model Numbers: FR02FR, FR02KR	1		●		●		●		●		●		●		●		●		●		●		●		●		●
	2			●	●			●	●					●	●			●	●			●	●			●	●
	4					●	●	●	●							●	●	●	●					●	●	●	●
	8									●	●									●	●	●	●	●	●	●	●
C Complement Coded Model Numbers: FR02FC, FR02KC	1	●		●		●		●		●		●		●		●		●		●		●		●		●	
	2	●	●			●	●			●	●	●	●			●	●			●	●			●	●		
	4	●	●	●	●					●	●	●	●	●	●					●	●	●	●				
	8	●	●	●	●	●	●	●	●			●	●	●	●	●	●	●	●								

Terminal numbers are actually on the switch.

Series FR02

10mm Ultra-Thin SMT DIP Rotaries

TYPICAL SWITCH ORDERING EXAMPLE

FR | 02 | F | R | 10 | P | — | S

Mounting

02	SMT

Circuits

R	Real Coded (Orange Actuator)
C	Complement Coded (Yellow Actuator)

Terminals

P	Gull Wing for Upright Mount

Actuation

F	Screwdriver
K	Plastic Shaft

Positions

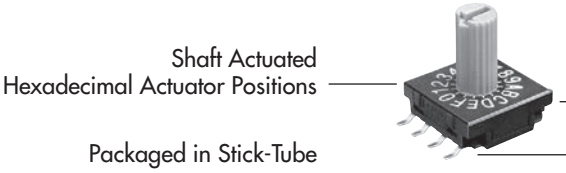
10	Decimal
16	Hexadecimal

Packaging

S	Stick-Tube 50 Pieces/Stick
R	Tape-Reel FR02F: 500 Pieces/Reel FR02K: 200 Pieces/Reel

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

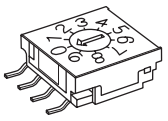
FR02KR16P-S



ACTUATION

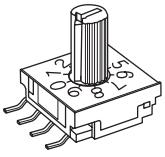
F **Screwdriver**

Adjusted with a flat tipped screwdriver



K **Plastic Shaft**

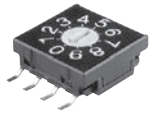
Adjusted by hand or with flat tipped screwdriver



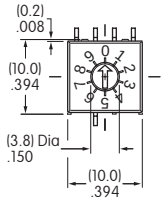
Actuators are fully rotational either clockwise or counterclockwise.
Actuator Colors: Orange for real coded devices; Yellow for complement coded devices.

TYPICAL SWITCH DIMENSIONS

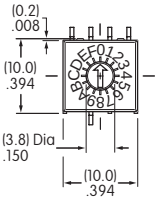
P **Upright • Screwdriver**



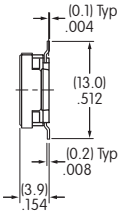
FR02FC10P

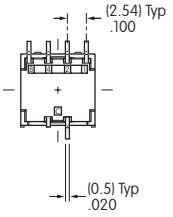


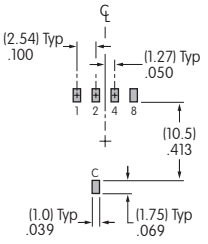
Decimal



Hexadecimal

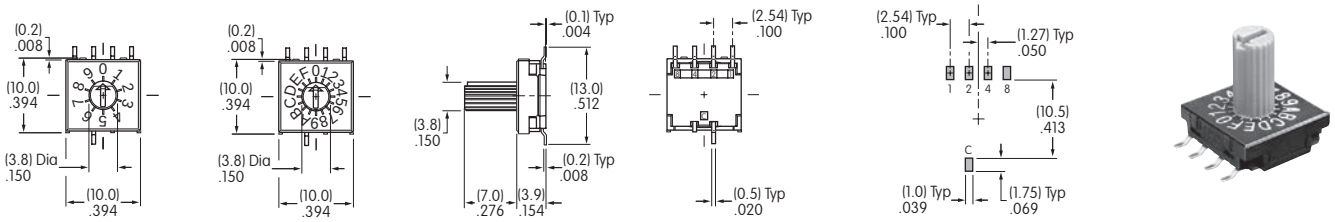






TYPICAL SWITCH DIMENSIONS

Upright • Plastic Shaft **P**



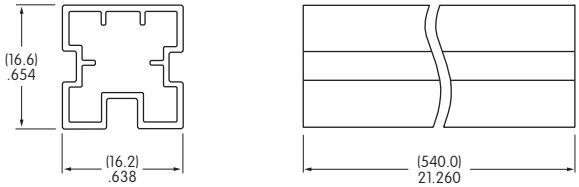
Decimal Hexadecimal

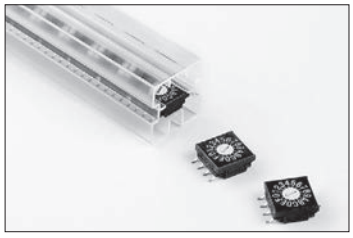
FR02KC16P

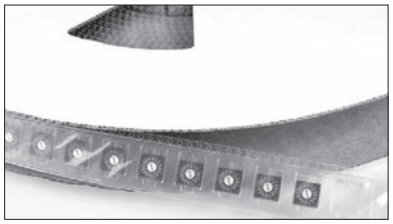
PACKAGING

S **Stick-Tube**

FR02F & FR02K
Each stick-tube contains 50 switches.
Switches must be ordered in 50-piece increments.







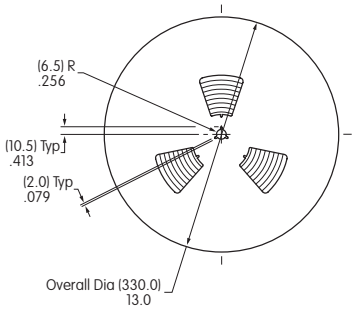
R **Tape-Reel**

FR02F
Switches must be ordered in 500-piece increments.
This packaging meets EIA-481-2 Standard.

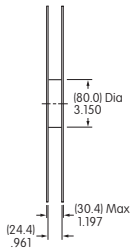
Each tape-reel of 550 pockets contains 500 switches.
Minimum Leader Length: 15.748″ (400mm)
Minimum Trailer Length: 6.299″ (160mm)

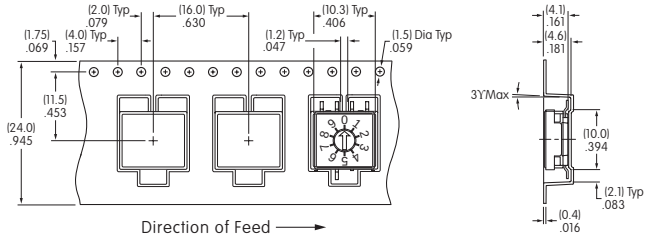
FR02K
Switches must be ordered in 200-piece increments.
This packaging meets EIA-481-2 Standard.

Each tape-reel of 250 pockets contains 200 switches.
Minimum Leader Length: 15.748″ (400mm)
Minimum Trailer Length: 6.299″ (160mm)

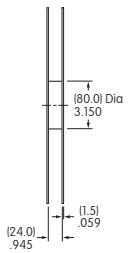


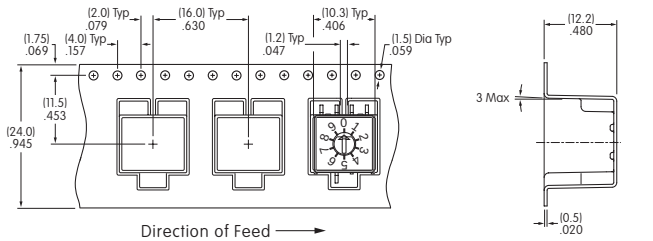
FR02F





FR02K





General Specifications

Electrical Capacity (Resistive Load)

For MRA: 250mA @ 125V AC
For MRF or MRK: 0.4VA maximum @ 28V AC/DC maximum
(Applicable Range 0.1mA ~ 0.1A @ 20mV ~ 28V)
Note: Find additional explanation of operating range in Supplement section.

Other Ratings

Contact Resistance: 10 milliohms maximum for MRA; 50 milliohms maximum for MRF & MRK
Insulation Resistance: 100 megohms minimum @ 500V DC
Dielectric Strength: 1,000V AC minimum for 1 minute minimum for MRA
500V AC minimum for 1 minute minimum for MRF & MRK
Mechanical Life: 30,000 operations minimum
Electrical Life: 10,000 operations minimum
Range of Operating Torque: 0.02 ~ 0.07Nm for MRA; 0.005 ~ 0.02Nm for MRF & MRK
Contact Timing: Nonshorting (break-before-make)
MRA – self-cleaning, sliding contact; MRF & MRK – self-cleaning, rotary contactor disk
Indexing: 30°

Materials & Finishes

Shaft: Brass with nickel plating
Stopper Plate: Steel with zinc plating for MRA & MRK; polyamide cover with stopper for MRF
Bushing/Housing: Zinc alloy with zinc plating
Movable Contacts: Copper with silver plating for MRA; phosphor bronze with gold plating for MRF & MRK
End Contacts & Terminals: Brass with silver plating for MRA; phosphor bronze with gold plating for MRF & MRK
Common Contacts & Terminals: Brass with silver plating for MRA; phosphor bronze with gold plating for MRF & MRK
Base: Diallyl phthalate for MRA; fiberglass reinforced polyamide for MRF & MRK

Environmental Data

Operating Temperature Range: –10°C through +70°C (+14°F through +158°F)
Humidity: 90 ~ 95% humidity for 96 hours @ 40°C (104°F)
Vibration: 10 ~ 55Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in 1 minute; 3 right angled directions for 2 hours
Shock: 50G (490m/s^2) acceleration (tested in 3 right angled directions, with 3 shocks in each direction)
Sealing: MRK model meets IP67 of IEC60529 standards

Installation

Mounting Torque: .686Nm (6.08 lb•in)
Cap Installation Force: 19.6 ~ 29.4N (4.41 ~ 6.61 lbf) for MRA & MRK

Processing

Soldering Time & Temperature: Wave Soldering for MRA: See Profile A in Supplement section.
Wave Soldering for MRF & MRK: See Profile B in Supplement section.
Manual Soldering for MRA: See Profile A in Supplement section.
Manual Soldering for MRF & MRK: See Profile B in Supplement section.
Cleaning: Automated cleaning recommended. Stopper plate, as well as washers for MRA & MRK, must be in place to maintain automated cleaning. See Cleaning specifications in Supplement section.

Standards & Certifications

MRA, MRF, & MRK models have not been tested for UL recognition or CSA certification.
These switches are designed for use in a low-voltage, low-current, logic-level circuit.
When used as intended in a logic-level circuit, the results do not produce hazardous energy.

Distinctive Characteristics

Low profile body of MRF model accommodates space limitations required for PCB mounting. For the MRA and MRK bushing mount models, the range of behind panel body depths is .323″ to .669″ (8.2mm to 17.0mm).

Positive detent mechanism for distinct feel and audible feedback.

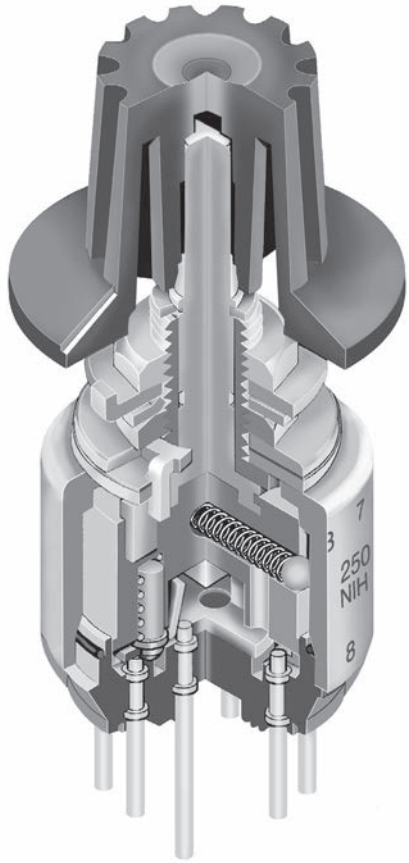
Metal bushing and housing construction increases durability.

Adjustable stopper plate allows 2–12 position settings.

High contact reliability achieved by the self-cleaning contact mechanism.

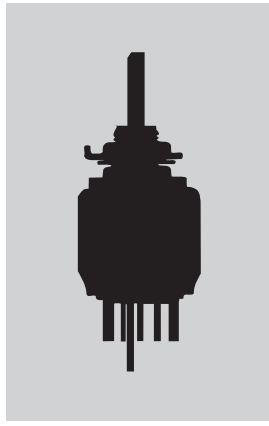
Break-before-make contact timing with sliding contacts in MRA and rotary contactor disk in MRF and MRK models.

Interior housing seal and molded-in PC terminals, plus shaft rubber o-ring on MRA and MRK and polyamide cover on MRF model, allow cleaning after automated soldering.



MRK model meets IP67 of IEC60529 specifications (similar to NEMA 4 & 13).

Actual Size



TYPICAL SWITCH ORDERING EXAMPLE

MR [A] [206] — [A] [ ]

Actuators & Terminals	
A	Shaft Actuated with PC Terminals
F	Low Profile Screwdriver Actuated with PC Terminals
K	Low Profile Shaft Actuated with PC Terminals

Poles & Circuits	
112	SP with 2-12 Positions
206	DP with 2-6 Positions
403	4P with 2-3 Positions

Knobs	
A	Plain Black
B	Small Color Tipped
C	Large Color Tipped

Colors	
For Plain Knob	
No Code	Black
For Color Tipped	
A	Black
B	White
C	Red
E	Yellow
F	Green
G	Blue
H	Gray

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

MRA206-A

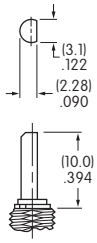
Shaft Actuated with Plain Black Knob

DP with 2-6 Adjustable Positions

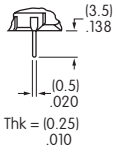
PC Terminals

ACTUATORS & TERMINALS

A Shaft Actuated with PC Terminals

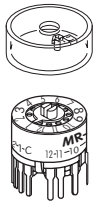


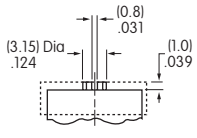
Shaft



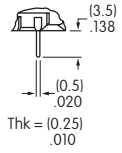
Terminal

F Low Profile Screwdriver Actuated with PC Terminals



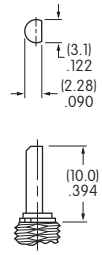


Slotted for Screwdriver

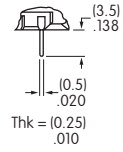


Terminal

K Low Profile Shaft Actuated with PC Terminals

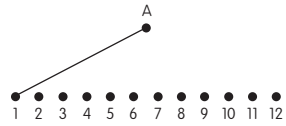
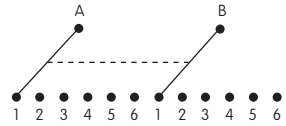
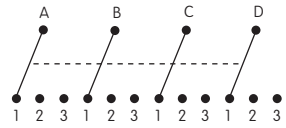


Shaft



Terminal

POLES & CIRCUITS

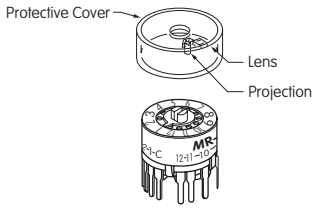
Pole	Model	Number of Positions	Stopper Settings	Number of Terminals	Schematics
SP	**MRA112**	2–12	2, 3, 4, . . . 12	1 COM, 12 LOAD	
	MRF112	2–12	2, 3, 4, . . . 12	1 COM, 12 LOAD	
	MRK112	2–12	2, 3, 4, . . . 12	1 COM, 12 LOAD	
DP	**MRA206**	2–6	2, 3, 4, 5, 6	2 COM, 12 LOAD	
	MRF206	2–6	2, 3, 4, 5, 6	2 COM, 12 LOAD	
	MRK206	2–6	2, 3, 4, 5, 6	2 COM, 12 LOAD	
4P	**MRA403**	2–3	2, 3	4 COM, 12 LOAD	
	MRF403	2–3	2, 3	4 COM, 12 LOAD	
	MRK403	2–3	2, 3	4 COM, 12 LOAD	

POSITION SETTING FOR MRA, MRF, & MRK MODELS

Each switch is supplied with the stopper set for the maximum number of positions allowed for that model. Prior to installation, the desired position setting should be made. Contact factory for continuous rotation.

MRF Models

1. Remove the protective cover from the switch body.
2. Turn the shaft counterclockwise to the extreme left by using a screwdriver.
3. Inside the cover is a magnifying lens which would be positioned over the number which is to be the maximum position used; when the cover is then snapped into the switch, the projection beside the lens fits into the correct hole for setting the stop.



MRK & MRA Models

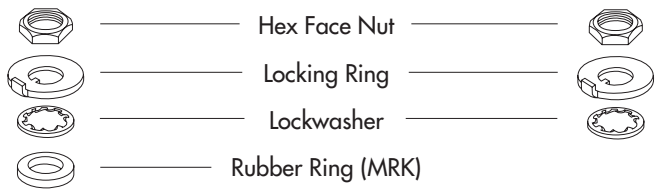
1. Using the actuator knob, turn the shaft counterclockwise to the extreme left. If the shaft is not turned counterclockwise to the extreme left, proper setting cannot be achieved. At this extreme position, the white line on the knob points to the number 1 position shown on the side of the switch.

2. Remove the knob from the shaft and loosen the nut far enough to allow raising the stopper plate, plus washer(s), for resetting to the desired position.

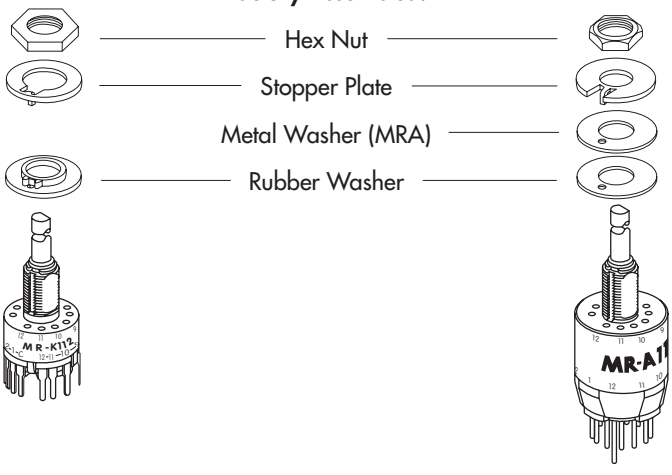
3. Note the position numbers on the side of the switch; these correspond to the terminal numbers and stopper holes. Insert the stopper in the hole numbered for the maximum desired number of stop settings. Satisfactory switch functioning cannot be assured if the stopper plate is not properly positioned.

4. Tighten the nut (beveled side up) firmly against the stopper plate.

Standard Mounting Hardware Packaged Loose with Each Switch:



Factory Assembled:

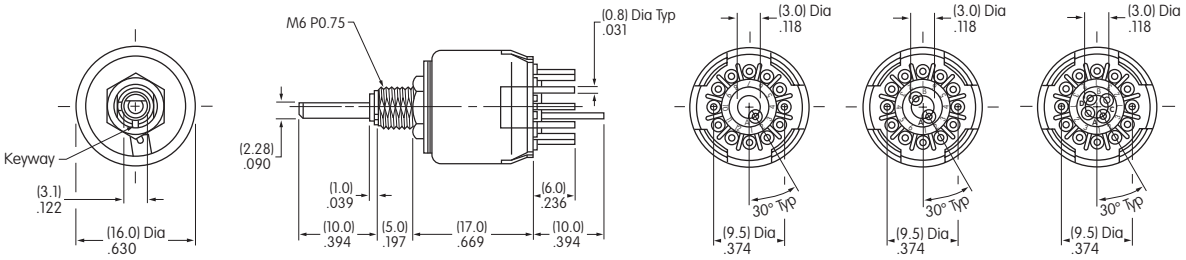


TYPICAL SWITCH DIMENSIONS

MRA • PC Terminals

1 Pole 2 Pole 4 Pole

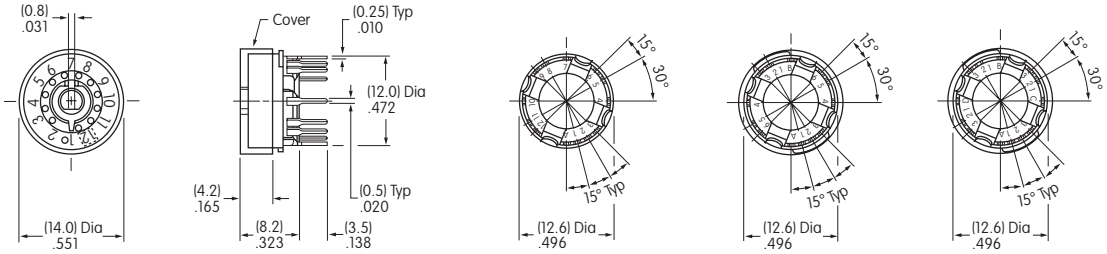
MRA112



MRF • PC Terminals

1 Pole 2 Pole 4 Pole

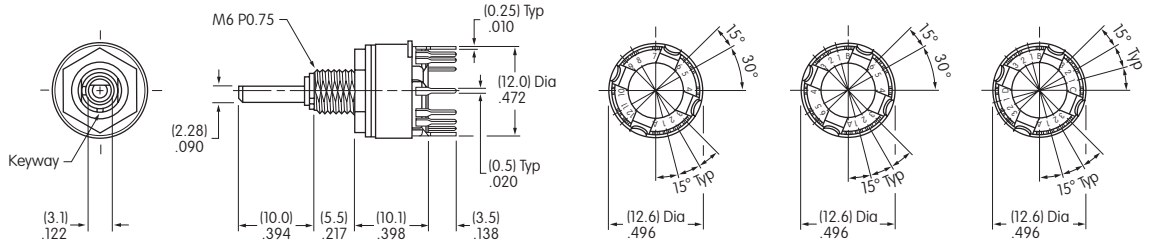
MRF403



MRK • PC Terminals

1 Pole 2 Pole 4 Pole

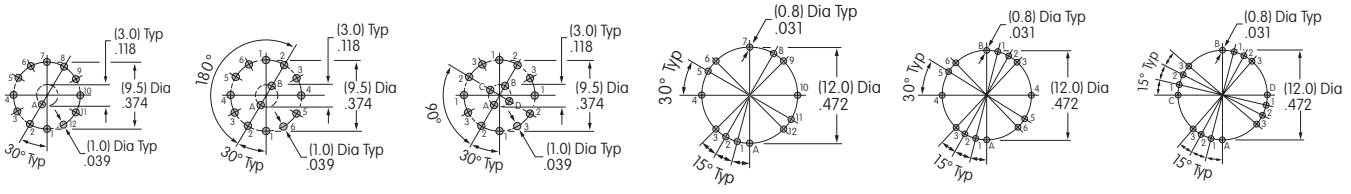
MRK112



MRK devices are designed to be panel mounted. Installation without panel mounting will affect reliability.

FOOTPRINTS

Single Pole MRA112	Double Pole MRA206	Four Pole MRA403	Single Pole MRF112 MRK112	Double Pole MRF206 MRK206	Four Pole MRF403 MRK403

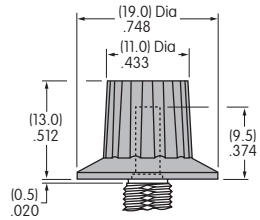


KNOBS

A AT433 Plain Black

Material:
Polyacetal

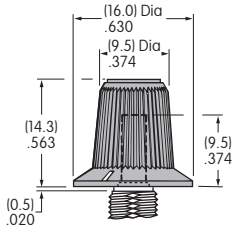
Color:
Black
only



B AT4103 Small Color Tipped

Base Material:
Polyester
Base Color:
Black

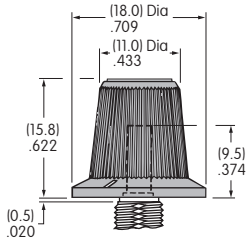
Polyamide Tip
Colors:
A, B, C, E, F, G, H



C AT4104 Large Color Tipped

Base Material:
Polyester
Base Color:
Black

Polyamide Tip
Colors:
A, B, C, E, F, G, H



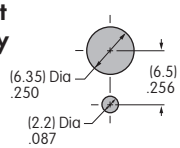
Color Codes: A Black · B White · C Red · E Yellow · F Green · G Blue · H Gray

PANEL CUTOUTS & MAXIMUM EFFECTIVE PANEL THICKNESS

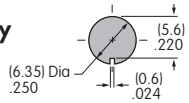
MRA & MRK

Nonsealed Panel

Without Keyway

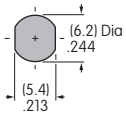


With Keyway



MRK

Sealed Panel



With Standard Hardware on Nonsealed Panel:
MRA .067" (1.7mm) MRK .087" (2.2mm)

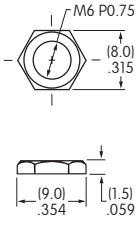
Without Locking Ring on Nonsealed Panel:
MRA .098" (2.5mm) MRK .118" (3.0mm)

With AT513M & AT535 only on Sealed Panel:
MRK .106" (2.7mm)

STANDARD MOUNTING HARDWARE

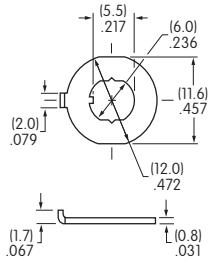
AT513M Metric Hexagon Nut

Material:
Brass, nickel plating
1 for MRA; 1 for MRK



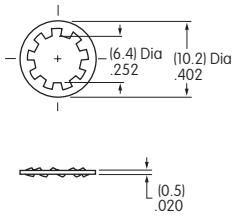
AT545 Locking Ring

Material:
Steel, chromate over zinc plating
1 for MRA; 1 for MRK



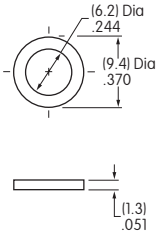
AT509 Lockwasher

Material:
Steel, chromate over zinc plating
1 for MRA; 1 for MRK



AT535 Rubber Ring

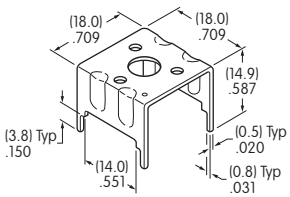
Material:
Nitrile butadiene rubber
1 for MRK

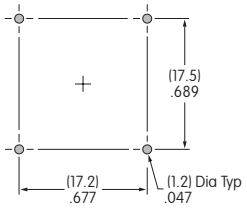


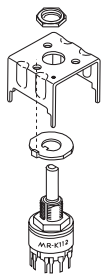
OPTIONAL SUPPORT BRACKET

AT543 Support Bracket for MRK

Material:
Steel with tin plating







A support bracket is needed when the MRK is mounted only to a PC board and does not have the bushing through a panel.

General Specifications

Electrical Capacity (Resistive Load)

For MRX: 2A @ 125V AC or 1A @ 30V DC

For MRY: For MRY106G: 0.4VA maximum @ 28V AC/DC maximum
(Applicable Range 0.1mA ~ 0.1A @ 20mV ~ 28V)
Note: See Supplement Index to find explanation of operating range.
For all other MRY models: 3A @ 125V AC or 2A @ 30V DC

For MRT: For MRT22: 10A @ 125V AC or 4A @ 30V DC
For MRT23: 5A @ 125V AC or 3A @ 30V DC

Other Ratings

Contact Resistance: 10 milliohms maximum for MRX, MRY, & MRT; 20 milliohms maximum for MRY106G

Insulation Resistance: 100 megohms minimum @ 500V DC for MRX & MRY
200 megohms minimum @ 500V DC for MRT

Dielectric Strength: 1,000V AC minimum for 1 minute minimum

Mechanical Life: 15,000 operations minimum

Electrical Life: 7,500 operations minimum

Range of Operating Torque: 0.03 ~ 0.15Nm for MRX; 0.02 ~ 0.10Nm for MRY; 0.02 ~ 0.05Nm for MRT

Contact Timing: Nonshorting (break-before-make)
MRX: Self-cleaning, sliding contact; MRY: Rotary contactor dish; MRT: Butt contacts

Indexing: 45° for MRX; 60° for MRY; 120° for MRT22; 60° for MRT23

Materials & Finishes

Shaft: Brass with nickel plating

Stopper Plate: Steel with zinc plating for MRX & MRY

Bushing/Housing: Brass with nickel plating

Movable Contacts: Silver alloy for MRX & MRT; copper with silver plating for MRY106;
copper with gold plating for MRY106G

End Contacts & Terminals: Silver alloy & copper with silver plating for MRX & MRT; silver alloy plus brass with silver plating for MRY106; silver alloy with gold plating for MRY106G

Common Contacts & Terminals: Copper with silver plating for MRX, MRY106 & MRT22; brass with gold plating for MRY106G; brass with silver plating for MRT23

Base: Phenolic resin

Environmental Data

Operating Temperature Range: –10°C through +70°C (+14°F through +158°F)

Humidity: 90 ~ 95% humidity for 96 hours @ 40°C (104°F)

Vibration: 10 ~ 55Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in 1 minute; 3 right angled directions for 2 hours

Shock: 50G (490m/s^2) acceleration (tested in 3 right angled directions, with 3 shocks in each direction)

Installation

Mounting Torque: .686Nm (6.08 lb•in)

Cap Installation Force: 19.6 ~ 29.4N (4.41 ~ 6.61 lbf)

Soldering Time & Temperature: Manual Soldering: See Profile A in Supplement section.

Standards & Certifications

UL: **File No. E44145 - Recognized only when ordered with marking on switch.**
Add "/U" or "/CUL" before dash in part number to order UL recognized switch.
MRT22 models recognized at 10A @ 125V AC; MRT23 models recognized at 5A @ 125V AC

Distinctive Characteristics

Positive detent mechanism for distinct feel and audible feedback.

Metal bushing and housing construction increases durability.

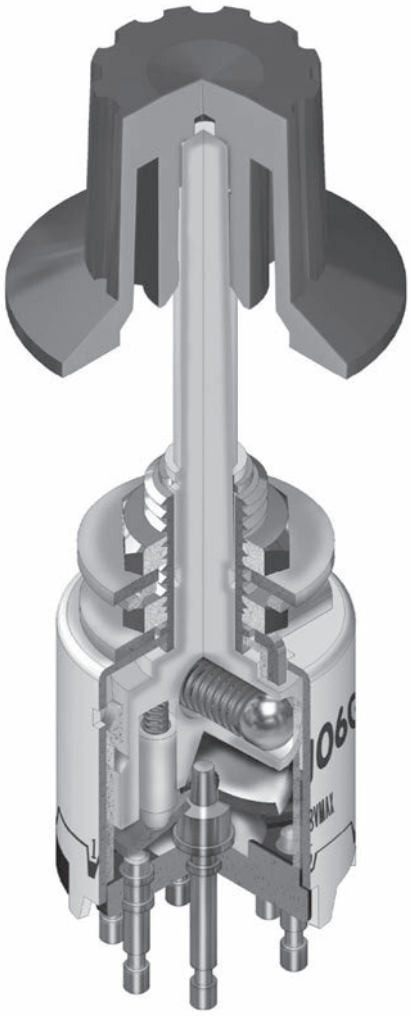
Adjustable stopper plate allows 2-8 position settings.

High contact reliability achieved by the self-cleaning contact mechanism.

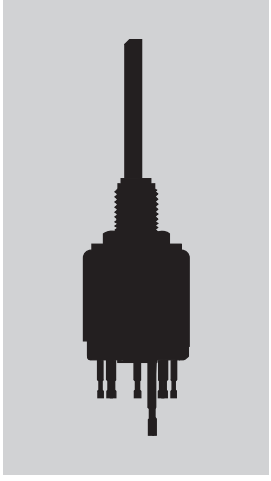
Break-before-make contact timing with various mechanism types: sliding contacts in MRX, contactor dish in MRY, and butt contacts in MRT models.

Terminal types include PC-turret for MRX, turret for MRY, and solder lug for MRT models.

Molded-in PC-turret and turret terminals prevent entry of flux and other contaminants.



Actual Size



TYPICAL SWITCH ORDERING EXAMPLE

MR [X] [108] — [A] [ ]

Actuators & Terminals

X	Shaft Actuated with PC-Turret Terminals
Y	Shaft Actuated with Turret Terminals
T	Shaft Actuated with Solder Lug Terminals

Poles & Circuits

108	SP with 2-8 Positions
204	DP with 2-4 Positions
402	4P with 2 Positions
106	SP with 2-6 Positions
106G	SP with 2-6 Positions Gold Contacts 0.4VA
22	DPDT ON-NONE-ON
23	DPDT ON-OFF-ON

Knobs

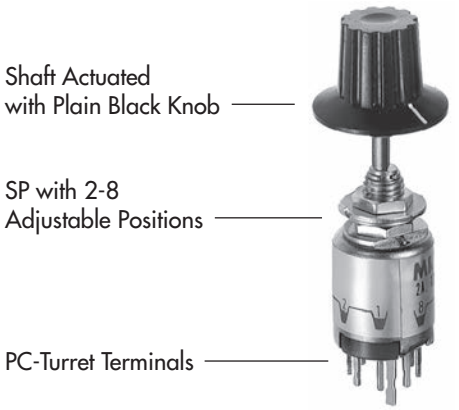
A	Plain Black
B	Small Color Tipped
C	Large Color Tipped

Colors

For Plain Knob	
No Code	Black
For Color Tipped	
A	Black
B	White
C	Red
E	Yellow
F	Green
G	Blue
H	Gray

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

MRX108-A

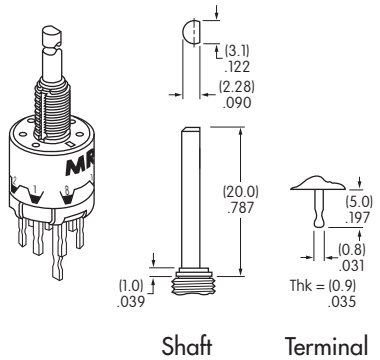


IMPORTANT:

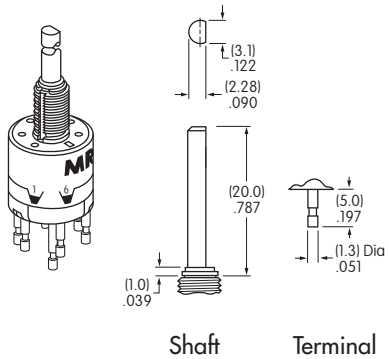
MRT Switches are supplied without UL & cULus marking unless specified.
UL & cULus recognized only when ordered with marking on the switch.
Specific models, ratings, & ordering instructions are noted on the General Specifications page.

ACTUATORS & TERMINALS

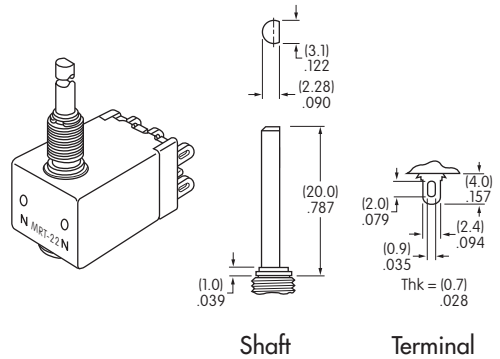
X **Shaft Actuated with PC-Turret Terminals**



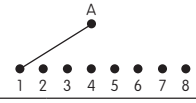
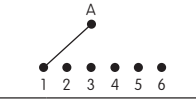
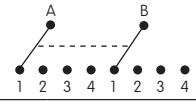
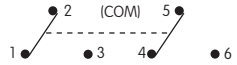
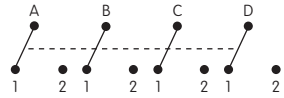
Y **Shaft Actuated with Turret Terminals**



T **Shaft Actuated with Solder Lug Terminals**



POLES & CIRCUITS

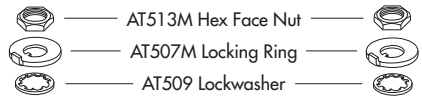
Pole	Model	Number of Positions	Stopper Settings	Number of Terminals	Schematics
SP	**MRX108**	2-8	2, 3, 4, 5, 6, 7, 8	1 COM, 8 LOAD	
	MRY106 MRY106G	2-6	2, 3, 4, 5, 6	1 COM, 6 LOAD	
DP	**MRX204**	2-4	2, 3, 4	2 COM, 8 LOAD	
DPDT	**MRT22**	2	ON-NONE-ON	2-3 2-1 5-6 5-4	
	MRT23	3	ON-OFF-ON	2-3 OPEN 2-1 5-6 OPEN 5-4	
4P	**MRX402**	2	1 & 2	4 COM, 8 LOAD	

POSITION SETTING FOR MRX & MRY MODELS

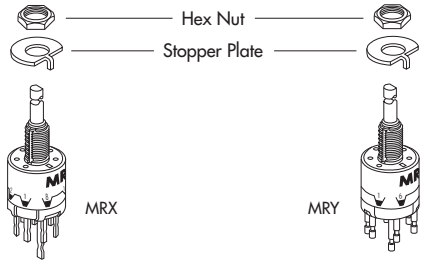
Each switch is supplied with the stopper set for the maximum number of positions allowed for that model. Prior to installation, the desired position setting should be made. Contact factory for continuous rotation.

1. Using the actuator knob, turn the shaft counterclockwise to the extreme left. If the shaft is not turned to this extreme position where the white line on the knob points to the number 1 position shown on the side of the switch, proper setting cannot be achieved.
2. Remove the knob from the shaft and loosen the nut far enough to allow raising the stopper plate for resetting to the desired position.
3. Note the position numbers on the side of the switch; these correspond to the terminal numbers and stopper holes. Insert the stopper in the hole numbered for the maximum desired number of stop settings. Satisfactory switch functioning cannot be assured if the stopper plate is not properly positioned.
4. Tighten the nub (beveled side up) firmly against the stopper plate.

Mounting Hardware Packaged Loose with Each Switch

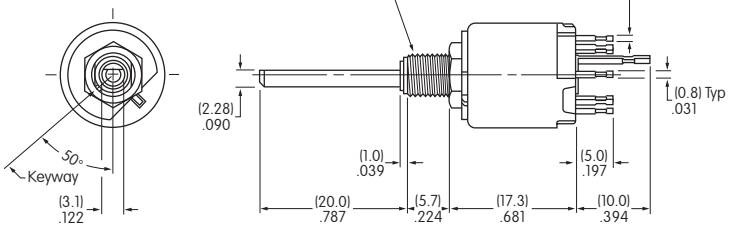


Factory Assembled:

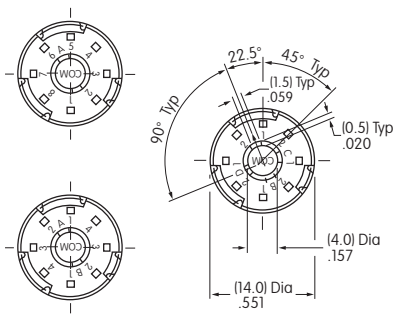


TYPICAL SWITCH DIMENSIONS

Single, Double & Four Pole



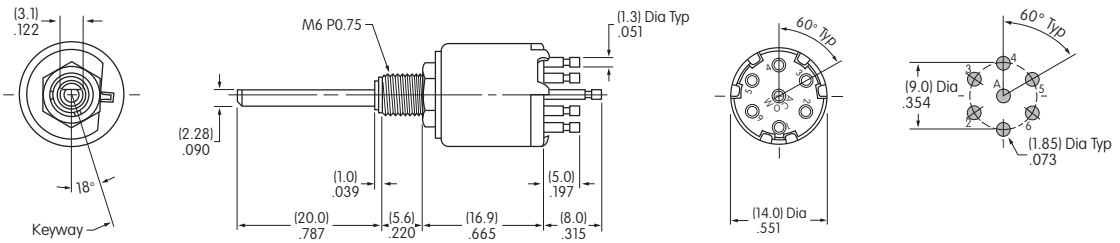
MRX • PC-Turret Terminals



MRX108

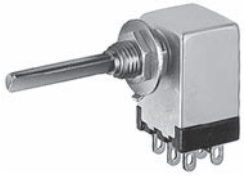
TYPICAL SWITCH DIMENSIONS

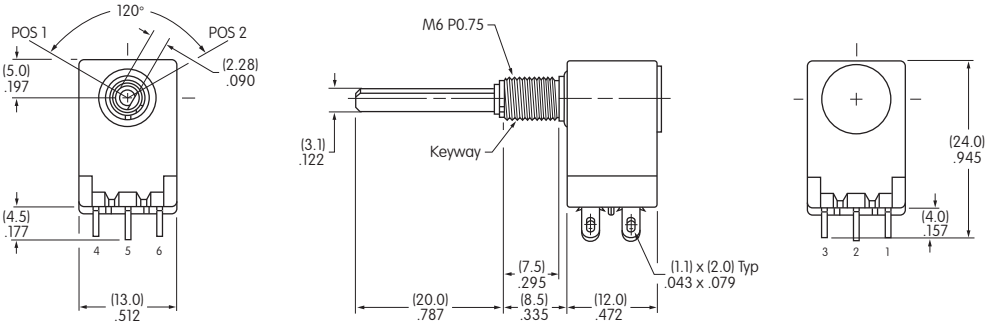
MRY • Turret Terminals — Single Pole



MRY106

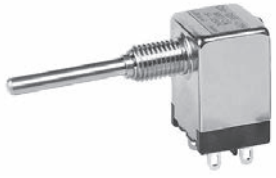
MRT • Solder Lug Terminals — Double Pole

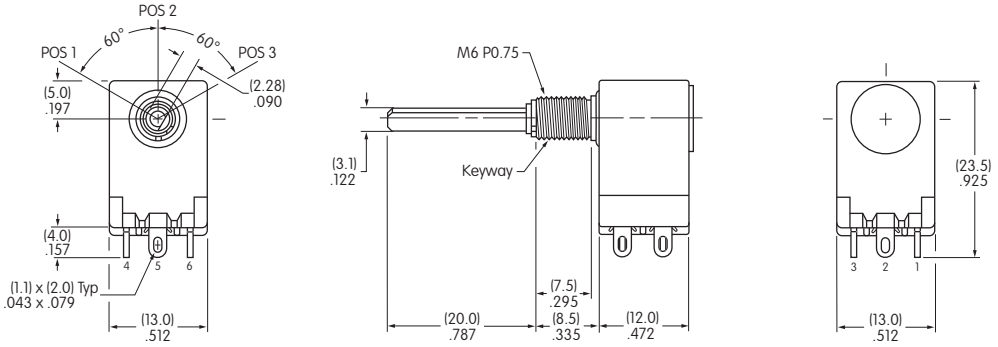




MRT22

MRT • Solder Lug Terminals — Double Pole

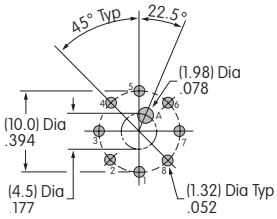




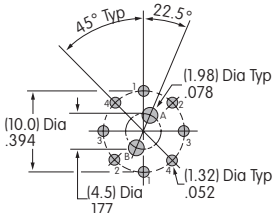
MRT23

PC FOOTPRINTS FOR MRX SINGLE, DOUBLE, & FOUR POLE

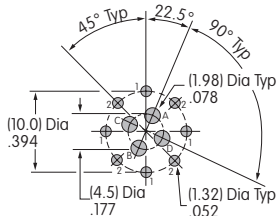
Single Pole



Double Pole

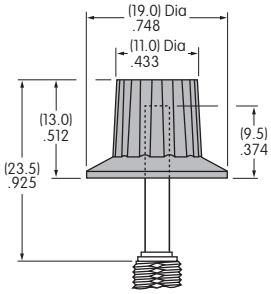


Four Pole



KNOBS

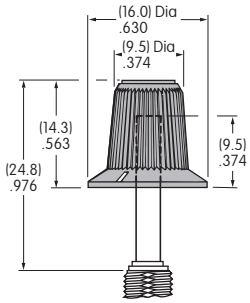
A **AT433 Plain Black**



Material: Polyacetal

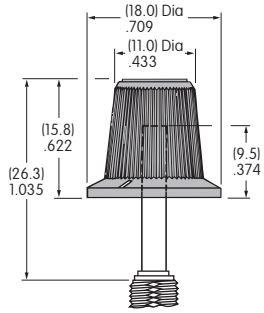
Color: Black only

B **AT4103 Small Color Tipped**



Base Material: Polyester
Base Color: Black
Polyamide Tip
Colors: A, B, C, E, F, G, H

C **AT4104 Large Color Tipped**

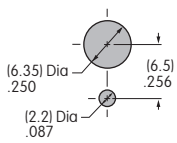


Base Material: Polyester
Base Color: Black
Polyamide Tip
Colors: A, B, C, E, F, G, H

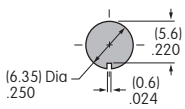
Color Codes: **A** Black **B** White **C** Red **E** Yellow **F** Green **G** Blue **H** Gray

PANEL CUTOUTS & MAXIMUM EFFECTIVE PANEL THICKNESS

Without Keyway



With Keyway



Maximum Effective Panel Thickness

With Standard Hardware: MRX & MRY .095" (2.4mm); MRT .106" (2.7mm)

Without Locking Ring: MRX & MRY .126" (3.2mm); MRT .138" (3.5mm)

General Specifications

Electrical Capacity (Resistive Load)

Logic Level: 0.4VA maximum @ 28V AC/DC maximum
(Applicable Range 0.1mA ~ 0.1A @ 20mV ~ 28V)
Note: See Supplement Index to find explanation of operating range.

Other Ratings

Contact Resistance: 80 milliohms maximum
Insulation Resistance: 100 megohms minimum @ 500V DC
Dielectric Strength: 500V AC minimum for 1 minute minimum
Mechanical Life: 30,000 operations minimum
Electrical Life: 10,000 operations minimum
Operating Torque: 0.04Nm average
Contact Timing: Nonshorting (break-before-make)
Indexing: 45° for On-On-On & 90° for On-None-On

Materials & Finishes

Shaft: Brass with nickel plating
Bushing: Zinc alloy with nickel plating
Frame/Bracket: Steel with tin plating
Movable Contacts: Beryllium copper spring with gold plating
Stationary Contacts: Copper with gold plating
Terminals: Brass with tin plating
Base: Polyamide

Environmental Data

Operating Temperature Range: –10°C through +70°C (+14°F through +158°F)
Humidity: 90 ~ 95% humidity for 96 hours @ 40°C (104°F)
Vibration: 10 ~ 55Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in 1 minute; 3 right angled directions for 2 hours
Shock: 50G (490m/s^2) acceleration (tested in 3 right angled directions, with 5 shocks in each direction)
Sealing: Use of optional o-ring AT535 with MRB meets IP67 of IEC60529 specifications

Installation

Mounting Torque: .686Nm (6.08 lb•in)
Cap Installation Force: 19.6 ~ 29.4N (4.41 ~ 6.61 lbf)

PCB Processing

Soldering: Wave Soldering Recommended: See Profile B in Supplement section
Manual Soldering: See Profile B in Supplement section
Cleaning: Automated cleaning. See Cleaning specifications in Supplement section.

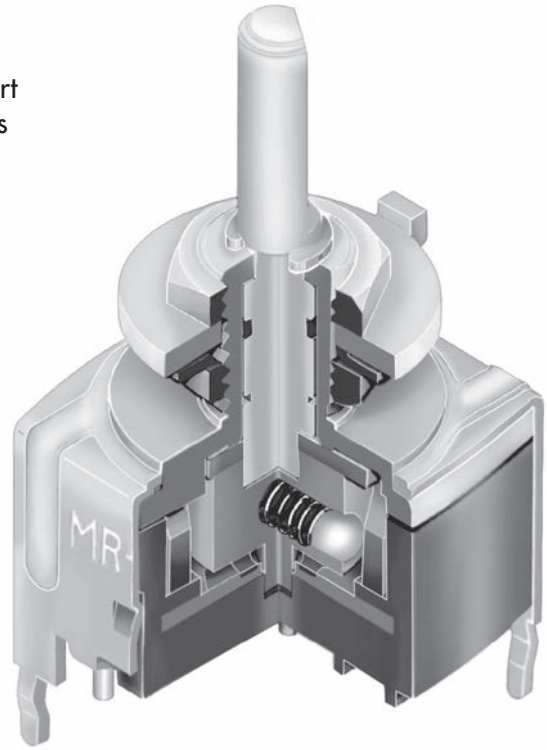
Standards & Certifications

The MRB Series rotaries have not been tested for UL recognition or CSA certification.
These switches are designed for use in a low-voltage, low-current, logic-level circuit.
When used as intended in a logic-level circuit, the results do not produce hazardous energy.

Distinctive Characteristics

Double flatted bushing prevents rotation in panel and increases stability.

Totally sealed construction, achieved with combination of an interior o-ring, a seal between the frame and base, plus insert molded terminals, prevents contact contamination and allows automated soldering and cleaning.



Positive detent mechanism for distinct feel and audible feedback.

Break-before-make contact timing with sliding contact mechanism.

Metal bushing and frame/bracket provide durability.

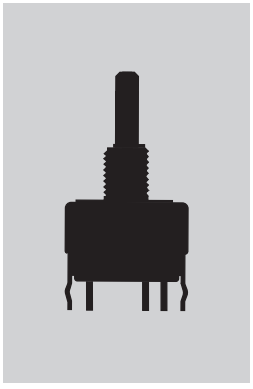
Panel seal, achieved with use of optional exterior o-ring, conforms to IP67 of IEC60529 Standards.

High contact reliability achieved by the self-cleaning contact mechanism.

.100" x .100" (2.54mm x 2.54mm) terminal spacing conforms to standard PC board grid spacing for straight and right angle mounting.

Insert molded terminals lock out flux and other contaminants.

Actual Size



TYPICAL SWITCH ORDERING EXAMPLE

MRB [1] [2] [B] — [A] [ ]

Poles

1	SPDT SP3T
2	DPDT DP3T

Terminals

B	Straight with Bracket
H	Right Angle with Bracket

Knobs

A	Plain Black
B	Small Color Tipped
C	Large Color Tipped

Colors

For Plain Knob	
No Code	Black
For Color Tipped	
A	Black
B	White
C	Red
E	Yellow
F	Green
G	Blue
H	Gray

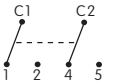
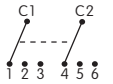
Circuits & Indexing

2	ON	NONE	ON	90°
4	ON	ON	ON	45°

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

MRB12B-A

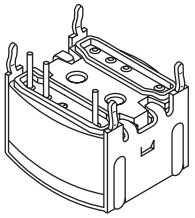
POLES & CIRCUITS

Pole	Model	Actuator Positions			Connected Terminals			Throw & Schematics
		Position 1	Position 2	Position 3	Position 1	Position 2	Position 3	Note: Terminal numbers are not actually on switch
SP	**MRB12**	ON	NONE	ON	C1-1	OPEN	C1-2	SPDT
	MRB14	ON	ON	ON	C1-1	C1-2	C1-3	SP3T
DP	**MRB22**	ON	NONE	ON	C1-1 C2-4	OPEN	C1-2 C2-5	DPDT 
	MRB24	ON	ON	ON	C1-1 C2-4	C1-2 C2-5	C1-3 C2-6	DP3T 

TERMINALS

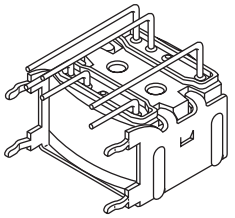
B **Straight PC Terminals with Bracket**

SPDT



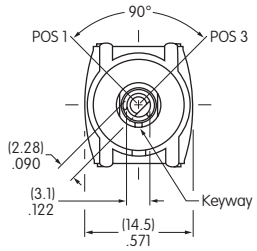
H **Right Angle PC Terminals with Bracket**

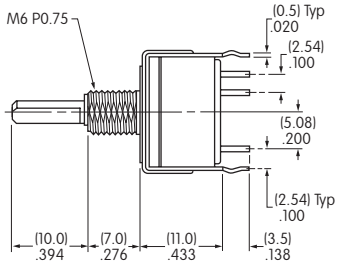
DPDT

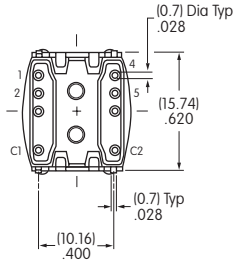


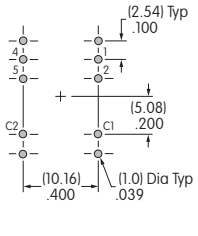
TYPICAL SWITCH DIMENSIONS

90° Indexing • SPDT & DPDT • Straight PC







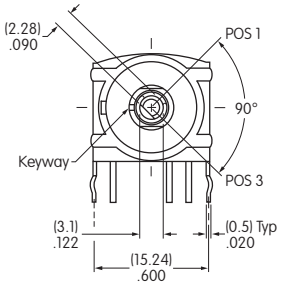


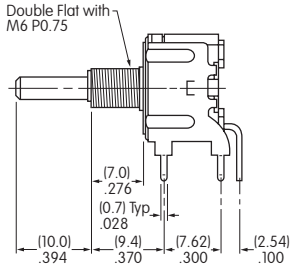
Actuator shown in Position 1

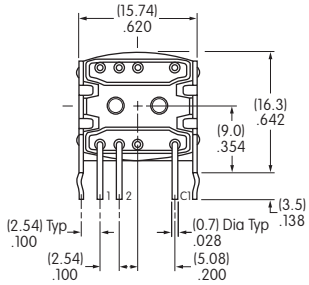
Single pole model does not have terminals 4, 5 & C2

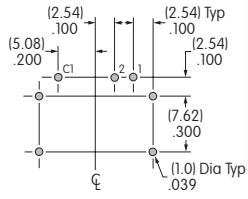
MRB12B

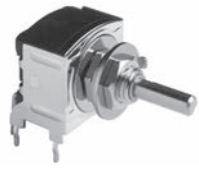
90° Indexing • SPDT • Right Angle PC







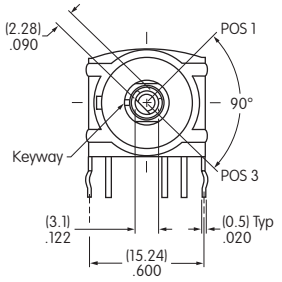


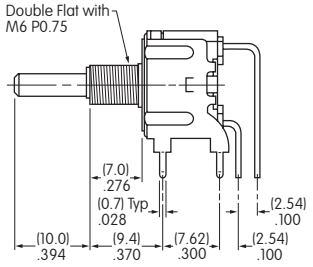


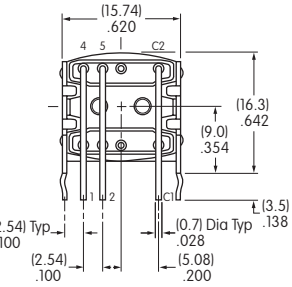
Actuator shown in Position 1

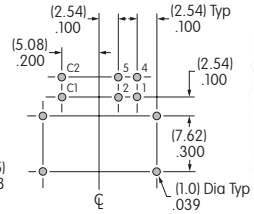
MRB12H

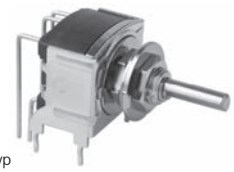
90° Indexing • DPDT • Right Angle PC







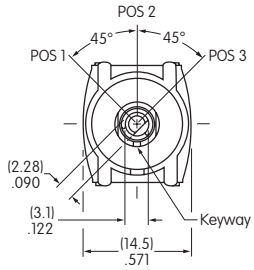


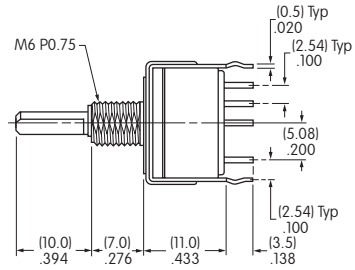


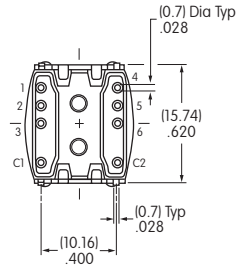
Actuator shown in Position 1

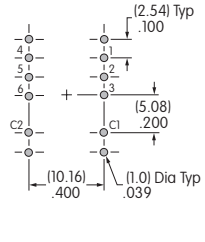
MRB22H

45° Indexing • SP3T & DP3T • Straight PC









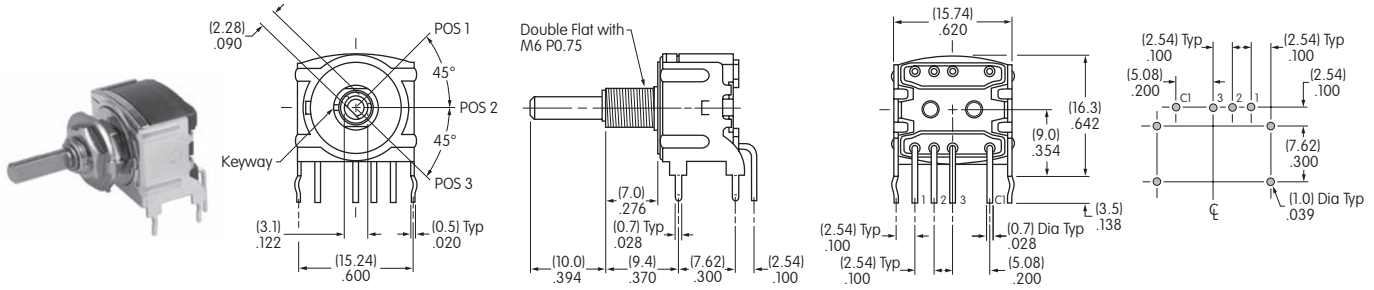
Actuator shown in Position 1

Single pole model does not have terminals 4, 5, 6 & C2

MRB14B

TYPICAL SWITCH DIMENSIONS

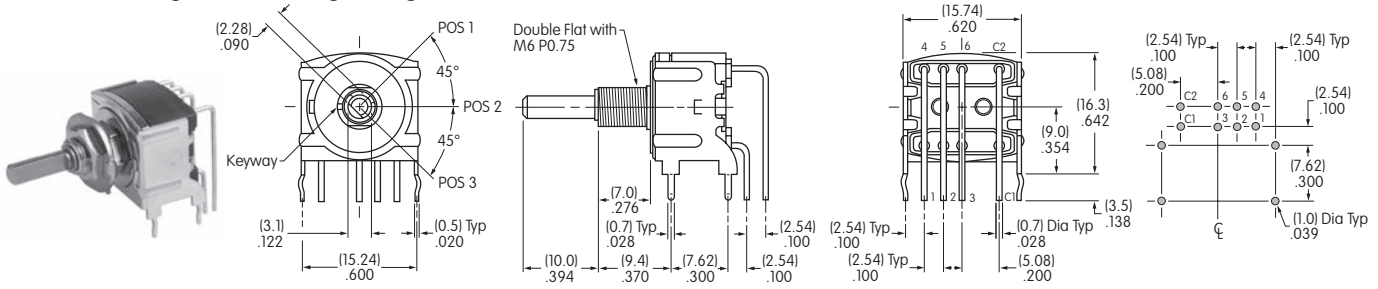
45° Indexing • SP3T • Right Angle PC



MRB14H

Actuator shown in Position 1

45° Indexing • DP3T • Right Angle PC



MRB24H

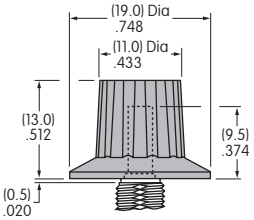
Actuator shown in Position 1

KNOBS

A **AT433 Plain Black**

Material: Polyacetal

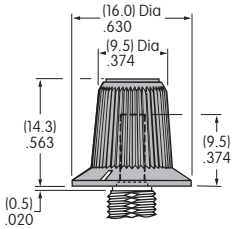
Color: Black



B **AT4103 Small Color Tipped**

Polyester Base: Black

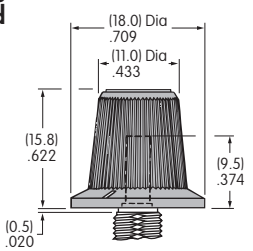
Polyamide Tip Colors: A, B, C, E, F, G, H



C **AT4104 Large Color Tipped**

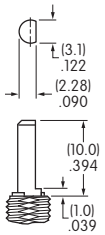
Polyester Base: Black

Polyamide Tip Colors: A, B, C, E, F, G, H



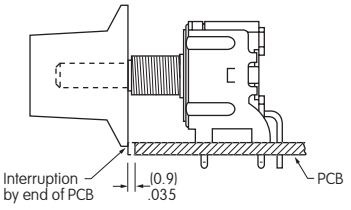
Color Codes: **A** Black **B** White **C** Red **E** Yellow **F** Green **G** Blue **H** Gray

Shaft Detail



Mounting Precaution for Cap Clearance on Right Angle Models

When mounting a right angle switch, a cap clearance of .035" (0.9mm) is recommended.

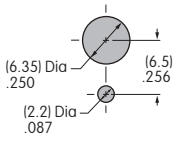


Standard Hardware Supplied
AT513M Hex Nut
AT545 Locking Ring
AT509 Lockwasher
Optional Hardware
AT535 O-ring for Panel Seal

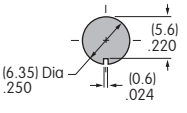
See Supplement for details

PANEL CUTOUTS & MAXIMUM EFFECTIVE PANEL THICKNESS

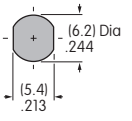
With Standard Hardware
.087" (2.2mm)



Without Locking Ring
.118" (3.0mm)



Sealed Panel
with 1 Hex Nut & 1 Rubber O-ring
.165" (4.2mm)



General Specifications

Electrical Capacity (Resistive Load)

Switching Rating: 100mA @ 5V DC
Nonswitching Rating: 100mA @ 50V DC

Other Ratings

Contact Resistance: 80 milliohms maximum for circuit; 30 milliohms maximum for contact point
Insulation Resistance: 1,000 megohms minimum @ 250V DC
Dielectric Strength: 250V AC minimum for 1 minute minimum
Mechanical Life: 20,000 detent operations minimum
Electrical Life: 20,000 detent operations minimum
Notes: A detent operation is one actuator position operation or stepping.
20,000 detent operations = 1,250 cycles for hexadecimal devices or 2,000 cycles for decimal devices. A cycle is one 360° rotation.
Nominal Operating Torque: 0.006Nm
Contact Timing: Nonshorting (break-before-make)

Materials & Finishes

Actuator: Glass fiber reinforced polyamide
Housing: Glass fiber reinforced polyamide (UL94V-0)
O-ring: Nitrile butadiene rubber
Base: Glass fiber reinforced polyamide (UL94V-0)
Movable Contact: Beryllium copper with gold plating
Stationary Contacts: Brass with gold plating
Terminals: Brass with gold plating

Environmental Data

Operating Temperature Range: –25°C through +75°C (–13°F through +167°F)
Humidity: 90 ~ 95% humidity for 96 hours @ 40°C (104°F)
Vibration: 10 ~ 55Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in 1 minute; 3 right angled directions for 2 hours
Shock: 50G (490m/s^2) acceleration (tested in 6 right angled directions, with 5 shocks in each direction)

Processing

Soldering: Wave Soldering Recommended: See Profile B in Supplement section.
Note: During Wave Soldering process, set the switch to the following position:
NDFR10, NDFR16, NDKR10, NDKR16: 0 position;
NDFC10, NDKC10: 7 position; NDFC16, NDKC16: F position.
Manual Soldering: See Profile B in Supplement section.
Cleaning: Automated Cleaning. See Cleaning Specifications in Supplement section.

Standards & Certifications

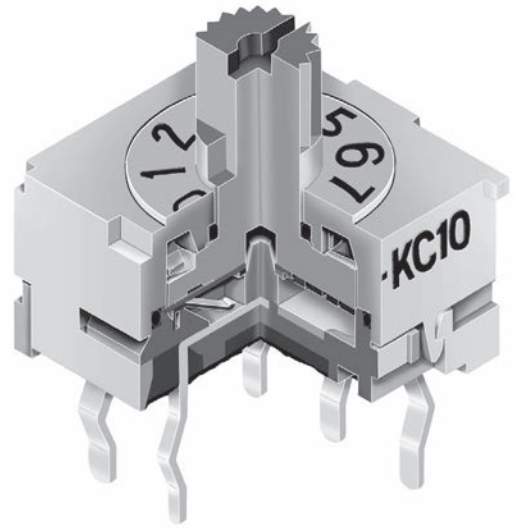
Flammability Standards: UL94V-0 rated housing & base
The ND Series rotaries have not been tested for UL recognition or CSA certification.
These switches are designed for use in a low-voltage, low-current, logic-level circuit.
When used as intended in a logic-level circuit, the results do not produce hazardous energy.

Distinctive Characteristics

Sealed construction prevents contact contamination and allows automated soldering and cleaning. Sealed design accomplished with seals between the actuator and housing and between housing and base.

Highly visible legends and choice of screwdriver or shaft actuation to provide trouble-free code setting.

Detent mechanism designed for crisp, positive action for accurate switch setting.



Bifurcated, spring loaded contacts give unmatched logic-level reliability.

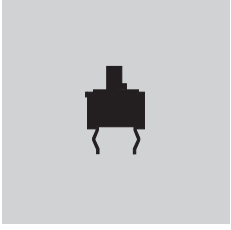
Heat tolerant resin used for body meets UL flammability rating of 94V-0 and maintains switch reliability through automated soldering process.

Crimped terminals ensure secure PC mounting and prevent dislodging during soldering.

.100″ (2.54mm) terminal grid spacing between pin centers, plus 3-by-3 terminal arrangement for footprint pattern equivalent to industry standard.

Epoxy sealed terminals lock out flux, solvents, and other contaminants.

Actual Size



TYPICAL SWITCH ORDERING EXAMPLE

ND **K** **C** **10** **P**

Actuators	
F	Screwdriver Actuated
K	Shaft Actuated

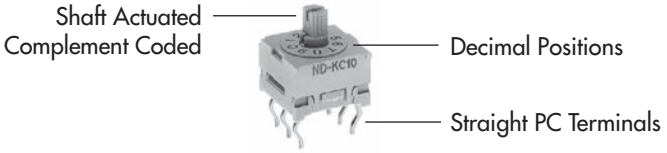
Circuits	
R	Real Coded (White Actuator)
C	Complement Coded (Red Actuator)

Positions	
10	Decimal
16	Hexadecimal

Terminals	
P	Straight
H	Right Angle

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

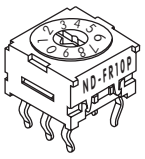
NDKC10P



ACTUATORS

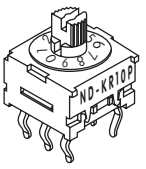
F **Screwdriver Actuated**

Actuator colors:
White for real coded
Red for complement coded



K **Shaft Actuated**

Actuator colors:
White for real coded
Red for complement coded



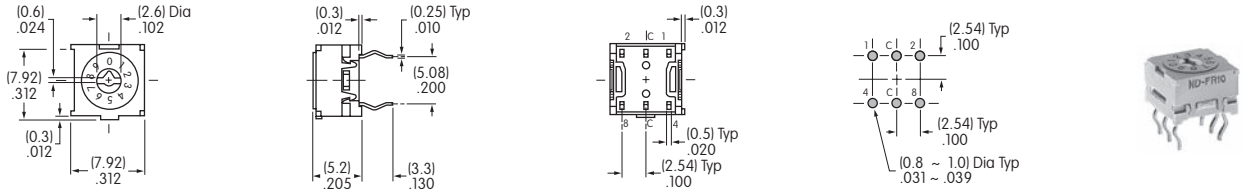
Actuators are fully rotational in either direction.

TRUTH TABLES (CIRCUITS & POSITIONS)

Terminal No. (Output) / Actuator Position ● = ON		10 Decimal										16 Hexadecimal															
		0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
R Real Coded Model Numbers: NDFR, NDKR	1		●		●		●		●		●		●		●		●		●		●		●		●		●
	2			●	●			●	●					●	●			●	●			●	●			●	●
	4					●	●	●	●							●	●	●	●					●	●	●	●
	8									●	●									●	●	●	●	●	●	●	●
C Complement Coded Model Numbers: NDFC, NDKC	1	●		●		●		●		●		●		●		●		●		●		●		●		●	
	2	●	●			●	●			●	●	●	●			●	●			●	●			●	●		
	4	●	●	●	●					●	●	●	●	●	●					●	●	●	●				
	8	●	●	●	●	●	●	●	●			●	●	●	●	●	●	●	●								

TYPICAL SWITCH DIMENSIONS

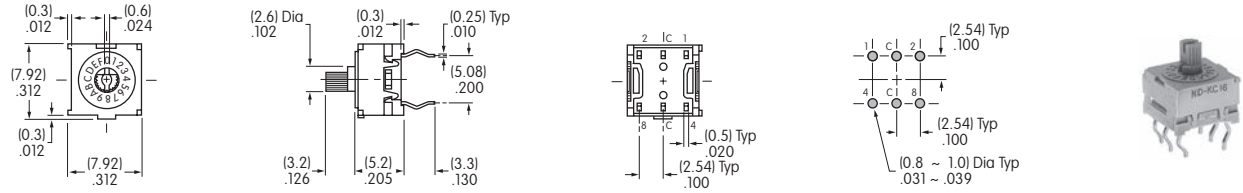
Screwdriver Actuated • Straight PC



Terminal numbers are not on switch

NDFR10P

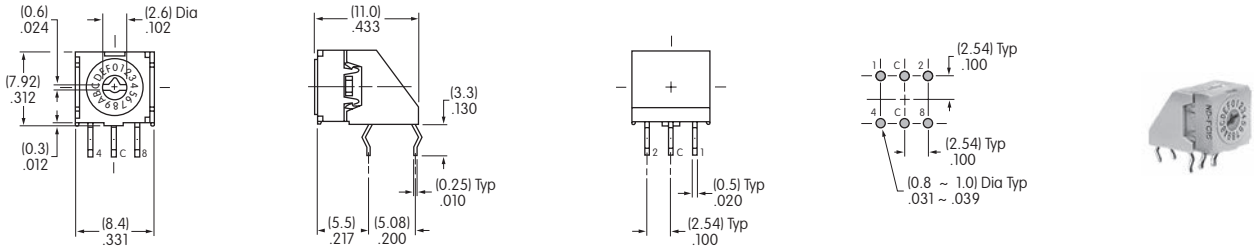
Shaft Actuated • Straight PC



Terminal numbers are not on switch

NDKC16P

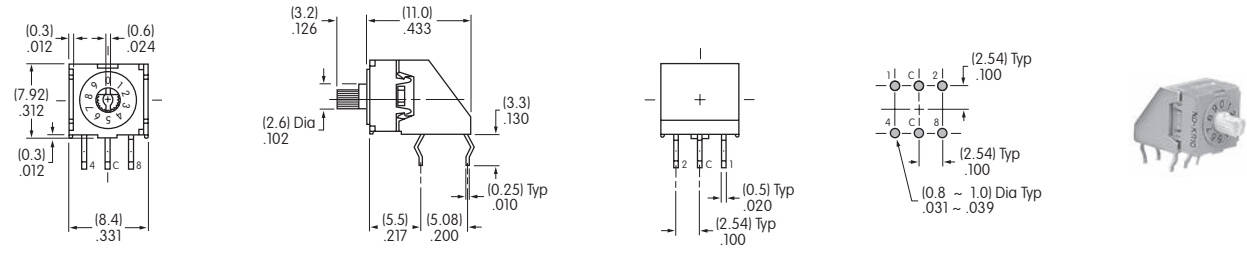
Screwdriver Actuated • Right Angle PC



Terminal numbers are on terminal cover

NDFC16H

Shaft Actuated • Right Angle PC



Terminal numbers are on terminal cover

NDKR10H

General Specifications

Electrical Capacity (Resistive Load)

Switching Rating: 100mA @ 5V DC
Nonswitching Rating: 100mA @ 50V DC

Other Ratings

Contact Resistance: 80 milliohms maximum for circuit; 30 milliohms maximum for contact point
Insulation Resistance: 1,000 megohms minimum @ 250V DC
Dielectric Strength: 250V AC minimum for 1 minute minimum
Mechanical Life: 20,000 detent operations minimum
Electrical Life: 20,000 detent operations minimum
Note: A detent operation is one actuator position operation or stepping.
20,000 detent operations = 1,250 cycles for hexadecimal devices or 2,000 cycles for decimal devices. A cycle is one 360° rotation.
Nominal Operating Torque: .061 kgf/cm (.846 oz/in)
Contact Timing: Nonshorting (break-before-make)

Materials & Finishes

Actuator: Glass fiber reinforced polyamide
Housing: Glass fiber reinforced polyamide (UL94V-0)
O-ring: Nitrile butadiene rubber
Base: Glass fiber reinforced polyamide (UL94V-0)
Movable Contact: Beryllium copper with gold plating
Stationary Contacts: Brass with gold plating
Terminals: Brass with gold plating

Environmental Data

Operating Temperature Range: –25°C through +85°C (–13°F through +185°F)
Humidity: 90 ~ 95% humidity for 100 hours @ 40°C (104°F)
Vibration: 10 ~ 55Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in 1 minute; 3 right angled directions for 2 hours
Shock: 50G (490m/s^2) acceleration (tested in 6 right angled directions, with 5 shocks in each direction)

Processing

Soldering: Reflow Soldering: See Profile B in Supplement section.
Note: During Reflow Soldering process, set the switch to the following position:
ND3FR10, ND3FR16, ND3KR10, ND3KR16: 0 position;
ND3FC10, ND3KC10: 7 position; ND3FC16, ND3KC16: F position.
Manual Soldering: See Profile B in Supplement section.
Cleaning: Automated cleaning. See Cleaning Specifications in Supplement section.

Standards & Certifications

Flammability Standards: UL94V-0 rated housing & base
The ND3 Series rotaries have not been tested for UL recognition or CSA certification.
These switches are designed for use in a low-voltage, low-current, logic-level circuit.
When used as intended in a logic-level circuit, the results do not produce hazardous energy.

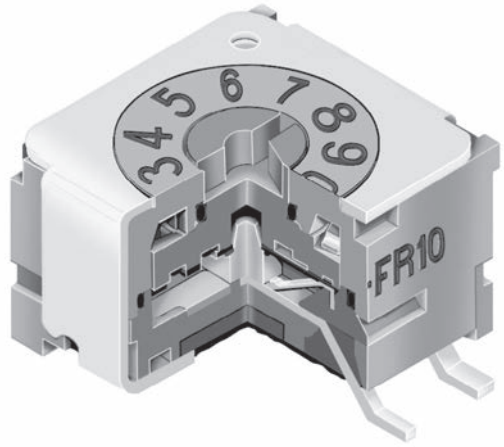
Distinctive Characteristics

Sealed construction prevents contact contamination and allows vapor phase and IR reflow soldering. Sealed design accomplished with seals between the actuator and housing and between housing and base.

Highly visible legends and choice of screwdriver or shaft actuation to provide trouble-free code setting.

Detent mechanism designed for crisp, positive action for accurate switch setting.

Bifurcated, spring loaded contacts give unmatched logic-level reliability.



Heat tolerant resin used for body meets UL flammability rating of 94V-0 and maintains switch reliability through vapor phase and infrared convection reflow soldering.

Gull-winged terminals ensure mechanical stability during soldering and simplified solder joint inspection.

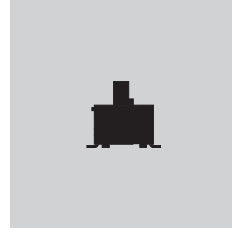
.100" (2.54mm) terminal grid spacing between pin centers, plus 3-by-3 terminal arrangement for pad layout pattern equivalent to industry standard.

Epoxy sealed terminals lock out flux, solvents, and other contaminants.

Packaging in tape-reel or partitioned tray. Tape-reel packaging meets EIA-481-D Standard.

Coplanarity: all considered surfaces must lie between two parallel planes that are a maximum distance apart of .0059" (0.15mm). (Additional coplanarity details in Terms and Acronyms in the Supplement section.)

Actual Size



TYPICAL SWITCH ORDERING EXAMPLE

ND3 [K] [C] [16] [B] — [ ]

Actuators	
F	Screwdriver Actuated
K	Shaft Actuated

Positions	
10	Decimal
16	Hexadecimal

Packaging	
R	Tape-Reel 500 Pieces/Reel
No Code	Partitioned Tray

Circuits	
R	Real Coded (White Actuator)
C	Complement Coded (Red Actuator)

Terminals	
P	Gull Wing for Upright Mount
B	Gull Wing for Upright with Bracket Mount
H	Gull Wing for Right Angle Mount

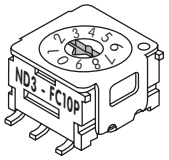
DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

ND3KC16B

ACTUATION

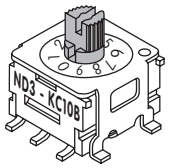
F **Screwdriver Actuated**

Actuator colors:
White for real coded
Red for complement coded



K **Shaft Actuated**

Actuator colors:
White for real coded
Red for complement coded



Actuators are fully rotational in either direction.

TRUTH TABLES (CIRCUITS & POSITIONS)

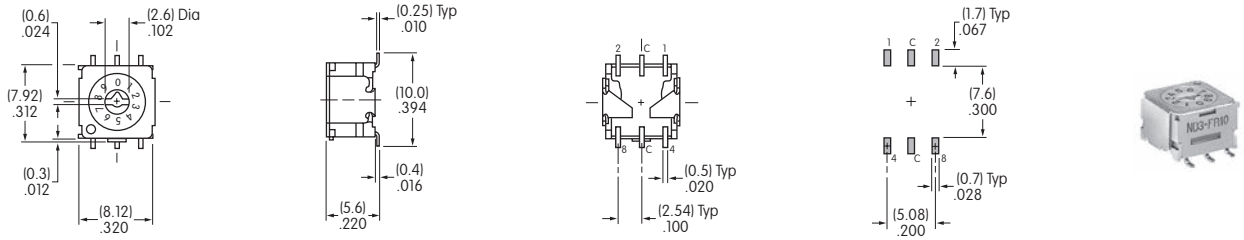
Actuator Position ● = ON

Terminal No. (Output)

		10 Decimal										16 Hexadecimal															
		0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
R Real Coded Model Numbers: ND3FR, ND3KR	1		●		●		●		●		●		●		●		●		●		●		●		●		●
	2			●	●			●	●					●	●			●	●			●	●			●	●
	4					●	●	●	●							●	●	●	●					●	●	●	●
	8									●	●									●	●	●	●	●	●	●	●
C Complement Coded Model Numbers: ND3FC, ND3KC	1	●		●		●		●		●		●		●		●		●		●		●		●		●	
	2	●	●			●	●			●	●	●	●			●	●			●	●			●	●		
	4	●	●	●	●					●	●	●	●	●	●					●	●	●	●				
	8	●	●	●	●	●	●	●	●			●	●	●	●	●	●	●	●								

TYPICAL SWITCH DIMENSIONS

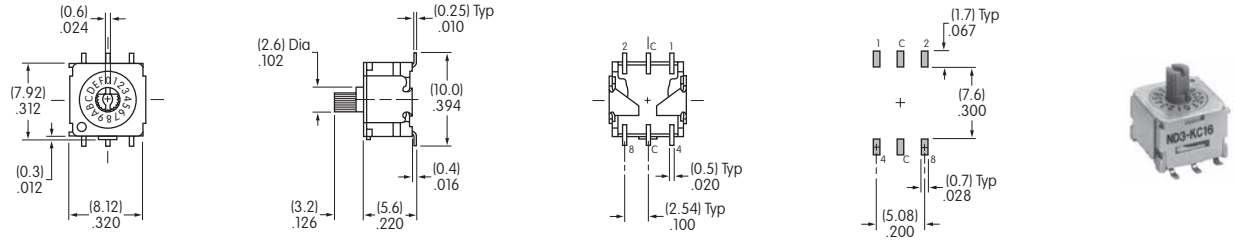
Screwdriver Actuated • Upright



Terminal numbers are not on switch.

ND3FR10P

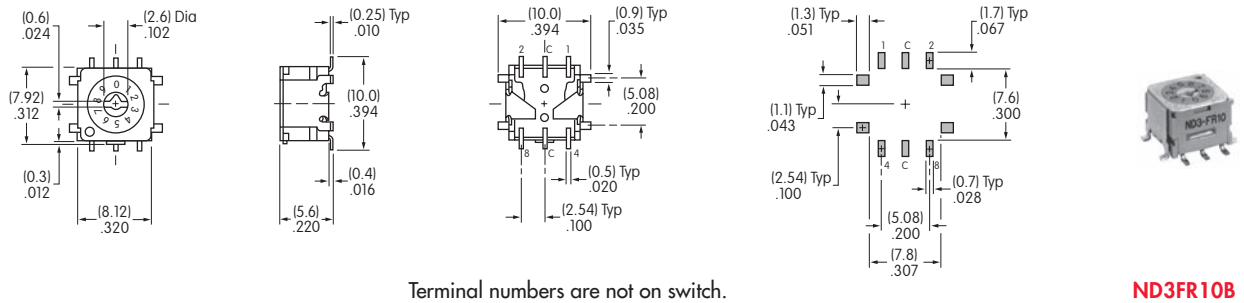
Shaft Actuated • Upright



Terminal numbers are not on switch.

ND3KC16P

Screwdriver Actuated • Upright with Bracket

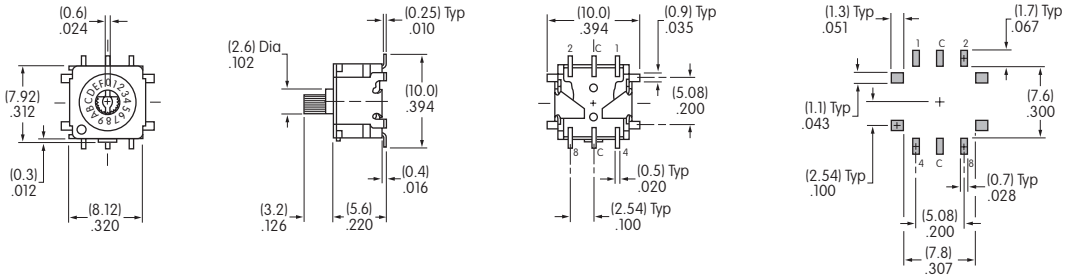


Terminal numbers are not on switch.

ND3FR10B

TYPICAL SWITCH DIMENSIONS

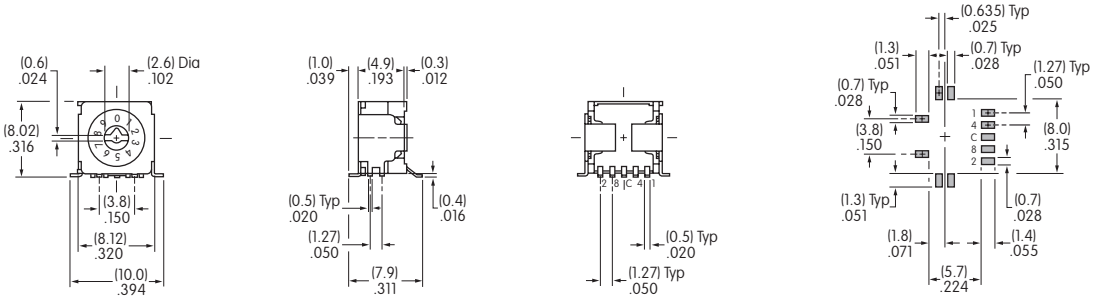
Shaft Actuated • Upright with Bracket



ND3KC16B

Terminal numbers are not on switch.

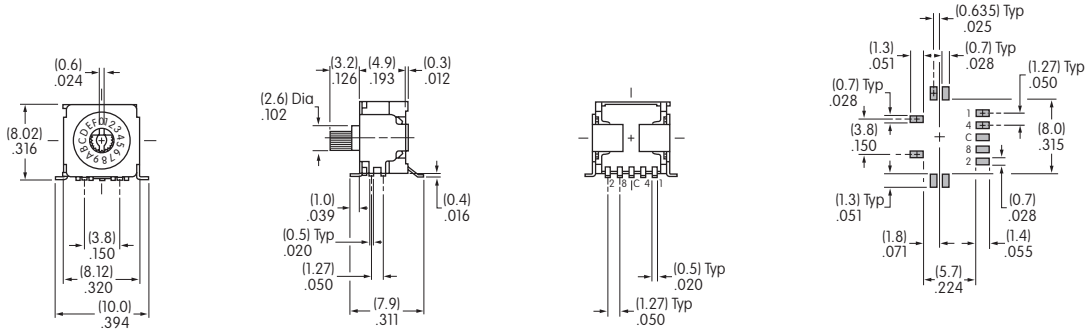
Screwdriver Actuated • Right Angle



ND3FC10H

Terminal numbers are not on switch.

Shaft Actuated • Right Angle



ND3KR16H

Terminal numbers are not on switch.

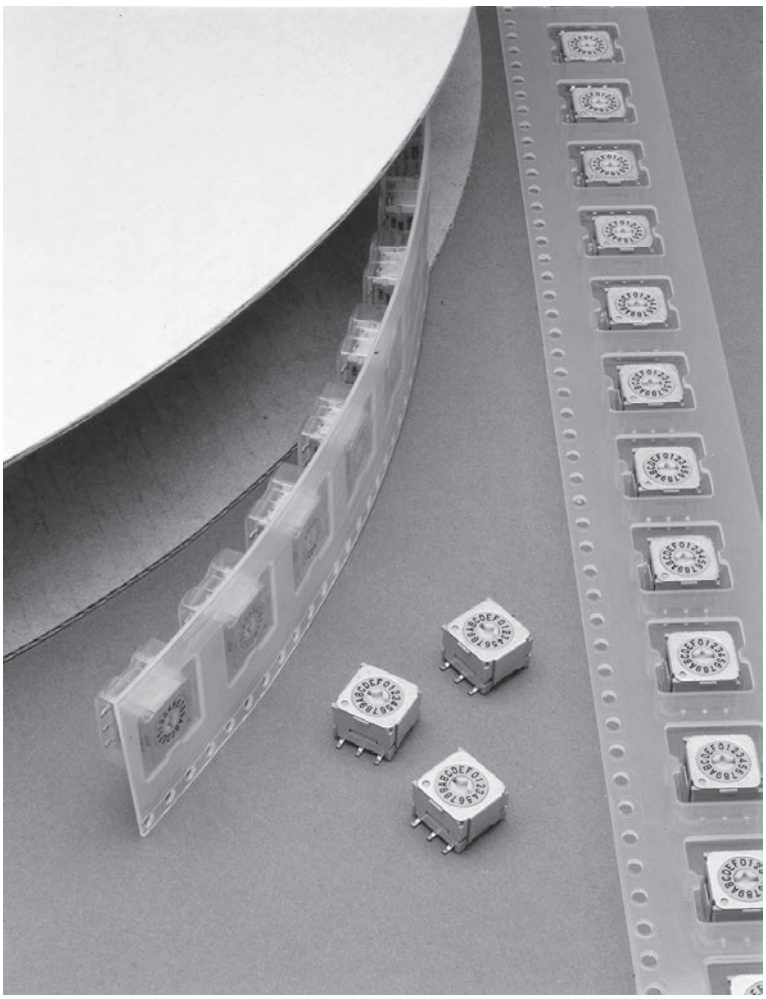
PACKAGING

R

Tape-Reel Packaging for Upright & Right Angle

Switches must be ordered in 500-piece increments when tape-reel packaging is selected.

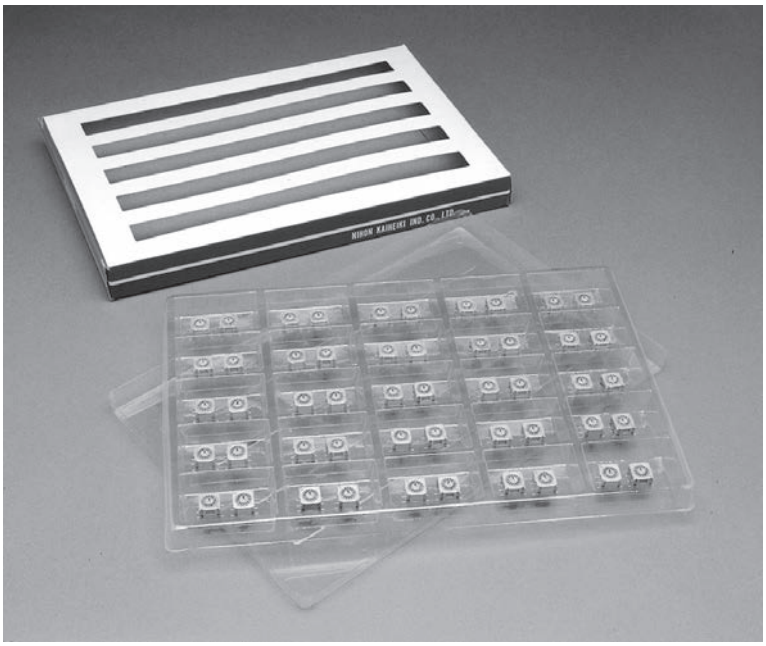
This packaging meets EIA-481-D Standard for "16mm and 24mm Embossed Carrier Taping of Surface Mount Components for Automatic Handling."



No Code

Partitioned Tray for Upright & Right Angle Any Quantity

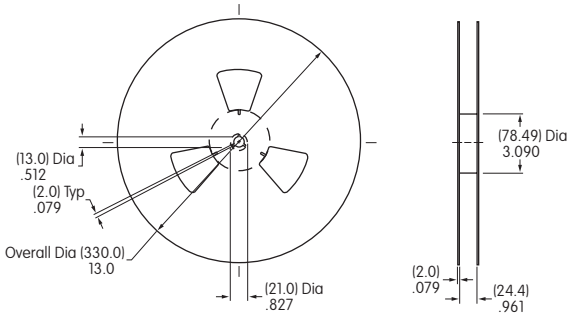
If the ND3 is ordered in less than 500-piece increments, the switches are packaged in a partitioned tray. No code is required.



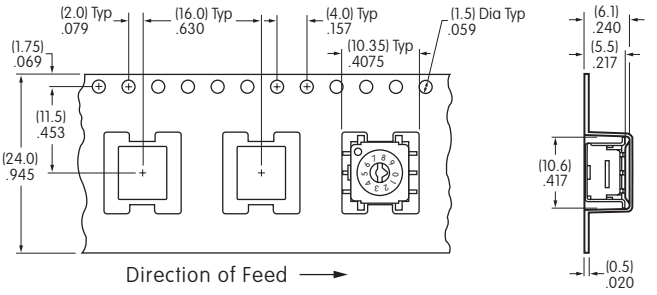
PACKAGING (CONTINUED)

For Upright & Upright with Bracket (Codes P & B with F Actuator)

Each tape-reel of 550 pockets contains 500 switches
Minimum Leader Length: 9.05″ (230mm) Minimum Trailer Length: 6.30″ (160mm)



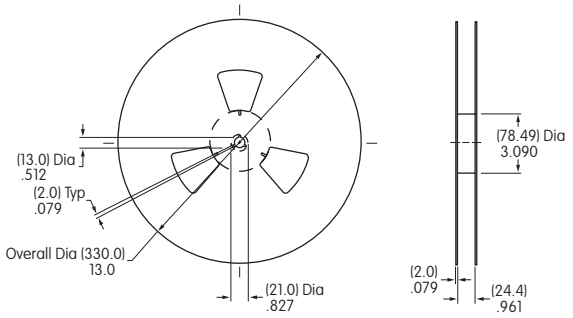
Reel Dimensions



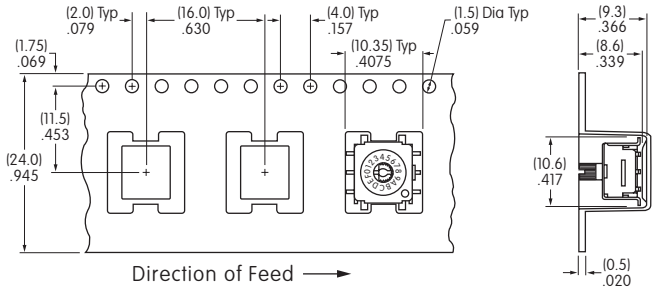
Tape Dimensions

For Upright & Upright with Bracket (Codes P & B with K Actuator)

Each tape-reel of 530 pockets contains 500 switches
Minimum Leader Length: 9.05″ (230mm) Minimum Trailer Length: 6.30″ (160mm)



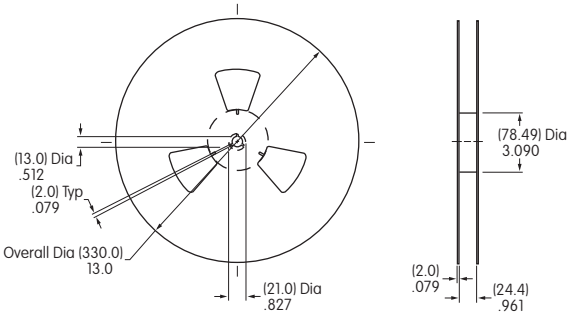
Reel Dimensions



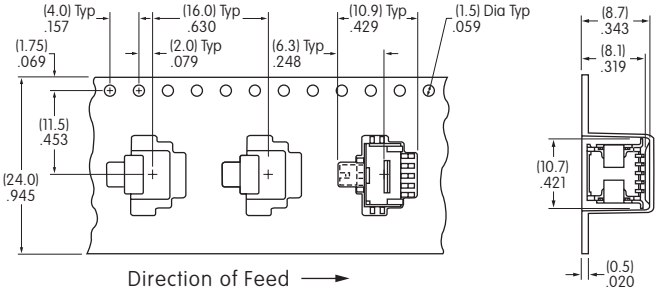
Tape Dimensions

For Right Angle (Code H with F or K Actuator)

Each tape-reel of 550 pockets contains 500 switches
Minimum Leader Length: 9.05″ (230mm) Minimum Trailer Length: 6.30″ (160mm)



Reel Dimensions



Tape Dimensions

GENERAL SPECIFICATIONS

Electrical Capacity

Resistive Load: HS13: 6A @ 125V AC, 3A @ 250V AC, or 5A @ 30V DC
HS16: 12A @ 125V AC or 6A @ 250V AC
TS: 6A @ 125/250V AC
PS: 30A @ 125/250V AC

Other Ratings

Contact Resistance: 10 milliohms maximum
Insulation Resistance: 200 megohms minimum @ 500V DC
Dielectric Strength: 1,500V AC minimum for 1 minute minimum
Mechanical Life: HS: 15,000 operations minimum
TS: 30,000 operations minimum
PS: 10,000 operations minimum
Electrical Life: HS: 7,500 operations minimum
TS: 10,000 operations minimum
PS: 5,000 operations minimum
Indexing: 30° for HS16, TS & PS; 45° for HS13
Contact Timing: Nonshorting HS13; Shorting & Nonshorting HS16; Nonshorting TS; Nonshorting PS
Range of Operating Torque: HS16: 0.54 ~ 0.64Nm for first pole & 0.05Nm for each additional pole
HS13: 0.15 ~ 0.24Nm
TS: 0.09Nm for first pole & (0.07Nm x total number of poles) + 0.13Nm for additional poles
PS: 0.14Nm for each pole

Materials & Finishes

Knob: Phenolic resin
Shaft: HS13: brass; HS16, TS, & PS: brass with nickel plating
Bushing: HS13: brass; HS16, TS, & PS: brass with nickel plating
Case: Phenolic resin
Movable Contacts: HS13, HS16, & TS phosphor bronze; PS silver alloy
Stationary Contacts: HS13, HS16, & PS: brass with silver plating; TS: phosphor bronze
Terminals: HS: phosphor bronze; TS & PS: copper with silver plating

Environmental Data

Operating Temp Range: –10°C through +70°C (+14°F through +158°F)
Humidity: 90 ~ 98% humidity for 96 hours @ 40°C (104°F)
Vibration: 10 ~ 55 Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in 1 minute; 3 right angled directions for 2 hours
Shock: 50G (490m/s^2) acceleration (tested in 3 right angled directions, with 3 shocks in each direction)

Installation

Mounting Torque: 2.94Nm (26 lb•in)
Maximum Panel Thickness: Shown with panel cutouts in following drawings
Soldering Time & Temperature: Manual Soldering (HS series only): See Profile A in Supplement section.

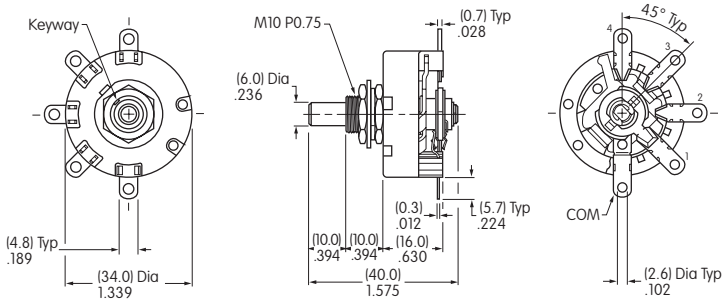
Standards & Certifications

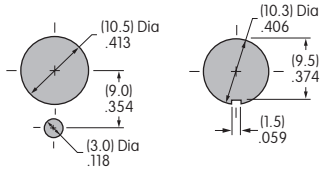
UL: **File No. E44145 - Recognized only when ordered with marking on switch.**
Add "/U" or "/CUL" to end of part number to order UL recognized switch.
HS16 models 1– through 6–pole are recognized at 12A @ 125V AC & 6A @ 250V AC
See Supplement section to find UL or cULus rating details.

6 AMP SINGLE POLE/NONSHORTING/45° INDEXING

Round Shaft	D-flat Shaft	Number of Positions	Stopper Settings	Number of Terminals	Load Terminals	Schematics
HS13X	HS13X-D	2	Fixed	1 COM, 2 LOAD	1 & 2	HS13X
HS13Y	HS13Y-D	3	Fixed	1 COM, 3 LOAD	1, 2, & 3	HS13Y
HS13Z	HS13Z-D	4	Fixed	1 COM, 4 LOAD	1, 2, 3, & 4	HS13Z

Switch is viewed from shaft end and shown in position 1. Terminal numbers are not on switch. Standard Hardware shown on last page of this section.



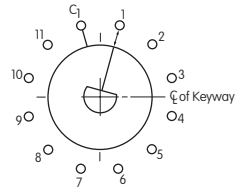


Maximum Effective Panel Thickness
With Locking Ring
.150" (3.8mm)
Without Locking Ring
.189" (4.8mm)

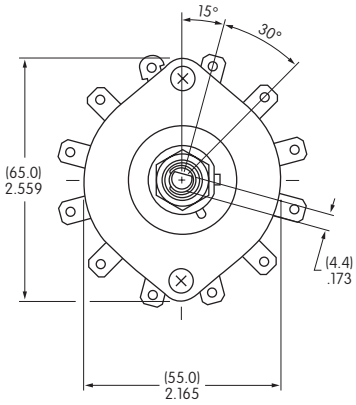
HS13X

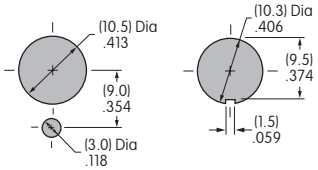
12 AMP/SHORTING & NONSHORTING/30° INDEXING

Knurled Shaft		D-flat Shaft		Pole	Number of Positions	Stopper Settings	Number of Terminals	Schematic
Nonshorting	Shorting	Nonshorting	Shorting					
HS16-1	HS16-1S	HS16-1N	HS16-1SN	1P	2-11	2, 3, 4 . . . 11	1 COM, 11 LOAD	
HS16-2	HS16-2S	HS16-2N	HS16-2SN	2P	2-11	2, 3, 4 . . . 11	2 COM, 22 LOAD	
HS16-3	HS16-3S	HS16-3N	HS16-3SN	3P	2-11	2, 3, 4 . . . 11	3 COM, 33 LOAD	
HS16-4	HS16-4S	HS16-4N	HS16-4SN	4P	2-11	2, 3, 4 . . . 11	4 COM, 44 LOAD	
HS16-5	HS16-5S	HS16-5N	HS16-5SN	5P	2-11	2, 3, 4 . . . 11	5 COM, 55 LOAD	
HS16-6	HS16-6S	HS16-6N	HS16-6SN	6P	2-11	2, 3, 4 . . . 11	6 COM, 66 LOAD	

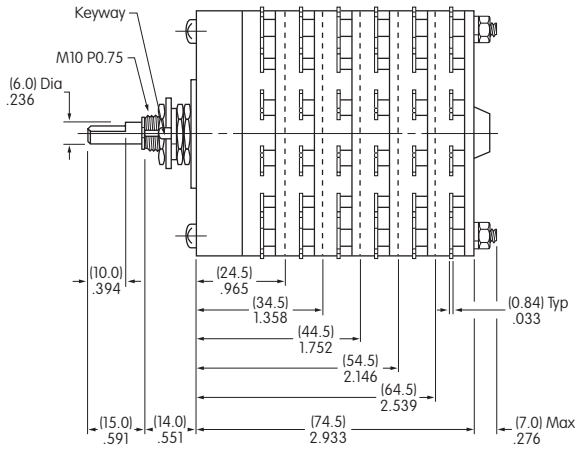


Switch is viewed from shaft end and shown in position 1. Terminal numbers are not on switch. Standard Hardware shown on last page of this section.

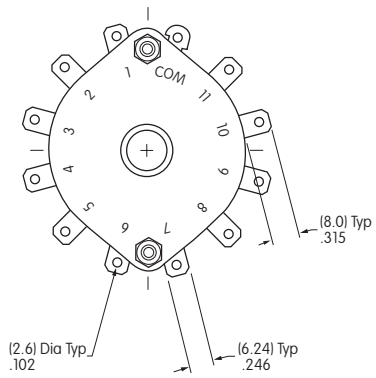




Maximum Effective Panel Thickness
With Locking Ring
.189" (4.8mm)
Without Locking Ring
.228" (5.8mm)



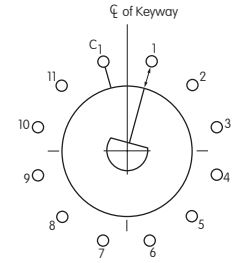
- On each deck of multipole devices common and load terminals are in the same positions as shown in the schematic above.
- Switch is viewed from the shaft end and shown in position 1.
- Terminal numbers are on the switch bottom. Stopper positions are molded on the top of the switch.
- Standard Hardware shown on last page of this section.



HS16-2N

6 AMP/NONSHORTING/ADJUSTABLE STOP/30° INDEXING

Model	Pole	Number of Positions	Stopper Settings	Number of Terminals	Shaft Type	Schematic
TS1N	1P	2-11	2, 3, 4 . . . 11	1 COM, 11 LOAD	D Flat	
TS2N	2P	2-11	2, 3, 4 . . . 11	2 COM, 22 LOAD	D Flat	
TS3N	3P	2-11	2, 3, 4 . . . 11	3 COM, 33 LOAD	D Flat	
TS4N	4P	2-11	2, 3, 4 . . . 11	4 COM, 44 LOAD	D Flat	
TS5N	5P	2-11	2, 3, 4 . . . 11	5 COM, 55 LOAD	D Flat	



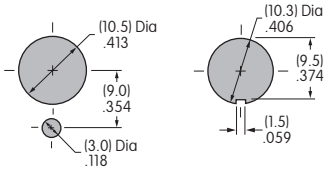
On each deck of multipole devices common & load terminals are in the same positions as shown in this schematic.

Switch is viewed from the shaft end and shown in position 1.

Terminal numbers are on the switch bottom. Stopper positions are molded on the top of the switch.

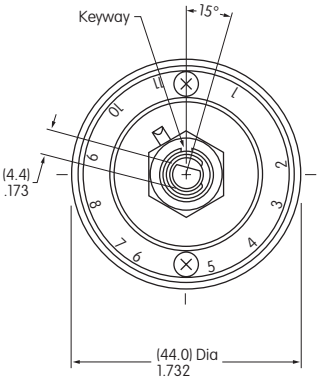
• Standard Hardware shown on last page of this section.

Panel Cutouts

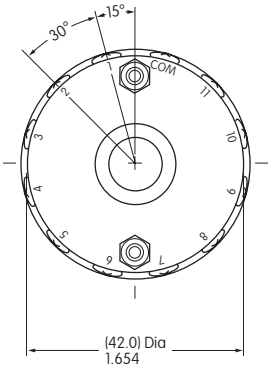


Maximum Effective Panel Thickness
With Locking Ring
.189" (4.8mm)
Without Locking Ring
.228" (5.8mm)

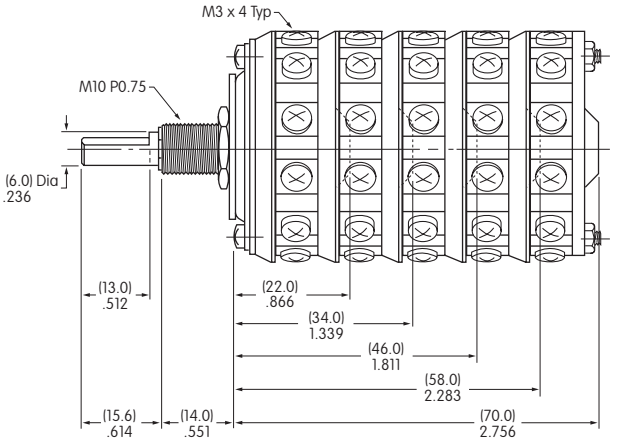
Top



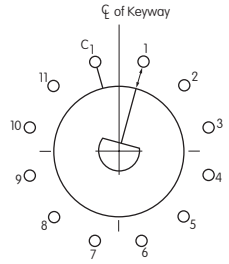
Bottom



TS5N



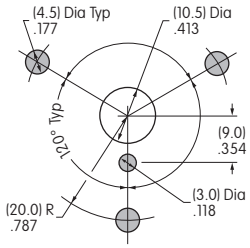
30 AMP/NONSHORTING/ADJUSTABLE STOP/30° INDEXING

Knurled Shaft	D Flat Shaft	Pole	Number of Positions	Stopper Settings	Number of Terminals	Schematic
PS1	PS1N	1P	2-11	2, 3, 4 . . . 11	1 COM, 11 LOAD	
PS2	PS2N	2P	2-11	2, 3, 4 . . . 11	2 COM, 22 LOAD	
PS3	PS3N	3P	2-11	2, 3, 4 . . . 11	3 COM, 33 LOAD	
PS4	PS4N	4P	2-11	2, 3, 4 . . . 11	4 COM, 44 LOAD	
PS5	PS5N	5P	2-11	2, 3, 4 . . . 11	5 COM, 55 LOAD	

On each deck of multipole devices common & load terminals are in the same positions as shown in this schematic. Switch is viewed from the shaft end and shown in position 1. Terminal numbers are on switch bottom. Stopper positions are molded on the top of the switch.

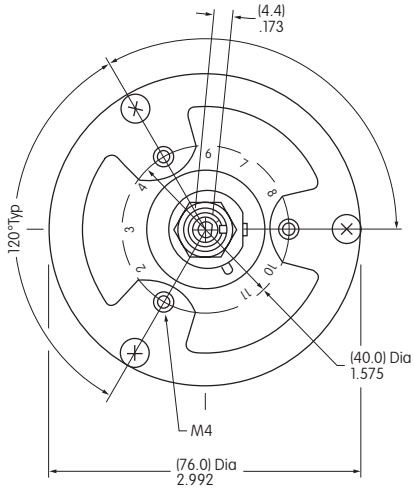
- Standard Hardware shown on last page of this section.

Panel Cutout

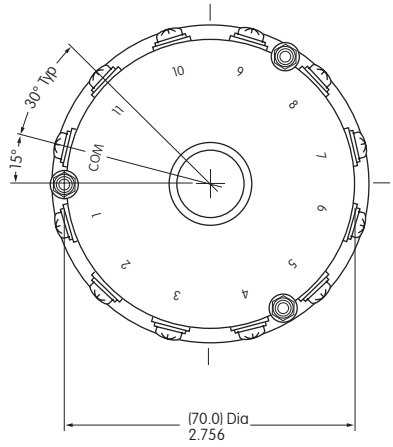


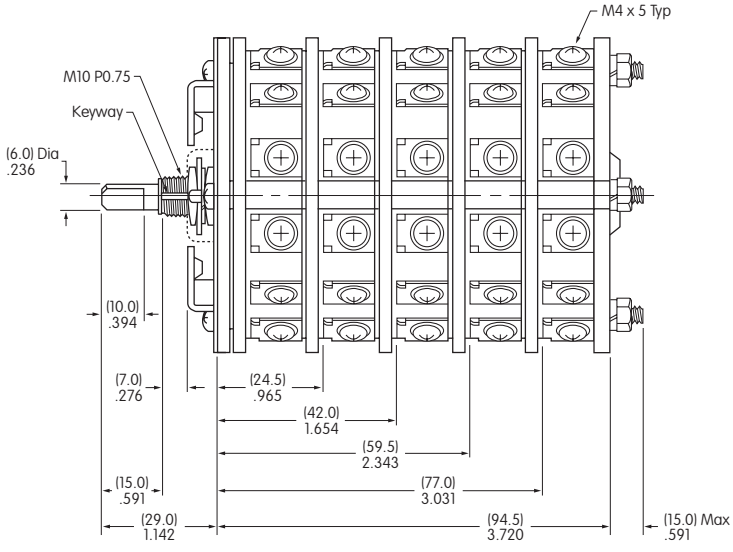
Maximum Effective Panel Thickness
Without Locking Ring
.189" (4.8mm)

Top



Bottom



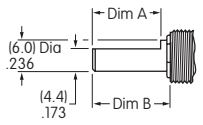


PS4N

SHAFT TYPES

D Flat Shaft

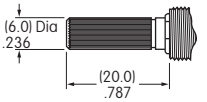
For use with
AT431 and AT432



	Dimension A	Dimension B
For TS	(13.0) .512	(15.6) .614
For HS or PS	(10.0) .394	(15.0) .591

Knurled Shaft

Not for use with
AT431 or AT432

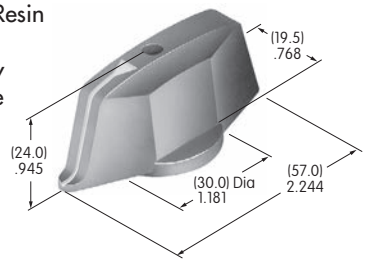


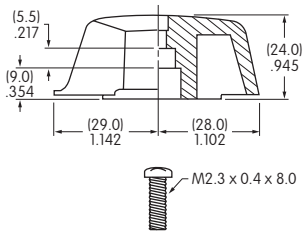
OPTIONAL KNOBS FOR D FLAT SHAFTS

AT431
Large Knob

Phenolic Resin

Black only with white indicator line

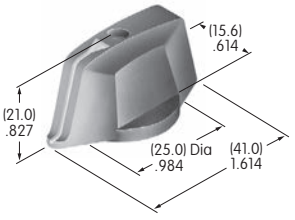


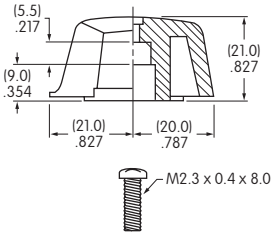


AT432
Small Knob

Phenolic Resin

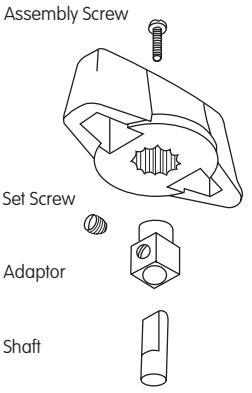
Black only with white indicator line





Knob Orientation

The rotary knobs used on the D-flat shafts can be oriented on the switch to suit the customer's particular front panel needs simply by sliding the knob over the square adaptor at the preferred orientation.



STOPPER SETTING

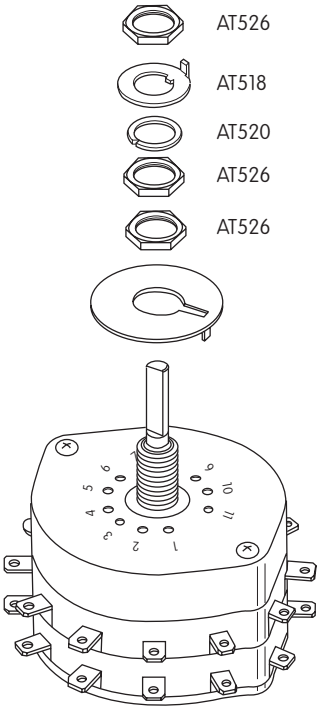
For HS16, TS, & PS Models

The HS16, TS, and PS switches are supplied with the stopper plate set for the maximum number of positions allowed for that model. Prior to installation, the desired stopper setting should be made:

1. Be sure the shaft is turned counterclockwise to the extreme left. If the shaft is not turned counterclockwise to the extreme left, proper setting cannot be achieved.
2. Loosen the nut far enough to allow raising the stopper plate for resetting.
3. Insert the stopper in the numbered hole for the desired stopper setting. Satisfactory switch functioning cannot be assured if the stopper plate is not properly positioned.
4. Tighten the nut firmly against the stopped plate.

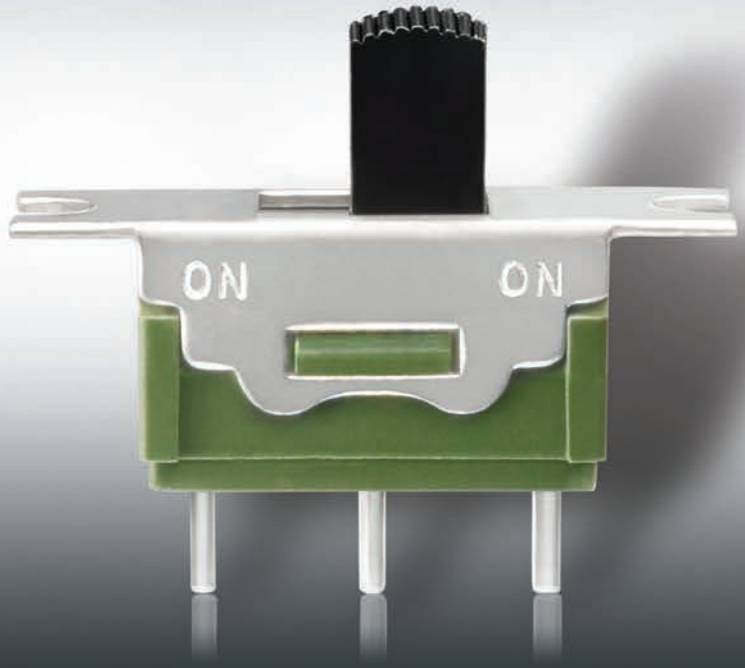
Standard Hardware Supplied with HS, TS, and PS:

AT526 Hex Mounting Nut (quantity 3)
AT518 Locking Ring (quantity 1)
AT520 Split Lockwasher (quantity 1)
Use of mounting supports on PS is optional; screws are not provided.



NKK SWITCHES

Slides



Contents Slides

AS Series H4
0.4VA Logic Level
Straight, Right Angle & Vertical PC

CS Series H10
3A Power Level
Straight PC
PCB Mount

FS Series H14
High Frequency
90MHz to 1GHz
Straight PC

JS01, JS03 Series H18
Extended & Piano Actuated DIP Slides
25mA @ 24V DC
Straight PC

JS02, JS04 SMT Series H24
Ultra-miniature 25mA DIP Slide
Gull Wing Terminals
4- & 8-position

MS Series H30

6A Power Level & 0.4VA Logic Level
Solder Lug, Straight PC, Right Angle & Vertical PC
Panel Mount, PCB Mount, & Bracket Mount

MS Illuminated Series H38

6A Power Level
LED Illumination
Solder Lug & Straight PC
PCB Mount & Flat Frame Mount

SM Series H42

Ultra-miniature
500mA or 1.0mA
Straight PC

SS Series H44

0.1A Power Level & 0.4VA Logic Level
Top & Side Actuated
PCB Mount

SS Illuminated Series H49

0.1A Power Level
LED Illumination
Top & Side Actuation
PCB Mount

SS3 SMT Series H53

Ultra-miniature 0.4VA Logic Level
Side Actuated

General Specifications

Electrical Capacity (Resistive Load)

Logic Level: 0.4VA maximum @ 28V AC/DC maximum
(Applicable Range 0.1mA ~ 0.1A @ 20mV ~ 28V)
Note: Find additional explanation of operating range in Supplement section.

Other Ratings

Contact Resistance: 50 milliohms maximum
Insulation Resistance: 500 megohms minimum @ 500V DC
Dielectric Strength: 500V AC minimum for 1 minute minimum
Mechanical Life: 50,000 operations minimum
Electrical Life: 50,000 operations minimum
Nominal Operating Force: 2.55N
Contact Timing: Nonshorting (break-before-make)
Travel: Pretravel: .082" (2.1mm); Overtravel: .016" (0.4mm); Total Travel: .098" (2.5mm)

Materials & Finishes

Actuator: Glass fiber reinforced polyamide
Upper Case Housing: Carbon blended polyacetal (antistatic)
Lower Case Housing: Glass fiber reinforced polyamide
Support Bracket: Tin plated phosphor bronze
Movable Contact: Phosphor bronze with gold plating
Stationary Contacts: Brass with gold plating
Terminals: Brass with gold plating

Environmental Data

Operating Temperature Range: –30°C through +85°C (–22°F through +185°F)
Humidity: 90 ~ 95% humidity for 192 hours @ 40°C (104°F)
Vibration: 10 ~ 60Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in 5 minutes; 3 right angled directions for 30 minutes
Shock: 50G (490m/s^2) acceleration (tested in 6 right angled directions, with 5 shocks in each direction)

PCB Processing

Soldering: Wave Soldering Recommended. See Profile A in Supplement section.
Manual Soldering: for single pole see Profile B in Supplement section; for double pole see Profile A.
Cleaning: These devices are not process sealed. Hand clean locally using alcohol based solution.

Standards & Certifications

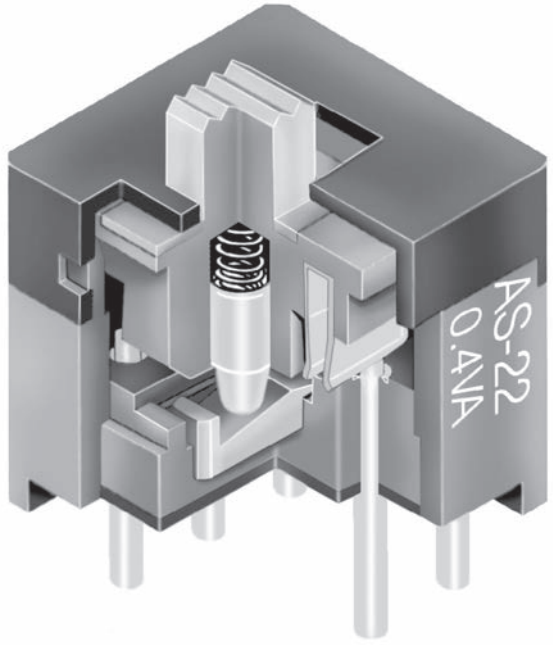
The A Series slides have not been tested for UL recognition or CSA certification.
These switches are designed for use in a low-voltage, low-current, logic-level circuit.
When used as intended in a logic-level circuit, the results do not produce hazardous energy.

Distinctive Characteristics

Subminiature size (1/3 size of Series M switches) saves space on PC boards.

Specifically developed for logic-level applications.

Award-winning STC contact mechanism with benefits unavailable in conventional mechanisms: smoother, positive detent actuation, increased contact stability and unparalleled logic-level reliability. (Additional STC details in Terms & Acronyms; see Supplement section.)



Available in various actuator lengths.

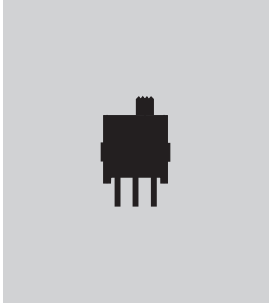
Antistatic superstructure of carbon blended polyacetal prevents static discharge to the contacts.

Molded-in, epoxy sealed or ultrasonically welded terminals lock out flux, solvents, and other contaminants.

.100" x .100" (2.54mm x 2.54mm) terminal spacing conforms to standard PC board grid spacing.

Matching indicators available.

Actual Size



TYPICAL SWITCH ORDERING EXAMPLE

AS 2 2 A H

Poles	
1	SPST SPDT
2	DPDT SP3T

Circuits			
1	ON	NONE	OFF
2	ON	NONE	ON
3	ON	OFF	ON
4	ON	ON	ON

Actuators	
A	.098″ (2.5mm) Long
B	Flush
C	.150″ (3.8mm) Long

PC Terminals	
P	Straight
*B	Straight with Bracket
*H	Right Angle with Bracket
*V	Vertical with Bracket

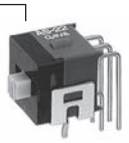
*Bracketed models are ESD protected

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

AS22AH

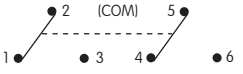
DPDT ON-NONE-ON Circuit

.098″ (2.5mm) Long Actuator

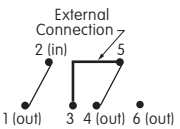
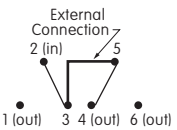
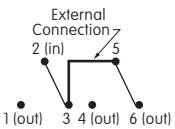
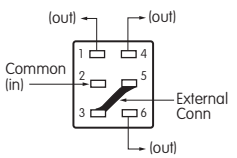


Right Angle PC Terminals

POLES & CIRCUITS

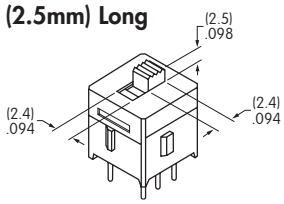
		Slide Position			Connected Terminals			Throw & Schematics
Pole	Model	Left	Center	Right	Left	Center	Right	Note: Terminal numbers are not actually on the switch.
SP	**AS11**	ON	NONE	OFF	3-1	OPEN	OPEN	SPST
SP	**AS12** **AS13**	ON ON	NONE OFF	ON ON	2-1 2-1	OPEN OPEN	2-3 2-3	SPDT
DP	**AS22** **AS23**	ON ON	NONE OFF	ON ON	2-1 5-4 2-1 5-4	OPEN OPEN	2-3 5-6 2-3 5-6	DPDT 

For 3 Throw (3-On)

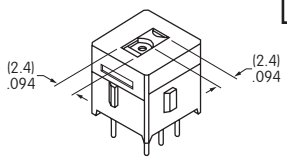
		Connected Terminals & Schematics			External Connection
Pole	Model	Left	Center	Right	The SP3T model utilizes a double pole base.
SP	**AS24**	ON  2-1 5-4	ON  2-3 5-4	ON  2-3 5-6	External connections must be made during field installation. 

ACTUATORS

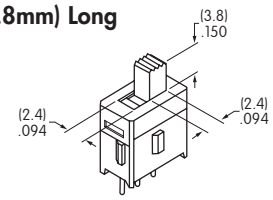
A .098" (2.5mm) Long



B Flush



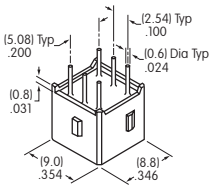
C .150" (3.8mm) Long



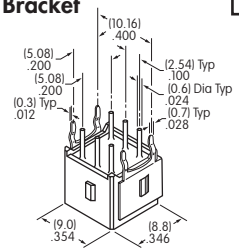
Actuator Color: Gray standard; contact factory for other colors.

PC TERMINALS

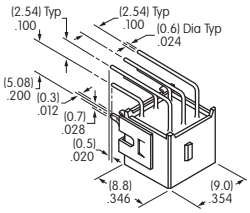
P Straight



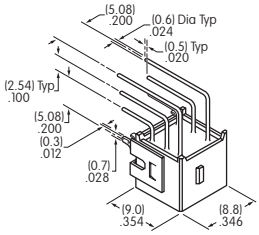
B Straight with Bracket



H Right Angle with Bracket



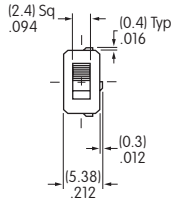
V Vertical with Bracket

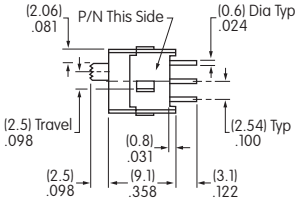


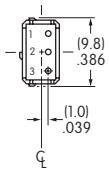
Use of a support bracket is recommended to increase PCB mounting strength and stability.

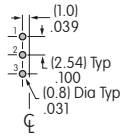
TYPICAL SWITCH DIMENSIONS

Single Pole — Straight PC







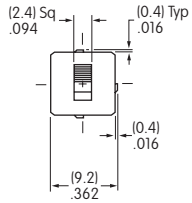


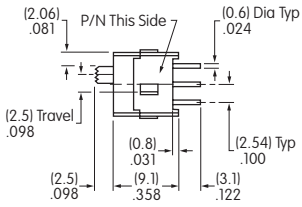
Actuator shown in LEFT position

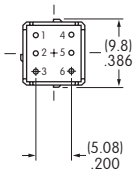
Single throw models do not have terminal 2.

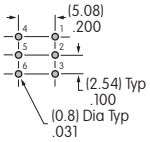
AS12AP

Double Pole — Straight PC





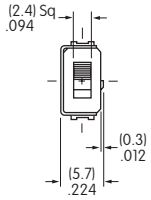


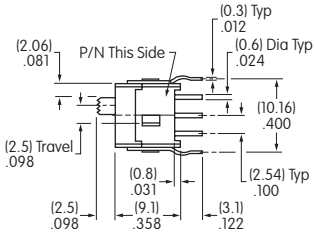


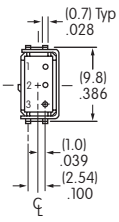
Actuator shown in LEFT position

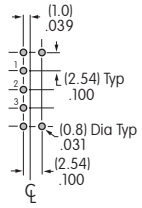
AS22AP

Single Pole — Straight PC • Bracket









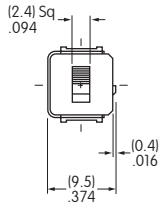
Actuator shown in LEFT position

AS12AB

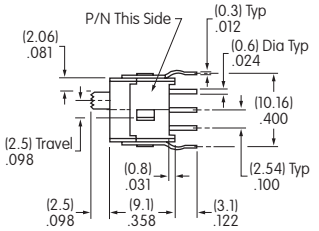
TYPICAL SWITCH DIMENSIONS

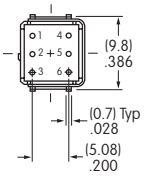
Straight PC • Bracket

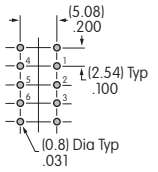
AS22AB



Double Pole



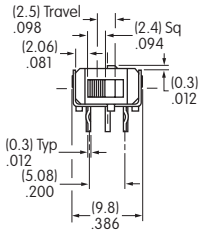




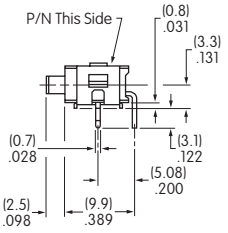
Actuator shown in LEFT position

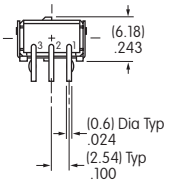
Right Angle PC

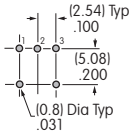
AS12AH



Single Pole



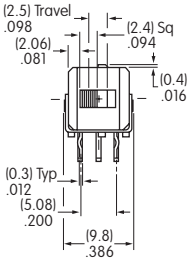




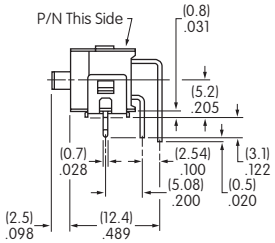
Actuator shown in LEFT position

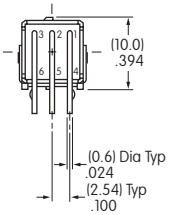
Right Angle PC

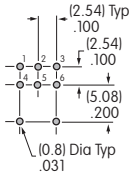
AS22AH



Double Pole



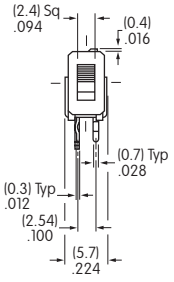




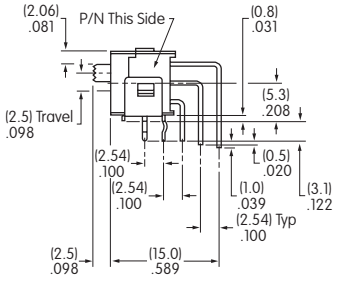
Actuator shown in LEFT position

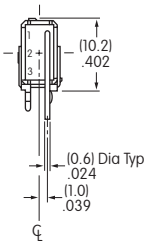
Vertical PC

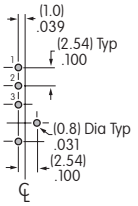
AS12AV



Single Pole



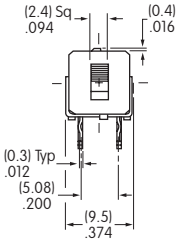




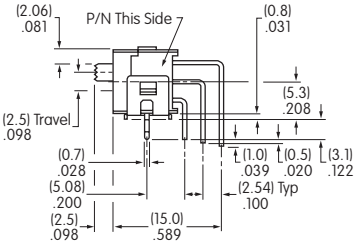
Actuator shown in LEFT position

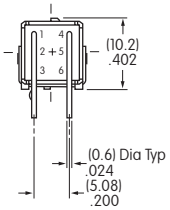
Vertical PC

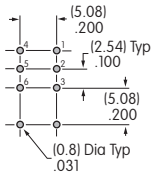
AS22AV



Double Pole







Actuator shown in LEFT position

General Specifications

Electrical Capacity (Resistive Load)

Power Level: 3A @ 125V AC or 2A @ 250V AC

Other Ratings

Contact Resistance: 10 milliohms maximum
Insulation Resistance: 1,000 megohms minimum @ 500V DC
Dielectric Strength: 1,000V AC minimum between contacts for 1 minute minimum;
1,500V AC minimum between contacts & case for 1 minute minimum
Mechanical Life: 50,000 operations minimum
Electrical Life: 20,000 operations minimum
Static Capability: Withstands 12 kilovolts ESD
Contact Timing: Nonshorting (break-before-make)
Total Travel: .087" (2.2mm)

Materials & Finishes

Actuator: Glass fiber reinforced polyamide
Cover & Case: Glass fiber reinforced polyamide (UL94V-0)
Movable Contacts: Copper with silver plating
Stationary Contacts: Silver capped copper with silver plating
Terminals: Copper with silver plating

Environmental Data

Operating Temp Range: –30°C through +85°C (–22°F through +185°F)
Humidity: 90 ~ 95% humidity for 240 hours @ 40°C (104°F)
Vibration: 10 ~ 55Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range
& returning in 1 minute; 3 right angled directions for 2 hours
Shock: 50G (490m/s^2) acceleration (tested in 6 right angled directions, with 5 shocks in each direction)

Installation

Soldering Time & Temp: Wave Soldering: See Profile A in Supplement section.
Manual Soldering: See Profile B in Supplement section.
Cleaning: These devices are not process sealed. Hand clean locally using alcohol based solution.

Standards & Certifications

Flammability Standard: UL94V-0 cover & case

Distinctive Characteristics

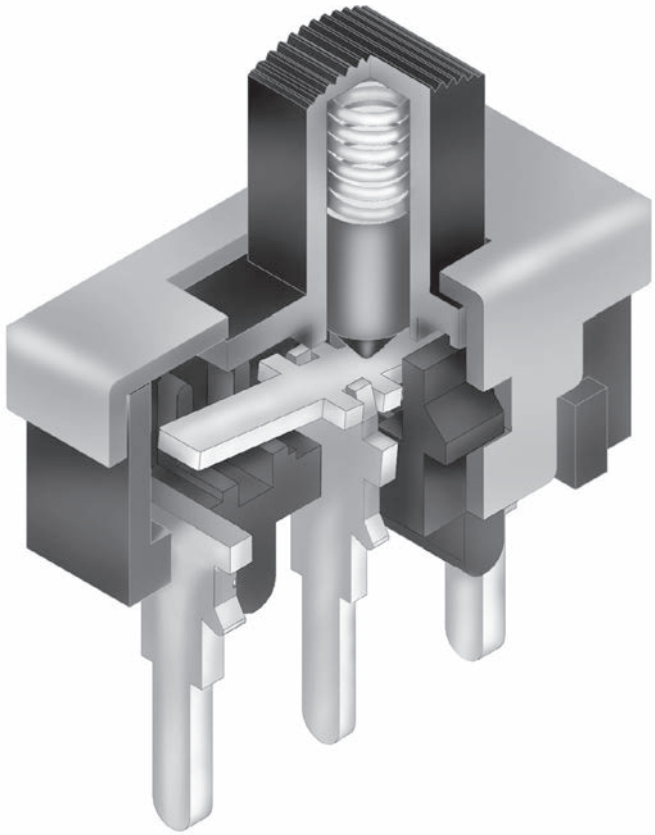
High performance and high quality at a low price.

Molded cover and case of high insulating material withstand 12 kilovolts of electrostatic discharge (ESD), providing antistatic feature.

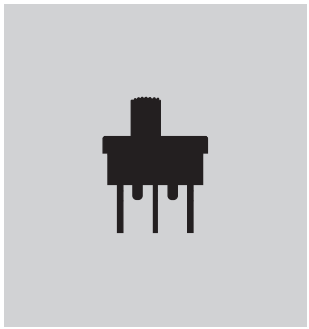
Cover and case UL 94V-0 flammability rated.

Epoxy sealed terminals to lock out flux, dust, and other contaminants.

Suited for a wide variety of applications including telecommunications, electronic controls, audio devices, and household appliances.



Actual Size



TYPICAL SWITCH ORDERING EXAMPLE

CS 1 2 A N W 03

Poles

1	SPDT
2	DPDT

Actuators

A	Narrow for Single Pole
B	Wide for Double Pole

Contact Material & Rating

W	Silver Rated 3A @ 125V AC

Circuits

2	ON	NONE	ON

Mounting

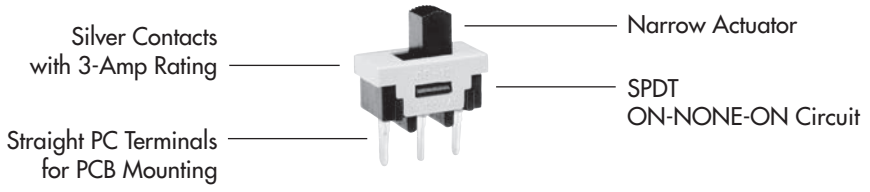
N	PCB Mount

Terminals

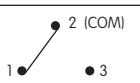
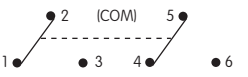
03	Straight PC

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

CS12ANW03

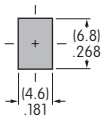


POLES & CIRCUITS

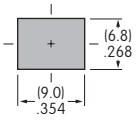
		Slide Position			Connected Terminals			Throw & Schematics
Pole	Model	Left	Center	Right	Left	Center	Right	Note: Terminal numbers are not actually on switch.
SP	**CS12**	ON	NONE	ON	2-1	OPEN	2-3	SPDT 
DP	**CS22**	ON	NONE	ON	2-1 5-4	OPEN	2-3 5-6	DPDT 

MOUNTING

Panel Cutouts

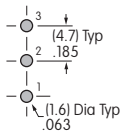


Single Pole

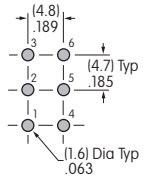


Double Pole

PCB Footprints



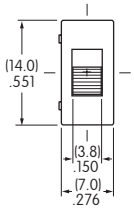
Single Pole

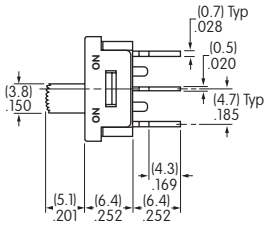


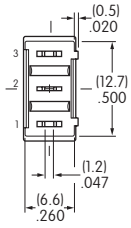
Double Pole

TYPICAL SWITCH DIMENSIONS

Single Pole



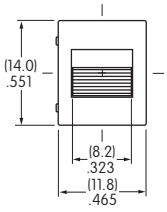


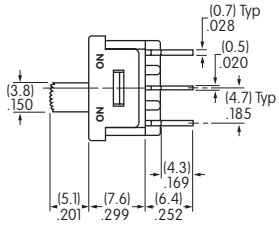


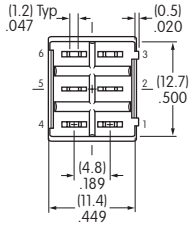
Actuator shown in LEFT position

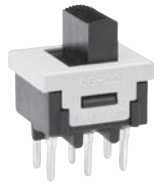
CS12ANW03

Double Pole









Actuator shown in LEFT position

CS22BNW03

General Specifications

For high frequency (DC through 1GHz): Isolation 40dB minimum at 1GHz.
Insertion loss 0.5dB maximum at 1GHz.

Impedance 75 ohms

Innovative alternative to relay products

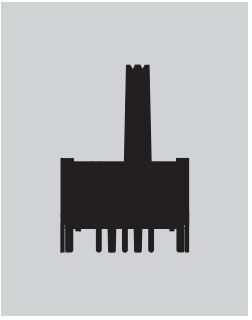
Highly reliable, self-cleaning twin contact mechanism with gold plating

Long total travel of .138" (3.5mm) for highly visible actuator position

Distinct audible and tactile feedback during actuation

Suited to high frequency applications (90MHz to 1GHz) such as CATV and communication equipment

Actual Size
with Tall Actuator



Distinctive Characteristics

Electrical Capacity (Resistive Load)

Logic Level: 0.4VA maximum @ 28V AC/DC maximum
(Applicable Range 0.1mA ~ 0.1A @ 20mV ~ 28V)
Note: Find additional explanation of operating range in Supplement section.

RF Ratings

Impedance: 75 ohms
Insertion Loss: 0.5dB maximum @ 1GHz
Isolation: 40dB minimum @ 1GHz

Other Ratings

Contact Resistance: 200 milliohms maximum
Insulation Resistance: 250 megohms minimum @ 500V DC
Dielectric Strength: 500V AC minimum for 1 minute minimum
Mechanical Life: 1,000 operations minimum
Electrical Life: 1,000 operations minimum
Contact Timing: Nonshorting (break-before-make)
Total Travel: .138" (3.5mm)

Environmental Data

Operating Temp Range: –30°C through +85°C (–22°F through +185°F)
Humidity: 90 ~ 95% humidity for 240 hours @ 40°C (104°F)
Vibration: 10 ~ 55Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in 5 minutes; 3 right angled directions for 2 hours
Shock: 50G (490m/s^2) acceleration (tested in 6 right angled directions, with 5 shocks in each direction)

Installation

Soldering Time & Temp: Wave Soldering: See Profile A in Supplement section.
Manual Soldering: See Profile A in Supplement section.
Cleaning: These devices are not process sealed. Hand clean locally using alcohol based solution.

TYPICAL SWITCH ORDERING EXAMPLE

FS 2 2 A A P

Pole	
2	DPDT

Frequency Band	
A	DC through 1GHz

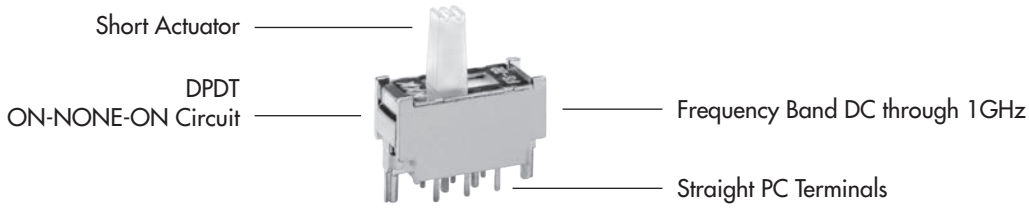
Terminals	
P	Straight PC

Circuit			
2	ON	NONE	ON

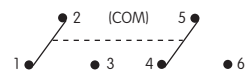
Actuators	
A	Short (.291" or 7.4mm)
B	Tall (.488" or 12.4mm)

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

FS22AAP

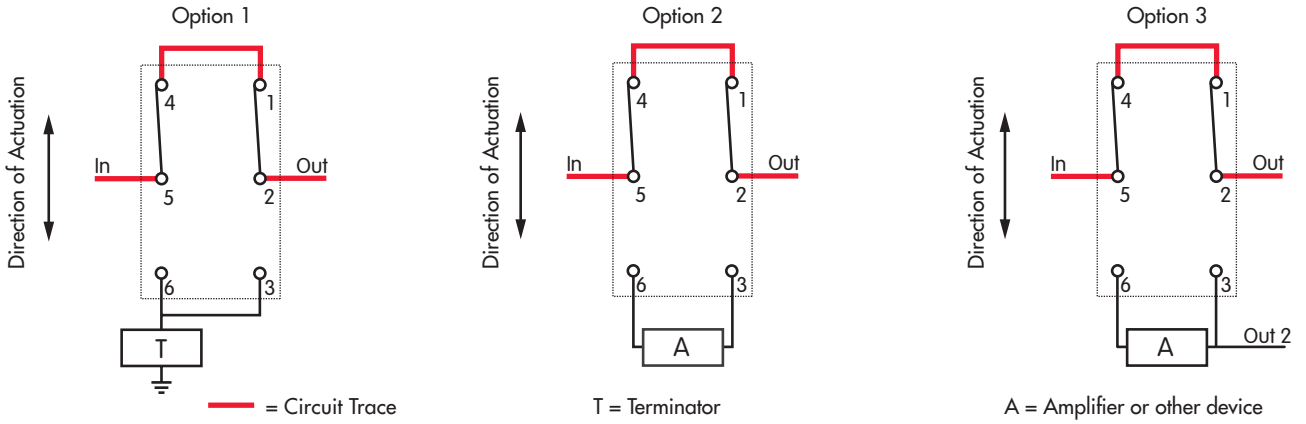


POLE & CIRCUIT

		Slide Position			Connected Terminals			Throw & Schematics
Pole	Model	Left	Center	Right	Left	Center	Right	Note: Terminal numbers are not actually on the switch.
DP	**FS22**	ON	NONE	ON	2-1 5-4	NA	2-3 5-6	DPDT 

HIGH FREQUENCY PERFORMANCE

RF Connection Options



Isolation

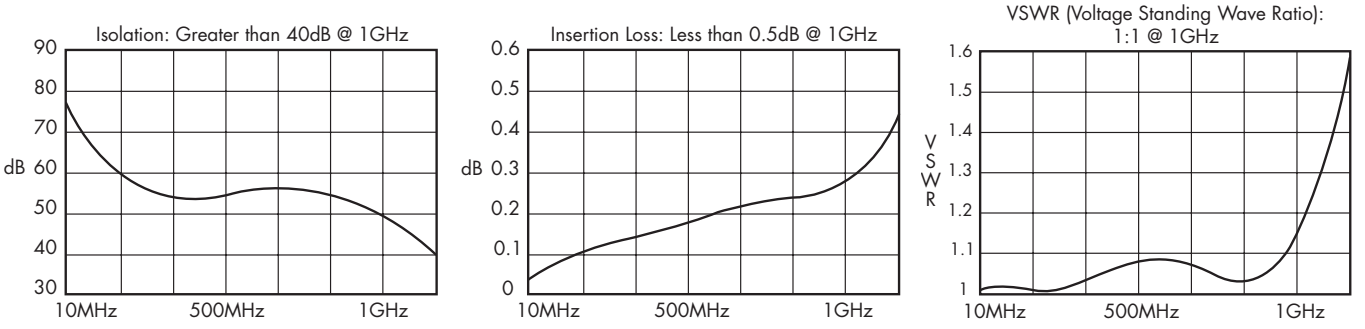
>40dB @ 1GHz
(higher value is better)

Insertion Loss

<0.5dB @ 1GHz
(lower value is better)

Standing Wave Ration or Impedance Matching

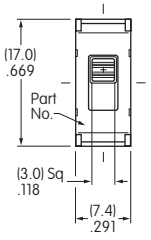
Standing Wave = ratio between highest voltage & lowest voltage
(must always be more than 1)

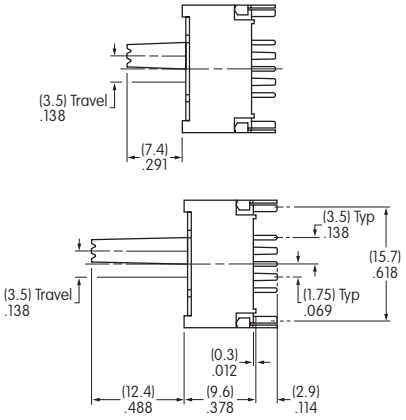


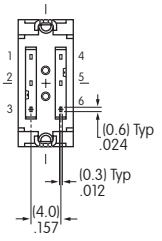
Note: The data above reflects the conditions using the FS switch on a test PCB with two coaxial connectors. High frequency applications require external connection on the PCB. Contact factory for details.

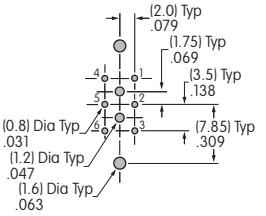
TYPICAL SWITCH DIMENSIONS

Short & Tall Actuators









FS22ABP

Actuator in LEFT position.

General Specifications

Electrical Capacity (Resistive Load)

Switching Rating: 25mA @ 24V DC
Nonswitching Rating: 0.1A @ 50V DC

Other Ratings

Contact Resistance: 50 milliohms maximum
Insulation Resistance: 100 megohms minimum @ 500V DC
Dielectric Strength: 500V AC minimum for 1 minute minimum
Mechanical Life: 2,000 operations minimum
Electrical Life: 2,000 operations minimum
Total Travel: For slide actuator: .031" (0.8mm); for piano actuator: .114" (2.9mm)

Materials & Finishes

	JS01 Slide DIP	JS03 Piano DIP
Actuator:	Glass fiber reinforced polyamide	Glass fiber reinforced PBT
Cover:	Glass fiber reinforced polyamide (UL94V-0)	Glass fiber reinforced PBT (UL94V-0)
Base:	Glass fiber reinforced polyamide (UL94V-0)	Glass fiber reinforced PBT (UL94V-0)
Contacts:	Beryllium copper with gold plating	Phosphor bronze with gold plating
Terminals:	Brass with gold plating	Phosphor bronze with gold plating

Environmental Data

Operating Temp Range: –25°C through +70°C (–13°F through +158°F)
Humidity: 90 ~ 95% humidity for 96 hours @ 40°C (104°F)
Vibration: 10 ~ 55Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in 1 minute; 3 right angled directions for 2 hours
Shock: 50G (490m/s^2) acceleration (tested in 6 right angled directions, with 5 shocks in each direction)

PCB Processing

Soldering: Wave Soldering Recommended. See Profile A in Supplement section.
Manual Soldering: See Profile A in Supplement section.
Note: Switches are packaged in OFF position and should be soldered in OFF position.
Cleaning: These devices are not process sealed. Hand clean locally using alcohol based solution.

Standards & Certifications

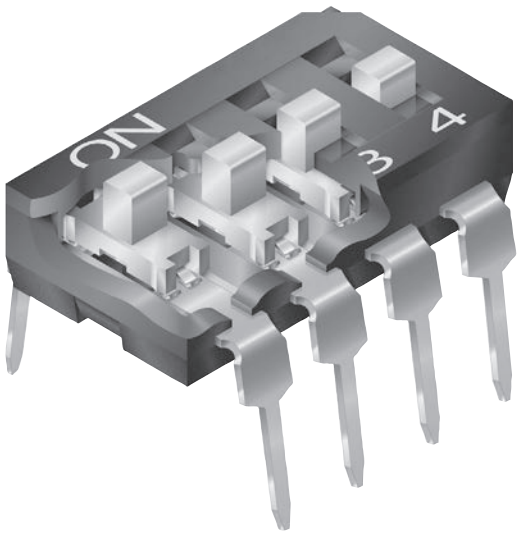
Flammability Standards: UL 94V-0 rated cover & base
The JS series devices have not been tested for UL recognition and CSA certification.
These switches are designed for use in a low-voltage, low-current circuit.
When used as intended in a low-voltage, low-current circuit, the results do not produce hazardous energy.

Distinctive Characteristics

Slide type and piano type actuators available.

Twin sliding contact mechanism with self-cleaning action (JS01) provides smooth actuation and produces high contact reliability.

Gold plated contacts prevent oxidation and sulfide effect and provide stable contact resistance.



Use of self-extinguishing UL94V-0 certified material in cover and base provides high arc resistance and high insulation resistance.

Slanted terminals ensure secure PCB mounting and prevent dislodging during wave soldering.

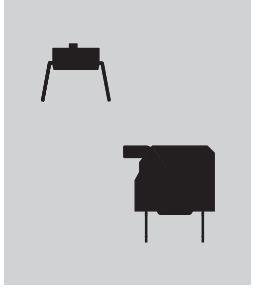
Terminal spacing conforms to standard .100" (2.54mm) PCB grid.

End-to-end stackable.

Actual Sizes

JS01

JS03



TYPICAL SWITCH ORDERING EXAMPLE

JS | 01 | 08 | A | P4 — S

Mounting

01	Through-hole for Slide Actuator
03	Through-hole for Piano Actuator

No. Of Positions

04	4 Positions
08	8 Positions

JS slides are SPST devices with OFF-ON circuit

Actuator

A	Extended Slide for 01 Mounting Code
P	Piano for 03 Mounting Code

Contact Material & Rating

P4	Gold Rated 25mA @ 24V DC

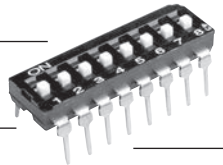
Packaging

S	Stick-Tube

Not available in bulk

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

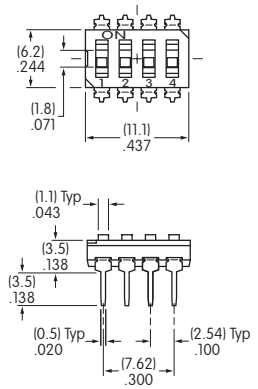
JS0108AP4-S



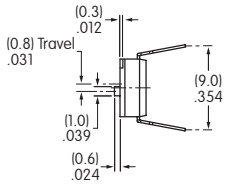
Stick-Tube Packaging

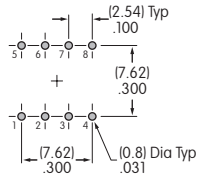
TYPICAL SWITCH DIMENSIONS

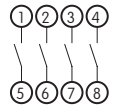
Slide Actuator — 4 Positions



End View



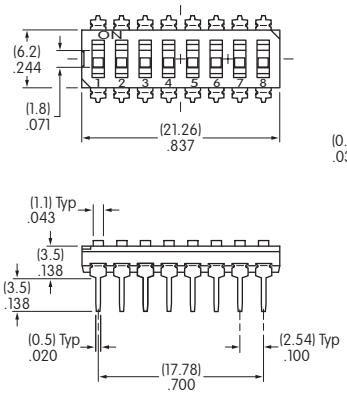




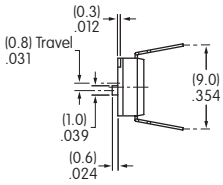
Schematic

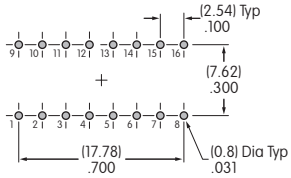
JS0104AP4

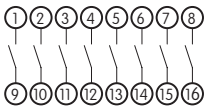
Slide Actuator — 8 Positions



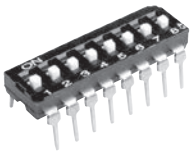
End View





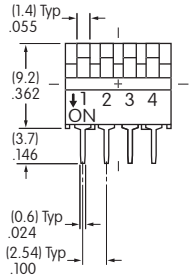


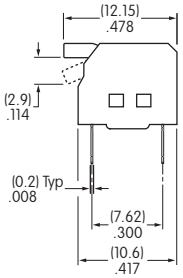
Schematic

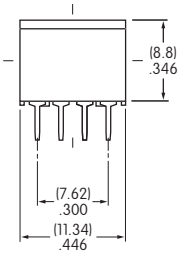


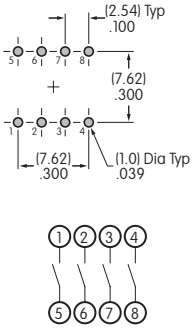
JS0108AP4

Piano Actuator — 4 Positions

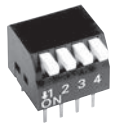






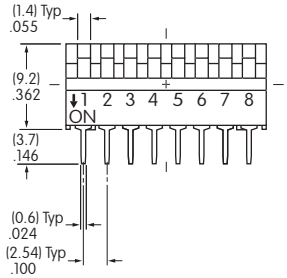


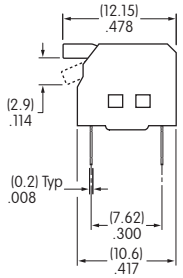
Schematic

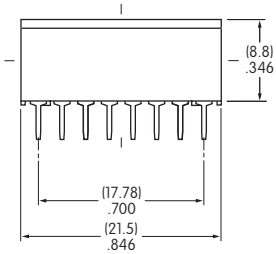


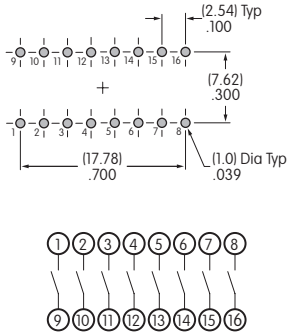
JS0304PP4

Piano Actuator — 8 Positions

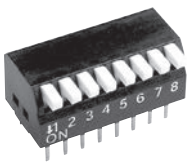








Schematic



JS0308PP4

PACKAGING

S

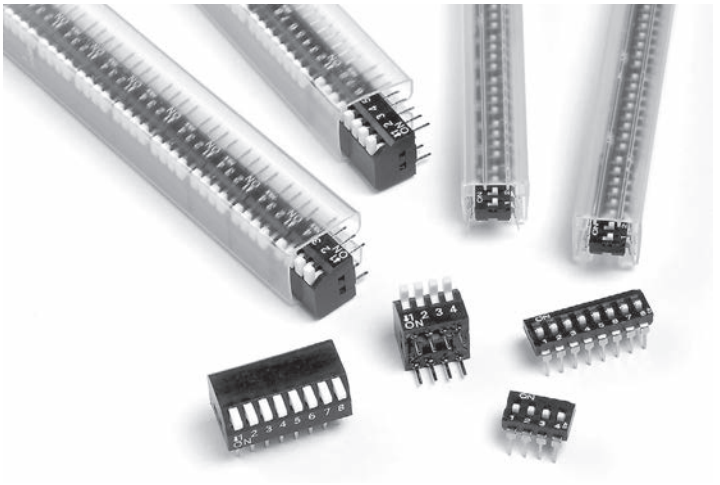
Stick-Tube Packaging

Switches are not available in bulk and must be ordered in increments of:

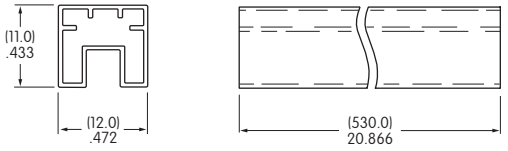
Slide Actuator
JS0104AP4-S: 46 pieces per stick-tube
JS0108AP4-S: 24 pieces per stick-tube

Piano Actuator
JS0304PP4-S: 44 pieces per stick-tube
JS0308PP4-S: 23 pieces per stick-tube

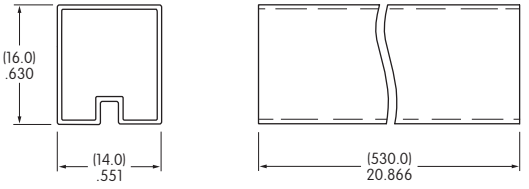
Switches are packaged in OFF position.



Stick-Tube Dimensions for Slide Actuator
JS0104AP4-S & JS0108AP4-S



Stick-Tube Dimensions for Piano Actuator
JS0304PP4-S & JS0308PP4-S



General Specifications

Electrical Capacity (Resistive Load)

Switching Rating: 25mA @ 24V DC
Nonswitching Rating: 0.1A @ 50V DC

Other Ratings

	JS02 Extended Actuator	JS04 Flush Actuator
Contact Resistance:	50 milliohms maximum	50 milliohms maximum
Insulation Resistance:	100 megohms minimum @ 500V DC	100 megohms minimum @ 100V DC
Dielectric Strength:	500V AC minimum for 1 minute minimum	300V AC minimum for 1 minute minimum
Mechanical Life:	2,000 operations minimum	2,000 operations minimum
Electrical Life:	2,000 operations minimum	2,000 operations minimum
Total Travel:	.031" (0.8mm)	.026" (0.65mm)

Materials & Finishes

	JS02 Extended Actuator	JS04 Flush Actuator
Actuator:	Glass fiber reinforced polyamide	Glass fiber reinforced polyamide
Cover:	Glass fiber reinforced polyamide (UL94V-0)	Glass fiber reinforced polyamide (UL94V-0)
Base:	Glass fiber reinforced polyamide (UL94V-0)	Glass fiber reinforced polyamide (UL94V-0)
Contacts:	Beryllium copper with gold plating	Copper alloy with gold plating
Terminals:	Brass with gold plating	Brass with gold plating

Environmental Data

Operating Temp Range: **JS02 Extended Actuator:** –20°C through +70°C (–4°F through +158°F)
JS04 Flush Actuator: –30°C through +85°C (–22°F through +185°F)
Humidity: 90 ~ 95% humidity for 96 hours @ 40°C (104°F)
Vibration: 10 ~ 55Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in 1 minute; 3 right angled directions for 2 hours
Shock: 50G (490m/s^2) acceleration (tested in 6 right angled directions, with 5 shocks in each direction)

PCB Processing

Soldering: Reflow Soldering Recommended. See Profile A in Supplement section.
Manual Soldering: See Profile A in Supplement section.
Note: Switches are packaged in OFF position and should be soldered in OFF position.
Cleaning: These devices are not process sealed. Hand clean locally using alcohol based solution.

Standards & Certifications

Flammability Standards: UL 94V-0 rated cover & base
The JS Series slides have not been tested for UL recognition or CSA certification.
These switches are designed for use in a low-voltage, low-current circuit.
When used as intended in a low-voltage, low-current circuit, the results do not produce hazardous energy.

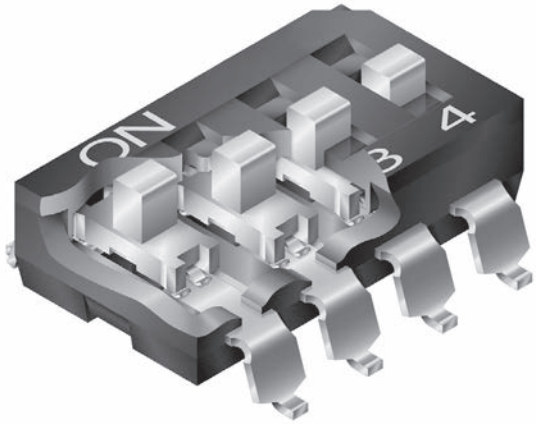
Distinctive Characteristics

Extended and flush slide actuators available.

Twin sliding contact mechanism with self-cleaning action (JS02) provides smooth actuation and produces high contact reliability.

Gold plated contacts prevent oxidation and sulfide effect and provide stable contact resistance.

Use of self-extinguishing UL94V-0 certified material in cover and base provides high arc resistance and high insulation resistance.



Gull-wing terminals ensure secure PCB mounting and prevent dislodging during vapor phase and infrared convection reflow soldering.

Terminal spacing conforms to standard PCB grid.
For JS02: .100″ (2.54mm)
For JS04: .050″ (1.27mm)

End-to-end stackable.

Packaged in tape-reel or stick-tube. Tape-reel packaging meets EIA-481-D Standard.

Coplanarity: all considered surfaces must lie between two parallel planes that are a maximum distance apart of .0059″ (0.15mm). (Additional coplanarity details in Terms and Acronyms in the Supplement section.)

Actual Sizes

JS02

JS04

TYPICAL SWITCH ORDERING EXAMPLE

JS | 02 | 08 | A | P4 — S

Mounting

02	SMT .100" (2.54mm) for Extended Actuator
04	SMT .050" (1.27mm) for Flush Actuator

Actuator

A	Extended for 02 Mounting Code
F	Flush for 04 Mounting Code

Packaging

S	Stick-Tube
R	Tape-Reel
Not available in bulk	

No. Of Positions

04	4 Positions
08	8 Positions

Contact Material & Rating

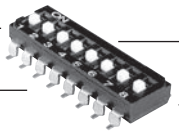
P4	Gold Rated 25mA @ 24V DC

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

JS0208AP4-S

Extended Slide Actuator, 8 Positions

.100" (2.54mm) Terminal Spacing



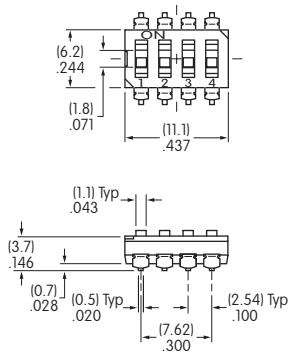
SPST OFF-ON Circuit

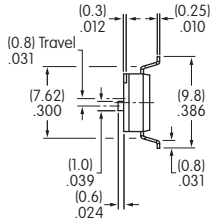
Gold Contacts with 25mA Rating

Stick-Tube Packaging

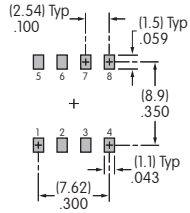
TYPICAL SWITCH DIMENSIONS

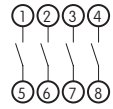
Single Pole — 4 Positions • Extended Actuator





End View

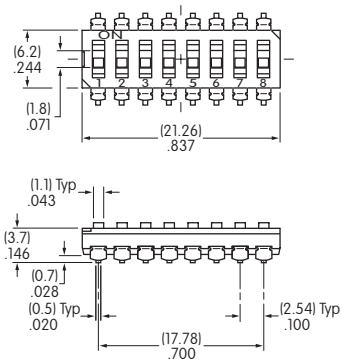


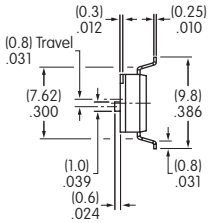


Schematic

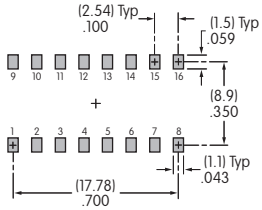
JS0204AP4

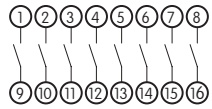
Single Pole — 8 Positions • Extended Actuator





End View

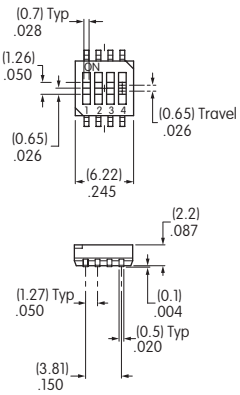


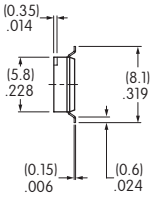


Schematic

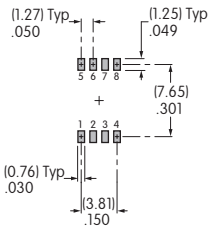
JS0208AP4

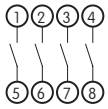
Single Pole — 4 Positions • Flush Actuator





End View

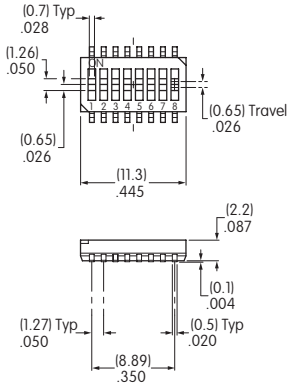


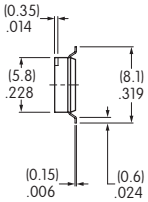


Schematic

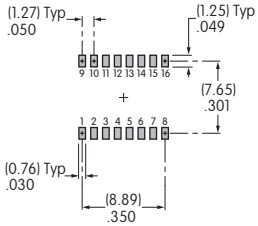
JS0404FP4

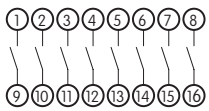
Single Pole — 8 Positions • Flush Actuator





End View





Schematic

JS0408FP4

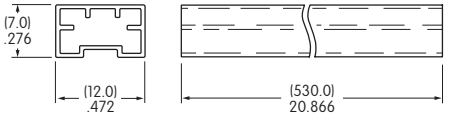
PACKAGING

S

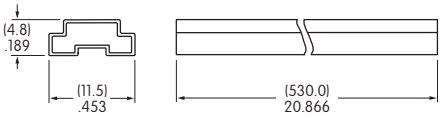
Stick-Tube Packaging

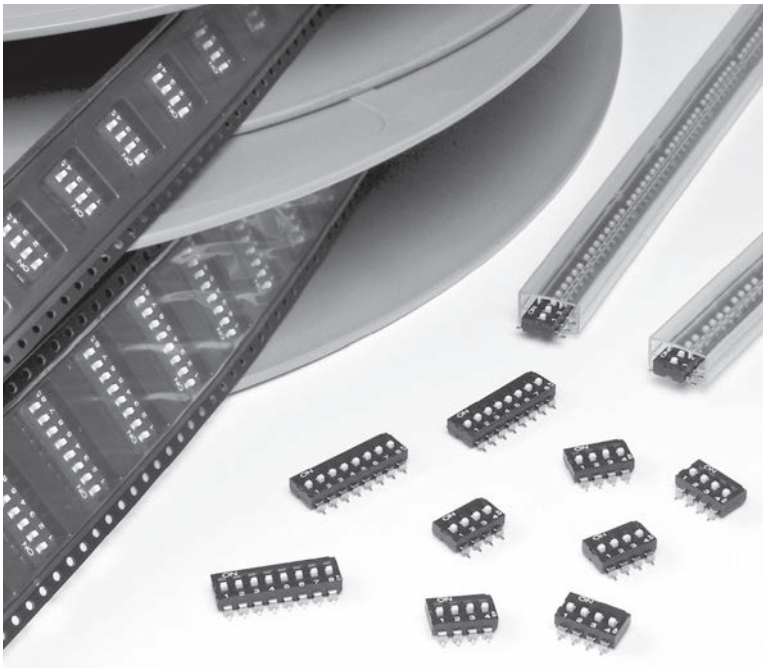
Switches are packaged in OFF position.
Switches are not available in bulk and must be ordered in the following increments:

Extended Actuator
JS0204AP4-S: 46 pieces per stick-tube
JS0208AP4-S: 24 pieces per stick-tube



Flush Actuator
JS0404FP4-S: 80 pieces per stick-tube
JS0408FP4-S: 45 pieces per stick-tube





R

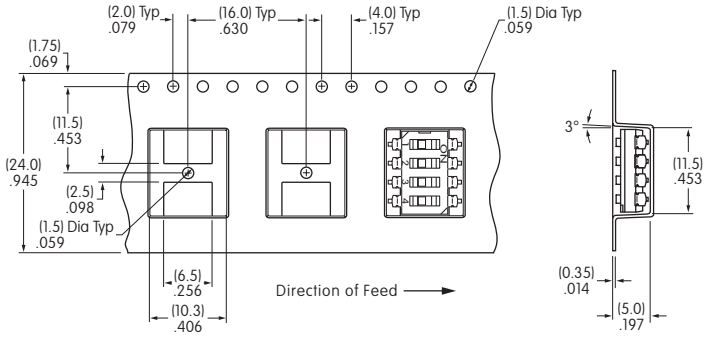
Tape-Reel Packaging for Extended Actuator

Switches are packaged in OFF position.
Switches are not available in bulk and must be ordered in the following increments:

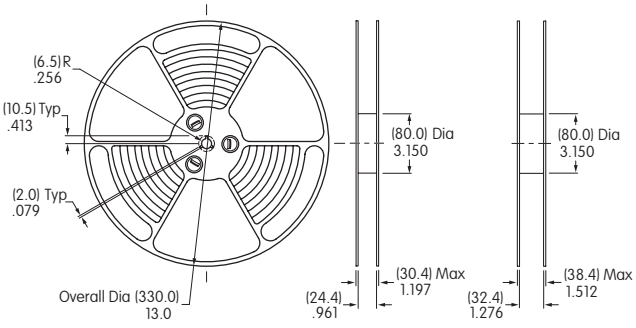
JS0204AP4-R: 500 pieces per tape-reel
JS0208AP4-R: 500 pieces per tape-reel

Minimum Leader Length: 15.75" (400mm)
Minimum Trailer Length: 6.3" (160mm)

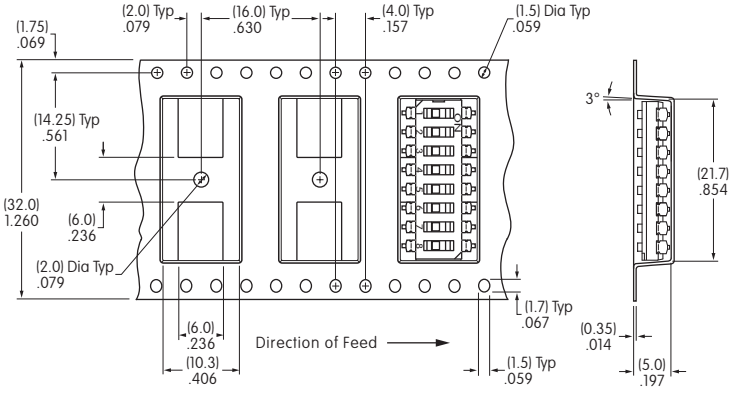
Tape-reel packaging meets EIA-481-D Standard.



Tape Dimensions for JS0204AP4-R



Reel Dimensions JS0204AP4-R JS0208AP4-R



Tape Dimensions for JS0208AP4-R

PACKAGING (CONTINUED)

R

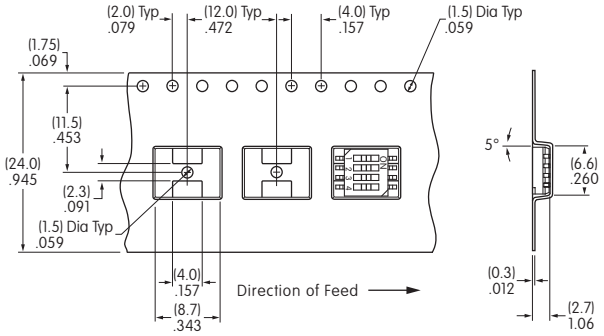
Tape-Reel Packaging for Flush Actuator

Switches are packaged in OFF position.
Switches are not available in bulk and must be ordered in the following increments:

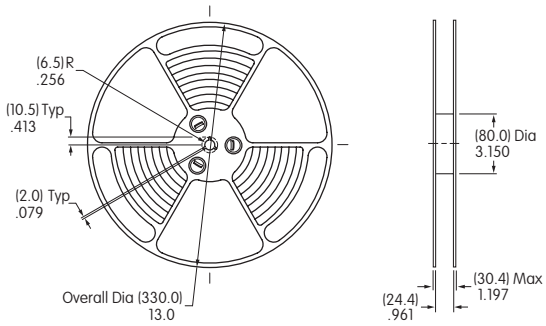
JS0404FP4-R: 2,000 pieces per tape-reel
JS0408FP4-R: 2,000 pieces per tape-reel

Minimum Leader Length: 15.75" (400mm)
Minimum Trailer Length: 6.3" (160mm)

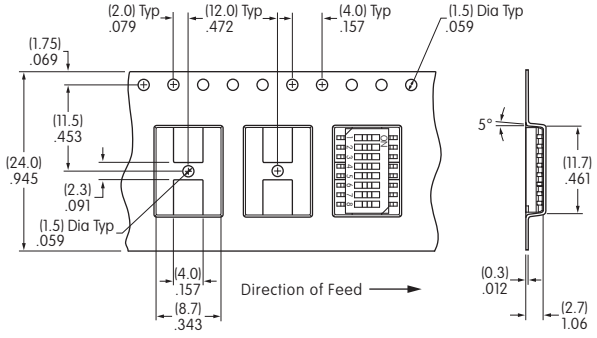
Tape-reel packaging meets EIA-481-D Standard.



Tape Dimensions for JS0404FP4-R



Reel Dimensions for JS0404FP4-R & JS0408FP4-R



Tape Dimensions for JS0408FP4-R

General Specifications

Electrical Capacity (Resistive Load)

Power Level (silver): 6A @ 125V AC or 3A @ 250V AC
Logic Level (gold): 0.4VA maximum @ 28V AC/DC maximum
(Applicable Range 0.1mA ~ 0.1A @ 20mV ~ 28V)
Logic/Power Level (gold over silver): Combines silver & gold ratings

Note: Find additional explanation of dual rating & operating range in Supplement section.

Other Ratings

Contact Resistance: 10 milliohms maximum for silver; 20 milliohms maximum for gold
Insulation Resistance: 1,000 megohms minimum @ 500V DC
Dielectric Strength: 1,000V AC minimum between contacts for 1 minute minimum;
1,500V AC minimum between contacts & case for 1 minute minimum
Mechanical Life: 100,000 operations minimum
Electrical Life: 25,000 operations minimum for silver; 50,000 operations minimum for gold
Contact Timing: Nonshorting (break-before-make)
Total Travel: On-None-On circuit .087" (2.2mm); all other circuits .138" (3.5mm)

Materials & Finishes

Actuator: Glass fiber reinforced PBT resin (UL94V-0)
Frame: Stainless steel for panel & PCB mount; phosphor bronze with tin plating for bracket mount
Dust Cover: Phosphor bronze with nickel plating
Case: Glass fiber reinforced diallyl phthalate resin (UL94V-0)
Movable Contacts: Silver alloy (code W); copper with gold plating (code G);
or silver alloy with gold plating (code A)
Stationary Contacts: Silver capped copper with silver plating (code W); copper with gold plating (code G);
or silver alloy with gold plating (code A)
Terminals: Copper or brass with silver or gold plating

Environmental Data

Operating Temp Range: –30°C through +85°C (–22°F through +185°F)
Humidity: 90 ~ 95% humidity for 96 hours @ 40°C (104°F)
Vibration: 10 ~ 55Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in 1 minute; 3 right angled directions for 2 hours
Shock: 50G (490m/s^2) acceleration (tested in 6 right angled directions, with 5 shocks in each direction)

Processing

Soldering: Wave Soldering recommended (PC Mount). See Profile A in Supplement section.
Manual Soldering: See Profile A in Supplement section.
Cleaning: These devices are not process sealed. Hand clean locally using alcohol based solution.

Standards & Certifications

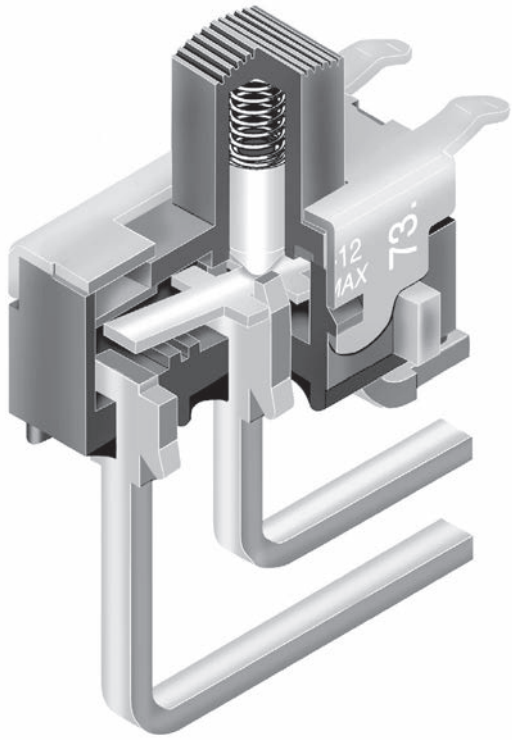
Flammability Standards: UL94V-0 rated actuator & case
UL: **File No. E44145 - Recognized only when ordered with marking on switch.**
Add "/U" or "/CUL" to end of part number to order UL recognized switch.
All Single & Double Pole Double Throw models recognized at 6A @ 125V AC & 3A @ 250V AC.
CSA: **File No. 023535_0_000 - Certified only when ordered with marking on switch.**
Add "/C" to end of part number to order CSA certified switch.
All Double Throw & 3 Throw models certified at 6A @ 125V AC, 3A @ 250V AC, &
0.4VA maximum @ 28V DC.

Distinctive Characteristics

Available in flat frame and bracketed PC mounting types.

Over-center actuator block and plunger design gives crisp actuation with clear indication of circuit status; this design also diminishes sparking and increases operating life.

Guide interlocked with actuator block prevents window locking and maintains correct plunger alignment to assure contact stability.



Antijamming design protects contacts from damage due to excessive downward force on the actuator.

High internal barriers between poles and insulating sheet between case and actuator block give added protection to contacts.

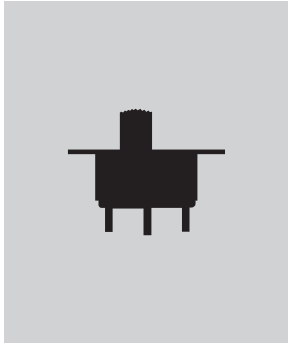
Specially composed silver alloy contacts for power applications or gold contacts for logic level applications give high contact reliability.

Prominent external insulating barriers increase insulation resistance and dielectric strength.

Epoxy sealed terminals prevent entry of flux, solvents, and other contaminants.

Clinching of frame to case well above base and terminals provides 1,500V dielectric strength.

Actual Size



TYPICAL SWITCH ORDERING EXAMPLE

MS | 1 | 2 | A | S | G | 30

Poles

1	SPDT
2	DPDT SP3T

Circuits

2	ON	NONE	ON
3	ON	OFF	ON
0	ON	ON	ON

Actuators

A	.150" (3.8mm) Wide for Single or Double Pole
B	.323" (8.2mm) Wide for Double Pole

Mounting

F	Panel Mount (Terminal 01 only)
N	PCB Mount (Terminal 03 only)
S	Bracket Mount (Terminals 13, 30, & 40 only)

Contact Materials & Ratings

W	Silver; Rated 6A @ 125V AC & 3A @ 250V AC
G	Gold; Rated 0.4VA max. @ 28V AC/DC max.
A	Gold over Silver; Rated 6A @ 125V AC & 0.4VA max. @ 28V AC/DC max.

Terminals

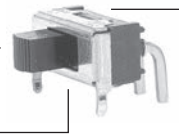
01	Solder Lug
03	Straight PC
13	Straight with Bracket
30	Right Angle PC
40	Vertical PC

IMPORTANT:

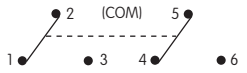
Switches are supplied without UL, cULus & CSA marking unless specified. **UL, cULus & CSA recognized only when ordered with marking on the switch.** Specific models, ratings, & ordering instructions are noted on the General Specifications page.

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

MS12ASG30

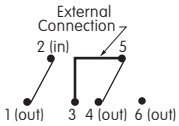
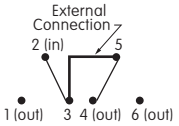
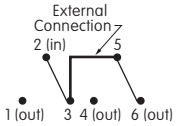
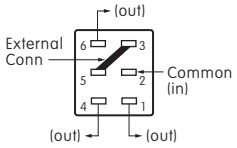


POLES & CIRCUITS

Pole	Model	Slide Position: Left	Slide Position: Center	Slide Position: Right	Connected Terminals: Left	Connected Terminals: Center	Connected Terminals: Right	Throw & Schematics
SP	**MS12** **MS13**	ON ON	NONE OFF	ON ON	2-1	OPEN	2-3	SPDT
DP	**MS22** **MS23**	ON ON	NONE OFF	ON ON	2-1 5-4	OPEN	2-3 5-6	DPDT 

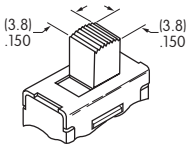
Note: Terminal numbers are not actually on the switch.

For 3 Throw (3-On)

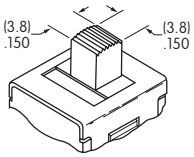
Pole	Model	Connected Terminals & Schematics: Left	Center	Right	External Connection
SP	**MS20**	ON  2-1 5-4	ON  2-3 5-4	ON  2-3 5-6	**The SP3T model utilizes a double pole base.** External connections must be made during field installation. 

ACTUATORS

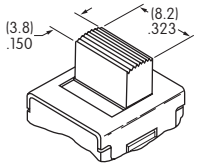
A **.150" (3.8mm) Wide for Single Pole**



.150" (3.8mm) Wide for Double Pole



B **.323" (8.2mm) Wide for Double Pole Only**



CONTACT MATERIALS & RATINGS

W **Silver over Silver** — **Power Level** — **6A @ 125V AC & 3A @ 250V AC**

G **Gold over Brass or Copper** — **Logic Level** — **0.4VA maximum @ 28V AC/DC maximum**

Note: Complete explanation of operating range in Supplement section.

A **Gold over Silver** — **Power Level or Logic Level** — **6A @ 125V AC or 0.4VA maximum @ 28V AC/DC maximum**

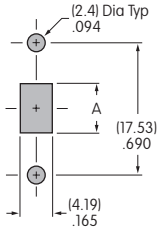
Note: This dual rated option is suitable when two or more identical switches are used in logic and in power circuits within the same application. See Supplement section for complete explanation of dual rating and operating range.

MOUNTING TYPES & TERMINALS

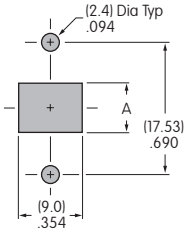
F **Panel Mount (Combines with Solder Lug Terminal 01 only)**

Dimension A =
.268″ (6.8mm) for on-none-on
.319″ (8.1mm) for on-off-on & on-on-on

Maximum Panel Thickness: .197″ (5.0mm)



SP or DP with .150″ (3.8mm) Actuator



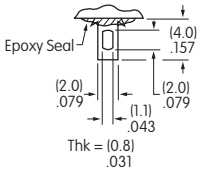
DP only with .323″ (8.2mm) Actuator

N **Straight PC Mount (Combines with Straight PC Terminal 03 only)**

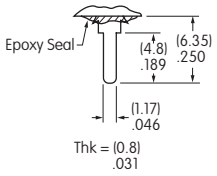
S **Support Bracket Mount (For Terminals 13, 30, & 40)**

Maximum Panel Thickness:
For Straight PC with Bracket Terminal 13: .197″ (5.0mm)
For Angle Mount Terminals 30 & 40: .177″ (4.5mm)

01 **Solder Lug**



03 **Straight PC**



13 **Straight PC with Bracket**

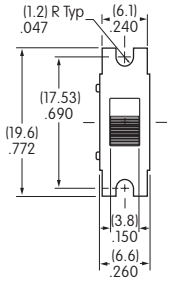
30 **Right Angle PC**

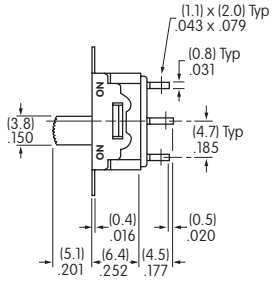
40 **Vertical PC**

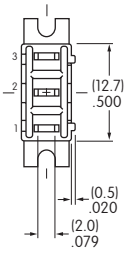
TYPICAL SWITCH DIMENSIONS

Solder Lug Terminals

Single Pole





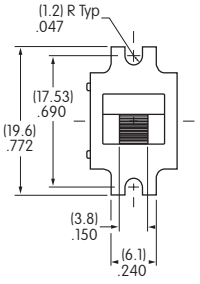


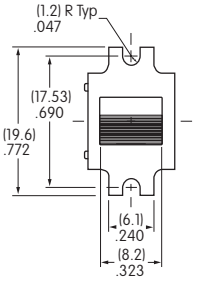
MS12AFW01

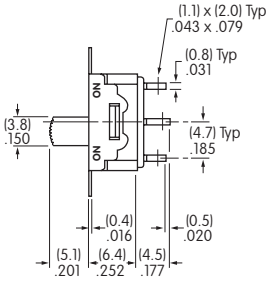
Actuator in LEFT Position

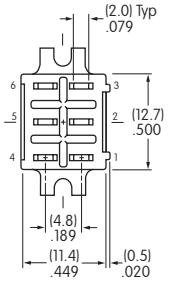
Solder Lug Terminals

Double Pole







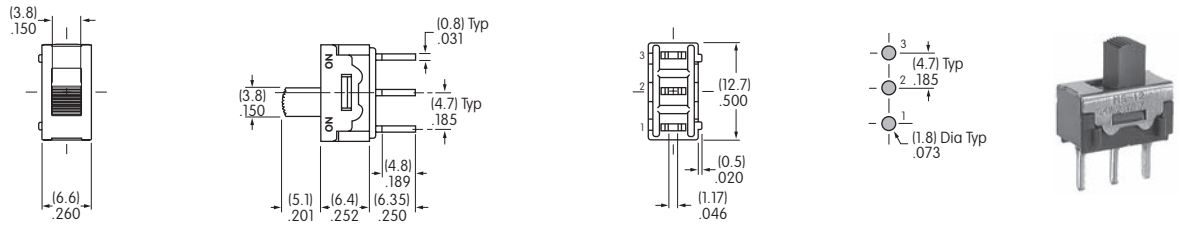


MS22BFW01

Actuator in LEFT Position

TYPICAL SWITCH DIMENSIONS

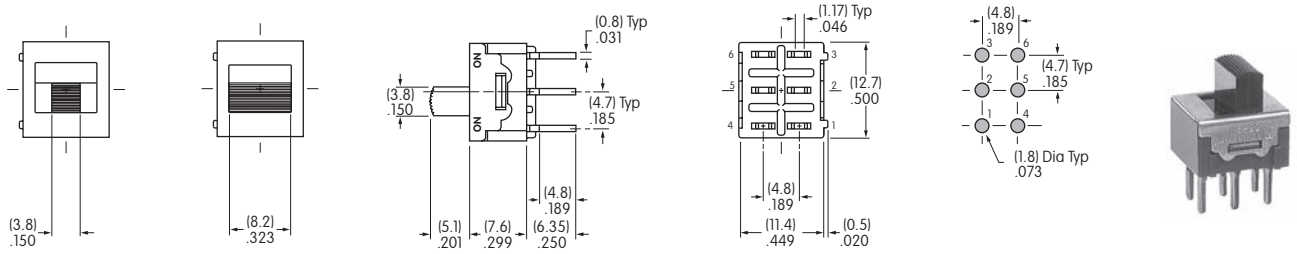
Single Pole — Straight PC Terminals



Actuator in LEFT Position

MS12ANG03

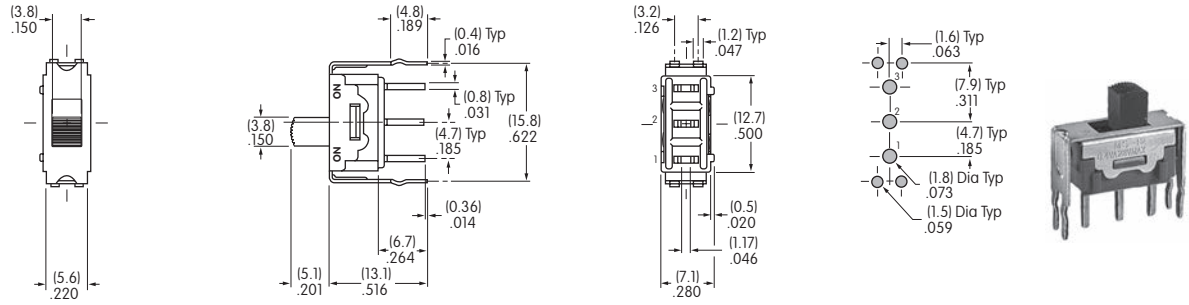
Double Pole — Straight PC Terminals



Actuator in LEFT Position

MS22BNG03

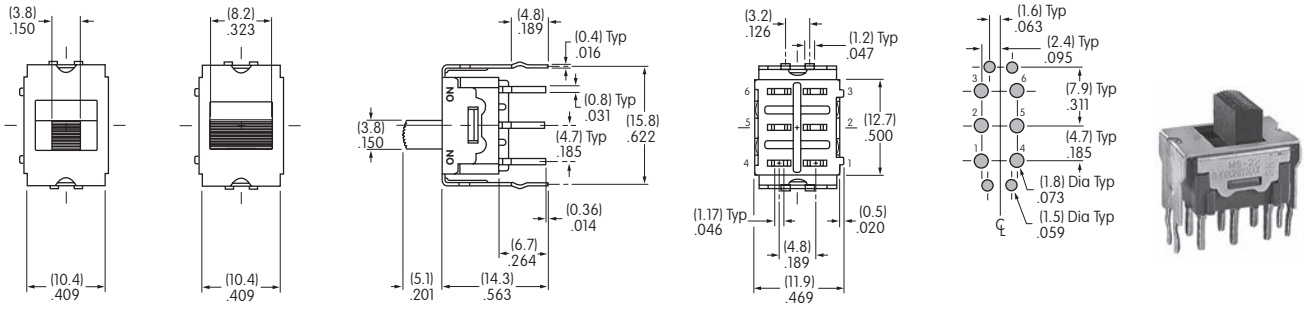
Single Pole — Straight PC Terminals with Bracket



Actuator in LEFT Position

MS12ASG13

Double Pole — Straight PC Terminals with Bracket

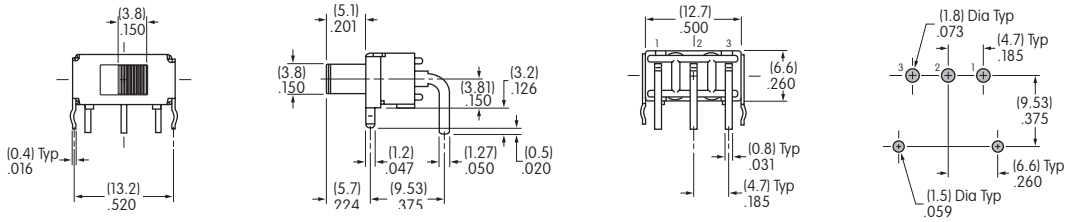


Actuator in LEFT Position

MS22BSG13

TYPICAL SWITCH DIMENSIONS

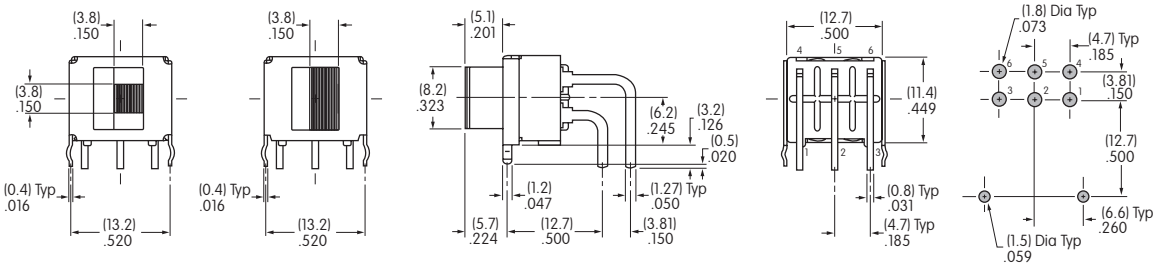
Right Angle PC Terminals — Single Pole



MS12ASG30

Actuator in LEFT Position

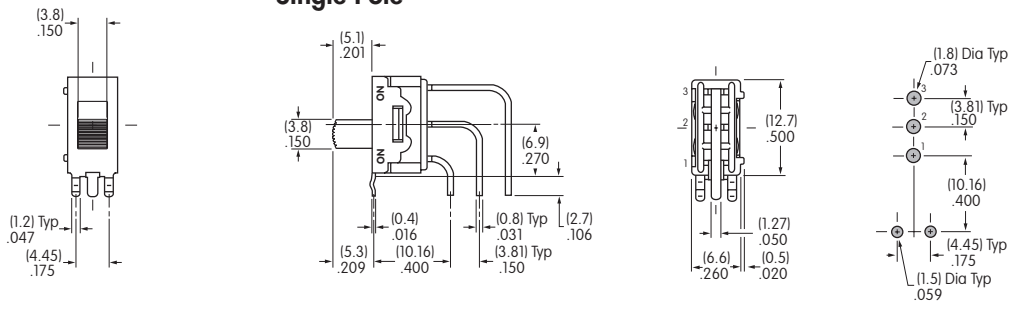
Right Angle PC Terminals — Double Pole



MS22BSG30

Actuator in LEFT Position

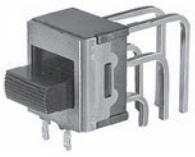
Vertical PC Terminals — Single Pole

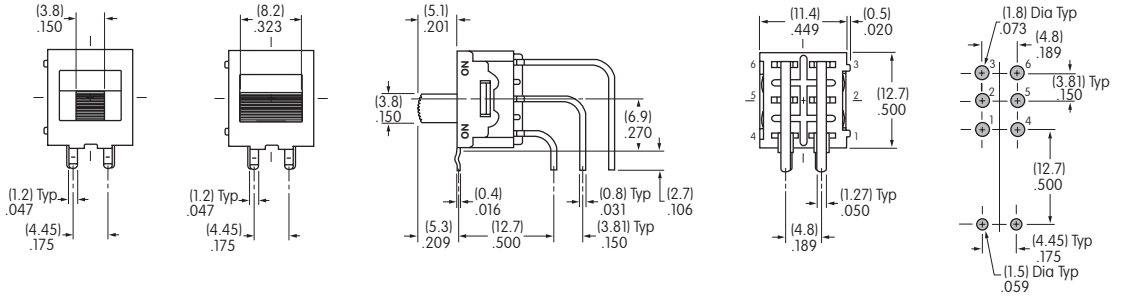


MS12ASG40

Actuator in LEFT Position

Vertical PC Terminals — Double Pole





MS22BSG40

Actuator in LEFT Position

General Specifications

Electrical Capacity (Resistive Load)

Power Level: 6A @ 125V AC or 3A @ 250V AC

Other Ratings

Contact Resistance: 10 milliohms maximum
Insulation Resistance: 1,000 megohms minimum @ 500V DC
Dielectric Strength: 1,000V AC minimum between contacts for 1 minute minimum;
1,500V AC minimum between contacts & case for 1 minute minimum
Mechanical Life: 50,000 operations minimum
Electrical Life: 25,000 operations minimum
Contact Timing: Nonshorting (break-before-make)
Total Travel: .087" (2.2mm)

Materials & Finishes

Actuator: Polyamide (UL94V-0)
Frame: Stainless steel
Case: Glass fiber reinforced diallyl phthalate resin (UL94V-0)
Movable Contacts: Silver alloy
Stationary Contacts: Silver capped copper with silver plating
Terminals: Copper or brass with silver plating

Environmental Data

Operating Temp Range: –10°C through +55°C (+14°F through +131°F)
Humidity: 90 ~ 95% humidity for 96 hours @ 40°C (104°F)
Vibration: 10 ~ 55Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range
& returning in 1 minute; 3 right angled directions for 2 hours
Shock: 50G (490m/s^2) acceleration (tested in 6 right angled directions, with 5 shocks in each direction)

Processing

Soldering Time & Temp: Wave Soldering Recommended (PC version): See Profile A in Supplement section.
Manual Soldering: See Profile A in Supplement section.
Note: Lever must be in center position while soldering.
Cleaning: These devices are not process sealed. Hand clean locally using alcohol based solution.

Standards & Certifications

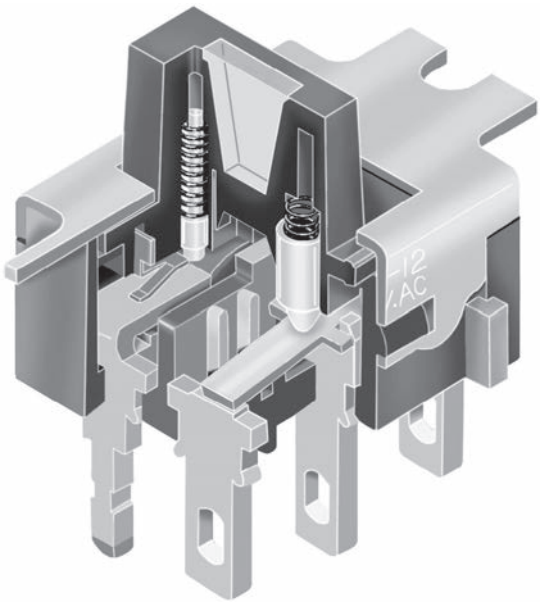
Flammability Standards: UL94V-0 rated actuator & case

Distinctive Characteristics

Bright, LED illumination at top of actuator.

Over-center actuator block and plunger design gives crisp actuation, diminishes sparking, and increases operating life.

Guide interlocked with actuator block prevents window locking and maintains correct plunger alignment to assure contact stability.



Antijamming design protects contacts from damage due to excessive downward force on the actuator.

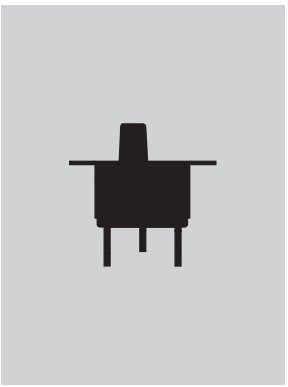
High internal barriers between poles and insulating sheet between case and actuator block give added protection to contacts.

Prominent external insulating barriers increase insulation resistance and dielectric strength.

Epoxy sealed terminals prevent entry of flux, solvents, and other contaminants.

Clinching of frame to case well above base and terminals provides 1,500V dielectric strength.

Actual Size



TYPICAL SWITCH ORDERING EXAMPLE

MS | 1 | 2 | L | F | W | 01 | C

Poles

1	SPDT

Illumination

L	LED Lighted

Contact Materials & Ratings

W	Silver; Rated 6A @ 125V AC & 3A @ 250V AC

LEDS

C	Red
E	Yellow
F	Green

Circuits

2	ON	NONE	ON
3	ON	OFF	ON

Mounting

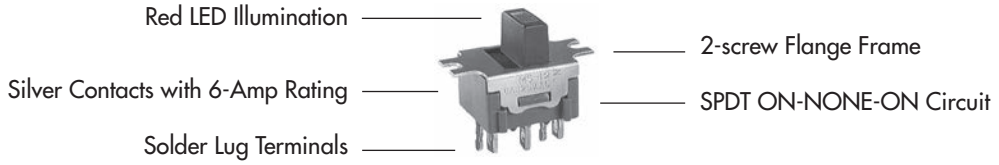
N	For Straight PC (Terminal 03 only)
F	With 2-screw Flange (Terminal 01 only)

Terminals

01	Solder Lug
03	Straight PC

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

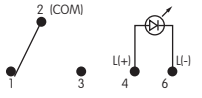
MS12LFW01C



POLES & CIRCUITS

Pole	Model	Slide Position: Left	Center	Right	Connected Terminals: Left	Center	Right	Throw & Schematics
SP	MS12	ON	NONE	ON	2-1	OPEN	2-3	SPDT
	MS13	ON	OFF	ON				

Note: Terminal numbers are not actually on the switch. LED circuit is isolated and requires an external connection.



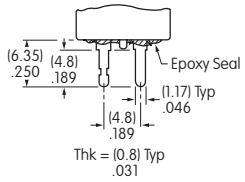
CONTACT MATERIALS & RATINGS

W	Silver over Silver	Power Level	6A @ 125V AC & 3A @ 250V AC

MOUNTING TYPES & TERMINALS

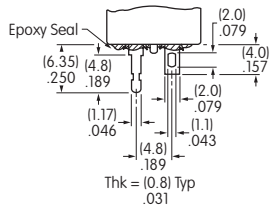
N **Straight PC Mount (Combines with Straight PC Terminal 03 only)**

03 **Straight PC**



F **2-screw Flange (Combines with Solder Lug Terminal 01 only)**

01 **Solder Lug**



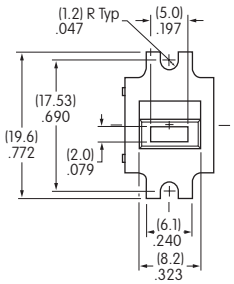
LED COLORS & SPECIFICATIONS

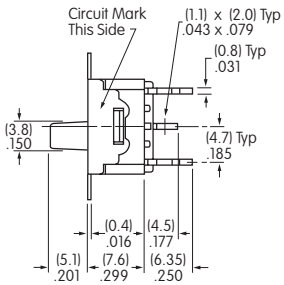
LEDs are supplied as an integral part of the switch (not available separately). The lamp circuit is independent of switch operation. Electrical specifications shown are determined at a basic temperature of 25°C.
If the source voltage exceeds the rated voltage, a ballast resistor is required. The resistor value can be calculated by using the formula given in the Supplement.

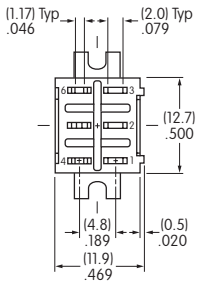
(+) (-)	Color	C Red	E Yellow	F Green
Maximum Forward Current	I_{FM}	30mA	30mA	25mA
Typical Forward Current	I_F	16mA	16mA	16mA
Forward Voltage	V_F	1.98V	2.06V	2.16V
Maximum Reverse Voltage	V_{RM}	5V	5V	5V
Current Reduction Rate Above 25°C	ΔI_F	0.40mA/°C	0.42mA/°C	0.33mA/°C
Ambient Temperature Range		−15° ~ +60°C		

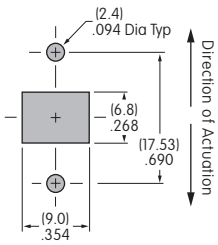
TYPICAL SWITCH DIMENSIONS

Solder Lug Terminals







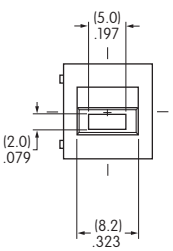


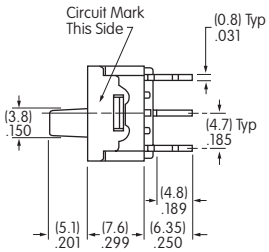
Actuator in LEFT Position

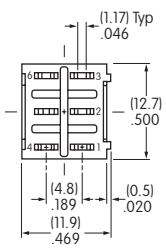
Maximum Panel Thickness .197" (5.0mm)

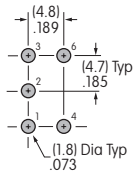
MS12LFW01C

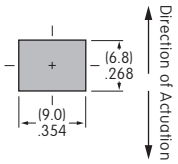
Straight PC Terminals











Actuator in LEFT Position

Maximum Panel Thickness .197" (5.0mm)

MS12LNW03C

General Specifications

Electrical Capacity (Resistive Load)

Maximum Level: 500mA @ 12V DC
Minimum Level: 1.0mA maximum @ 10mV AC/DC maximum

Other Ratings

Contact Resistance: 30 milliohms maximum
Insulation Resistance: 100 megohms minimum @ 500V DC
Dielectric Strength: 500V AC for 1 minute minimum
Mechanical Life: 1,000 operations minimum
Electrical Life: 1,000 operations minimum
Nominal Operating Force: 2.0N
Contact Timing: Nonshorting (Break-before-make)
Total Travel: .063" (1.6mm)

Materials & Finishes

Actuator: Glass fiber reinforced polyester (UL94V-0)
Case: Glass fiber reinforced polyamide (UL94V-0)
Lower Case: Glass fiber reinforced polyester (UL94V-0)
Movable Contacts: Brass with gold plating over nickel
Stationary Contacts Brass with gold plating over nickel
Terminals: Brass with gold plating over nickel

Environmental Data

Operating Temp Range: –40°C through +85°C (–40°F through +185°F)
Humidity: 90-95% humidity for 96 hours @ 40°C (104°F)
Vibration: 10 ~ 55Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in 1 minute; 3 right angled directions for 2 hours
Shock: 50G (490m/s^2) acceleration (tested in 6 right angled directions, with 5 shocks in each direction)

PCB Processing

Soldering: Wave Soldering Recommended: See Profile A in Supplement section.
Manual Soldering: See Profile B in Supplement section.
Cleaning: These devices are not process sealed. Hand clean locally using alcohol based solution.

Standards & Certifications

Flammability Standards: Actuator and lower case of glass fiber reinforced polyester and case of glass fiber reinforced polyamide UL94V-0
The SM series devices have not been tested for UL recognition and CSA certification.
These switches are designed for use in a low-voltage, low-current circuit.
When used as intended in a low-voltage, low-current circuit, the results do not produce hazardous energy.

Distinctive Characteristics

Very compact dimensions allow for high density, side-by-side or end-to-end mounting within tight dimensional applications.

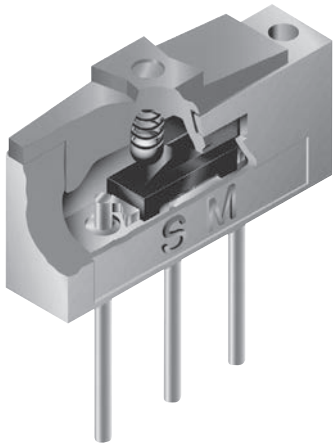
Detent mechanism provides positive actuation to indicate circuit status.

Visible indication of position by spot on top of red actuator and through window on side.

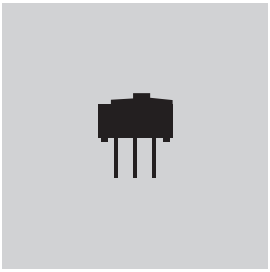
Twin sliding contact mechanism with self-cleaning action provides smooth actuation and produces high contact reliability.

.100" x .100" (2.54mm x .2.54mm) center-to-center inch terminal spacing allows standard PC board mounting in side-by-side or end-to-end arrangements.

Insert molded terminals lock out flux, solvents, and other contaminants.



Actual Size

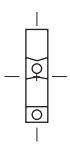


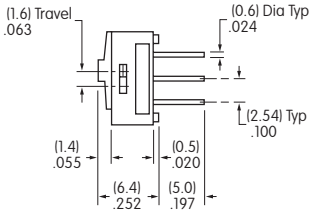
POLES & CIRCUITS

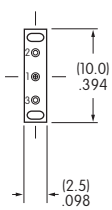
	Slide Position			Connected Terminals			Throw & Schematics
Model	Right	Center	Left	Right	Center	Left	Note: Terminal numbers are on the switch.
SM0320102	ON	NONE	ON	1-3	OPEN	1-2	SPDT

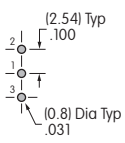
TYPICAL SWITCH DIMENSIONS

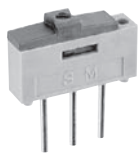
Single Pole • Straight PC











Actuator shown in RIGHT position

SM0320102

General Specifications

Electrical Capacity (Resistive Load)

Power Level (silver): 0.1A @ 30V DC
Logic Level (gold): 0.4VA maximum @ 28V AC/DC maximum
(Applicable Range 0.1mA ~ 0.1A @ 20mV ~ 28V)
Note: Find additional explanation of operating range in Supplement section.

Other Ratings

Contact Resistance: 20 milliohms maximum for power level; 40 milliohms maximum for logic level
Insulation Resistance: 100 megohms minimum @ 500V DC
Dielectric Strength: 500V AC minimum 1 minute minimum
Mechanical Life: 10,000 operations minimum
Electrical Life: 10,000 operations minimum
Contact Timing: SS12S & SS22S – Shorting (make-before-break)
Total Travel: .079" (2.0mm)

Materials & Finishes

Actuator: Polyamide
Upper Case: Polyester for 3-On models; polyacetal for all other models
Lower Case: Glass fiber reinforced polyester for 3-On models;
glass fiber reinforced polybutylene terephthalate (thermoplastic) for other models
Movable Contactor: Phosphor bronze with silver plating (code 2) or
phosphor bronze with gold plating (code 4)
Interior Base: Phenolic resin (thermoset)
Terminals: Brass with silver plating over copper plating or brass with gold plating

Environmental Data

Operating Temp Range: –15°C through +60°C (+5°F through +140°F)
Humidity: 90 ~ 95% humidity for 96 hours @ 40°C (104°F)
Vibration: 10 ~ 55Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in 1 minute; 3 right angled directions for 2 hours
Shock: 50G (490m/s^2) acceleration (tested in 6 right angled directions, with 5 shocks in each direction)

PCB Processing

Soldering: Wave Soldering: For non-supported through-hole, see Profile B in Supplement section.
For supported through-hole, 5 seconds maximum @ 250°C maximum.
Manual Solder: See Profile B in Supplement section.
Cleaning: These devices are not process sealed. Hand clean locally using alcohol based solution.

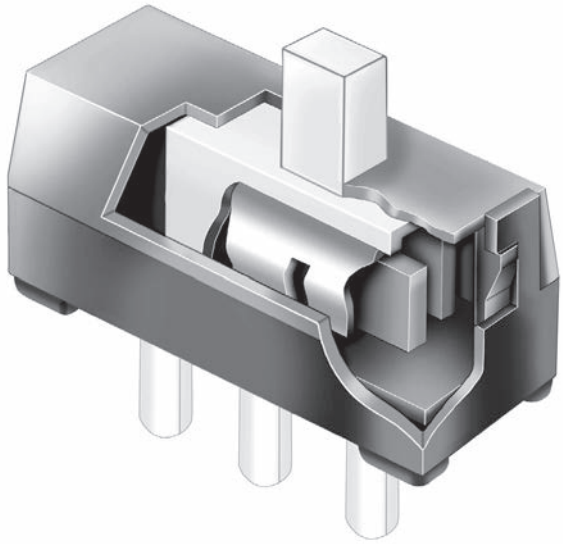
Standards & Certifications

The SS series devices have not been tested for UL recognition and CSA certification.
These switches are designed for use in a low-voltage, low-current circuit.
When used as intended in a low-voltage, low-current circuit, the results do not produce hazardous energy.

Distinctive Characteristics

Top or side actuation permits flexible board design.

Compact dimensions and low profile allow high density mounting and close stacking of PC boards.



Crisp actuation positively indicates circuit status.

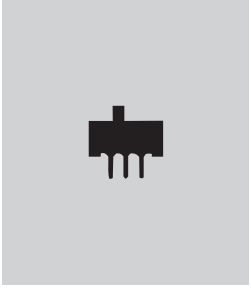
Double molded thermoset base and thermo-plastic housing prevent loosening of terminals due to high soldering temperatures.

Award-winning STC mechanism with benefits unavailable in conventional mechanisms: smoother, positive detend actuation, increased contact stability, and unparalleled logic-level reliability. (Additional STC details in Terms and Acronyms in the Supplement section.)

Insert molded terminals lock out flux, solvents, and other contaminants.

Inch or metric terminal spacing for standard PC board grid (.100" x .100" or 2.0mm x 2.0mm).

Actual Size



TYPICAL SWITCH ORDERING EXAMPLE

SS | 12S | D | P | 2

Poles & Circuits

12S	SPDT	ON	NONE	ON
SS12S model has shorting contacts.				
***14M**	SP3T	ON	ON	ON
22S	DPDT	ON	NONE	ON
SS22S model has shorting contacts.				
See Poles & Circuits chart below.				
* 14M Circuit with silver contacts only.				

Terminal Spacing

B	Metric 2.0mm x 2.0mm
D	Inch .100" x .100"

Actuation

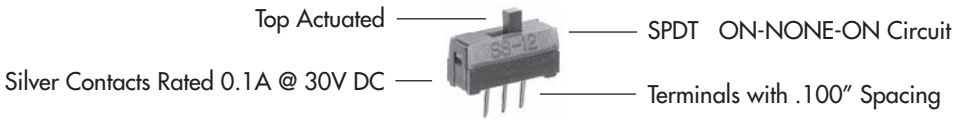
P	Top Actuated
H	Side Actuated

Contact Material & Ratings

2	Silver Rated 0.1A @ 30V DC
***4**	Gold Rated 0.4VA maximum @ 28V AC/DC maximum
* Gold not available with SS14M.	

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

SS12SDP2

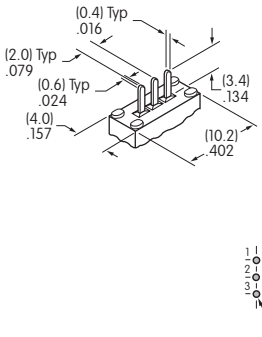


POLES & CIRCUITS

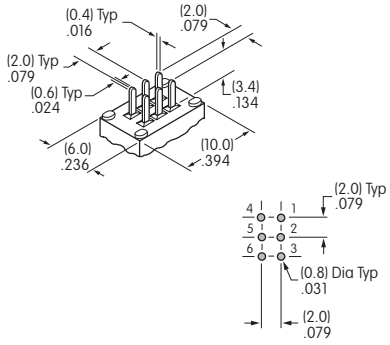
		Slide Position			Connected Terminals			Throw & Schematics
Pole	Model	Right	Center	Left	Right	Center	Left	Note: Terminal numbers are not actually on switch.
SP	**SS12S**	ON	NONE	ON	2-1	NONE	2-3	SPDT
SP	**SS14M**	ON	ON	ON	3-4	3-2	3-1	SP3T ON-OFF-ON circuit can be created by not connecting terminal 2.
DP	**SS22S**	ON	NONE	ON	2-1 5-4	NONE	2-3 5-6	DPDT

TERMINAL SPACING

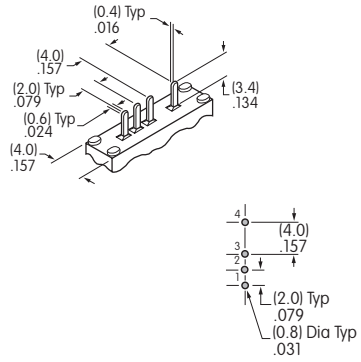
B **Metric 2.0mm x 2.0mm with Black Base**



On-None-On Single Pole Models

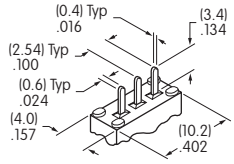


On-None-On Double Pole Models

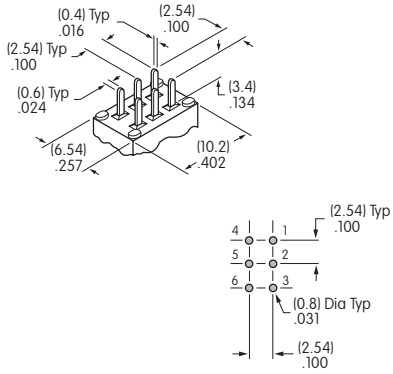


3-On Models

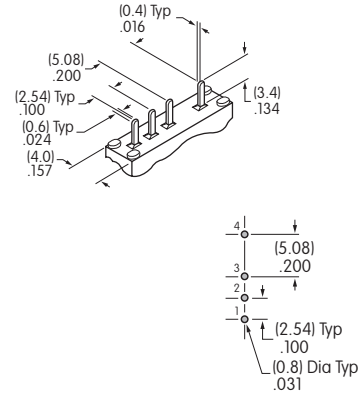
D **Inch .100" x .100" with Gray Base**



On-None-On Single Pole Models



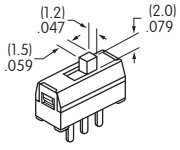
On-None-On Double Pole Models



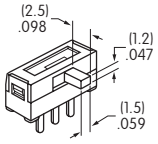
3-On Models

ACTUATION

P **Top Actuated**



H **Side Actuated**



CONTACT MATERIALS & RATINGS

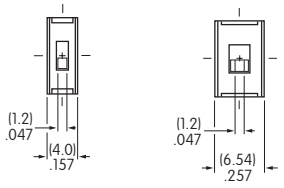
2 **Silver over Phosphor Bronze** **Power Level** **0.1A @ 30V DC**

4 **Gold over Silver/Phosphor Bronze** **Logic Level** **0.4VA max @ 28V AC/DC max**

Complete explanation of operating range in Supplement section.

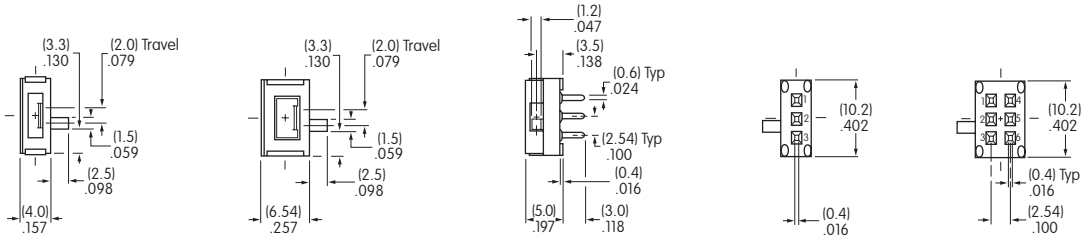
TYPICAL SWITCH DIMENSIONS

Top Actuated — Single & Double Pole



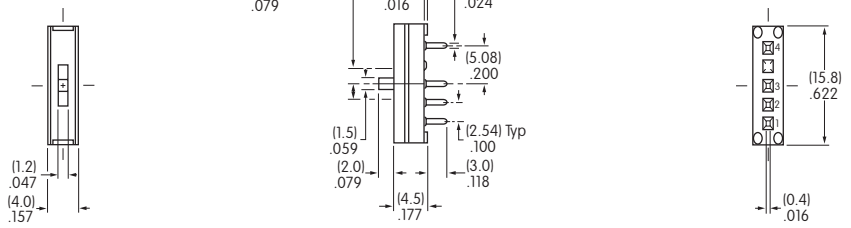
SS12SDP2

Side Actuated — Single & Double Pole



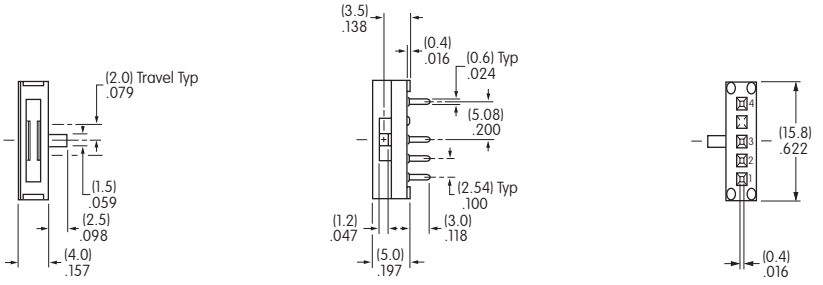
SS12SDH2

3-On Circuit • Top Actuated — Single Pole



SS14MDP2

3-On Circuit • Side Actuated — Single Pole



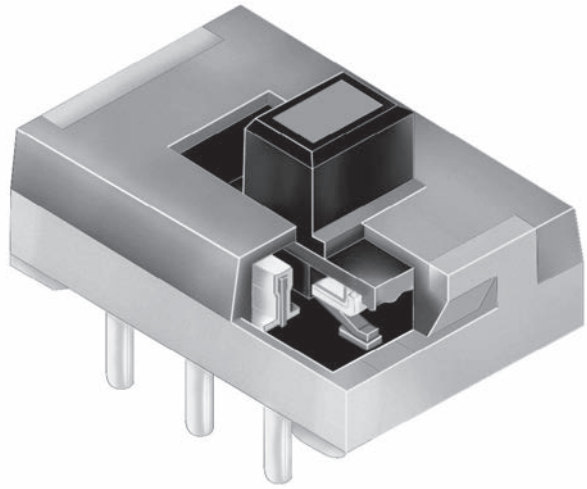
SS14MDH2

Distinctive Characteristics

Top or side actuation permits flexible board design.

Bright, LED illumination at tip of actuator.

Compact dimensions and low profile allow high density mounting and close stacking of PC boards.



Crisp actuation positively indicates circuit status.

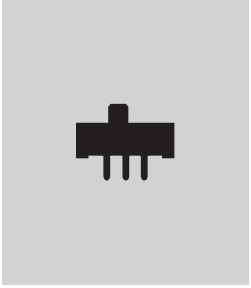
Double molded thermoset base and thermoplastic housing prevent loosening of terminals due to high soldering temperatures.

Sliding twin contact mechanism with self-cleaning action provides smooth actuation and produces high contact reliability.

Insert molded terminals lock out flux, solvents, and other contaminants.

Inch terminal spacing for standard PC board grid (.100" x .100").

Actual Size



General Specifications

Electrical Capacity (Resistive Load)

Power Level: 0.1A @ 30V DC

Other Ratings

Contact Resistance: 20 milliohms maximum
Insulation Resistance: 100 megohms minimum @ 500V DC
Dielectric Strength: 500V AC minimum 1 minute minimum
Mechanical Life: 10,000 operations minimum
Electrical Life: 10,000 operations minimum
Contact Timing: Shorting (make-before-break)
Total Travel: .079" (2.0mm)

Materials & Finishes

Actuator: Polyacetal
Upper Case: Polyacetal
Lower Case: Glass fiber reinforced polyester
Movable Contactor: Phosphor bronze with silver plating
Interior Base: Phenolic resin (thermoset)
Terminals: Brass with silver plating over copper plating

Environmental Data

Operating Temp Range: –15°C through +60°C (+5°F through +140°F)
Humidity: 90 ~ 95% humidity for 96 hours @ 40°C (104°F)
Vibration: 10 ~ 55Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in 1 minute; 3 right angled directions for 2 hours
Shock: 50G (490m/s^2) acceleration (tested in 6 right angled directions, with 5 shocks in each direction)

PCB Processing

Soldering: Wave Soldering: For non-supported through-hole, see Profile B in Supplement section. For supported through-hole, 5 seconds maximum @ 250°C maximum. Manual Soldering: See Profile B in Supplement section.
Cleaning: These devices are not process sealed. Hand clean locally using alcohol based solution.

Standards & Certifications

The SS series devices have not been tested for UL recognition and CSA certification.
These switches are designed for use in a low-voltage, low-current circuit.
When used as intended in a low-voltage, low-current circuit, the results do not produce hazardous energy.

TYPICAL SWITCH ORDERING EXAMPLE

SS | 12S | D | P | 2 | L | C

Poles & Circuits

12S	SPDT	ON	NONE	ON
22S	DPDT	ON	NONE	ON

Actuation

P	Top Actuated
H	Side Actuated

LED Colors

C	Red
E	Yellow
F	Green

Terminal Spacing

D	Inch .100" x .100"

Contact Material & Ratings

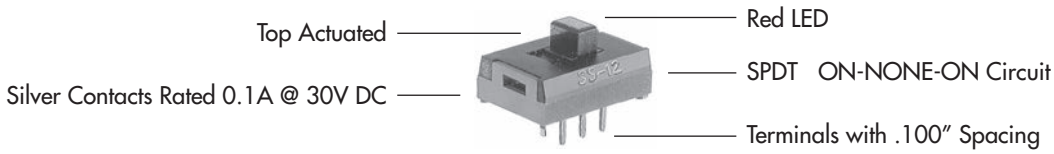
2	Silver Rated 0.1A @ 30V DC

LED Circuit

L	Isolated

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

SS12SDP2LC



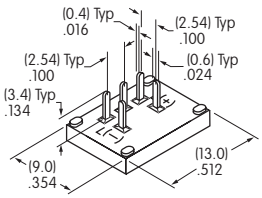
POLES & CIRCUITS

		Slide Position			Connected Terminals			Throw & Schematics
Pole	Model	Right	Center	Left	Right	Center	Left	Note: Terminal numbers are not actually on switch. Isolated LED circuit requires external power source.
SP	**SS12S**	ON	NONE	ON	2-1	NONE	2-3	SPDT
DP	**SS22S**	ON	NONE	ON	2-1 5-4	NONE	2-3 5-6	DPDT

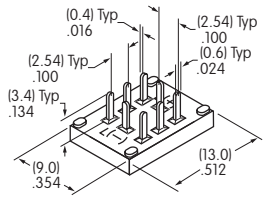
TERMINAL SPACING

D **Inch .100" x .100"**

Single Pole Models



Double Pole Models



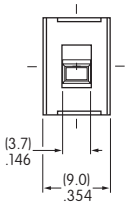
CONTACT MATERIALS & RATINGS

2 Silver over Phosphor Bronze

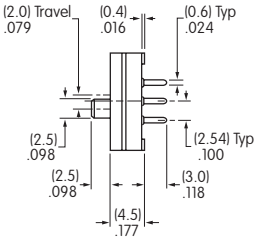
Power Level 0.1A @ 30V DC

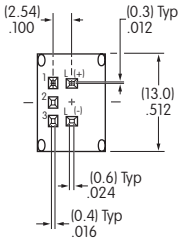
TYPICAL SWITCH DIMENSIONS

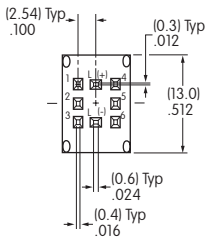
Top Actuated

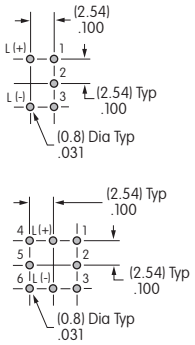


Single & Double Pole



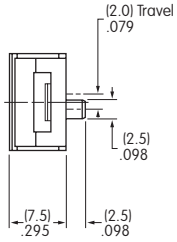




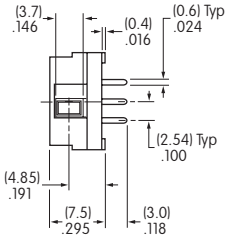


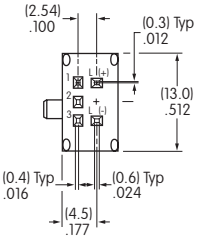
SS22SDP2LC

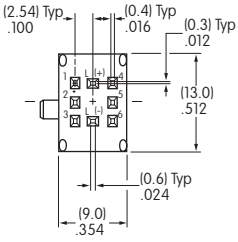
Side Actuated

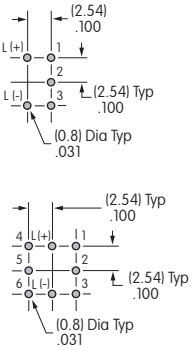


Single & Double Pole









SS12SDH2LC

LED COLORS & SPECIFICATIONS

LEDs are supplied as an integral part of the switch (not available separately). The lamp circuit is independent of switch operation. Electrical specifications shown are determined at a basic temperature of 25°C.
If the source voltage exceeds the rated voltage, a ballast resistor is required. The resistor value can be calculated by using the formula given in the Supplement.

L Isolated, 1-element (+)○ ○(-)	Color	**C** Red	**E** Yellow	**F** Green
Maximum Forward Current	I_{FM}	30mA	30mA	25mA
Typical Forward Current	I_F	16mA	16mA	16mA
Forward Voltage	V_F	1.98V	2.06V	2.16V
Maximum Reverse Voltage	V_{RM}	5V	5V	5V
Current Reduction Rate Above 25°C	ΔI_F	0.40mA/°C	0.42mA/°C	0.33mA/°C
Ambient Temperature Range		−15° ~ +60°C		

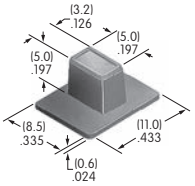
OPTIONAL CAP

AT4065 Slide Cap

Material: Polycarbonate

Cap can be assembled on request

Cap Color: Black only



Window color should match LED color.

Colors Available:

C Red **E** Yellow **F** Green

Distinctive Characteristics

Compact dimensions and low profile allow high density mounting and close stacking of PC boards.

Crisp actuation positively indicates circuit status.

Heat resistant resin allows vapor phase and infrared convection reflow soldering.

Award-winning STC mechanism with benefits unavailable in conventional mechanisms: smoother, positive detent actuation, increased contact stability, and unparalleled logic-level reliability. (Additional STC details in Terms and Acronyms in the Supplement section.)

Insert molded terminals lock out flux, solvents, and other contaminants.

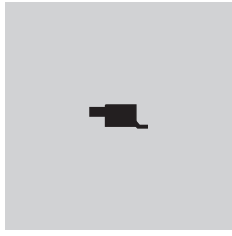
Metric terminal spacing for standard PC board grid (2.0mm x 2.0mm).

Gull-wing terminals provide mechanical stability during soldering and simplified solder joint inspection.

Packaged in tape-reel or partitioned tray. Tape-reel packaging meets EIA-481-D Standard.

Coplanarity: all considered surfaces must lie between two parallel planes that are a maximum distance apart of .0059" (0.15mm). (Additional coplanarity details in Terms and Acronyms in the Supplement section.)

Actual Size



General Specifications

Electrical Capacity (Resistive Load)

Logic Level: 0.4VA maximum @ 28V AC/DC maximum
(Applicable Range 0.1mA ~ 0.1A @ 20mV ~ 28V)
Note: Find additional explanation of operating range in Supplement section.

Other Ratings

Contact Resistance: 50 milliohms maximum
Insulation Resistance: 100 megohms minimum @ 500V DC
Dielectric Strength: 500V AC minimum for 1 minute minimum
Mechanical Life: 10,000 operations minimum
Electrical Life: 10,000 operations minimum
Contact Timing: SS312S ~ Shorting (make-before-break)
Total Travel: .079" (2.0mm)

Materials & Finishes

Actuator: Polyphenylene sulfide
Housing: Phosphor bronze with tin plating (UL94V-0)
Base: Polyphenylene sulfide (UL94V-0)
Movable Contactor: Phosphor bronze with gold plating over silver plating (code 4)
Terminals: Phosphor bronze with gold plating

Environmental Data

Operating Temp Range: –25°C through +85°C (–13°F through +185°F)
Humidity: 90 ~ 95% humidity for 240 hours @ 40°C (104°F)
Vibration: 10 ~ 55Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in 1 minute; 3 right angled directions for 2 hours
Shock: 50G (490m/s^2) acceleration (tested in 6 right angled directions, with 5 shocks in each direction)

Installation

Soldering: Reflow Soldering Recommended. See Profile A in Supplement section.
Manual Soldering: See Profile A in Supplement section.
Cleaning: These devices are not process sealed. Hand clean locally using alcohol based solution.

Standards & Certifications

Flammability Standards: UL 94V-0 rated housing & base
The SS3 Series slides have not been tested for UL recognition or CSA certification.
These switches are designed for use in a low-voltage, low-current, logic-level circuit.
When used as intended in a logic-level circuit, the results do not produce hazardous energy.

TYPICAL SWITCH ORDERING EXAMPLE

SS3 | 14M | A | H | 4 | — | □

Poles & Circuits

12S	SPDT	ON	NONE	ON

SS312S model has shorting contacts.

14M	SPDT	ON	OFF	ON
	SP3T	ON	ON	ON

For 3-on: External connection must be made during installation; see Poles & Circuits chart.

Actuation

H	Side Actuated

Packaging

R	Tape-Reel 500 Pieces/Reel
No Code	Partitioned Tray

Terminal Spacing

A	Metric 2.0mm x 2.0mm

Contact Material & Rating

4	Gold Rated 0.4VA maximum @ 28V AC/DC maximum

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

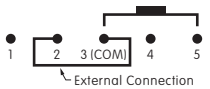
SS314MAH4

- Gold Contacts with 0.4VA Rating
- Side Actuated
- SPDT ON-OFF-ON Circuit
- 2.0mm x 2.0mm Terminal Spacing

Series SS3

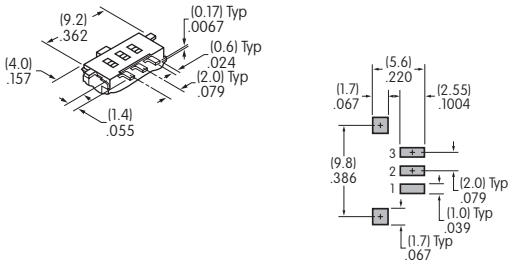
Ultra-Miniature SMT Slides

POLES & CIRCUITS

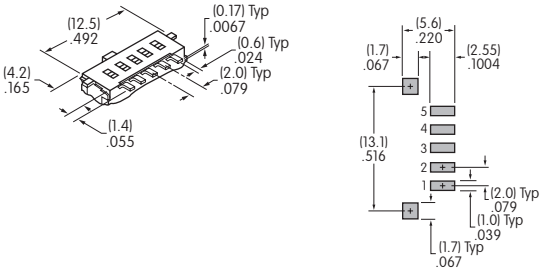
Pole	Model	Slide Position: Right	Slide Position: Center	Slide Position: Left	Connected Terminals: Right	Connected Terminals: Center	Connected Terminals: Left	Throw & Schematics
								Note: Terminal numbers are not actually on switch.
SP	SS312S	ON	NONE	ON	2-3	NONE	2-1	SPDT
SP	SS314M	ON	OFF	ON	3-5	4-2	3-1	SPDT
		ON	ON	ON	3-5	3-4	3-1	SP3T  External connection must be made during installation to create ON-ON-ON circuit.

TERMINAL SPACING

A **Metric 2.0mm x 2.0mm**



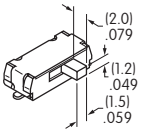
SS312



SS314

ACTUATION

H **Side Actuated**



CONTACT MATERIALS & RATING

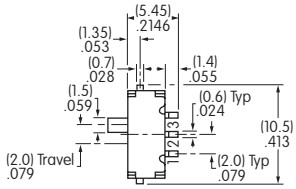
4 **Gold over Silver/Phosphor Bronze** **Logic Level** **0.4VA maximum @ 28V AC/DC maximum**

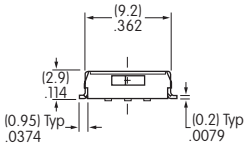
Complete explanation of operating range in Supplement section.

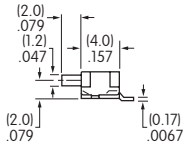
TYPICAL SWITCH DIMENSIONS

Shorting Contacts

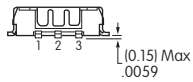
Single Pole







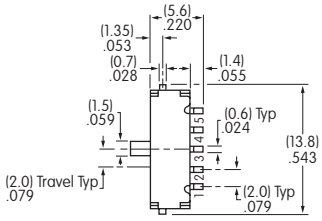
Coplanar Dimension

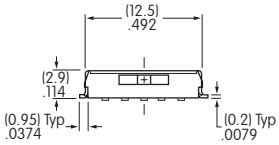


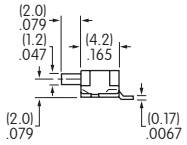
SS312SAH4

Nonshorting Contacts

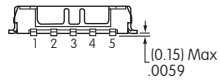
Single Pole







Coplanar Dimension



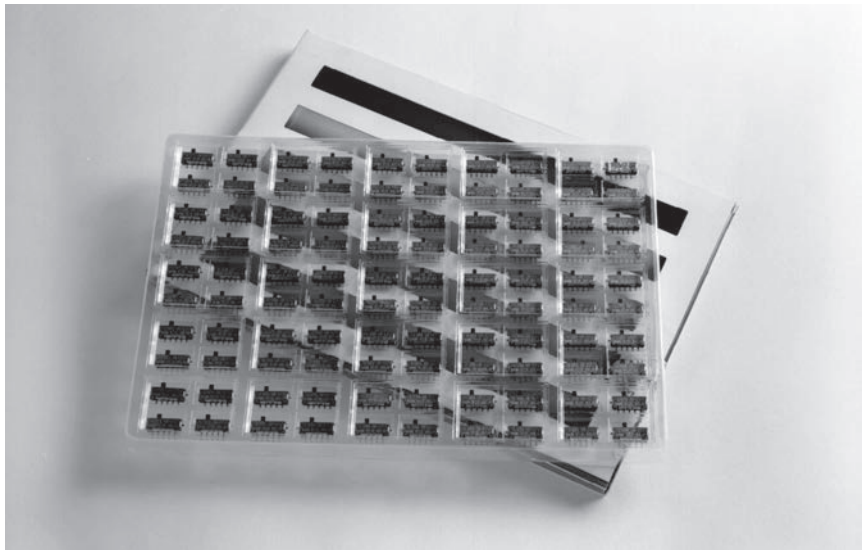
SS314MAH4

PACKAGING

No Code

Partitioned Tray

If the SS3 is ordered in less than 500-piece increments, the switches are packaged in a partitioned tray. No code is required.

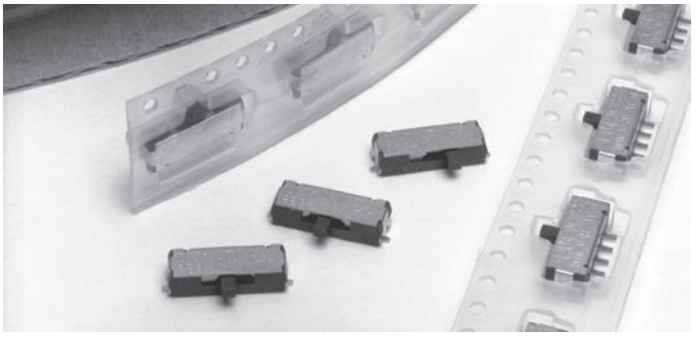


PACKAGING

R **Tape-Reel Packaging**

Switches must be ordered in 500-piece increments when tape-reel packaging is selected.

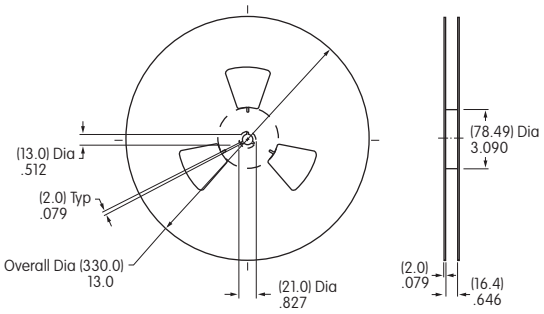
Tape-reel packaging meets EIA-481-D Standard.



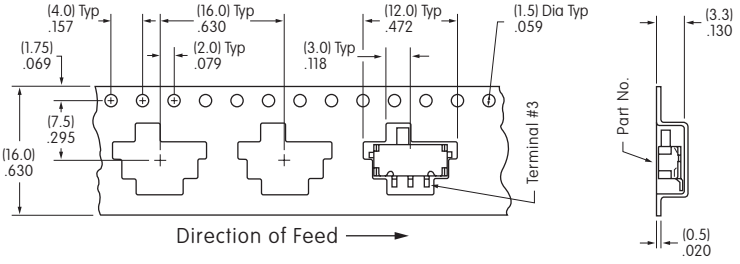
Tape-Reel Packaging for SS312SAH4

Each tape-reel of 530 pockets contains 500 switches.

Minimum Leader Length: 11.97" (304mm) Minimum Trailer Length: 6.93" (176mm)



Reel Dimensions

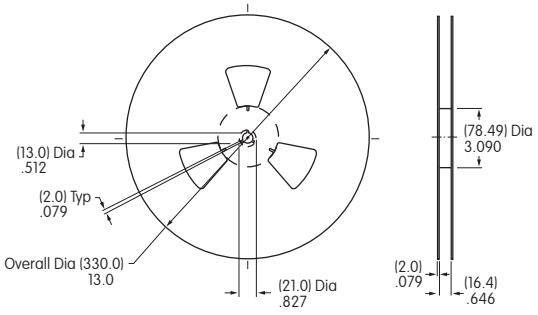


Tape Dimensions

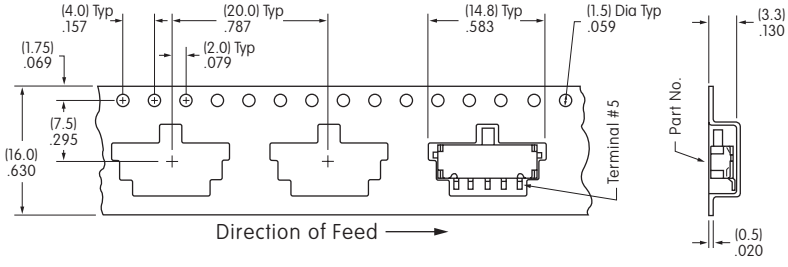
Tape-Reel Packaging for SS314MAH4

Each tape-reel of 530 pockets contains 500 switches.

Minimum Leader Length: 14.96" (380mm) Minimum Trailer Length: 8.66" (220mm)



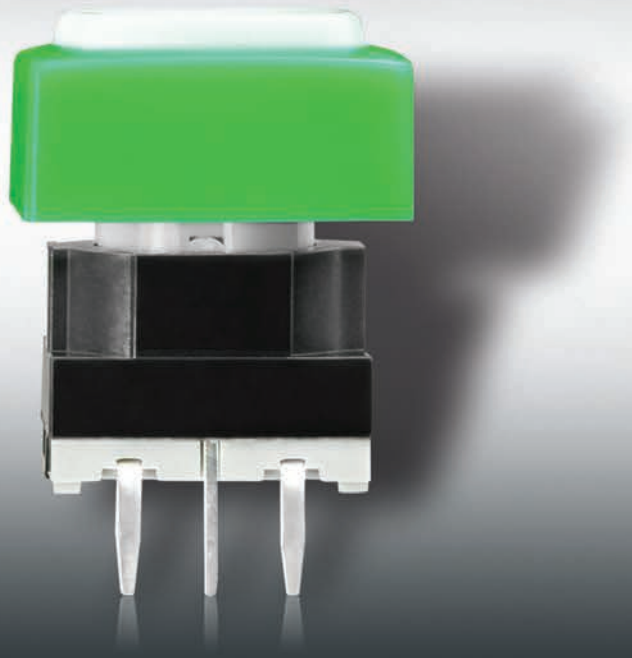
Reel Dimensions



Tape Dimensions

NKK SWITCHES

Tactiles



CB Series J4

6mm Process Sealed
50mA Low/Logic Level
Straight PC
PCB Mount
Flat Button

CB3 Series J8

6mm SMT
Process Sealed
50mA Low/Logic Level
Gull Wing Terminals
Upright Mount
Flat Button

HP02 Series.....J12

6mm
3VA DC Power Level or 0.4VA Logic Level
Straight PC
PCB Mount

HP03 Series.....J16

6mm SMT
3VA DC Power Level & 0.4VA Logic Level
Gull Wing Terminals
Upright Mount

Contents

JB Series J20

10mm Process Sealed
50mA or 125mA Low/Logic Level
Straight or Right Angle PC
PCB Mount

JB Illuminated Series J28

Low Profile
50mA or 125mA Low/Logic Level
Process Sealed
Straight PC

JF Series J34

Ultra-Thin
50mA Low/Logic Level
Straight PC
PCB Mount

JF Illuminated Series J40

Ultra-thin
50mA Low/Logic Level
Process Sealed
Straight PC

JL Illuminated Series.....J46

Ultra-thin
19mm Full Face
50mA Low/Logic Level
Straight PC

General Specifications

Electrical Capacity (Resistive Load)

Low/Logic Level: 50mA @ 24V DC maximum

Other Ratings

Contact Resistance: 100 milliohms maximum
Insulation Resistance: 100 megohms minimum @ 250V DC
Dielectric Strength: 250V AC minimum between contacts & between contacts & case for 1 minute minimum
Mechanical Life: 100,000 operations minimum
Electrical Life: 100,000 operations minimum
Nominal Operating Force: 1.57N
Total Travel: .010" (.250mm)

Materials & Finishes

Actuator: Glass fiber reinforced polyamide (UL94V-0)
Case: Stainless steel
Seal: Polytetrafluoroethylene
Base: Polyphthalamide (UL94V-0)
Movable Contacts: Beryllium copper with silver plating
Stationary Contacts: Brass with silver plating
Terminals: Brass with silver plating

Environmental Data

Operating Temperature Range: –25°C through +70°C (–13°F through +158°F)
Humidity: 90 ~ 95% humidity for 96 hours @ 40°C (104°F)
Vibration: 10 ~ 55Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in 1 minute; 3 right angled directions for 2 hours
Shock: 50G (490m/s^2) acceleration (tested in 6 right angled directions, with 5 shocks in each direction)

PCB Processing

Soldering: Wave Soldering Recommended. See Profile A in Supplement section.
Manual Soldering: See Profile A in Supplement section.
Cleaning: Automated cleaning. See Cleaning specifications in Supplement section.

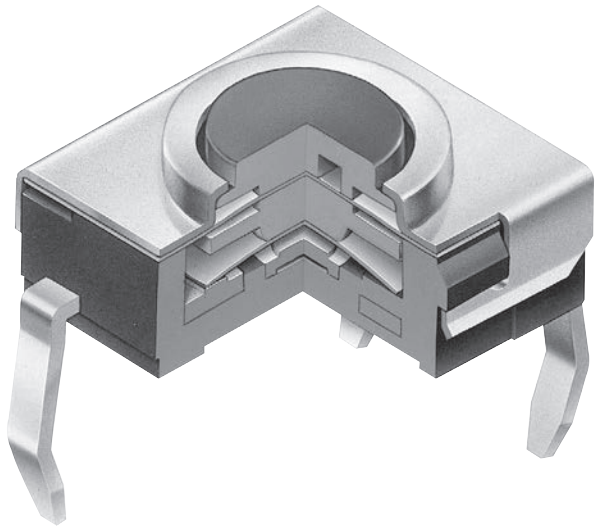
Standards & Certifications

Flammability Standards: UL94V-0 actuator & base
The CB Series tactiles have not been tested for UL recognition or CSA certification.
These switches are designed for use in a low-voltage, low-current, logic-level circuit.
When used as intended in a logic-level circuit, the results do not produce hazardous energy.

Distinctive Characteristics

Sealed construction prevents contact contamination and allows automated soldering and cleaning.

.244" (6.2mm) square body allows compact mounting.



Actuator and base meet UL flammability rating of 94V-0.

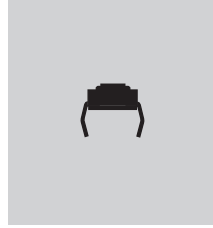
Dome contact gives crisp tactile feedback to positively indicate circuit transfer and assures high reliability and long life – more than 100,000 operations.

Crimped terminals ensure secure mounting and prevent dislodging during wave soldering.

Insert molded terminals lock out flux, solvents, and other contaminants.

Packaged in stick tube or partitioned tray.

Actual Size



TYPICAL SWITCH ORDERING EXAMPLE

CB | 15 | F | P | — | ☐

Pole & Circuit			
15	SPST	OFF	(ON)
( ) = Momentary			

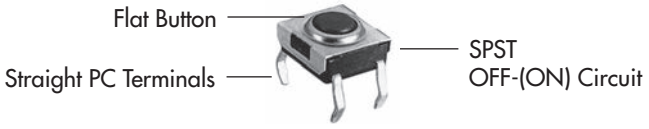
Actuator	
F	Flat Button

Terminals	
P	Straight PC

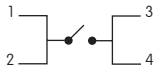
Packaging	
S	Stick-Tube 50 Pieces/Tube
No Code	Partitioned Tray

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

CB15FP



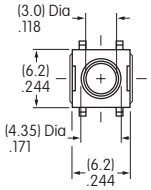
POLE & CIRCUIT

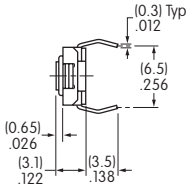
		Actuator Position ( ) = Momentary		Switch Throw & Schematic	
Pole	**Model**	**Normal**	**Down**		
SP	**CB15**	OFF	(ON)	SPST 	Note: Terminal numbers are not actually on the switch.

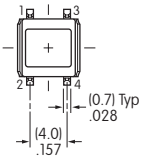
TYPICAL SWITCH DIMENSIONS

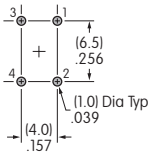
Single Pole • Single Throw

CB15FP





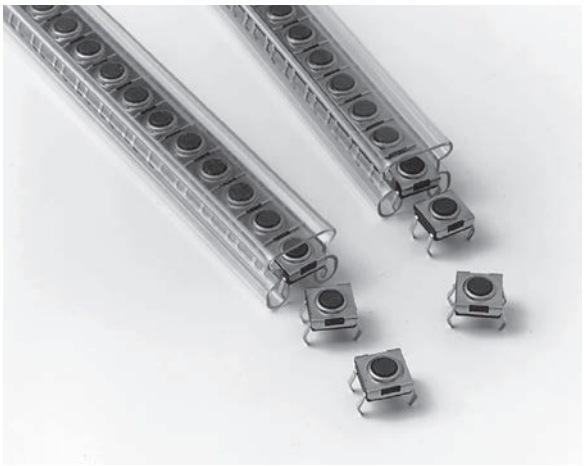




PACKAGING

S **Stick-Tube**

Switches must be ordered in 50-piece increments when stick-tube packaging is selected.

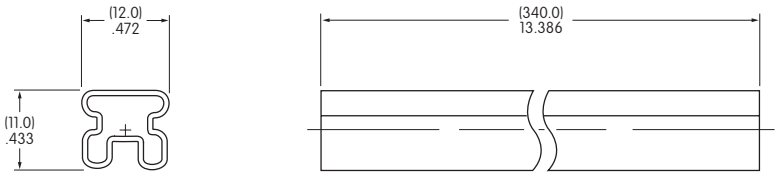


No Code **Partitioned Tray**

If ordered in less than 50-piece increments, the switches are packaged in a partitioned tray.

Stick-Tube Dimensions

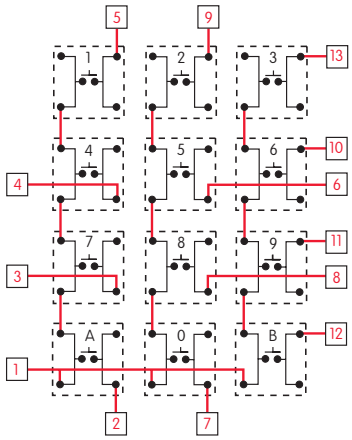
Each stick-tube contains 50 switches

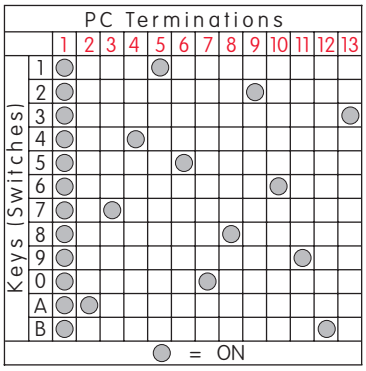


KEYBOARD MATRIX

Common Bus Matrix

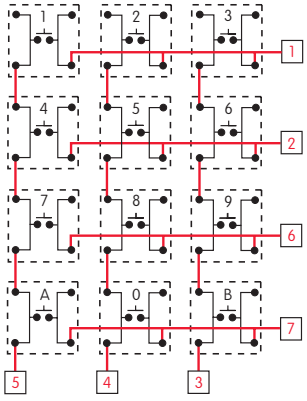
These single pole, single throw switches can be used in a keyboard matrix and, using strapped terminals, achieve a common bus electrical configuration on a single-sided PC board.

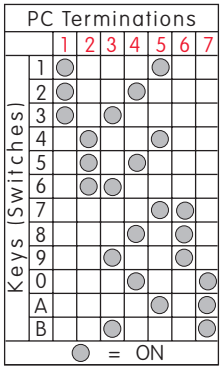




X-Y Matrix

These single pole, single throw switches can be arranged on a single-sided PC board matrix with strapped terminals to achieve an X-Y type electrical interconnection.





Red = PCB Trace Black = Switch Circuit

General Specifications

Electrical Capacity (Resistive Load)

Low/Logic Level: 50mA @ 24V DC maximum

Other Ratings

Contact Resistance: 100 milliohms maximum
Insulation Resistance: 100 megohms minimum @ 250V DC
Dielectric Strength: 250V AC minimum between contacts & between contacts & case for 1 minute minimum
Mechanical Life: 100,000 operations minimum
Electrical Life: 100,000 operations minimum
Nominal Operating Force: 1.57N
Total Travel: .010" (.250mm)

Materials & Finishes

Actuator: Glass fiber reinforced polyamide (UL94V-0)
Case: Stainless steel
Seal: Polytetrafluoroethylene
Base: Polyphthalamide (UL94V-0)
Movable Contacts: Beryllium copper with silver plating
Stationary Contacts: Brass with silver plating
Terminals: Brass with silver plating

Environmental Data

Operating Temperature Range: –25°C through +70°C (–13°F through +158°F)
Humidity: 90 ~ 95% humidity for 96 hours @ 40°C (104°F)
Vibration: 10 ~ 55Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in 1 minute; 3 right angled directions for 2 hours
Shock: 50G (490m/s^2) acceleration (tested in 6 right angled directions, with 5 shocks in each direction)

Processing

Soldering: Reflow Soldering Recommended. See Profile A in Supplement section.
Manual Soldering: See Profile A in Supplement section.
Cleaning: Automated cleaning. See Cleaning Specifications in Supplement section.

Standards & Certifications

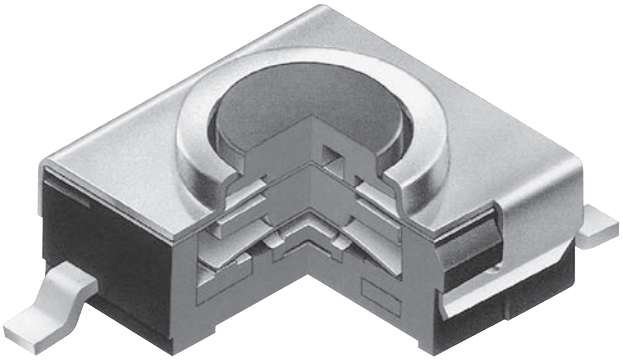
Flammability Standards: UL94V-0 actuator & base
The CB3 Series tactiles have not been tested for UL recognition or CSA certification.
These switches are designed for use in a low-voltage, low-current, logic-level circuit.
When used as intended in a logic-level circuit, the results do not produce hazardous energy.

Distinctive Characteristics

Sealed construction prevents contact contamination and allows automated soldering and cleaning.

.244" (6.2mm) square body allows compact mounting.

Heat tolerant resin used for actuator and base meets UL flammability rating of 94V-0 and maintains switch reliability through vapor phase and infrared convection reflow soldering.



Dome contact gives crisp tactile feedback to positively indicate circuit transfer and assures high reliability and long life – more than 100,000 operations.

Gull-winged terminals ensure mechanical stability during soldering and simplify solder joint inspection.

Insert molded terminals lock out flux, solvents, and other contaminants.

Packaged in tape-reel or partitioned tray. Tape-reel packaging meets EIA-481-D Standard.

Coplanarity: all considered surfaces must lie between two parallel planes that are a maximum distance apart of .0059" (0.15mm). (Additional coplanarity details in Terms and Acronyms in the Supplement section.)

Actual Size

TYPICAL SWITCH ORDERING EXAMPLE

CB3 | 15 | F | P | — | ☐

Pole & Circuit

15	SPST	OFF	(ON)

( ) = Momentary

Actuator

F	Flat Button

Terminals

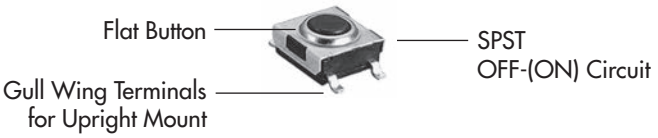
P	Gull Wing for Upright Mount

Packaging

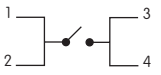
R	Tape-Reel 1,000 Pieces/Reel
No Code	Partitioned Tray

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

CB315FP



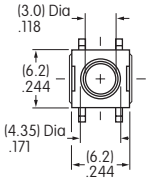
POLE & CIRCUIT

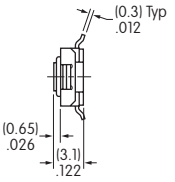
		Actuator Position ( ) = Momentary		Switch Throw & Schematic	
Pole	Model	Normal	Down		
SP	CB315	OFF	(ON)	SPST 	Note: Terminal numbers are not actually on switch.

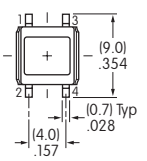
TYPICAL SWITCH DIMENSIONS

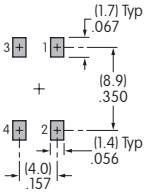
Single Pole • Single Throw

CB315FP





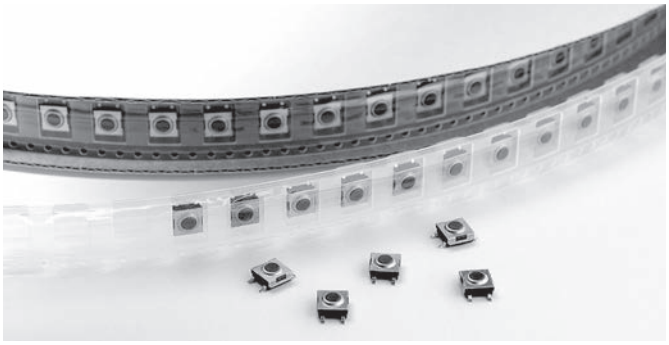




PACKAGING

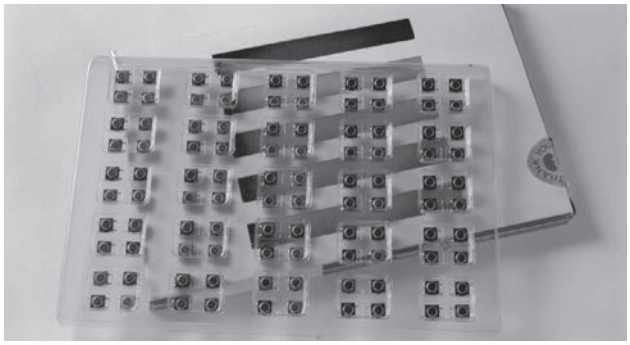
R **Tape-Reel** (packaged to EIA-481-D standard)

Switches must be ordered in 1,000-piece increments when tape-reel packaging is selected.



No Code **Partitioned Tray**

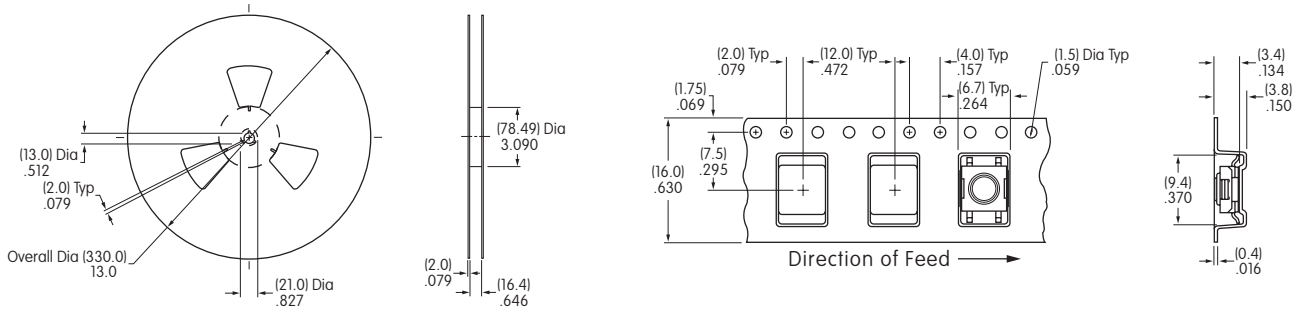
If less than 1,000 pieces are ordered, the switches are packaged in a partitioned tray. No code is required.



Tape-Reel Dimensions & Specifications

Each tape-reel of 1,050 pockets contains 1,000 switches

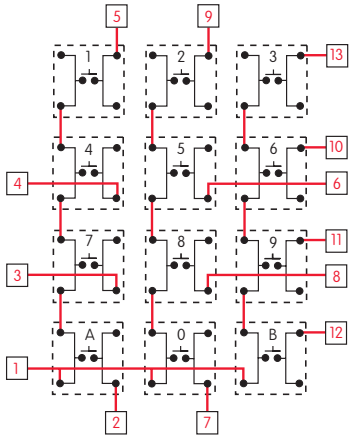
Minimum Leader Length: 16.54" (420mm) Minimum Trailer Length: 7.09" (180mm)

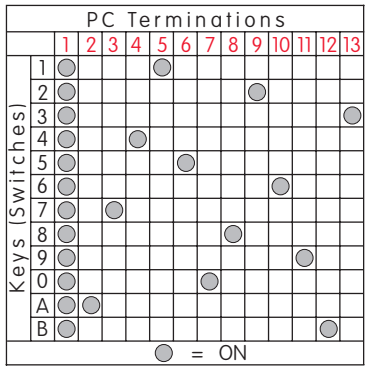


KEYBOARD MATRIX

Common Bus Matrix

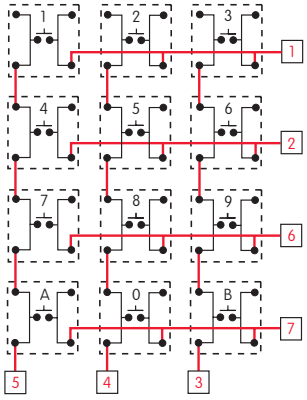
These single pole, single throw switches can be used in a keyboard matrix and, using strapped terminals, achieve a common bus electrical configuration on a single-sided PC board.

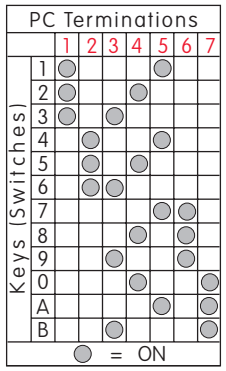




X-Y Matrix

These single pole, single throw switches can be arranged on a single-sided PC board matrix with strapped terminals to achieve an X-Y type electrical interconnection.





Red = PCB Trace **Black = Switch Circuit**

General Specifications

Electrical Capacity (Resistive Load)

Power Level (silver): 3VA maximum @ 28V DC maximum
(Applicable Range 10mA ~ 125mA @ 0.1V ~ 28V)

Logic Level (gold): 0.4VA maximum @ 28V AC/DC maximum
(Applicable Range 0.1mA ~ 0.1A @ 20mV ~ 28V)
Note: See Supplement for further explanation of operating range.

Other Ratings

Contact Resistance: 100 milliohms maximum
Insulation Resistance: 100 megohms minimum @ 100V DC
Dielectric Strength: 250V AC minimum for 1 minute minimum between contacts & between contacts & case
Mechanical Life: 500,000 operations minimum
Electrical Life: 500,000 operations minimum
Nominal Operating Force: 1.60N
Total Travel: .008" (0.2mm)

Materials & Finishes

Actuator: Glass fiber reinforced polyamide (UL94V-0)
Case: Stainless steel
Base: Glass fiber reinforced polyamide (UL94V-0)
Movable Contacts: Stainless steel with silver or gold plating
Stationary Contacts: Brass with silver or gold plating
Terminals: Brass with silver or gold plating

Environmental Data

Operating Temperature Range: –20°C through +70°C (–4°F through +158°F)
Humidity: 90 ~ 95% humidity for 240 hours @ 40°C (104°F)
Vibration: 10 ~ 55Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in 1 minute; 3 right angled directions for 2 hours
Shock: 100G (981m/s^2) acceleration (tested in 6 right angled directions, with 5 shocks in each direction)

PCB Processing

Soldering: Wave Soldering Recommended. See Profile A in Supplement section.
Manual Soldering: See Profile A in Supplement section.
Cleaning: These devices are not process sealed. Hand clean locally using alcohol based solution.

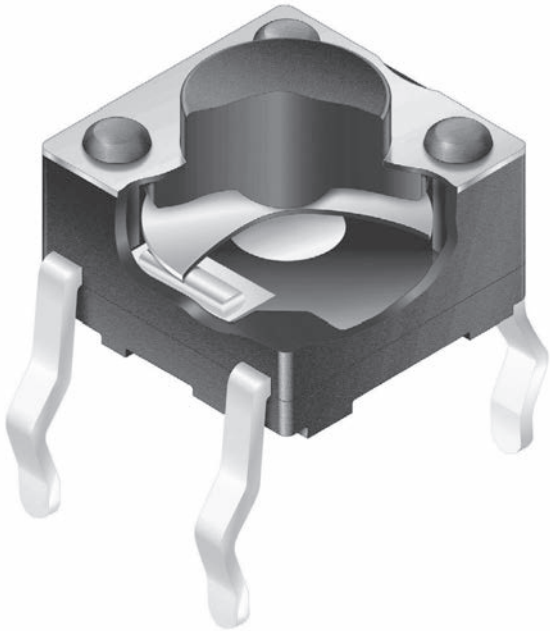
Standards & Certifications

Flammability Standards: UL94V-0 actuator and base
These switches are designed for use in a low-voltage, low-current circuit.
When used as intended, the results do not produce hazardous energy.

Distinctive Characteristics

.244" (6.2mm) square body allows compact mounting.

Heat resistant resin body meets lead-free solder processing requirements and UL flammability rating of 94V-0.



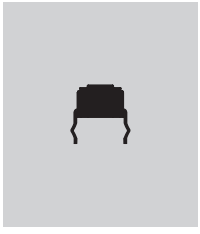
Stick-tube packaging allows rapid automated placement of devices.

Gold plated contacts available for very low voltage/current applications offer advantages of little or no oxidization or sulfurization and stable contact resistance.

Crimped terminals provide a spring type action which ensures secure mounting and prevents dislodging during automated soldering.

Insert molded terminals lock out flux, solvents, and other contaminants and allow automated soldering.

Actual Size



TYPICAL SWITCH ORDERING EXAMPLE

HP02 | 15A | F | K | P2 — S

Pole & Circuit

15A	SPST	OFF	(ON)

( ) = Momentary
Normally Open Contacts

Actuator

F	Flat Button

Actuator Color

K	Black

Terminals & Contacts

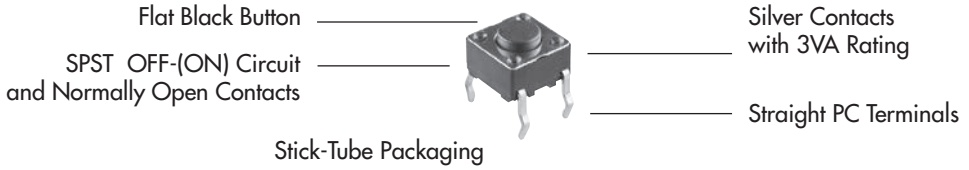
P2	Straight PC; Silver Contacts Rated 3VA max. DC
P4	Straight PC; Gold Contacts Rated 0.4VA max. @ 28V AC/DC max.

Packaging

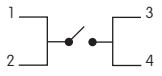
S	Stick-Tube 100 Pieces/ Tube

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

HP0215AFKP2-S



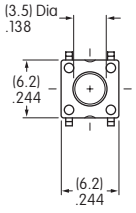
POLE & CIRCUIT

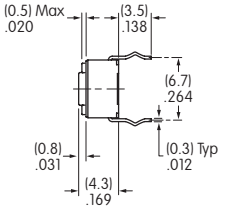
		Actuator Position ( ) = Momentary		Switch Throw & Schematic	
Pole	**Model**	**Normal**	**Down**		
SP	**HP0215A**	OFF	(ON)	SPST 	Note: Terminal numbers are not actually on the switch.

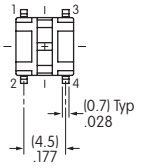
TYPICAL SWITCH DIMENSIONS

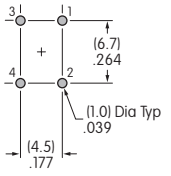
Straight PC

HP0215AFKP2





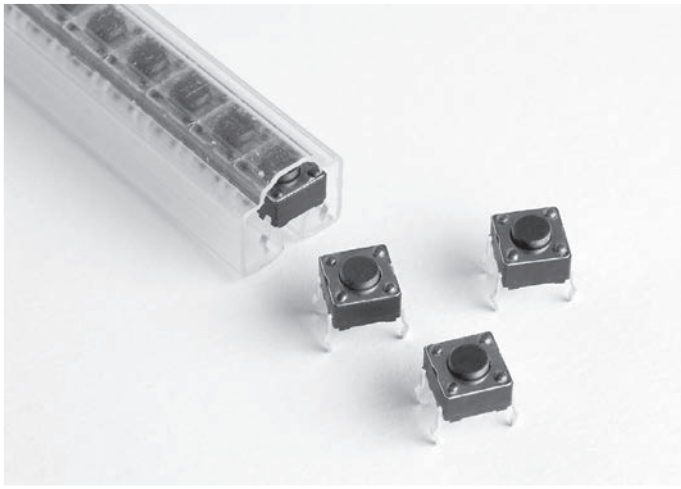




PACKAGING

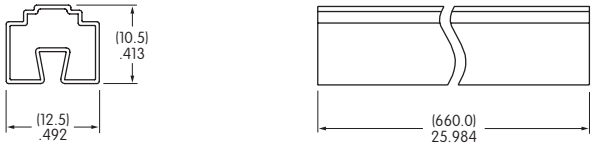
S **Stick-Tube**

Switches must be ordered in 100-piece increments.



Stick-Tube Dimensions

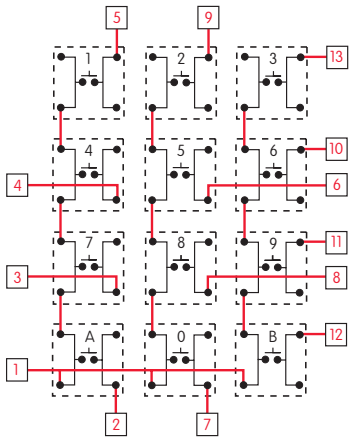
Each stick-tube contains 100 switches.

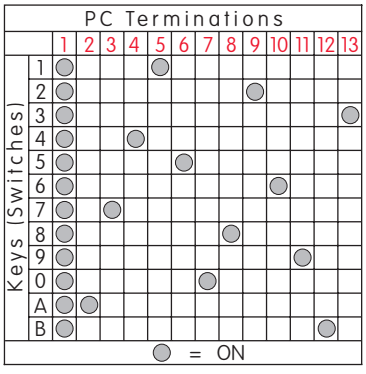


KEYBOARD MATRIX

Common Bus Matrix

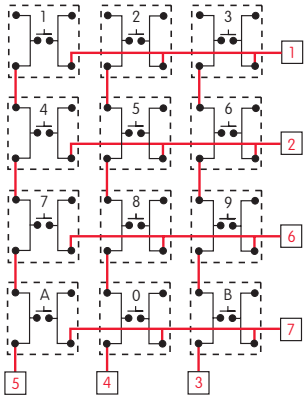
These single pole, single throw switches can be used in a keyboard matrix and, using strapped terminals, achieve a common bus electrical configuration on a single-sided PC board.

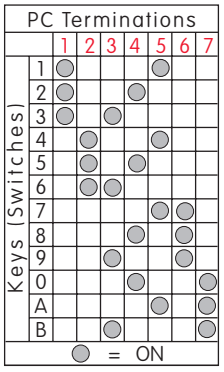




X-Y Matrix

These single pole, single throw switches can be arranged on a single-sided PC board matrix with strapped terminals to achieve an X-Y type electrical interconnection.





Red = PCB Trace Black = Switch Circuit

General Specifications

Electrical Capacity (Resistive Load)

Power Level (silver): 3VA maximum @ 28V DC maximum
(Applicable Range 10mA ~ 125mA @ 0.1V ~ 28V)

Logic Level (gold): 0.4VA maximum @ 28V AC/DC maximum
(Applicable Range 0.1mA ~ 0.1A @ 20mV ~ 28V)
Note: See Supplement for further explanation of operating range.

Other Ratings

Contact Resistance: 100 milliohms maximum
Insulation Resistance: 100 megohms minimum @ 100V DC
Dielectric Strength: 250V AC minimum for 1 minute minimum between contacts & between contacts & case
Mechanical Life: 500,000 operations minimum
Electrical Life: 500,000 operations minimum
Nominal Operating Force: 1.60N
Total Travel: .008" (0.2mm)

Materials & Finishes

Actuator: Glass fiber reinforced polyamide (UL94V-0)
Case: Stainless steel
Base: Glass fiber reinforced polyamide (UL94V-0)
Movable Contacts: Stainless steel with silver or gold plating
Stationary Contacts: Brass with silver or gold plating
Terminals: Brass with silver or gold plating

Environmental Data

Operating Temperature Range: –20°C through +70°C (–4°F through +158°F)
Humidity: 90 ~ 95% humidity for 240 hours @ 40°C (104°F)
Vibration: 10 ~ 55Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in 1 minute; 3 right angled directions for 2 hours
Shock: 100G (981m/s^2) acceleration (tested in 6 right angled directions, with 5 shocks in each direction)

Processing

Soldering: Reflow Soldering Recommended. See Profile A in Supplement section.
Manual Soldering: See Profile A in Supplement section.
Cleaning: These devices are not process sealed. Hand clean locally using alcohol based solution.

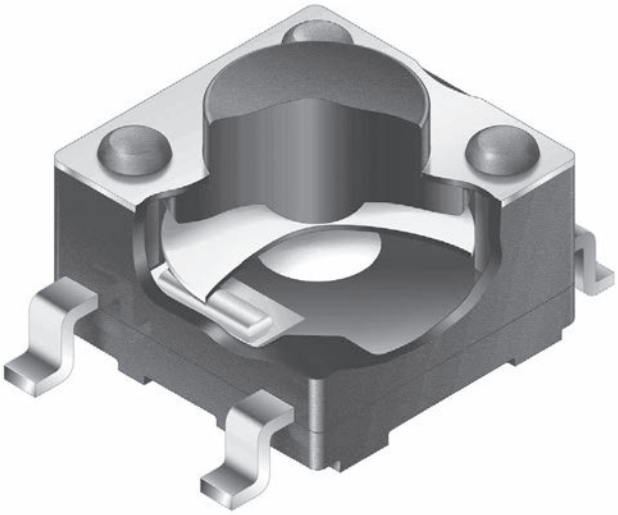
Standards & Certifications

Flammability Standards: UL94V-0 actuator and base
These switches are designed for use in a low-voltage, low-current circuit.
When used as intended, the results do not produce hazardous energy.

Distinctive Characteristics

.244" (6.2mm) square body allows compact mounting.

Heat resistant resin body meets lead-free solder processing requirements and UL flammability rating of 94V-0.



Stick-tube and tape-reel packaging allow rapid automated placement of devices.

Gold plated contacts available for very low voltage/current applications offer advantages of little or no oxidization or sulfurization and stable contact resistance.

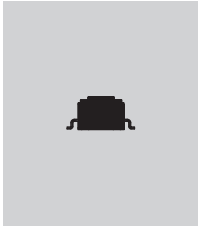
Gull-winged terminals ensure mechanical stability during soldering and simplified solder joint inspection.

Insert molded terminals lock out flux, solvents, and other contaminants and allow automated soldering.

Tape-reel packaging meets EIA-481-D Standard.

Coplanarity: all considered surfaces must lie between two parallel planes that are a maximum distance apart of .0039" (0.10mm). (Additional coplanarity details in Terms and Acronyms in the Supplement section.)

Actual Size



TYPICAL SWITCH ORDERING EXAMPLE

HP03 | 15A | F | K | P4 — R

Pole & Circuit

15A	SPST	OFF	(ON)

( ) = Momentary
Normally Open Contacts

Actuator

F	Flat Button

Actuator Color

K	Black

Terminals & Contacts

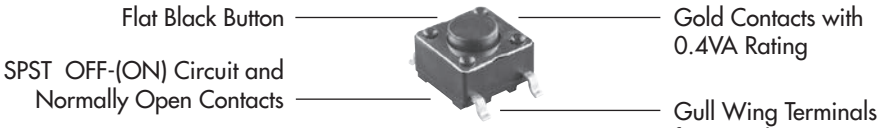
P2	Gull Wing for Upright Mount; Silver Contacts Rated 3VA max. DC
P4	Gull Wing for Upright Mount; Gold Contacts Rated 0.4VA max. @ 28V AC/DC max.

Packaging

S	Stick-Tube 100 Pieces/ Tube
R	Tape-Reel 1,000 Pieces/ Reel

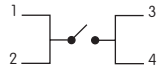
DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

HP0315AFKP4-R



Tape-Reel Packaging

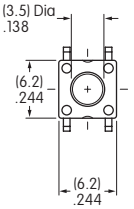
POLE & CIRCUIT

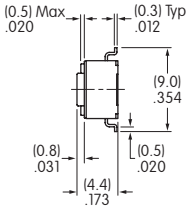
		Actuator Position ( ) = Momentary		Switch Throw & Schematic	
Pole	**Model**	**Normal**	**Down**		
SP	**HP0315A**	OFF	(ON)	SPST 	Note: Terminal numbers are not actually on the switch.

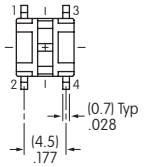
TYPICAL SWITCH DIMENSIONS

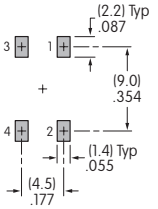
Gull-winged

HP0315AFKP4









PACKAGING

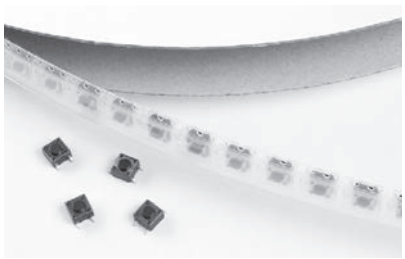
S **Stick-Tube**

Switches must be ordered in 100-piece increments when stick-tube packaging is selected.

R **Tape-Reel**

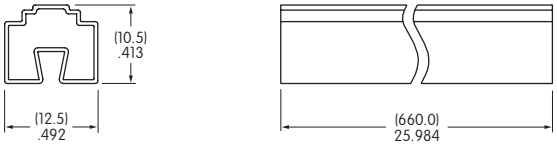
Switches must be ordered in 1,000-piece increments when tape-reel packaging is selected.

Packaging meets EIA-481-D Standard.



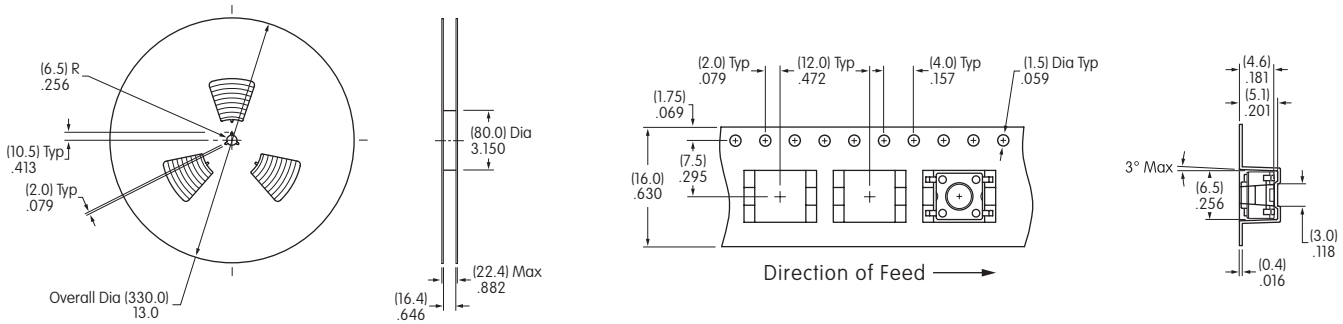
Stick-Tube Dimensions

Each stick-tube contains 100 switches



Tape-Reel Dimensions

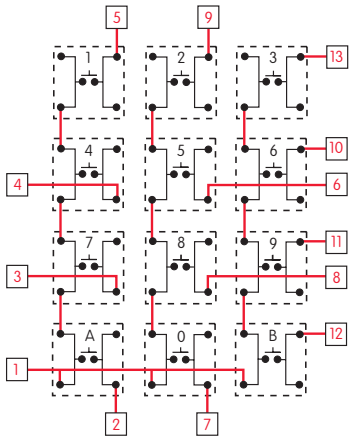
Each tape-reel of 1,100 pockets contains 1,000 switches.
Minimum Leader Length: 15.748" (400mm). Minimum Trailer Length: 6.299" (160mm).

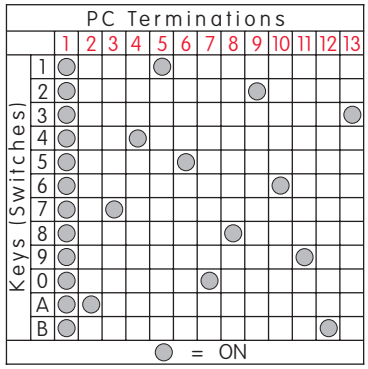


KEYBOARD MATRIX

Common Bus Matrix

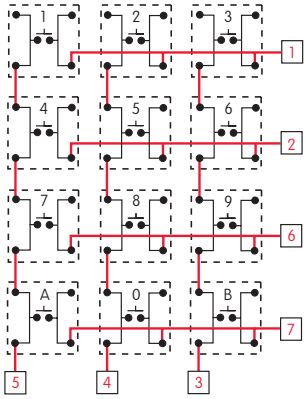
These single pole, single throw switches can be used in a keyboard matrix and, using strapped terminals, achieve a common bus electrical configuration on a single-sided PC board.

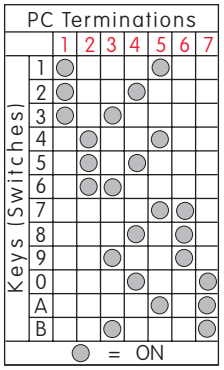




X-Y Matrix

These single pole, single throw switches can be arranged on a single-sided PC board matrix with strapped terminals to achieve an X-Y type electrical interconnection.





Red = PCB Trace **Black = Switch Circuit**

General Specifications

Electrical Capacity (Resistive Load)

Low/Logic Level: 50mA @ 24V DC maximum for Standard Operating Force models
125mA @ 24V DC maximum for High Operating Force models

Other Ratings

	Standard Operating Force	High Operating Force
Contact Resistance:	50 milliohms maximum	50 milliohms maximum
Insulation Resistance:	500 megohms minimum @ 250V DC	500 megohms minimum @ 250V DC
Dielectric Strength:	250V AC minimum for 1 minute minimum	250V AC minimum for 1 minute minimum
Mechanical Life:	5,000,000 operations minimum	1,000,000 operations minimum
Electrical Life:	5,000,000 operations minimum	1,000,000 operations minimum
Nominal Operating Force:	1.76N for JB15	2.65N for JB15H
Total Travel:	.010" (.250mm)	.012" (.300mm)

Materials & Finishes

Actuator: Glass fiber reinforced PBT for Extended actuator; PBT for Flat; Polyacetal for Short
Case: Glass fiber reinforced polyamide (UL94V-0)
Seal: Nitrile butadiene rubber
Base: Glass fiber reinforced PBT (UL94V-0)
Movable Contacts: Stainless steel
Stationary Contacts: Brass with silver plating
Terminals: Brass with silver plating
Mounting Bracket: Phosphor bronze with tin plating

Environmental Data

Operating Temperature Range: –25°C through +70°C (–13°F through +158°F)
Humidity: 90 ~ 95% humidity for 240 hours @ 40°C (104°F)
Vibration: 10 ~ 55Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in 1 minute; 3 right angled directions for 2 hours
Shock: 50G (490m/s2) acceleration (tested in 6 right angled directions, with 5 shocks in each direction)

PCB Processing

Soldering: Wave Soldering Recommended. See Profile A in Supplement section.
Manual Soldering: See Profile A in Supplement section.
Cleaning: Automated cleaning. See Cleaning specifications in Supplement section.

Standards & Certifications

Flammability Standards: UL94V-0 rated case & base
The JB Series tactiles have not been tested for UL recognition or CSA certification.
These switches are designed for use in a low-voltage, low-current, logic-level circuit.
When used as intended in a logic-level circuit, the results do not produce hazardous energy.

Distinctive Characteristics

Special bracket for right angle mounting provides added design variations.

Higher operating force type provides more pronounced operating feel.

Rubber seal construction prevents contact contamination and allows automated soldering and cleaning.

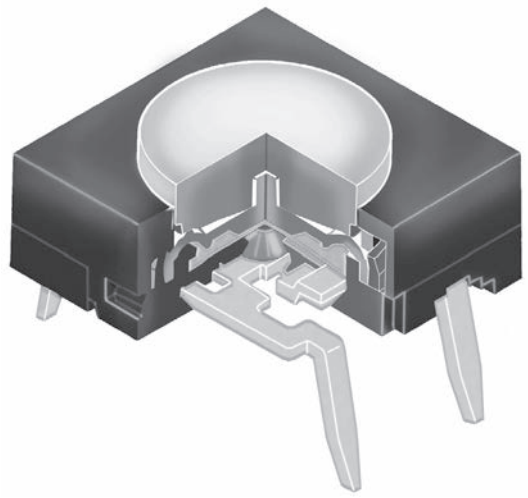
Choice of dimensions from PCB to top of cap allows design flexibility.

Dome contact gives crisp tactile feedback to positively indicate circuit transfer and assures high reliability and long life of up to 5,000,000 operations.

Slanted terminals provide a spring type action which ensures secure mounting and prevents dislodging during wave soldering.

Molded-in terminals are part of the sealed construction which allows automated soldering and washing.

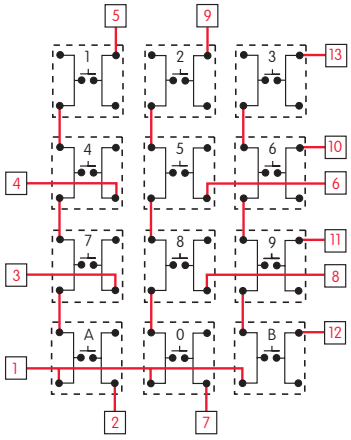
Terminal spacing conforms to standard .100" (2.54mm) PCB grid.

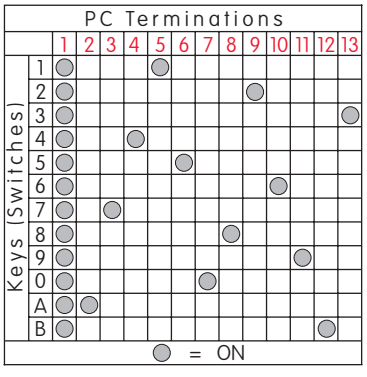


Actual Size

Common Bus Matrix

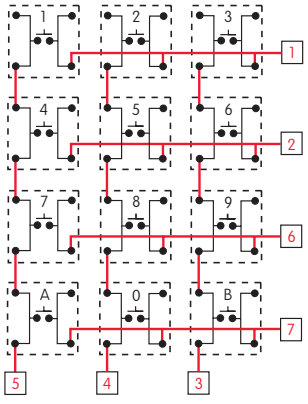
These single pole, single throw switches can be used in a keyboard matrix and, using strapped terminals, achieve a common bus electrical configuration on a single-sided PC board.

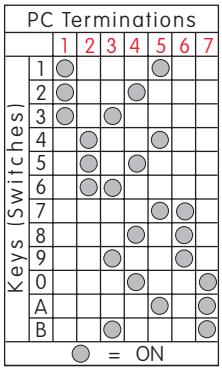




X-Y Matrix

These single pole, single throw switches can be arranged on a single-sided PC board matrix with strapped terminals to achieve an X-Y type electrical interconnection.





Red = PCB Trace Black = Switch Circuit

TYPICAL SWITCH ORDERING EXAMPLE

JB [15] [ ] [F] [P] — [ ] [ ]

Pole & Circuit

15	SPST	OFF	(ON)

( ) = Momentary

Terminals

P	Straight PC
H	Right Angle PC

Operating Force

No Code	Standard for Actuators F & K
H	High for Actuators F, K & A

Actuators

F	Flat Blue Button
K	Short
A	Extended (H operating force only; not for Right Angle)

Snap-On Caps

For Straight & Right Angle PC

No Code	No Cap for F Actuator

For Straight PC

1	Sculptured
2	Flat

For Right Angle PC

4	Framed
5	Cap with Black Mounter
6	Flat

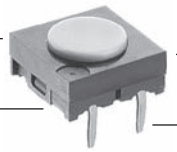
Cap Colors

A	Black
B	White
C	Red
E	Yellow
F	Green
G	Blue
H	Gray

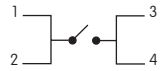
Button		Frame
B	White	B
C	Red	C
E	Yellow	E
F	Green	F
G	Blue	G
H	Gray	H

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

JB15FP



POLE & CIRCUIT

		Actuator Position ( ) = Momentary		Switch Throw & Schematic	
Pole	Model	Normal	Down	SPST 	Note: Terminal numbers are shown on the switch.
SP	**JB15**	OFF	(ON)		

OPERATING FORCE

No Code **Standard Operating Force**
1.76N

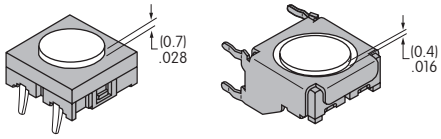
For F & K Actuators

H **High Operating Force**
2.65N

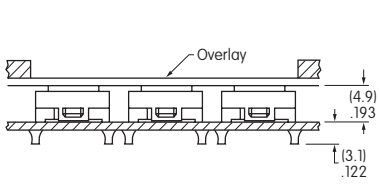
For F, K & A Actuators

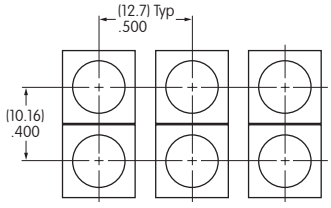
ACTUATORS

F Flat Blue Button



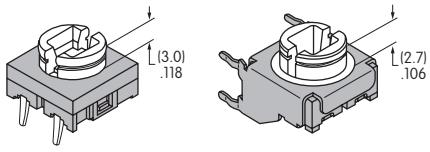
Flat button is an integral part of the switch and cannot be ordered separately.

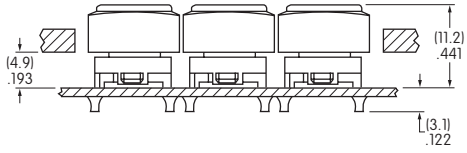


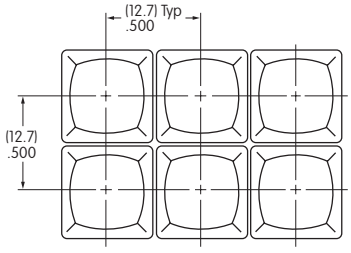


Custom keyboards can be designed with flat buttons beneath an overlay. Not applicable for right angle mounting.

K Short Actuator

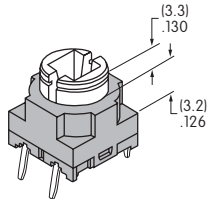




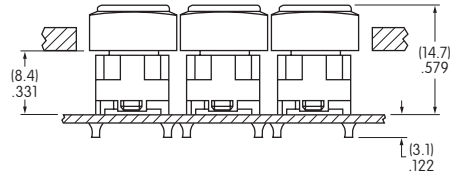


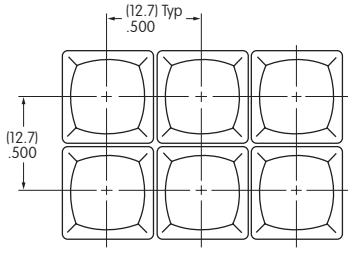
Custom keyboards can be designed with caps installed through a panel cutout (illustration with framed cap AT4078 and button AT4077). Not applicable for right angle mounting.

A Extended Actuator



Combines with high operating force only; not for right angle.

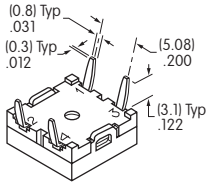


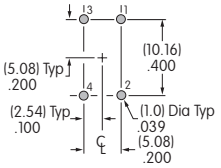


Custom keyboards can be designed with caps installed through a panel cutout (illustration with framed cap AT4078 and button AT4077).

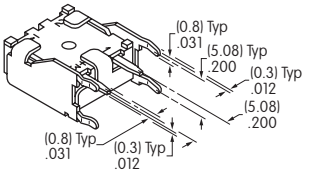
TERMINALS

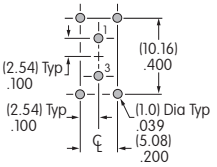
P Straight PC





H Right Angle PC



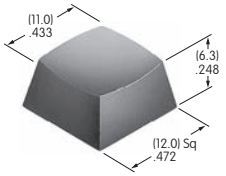


Further details shown in Typical Switch Dimensions

SNAP-ON CAPS

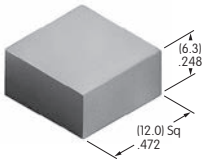
1 AT4058 Sculptured for Straight PC

Material: Polyamide
Finish: Matte
Colors: A B C E F G H



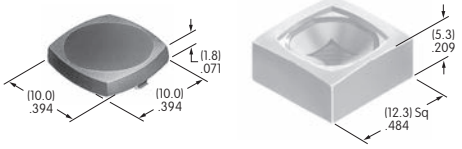
2 AT4059 Flat for Straight PC

Material: Polycarbonate
Finish: Glossy
Colors: A B C E F G H



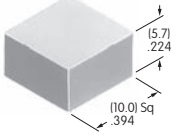
4 Framed: AT4077 Button & AT4078 Frame for Straight PC

Material: Polycarbonate
Finish: Matte
Colors: B C E F G H



6 AT4139 Flat for Right Angle PC

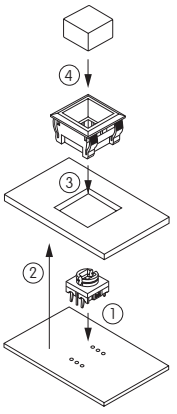
Material: Polycarbonate
Finish: Glossy
Colors: A B C H



5 AT4140 Cap with AT547 Mounter for Straight PC

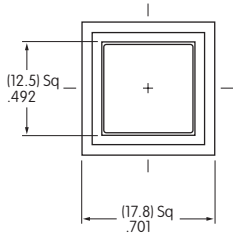
Cap
Material: Polycarbonate
Finish: Glossy
Colors: A B C H

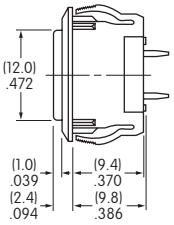
Mounter
Material: Polyamide
Finish: Matte
Color: A



Assembly Procedure

1. Solder switch to PCB.
2. Install PCB in equipment.
3. Snap mounter into panel. Dimension from top of panel to top of PCB is .386" (9.8mm).
4. Snap cap onto plunger.

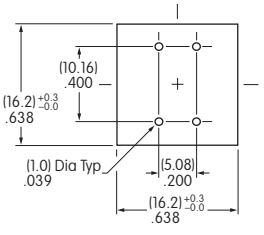




Panel Mounting Dimensions

Panel Thickness:
.039" ~ .079"
(1.0mm ~ 2.0mm)

Panel Cutout & Footprint



Cap Colors Available: A Black, B White, C Red, E Yellow, F Green, G Blue, H Gray

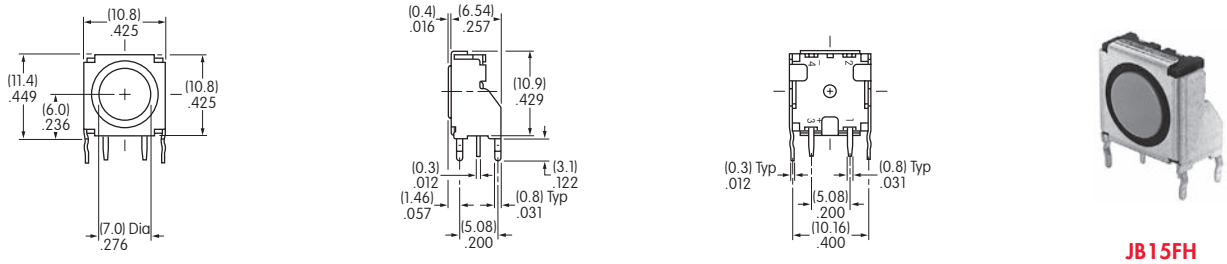
TYPICAL SWITCH DIMENSIONS

Flat Blue Button • Straight PC

Spring action terminals conform to .100" (2.54mm) PCB spacing

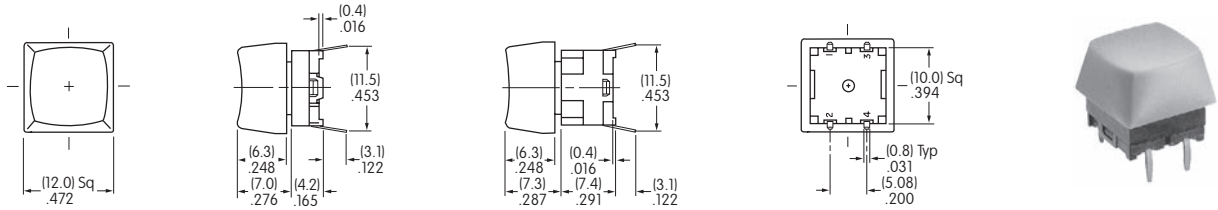
JB15FP

Flat Blue Button • Right Angle PC



JB15FH

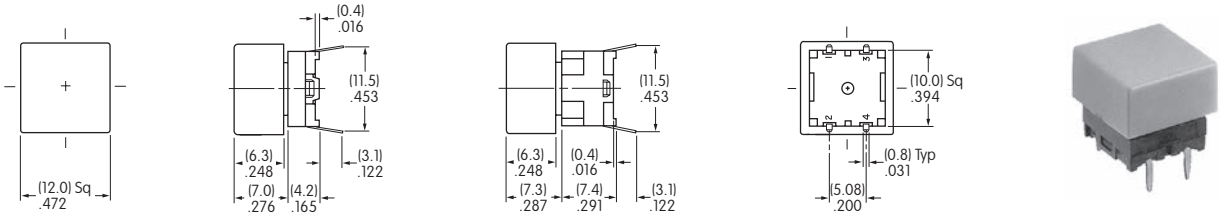
Short Actuator / Extended Actuator / Sculptured Snap-on Cap • Straight PC



Spring action terminals conform to .100" (2.54mm) PCB spacing

JB15KP-1C

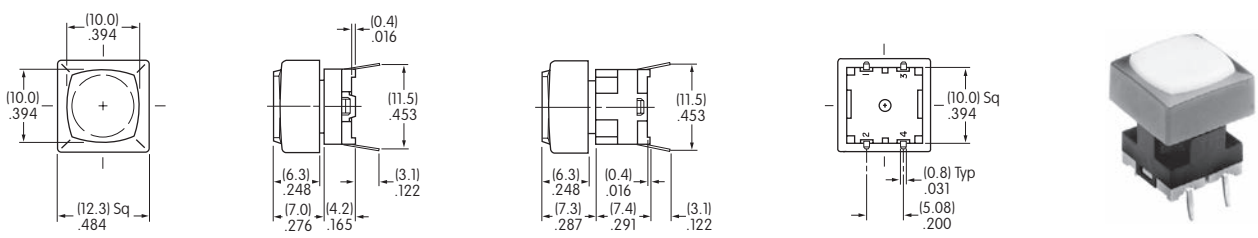
Short Actuator / Extended Actuator / Flat Snap-on Cap • Straight PC



Spring action terminals conform to .100" (2.54mm) PCB spacing

JB15KP-2C

Short Actuator / Extended Actuator / Framed Snap-on Cap • Straight PC



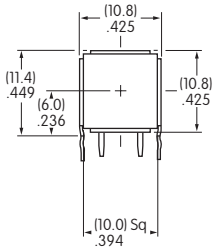
Spring action terminals conform to .100" (2.54mm) PCB spacing

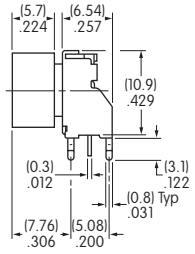
JB15FHAP-4BC

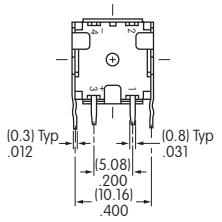
TYPICAL SWITCH DIMENSIONS

Flat Snap-on Cap • Right Angle PC

JB15KH-6C





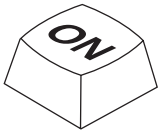


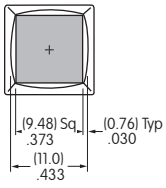
LEGENDS

NKK Switches can provide custom legends for caps. Contact factory for more information.

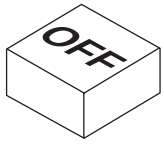
Shaded Areas are Printable Areas

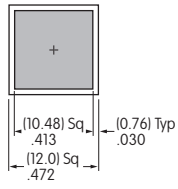
AT4058



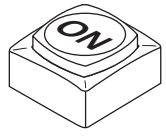


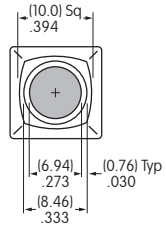
AT4059 & AT4140



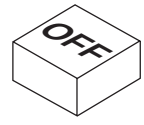


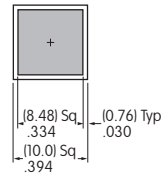
AT4077 Button





AT4139





Recommended Print Method: Screen Print or Pad Print. Epoxy based ink is recommended.

General Specifications

Electrical Capacity (Resistive Load)

Low/Logic Level: 50mA @ 24V DC maximum for Standard Operating Force models
125mA @ 24V DC maximum for High Operating Force models

Other Ratings

	Standard Operating Force	High Operating Force
Contact Resistance:	50 milliohms maximum	50 milliohms maximum
Insulation Resistance:	500 megohms minimum @ 250V DC	500 megohms minimum @ 250V DC
Dielectric Strength:	250V AC minimum for 1 minute minimum	250V AC minimum for 1 minute minimum
Mechanical Life:	5,000,000 operations minimum	1,000,000 operations minimum
Electrical Life:	5,000,000 operations minimum	1,000,000 operations minimum
Nominal Operating Force:	1.76N for JB15L	2.65N for JB15HL & JB15HB
Total Travel:	.010" (.254mm)	.012" (.300mm)

Materials & Finishes

Actuator: Polyacetal for Short; Glass fiber reinforced PBT for Extended
Case: Glass fiber reinforced polyamide (UL94V-0)
Seal: Nitrile butadiene rubber
Base: Glass fiber reinforced PBT (UL94V-0)
Movable Contacts: Stainless steel
Stationary Contacts: Brass with silver plating
Terminals: Brass with silver plating

Environmental Data

Operating Temperature Range: –25°C through +70°C (–13°F through +158°F)
Humidity: 90 ~ 95% humidity for 240 hours @ 40°C (104°F)
Vibration: 10 ~ 55Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in 1 minute; 3 right angled directions for 2 hours
Shock: 50G (490m/s^2) acceleration (tested in 6 right angled directions, with 5 shocks in each direction)

PCB Processing

Soldering: Wave Soldering recommended. See Profile A in Supplement section.
Manual Soldering: See Profile A in Supplement section.
Cleaning: Automated cleaning. See Cleaning specifications in Supplement section.

Standards & Certifications

Flammability Standards: UL94V-0 rated case & base
The JB Series tactiles have not been tested for UL recognition or CSA certification.
These switches are designed for use in a low-voltage, low-current, logic-level circuit.
When used as intended in a logic-level circuit, the results do not produce hazardous energy.

Distinctive Characteristics

Choice of dimensions from PCB to top of cap adds to design flexibility.

Bright, full-face illumination with red, green, or yellow LEDs for attractive, functional panel layouts.

Higher operating force type provides more pronounced operating feel.

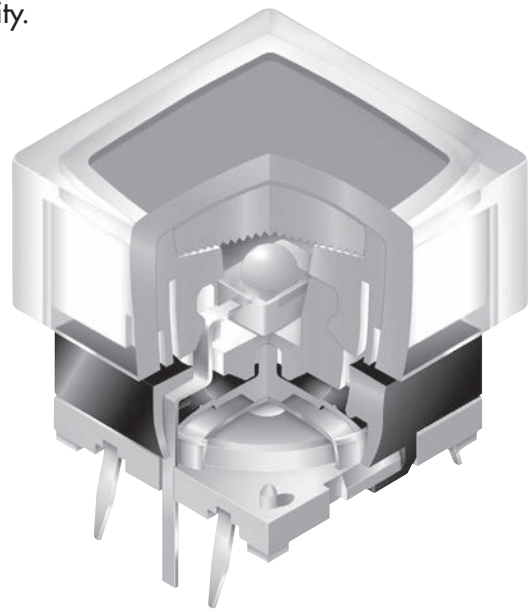
Dome contact gives crisp tactile feedback to positively indicate circuit transfer and assures high reliability and long life of up to 5,000,000 operations.

Rubber seal construction prevents contact contamination and allows automated soldering and cleaning.

Slanted terminals provide a spring type action which ensures secure mounting and prevents dislodging during wave soldering.

Molded-in terminals are part of the sealed construction which allows automated soldering and cleaning.

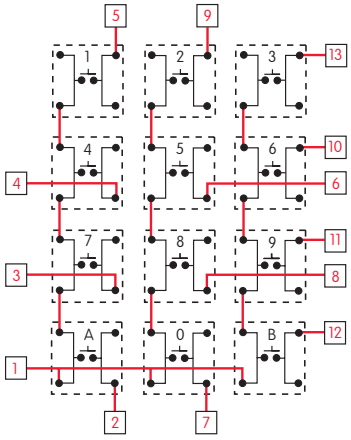
Terminal spacing conforms to standard .100" (2.54mm) PCB grid.

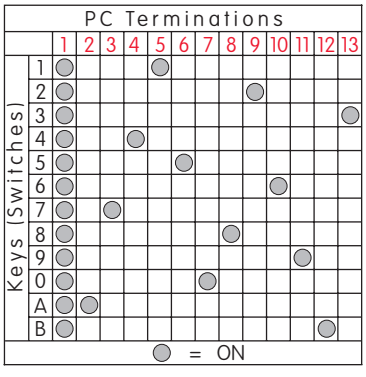


Actual Size

Common Bus Matrix

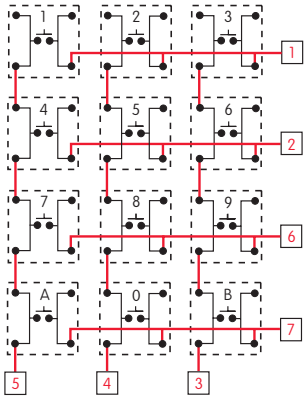
These single pole, single throw switches can be used in a keyboard matrix and, using strapped terminals, achieve a common bus electrical configuration on a single-sided PC board.

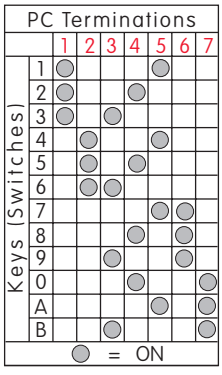




X-Y Matrix

These single pole, single throw switches can be arranged on a single-sided PC board matrix with strapped terminals to achieve an X-Y type electrical interconnection.





Red = PCB Trace Black = Switch Circuit

TYPICAL SWITCH ORDERING EXAMPLE

JB 15 ☐ L P C — JC

Pole & Circuit

15	SPST	OFF	(ON)

( ) = Momentary

Actuators

L	Short
B	Extended (H operating force only)

Operating Force

No Code	Standard (L actuator only)
H	High

Terminals

P	Straight PC

LED Colors

C	Red
E	Yellow
F	Green

Cap Types & Colors

Flat Cap Colors

B	Translucent White
C	Red
E	Yellow
F	Green

Flat Cap Lens/Diffuser Colors

JB	Clear/White
JC	Clear/Red
JE	Clear/Yellow
JF	Clear/Green

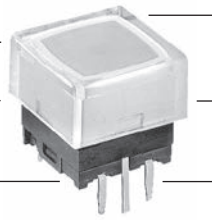
For JC, JE & JF, diffuser color must match LED color

Framed Cap Button/Frame Colors

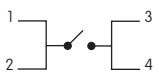
BB	White/White
BC	White/Red
BE	White/Yellow
BF	White/Green
BH	White/Gray

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

JB15LPC-JC



POLE & CIRCUIT

Pole & Throw	Model	Actuator Position ( ) = Momentary: Normal	Actuator Position ( ) = Momentary: Down	Switch Throw & Schematic	LED Schematic	
SPST	**JB15**	OFF	(ON)	SPST 		Notes: Terminal numbers are shown on switch. LED circuit is isolated & requires external power source.

OPERATING FORCE

No Code — **Standard Nominal Operating Force**
1.76N

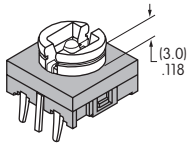
Available with short actuator only (code L)

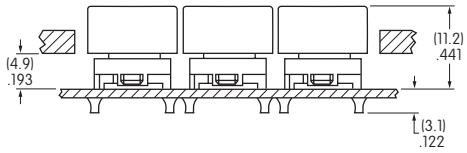
H — **High Nominal Operating Force**
2.65N

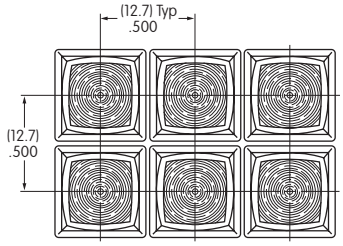
Available with both short and extended actuators

ACTUATORS

L — **Short Actuator**

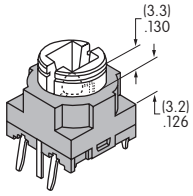




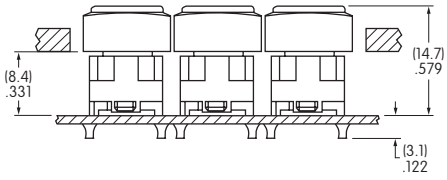


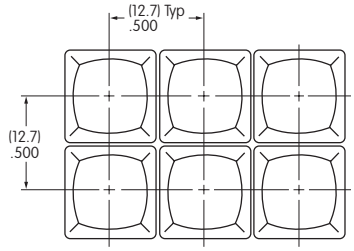
Custom keyboards can be designed with caps installed through a panel cutout (illustration with cap AT4060).

B — **Extended Actuator**



High operating force only



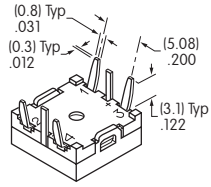


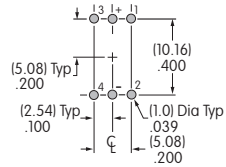
Custom keyboards can be designed with caps installed through a panel cutout (illustration with cap AT4076).

TERMINALS

P — **Straight PC Terminals**

Further details in Typical Switch Dimensions





LED COLORS & SPECIFICATIONS

LEDs are supplied as an integral part of illuminated devices and are not available separately.

LED polarity markings are on the bottom of the switch.

The electrical specifications shown here are determined at a basic temperature of 25°C.

If the source voltage exceeds the rated voltage, a ballast resistor is required.

The resistor value can be calculated by using the formula in the Supplement section.

Color		C Red	E Yellow	F Green
Maximum Forward Current	I_{FM}	30mA	20mA	30mA
Typical Forward Current	I_F	10mA	10mA	10mA
Forward Voltage	V_F	1.8V	2.0V	2.1V
Maximum Reverse Voltage	V_{RM}	5V	5V	5V
Current Reduction Rate Above 25°C	ΔI_F	* 0.50mA/°C	* 0.33mA/°C	* 0.50mA/°C
Ambient Temperature Range		−25°C ~ +70°C		

* Applies to temperatures above 50°C

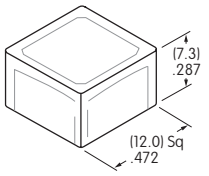
SNAP-ON CAPS

AT4135 Flat

Cap Color Codes:

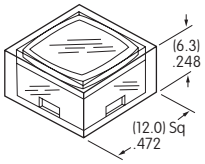
- **B** Translucent White
- **C** Red
- **E** Yellow
- **F** Green

Material: Polycarbonate Finish: Frosted

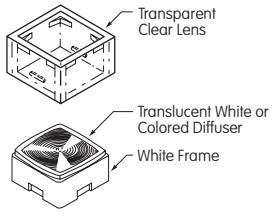


AT4060 Flat

Lens/Diffuser Color Codes:



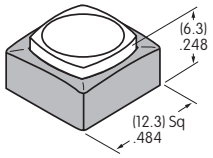
- **JB** Clear/Translucent White
- **JC** Clear/Red
- **JE** Clear/Yellow
- **JF** Clear/Green



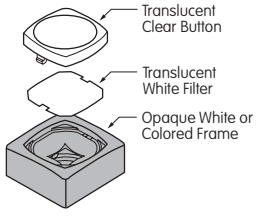
Material: Polycarbonate Lens Finish: Glossy

Framed:
AT4076 Button with Frame

Translucent Button/Frame Color Codes:



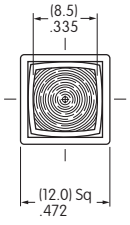
- **BB** White/White
- **BC** White/Red
- **BE** White/Yellow
- **BF** White/Green
- **BH** White/Gray



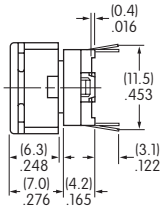
Material: Polycarbonate Button Finish: Frosted

TYPICAL SWITCH DIMENSIONS

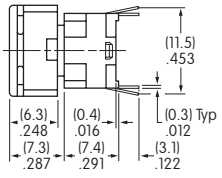
Flat Snap-on Cap

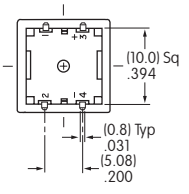


Short Actuator



Extended Actuator

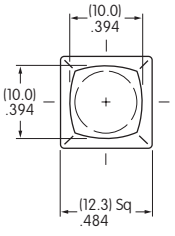




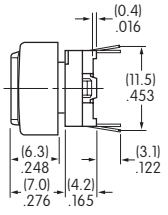
JB15LPC-JC

Spring action terminals conform to .100" (2.54mm) PCB spacing

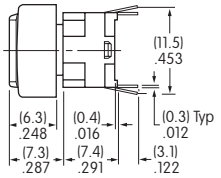
Framed Snap-on Cap

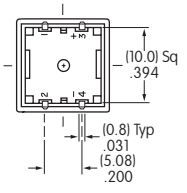


Short Actuator



Extended Actuator





JB15HBPC-BC

Spring action terminals conform to .100" (2.54mm) PCB spacing

LEGENDS

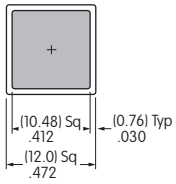
NKK Switches can provide custom legends for caps. Contact factory for more information.

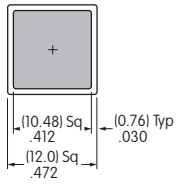
Suggested Printable Area for Cap, Lens, or Button

Recommended Methods:

Laser Etch, Screen Print or Pad Print

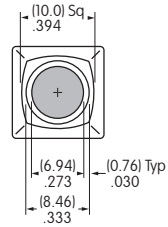
Epoxy based ink is recommended.





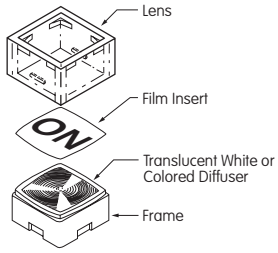
Laser Etch or Pad Print

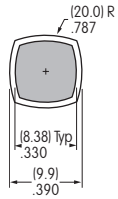
Epoxy based ink is recommended.



Shaded areas are printable areas.

Suggested Printable Area for Film Insert





Shaded area is printable area.

Film Insert: Clear Polyester 7 mil maximum thickness

General Specifications

Electrical Capacity (Resistive Load)

Low/Logic Level: 50mA @ 24V DC

Other Ratings

Contact Resistance: 50 milliohms maximum
Insulation Resistance: 500 megohms minimum @ 250V DC
Dielectric Strength: 250V AC minimum for 1 minute minimum
Mechanical Life: 500,000 operations minimum
Electrical Life: 500,000 operations minimum
Nominal Operating Force: 1.96N for sculptured actuator
2.0N for piano actuator
3.0N for square & round flush actuators
Total Travel: Flush Actuators .016" (0.4mm)
Sculptured & Piano Actuators .031" (0.8mm)

Materials & Finishes

Actuator: Polyamide
Case: Glass fiber reinforced polyamide
Seal: Nitrile butadiene rubber
Base: Glass fiber reinforced polyester
Movable Contact: Phosphor bronze with silver plating
Stationary Contacts: Brass with silver plating
Terminals: Brass with silver plating

Environmental Data

Operating Temperature Range: –25°C through +85°C (–13°F through +185°F)
Humidity: 90 ~ 95% humidity for 96 hours @ 40°C (104°F)
Vibration: 10 ~ 55Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in 1 minute; 3 right angled directions for 2 hours
Shock: 50G (490m/s^2) acceleration (tested in 6 right angled directions, with 5 shocks in each direction)

PCB Processing

Soldering: Wave Soldering Recommended. See Profile A in Supplement section.
Manual Soldering: See Profile A in Supplement section.
Cleaning: Automated cleaning. See Cleaning specifications in Supplement section.

Standards & Certifications

The JF Series tactiles have not been tested for UL recognition or CSA certification.
These switches are designed for use in a low-voltage, low-current, logic-level circuit.
When used as intended in a logic-level circuit, the results do not produce hazardous energy.

Distinctive Characteristics

Extremely low profile of 5mm from PCB to top of switch.

Rubber seal construction prevents contact contamination and allows automated soldering and cleaning.

Minimal operating force and short stroke permit light touch operation.

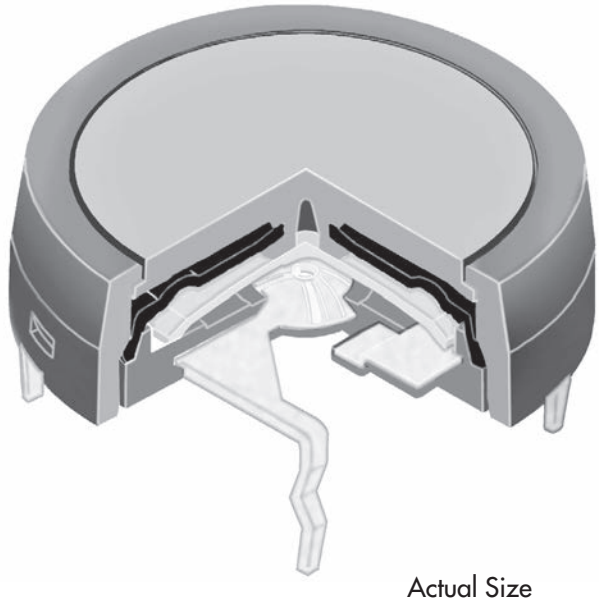
Dome contact gives crisp tactile and audible feedback to positively indicate circuit transfer and assures high reliability and long life.

Wide choice of body shapes and colors.

Crimped terminals provide a spring type action to ensure secure mounting and prevent dislodging during wave soldering.

Space saving body dimensions provide for compact, side-by-side mounting on a standard grid.

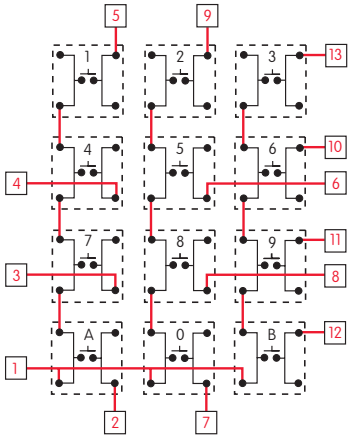
Terminal spacing conforms to standard .100" (2.54mm) PCB grid.

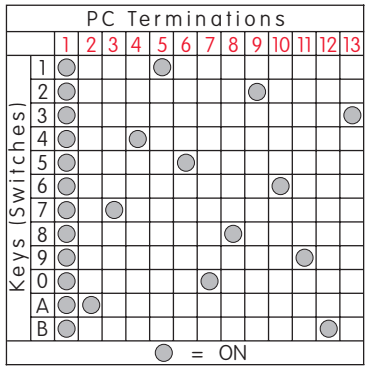


Actual Size

Common Bus Matrix

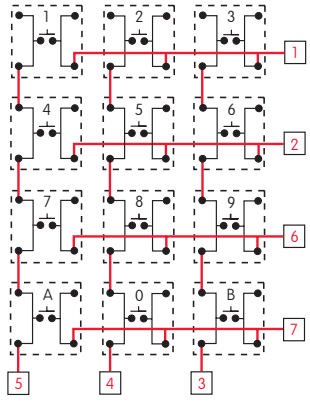
These single pole, single throw switches can be used in a keyboard matrix and, using strapped terminals, achieve a common bus electrical configuration on a single-sided PC board.

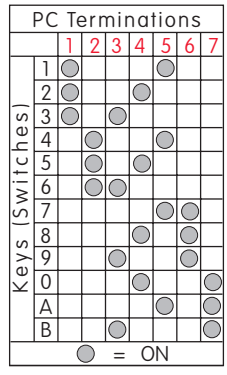




X-Y Matrix

These single pole, single throw switches can be arranged on a single-sided PC board matrix with strapped terminals to achieve an X-Y type electrical interconnection.





Red = PCB Trace Black = Switch Circuit

TYPICAL SWITCH ORDERING EXAMPLE

JF 15 S P 2 C

Pole & Circuit

15	SPST	OFF	(ON)

( ) = Momentary

Housing Shapes

C	Round (with round actuator only)
S	Square

Terminals

P	Straight PC

Actuator Types

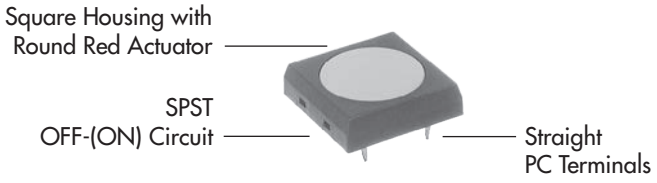
1	Square
2	Round
3	Sculptured
4	Piano

Actuator Colors

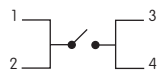
C	Red
D	Orange
F	Green
G	Blue
H	Gray

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

JF15SP2C



POLE & CIRCUIT

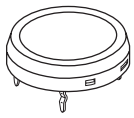
Pole	Model	Actuator Position ( ) = Momentary Normal	Down	Switch Throw & Schematic	
SP	**JF15**	OFF	(ON)	SPST 	Note: Terminal numbers are shown on the switch.

HOUSING SHAPES & ACTUATOR TYPES

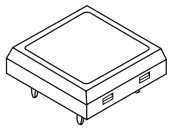
C Round Housing

S Square Housing

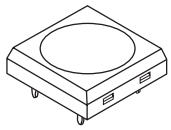
2 Round Actuator



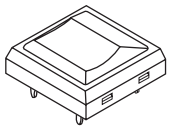
1 Square Actuator



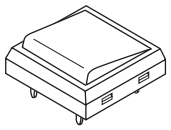
2 Round Actuator



3 Sculptured Actuator



4 Piano Actuator



Actuator Colors Available:

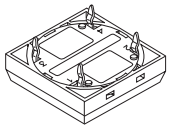
C Red **D** Orange **F** Green **G** Blue **H** Gray

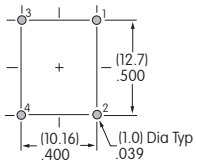
Housing is Black

TERMINALS & PANEL DESIGN

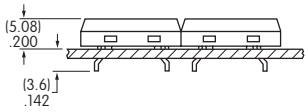
P Straight PC

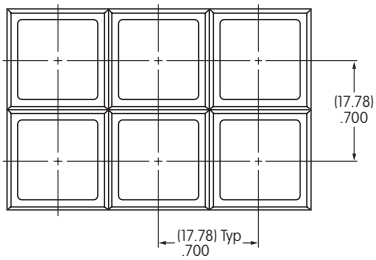
Additional details in Typical Switch Dimensions





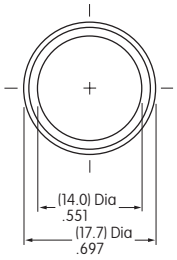
Versatile panel arrangements can be made to fit individual design needs.

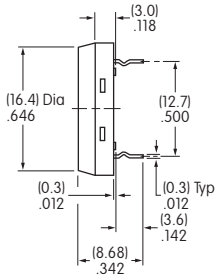


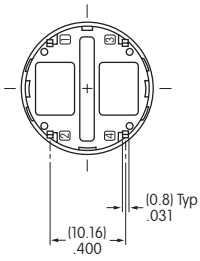


TYPICAL SWITCH DIMENSIONS

Round Actuator



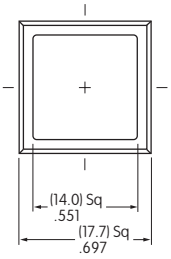


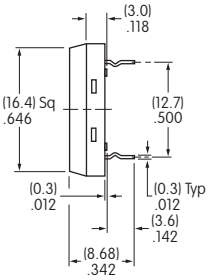


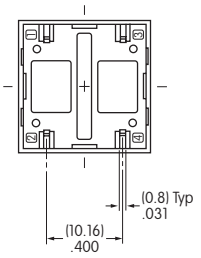
JF15CP2C

TYPICAL SWITCH DIMENSIONS

Square Actuator

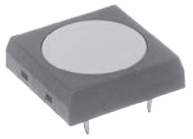


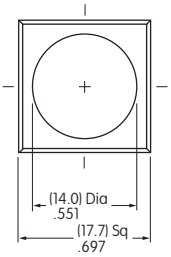


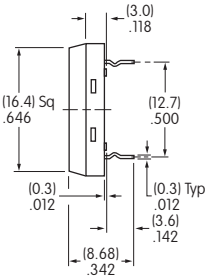


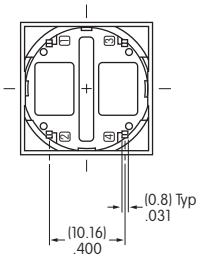
JF15SP1C

Round Actuator



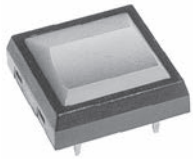


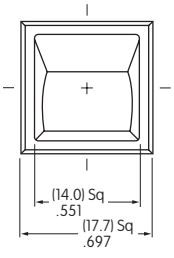


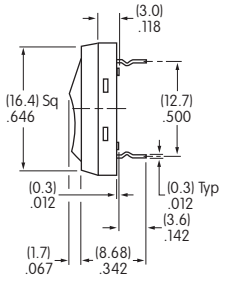


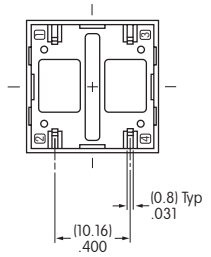
JF15SP2C

Sculptured Actuator



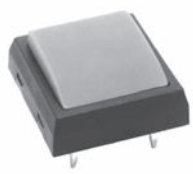


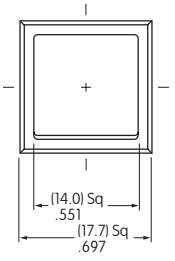


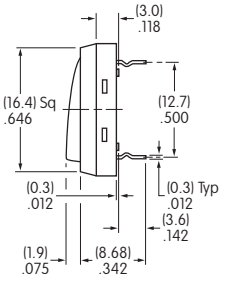


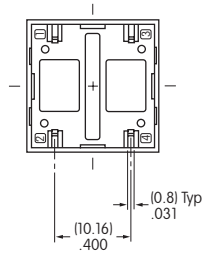
JF15SP3C

Piano Actuator







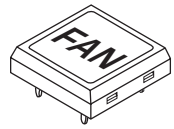


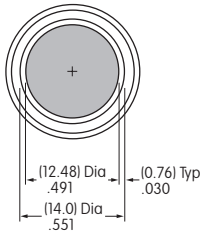
JF15SP4C

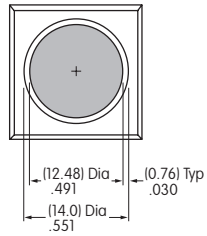
LEGENDS

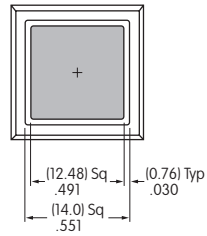
NKK Switches can provide custom legends for caps. Contact factory for more information.

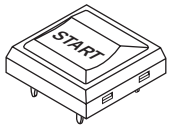
Shaded Areas are Printable Areas

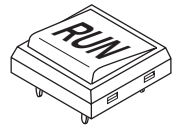


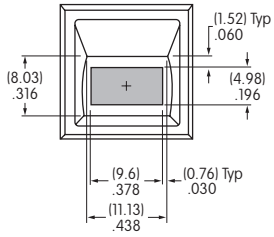


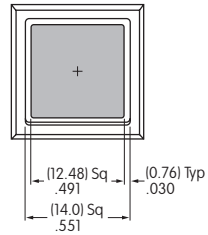












Recommended Print Methods: Screen Print or Pad Print. Epoxy based ink is recommended.

General Specifications

Electrical Capacity (Resistive Load)

Low/Logic Level: 50mA @ 24V DC

Other Ratings

Contact Resistance: 50 milliohms maximum
Insulation Resistance: 500 megohms minimum @ 250V DC
Dielectric Strength: 250V AC minimum for 1 minute minimum
Mechanical Life: 500,000 operations minimum
Electrical Life: 500,000 operations minimum
Nominal Operating Force: 3.0N for flush actuator
2.0N for sculptured actuator
Total Travel: Flush Actuators .016" (0.4mm); Sculptured Actuator: .031" (0.8mm)

Materials & Finishes

Actuator: Polyamide for spot illuminated; polycarbonate for full face
Case: Glass fiber reinforced polyamide
Seal: Nitrile butadiene rubber
Base: Glass fiber reinforced polyester
Movable Contact: Phosphor bronze with silver plating
Stationary Contacts: Brass with silver plating
Terminals: Brass with silver plating

Environmental Data

Operating Temperature Range: –25°C through +70°C (–13°F through +158°F)
Humidity: 90 ~ 95% humidity for 96 hours @ 40°C (104°F)
Vibration: 10 ~ 55Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in 1 minute; 3 right angled directions for 2 hours
Shock: 50G (490m/s^2) acceleration (tested in 6 right angled directions, with 5 shocks in each direction)

PCB Processing

Soldering: Wave Soldering recommended. See Profile A in Supplement section.
Manual Soldering: See Profile A in Supplement section.
Cleaning: Automated cleaning. See Cleaning specifications in Supplement section.
Switches should not be operated or have any pressure on the actuators during cleaning.
Full face illuminated models suitable only for bottom board spray wash to avoid contamination of the 2-layered actuator, which may compromise the aesthetics.

Standards & Certifications

The JF Series tactiles have not been tested for UL recognition or CSA certification.
These switches are designed for use in a low-voltage, low-current, logic-level circuit.
When used as intended in a logic-level circuit, the results do not produce hazardous energy.

Distinctive Characteristics

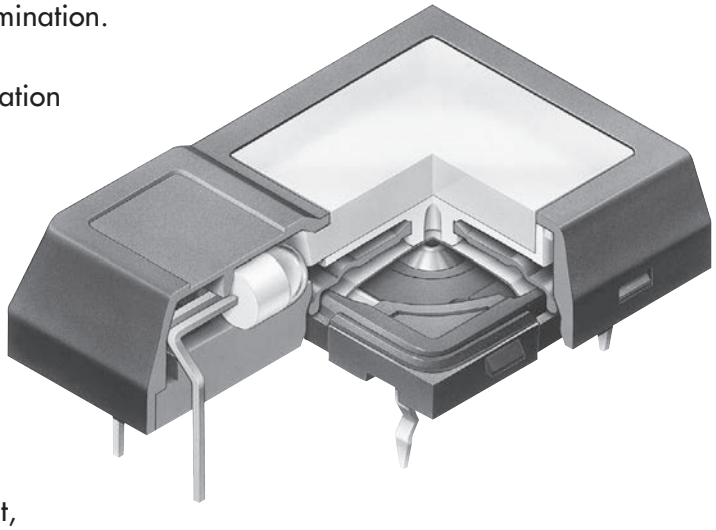
Extremely low profile of .224" (5.7mm) from PCB to top of switch.

Red, green, or yellow LED with spot or full face illumination.

Rubber seal construction prevents contact contamination and allows automated soldering and cleaning.

Minimal operating force and short stroke permit light touch operation.

Dome contact gives crisp tactile and audible feedback to positively indicate circuit transfer and assures high reliability and long life.



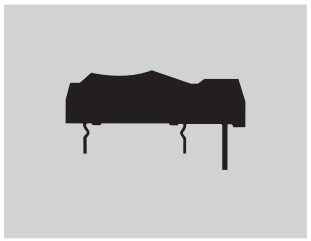
Space saving body dimensions provide for compact, side-by-side mounting on a standard grid.

Crimped terminals ensure secure mounting and prevent dislodging during wave soldering.

Terminal spacing conforms to standard .100" (2.54mm) PCB grid.

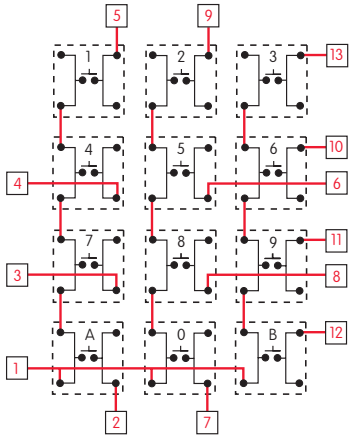
Matching indicator available and shown at the end of Section M.

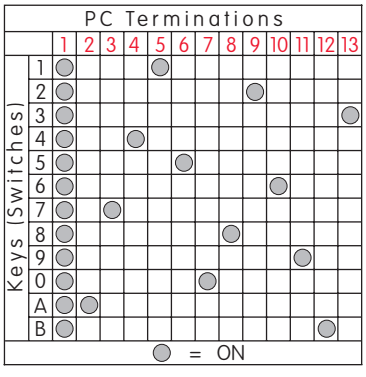
Actual Size



Common Bus Matrix

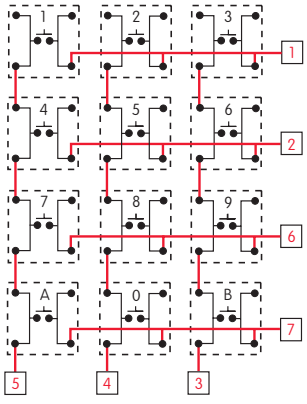
These single pole, single throw switches can be used in a keyboard matrix and, using strapped terminals, achieve a common bus electrical configuration on a single-sided PC board.

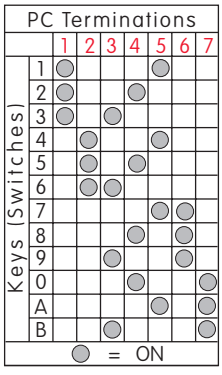




X-Y Matrix

These single pole, single throw switches can be arranged on a single-sided PC board matrix with strapped terminals to achieve an X-Y type electrical interconnection.





Red = PCB Trace Black = Switch Circuit

TYPICAL SWITCH ORDERING EXAMPLE

JF 15 R P 2 C C

Pole & Circuit

15	SPST	OFF	(ON)

( ) = Momentary

Terminals

P	Straight PC

Actuator Types

1	Square
2	Round
3	Sculptured

LED Colors

C	Red
E	Yellow
F	Green

Illumination

R	Spot
A	Full Face (with square actuator only)

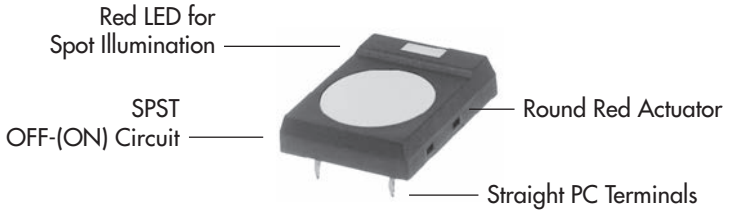
Actuator Colors

Spot Illuminated	
C	Red
D	Orange
F	Green
G	Blue
H	Gray
***Full Face Illuminated**	
C	Red
E	Yellow
F	Green

*LED color must match actuator color.

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

JF15RP2CC



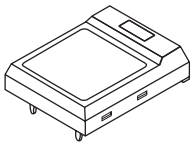
POLE & CIRCUIT

		Actuator Position ( ) = Momentary		Switch Throw & Schematic	LED Schematic	
Pole	Model	Normal	Down			
SP	JF15	OFF	(ON)	SPST		Notes: Terminal numbers are shown on switch. LED circuit is isolated & requires external power source.

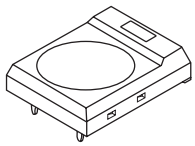
ILLUMINATION & ACTUATOR TYPES

R **Spot Illumination**

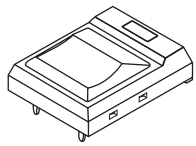
1 **Square Actuator**



2 **Round Actuator**



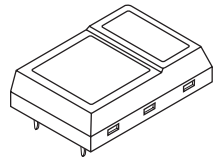
3 **Sculptured Actuator**



Actuator Colors Available: C, D, F, G, H
Housing is black

A **Full Face Illumination**

1 **Square Actuator**

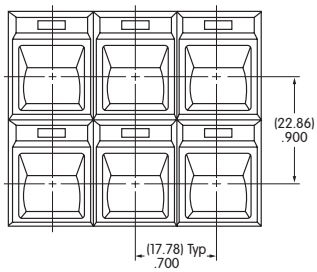


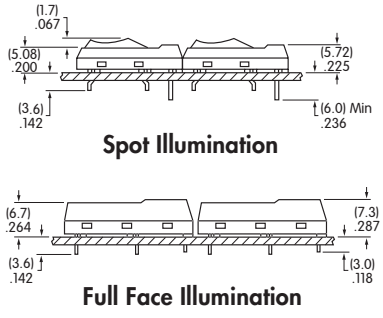
Actuator Colors Available: C, E, F
Housing is black

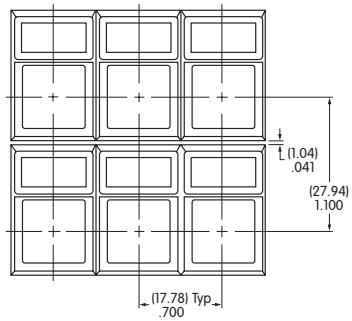
Color Codes: **C** Red **D** Orange **E** Yellow **F** Green **G** Blue **H** Gray

Flexible Panel Design

Versatile panel arrangements can be made to fit individual design needs.



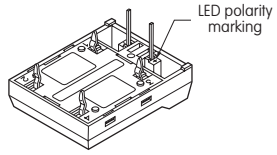




TERMINALS

P **Straight PC Terminals**

With isolated lamp circuit
Further details in Typical Switch Dimensions



LED COLORS & SPECIFICATIONS

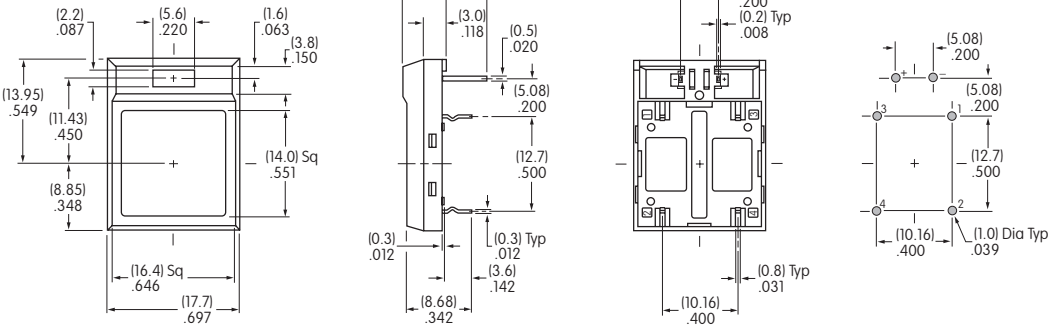
LEDs are supplied as an integral part of the switch. The electrical specifications shown are determined at a basic temperature of 25°C.
If the source voltage exceeds the rated voltage, a ballast resistor is required.
The resistor value can be calculated by using the formula in the Supplement section.

		Spot Illumination			Full Face Illumination		
Color		Red **C**	Yellow **E**	Green **F**	Red **C**	Yellow **E**	Green **F**
Maximum Forward Current	I_{FM}	40mA	40mA	40mA	30mA	30mA	30mA
Typical Forward Current	I_F	30mA	30mA	30mA	20mA	20mA	20mA
Forward Voltage	V_F	1.7V	2.2V	2.2V	1.77V	2.1V	2.3V
Maximum Reverse Voltage	V_{RM}	4V	4V	4V	4V	4V	4V
Current Reduction Rate Above 25°C	ΔI_F	0.67mA/°C	0.67mA/°C	0.67mA/°C	0.4mA/°C	0.4mA/°C	0.4mA/°C
Ambient Temperature Range		−25° ~ +70°C			−25° ~ +70°C		

TYPICAL SWITCH DIMENSIONS

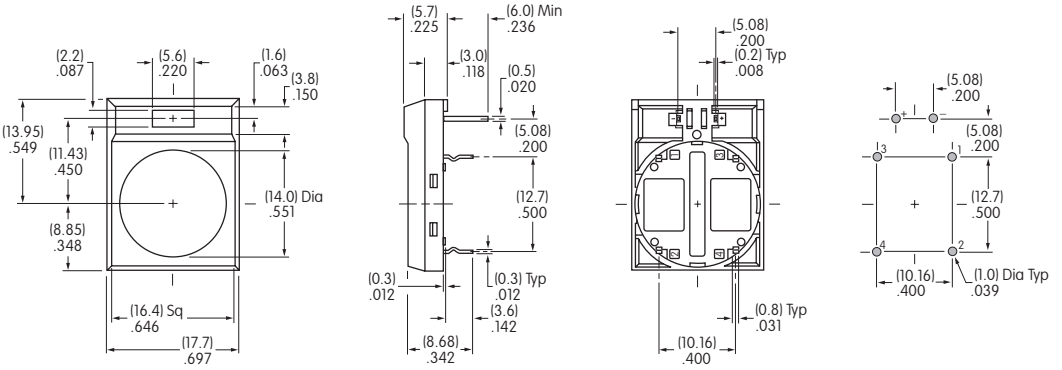
Spot Illuminated with Square Actuator

JF15RP1CC



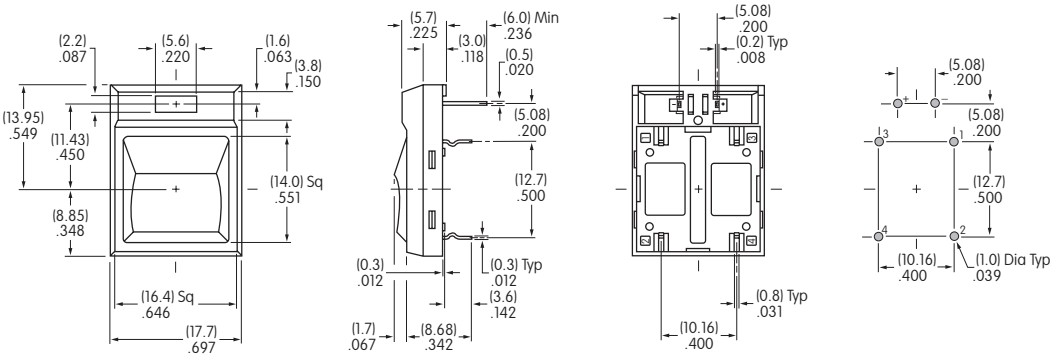
Spot Illuminated with Round Actuator

JF15RP2CC



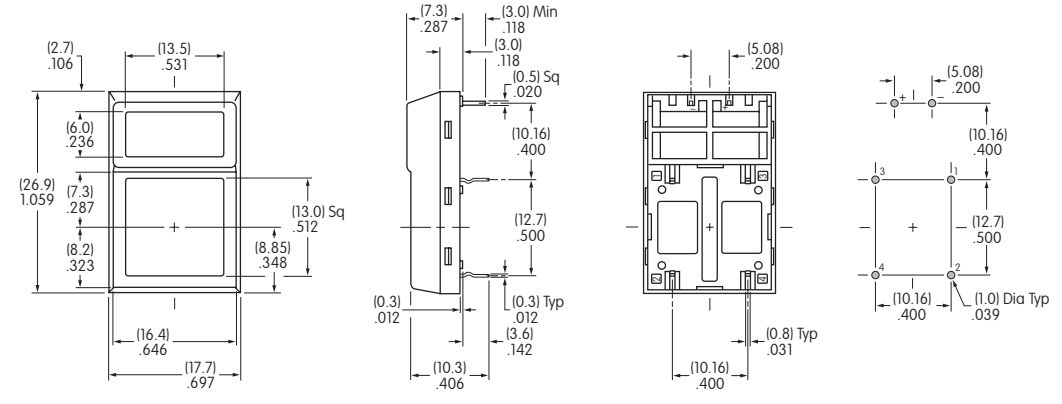
Spot Illuminated with Sculptured Actuator

JF15RP3CC



Full Face Illuminated with Square Actuator

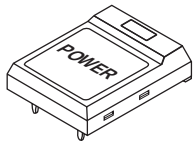
JF15AP1CC

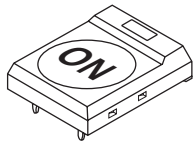


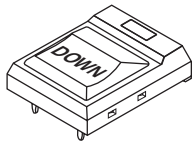
LEGENDS

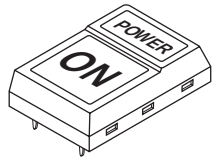
NKK Switches can provide custom legends for caps. Contact factory for more information.

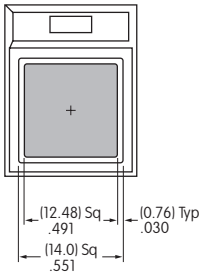
Suggested Printable Area

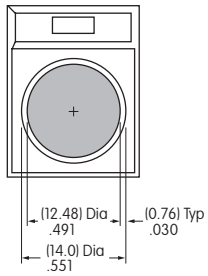


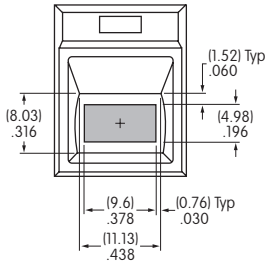


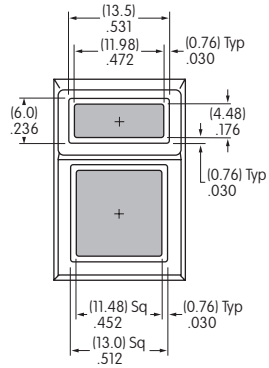












Recommended Print Method:

Screen Print or Pad Print

Epoxy based ink is recommended.

Shaded areas are printable areas.

General Specifications

Electrical Capacity (Resistive Load)

Low/Logic Level: 50mA @ 24V DC

Other Ratings

Contact Resistance: 50 milliohms maximum
Insulation Resistance: 500 megohms minimum @ 250V DC
Dielectric Strength: 250V AC minimum for 1 minute minimum
Mechanical Life: 1,000,000 operations minimum
Electrical Life: 1,000,000 operations minimum
Nominal Operating Force: 3.0N
Total Travel: .030" (0.75mm)

Materials & Finishes

Actuator: Polycarbonate
Case: Glass fiber reinforced polyamide
Base: Glass fiber reinforced polybutylene terephthalate (PBT)
Movable Contact: Stainless steel
Stationary Contacts: Brass with silver plating
Switch Terminals: Brass with silver plating
Lamp Terminals: Brass with tin plating

Environmental Data

Operating Temperature Range: –25°C through +50°C (–13°F through +122°F)
Humidity: 90 ~ 95% humidity for 240 hours @ 40°C (104°F)
Vibration: 10 ~ 55Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in 1 minute; 3 right angled directions for 2 hours
Shock: 50G (490m/s^2) acceleration (tested in 6 right angled directions, with 5 shocks in each direction)

PCB Processing

Soldering: Wave Soldering: See Profile A in Supplement section.
Manual Soldering: See Profile A in Supplement section.
Cleaning: These devices are not process sealed. Hand clean locally using alcohol based solution.

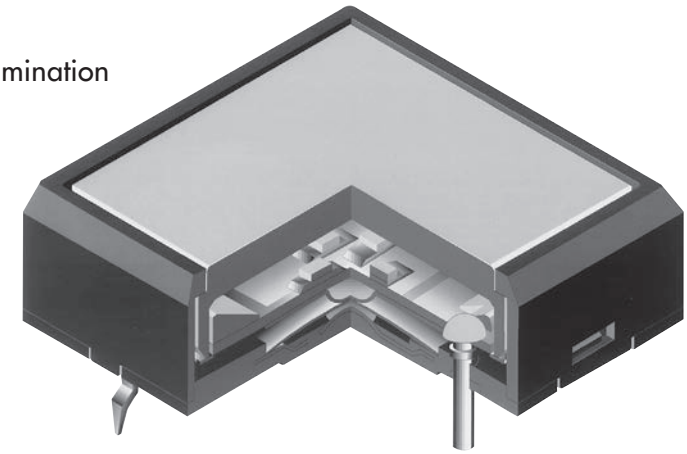
Standards & Certifications

The JL Series tactiles have not been tested for UL recognition or CSA certification.
These switches are designed for use in a low-voltage, low-current circuit.
When used as intended, the results do not produce hazardous energy.

Distinctive Characteristics

Bright, full face illumination with choice of red, green, or amber LEDs.

Multiple LED arrays and interior reflectors enhance illumination of the large, .75" (19mm) square actuator surface.



Distinctive design allows full face illumination in extra low profile of 0.31" (7.85mm) from PCB to top of switch.

Dome contact gives crisp tactile and audible feedback with short stroke and assures high reliability and long life of 1,000,000 operations.

Crimped terminals provide a spring type action to ensure secure mounting and prevent dislodging during the soldering process.

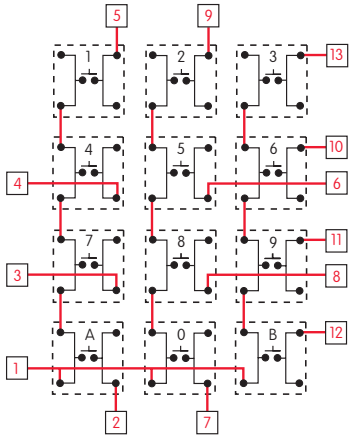
Actual Size

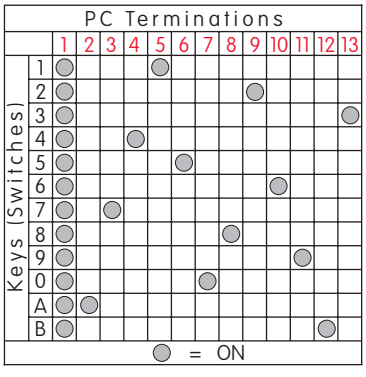
Streamlined housing dimensions provide for compact, side-by-side mounting on a standard grid.

Terminal spacing conforms to standard .100" (2.54mm) PCB grid.

Common Bus Matrix

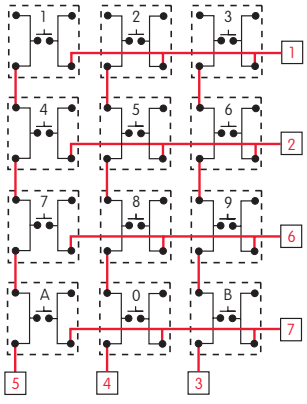
These single pole, single throw switches can be used in a keyboard matrix and, using strapped terminals, achieve a common bus electrical configuration on a single-sided PC board.

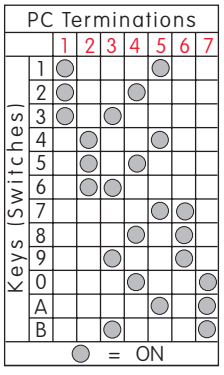




X-Y Matrix

These single pole, single throw switches can be arranged on a single-sided PC board matrix with strapped terminals to achieve an X-Y type electrical interconnection.





Red = PCB Trace Black = Switch Circuit

TYPICAL SWITCH ORDERING EXAMPLE

JL | 15 | SK | S | C | C | P2

Pole & Circuit

15	SPST	OFF	(ON)

( ) = Momentary

Housing & Color

SK	Square Black

Actuator Shape

S	Square

Actuator Colors

B	White
C	Red
D	Amber
F	Green

Terminals

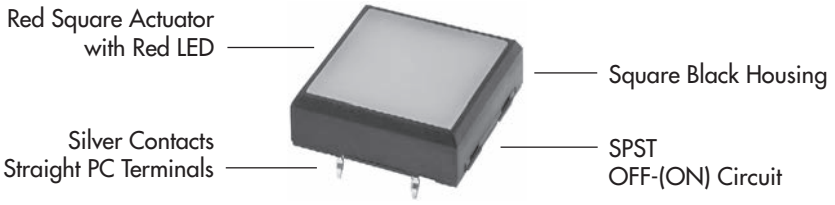
P2	Silver Contacts Straight PC

LED Colors

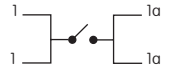
C	Red
D	Amber
F	Green

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

JL15SKSCCP2

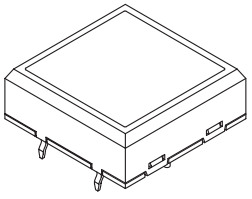


POLE & CIRCUIT

Pole	Model	Actuator Position ( ) = Momentary: Normal	Actuator Position ( ) = Momentary: Down	Switch Throw & Schematic	LED Schematic	
SP	JL15	OFF	(ON)	SPST 		Note: Terminal markings "1", "1a", "–", and "+" are shown on the switch.

HOUSING & COLOR

SK Square Black Housing



ACTUATOR SHAPE & COLORS

S .748" (19.0mm) Square Actuator

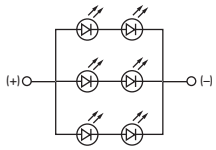
Actuator Colors Available:

B White | C Red | D Amber | F Green

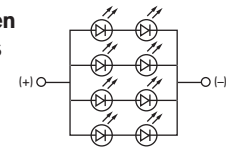
LED COLORS & SPECIFICATIONS

LEDs are an integral part of the switch. The electrical specifications shown are determined at a basic temperature of 25°C.
If the source voltage exceeds the rated voltage, a ballast resistor is required.
The resistor value can be calculated by using the formula in the Supplement.

Red LED model has 6 LEDs.



Amber & Green models each have 8 LEDs.

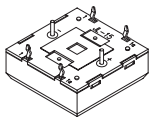


1-color, 1-element LEDs grouped in arrays of 6 or 8.	Color	C Red	D Amber	F Green
Maximum Forward Current	I_{FM}	90mA	120mA	120mA
Typical Forward Current	I_F	60mA	80mA	80mA
Forward Voltage	V_F	3.9V	4.0V	4.2V
Maximum Reverse Voltage	V_{RM}	10V	10V	10V
Current Reduction Rate Above 25°C	ΔI_F	1.2mA/°C	1.6mA/°C	1.6mA/°C
Ambient Temperature Range		–25°C ~ +50°C		

TERMINALS

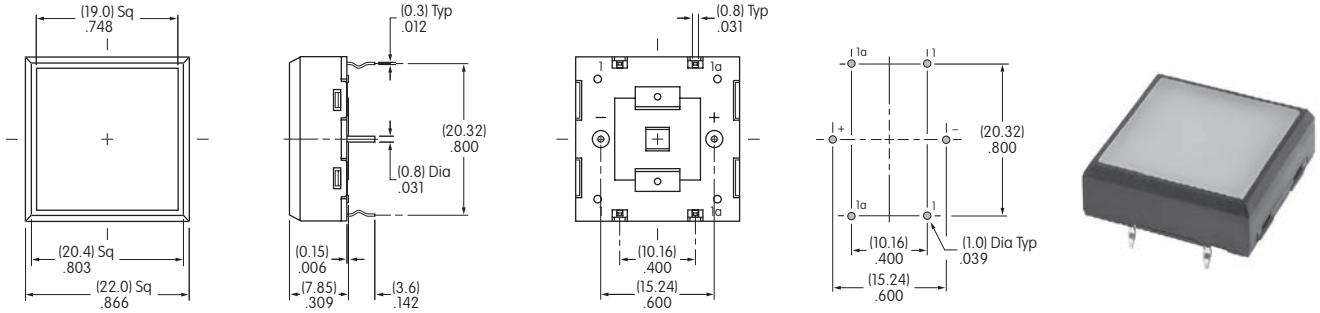
P2 **Silver Contacts**
Straight PC

Additional details in
Typical Switch Dimensions



TYPICAL SWITCH DIMENSIONS

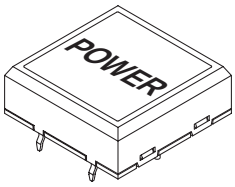
Square Actuator

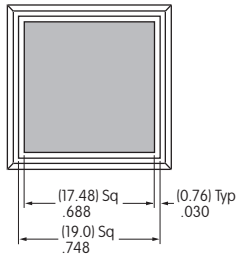


JL15SKSCCP2

LEGENDS

NKK Switches can provide custom legends for caps. Contact factory for more information.





Shaded area is printable area.

Recommended Print Methods:

Screen Print or Pad Print.

Epoxy based ink is recommended.

Additional Method

Engraving is not recommended as an additional method for legends.

Contact factory if engraving is required; it must be done before the actuator is assembled.

Notes

NKK SWITCHES

Tilt Switches

Distinctive Characteristics

DSA

Environmentally friendly, contains no mercury.

High contact reliability due to sealed body.

The switch is triggered when tilted beyond ±10° of the horizontal.

PCB adaptor available as an accessory.

DSB

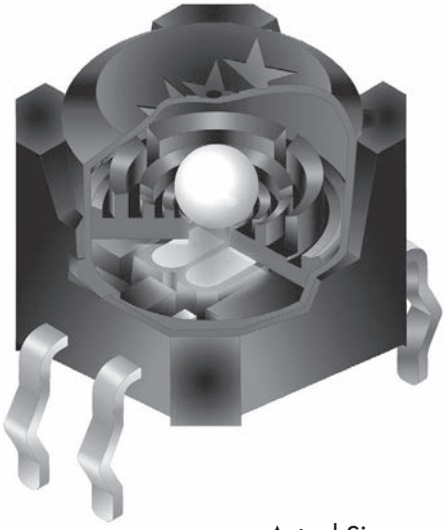


Photo interrupter, rather than contacts, ensures high reliability. 1 million operations minimum.

Sealed construction for protection from environmental elements, including hydrogen sulfide, sulfur dioxide, and nitrogen hydroxide. Terminals are made of ammonia-resistant materials.

Totally sealed body allows process compatibility for time- and money-saving automatic soldering and cleaning.

Space-saving compact dimensions allow high density mounting.

Internal steel ball movement allows functionality of 360° circumference rotation.

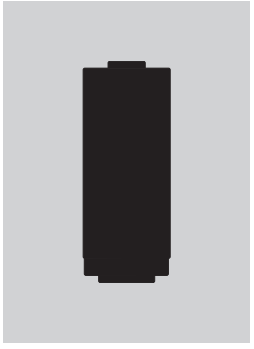
The DSB series switch is well-suited to meet product safety concerns due to normally closed (on) status.

Crimped terminals ensure secure mounting and prevent dislodging during wave soldering.

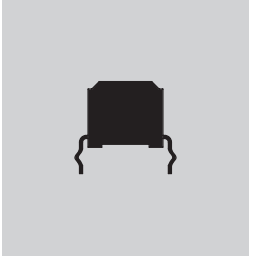
The switch is triggered when tilted beyond ±30° of the horizontal.

Actual Sizes

DSA



DSB



DSA SWITCH PART NUMBER & DESCRIPTION

DSA01

DSA SWITCH SPECIFICATIONS

Mechanical & Electrical Specifications	
Poles and Circuits:	Single Pole Single Throw ON – OFF
Operating Range:	ON Angle = 10° ~ 170°; OFF Angle = 190° ~ 350°
Resistive Load:	0.1A @ 12V DC
Contact Resistance:	100 milliohms maximum
Insulation Resistance:	50 megohms minimum @ 250V DC
Dielectric Strength:	250V AC for 1 minute minimum between terminals
Mechanical Life:	100,000 operations minimum
Electrical Life:	100,000 operations minimum

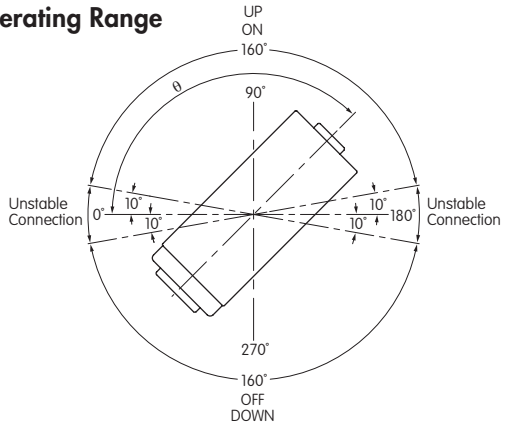
Materials & Finishes	
Housing:	PBT
Rubber Rings:	Nitrile Butadiene Rubber
Contact Balls:	Brass with Silver Plating
Terminals:	Brass with Silver Plating

Environmental Specifications	
Operating Temperature Range:	–10°C ~ +70°C (+14°F ~ +158°F)
Storage Temperature Range:	–25°C ~ +85°C (–13°F ~ +185°F)
Contact Bounce (for reference):	500ms maximum
Humidity:	90% humidity for 96 hours @ 40°C (104°F)
Vibration (for reference):	Frequency range 10Hz ~ 500Hz for 2 hours; 2 directions; Acceleration: 0.2G
Notes:	1. Do not install switch near vibration source. 2. Terminals should not be exposed to liquid.

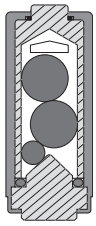
Processing for AT094 PCB Adaptor	
Soldering (with PCB Mount Holder):	Wave Soldering: See Profile A in Supplement section. Manual Soldering: See Profile B in Supplement section.
Automated Cleaning:	Hand clean locally using alcohol based solution.

DSA SWITCH SPECIFICATIONS (CONTINUED)

Operating Range

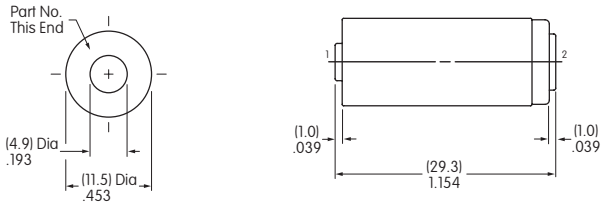


Cross Section



Allow 500ms settling time between states.

TYPICAL SWITCH DIMENSIONS



Terminal numbers are not on the switch.

DSA01

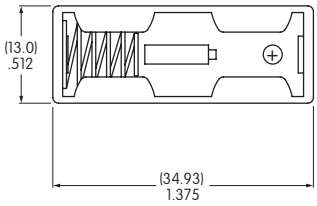
OPTIONAL ADAPTOR

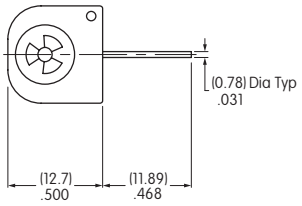
AT094
PCB Adaptor for DSA01

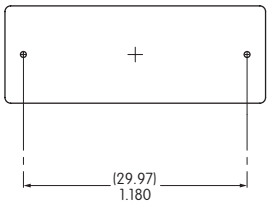
Materials:

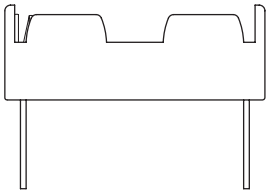
Holder:	Polypropylene
Spring:	Spring Steel with Nickel Plating
PC Pins:	Brass with Nickel Plating

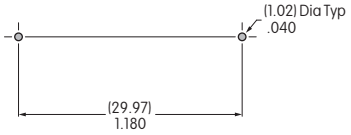
Assembled DSA Switch & Adaptor





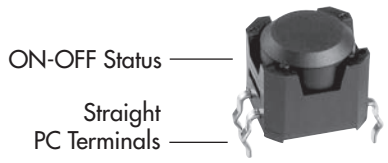




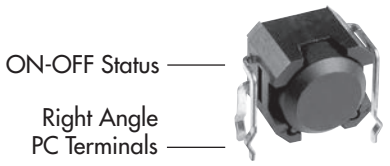


PCB Footprint

DSB SWITCH PART NUMBERS & DESCRIPTION



DSBA1P



DSBA1H

DSB SWITCH SPECIFICATIONS

Absolute Maximum Ratings
Temperature at 25°C

		Symbol	Rating	Unit
Input	Forward Current	I_F	50	mA
	Reverse Voltage	V_R	5	V
	Power Dissipation	P_D	75	mW
Output	Collector-Emitter Voltage	V_{CEO}	30	V
	Emitter-Collector Voltage	V_{ECO}	3	V
	Collector Current	I_C	20	mA
	Collector Power Dissipation	P_C	50	mW
	Total Power Dissipation	P_{tot}	100	mW

Mechanical Specifications

Mechanical Life:	1,000,000 operations minimum
Electrical Life:	1,000,000 operations minimum using applicable circuit

Materials & Finishes

Housing:	Glass fiber reinforced polyamide (UL94V-0 flammability rating)
Base:	Glass fiber reinforced polyamide (UL94V-0 flammability rating)
Terminals:	Phosphor bronze with tin plating

Environmental Specifications

Operating Temperature Range:	–25°C ~ +80°C (–13°F ~ +176°F)
Storage Temperature Range:	–30°C ~ +85°C (–22°F ~ +185°F)
Humidity:	85% humidity for 500 hours @ +85°C (+185°F)
Vibration:	10Hz with peak-to-peak amplitude of 10mm traversing the frequency range & returning in 1 minute; 3 right angled directions for 500,000 cycles
Shock:	100G (981m/s²) acceleration (tested in 6 right angled directions, with 5 shocks in each direction)
Notes:	1. Prevent exposure to magnetic fields. 2. Do not install switch near vibration source.

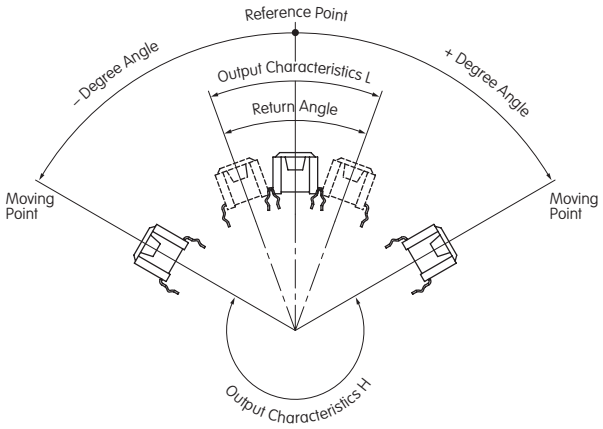
DSB SWITCH SPECIFICATIONS (CONTINUED)

Operating Characteristics

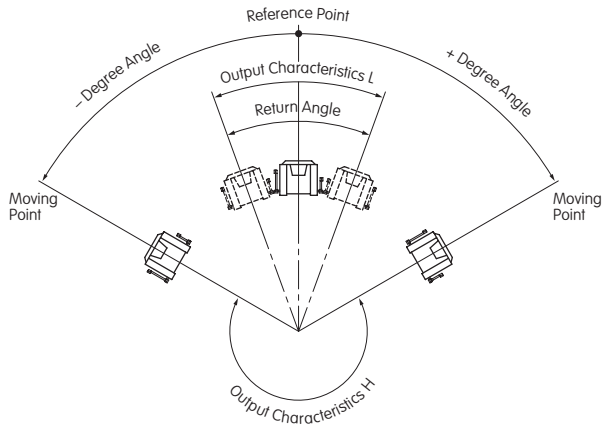
	Operating Angle	Return Angle
Circuit Characteristics (ON-OFF)	±30° to ±60°	Minimum 10°
	Output $V_{OL} \rightarrow V_{OH}$	Output $V_{OH} \rightarrow V_{OL}$

Output Characteristics V_{OL} with Photo transistor ON: 1.0V maximum (horizontal)
Output Characteristics V_{OH} with Photo transistor OFF: 4.0V minimum (inclined at an angle of –60° minimum)

Output Characteristics



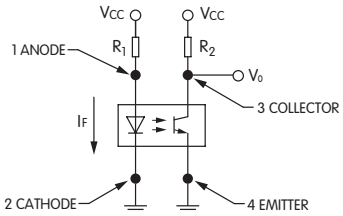
Straight PC



Right Angle PC

Circuit Design Considerations

V_{CC} = 5V
R_2 = 100kΩ
I_F = 19mA (V_{CC} = 5V, R_1 = 200Ω)
V_F of the LED Maximum = 1.3V

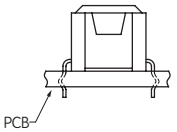


PCB Processing

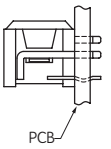
Soldering : Wave Soldering: See Profile A in Supplement section.
Manual Soldering: See Profile A in Supplement section.

Automated Cleaning: Use alcohol based solution at 50°C maximum. Do not submerge over 2.0" (5.0cm) for 1 minute maximum. Do not use organic solvents.

MOUNTING OPTIONS



PCB mounting option for Straight PC

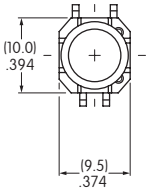


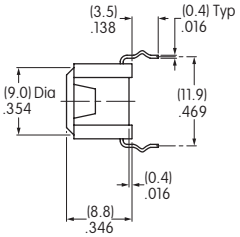
PCB mounting option for Right Angle PC

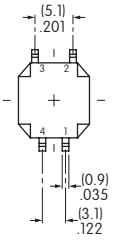
Install switch at an angle less than ±3° from the mounting surface.

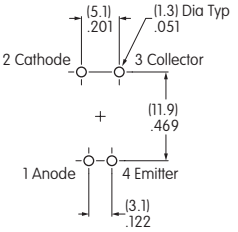
TYPICAL SWITCH DIMENSIONS

Straight PC





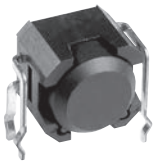


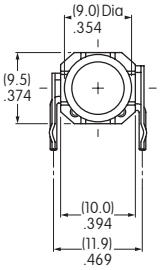


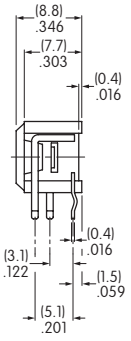
DSBA1P

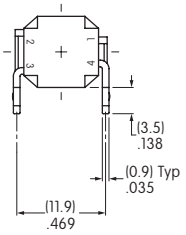
Terminal numbers are on bottom of switch.

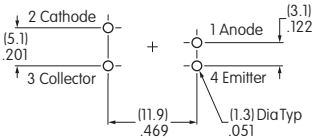
Right Angle PC











DSBA1H

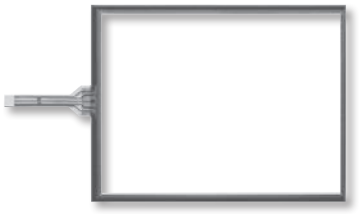
Terminal numbers are on bottom of switch.

Notes

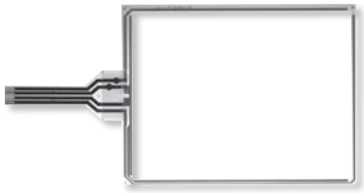
NKK SWITCHES

Touch Screens & Membranes

Contents Touch Screens & Membranes



5-Wire Touchscreens.....L5



4-Wire Touchscreens.....L8

Digital Touchscreens.....L14

FM Membranes L15

Resistive Touch Screens

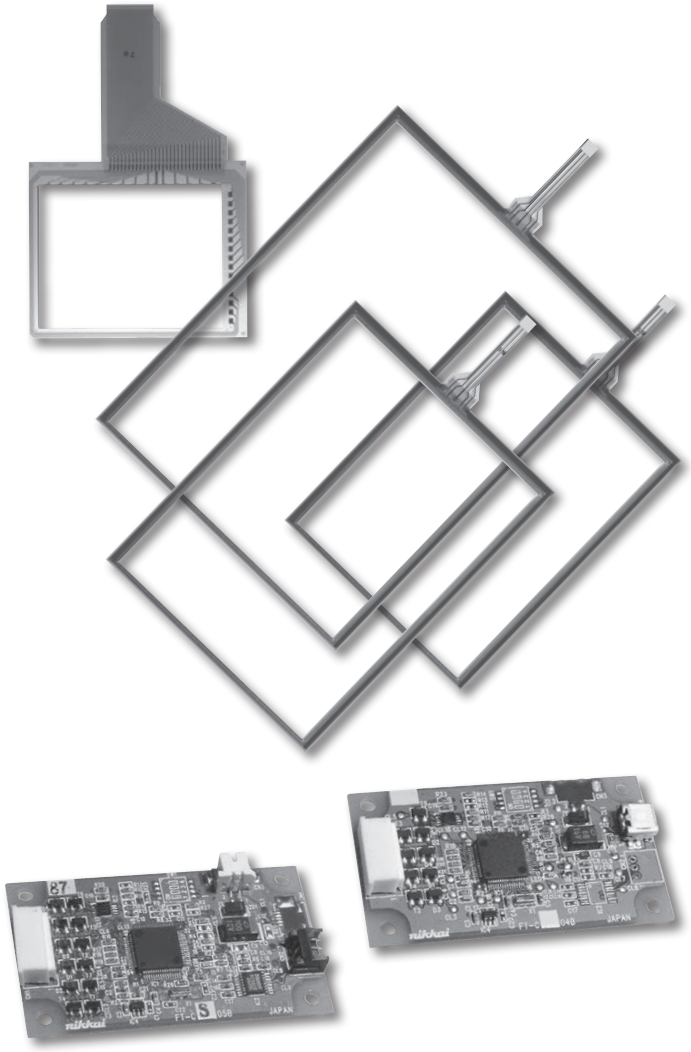
5-Wire, 4-Wire & Digital Solutions

NKK's transparent touch screens are engineered to complement the application of choice while offering superior durability and flexibility. With options in multiple sizes, and choices of input by finger, gloved finger or stylus, we maintain a consistent focus on impeccable quality and value added solutions with the diverse needs of our customers at the forefront.

Whether an application requires the 5- or 4-wire technology, the features include metal tails (analog), contact reliability with a connector, and ANR film, eliminating many of the typical visual artifacts. The film surface is non-glare and hard coated for ease of use and integrity of the surface.

Additional benefits of NKK's 5-wire touch screens include:

- Screens highly resistant to static electricity and noise pollution
- Drift-free operation despite any temperature fluctuation
- Greater touch point density translating to more precision and reduction of false actuations
- Quicker response time



DISTINCTIVE CHARACTERISTICS

- Wide Range of Available Sizes
- Custom Solutions a Specialty
- Digital and Analog Solutions
- Controllers Available
- Anti-Newton Ring (ANR) Technology for Analog Touch Screens
- Design Minimizes Visual Artifacts
- RoHS Compliant

APPLICATIONS

- Information Kiosks
- Industrial Automation
- Banking, Exchange Management Systems
- Broadcast
- Office Automation
- Medical Equipment
- Hand-held Devices
- Hospitality and Restaurant
- Gaming

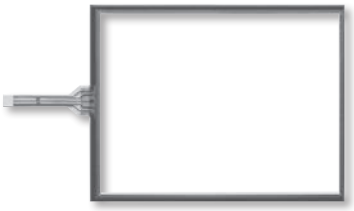
Customization Options

Parameter	Notes & Options
Resistive Analog Touch Screen	4-Wire or 5-Wire
Integrate LCD & Touchscreen	Yes - No
5-Wire - Screen Size Diagonal Inches	Standard 10.4, 12.1, 15 (min 10.4, max 19)
4-Wire - Screen Size Diagonal Inches	Standard 5.7, 6.5, 8.4, 10.4, 12.1, 15 (min 2.5, max 19)
Data Entry Area mm x mm	Same as the dimensions of the display area of the LCD
Viewable Area mm x mm	Same as the dimensions of the bezel opening of the LCD
Perimeter Dimensions mm x mm	
Tail Type	PCB standard, FPC option
Tail Pitch	1.25mm is standard
Tail Pins	8 is standard, 4 is option
Tail Length	2 standard options: 65mm or 80mm
Tail Base Width	28.2mm is standard
Tail Location	Left side is standard, non-std options top or bottom
Tail Material	Carbon-coated silver is standard, option is copper-gold
Glass Thickness	1.1 and 1.8mm are standard (note: total thickness = glass thickness + 0.3mm)
Hardcoat Treatment	Standard
Anti-Newton Ring Treatment	Standard
Optical Transmission Factor	80% is standard
Controller	Yes - No (no = customer will supply)
Communication	USB or RS232
Operating System	Windows 7 or Windows XP

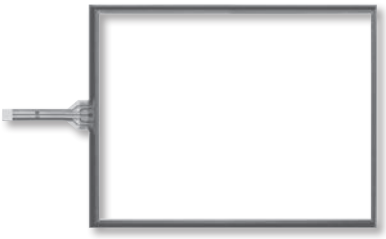
GENERAL SPECIFICATIONS FOR 5-WIRE

5-Wire Resistive Analog Touch Screens

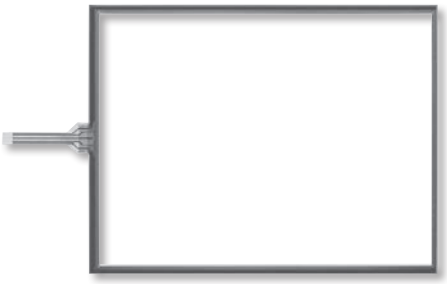
Optical	
Light Transmission	80% standard
Film Options	Anti-glare, anti-Newton ring standard
Electrical	
Power Level	5.5V DC
X Y Resistive Value	20 ~ 80Ω
Insulation Impedance	10MΩ minimum @ 25V DC
Linearity	±2% maximum (after adjustment made by control board or device driver)
Chattering Time	10 milliseconds maximum
Mechanical	
Touch Activation Force	1.47N
Available Sizes	10.4", 12.1" and 15.0"
Durability	
Surface Hardness	2H (JIS K5600)
Expected Operational Life	Writing: 50,000 minimum operations (approximately 30mm movement with stylus)
	Tapping: 10,000,000 operations minimum (using silicon rubber)
Environmental	
Operating Temperature Range	–20°C ~ +70°C (–4°F ~ +158°F)
Storage Temperature Range	–40°C ~ +80°C (-22°F ~ +158°F)
Relative Humidity	+60°C (+140°F), humidity 90%, 240 hours



FTAS00-104A5



FTAS00-121A5



FTAS00-150A5

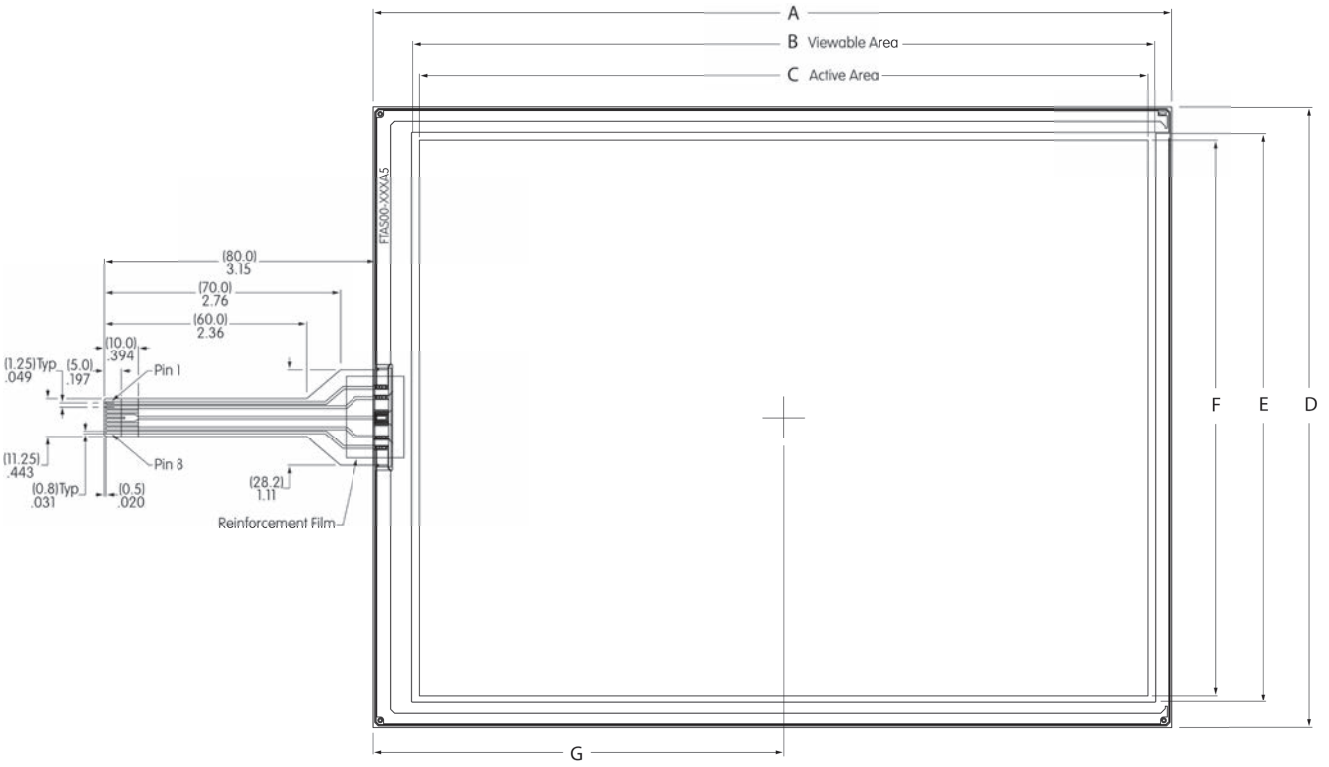
PART NUMBERS & DESCRIPTIONS FOR 5-WIRE

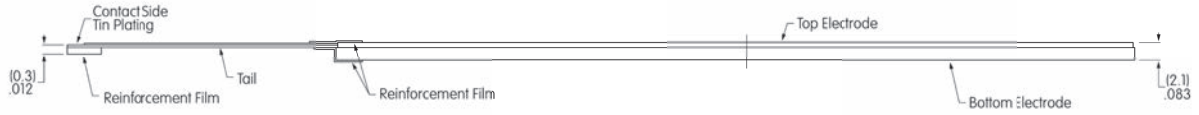
5-Wire Analog Touch Screens

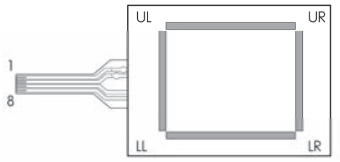
Part Number	Screen Size in Inches	Key Area Dimensions	Viewing Area Dimensions	External Dimensions	Panel Thickness	Terminal Detail 8 Pin .049" (1.25mm) Pitch
FTAS00-104A5	10.4	8.5" x 6.45" (215.9mm x 163.9mm)	8.66" x 6.61" (219.9mm x 167.9mm)	9.31" x 7.22" (236.5mm x 183.3mm)	.083" (2.1mm)	Length 3.15" (80.0mm)
FTAS00-121A5	12.1	9.8" x 7.37" (249.0mm x 187.2mm)	9.94" x 7.50" (252.4mm x 190.6mm)	10.52" x 8.1" (267.1mm x 205.8mm)	.083" (2.1mm)	Length 3.15" (80.0mm)
FTAS00-150A5	15.0	12.05" x 9.06" (306.1mm x 230.1mm)	12.19" x 9.19" (309.5mm x 233.5mm)	12.79" x 9.79" (324.8mm x 248.7mm)	.083" (2.1mm)	Length 3.15" (80.0mm)

Note: See web site for dimensioned drawings for all 5-Wire Analog Touch Screens.

GENERAL SPECIFICATIONS FOR 5-WIRE







UL, LL, UR, LR: Bottom Electrode Terminal
SENSE: Top Electrode Terminal

Pins	Signal
1	UR
2	UL
3	NC
4,5	SENSE
6	NC
7	LL
8	LR

5-Wire Analog Touch Screen Dimensions

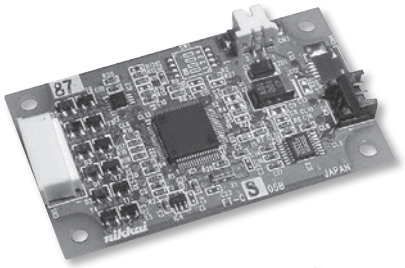
Part Number	Screen Size in Inches	Dim A	Dim B Viewable Area	Dim C Active Area	Dim D	Dim E Viewable Area	Dim F Active Area	Dim G Center of Active Area
FTAS00-104A5	10.4	9.31 (236.5) +/–0.3	8.66 (219.9)	8.50 (215.9)	7.22 (183.3) +/–0.3	6.61 (167.9)	6.45 (163.9)	4.79 (121.55)
FTAS00-121A5	12.1	10.52 (267.1) +/–0.3	9.94 (252.4)	9.80 (249.0)	8.10 (205.8) +/–0.3	7.50 (190.6)	7.37 (187.2)	5.37 (136.4)
FTAS00-150A5	15.0	12.79 (324.8) +/–0.3	12.19 (309.5)	12.05 (306.1)	9.79 (248.7) +/–0.3	9.19 (233.5)	9.06 (230.1)	6.49 (164.95)

5-Wire Touch Screen Controller Boards & Drivers

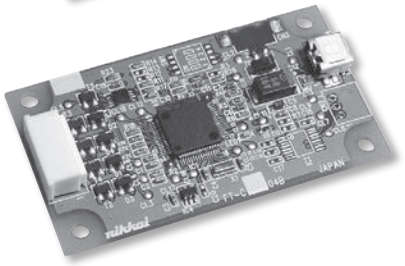
DISTINCTIVE CHARACTERISTICS

- High Quality and Reliability
- Easy Integration Replacing Mouse Functionality
- Compatible with Control Board USB/RS232C
- Device Driver Compatible with Vista and Windows XP Operating Systems

Controller Boards Available for RS232C



Controller Boards Available for USB



NKK offers controller boards compatible with USB or with RS232C. See web site or contact factory for specifications and technical data.

Controller Boards		
Type	**Part No.**	**Communication Protocol**
5-Wire	**FTCS05B**	RS232C
5-Wire	**FTCU05B**	USB

See web site for dimensioned drawings or technical data for any of the controller boards and drivers.

IC & Accessories

DISTINCTIVE CHARACTERISTICS

- Interface: USB and RS232C
- High Speed and Accuracy
- Built-in Calibration Function
- Data Function Removal Built In to Eliminate Noise

IC FTCSU564

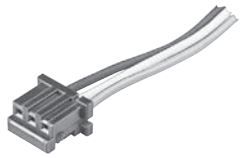
The IC is for use with the 5- and 4-wire transparent touch screens, and is available for those who prefer to design their own controller boards. When the screen is touched, it recognizes the position of the touch by the level of analog voltage detected by the A/D. The A/D converter receives the value and sends a set of coordinate values as serial data or USB.

See web site or contact factory for IC specifications.

OPTIONAL ACCESSORIES

AT713 Receptacle Connector

This Receptacle Connector with code connects to RS232C communication of the controller boards.



AT714 Receptacle Connector

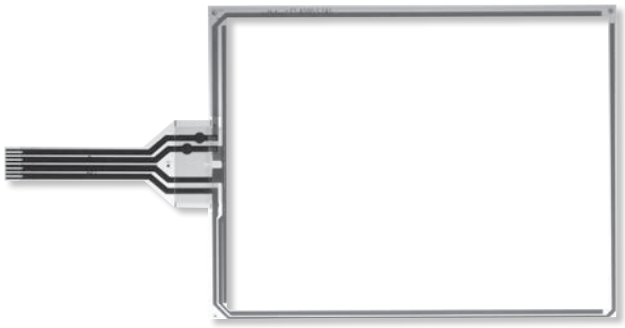
AT714 is a Receptacle Connector with code to connect to power source of the control boards.

For more details and dimensioned drawings of the accessories, go to the web site or call our engineering support personnel.

GENERAL SPECIFICATIONS FOR 4-WIRE

4-Wire Analog Resistive Touch Screens

Optical	
Light Transmission	Analog: 80% standard Digital: 78% standard
Film Options	Anti-glare, anti-Newton ring standard
Electrical	
Power Level	1mA @ 5V DC (resistive load)
Insulation Impedance	10MΩ minimum @ 25V DC
Linearity	3% maximum (analog)
Chattering Time	10 milliseconds maximum
Mechanical	
Touch Activation Force	1.4N maximum
Available Sizes	5.7″ ~ 15″ standard
Durability	
Surface Hardness	2H (JIS K5600)
Expected Operational Life	1,000,000 operations minimum
Environmental	
Operating Temperature Range	–10°C ~ +60°C (+14°F ~ +140°F)
Storage Temperature Range	–20°C ~ +70°C (–4°F ~ +158°F)
Relative Humidity	+60°C (+140°F), humidity 90%, 240 hours



Analog
FTAS00-57AS4

PART NUMBERS & DESCRIPTIONS FOR 4-WIRE

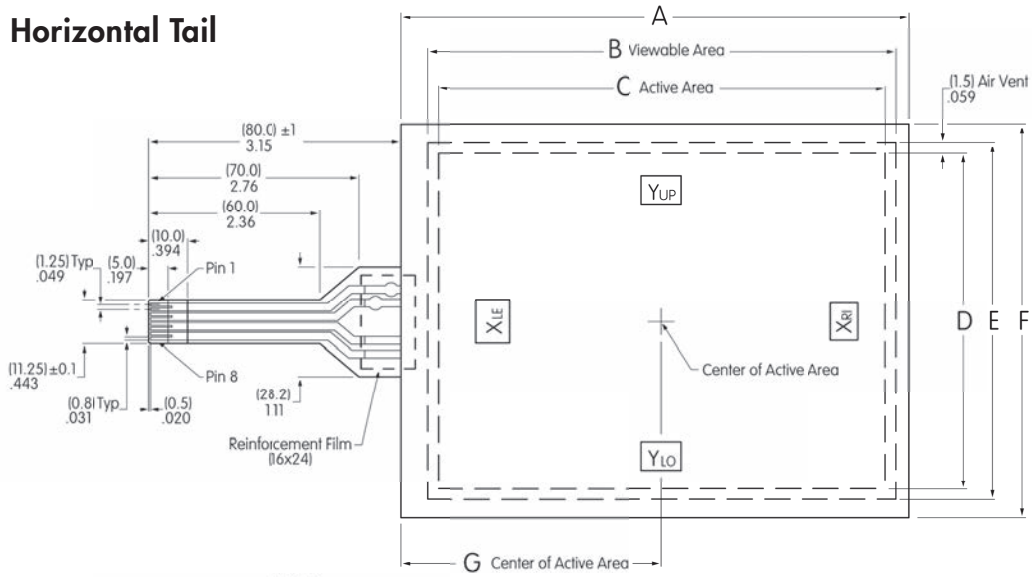
4-Wire Analog Touch Screens

Part Number	Screen Size in Inches	Key Area Dimensions	Viewing Area Dimensions	External Dimensions	Panel Thickness	* Terminal Detail 8 Pin .049″ (1.25mm) Pitch
FTAS00-57AS4	5.7	4.54″ x 3.40″ (115.2mm x 86.4mm)	4.76″ x 3.61″ (121.0mm x 91.6mm)	5.16″ x 3.98″ (131.0mm x 101.0mm)	.055″ (1.4mm)	Length 2.56″ (65.0mm)
FTAS00-65AS4	6.5	5.20″ x 3.90″ (132.0mm x 99.0mm)	5.43″ x 4.13″ (138.0mm x 105.0mm)	5.91″ x 4.57″ (150.0mm x 116.0mm)		Length 2.56″ (65.0mm)
FTAS00-84AS4	8.4	6.73″ x 5.10″ (170.9mm x 129.6mm)	6.95″ x 5.33″ (176.5mm x 135.4mm)	7.34″ x 5.69″ (186.5mm x 144.4mm)	.083″ (2.1mm)	Length 3.15″ (80.0mm)
FTAS00-104AS4	10.4	8.32″ x 6.24″ (211.2mm x 158.4mm)	8.47″ x 6.39″ (215.0mm x 162.4mm)	8.88″ x 6.75″ (225.6mm x 171.4mm)		Length 3.15″ (80.0mm)
FTAS00-104AV4	10.4	8.35″ x 6.28″ (212.2mm x 159.4mm)	8.52″ x 6.43″ (216.4mm x 163.4mm)	8.92″ x 7.21″ (226.5mm x 183.0mm)		Length 3.15″ (80.0mm)
FTAS00-121A4	12.1	9.72″ x 7.30″ (246.76mm x 185.32mm)	10.04″ x 7.53″ (255.0mm x 191.32mm)	10.67″ x 8.07″ (271.0mm x 205.0mm)		Length 3.15″ (80.0mm)
FTAS00-121AS4	12.1	9.69″ x 7.26″ (246.0mm x 184.5mm)	9.84″ x 7.42″ (250.0mm x 188.5mm)	10.28″ x 7.80″ (261.0mm x 198.0mm)		Length 3.15″ (80.0mm)
FTAS00-150A4	15.0	12.05″ x 9.06″ (306.1mm x 230.1mm)	12.21″ x 9.25″ (310.0mm x 235.0mm)	12.91″ x 9.84″ (328.0mm x 250.0mm)		Length 3.15″ (80.0mm)

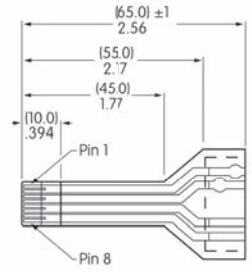
Note: Input methods are finger or stylus.

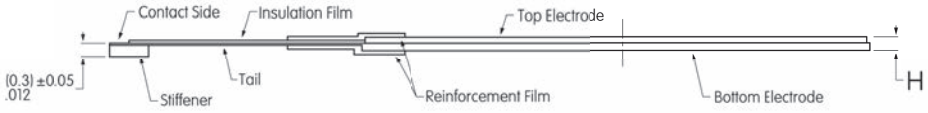
* 4 pin available with 1.0mm or 1.25mm pitch. Contact factory for details.

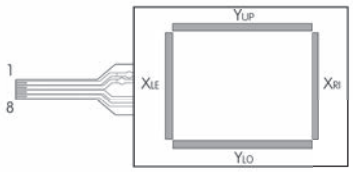
4-Wire with Horizontal Tail



Tail Dimensions for
FTAS00-57AS4
FTAS00-65AS4







XLE, XRI: Top Electrode Terminal
YJP, YLO: Bottom Electrode Terminal

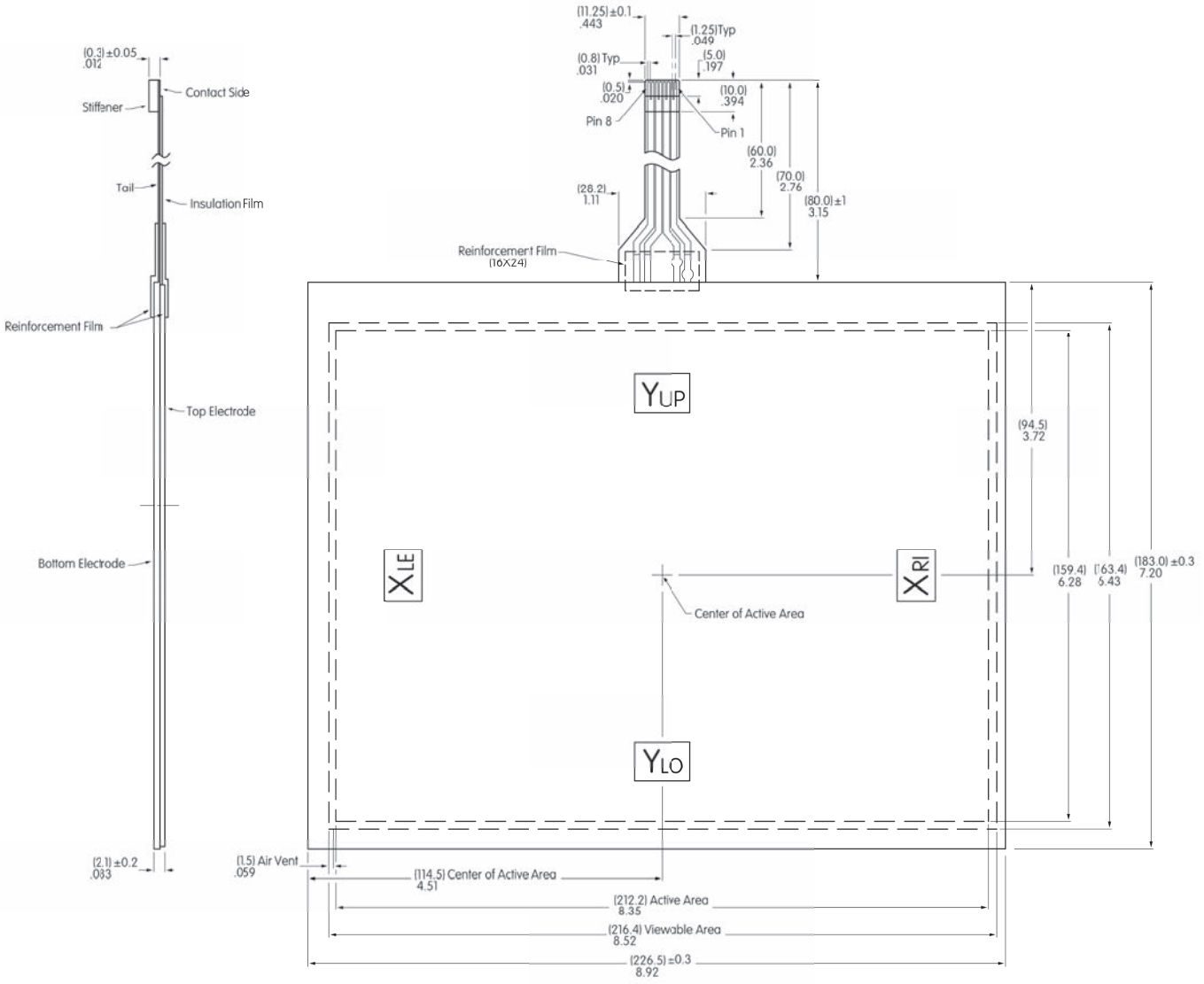
Pins	Signal
1,2	Y_{UP}
3,4	Y_{LO}
5,6	X_{LE}
7,8	X_{RI}

4-Wire Analog Touch Screen Dimensions

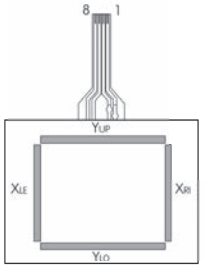
Part Number	Screen Size in Inches	Dim A	Dim B Viewable Area	Dim C Active Area	Dim D	Dim E Viewable Area	Dim F Active Area	Dim G Center of Active Area	Dim H
FTAS00-57AS4	5.7	5.16″ (131±0.3mm)	4.76″ (121mm)	4.54″ (115.2mm)	3.40″ (86.4mm)	3.61″ (91.6mm)	3.98″ (101±0.3mm)	2.65″ (67.25mm)	.055″ (1.4mm)
FTAS00-65AS4	6.5	5.91″ (150±0.3mm)	5.43″ (138mm)	5.20″ (132mm)	3.90″ (99mm)	4.13″ (105mm)	4.57″ (116±0.3mm)	3.03″ (77mm)	.055″ (1.4mm)
FTAS00-84AS4	8.4	7.34″ (186.5±0.3mm)	6.95″ (176.5mm)	6.73″ (170.9mm)	5.10″ (129.6mm)	5.33″ (135.4mm)	5.69″ (144.4±0.3mm)	3.73″ (94.85mm)	.083″ (2.1mm)
FTAS00-104AS4	10.4	8.88″ (225.6±0.3mm)	8.46″ (215mm)	8.31″ (211.2mm)	6.24″ (158.4mm)	6.39″ (162.4mm)	6.75″ (171.4±0.3mm)	4.49″ (114.1mm)	.083″ (2.1mm)
FTAS00-121AS4	12.1	10.28″ (261±0.3mm)	9.84″ (250mm)	9.69″ (246mm)	7.26″ (184.5mm)	7.42″ (188.5mm)	7.80″ (198±0.3mm)	5.18″ (131.6mm)	.083″ (2.1mm)
FTAS00-150A4	15.0	12.91″ (328±0.3mm)	12.20″ (310mm)	12.05″ (306.1mm)	9.06″ (230.1mm)	9.25″ (235mm)	9.84″ (250±0.3mm)	6.52″ (165.6mm)	.083″ (2.1mm)

4-Wire with Vertical Tail

FTAS00-104AV4



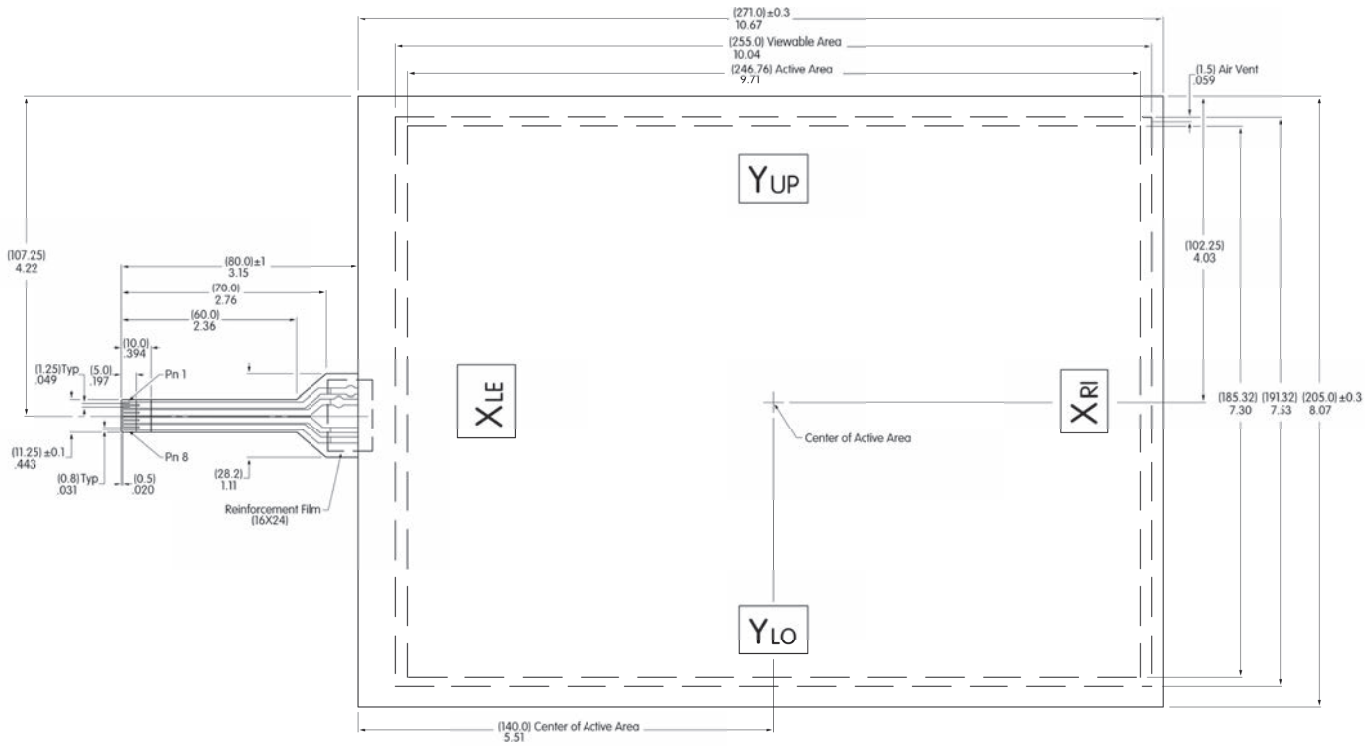
Pins	Signal
1, 2	Y_{UP}
3, 4	Y_{LO}
5, 6	X_{RI}
7, 8	X_{LE}

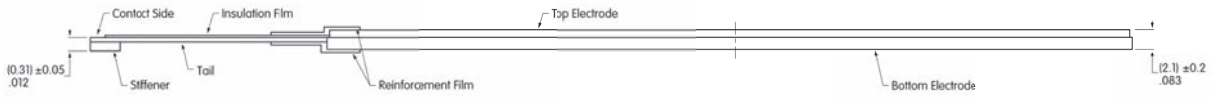


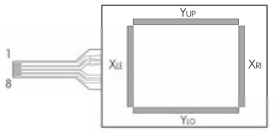
XLE, XRI: Top Electrode Terminal
YUP, YLO: Bottom Electrode Terminal

4-Wire with Horizontal Tail (Off-Center)

FTAS00-121A4







XLE, XRI: Top Electrode Terminal
YUP, YLO: Bottom Electrode Terminal

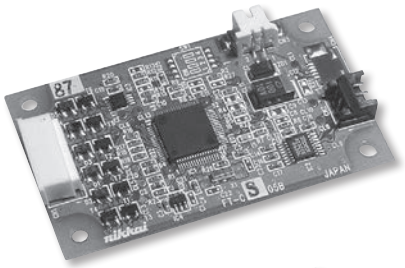
Pins	Signal
1, 2	Y_{UP}
3, 4	Y_{LO}
5, 6	X_{LE}
7, 8	X_{RI}

4-Wire Touch Screen Controller Boards & Drivers

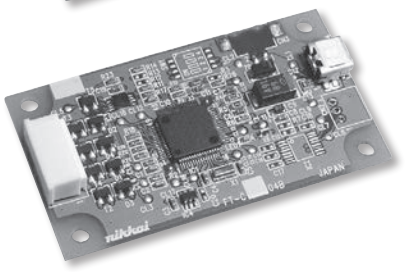
DISTINCTIVE CHARACTERISTICS

- High Quality and Reliability
- Easy Integration Replacing Mouse Functionality
- Compatible with Control Board USB/RS232C
- Device Driver Compatible with Vista and Windows XP Operating Systems

Controller Boards Available for RS232C



Controller Boards Available for USB



NKK offers controller boards compatible with USB or with RS232C. See web site or contact factory for specifications and technical data.

Controller Boards		
Type	**Part No.**	**Communication Protocol**
4-Wire	**FTCS04B**	RS232C
4-Wire	**FTCU04B**	USB

See web site for dimensioned drawings or technical data for any of the controller boards and drivers.

IC & Accessories

DISTINCTIVE CHARACTERISTICS

- Interface: USB and RS232C
- High Speed and Accuracy
- Built-in Calibration Function
- Data Function Removal Built In to Eliminate Noise

IC FTCSU564

The IC is for use with the 5- and 4-wire transparent touch screens, and is available for those who prefer to design their own controller boards. When the screen is touched, it recognizes the position of the touch by the level of analog voltage detected by the A/D. The A/D converter receives the value and sends a set of coordinate values as serial data or USB.

See web site or contact factory for IC specifications.

OPTIONAL ACCESSORIES

AT713 Receptacle Connector

This Receptacle Connector with code connects to RS232C communication of the controller boards. It is compatible with FTCS04A and FTCS04A2.

AT714 Receptacle Connector

AT714 is a Receptacle Connector with code to connect to power source of the control boards.

For more details and dimensioned drawings of the accessories, go to the web site or call our engineering support personnel.

Storage, Handling & Installation

Below are some general precautions for the 5-wire & 4-wire touch screen devices. Please check web site for complete documentation.

Installation (4-wire, 5-wire)

- Do not pull on the tail. Do not apply stress to the tail area.
- Avoid vibration or shock.
- The touch screen mounting should not be loose.
- Ensure there are no burrs around the edges of the case or housing that can cause false actuation. The edges of the case or housing should not enter the keying area.
- The case or housing and upper electrode should have a space of about 0.5 mm to accommodate expansion or shrinkage due to humidity variances. If a shock barrier is used do not press hard on the upper electrode area. Any shock barrier should be installed more than 0.6 mm above the screen.
- To secure the touch screen, secure the lower portion with an item such as the LCD display panel. Do not secure the upper electrode with double-sided tape or similar items to avoid stress that can damage the upper or lower electrode.
- In order to balance upper and lower pressure, an air vent may be installed. Ensure that no liquid or oil will enter into the device.

Handling Precautions (4-wire, 5-wire)

- When opening product, take precaution with up/down and front/back directions. Glass edges are not chamfered, corners or edges can be sharp. Wear gloves when handling the product.
- Do not pick up the product by the tail or pull the tail area.
- Use gloves or finger cots to prevent fingerprints on surface.
- When handling the product, hold it outside of the viewing area.
- Avoid stacking multiple products or placing other items on the product.
- Remove protective film after installation is completed.

Operating Precautions (4-wire, 5-wire)

- Only operate with fingers or a touch screen stylus.
- Do not press hard with pen or similar objects between viewing area and key area.

Design Precautions (4-wire, 5-wire)

- With analog type, resistive value change can dislocate the input area. Input area can be calibrated with software.
- When installing on top of a LCD, noise from the display device can create misoperation. To avoid noise, implement actions such as grounding the display device frame.
- Do not create software for simultaneous touch points as analog type will read the center point between two touch points.
- When used to draw a line, analog type will have a break at dot spacer. Compensate for this with software.

Other Precautions (4-wire, 5-wire)

- Clean with a soft cloth and ethanol. Do not use any cleaning agents other than ethanol.
- Store product in original package and store at the temperature and humidity range specified.
- Do not store in an environment with acids or other corrosive gases or dew.
- Not suited for use in critical control systems such as nuclear power, aerospace, medical or transportation equipment, without proper failsafe design consideration.

Handling Precautions (5-wire)

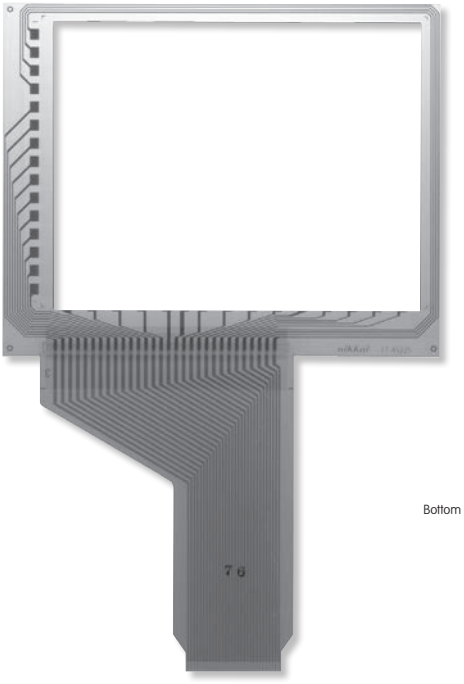
- NKK warranties the 5-wire touch panel when it is used with the NKK control board and driver. Do not use third party control boards.
- 5-wire devices can misalign cathode position or touch position even after calibration. See web site for details.
- Create a larger input area. If you have the input button at the edge of a screen, it might not operate properly.
- Complete 9 point calibration with NKK driver. If more precision is desired, 25 point calibration is recommended.

Handling of Controller Board (5-wire)

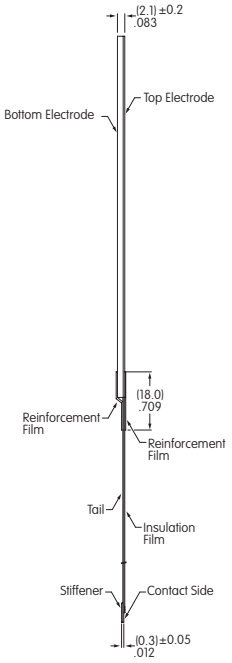
- Warranty for one year after delivery. We do not warranty the controller board unless used with NKK touch panel.
- Use arc prevention to protect device from static electricity.
- Power source should be activated after host and touch panel are connected.
- When inserting connector CN1 and touch panel tail, be sure the slider of connector CN1 is pulled. Do not pull more than 10 times.
- Do not alter the product.
- Do not use any commands other than the ones specified in specifications.
- Place the product away from noise source (such as inverter from LCD operation) since tail can be affected by noise.
- If device driver (USB) does not work after installation, reboot the host computer while connected to the controller board.
- This product does not support suspended mode (USB).
- Protocol of USB transmission is one frame per one transaction.
- Contact factory if not using protocol above.

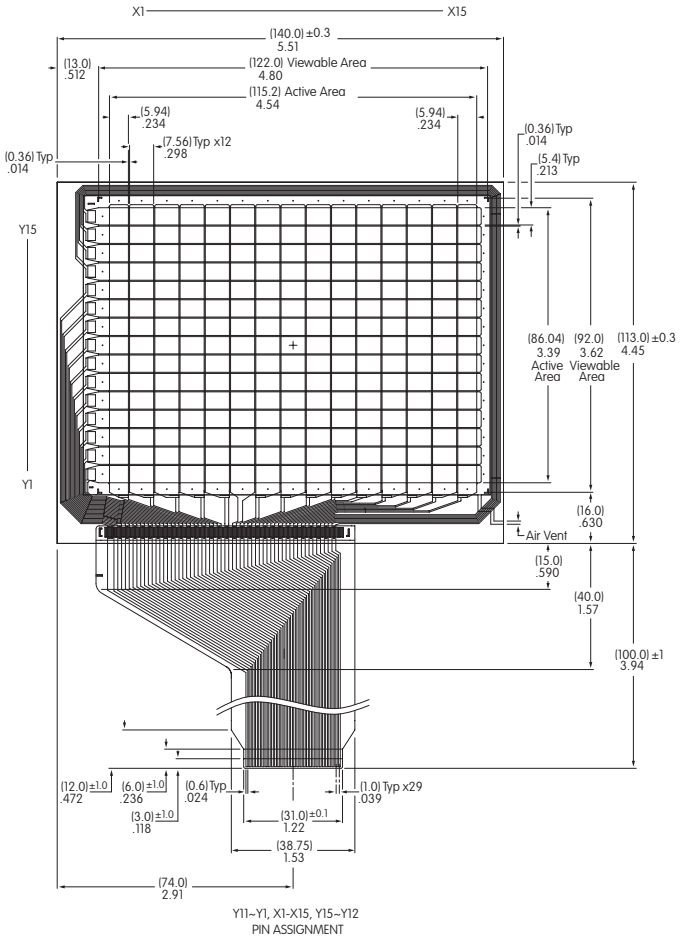
Digital Touch Screen						
Part Number	**Screen Size in Inches**	**Key Area Dimensions**	**Viewing Area Dimensions**	**External Dimensions**	**Panel Thickness**	**Terminal Detail** 30 Pin .039" (1.0mm) Pitch
FTAS225-57AN	5.7	4.54" x 3.39" (115.2mm x 86.04mm)	4.80" x 3.62" (122.0mm x 92.0mm)	5.51" x 4.45" (140.0mm x 113.0mm)	.083" (2.1mm)	Length 3.94" (100.0mm)

Notes: Input method is finger. Number of keys for Digital Touch Screen: 15 x 15. See web site for dimensioned drawings for the Digital Touch Screen.

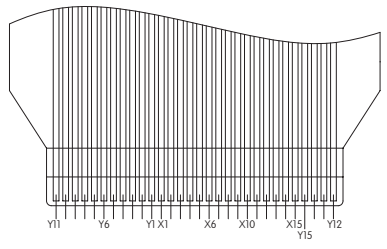


Digital
FTAS225-57AN





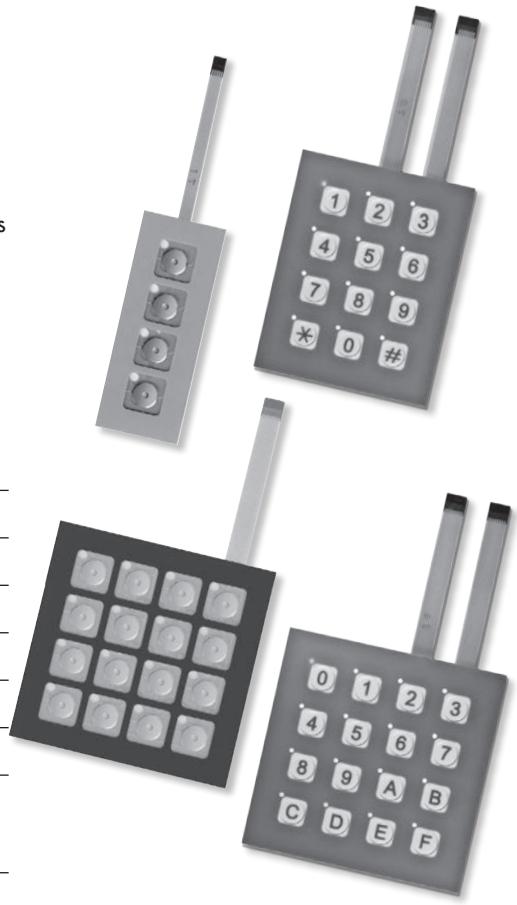
Y11~Y1, X1-X15, Y15~Y12
PIN ASSIGNMENT



Y11~Y1, X1-X15, Y15~Y12
PIN ASSIGNMENT

DISTINCTIVE CHARACTERISTICS

- Nonilluminated options in 4 or 16 keys, illuminated choices in 12 or 16 keys
- 1.0mm (.039″) tail pitch
- Easily integrated into designs: replaces multiple mechanical switches, soldered wires and cable assemblies
- Card insertion into design supports customized legends for nonilluminated models
- Actuating dome offers crisp, tactile feedback to positively indicate circuit transfer
- Illuminated models feature legends on embossed keypads
- Adhesive backing for easy mounting



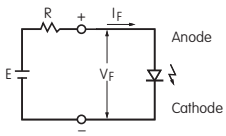
GENERAL SPECIFICATIONS

Power Level	20mA @ 24V DC
Contact Resistance	500Ω maximum (10mA @ 10V DC)
Insulation Resistance	100 megohms minimum @ 250V DC minimum
Dielectric Strength	250V AC minimum for one minute minimum
Operational Life	1,000,000 operations minimum
Contact Timing	10 milliseconds maximum
Nominal Operating Force	1.0N ~ 6.0N
Stroke: Nonilluminated Illuminated with Overlay	 .016″ ~ .039″ (0.4mm ~ 1.0mm) .020″ ~ .047″ (0.5mm ~ 1.2mm)
Operating Temperature Range	–15°C ~ +50°C (+5°F ~ +122°F) illuminated
	–15°C ~ +55°C (+5°F ~ +131°F) nonilluminated

LED SPECIFICATIONS

Single Element LED Color: Amber			Unit
Forward Voltage (Typical)	V_F	2.1	V
Forward Current (Typical)	I_F	20	mA
Forward Current (Maximum)	I_F	30	mA
* Forward Peak Current (Max)	I_{FM}	195	mA
Reverse Voltage (Maximum)	V_R	5.0	V

The electrical specifications shown are determined at a basic temperature of 25°C. LED is an integral part of the switch. LEDs are not sold separately.



$$R = \frac{E - V_F}{I_F}$$

Where: R = Resistor Value (Ohms)
E = Source Voltage (V)
V_F = Forward Voltage (V)
I_F = Forward Current (A)

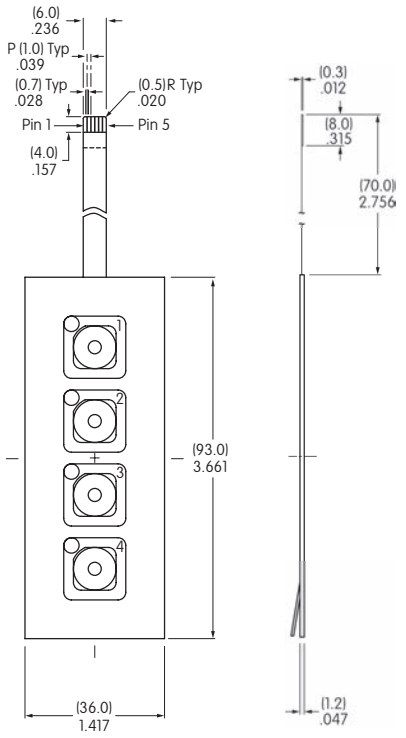
LED circuits are isolated and require an external power source.
If the source voltage exceeds the rated voltage, a ballast resistor is required.

* Note: Pulse width 0.1msec maximum with a maximum duty cycle ratio of 1/10

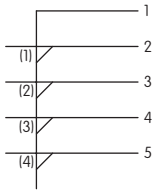
Ordering Information	Description				
Part Number	Illumination	Number of Keys	Surface Sheet Black (D)	Surface Sheet Gray (E)	Overlay
FMBN04BD	Nonilluminated	4	●		
FMBN04BE		4		●	
FMBN16BD		16	●		
FMBN16BE		16		●	
FMBP12BF	Dot Illuminated with Overlay	12			Gray Surface Sheet with Embossed White Keypad and Gray Legends
FMBP16BF		16			

TYPICAL SWITCH DIMENSIONS

Nonilluminated • 4 or 16 Keys



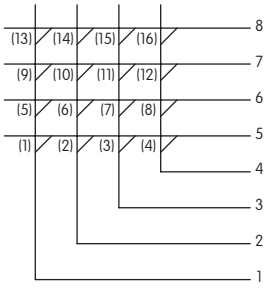
Switch Circuit Matrix For 4 Key



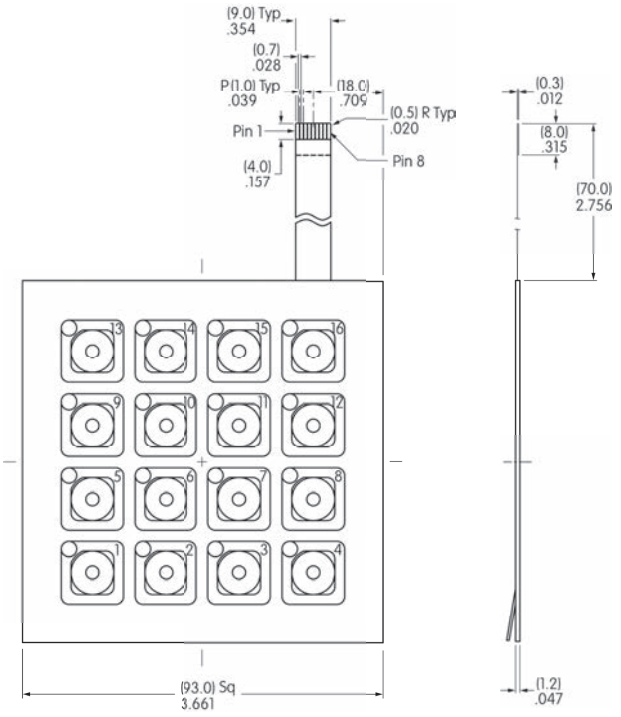
Key numbers in parenthesis are not actually on panel and are for reference only

Switch Circuit Matrix Detail For 4 or 16 Key

Switch Circuit Matrix For 16 Key

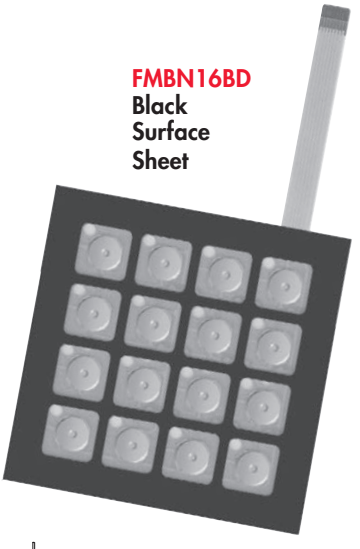


Key numbers in parenthesis are not actually on panel and are for reference only

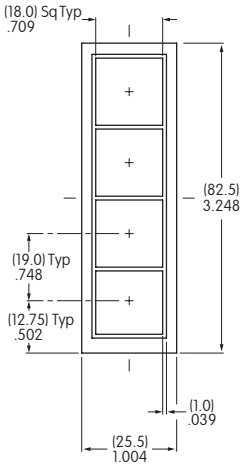


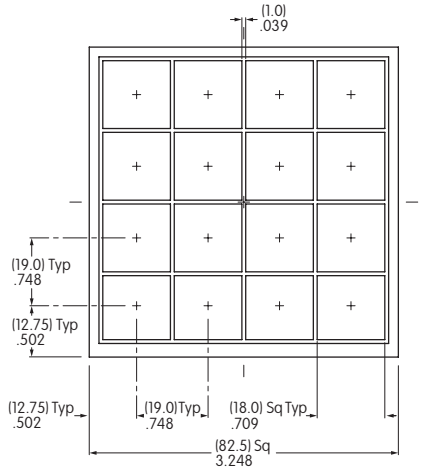
FMBN04BE
Gray Surface Sheet

FMBN16BD
Black Surface Sheet



Insertable Legend Card for 4 Key or 16 Key

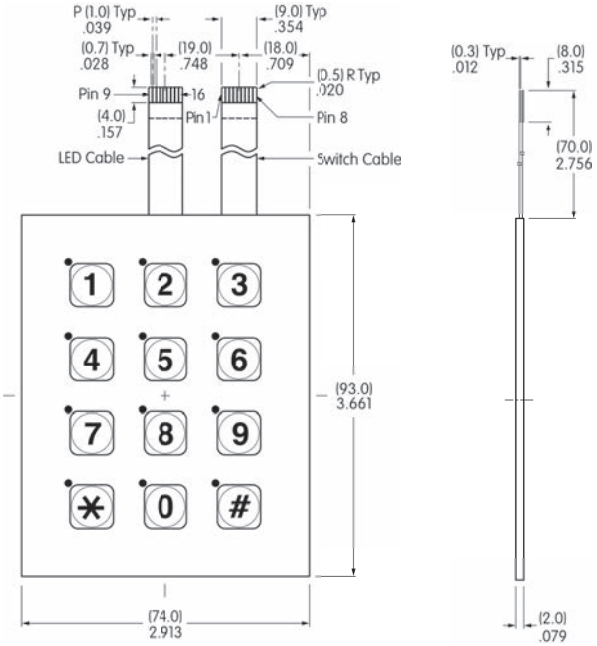




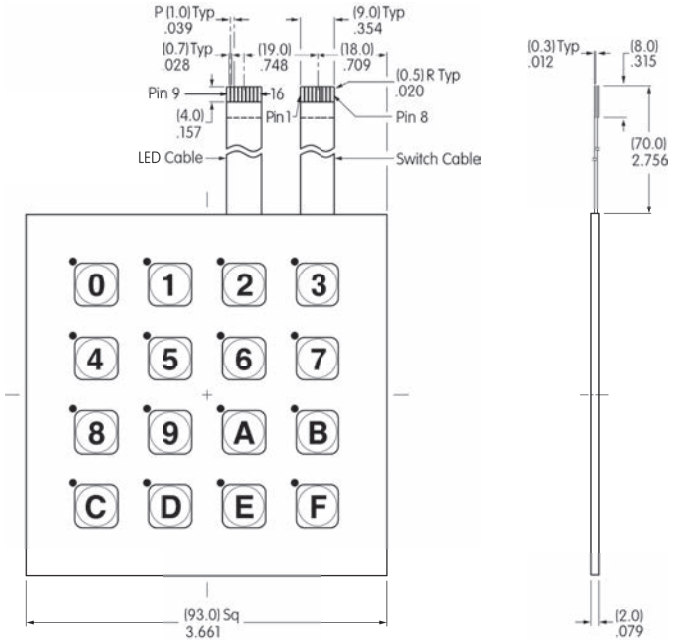
Insertable Legend Cards are supplied with the nonilluminated switch keypad assembly in Black, Gray and Yellow

TYPICAL SWITCH DIMENSIONS

Illuminated • 12 or 16 Keys

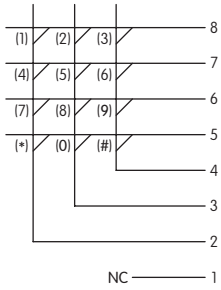


Dot illumination at upper left corner of each keypad

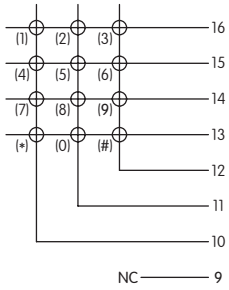


Dot illumination at upper left corner of each keypad

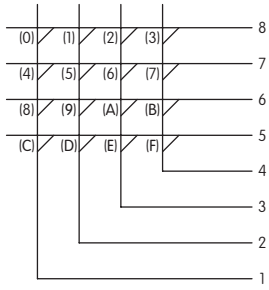
Switch Circuit Matrix For 12 Key



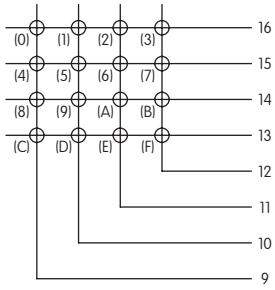
LED Circuit Matrix For 12 Key



Switch Circuit Matrix For 16 Key



LED Circuit Matrix For 16 Key

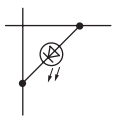


Key numbers in parenthesis are not actually on panel and are for reference only

FMBP12BF

Switch Circuit Matrix Detail For 12 or 16 Key

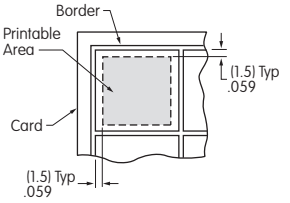
LED Circuit Matrix Detail For 12 or 16 Key



FMBP16BF

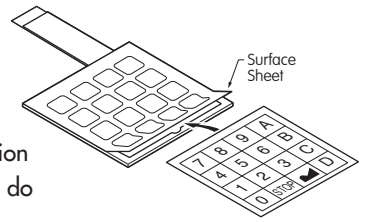
INSERTABLE LEGEND CARDS

Instructions for Customizing Insertable Legends



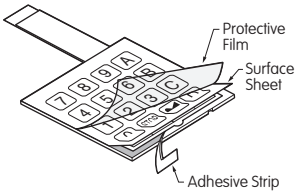
The membrane keypad assembly comes with three insertable legend cards: yellow, gray and black. The following provides guidelines for creating and insertion of legend cards for the membrane switch keypad assembly. Read all of the instructions prior to customizing and inserting the legend card.

- Using the borders on the insertable legend card as a guide, be sure characters on the card are about 1.5mm (.059") within these borders. This is the printable area.
- Legend characters may be drawn, printed, etc. Be sure that application choice is completely dry before inserting into membrane keypad assembly.



Instructions for Inserting Legend Card

- Note correct orientation of insertable legend card. Insert card under surface sheet, and use caution to avoid bending the membrane keypad assembly. Do not use pointed object to insert card, and do not remove surface sheet.
- Align and center all legend characters within the squares of the surface sheet.
- Smooth any wrinkles or air pockets from surface sheet.
- Peel off adhesive strip from the membrane keypad assembly.
- The legend card is now firmly in place and cannot be removed.
- Detach the protective film.



Connectors

Recommended Connectors for 5 Pin

Straight: FCI Part No. SLW5S-5C7LF
Right Angle: FCI Part No. SLW5R-5C7LF

Recommended Connectors for 8 Pin

Straight: FCI Part No. SLW8S-5C7LF
Right Angle: FCI Part No. SLW8R-5C7LF

PRECAUTIONS FOR HANDLING

- Assembly of legend card insert is handled by the customer. Therefore, we recommend to evaluate the finished product with the card assembled.
- Nonilluminated products have a loophole on each key. It is possible to add optional illumination by installing appropriate LEDs. Legend card does not have loopholes.
- To test proper electrical operation of switches, use of an electric buzzer is recommended.
- Use an additional chattering prevention circuit for the switch circuit.
- Do not operate switches with pointed objects (i.e. screwdrivers) to prevent perforation of film overlay.
- Use an FPC connector that corresponds to the printed circuit. Contact factory for suitable connectors.
- During assembly and installation of legends place devices on a level, sturdy surface. We do not recommend assembly and installation of device using a free hand or on a soft surface.
- Do not fold, bend, or apply pressure to the product.
- These devices contain adhesive that may emit noise. This does not affect product functionality.
- Do not depress any switch areas during assembly/installation.
- These membrane switches are built with air vents. Prior to installation, make corresponding holes to allow air vents to function. These holes should first be aligned with the membrane switch device, then made on the body of the final installation structure. Do not allow water or oil to penetrate through the air vents. Entry of any liquids through the air vents may cause contact failure.

APPLICATIONS

- Communication equipment
- Automation equipment
- Office machines
- Electronic equipment
- Electronic equipment for national security
- Amusement equipment

NKK SWITCHES

Indicators

Contents Indicators

A Series M3
Complement to A Switches

G Series M5
Complement to G Switches

HB Series M6
Complement to HB Pushbuttons

JF Series M8
Complement to JF Tactiles

KB Series M9
Complement to KB Pushbuttons

LB Series M14
Complement to LB Pushbuttons

P01 for MLW Series M19
Complement to MLW Rockers

UB Series M21
Complement to UB Pushbuttons

UB2 Series M26
Complement to UB2 Pushbuttons

YB Series M29
Complement to YB Pushbuttons

TYPICAL INDICATOR ORDERING EXAMPLE

A 01 V F

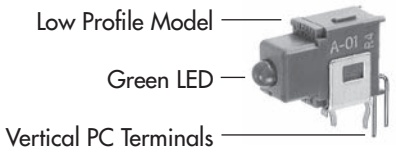
Model	
01	Low .079" (2.0mm) Profile

PC Terminals	
P	Straight
B	Straight with Bracket
H	Right Angle
V	Vertical

LED Colors	
C	Red
E	Yellow
F	Green

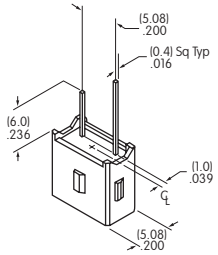
DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

A01VF

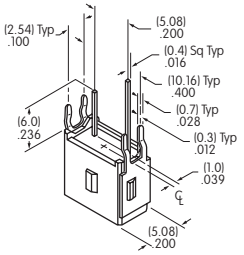


PC TERMINALS

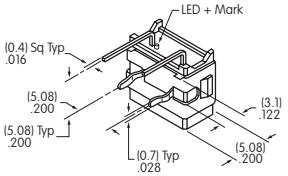
P Straight



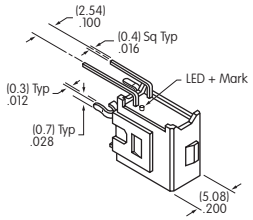
B Straight with Bracket



H Right Angle



V Vertical



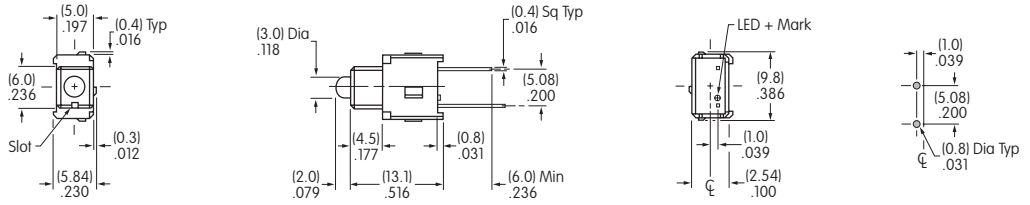
LED COLORS & SPECIFICATIONS

		A01 Indicator		
		C	E	F
LED is colored in OFF state	Color	Red	Yellow	Green
Maximum Forward Current	I_{FM}	50mA	50mA	50mA
Typical Forward Current	I_F	30mA	30mA	30mA
Forward Voltage	V_F	1.7V	2.2V	2.1V
Maximum Reverse Voltage	V_{RM}	4V	4V	4V
Current Reduction Rate Above 25°C	ΔI_F	0.67mA/°C	0.67mA/°C	0.67mA/°C
Ambient Temperature Range		−30°C ~ +85°C		

Electrical specifications are determined at a basic temperature of 25°C.
If the source voltage is greater than the LED's rated voltage, a ballast resistor must be connected in series with the LED.
The ballast resistor value can be calculated by using the formula shown in the Supplement section.

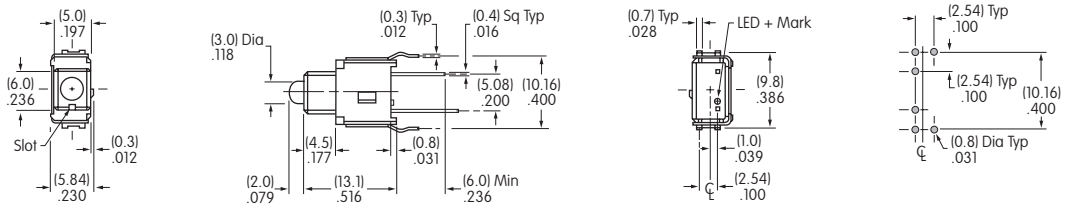
TYPICAL INDICATOR DIMENSIONS

Straight PC



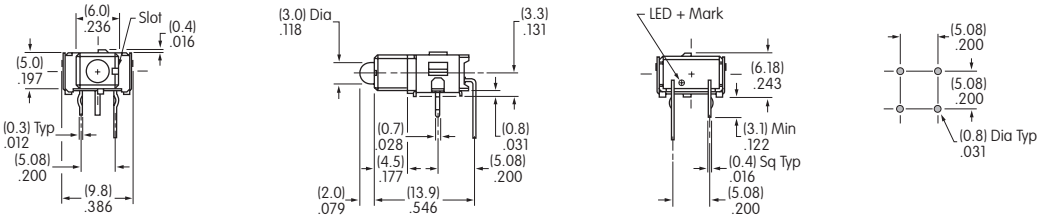
A01PF

Straight PC • Bracket



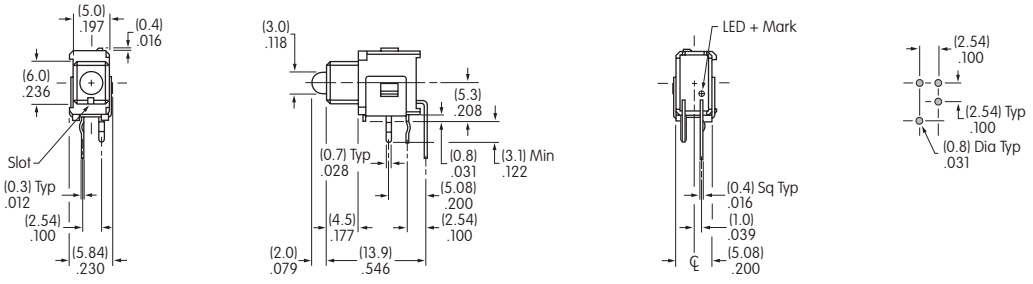
A01BF

Right Angle PC



A01HF

Vertical PC



A01VF

G Indicators

TYPICAL INDICATOR ORDERING EXAMPLE

G01 P C

PC Terminals	
P	Straight
V	Vertical

LED Colors	
C	Red
E	Yellow
F	Green

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

G01PC

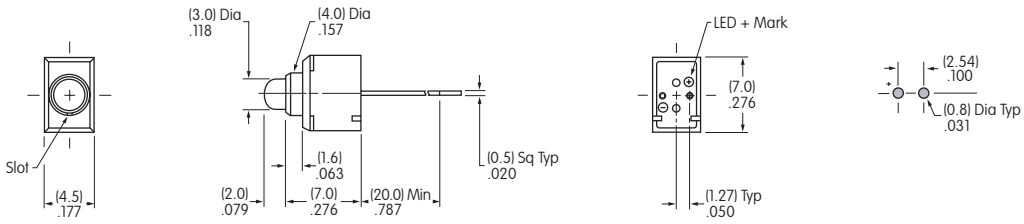
LED COLORS & SPECIFICATIONS

		C	E	F
LED is colored in OFF state	Color	Red	Yellow	Green
Maximum Forward Current	I_{FM}	30mA	30mA	25mA
Typical Forward Current	I_F	20mA	20mA	20mA
Forward Voltage	V_F	2.0V	2.1V	2.25V
Maximum Reverse Voltage	V_{RM}	5V	5V	5V
Current Reduction Rate Above 25°C	ΔI_F	0.40mA/°C	0.40mA/°C	0.33mA/°C
Ambient Temperature Range		−25°C ~ +85°C		

Electrical specifications are determined at a basic temperature of 25°C.
If the source voltage is greater than the LED's rated voltage, a ballast resistor must be connected in series with the LED.
That ballast resistor value can be calculated by using the formula shown in the Supplement section.

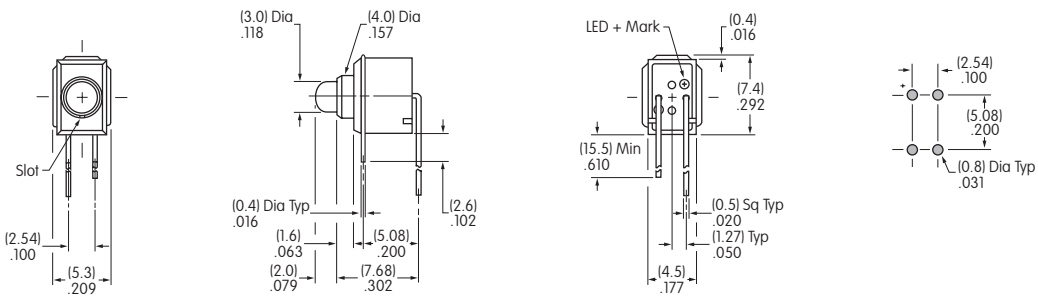
TYPICAL INDICATOR DIMENSIONS

Straight PC



G01PC

Vertical PC



These indicators have anode and cathode terminals along with 2 support pins.

G01VC

HB Indicators

Complement to HB Pushbuttons

TYPICAL INDICATOR ORDERING EXAMPLE

HB 01 K W01 – 5C – CB

Shapes	
01	Square
02	Round

Housing	
K	Black

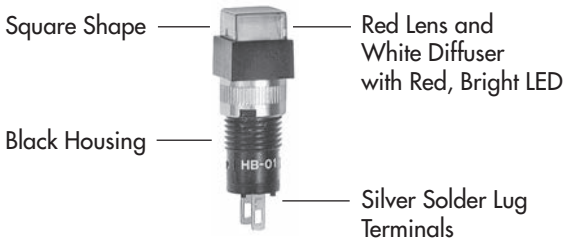
Terminals	
W01	Silver Solder Lug

LEDs	
Bright	
5C	Red
5D	Amber
5F	Green
Super Bright	
6B	White
6F	Green
6G	Blue

Cap Types & Colors	
LED Cap: Lens/Diffuser Color	
CB	Red/White
DB	Amber/White
FB	Green/White
JB	Clear/White
LED Cap: Lens/Diffuser Color	
JB	Clear/White

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

HB01KW01-5C-CB



LED COLORS & SPECIFICATIONS

The electrical specifications shown are determined at a basic temperature of 25°C.
LED circuit is isolated and requires external power source. Single element LED is colored in OFF state.
If the source voltage exceeds the rated voltage, a ballast resistor is required.
The resistor value can be calculated by using the formula in the Supplement section.

Bright
AT633

Super Bright
AT624G
Blue

AT629B
White

AT630F
Green

T-1 Bi-pin

Note for Super Bright:

ATTENTION ELECTROSTATIC SENSITIVE DEVICES

		Bright			Super Bright			
		5C	5D	5F	6B	6F	6G	
Color		Red	Amber	Green	White	Green	Blue	Unit
Maximum Forward Current	I_{FM}	30	30	30	30	30	30	mA
Typical Forward Current	I_F	20	20	20	20	20	20	mA
Forward Voltage	V_F	1.95	2.0	2.1	3.3	3.3	3.3	V
Maximum Reverse Voltage	V_{RM}	5	5	5	7	7	7	V
Current Reduction Rate Above 25°C	ΔI_F	0.42	0.42	0.42	0.40	0.40	0.40	mA/°C
Ambient Temperature Range		–25° ~ +50°C			–25° ~ +50°C			

HB Indicators

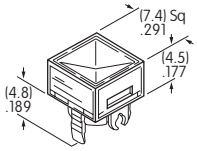
CAP TYPES & COLORS

Colored Cap for Bright LEDs

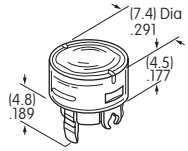
Lens/Diffuser Colors Available:

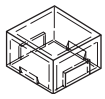
- **CB** Red/White
- **DB** Amber/White
- **FB** Green/White

AT4168 Square



AT4169 Round





Transparent Colored Lens

Translucent White Diffuser

Colored LED AT633

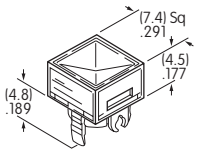
Material: Polycarbonate Finish: Glossy

White Cap for Bright & Super Bright LEDs

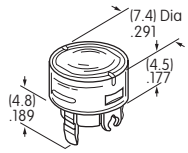
- **JB** Clear Lens/ White Diffuser

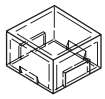
Material: Polycarbonate
Finish: Glossy

AT4033 Square



AT4034 Round





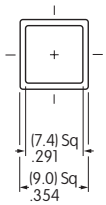
Transparent Clear Lens

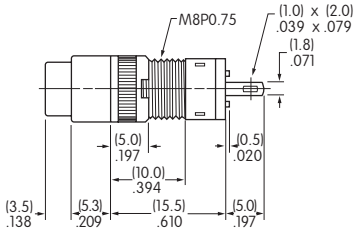
Translucent White Diffuser

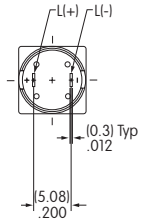
Colored LEDs AT624, AT629, AT630, or AT633

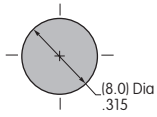
TYPICAL INDICATOR DIMENSIONS

Square





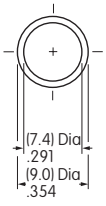


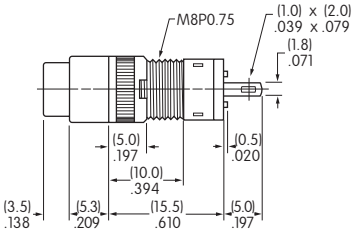


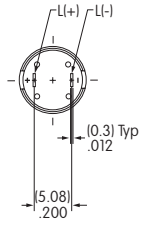
Recommended Panel Thickness: .020" ~ .197" (0.5 ~ 5.0mm)

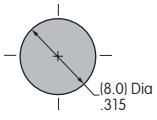
HB01KW01-5C-CB

Round









Recommended Panel Thickness: .020" ~ .197" (0.5 ~ 5.0mm)

HB02KW01-5C-CB

JF Indicators

TYPICAL INDICATOR ORDERING EXAMPLE

JF 01 P C

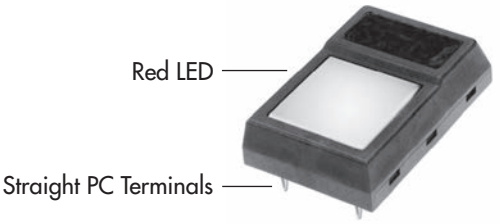
Shape	
01	Square

Terminals	
P	Straight PC

LED Colors	
C	Red
E	Yellow
F	Green

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

JF01PC



LED COLORS & SPECIFICATIONS

LED is an integral part of the indicator and not available separately.

LED polarity markings are on the bottom of the indicator.

The electrical specifications shown are determined at a basic temperature of 25°C. If the source voltage exceeds the rated voltage, a ballast resistor is required.

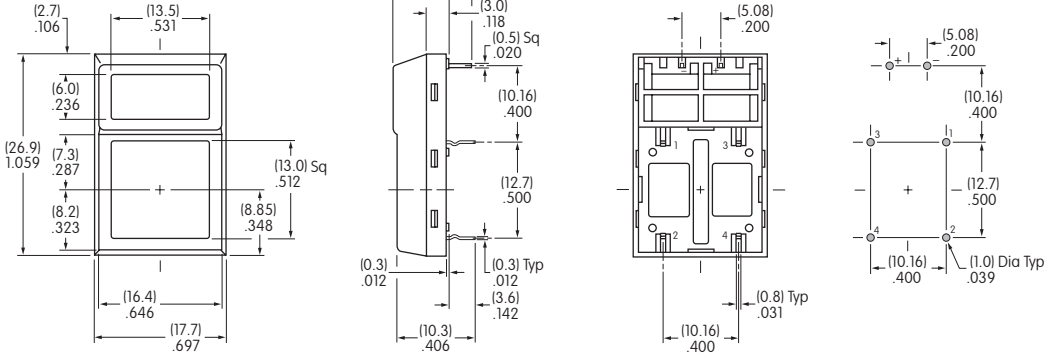
The resistor value can be calculated by using the formula in the Supplement section.

	Color	C Red	E Yellow	F Green
Maximum Forward Current	I_{FM}	30mA	30mA	30mA
Typical Forward Current	I_F	20mA	20mA	20mA
Forward Voltage	V_F	1.77V	2.1V	2.3V
Maximum Reverse Voltage	V_{RM}	4V	4V	4V
Current Reduction Rate Above 25°C	ΔI_F	0.4mA/°C	0.4mA/°C	0.4mA/°C
Ambient Temperature Range		−25° ~ +70°C		

TYPICAL INDICATOR DIMENSIONS

Square

JF01PC



KB Indicators

TYPICAL INDICATOR ORDERING EXAMPLE

KB | 02 | K | W01 | — | 12 | — | FF

Shapes

Bushing Mounting	
01	Square
02	Round
03	Rectangular
Snap-in Mounting	
04	Square
05	Round
06	Rectangular

Housing

K	Black only

Terminals

W01	Silver Solder Lug

Lamps

Incandescent Lamp Used with Solid Cap	
05	5-volt
12	12-volt

Incandescent or Neon Lamp Used with Insert Cap	
05	5-volt
12	12-volt
01	110-volt Neon

Bright LED Used with Cap for LED			
Colors		**Resistor**	
5C	Red	**No Code**	No Resistor
5D	Amber	**05**	5-volt
5F	Green	**12**	12-volt
		24	24-volt

Super Bright LED Used with Cap for LED	
6B	White
6F	Green
6G	Blue

Cap Types & Colors

Solid Cap: Lens/Filter Colors			
BB	White/White	**FB**	Green/White
CB	Red/White	**FF**	Green/Green
CC	Red/Red	**GB**	Blue/White
EB	Yellow/White	**GG**	Blue/Blue

Insert Cap: Lens/Filter Colors	
JB	Clear/White
JC	Clear/Red
JE	Clear/Yellow
***JF**	Clear/Green
***JG**	Clear/Blue

* JF & JG not suitable with neon.

LED Cap: Lens/Diffuser Colors	
AB	Square Spot Illuminated Black Cap/White Window
JB	Clear/White
JC	Clear/Red
JD	Clear/Amber
JF	Clear/Green

LED Cap: Lens/Diffuser Colors	
JB	Clear/White

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

KB02KW01-12-FF

12-volt Incandescent Lamp
Solid Cap with Green Lens
and Green Filter

Black Housing
Round with Bushing Mounting

Silver Solder Lug Terminals

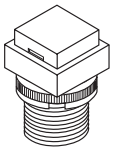
KB Indicators

Complement to KB Pushbuttons

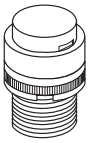
SHAPES & MOUNTING TYPES

Bushing Mounting

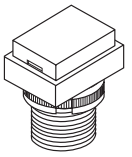
01 .551" (14mm) Square



02 .551" (14mm) Round

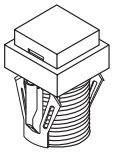


03 .551" x .728" (14mm x 18.5mm) Rectangular

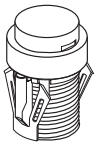


Snap-in Mounting

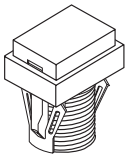
04 .551" (14mm) Square



05 .551" (14mm) Round



06 .551" x .728" (14mm x 18.5mm) Rectangular

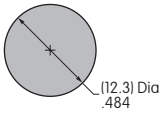


The bezel is an integral part of the indicator body.

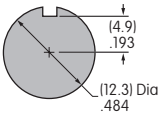
Panel Cutouts

Bushing Mounting

Without Keyway



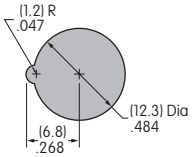
Panel Thickness:
.020" ~ .315"
(0.5 ~ 8mm)



With Keyway

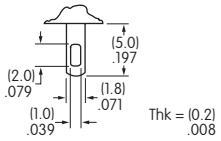
Snap-in Mounting

Panel Thickness:
.039" ~ .138"
(1.0 ~ 3.5mm)



TERMINALS

W01 Silver Solder Lug



LAMP COLORS & SPECIFICATIONS

The electrical specifications shown are determined at a basic temperature of 25°C.
If the source voltage exceeds the rated voltage,a ballast resistor is required.
The ballast resistor calculation and more lamp detail are shown in the Supplement section.

Incandescent & Neon Lamps

AT611 Incandescent

T-1 Bi-pin

AT615 Neon

		05	12	01
Voltage	V	5V AC	12V AC	110V AC
Current	I	115mA	60mA	1.5mA
Endurance	Hours	7,000 average		10,000

Recommended Resistors for Neon:
33K ohms for 110V AC;
100K ohms for 220V AC

Bright LED without Resistor

AT635

LEDs are colored in OFF state.

T-1½ Bi-pin

Color Codes	Red 5C	Amber 5D	Green 5F	No Code: No Resistor
				Red / Amber / Green
Maximum Forward Current	I_{FM}			30mA / 30mA / 30mA
Typical Forward Current	I_F			20mA / 20mA / 20mA
Forward Voltage	V_F			1.9V / 2.0V / 2.1V
Maximum Reverse Voltage	V_{RM}			5V / 5V / 5V
Current Reduction Rate Above 25°C	ΔI_F			0.42mA/°C / 0.29mA/°C / 0.42mA/°C
Ambient Temperature Range				−25° ~ +50°C

LAMP COLORS & SPECIFICATIONS

The electrical specifications shown are determined at a basic temperature of 25°C.
If the source voltage exceeds the rated voltage,a ballast resistor is required.
The ballast resistor calculation and more lamp detail are shown in the Supplement section.

Bright LED with Resistor

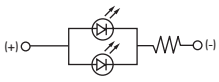
AT634

LEDs are colored in OFF state.

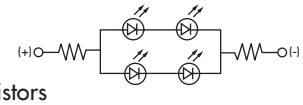
T-1¼ Bi-pin

Color Codes:	Red 5C	Amber 5D	Green 5F	Resistor Codes 05	12	24
Maximum Forward Current	I_{FM}			—	—	—
Typical Forward Current	I_F			25mA	20mA	10mA
Forward Voltage	V_F			5V	12V	24V
Maximum Reverse Voltage	V_{RM}			4V	8V	16V
Current Reduction Rate Above 25°C	ΔI_F			—	—	—
Ambient Temperature Range				−25° ~ +50°C		

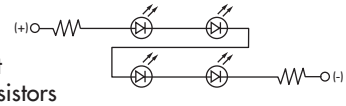
AT634
5-volt
2-element
with 1 Resistor



AT634
12-volt
4-element
with 2 Resistors



AT634
24-volt
4-element
with 2 Resistors

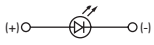


Super Bright Single Element LED

AT625G Blue

AT631B White

AT632F Green



T-1 Bi-pin

ATTENTION ELECTROSTATIC SENSITIVE DEVICES		6B	6F	6G
Color		White	Green	Blue
Maximum Forward Current	I_{FM}	30mA	30mA	30mA
Typical Forward Current	I_F	20mA	20mA	20mA
Forward Voltage	V_F	3.3V	3.3V	3.3V
Maximum Reverse Voltage	V_{RM}	7V	7V	7V
Current Reduction Rate Above 25°C	ΔI_F	0.40mA/°C	0.40mA/°C	0.40mA/°C
Ambient Temperature Range		−25° ~ +50°C		

CAP TYPES & COLOR COMBINATIONS

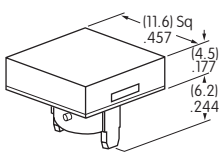
Color Codes: **B** White **C** Red **E** Yellow **F** Green **G** Blue **J** Clear

Solid Cap for Incandescent Lamp

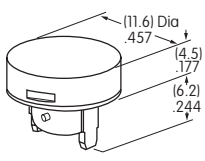
Lens/Filter Colors Available:

BB FB
CB FF
CC GB
EB GG

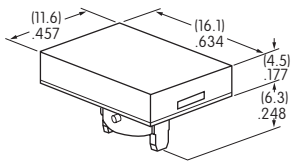
AT485
Square



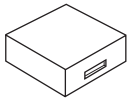
AT486
Round



AT4021
Rectangular



Material: Polycarbonate Finish: Glossy



Translucent Colored Lens

Translucent Colored Filter

Lamp AT611

KB Indicators

Complement to KB Pushbuttons

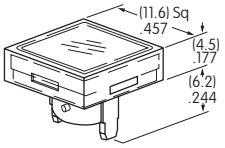
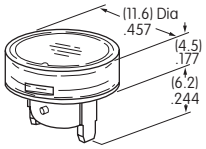
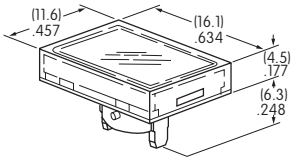
CAP TYPES & COLOR COMBINATIONS

Color Codes: **A** Black **B** White **C** Red **D** Amber **E** Yellow **F** Green **G** Blue **J** Clear

Insert Cap for Incandescent or Neon Lamp

Lens/Filter Colors Available:

JB **JC** **JE** **JF** **JG**

AT487 Square	AT488 Round	AT4022 Rectangular
		

Transparent Clear Lens

Translucent Colored Filter

Lamp AT611

Lamp AT615

JF and JG not suitable with neon lamp.

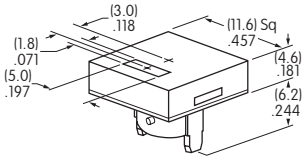
Material: Polycarbonate Finish: Glossy

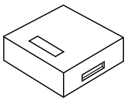
Spot Illuminated Cap for Bright LED without Resistor or with Resistor

Cap/Window Colors Available:

AB **Opaque Black Cap with Translucent White Window for Spot Illumination**

AT4051 Square





Bright LED AT635

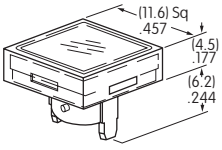
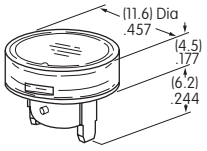
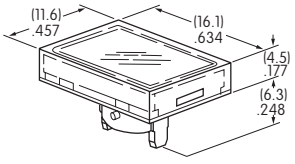
Bright LED AT634

Material: Polycarbonate Finish: Matte

Cap for Bright LED without Resistor or LED with Resistor

Lens/Diffuser Colors Available: (AT4133, 4132, 4134 white diffusers; AT4158, 4160, 4159 colored diffusers)

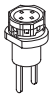
JB **JC** **JD** **JF**

AT4133 Square	AT4132 Round	AT4134 Rectangular
AT4158	AT4160	AT4159
		

Transparent Clear Lens

Translucent Diffuser

Bright LED AT635



Bright LED AT634

Material: Polycarbonate Finish: Glossy

CAP TYPES & COLOR COMBINATIONS

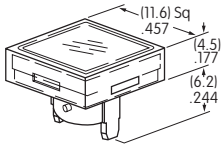
Cap for Super Bright LED

Lens/Diffuser Colors Available:

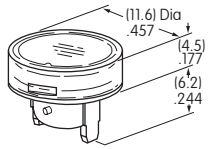
JB

Clear Lens
White Diffuser

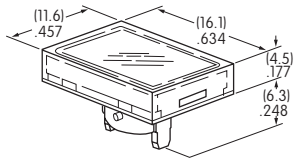
AT4133
Square



AT4132
Round



AT4134
Rectangular



Translucent Clear Lens

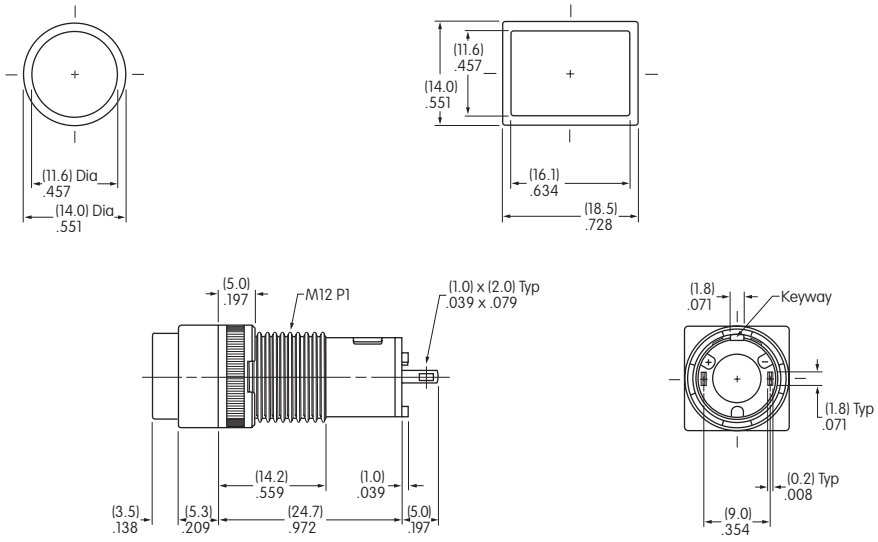
Translucent White Diffuser

Super Bright LEDs
AT625, AT631, AT632

Material: Polycarbonate Finish: Glossy

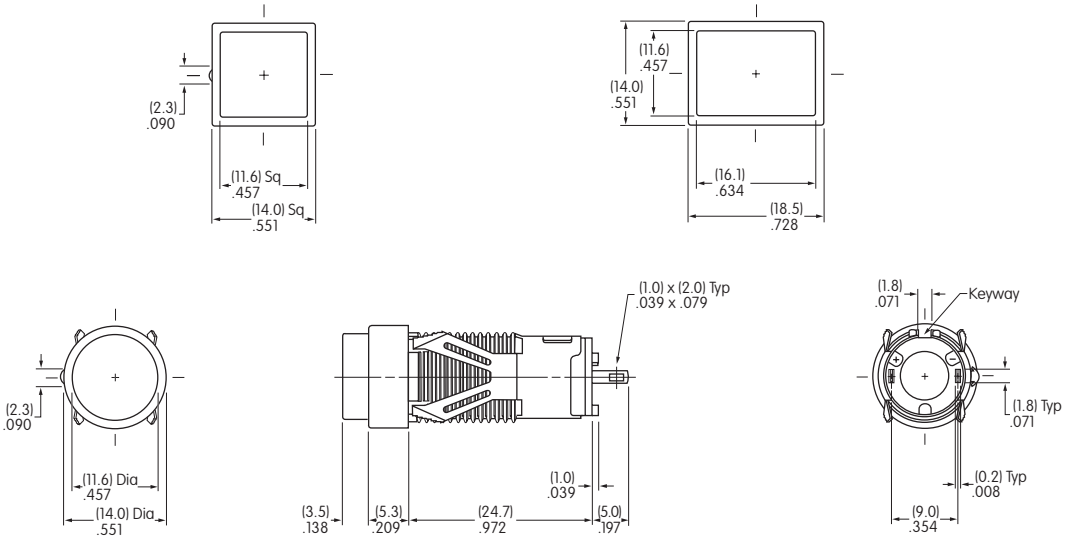
TYPICAL INDICATOR DIMENSIONS

Bushing Mount



KB01KW01-05-GG

Snap-in Mount



KB05KW01-05-FF

LB Indicators

Complement to LB Pushbuttons

TYPICAL INDICATOR ORDERING EXAMPLE

LB 01 G W01 — 5C 12 — JC

Shapes

01	Square
02	Round
03	Rectangular

Housing

K	Black
G	Gray

Terminals

W01	Silver Solder Lug/ Quick Connect Terminals

Lamps

Incandescent Lamp Used with Solid Cap

05	5-volt
12	12-volt

Incandescent or Neon Used with Insert Cap

01	110-volt Neon
05	5-volt Incandescent
12	12-volt Incandescent

Bright LED Used with LED Cap

Colors		Resistor	
5C	Red	No Code	No Resistor
5D	Amber	05	5-volt
5F	Green	12	12-volt
		24	24-volt

Super Bright LED Used with LED Cap

6B	White
6F	Green
6G	Blue

Cap Types & Colors

Solid Cap: Lens/Filter Colors

BJ	White/Clear
CJ	Red/Clear
EJ	Yellow/Clear
FJ	Green/Clear
GJ	Blue/Clear

Insert Cap: Lens/Filter Colors

JB	Clear/White
JC	Clear/Red
JE	Clear/Yellow
*JF	Clear/Green
*JG	Clear/Blue

*JF & JG not suitable with neon.

LED Cap: Lens/Diffuser Colors

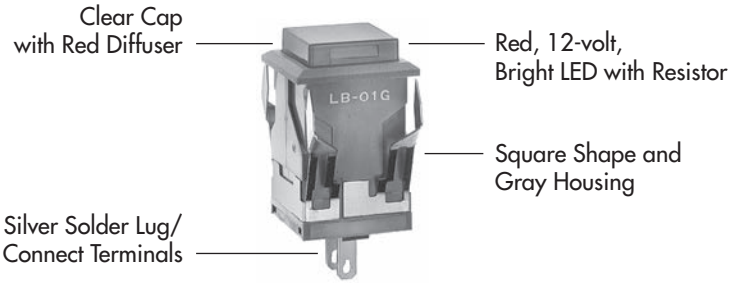
JB	Clear/White
JC	Clear/Red
JD	Clear/Amber
JF	Clear/Green

LED Cap: Lens/Diffuser Colors

JB	Clear/White

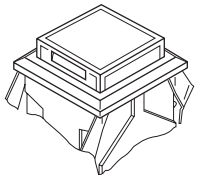
DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

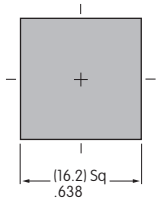
LB01GW01-5C12-JC



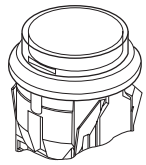
SHAPES & PANEL CUTOUTS

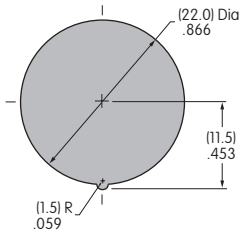
01 .622" (15.8mm) Square



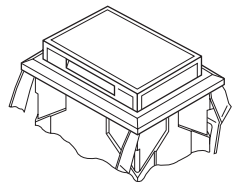


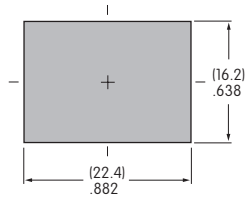
02 .854" (21.7mm) Round





03 .622" x .866" (15.8mm x 22.0mm) Rectangular





Panel Thickness: .039" ~ .157" (1.0 ~ 4.0mm)

HOUSING

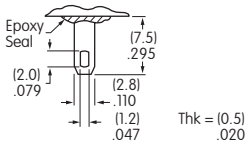
Housing Colors Available:

K Black

G Gray

TERMINALS

W01 Silver Solder Lug/.110" (2.8mm) Quick Connect



LAMP CODES & SPECIFICATIONS

Incandescent Lamp for Solid Colored and Colored Insert Caps

AT607			**05**	**12**
T-1 Bi-pin	Voltage	V	5V AC	12V AC
	Current	I	115mA	60mA
	Endurance	Hours	10,000 average	
	Ambient Temp. Range		–25°C ~ +50°C	

Neon Lamp for Colored Insert Cap

AT607N			**01**
T-1 Bi-pin	Voltage	V	110V AC
	Current	I	1.5mA
	Endurance	Hours	10,000 average
	Ambient Temp. Range		–25°C ~ +50°C
	Recommended Resistors: 33K ohms for 110V AC; 100K ohms for 220V AC		

The electrical specifications shown are determined at a basic temperature of 25°C.

LED COLORS & SPECIFICATIONS

The electrical specifications shown are determined at a basic temperature of 25°C. Polarity marks are on the device.
If the source voltage exceeds the rated voltage, a ballast resistor is required.
The resistor value can be calculated by using the formula in the Supplement section.
Additional lamp detail is shown in the Accessories & Hardware section.

Bright LED without Resistor

AT635

LEDs are colored in OFF state.

T-1½ Bi-pin

Color Codes		Red 5C	Amber 5D	Green 5F
		No Code	No Resistor	
		Red	Amber	Green
Maximum Forward Current	I_{FM}	30mA	30mA	30mA
Typical Forward Current	I_F	20mA	20mA	20mA
Forward Voltage	V_F	1.9V	2.0V	2.1V
Maximum Reverse Voltage	V_{RM}	5V	5V	5V
Current Reduction Rate Above 25°C	ΔI_F	0.42mA/°C	0.42mA/°C	0.42mA/°C
Ambient Temperature Range		−25° ~ +50°C		

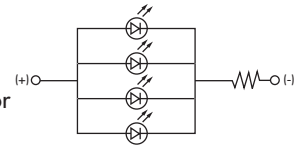
Bright LED with Resistor

AT627 with Resistor

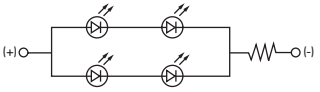
T-1 Bi-pin

Color Codes:		Red 5C	Amber 5D	Green 5F	Resistor Codes
					05 / 12 / 24
Maximum Forward Current	I_{FM}				— / — / —
Typical Forward Current	I_F				52mA / 26mA / 13mA
Forward Voltage	V_F				5V / 12V / 24V
Maximum Reverse Voltage	V_{RM}				4V / 8V / 16V
Current Reduction Rate Above 25°C	ΔI_F				0.50mA/°C
Ambient Temperature Range					−25° ~ +50°C

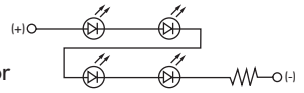
AT627
5-volt
4-element
with Resistor



AT627
12-volt
4-element
with Resistor



AT627
24-volt
4-element
with Resistor



Super Bright Single Element LED

AT625G Blue
AT631B White
AT632F Green

T-1 Bi-pin

ATTENTION ELECTROSTATIC SENSITIVE DEVICES		6B	6F	6G
Color		White	Green	Blue
Maximum Forward Current	I_{FM}	30mA	30mA	30mA
Typical Forward Current	I_F	20mA	20mA	20mA
Forward Voltage	V_F	3.3V	3.3V	3.3V
Maximum Reverse Voltage	V_{RM}	7V	7V	7V
Current Reduction Rate Above 25°C	ΔI_F	0.40mA/°C	0.40mA/°C	0.40mA/°C
Ambient Temperature Range		−25° ~ +50°C		

CAP TYPES & COLOR COMBINATIONS

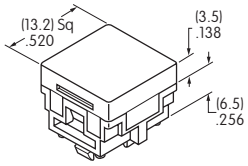
Color Codes: **B** White **C** Red **D** Amber **E** Yellow **F** Green **G** Blue **J** Clear

Solid Cap for Incandescent Lamp

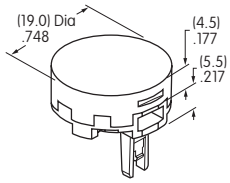
Lens/Filter Colors Available:

BJ FJ CJ GJ EJ

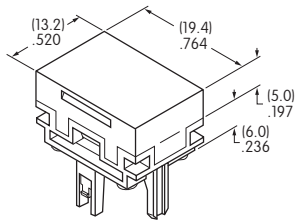
AT476 Square

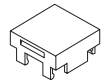


AT4012 Round

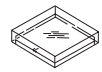


AT4026 Rectangular





Translucent Colored Lens



Transparent Clear Filter

Lamp AT607

Material: Polycarbonate Finish: Glossy

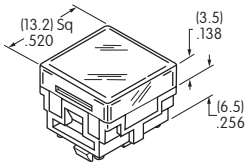
Insert Cap for Incandescent or Neon Lamp

Lens/Filter Colors Available:

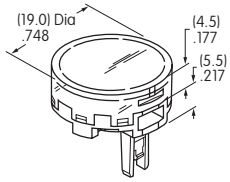
JB JF JC JG JE

JF and JG not suitable with neon lamp.

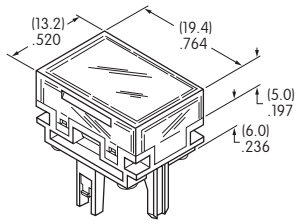
AT477 Square



AT4013 Round



AT4027 Rectangular



Transparent Clear Lens

Translucent Colored Filter

Lamp AT607 or 607N

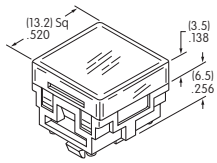
Material: Polycarbonate Finish: Glossy

Cap for Bright LED without Resistor

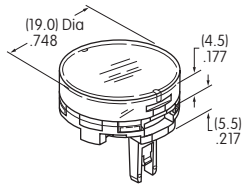
Lens/Diffuser Colors Available:

JB JC JD JF

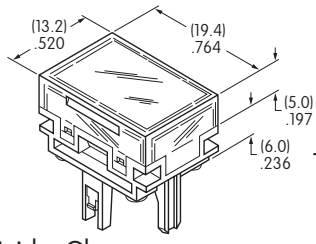
AT4176 Square

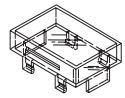


AT4178 Round

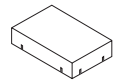


AT4177 Rectangular





Transparent Clear Lens



Translucent Colored Diffuser

Bright LED AT635

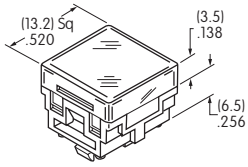
Material: Polycarbonate Finish: Glossy

Cap for Bright LED with Resistor

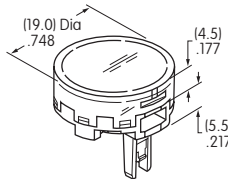
Lens/Diffuser Colors Available:

JB JC JD JF

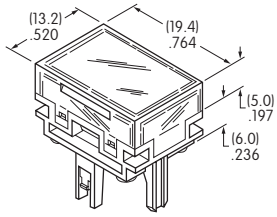
AT4162 Square

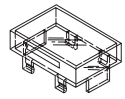


AT4164 Round

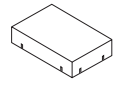


AT4163 Rectangular





Transparent Clear Lens



Translucent Colored Diffuser

Bright LED AT627

Material: Polycarbonate Finish: Glossy

LB Indicators

Complement to LB Pushbuttons

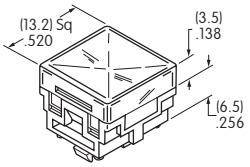
CAP TYPES & COLOR COMBINATIONS

Cap for Super Bright LEDs

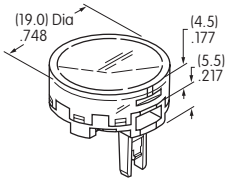
JB **Clear Lens White Diffuser**

Material:
Polycarbonate
Finish: Glossy

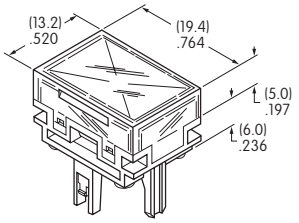
AT4129 Square

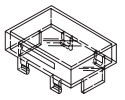


AT4128 Round

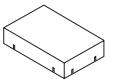


AT4130 Rectangular





Transparent Clear Lens

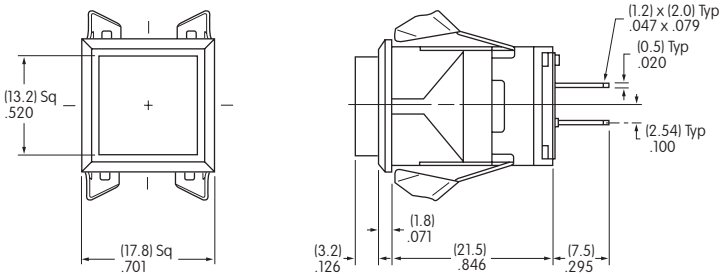


Translucent White Diffuser

LEDs AT625
AT631 AT632

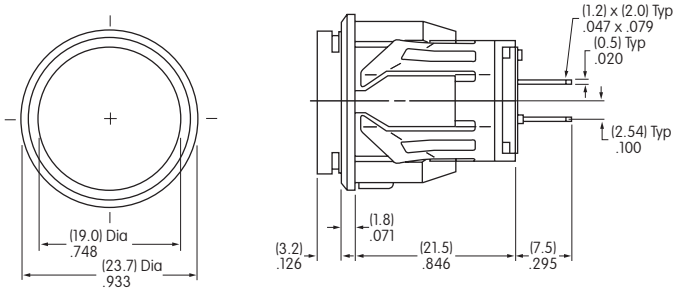
TYPICAL INDICATOR DIMENSIONS

Square



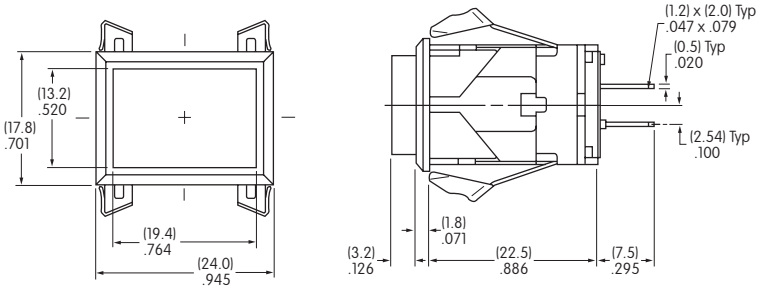
LB01KW01-12-CJ

Round



LB02KW01-12-CJ

Rectangular



LB03KW01-12-CJ

P01 Indicators

TYPICAL INDICATOR ORDERING EXAMPLE

P01 — 12 — C — 1 — A

Lamps	
Incandescent	
06	6-volt
12	12-volt
18	18-volt
24	24-volt
28	28-volt
Neon	
N	110-volt

Cap Colors	
B	White
C	Red
D	Orange
E	Yellow
***F**	Green
***G**	Blue

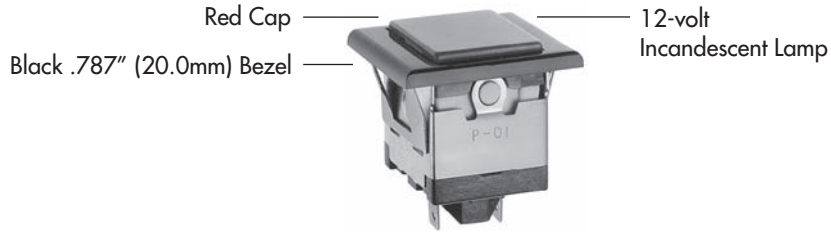
*F & G not suitable with neon.

Bezels	
1	.787″ (20.0mm) Wide
2	.937″ (23.8mm) Wide

Bezel Colors	
A	Black
B	White
C	Red
D	Orange
E	Yellow
F	Green
G	Blue
H	Gray

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

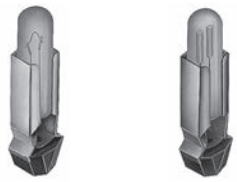
P01-12-C-1A



LAMP CODES & SPECIFICATIONS

Incandescent & Neon Lamps for Solid & Design Caps

AT602 Incandescent | **AT602N Neon**



T-1½ Pilot Slide Base

L(+) ○—○ L(-)		06	12	18	24	28	N
Voltage	V	6V	12V	18V	24V	28V	110V
Current	I	80mA	50mA	35mA	25mA	22mA	1.5mA
MSCP		.159	.215	.398	.215	.247	NA
Endurance	Hours	2,000 Average					15,000 Avg.
Ambient Temperature Range		−10° ~ +50°C					
Recommended Resistor for Neon: 33K ohms for 110V AC & 100K ohms for 220V AC							

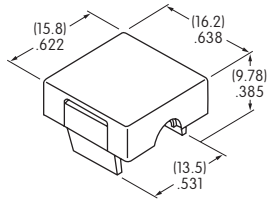
Electrical specifications are determined at a basic temperature of 25°C.
For dimension drawings of lamps, see Accessories & Hardware Index.
If the source voltage is greater than rated voltage, a ballast resistor is required.
The ballast resistor calculation and more lamp detail are shown in the Supplement section.

CAP COLORS

B White
C Red
D Orange
E Yellow
F Green
G Blue

Material: Polycarbonate
Finish: Glossy
F & G not suitable for neon

AT429



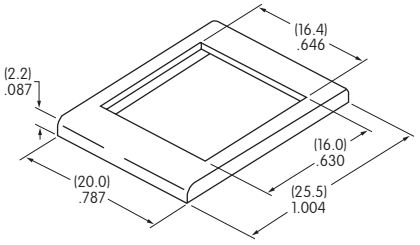
P01 Indicators

Complement to MLW Rockers

OPTIONAL BEZELS & COLORS

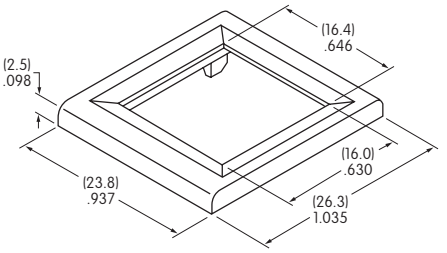
1A 1E 1B 1F 1C 1G 1D 1H

AT204
.787" (20.0mm) Wide Bezel



2A 2E 2B 2F 2C 2G 2D 2H

AT9201
.937" (23.8mm) Wide Bezel



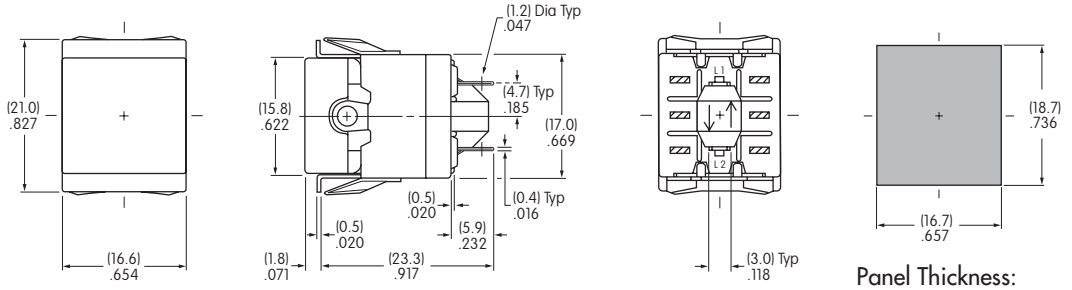
Material: Polycarbonate Standard Finish: Glossy

Color Codes: **A** Black **B** White **C** Red **D** Orange **E** Yellow **F** Green **G** Blue **H** Gray

TYPICAL INDICATOR DIMENSIONS

Without Bezel

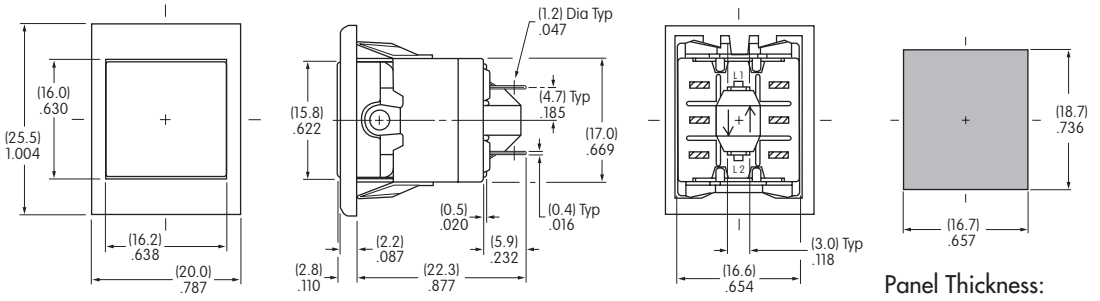
P01-12-C



Panel Thickness:
.039" ~ .157"
(1.0mm ~ 4.0mm)

With Bezel

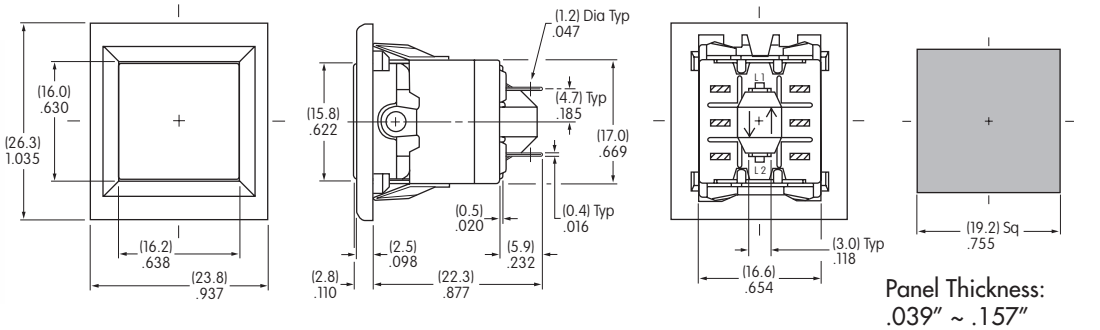
P01-12-C-1A



Panel Thickness:
.039" ~ .157"
(1.0mm ~ 4.0mm)

With Large Bezel

P01-12-C-2A



Panel Thickness:
.039" ~ .157"
(1.0mm ~ 4.0mm)

UB Indicators

UB 01 K W03 5C – JC

Mounting Types

PCB Mounting	
01	Square
03	Rectangular
* Snap-in Mounting	
04	Square
06	Rectangular
06B	Rectangular with Side Barriers

* Standard with Solder Lug terminals

Housing

K	Black

Terminals

W01	Silver Solder Lug (for Snap-in Mounting)
W03	Silver Straight PC (for PCB Mounting)

LEDs

Bright LED	
5C	Red
5D	Amber
5F	Green

Super Bright LED	
6B	White
6F	Green
6G	Blue

Super Bright Bicolor LED	
6CF	Red/Green
6DG	Amber/Blue

Cap Types & Colors

Full Face Illuminated Cap for Bright LED			
Lens/Diffuser Colors			
CB	Red/White	FF	Green/Green
CC	Red/Red	*FJ	Green/Clear
*CJ	Red/Clear	JB	Clear/White
DB	Amber/White	JC	Clear/Red
DD	Amber/Amber	JD	Clear/Amber
*DJ	Amber/Clear	JF	Clear/Green
FB	Green/White	*JJ	Clear/Clear

* Not available with Rectangular cap

Full Face Illuminated Cap for Super Bright LED	
JB	Clear Lens/White Diffuser

Spot Illuminated Cap for Bright & Super Bright LEDs	
AB	Black with White Window

Bicolor Alternating Legend Cap/Diffuser for Square or Rectangular	
JCF	Red/Green
JDG	Amber/Blue

Alternating Legends

11	ON (pos)	OFF (pos)
12	ON (neg)	OFF (neg)
13	START	STOP
14	OPEN	CLOSE

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

UB01KW035C-JC

Part Numbers for Alternating Legends

Square Alternating Legends				Rectangular Alternating Legends			
Color	Part Number	Color	Part Number	Color	Part Number	Color	Part Number
Red/Green	AT9450CF11	Amber/Blue	AT9450DG11	Red/Green	AT9451CF11	Amber/Blue	AT9451DG11
	AT9450CF12		AT9450DG12		AT9451CF12		AT9451DG12
	AT9450CF13		AT9450DG13		AT9451CF13		AT9451DG13
	AT9450CF14		AT9450DG14		AT9451CF14		AT9451DG14

Refer to Ordering Table for Alternating Legend that corresponds with last 2 digits of part number.

UB Indicators

Complement to UB Pushbuttons

BRIGHT & SUPER BRIGHT LED COLORS & SPECIFICATIONS

The electrical specifications shown are determined at a basic temperature of 25°C. LED circuit is isolated and requires external power source. Polarity marks are on bottom of switch. If the source voltage exceeds the rated voltage, a ballast resistor is required. Resistor value can be calculated by using the formula in the Supplement section. LED is an integral part of switch and not available separately.

Super Bright LEDs are Electrostatic Sensitive

ATTENTION ELECTROSTATIC SENSITIVE DEVICES

		Bright			Super Bright			
	Color	5C Red	5D Amber	5F Green	6B White	6F Green	6G Blue	Unit
Maximum Forward Current	I_{FM}	30	30	25	30	30	30	mA
Typical Forward Current	I_F	20	20	20	20	20	20	mA
Forward Voltage	V_F	1.85	2.0	2.1	3.2	3.2	3.2	V
Maximum Reverse Voltage	V_{RM}	5	5	5	5	5	5	V
Current Reduction Rate Above 25°C	ΔI_F	0.40	0.42	0.46	0.40	0.40	.040	mA/°C
Ambient Temperature Range		−25° ~ +50°C			−25° ~ +50°C			

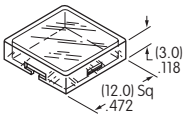
CAP TYPES & COLOR COMBINATIONS

Full Face Illuminated Cap for Bright LED

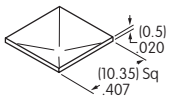
Lens/Diffuser Colors Available for Square Cap:

CB DJ JC
CC FB JD
CJ FF JF
DB FJ JJ
DD JB

AT4074 Lens



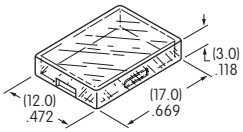
AT4075 Diffuser



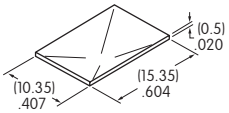
Lens/Diffuser Colors Available for Rectangular Cap:

CB FB JD
CC FF JF
DB JB
DD JC

AT4117 Lens



AT4118 Diffuser

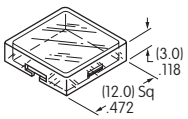


Lens & Diffuser Material: Polycarbonate Lens Finish: Glossy Diffuser Finish: Textured

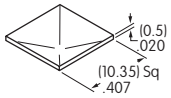
Full Face Illuminated Caps for Super Bright Bicolor LED

JB

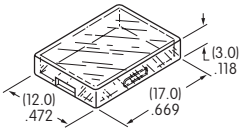
AT4074 Square Lens



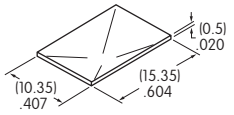
AT4188 Square Diffuser



AT4117 Rectangular Lens



AT4189 Rectangular Diffuser



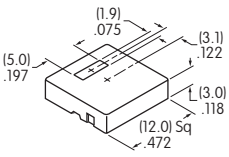
Lens & Diffuser Material: Polycarbonate Lens Finish: Glossy Diffuser Finish: Textured

Spot Illuminated Caps

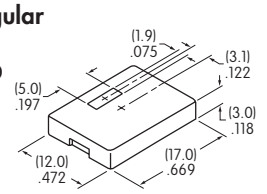
AB **Black Cap with Translucent White Window for LED Display**

Material: Polycarbonate
Finish: Matte

AT4119 Square for Bright and Super Bright LED



AT4120 Rectangular for Bright and Super Bright LED



Color Codes: **A** Black **B** White **C** Red **D** Amber **F** Green **J** Clear

SUPER BRIGHT BICOLOR LEDS FOR ALTERNATING LEGENDS

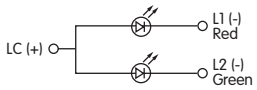
The electrical specifications shown are determined at a basic temperature of 25°C. LED circuit is isolated and requires external power source. Polarity marks are on bottom of switch. If the source voltage exceeds the rated voltage, a ballast resistor is required. Resistor value can be calculated by using the formula in the Supplement section. LED is an integral part of switch and not available separately.

Electrical Specifications for Super Bright Bicolor LEDs

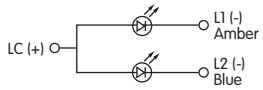
Super Bright LEDs are Electrostatic Sensitive — ATTENTION ELECTROSTATIC SENSITIVE DEVICES	Color	6CF Red	6CF Green	6DG Amber	6DG Blue	Unit
Maximum Forward Current	I_{FM}	* 30	* 30	* 30	* 30	mA
Typical Forward Current	I_F	20	20	20	20	mA
Forward Voltage	V_F	2.3	3.2	2.1	3.0	V
Maximum Reverse Voltage	V_{RM}	4	4	4	4	V
Current Reduction Rate Above 25°C	ΔI_F	0.33	0.33	0.33	0.33	mA/°C
Ambient Temperature Range		−25° ~ +50°		−25° ~ +50°		°C

* Value applies to single color illumination for either Red or Green or Amber or Blue. When both colors are illuminated simultaneously, the sum of the currents should not exceed the smallest value of the maximum forward current.

Super Bright Bicolor Red/Green LED with 2 elements



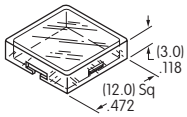
Super Bright Bicolor Amber/Blue LED with 2 elements



Alternating Legend Caps for Super Bright Bicolor LED

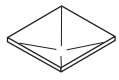
JCF JDG

AT4074 12.0mm Square Flat Cap



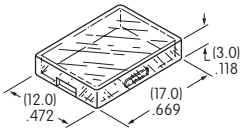
AT9450 Square Legend Insert

AT4188 Square Diffuser



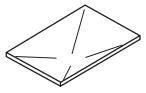
JCF JDG

AT4117 12.0mm x 17.0mm Rectangular Flat Cap



AT9451 Rectangular Legend Insert

AT4189 Rectangular Diffuser



Lens & Diffuser Material: Polycarbonate Legend Insert Material: Polyethylene Terephthalate (PET)

Lens Finish: Glossy Diffuser Finish: Textured

Standard Alternating Legend Pairs

11	12	13	14
ON / OFF	ON / OFF	START / STOP	OPEN / CLOSE
Green/Red or Blue/Amber	Green/Red or Blue/Amber	Green/Red or Blue/Amber	Green/Red or Blue/Amber

Cap illumination is alternating Green/Red or Blue/Amber; legend text is black.
Contact factory for other Alternating Legends.

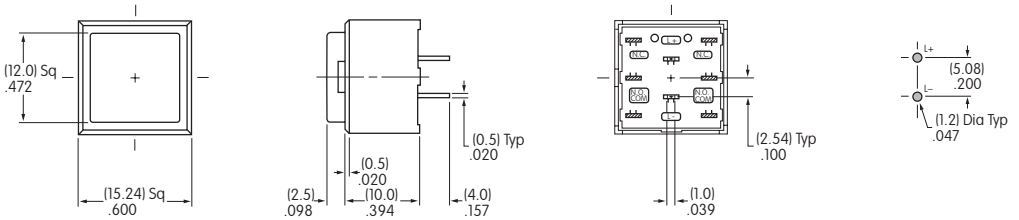
Legend illustrations are approximate representations of the actual characters on the filters.

UB Indicators

Complement to UB Pushbuttons

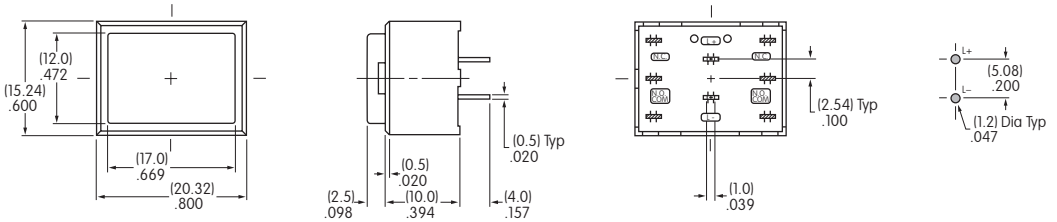
TYPICAL INDICATOR DIMENSIONS

Square • PCB Mount



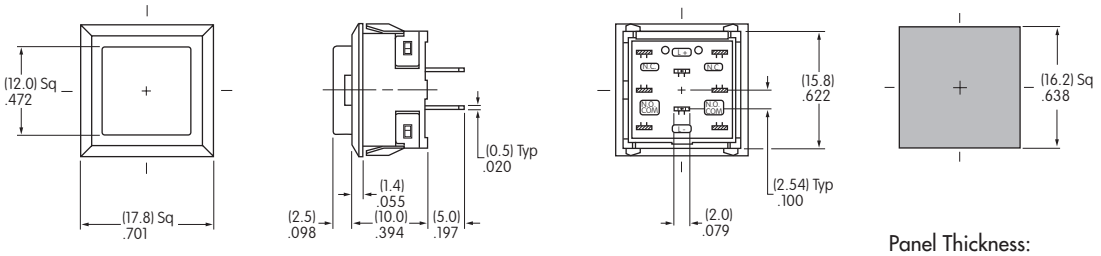
UB01KW035C-JC

Rectangular • PCB Mount



UB03KW035F-FF

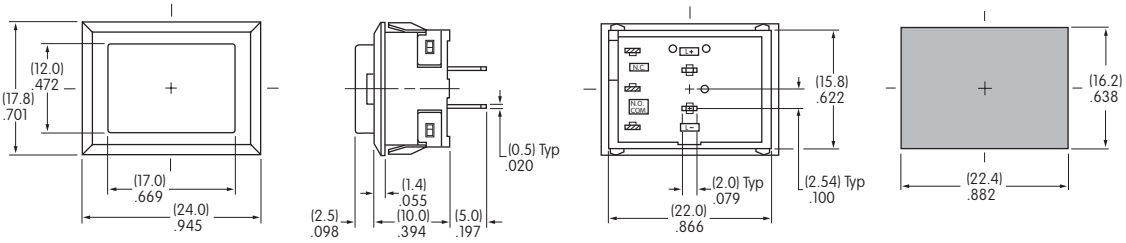
Square • Snap-in Mount • Built-in Bezel



UB04KW015C-JC

Panel Thickness:
1.0 ~ 3.2mm (.039 ~ .126")

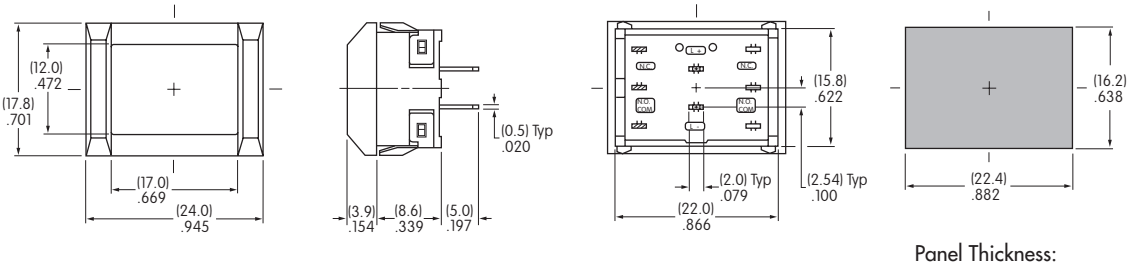
Rectangular • Snap-in Mount • Built-in Bezel



UB06KW015D-DD

Panel Thickness:
1.0 ~ 3.2mm (.039 ~ .126")

Rectangular • Snap-in Mount • Built-in Side Barriers

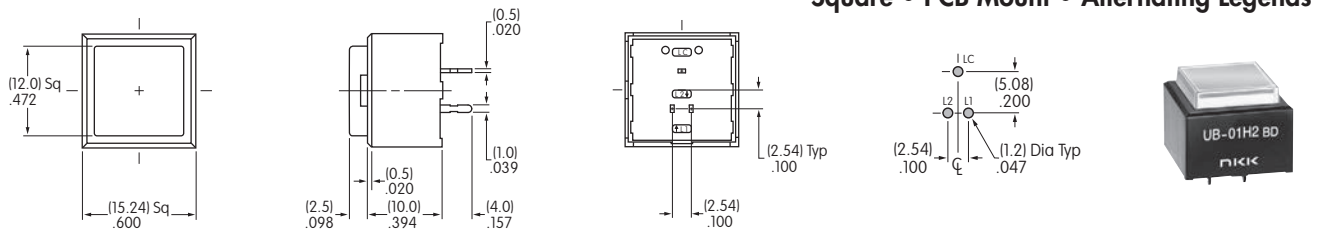


UB06BKW015F-FF

Panel Thickness:
1.0 ~ 3.2mm (.039 ~ .126")

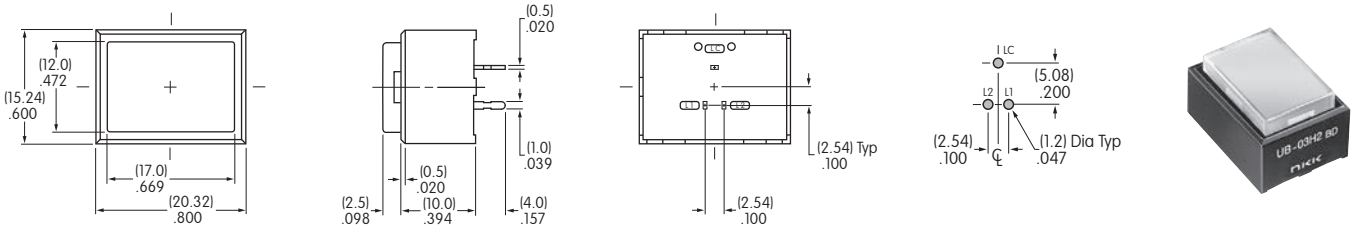
TYPICAL INDICATOR DIMENSIONS

Square • PCB Mount • Alternating Legends



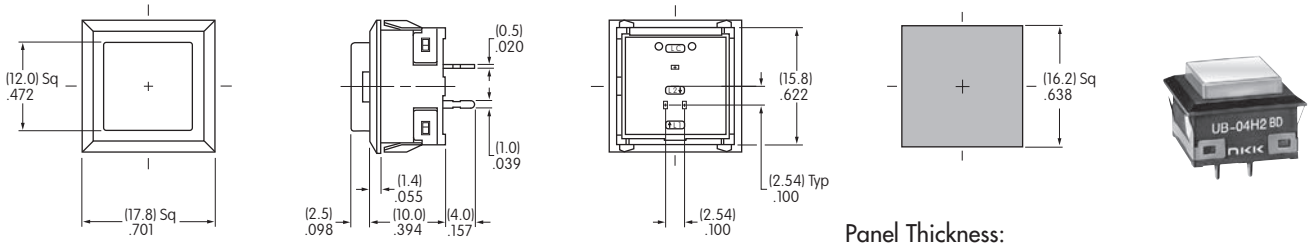
UB01KW036DG-JDG11

Rectangular • PCB Mount • Alternating Legends



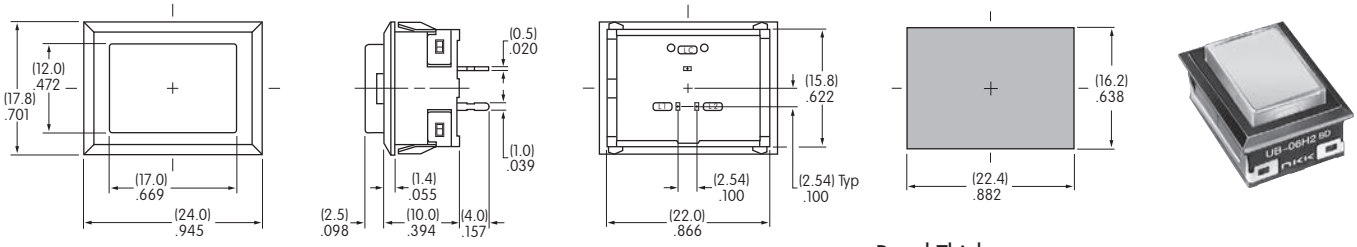
UB03KW016DG-JDG11

Square • Snap-in Mount • Built-in Bezel • Alternating Legends



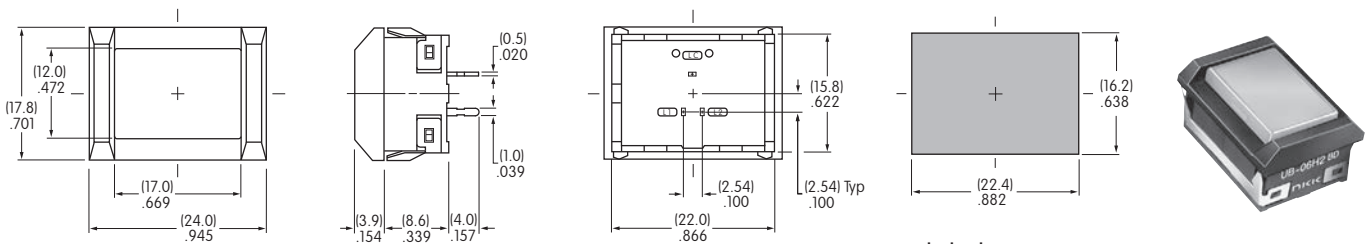
Panel Thickness:
(1.0 ~ 3.2mm) .039 ~ .126″ UB04KW016DG-JDG11

Rectangular • Snap-in Mount • Built-in Bezel • Alternating Legends



Panel Thickness:
(1.0 ~ 3.2mm) .039 ~ .126″ UB06KW016DG-JDG11

Rectangular • Snap-in Mount • Built-in Side Barriers • Alternating Legends



Panel Thickness:
(1.0 ~ 3.2mm) .039 ~ .126″ UB06BKW016DG-JDG11

UB2 Indicators

Complement to UB2 Pushbuttons

TYPICAL INDICATOR ORDERING EXAMPLE

UB2 | 01 | K | W03 | 6CF | — | 1JB | ☐

Mounting Types

PCB Mounting	
01	Square
Snap-in Mounting	
04	Square

Housing

K	Black

Terminals

W03	Silver PC/Turret

LEDs

Bright LED	
5C	Red
5D	Amber
5F	Green

Super Bright LED	
6B	White
6F	Green
6G	Blue

Super Bright Bicolor LED	
6CF	Red/Green
6DG	Amber/Blue

Cap Types & Colors

Sculptured Cap Lens/Diffuser Colors	
1JB	Clear/White
1JC	Clear/Red
1JD	Clear/Amber
1JF	Clear/Green
Beveled Cap & Colors	
2B	White
2C	Red
2D	Amber
2F	Green
Flat Cap Lens/Diffuser Colors	
3JB	Clear/White
3JC	Clear/Red
3JD	Clear/Amber
3JF	Clear/Green

Sculptured Cap Lens/Diffuser Color	
1JB	Clear/White
Beveled Cap & Color	
2B	White
Flat Cap Lens/Diffuser Color	
3JB	Clear/White

Sculptured Cap Lens/Diffuser Color	
1JB	Clear/White
Beveled Cap & Color	
2B	White
Flat Cap Lens/Diffuser Color	
3JB	Clear/White
Sculptured Cap with Alternating Legend	
4JCF	Clear; Red/Green
4JDG	Clear; Amber/Blue
Flat Cap with Alternating Legend	
5JCF	Clear; Red/Green
5JDG	Clear; Amber/Blue

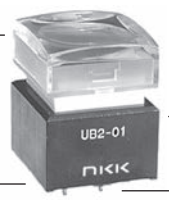
Alternating Legends

11	ON (pos)	OFF (pos)
12	ON (neg)	OFF (neg)
13	START	STOP
14	OPEN	CLOSE

See Part Numbers Table on Next Page

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

UB201KW036CF-1JB



Sculptured Cap with Clear Lens, White Diffuser

Red/Green Super Bright Bicolor LED

Square with PCB Mounting

Black Housing

Silver PC/ Turret Terminals

UB2 Indicators

Part Numbers for Alternating Legends

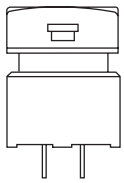
Color	15mm Square Sculptured Cap	15mm Square Flat Cap
	Part Number	Part Number
Red/Green	AT3069JCF11 ~ AT3069JCF14	AT3070JCF11 ~ AT3070JCF14
Amber/Blue	AT3069JDG11 ~ AT3069JDG14	AT3070JDG11 ~ AT3070JDG14

Refer to Ordering Table for Alternating Legend that corresponds with last 2 digits of part number.

MOUNTING TYPES, SHAPES, & TERMINALS

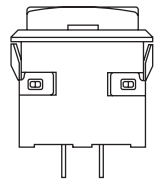
01 **PCB Mounting**

Square



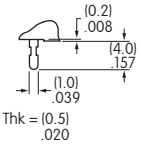
04 **Snap-in Mounting**

Square with Built-in Bezel



W03 **Terminals**

Silver PC/Turret



Panel Thickness: .039 ~ .126" (1.0 ~ 3.2mm)

LED COLORS & SPECIFICATIONS

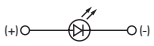
The electrical specifications shown are determined at a basic temperature of 25°C. Polarity marks are on the bottom of the device. If the source voltage exceeds the rated voltage, a ballast resistor is required. The resistor value can be calculated by using the formula in the Supplement section. The LED is an integral part of the indicator and not available separately.

Note for Super Bright:

ATTENTION ELECTROSTATIC SENSITIVE DEVICES

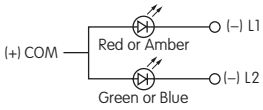
		Bright			Super Bright			Super Bright Bicolor		
		5C	5D	5F	6B	6F	6G	6CF	6DG	
	Color	Red	Amber	Green	White	Green	Blue	Red/Green	Amber/Blue	Unit
Maximum Forward Current	I_{FM}	30	30	25	20	30	30	30/25 *Amber 25/22	30/30	mA
Typical Forward Current	I_F	20	20	20	15	20	20	20/20	15/15	mA
Forward Voltage	V_F	1.85	2.0	2.1	3.3	3.5	3.6	2.1/3.5	2.0/2.8	V
Maximum Reverse Voltage	V_{RM}	5	5	5	5	5	5	4/4	4/4	V
Current Reduction Rate Above 25°C	ΔI_F	0.40	0.42	0.46	0.25	0.50	0.50	0.40/0.33	0.33/0.33	mA/°C
Ambient Temperature Range		−25° ~ +50			−20° ~ +50			−25° ~ +50	−25° ~ +50	°C

Bright
Single Color LED
with 1 element



Super Bright
Single Color LED
with 1 element

Super Bright
Bicolor LED
with 2 elements



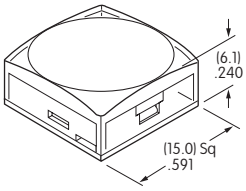
*Amber color can be achieved by lighting red and green simultaneously on the bicolor LED (not suitable for Alternating Legends).

UB2 Indicators

Complement to UB2 Pushbuttons

CAP TYPES & COLOR COMBINATIONS

1 AT3074 Sculptured

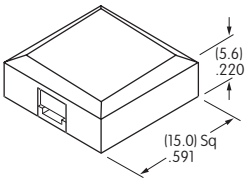


Material: Polycarbonate
Finish: Glossy

Lens/Diffuser Colors Available:

JB	Clear/ White
JC	Clear/ Red
JD	Clear/ Amber
JF	Clear/ Green

2 AT3075 Beveled

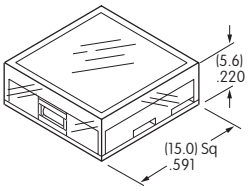


Material: Polycarbonate
Finish: Glossy

Cap Colors Available:

B	White
C	Red
D	Amber
F	Green

3 AT3076 Flat



Material: Polycarbonate
Finish: Glossy

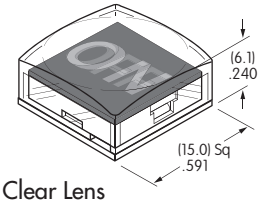
Lens/Diffuser Colors Available:

JB	Clear/ White
JC	Clear/ Red
JD	Clear/ Amber
JF	Clear/ Green

Alternating Legend Caps for Super Bright Bicolor LED

AT3069J Sculptured Cap with Alternating Legend

4JCF	Red/Green
4JDG	Amber/Blue

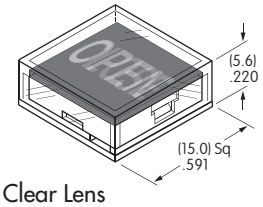


Clear Lens
Alternating Legend Filter
Material: Polycarbonate

AT3070J Flat Cap with Alternating Legend

5JCF	Red/Green
5JDG	Amber/Blue

Finish: Glossy



Clear Lens
Alternating Legend Filter

Standard Alternating Legend Pairs

11	ON	OFF	Green/Red or Blue/Amber
12	ON	OFF	Green/Red or Blue/Amber
13	START	STOP	Green/Red or Blue/Amber
14	OPEN	CLOSE	Green/Red or Blue/Amber

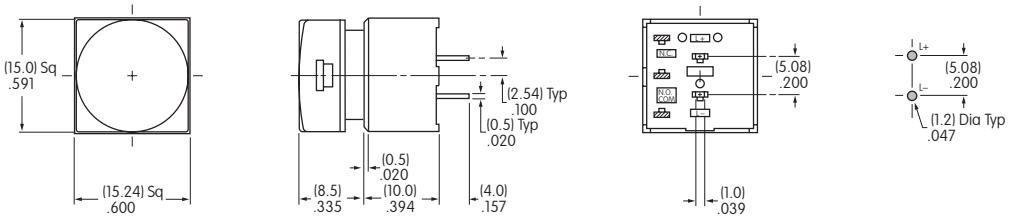
Cap illumination is alternating Green/Red or Blue/Amber; legend text is black. Contact factory for other Alternating Legends.
Legend illustrations are approximate representations of the actual characters on the filters.

Note: Cap Removal Tool available for PCB Mount. See AT093ABC in Accessories & Hardware section for dimensions and other details.

TYPICAL INDICATOR DIMENSIONS

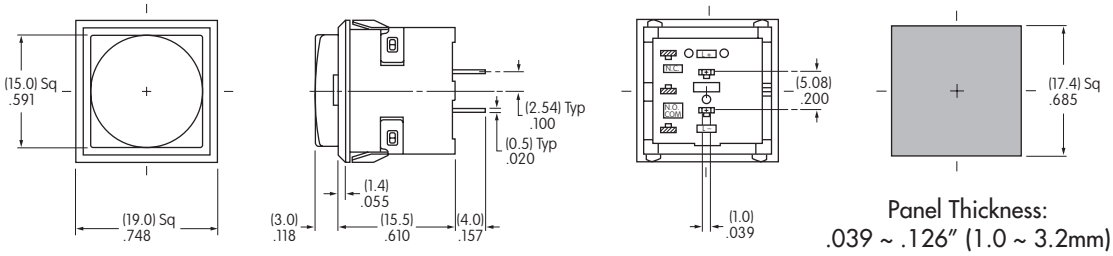
PCB Mount

UB201KW035C-1JC



Snap-in Mount

UB204KW035C-1JC



Panel Thickness:
.039 ~ .126" (1.0 ~ 3.2mm)

TYPICAL INDICATOR ORDERING EXAMPLE

YB | 04 | ☐ | K | W01 | – | ☐ 12 | – | FB

Shapes

Bushing Mounting	
01	Square
02	Round
03	Rectangular
Snap-in Mounting	
04	Square
05	Round
06	Rectangular

Panel Seal

No Code	Without Panel Seal
W	With Panel Seal (Bushing Mount only)

Housing

K	Black only

Terminals

W01	Silver Solder Lug/ .110″ (2.8mm) Quick Connect

Lamps

Incandescent Lamp

05	5-volt
12	12-volt

Bright LED

LED Colors		Resistor	
5C	Red	**No Code**	No Resistor
5D	Amber	**05**	5-volt
5F	Green	**12**	12-volt
		24	24-volt

Super Bright LED

6B	White
6F	Green
6G	Blue

Bicolor LED

LED Colors		Forward Voltage	
2CF	Red/Green	**02**	2-volt (no resistor)
		05	5-volt
		12	12-volt
		24	24-volt

Cap Types & Colors

Solid Cap: Lens/Insert Colors

BB	White/White
CB	Red/White
EB	Yellow/White
FB	Green/White
GB	Blue/White

LED Cap: Lens/Insert Colors

JB	Clear/White
JC	Clear/Red
JD	Clear/Amber
JF	Clear/Green

LED Cap: Lens/Insert Colors

JB	Clear/White

LED Cap: Lens/Insert Colors

JB	Clear/White

DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

YB04KW01-12-FB

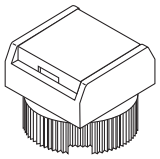
YB Indicators

Complement to YB Pushbuttons

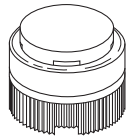
SHAPES & MOUNTING TYPES

Bushing Mounting

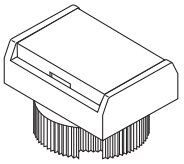
01 Square



02 Round

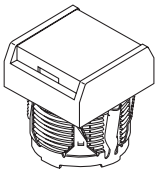


03 Rectangular

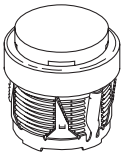


Snap-in Mounting

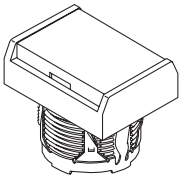
04 Square



05 Round



06 Rectangular



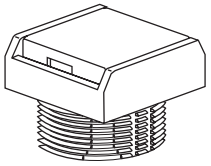
Bezel-barrier is an integral part of the indicator body.

PANEL SEAL

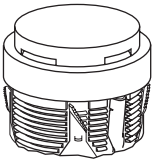
No Code Without Panel Seal

Bushing Mounting

Supplied with mounting nut.



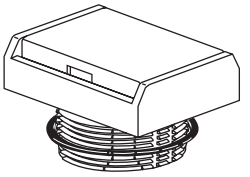
Snap-in Mounting



W With Panel Seal

Bushing Mounting only

Supplied with mounting nut and o-ring AT089.



INCANDESCENT LAMP & SOLID CAP

The electrical specifications shown are determined at a basic temperature of 25°C.
If the source voltage exceeds the rated voltage, a ballast resistor is required.
The resistor value can be calculated by using the formula in the Supplement section.

AT611

T-1 Bi-pin

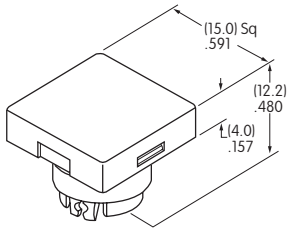
		05	12
Voltage	V	5V AC	12V AC
Current	I	115mA	60mA
MSCP		.150	.150
Endurance	Hours	7,000 average	
Ambient Temperature Range		−25°C ~ +50°C	

Solid Cap for Incandescent Lamp

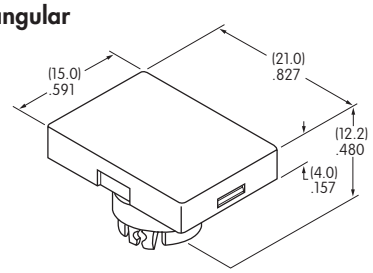
Lens/Insert Colors Available:

- **BB** White/White
- **CB** Red/White
- **EB** Yellow/White
- **FB** Green/White
- **GB** Blue/White

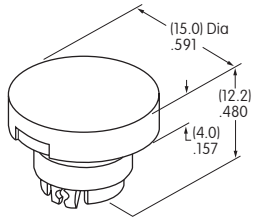
AT3001 Square



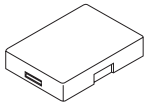
AT3003 Rectangular



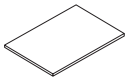
AT3002 Round



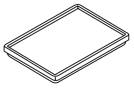
Materials: Polycarbonate (Lens & Insert)
Thermoplastic Elastomer (Seal/Filter)
Finish: Glossy



Translucent Colored Lens



Translucent White Insert



Translucent White Seal/Filter

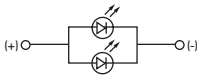
Incandescent Lamp AT611

BRIGHT LEDS & LED CAPS

The electrical specifications shown are determined at a basic temperature of 25°C.
If the source voltage exceeds the rated voltage, a ballast resistor is required.
The resistor value can be calculated by using the formula in the Supplement section.

Electrical Specifications for Bright LED without Resistor

Bright AT628



T-1 Bi-pin

Colors Available: 5C Red, 5D Amber, 5F Green		No Code No Resistor			Unit
Maximum Forward Current	I_{FM}	40	40	40	mA
Typical Forward Current	I_F	26	26	26	mA
Forward Voltage	V_F	1.9	2.0	2.0	V
Maximum Reverse Voltage	V_{RM}	4	4	4	V
Current Reduction Rate Above 25°C	ΔI_F	0.50			mA/°C
Ambient Temperature Range		−25 ~ +50			°C

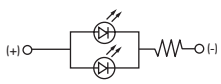
Electrical Specifications for Bright LED with Resistor

Bright AT634

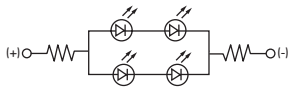
T-1¼ Bi-pin

Colors Available: 5C Red, 5D Amber, 5F Green		05	12	24	Unit
Maximum Forward Current	I_{FM}	—	—	—	mA
Typical Forward Current	I_F	25	20	10	mA
Forward Voltage	V_F	5	12	24	V
Maximum Reverse Voltage	V_{RM}	4	8	16	V
Current Reduction Rate Above 25°C	ΔI_F	—	—	—	mA/°C
Ambient Temperature Range		−25 ~ +50			°C

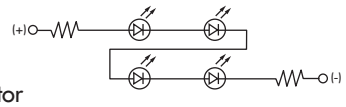
AT634 5-volt, 2-element with Resistor



AT634 12-volt, 4-element with Resistor



AT634 24-volt, 4-element with Resistor

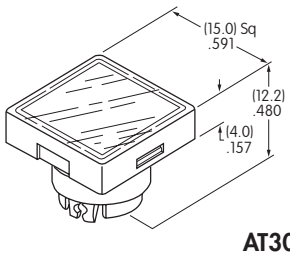


Cap for Bright LED

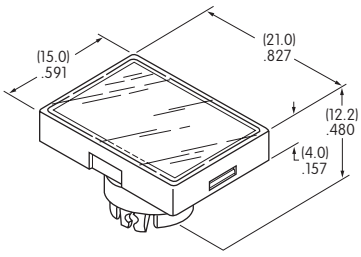
Lens/Insert Colors Available:

- **JB** Clear/White
- **JC** Clear/Red
- **JD** Clear/Amber
- **JF** Clear/Green

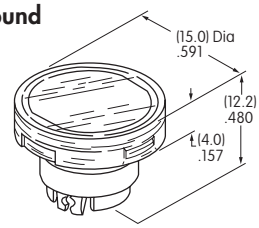
AT3004 Square

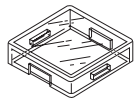


AT3006 Rectangular

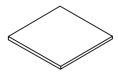


AT3005 Round

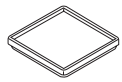




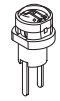
Transparent Clear Lens



Translucent Colored Insert



Translucent White Seal/Diffuser



Bright LEDs
AT628 AT634

Materials: Polycarbonate (Lens & Insert)
Thermoplastic Elastomer (Seal/Diffuser)
Finish: Glossy

SUPER BRIGHT LEDS & LED CAPS

The electrical specifications shown are determined at a basic temperature of 25°C.
If the source voltage exceeds the rated voltage, a ballast resistor is required.
The resistor value can be calculated by using the formula in the Supplement section.

Super Bright
AT625G Blue
AT631B White
AT632F Green

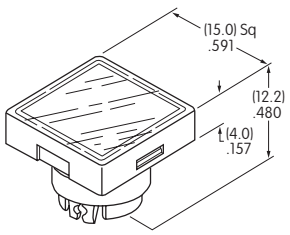
T-1 Bi-pin

ATTENTION
ELECTROSTATIC
SENSITIVE DEVICES

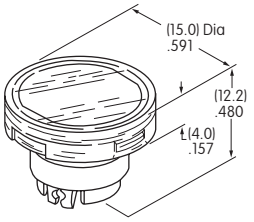
Colors:		6B White	6F Green	6G Blue	Unit
Maximum Forward Current	I_{FM}	30	30	30	mA
Typical Forward Current	I_F	20	20	20	mA
Forward Voltage	V_F	3.3	3.3	3.3	V
Maximum Reverse Voltage	V_{RM}	7	7	7	V
Current Reduction Rate Above 25°C	ΔI_F	0.40	0.40	0.40	mA/°C
Ambient Temperature Range		−25 ~ +50			°C

Cap for Super Bright LED

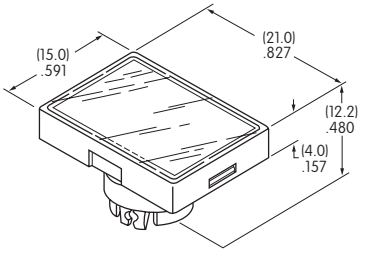
AT3014
Square



AT3015
Round

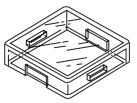


AT3016
Rectangular

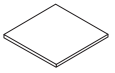


Lens/Insert
Colors Available:

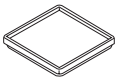
JB **Clear/White**



Transparent Clear Lens



Translucent White Insert



Translucent White Seal/Diffuser

Super Bright LEDs
AT625 AT631
AT632

Materials: Polycarbonate (Lens & Insert)
Thermoplastic Elastomer (Seal/Diffuser)

BICOLOR LED & LED CAPS

The electrical specifications shown are determined at a basic temperature of 25°C.
If the source voltage exceeds the rated voltage, a ballast resistor is required.
The resistor value can be calculated by using the formula in the Supplement section.

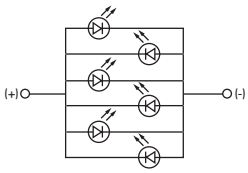
Bicolor AT621

2CF Red/Green

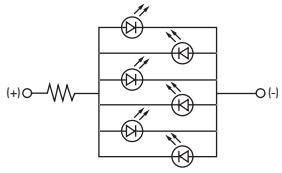
T-1½ Bi-pin

Bicolor LED is translucent white in OFF state.		02	05	12	24	Unit
Maximum Forward Current	I_{FM}	60	60	20	12	mA
Typical Forward Current	I_F	45	45	15	10	mA
Forward Voltage (Red/Green)	V_F	1.9 / 2.1	5	12	24	V
Current Reduction Rate Above 25°C	ΔI_F	0.80	----	----	----	mA/°C
Ambient Temperature Range		–25 ~ +50				°C

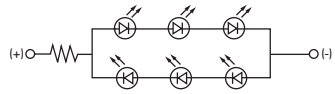
AT621
Bicolor LED
2-volt
6-element
w/o Resistor



AT621
Bicolor LED
5-volt
6-element
with Resistor



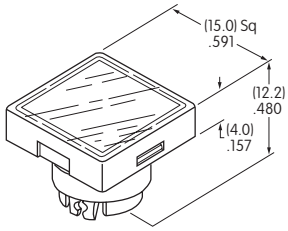
AT621
Bicolor LED
12 & 24-volt
6-element
with Resistor



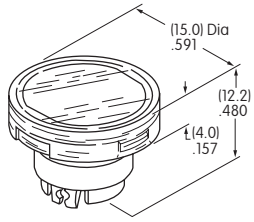
As shown for Red;
Reverse polarity for Green

LED Caps

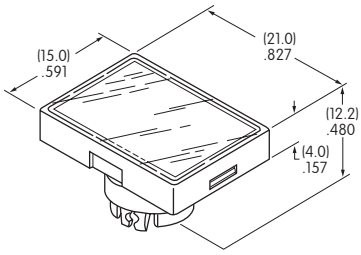
AT3004
Square



AT3005
Round

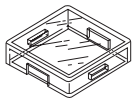


AT3006
Rectangular

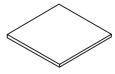


Lens/Insert
Colors Available:

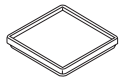
JB **Clear/White**



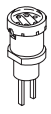
Transparent Clear Lens



Transparent White Insert



Translucent White Seal/Diffuser



Bicolor LED AT621

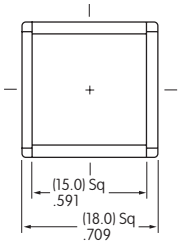
Materials: Polycarbonate (Lens & Insert)
Thermoplastic Elastomer (Seal/Diffuser)

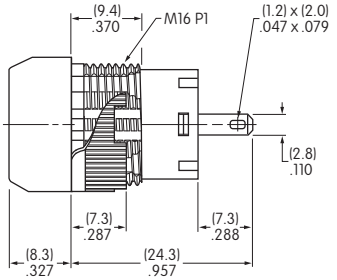
YB Indicators

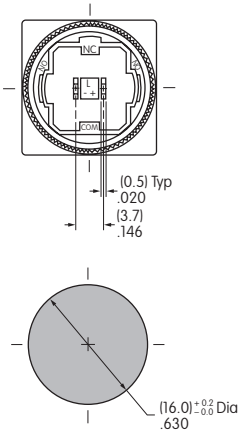
Complement to YB Pushbuttons

TYPICAL INDICATOR DIMENSIONS

Square • Bushing Mounting



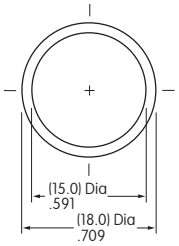


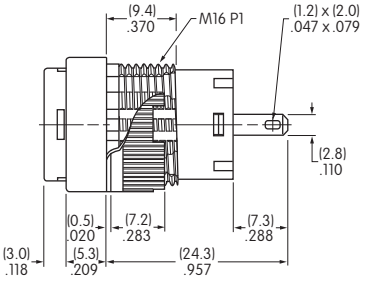


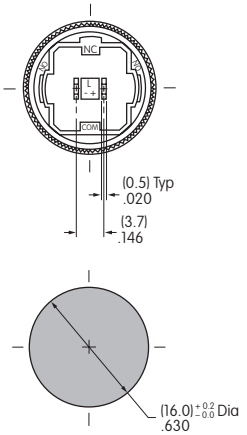
YB01KW01-12-CB

Panel Thickness
.020" ~ .197" (0.5mm ~ 5.0mm)

Round • Panel Seal



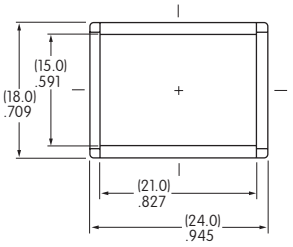


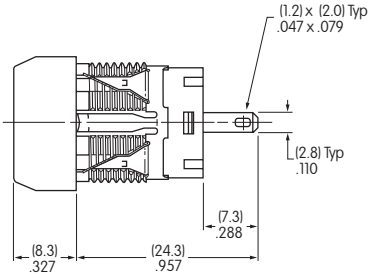


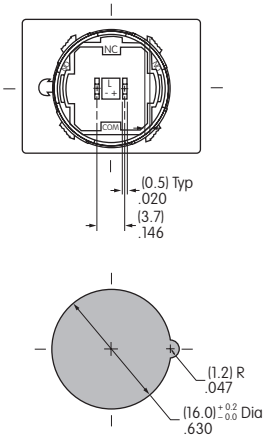
YB02WKW01-12-GB

Panel Thickness
.020" ~ .197" (0.5mm ~ 5.0mm)

Rectangular • Snap-in Mounting







YB06KW01-12-EB

Panel Thickness
.039" ~ .138" (1.0mm ~ 3.5mm)

NKK SWITCHES

Accessories & Hardware

Accessories & Hardware

Contents

Part Number	Page
AT001s	Y3
AT100s	Y5
AT200s	Y6
AT400s	Y8
AT500s	Y13
AT600s	Y16
AT700s	Y18
AT2100s	Y19
AT3000s	Y19
AT4000s	Y23
AT4100s	Y27
AT9000s	Y34

Color Codes

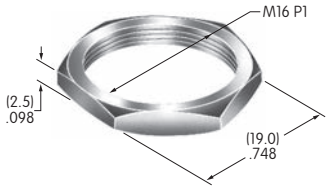
A Black	**D** Amber	**G** Blue	**P** Brushed Chrome
B White	**E** Yellow	**H** Gray	**S** Metallic Silver
C Red	**F** Green	**J** Clear	

Hardware Threading

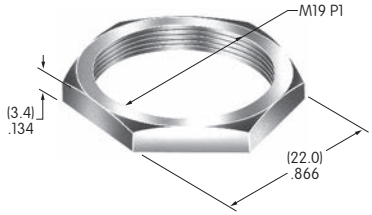
Many hardware pieces are available in both metric and inch threading, and in such cases **M** (metric) and **H** (inch) are noted in the descriptions. The customer must select threading by placing an M or H after the basic AT part number. If the hardware is available only in metric or inch, no code is used in the description; threading is designated on the drawing.

AT010s~ AT090s

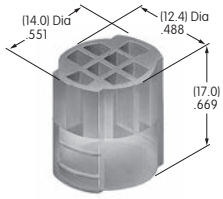
AT016
16mm Hex Mounting Nut
Steel with nickel plating
Series: CKM LP01



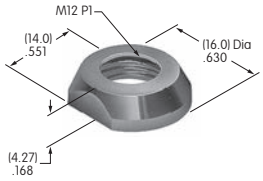
AT019
19mm Hex Mounting Nut
Steel with nickel plating
Series: CKL



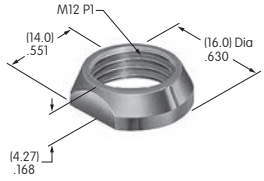
AT055
Crossover Guard
Polypropylene
Series: KB



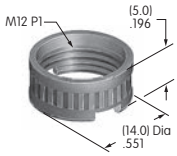
AT056
Dress Cap Nut
Brass with chrome plating
Series: M P S



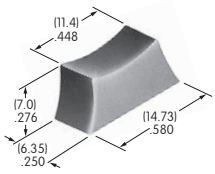
AT056T
Threaded Through Dress Nut
Brass with chrome plating
Series: M P S



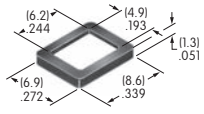
AT057
Mounting Nut
Brass with zinc plating, chromate finish
Series: KB



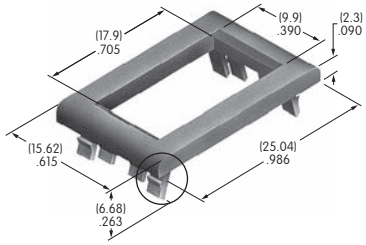
AT062
.250" Wide Rocker
Polyamide
Colors: A B C
Series: A



AT063
Gasket
Nitrile butadiene rubber
Color: A
Series: B Threaded Bushing



AT064-1
Panel Frame for Rocker & Paddle .365" Wide
Polyamide
Color: A
Series: M



AT064-1 accommodates panel thickness 1.2 ~ 2.3mm (.047 ~ .090")

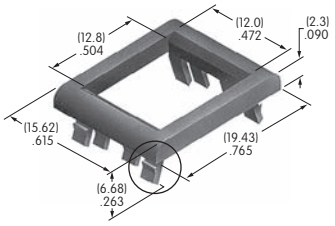
AT064-2
Panel Frame for Rocker & Paddle .365" Wide
Polyamide
Color: A
Series: M

AT064-2 accommodates panel thickness 1.57 ~ 3.18mm (.062 ~ .125")

Color Codes: **A** Black **B** White **C** Red **D** Amber **E** Yellow **F** Green **G** Blue **H** Gray **J** Clear

Accessories & Hardware

AT065-1
Panel Frame for Rocker & Paddle .450" Wide
Polyamide
Color: A
Series: M

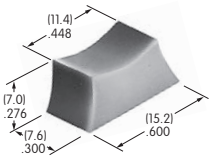


AT065-1 accommodates panel thickness
1.2 ~ 2.3mm
(.047 ~ .090")

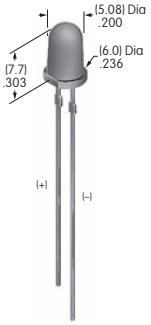
AT065-2
Panel Frame for Rocker & Paddle .450" Wide
Polyamide
Color: A
Series: M

AT065-2 accommodates panel thickness
1.57 ~ 3.18mm
(.062 ~ .125")

AT066
.300" Wide Rocker
Polyamide
Color: A B C
Series: A

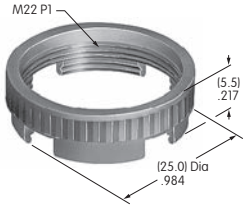


AT070
LED for AT208 Bezel
Colors: C F
Series: EB M MB24

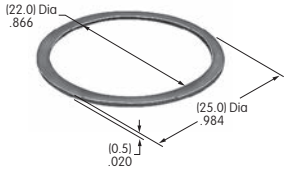


AT073
Mounting Nut
Brass with nickel plating
Series: HB

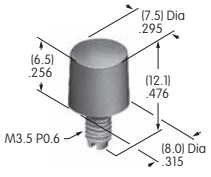
AT074
Mounting Nut for LB Panel Seal
Brass with chromate
Series: LB



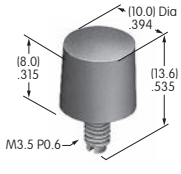
AT075
O-ring for LB Panel Seal
Nitrile butadiene rubber
Series: LB



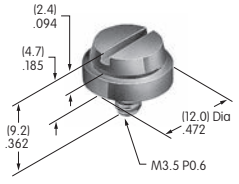
AT078
.315" (8.0mm) Diameter Screw-on Cap
Polystyrene
Colors: A B C E F G H
Series: MB20 SCB WB



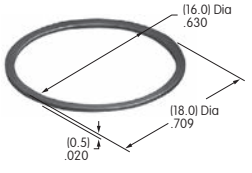
AT079
.394" (10.0mm) Diameter Screw-on Cap
Polystyrene
Colors: A B C E F G H
Series: MB20 SCB WB



AT080
Screw Adaptor for AT452 & AT454
Brass
Series: MB20 SCB

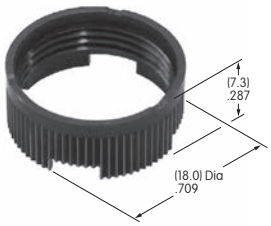


AT089
O-ring for YB Panel Seal
Nitrile butadiene rubber
Series: YB

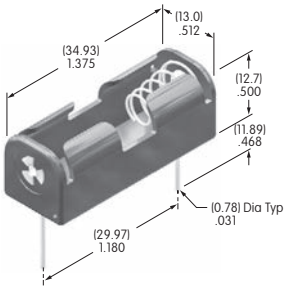


Color Codes: **A** Black **B** White **C** Red **D** Amber **E** Yellow **F** Green **G** Blue **H** Gray **J** Clear

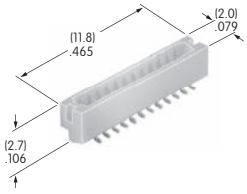
AT092
Knurled Mounting Nut
Glass fiber reinforced PBT
Series: YB YB2 (Square)



AT094
PC Adaptor
Holder: Polypropylene
Spring: Spring steel with nickel plating
PC Pins: Brass with nickel plating
Series: DSA01

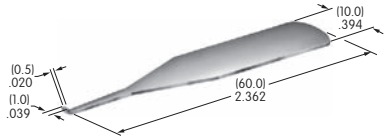


AT097
JST Connector for OLED Rocker
JST Part No. BM12B-SURS
PCB Mount
Series: SmartSwitch

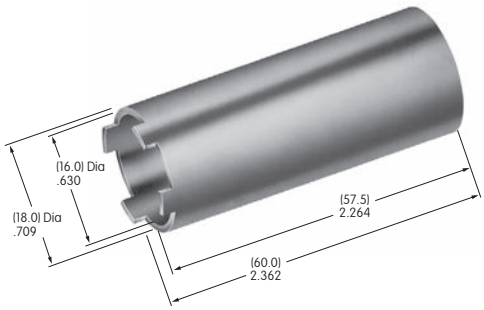


AT100s

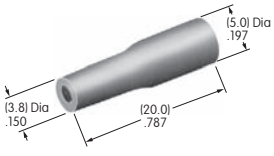
AT105
Cap Removal Tool
Stainless steel
Series: HB KB LB UB YB



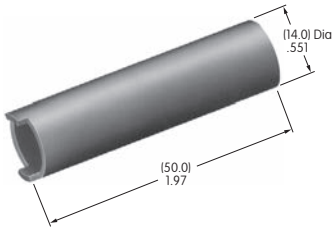
AT106
Socket Wrench
Aluminum with black alumite finish
Series: YB YB2



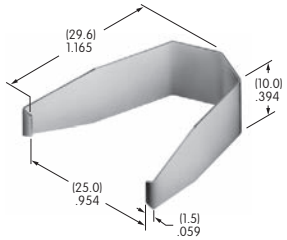
AT107
Lamp Extractor
Polyvinyl chloride
Series: KB LW MLW YB



AT108
Socket Wrench
Aluminum with black alumite finish
Series: KB



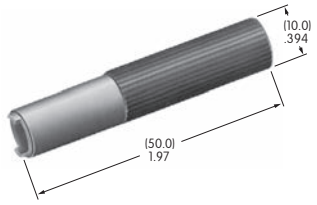
AT109
Cap Extractor
Stainless steel
Series: HB KB LB UB YB



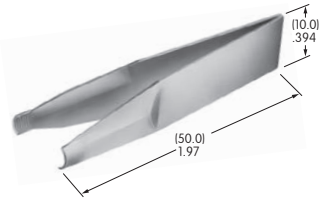
Color Codes: **A** Black **B** White **C** Red **D** Amber **E** Yellow **F** Green **G** Blue **H** Gray **J** Clear

Accessories & Hardware

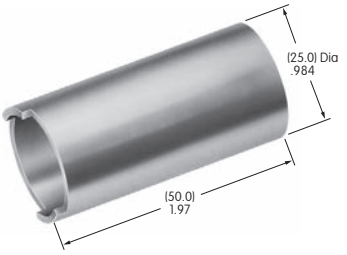
AT110
Socket Wrench
Brass
Series: HB



AT111
Lamping Tool
Stainless steel
Series: HB KB YB

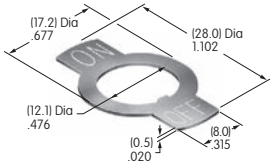


AT112
Socket Wrench
Brass with nickel plating
Series: LB

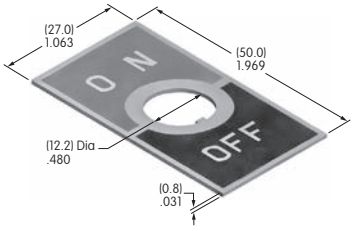


AT200s

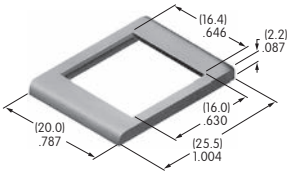
AT201
ON-OFF Plate for 12mm Threaded Bushing
Brass with nickel plating
Series: M P S



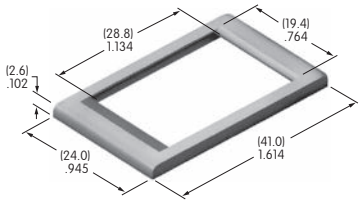
AT202
ON-OFF Plate for 12mm Threaded Bushing
Aluminum
Colors: Red & black enamel
Series: M P S



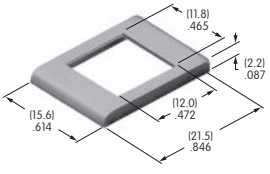
AT204
Bezel
Polycarbonate
Colors: A B C D E F G H
Series: MLW



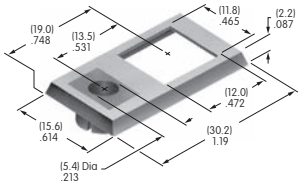
AT206
Bezel
Polycarbonate
Colors: A B C D E F G H
Series: LW



AT207
Bezel
Polycarbonate
Colors: A B C E F G H
Series: EB MB24 MB25

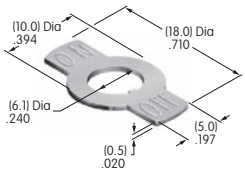


AT208
Bezel for AT070 LED
Polycarbonate
Color: A
Series: EB M MB24 MB25

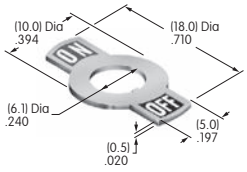


Color Codes: **A** Black **B** White **C** Red **D** Amber **E** Yellow **F** Green **G** Blue **H** Gray **J** Clear

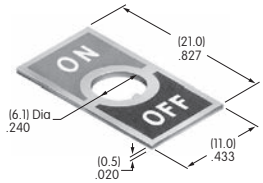
AT209
ON-OFF Plate for 6mm Threaded Bushing
Brass with nickel plating
Series: M P



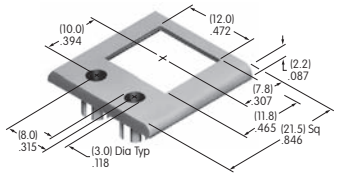
AT210
ON-OFF Plate for 6mm Threaded Bushing
Aluminum
Colors: Red & black ink
Series: M P



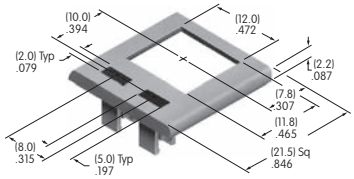
AT211
ON-OFF Plate for 6mm Threaded Bushing
Aluminum
Colors: Red & black enamel
Series: M P



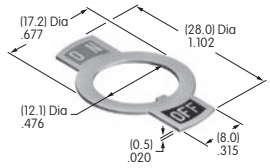
AT212
Bezel for 2 AT617 LEDs
Polycarbonate
Color: A
Series: EB M MB24 MB25



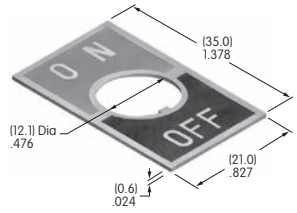
AT213
Bezel for 2 AT618 LEDs
Polycarbonate
Color: A
Series: EB M MB24 MB25



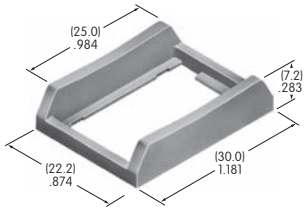
AT214
ON-OFF Plate for 12mm Threaded Bushing
Aluminum
Colors: Red & black ink
Series: M P S



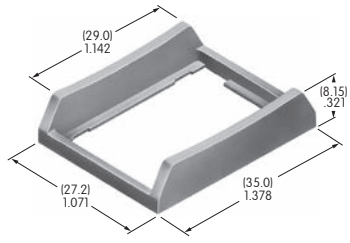
AT215
ON-OFF Plate for 12mm Threaded Bushing
Aluminum
Colors: Red & black enamel
Series: M P S



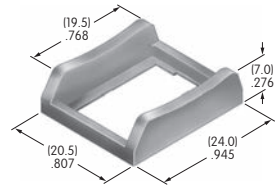
AT217
Barrier
Polyamide
Colors: A B H
Series: JWM



AT218
Barrier
Polyamide
Colors: A B H
Series: JWL



AT219
Barrier
Polyamide
Colors: A
Series: JWS

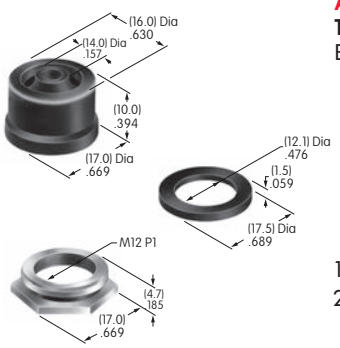


Color Codes: **A** Black **B** White **C** Red **D** Amber **E** Yellow **F** Green **G** Blue **H** Gray **J** Clear

Accessories & Hardware

AT400s

AT401A/H/S
Splashproof Boot Assembly
Hex Nut Material & Finish:
Nickel plated brass
O-ring Material:
Nitrile butadiene rubber
Series: M P S WT



AT401A for Oil Resistance
Boot Material: Black nitrile butadiene rubber

AT401H for Dust & Ozone Resistance
Boot Material: Gray ethylene propylene rubber

AT401S for Flexibility, Resilience, and Tensile Strength over Wide Temperature Range
Boot Material: Black silicone rubber

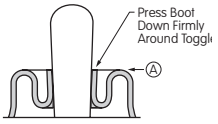
Switch Installation Instructions

1. Install switch bushing into mounting hole of panel from the back and adjust bushing to protrude 3.5 ~ 5.5mm (.138 ~ .217") above panel.
2. Install boot over bushing and tighten with hex nut.

For 12mm Bushings in M, P, S and WT Toggles

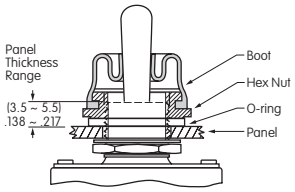
Boot Assembly Instructions

1. After mounting boot AT401 over toggle, press into place.
2. Be sure boot is pressed evenly and firmly down at or below height Ⓐ as shown.



Non-Splashproof Switches

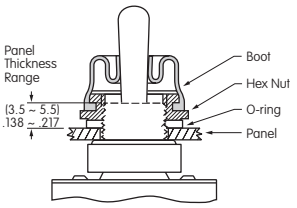
M, P or S Toggles with 12mm Bushings



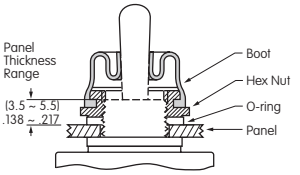
Use boot, nut and o-ring as shown. Use lockwasher and hexagon nut (from standard switch hardware) behind panel.

Splashproof Switches

S1AW ~ S29AW S Toggles

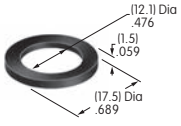


WT Toggles or M Toggle with B3 Bushing

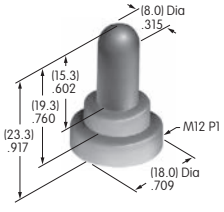


Use boot, nut and o-ring as shown. Use o-ring only (from standard switch hardware) behind panel.

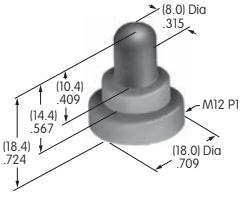
AT401P
O-ring
Nitrile butadiene rubber
Color: A
Series: M MB20 TL WB WT



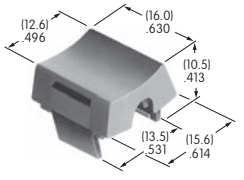
AT402
Splashproof Boot
Silicon rubber for A C E F
Ethylene propylene rubber for H
Colors: A C E F H
Series: M P S



AT402S
Splashproof Boot
Silicon rubber
Color: A
Series: M



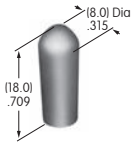
AT405
Solid Color Rocker
Polycarbonate
Colors: A B C D E F G
Series: MLW



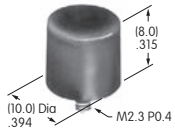
Color Codes: **A** Black **B** White **C** Red **D** Amber **E** Yellow **F** Green **G** Blue **H** Gray **J** Clear

Accessories & Hardware

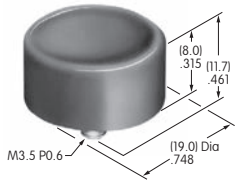
AT406
Bat Lever Cap
Polyvinyl chloride
Colors: A B C E F G
Series: M P S



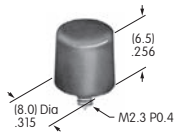
AT407
.394" Diameter
Screw-on Cap
PBT
Colors: A B C E F G H
Series: MB20



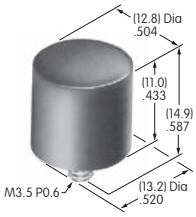
AT412
.748" Diameter
Screw-on Cap
Polystyrene
Colors: A B C F
Series: MB20 SCB WB



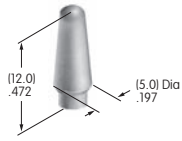
AT413
.315" Diameter
Screw-on Cap
PBT
Colors: A B C E F G H
Series: MB20



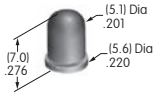
AT414
.520" Diameter
Screw-on Cap
PBT
Colors: A B C D E F G H
Series: MB20 SB SCB WB



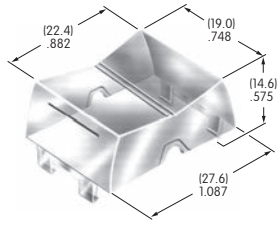
AT415
Bat Lever Cap
Polyethylene
Colors: A B C E F G
Series: D2 M



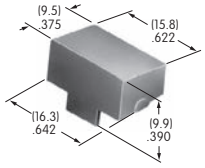
AT416
Lamp Cover for AT602
Silicon rubber
Colors: C D F
Series: LW



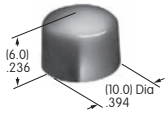
AT420
Rocker
Polycarbonate
Colors: B J
Series: LW



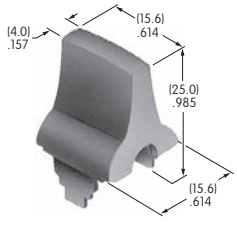
AT421
Filter for AT420
Polycarbonate
Colors: B C D E F G
Series: LW



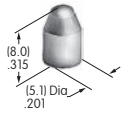
AT422
Slip-on Cap
Polyethylene
Colors: A B C E F G
Series: SB40



AT426
Solid Color Paddle
Polycarbonate
Colors: A B C D E F G
Series: MLW



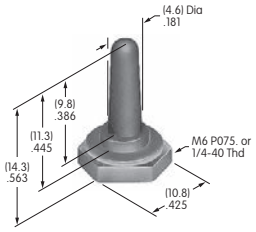
AT427
Cap for Locking Lever (code L)
Brass with bright nickel plating
(supplied with switch)
Anodized aluminum
Colors: A C G
Series: D2 M



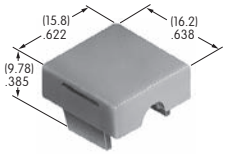
Color Codes: **A** Black **B** White **C** Red **D** Amber **E** Yellow **F** Green **G** Blue **H** Gray **J** Clear

Accessories & Hardware

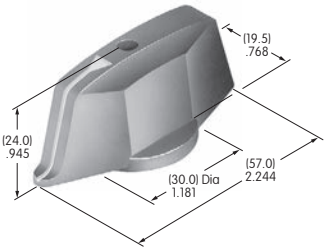
AT428 (M-metric H-inch)
Splashproof Boot
Silicone rubber
Color: A
Series: D2 M P



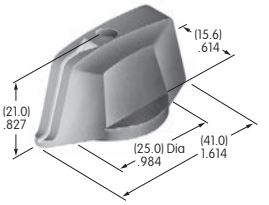
AT429
Indicator Cap
Polycarbonate
Colors: B C D E F G
Series: P01



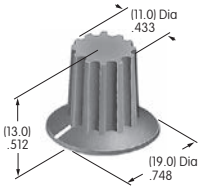
AT431
Large Rotary Knob
Phenolic resin
Color: A
Series: HS PS TS



AT432
Small Rotary Knob
Phenolic resin
Color: A
Series: HS PS TS

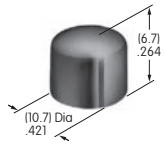


AT433
Knob for Miniature Rotaries
Polyacetal
Color: A
Series: FR01 MR

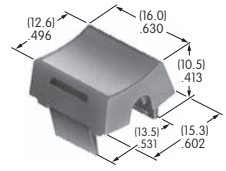


AT434
Bat Lever Cap
Polyvinyl chloride
Colors: A B C E F G
Series: M

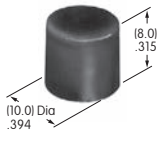
AT435
Screw-on Cap
Brass with chrome plating
Series: SB265



AT438
Design Rocker
Polycarbonate
Colors: B C D F G
Series: MLW



AT442
.394" Diameter
Snap-on Cap
Polycarbonate
Colors: A B C E F G H
Series: DB EB M2B MB20
MB25



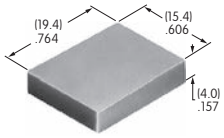
AT443
.315" Diameter
Snap-on Cap
Polycarbonate
Colors: A B C E F G H
Series: DB EB M2B MB20
MB25

AT444
Bat Lever Conical Cap
Polyethylene
Colors: A B C E F G
Series: D2 M M2T

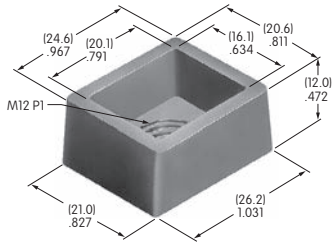
AT445
Cap for Color Tipped
Cone Toggle
Polycarbonate
Colors: A B C
Series: M

Color Codes: **A** Black **B** White **C** Red **D** Amber **E** Yellow **F** Green **G** Blue **H** Gray **J** Clear

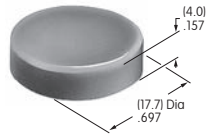
AT452
Rectangular Insert
Polycarbonate
Colors: A B C F G H
Series: MB20 SCB
Used with Screw Adaptor AT080



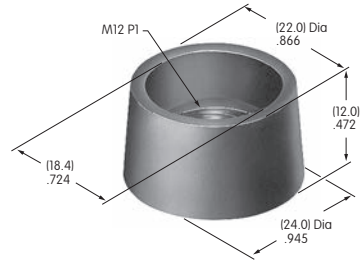
AT453
Rectangular Shroud
Polycarbonate
Colors: A B H
Series: MB20 SCB



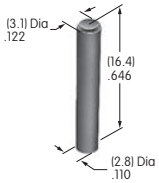
AT454
Round Insert
Polycarbonate
Colors: A B C F G H
Series: MB20 SCB
Used with Screw Adaptor AT080



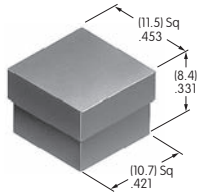
AT455
Round Shroud
Polycarbonate
Colors: A B H
Series: MB20 SCB



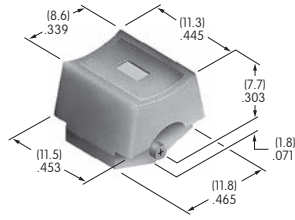
AT460
Cap for Color Capped Cone Toggle
Polyethylene
Colors: A B C E F G
Series: M



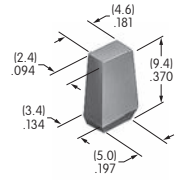
AT465
.453" Square Cap
Polycarbonate
Colors: A B C E F G H
Series: EB MB24 MB25



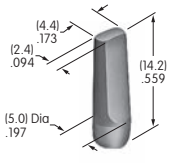
AT466
.453" False Illuminated Rocker
Polycarbonate
Cap Color: A
Window Color: B/C
Series: M



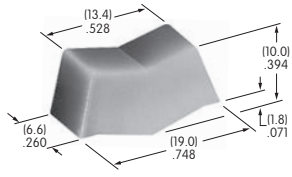
AT467
Short Paddle
Polyamide
Colors: A B C E F G H
Series: A



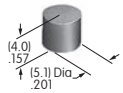
AT468
Long Paddle
Polyamide
Colors: A B C E F G H
Series: A



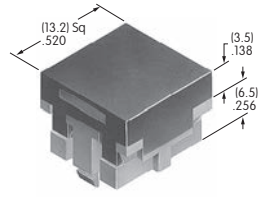
AT469
.260" Wide Rocker
Polyamide
Colors: A B C E F G H
Series: A



AT475
.201" Diameter Cap
Polyamide
Colors: A B C
Series: AB BB FB M2B MB24



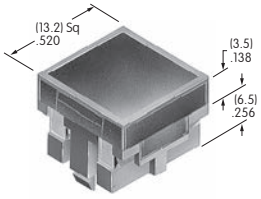
AT476
Square Solid Colored Cap
Polycarbonate
Colors: BJ CJ EJ FJ GJ
Series: LB



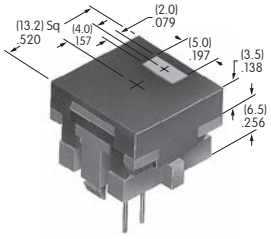
Color Codes: **A** Black **B** White **C** Red **D** Amber **E** Yellow **F** Green **G** Blue **H** Gray **J** Clear

Accessories & Hardware

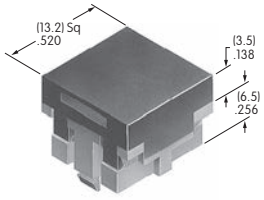
AT477
Square Colored Insert Cap
Polycarbonate
Colors: JB JC JE JF JG
Series: LB



AT480
Square Spot Illuminated Cap
Polycarbonate
Cap Colors: A B C F
LED Colors: C D F CF
Series: LB



AT484
Square Nonilluminated Cap
Polycarbonate
Colors: A B C E F G H
Series: LB



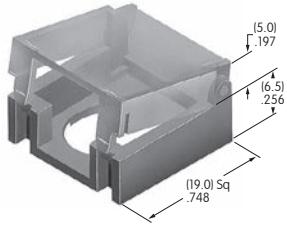
AT485
Square Solid Colored Cap
Polycarbonate
Colors: A BB CB CC EB
FB FF GB GG
Series: KB

AT486
Round Solid Colored Cap
Polycarbonate
Colors: A BB CB CC EB
FB FF GB GG
Series: KB

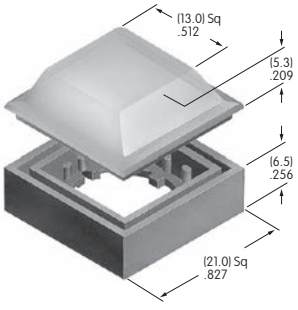
AT487
Square Colored Insert Cap
Polycarbonate
Colors: JB JC JE JF JG
Series: KB

AT488
Round Colored Insert Cap
Polycarbonate
Colors: JB JC JE JF JG
Series: KB

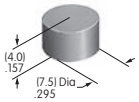
AT494
Protective Guard
Cover: Polycarbonate
Base: Polyamide
Series: KB



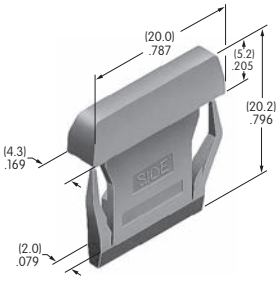
AT495
Dust Cover
Lid: Polyvinyl chloride
Base: Polyamide
Series: KB



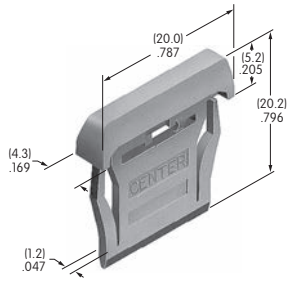
AT496
.295" Diameter Cap
Polyamide
Colors: A B C
Series: AB BB FB M2B MB24



AT497
End Barrier
Polyamide
Color: A
Series: LB



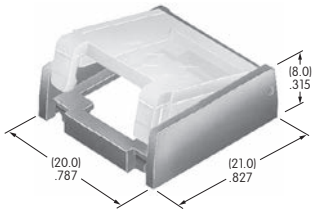
AT498
Center Barrier
Polyamide
Color: A
Series: LB



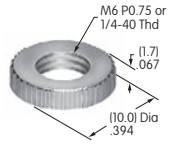
Color Codes: **A** Black **B** White **C** Red **D** Amber **E** Yellow **F** Green **G** Blue **H** Gray **J** Clear

AT500s

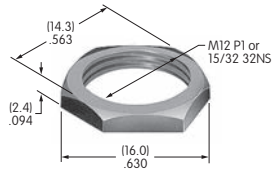
AT499
Protective Guard for Square
Cover: Polycarbonate
Base: Polyamide
Series: LB



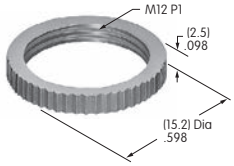
AT501 (M-metric H-inch)
Knurled Face Nut
Brass with chrome plating
Series: D2 DB EB M MB20 MB24 P



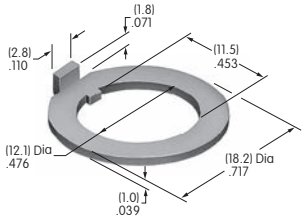
AT503 (M-metric H-inch)
Hex Face Nut
Brass with chrome plating
Series: M P S SB WB WT



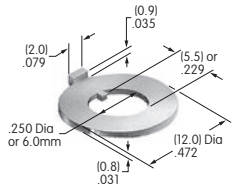
AT504M
Knurled Face Nut
Brass with chrome plating
Series: M P S SB SCB WB WT



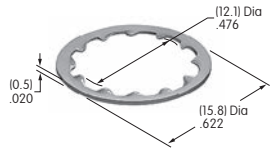
AT506M
Locking Ring
Steel with zinc/chromate
Series: M MB20 P S SB



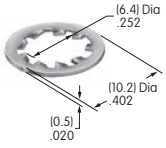
AT507 (M-metric H-inch)
Locking Ring
Steel with zinc/chromate
Series: D2 DB EB M MB20 MB24 MB25 MR P



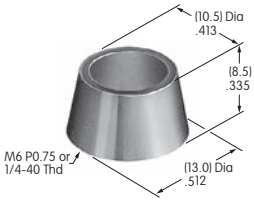
AT508
Internal Tooth Lockwasher
Steel with zinc/chromate
Series: M P S SB SCB SK TL WB WT



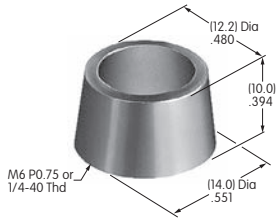
AT509
Internal Tooth Lockwasher
Steel with zinc/chromate
Series: D2 DB EB FR01 M MB25 MR P S SB



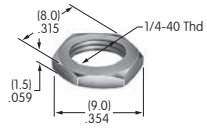
AT512 (M-metric H-inch)
Conical Nut
Brass with chrome plating
Series: EB MB20



AT512C (M-metric H-inch)
Conical Nut
Brass with chrome plating
Series: EB MB20



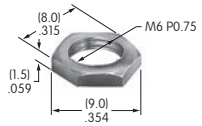
AT513H
Hex Nut
Brass with nickel plating
Series: M MB20 MB24



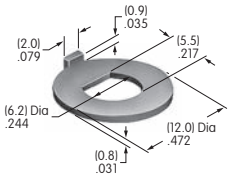
Color Codes: **A** Black **B** White **C** Red **D** Amber **E** Yellow **F** Green **G** Blue **H** Gray **J** Clear

Accessories & Hardware

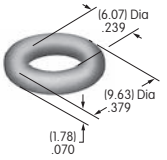
AT513M
Hex Nut
Brass with nickel plating
Series: B D2 DB EB FR01 M MB20 MB25 MR P



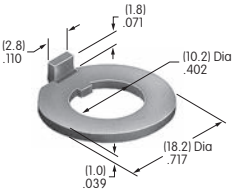
AT515 (M-metric H-inch)
Locking Ring for D Flat Bushing
Steel with zinc/chromate
Series: FR01 M MB24



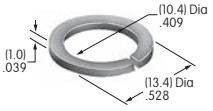
AT516
O-ring
Nitrile butadiene rubber
Series: M MB20



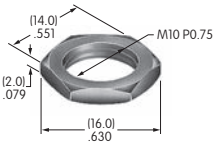
AT518
Locking Ring
Steel with zinc/chromate
Series: HS PS TS



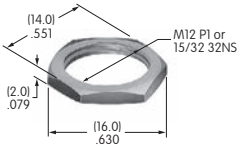
AT520
Split Lockwasher
Steel with zinc/chromate
Series: HS PS TS



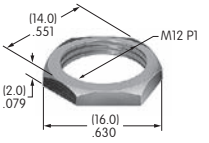
AT526
Hex Mounting Nut
Steel with nickel plating
Series: HS PS TS



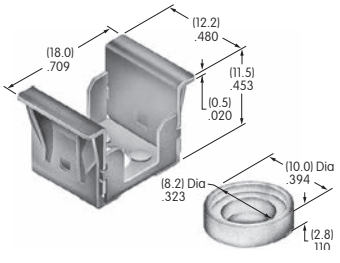
AT527 (M-metric H-inch)
Hex Mounting Nut
Steel with nickel plating
Series: M P S SB SCB SK TL



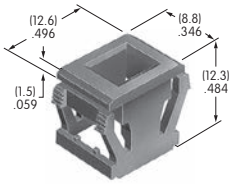
AT527MA
Black Hex Face Nut
Steel with black chrome plating
Series: TL



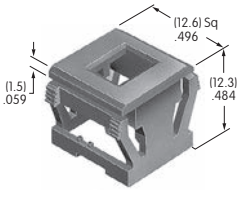
AT529
Mounter for Square Cap
Stainless steel frame
GFR PBT spacer
Series: EB



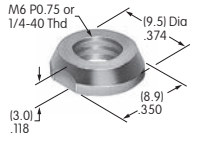
AT530
Panel Mount for Single Pole
Polyamide & polyacetel
Colors: A B C E F G H
Series: A AB



AT531
Panel Mount for Single or Double Pole
Polyamide & polyacetel
Colors: A B C E F G H
Series: A AB

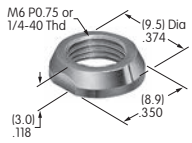


AT532 (M-metric H-inch)
Dress Cap Nut
Brass with nickel plating
Series: EB M MB20 MB24 P

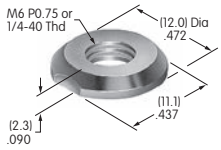


Color Codes: **A** Black **B** White **C** Red **D** Amber **E** Yellow **F** Green **G** Blue **H** Gray **J** Clear

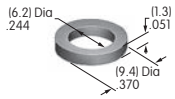
AT532T (M-metric H-inch)
Threaded Through Dress Nut
Brass with nickel plating
Series: EB M MB20 MB24 P



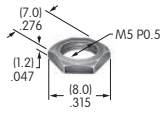
AT533T (M-metric H-inch)
Threaded Through Dress Nut
Brass with nickel plating
Series: EB M MB20 MB24 P



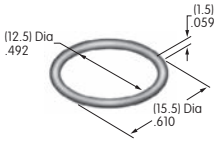
AT535
Rubber Ring for MR Panel Seal
Nitrile butadiene rubber
Series: MRB MRK



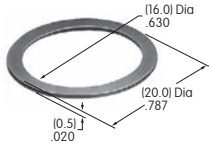
AT536
Hex Nut
Brass with nickel plating
Series: FB



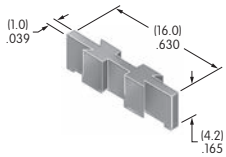
AT537
O-ring
Nitrile butadiene rubber
Series: S



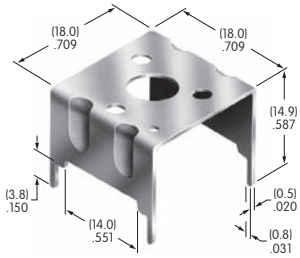
AT541
O-ring for Panel Seal with AT4115
Nitrile butadiene rubber
Series: YB



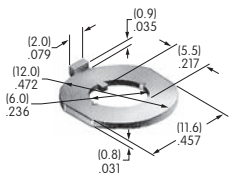
AT542
Coupler for LCD 36 x 24 Pushbutton
PBT
Series: SmartSwitch



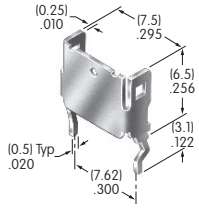
AT543
Support Bracket
Steel with tin plating
Series: MRK



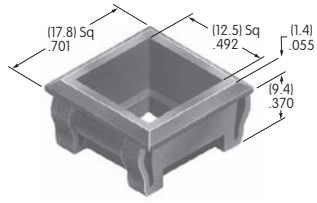
AT545
Locking Ring
Steel with zinc/chromate
Series: MRA MRB MRK



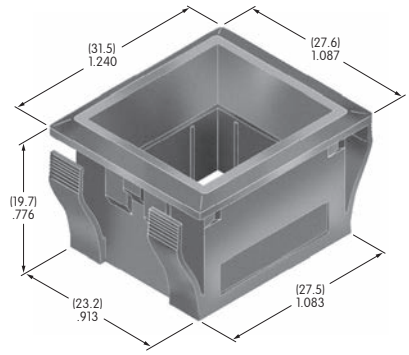
AT546
Mounting Bracket for Block Mounting
Phosphor bronze with tin plating
Series: GB2



AT547
Mounter for AT4140
Polyamide
Color: A
Series: JB



AT548
Panel Mount Housing for LCD 36 x 24 Pushbutton
(not for Compact SmartSwitch)
Polyamide
Color: A
Series: SmartSwitch

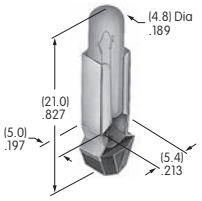


Color Codes: **A** Black **B** White **C** Red **D** Amber **E** Yellow **F** Green **G** Blue **H** Gray **J** Clear

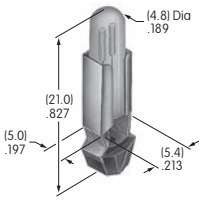
Accessories & Hardware

AT600s

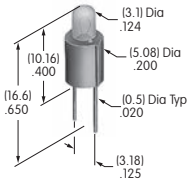
AT602
Incandescent Lamp
Volts: 6 12 18 24 28
Series: LW MLW
T-1½ Pilot Slide Base



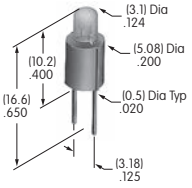
AT602N
Neon Lamp
Volts: 110
Series: LW MLW
T-1½ Pilot Slide Base



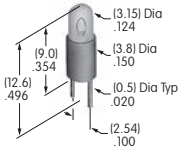
AT607
Incandescent Lamp
Volts: 5 12
Series: LB
T-1 Bi-pin



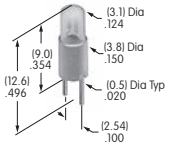
AT607N
Neon Lamp
Volts: 110
Series: LB
T-1 Bi-pin



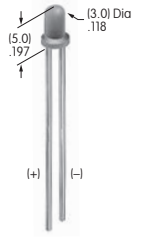
AT611
Incandescent Lamp
Volts: 5 12
Series: KB YB
T-1 Bi-pin



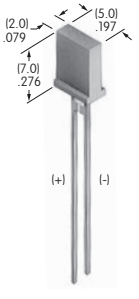
AT615
Neon Lamp
Volts: 110
Series: KB
T-1 Bi-pin



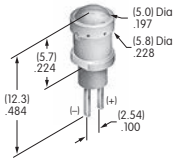
AT617
Single Element LED
Colors: C E F
Used for AT212 Bezel



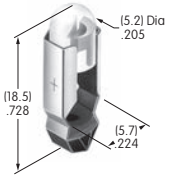
AT618
Single Element LED
Colors: C E F
Used for AT213 Bezel



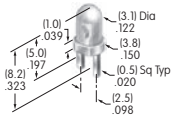
AT621
6-element Bicolor LED
Without Resistor; Volts: 2
With Resistor; Volts: 5 12 24
Colors: CF
Series: YB
T-1½ Bi-pin



AT622
Single Element LED
Colors: C E F
Series: MLW
T-1¾ Pilot Slide Base

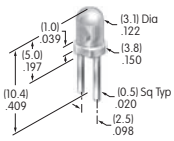


AT624
Single Element LED
Color: G
Series: HB
T-1 Bi-pin

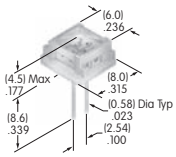


Color Codes: **A** Black **B** White **C** Red **D** Amber **E** Yellow **F** Green **G** Blue **H** Gray **J** Clear

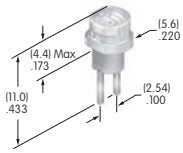
AT625
Super Bright
Single Element LED
Color: G
Series: KB LB YB YB2
T-1 Bi-pin



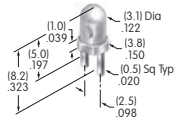
AT627
Bright
4-Element LED
With Resistor; Volts: 5 12 24
Colors: C D F
Series: LB
T-1 Bi-pin



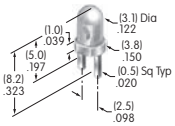
AT628
Bright
Double Element LED
Colors: C D F
Series: YB YB2
T-1 Bi-pin



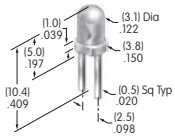
AT629
Single Element LED
Color: B
Series: HB
T-1 Bi-pin



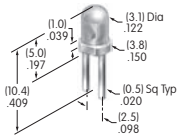
AT630
Single Element LED
Color: F
Series: HB
T-1 Bi-pin



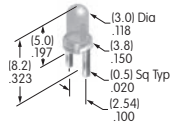
AT631
Super Bright
Single Element LED
Color: B
Series: KB LB YB YB2
T-1 Bi-pin



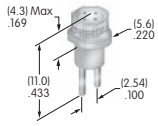
AT632
Super Bright
Single Element LED
Color: F
Series: KB LB YB YB2
T-1 Bi-pin



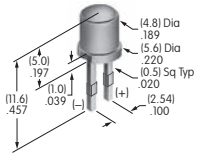
AT633
Single Element LED
Colors: C D F
Series: HB
T-1 Bi-pin



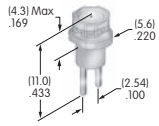
AT634
Bright
2- or 4-Element LED
With Resistor; Volts: 5 12 24
Colors: C D F
Series: KB YB YB2
T-1¼ Bi-pin



AT635
Bright
Single Element LED
Colors: C D F
Series: KB LB
T-1½ Bi-pin



AT636
Bright
Single Element LED
With Resistor; Volts: 5 12 24
Color: F
Series: YB2
T-1¼ Bi-pin

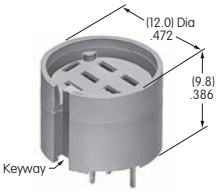


Color Codes: **A** Black **B** White **C** Red **D** Amber **E** Yellow **F** Green **G** Blue **H** Gray **J** Clear

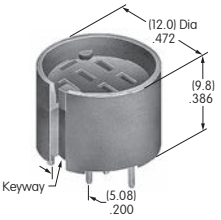
Accessories & Hardware

AT700s

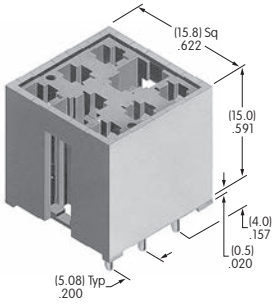
AT701
Single Pole
Straight PC Adaptor
Glass fiber
reinforced polyamide
Series: KB



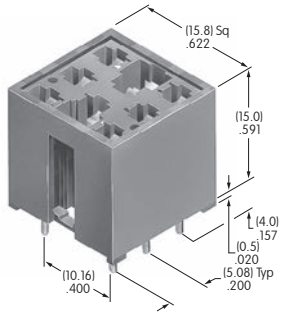
AT702
Double Pole
Straight PC Adaptor
Glass fiber
reinforced polyamide
Series: KB



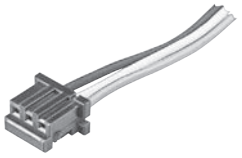
AT711
Single Pole
Straight PC Adaptor
Glass fiber
reinforced polyamide
Series: LB



AT712
Double Pole
Straight PC Adaptor
Glass fiber reinforced polyamide
Series: LB



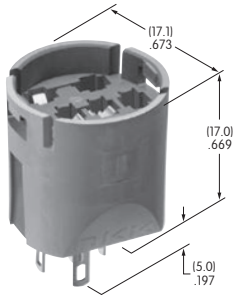
AT713
Receptacle Connector
Connects to RS232C
Compatible with
FTCS04B & FTCS05B (5-wire) or
FTCS04A & FTCS04A2 (4 wire)
Length: 19.7″ (500.0mm)
Series: FT



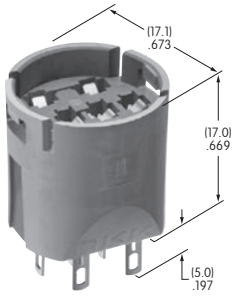
AT714
Receptacle Connector
Connects to Power Source
of Control Boards
FTCS04B & FTCS05B (5-wire)
Length: 19.7″ (500.0mm)
Series: FT

AT715
Connector Cable
Cable for OLED Rocker
Length: 19.7″ (500.0mm)
Series: SmartSwitch

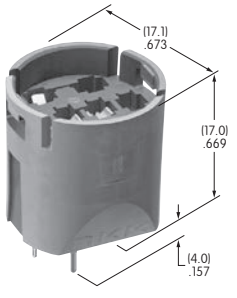
AT716
Single Pole Solder Lug/
Quick Connect Adaptor
Glass fiber reinforced polyamide
Series: LP01, YB, YB2



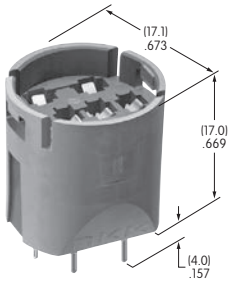
AT717
Double Pole Solder Lug/
Quick Connect Adaptor
Glass fiber reinforced polyamide
Series: LP01, YB, YB2



AT718
Single Pole
Straight PC Adaptor
Glass fiber reinforced polyamide
Series: LP01, YB, YB2



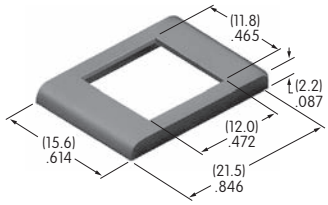
AT719
Double Pole
Straight PC Adaptor
Glass fiber reinforced polyamide
Series: LP01, YB, YB2



Color Codes: **A** Black **B** White **C** Red **D** Amber **E** Yellow **F** Green **G** Blue **H** Gray **J** Clear

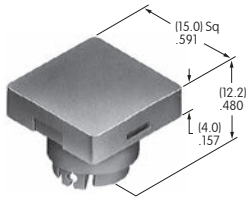
AT2100s

AT2107
Bezel
Polyamide
Colors: A B E F G H
Series: M M2100

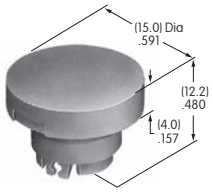


AT3000s

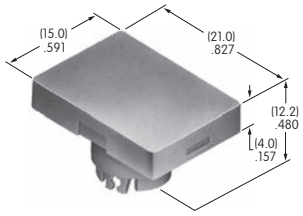
AT3001
Square Solid Cap
Polycarbonate
Colors: BB CB EB FB GB
Series: YB



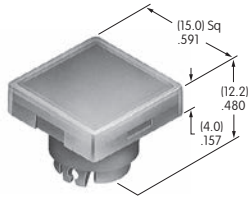
AT3002
Round Solid Cap
Polycarbonate
Colors: BB CB EB FB GB
Series: YB



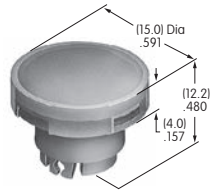
AT3003
Rectangular Solid Cap
Polycarbonate
Colors: BB CB EB FB GB
Series: YB



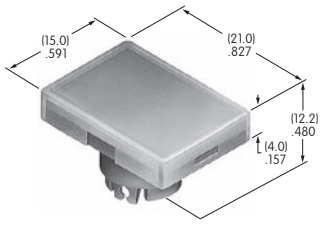
AT3004
Square Cap for Bright LED & Bicolor
Polycarbonate
Colors: JB JC JD JF
Series: YB



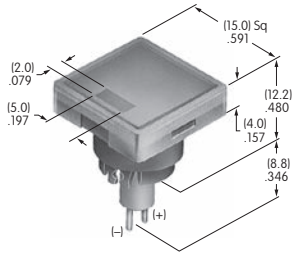
AT3005
Round Cap for Bright LED & Bicolor
Polycarbonate
Colors: JB JC JD JF
Series: YB



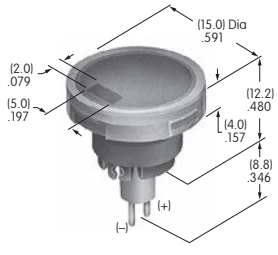
AT3006
Rectangular Cap for Bright LED & Bicolor
Polycarbonate
Colors: JB JC JD JF
Series: YB



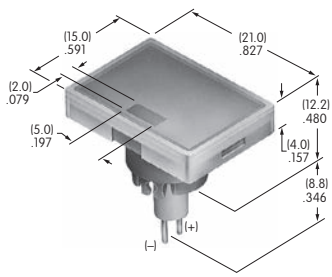
AT3010
Square Spot Illuminated Cap with Built-in LED
Without Resistor; Volts: 2
With Resistor; Volts: 5 12 24
Polycarbonate
Cap Colors: JA JB JC JE JF
LED Colors: C D F CF
Series: YB



AT3011
Round Spot Illuminated Cap with Built-in LED
Without Resistor; Volts: 2
With Resistor; Volts: 5 12 24
Polycarbonate
Cap Colors: JA JB JC JE JF
LED Colors: C D F CF
Series: YB



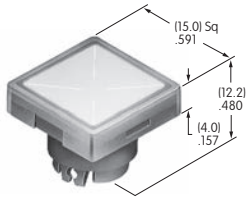
AT3012
Rectangular Spot Illuminated Cap with Built-in LED
Without Resistor; Volts: 2
With Resistor; Volts: 5 12 24
Polycarbonate
Cap Colors: JA JB JC JE JF
LED Colors: C D F CF
Series: YB



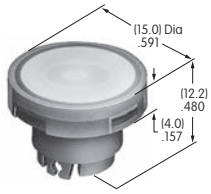
Color Codes: **A** Black **B** White **C** Red **D** Amber **E** Yellow **F** Green **G** Blue **H** Gray **J** Clear

Accessories & Hardware

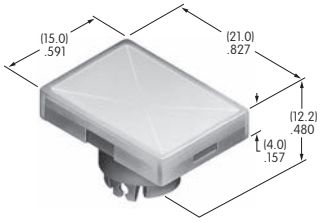
AT3014
Square Cap for Super Bright LED
Polycarbonate
Color: JB
Series: YB



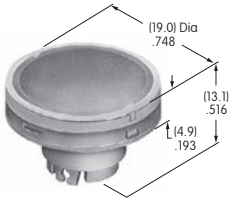
AT3015
Round Cap for Super Bright LED
Polycarbonate
Color: JB
Series: YB



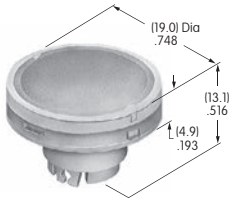
AT3016
Rectangular Cap for Super Bright LED
Polycarbonate
Color: JB
Series: YB



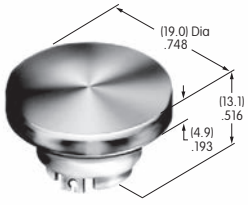
AT3017
Round Cap for Bright LED or Nonilluminated
Polycarbonate
HB Lens: ABS Resin & Unbrushed Chrome Plating
Colors: JB CB EB FB HB
Series: YB2



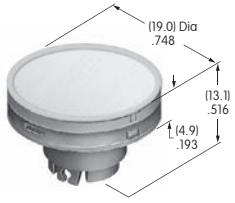
AT3018
Round Cap for Super Bright LED
Polycarbonate
HB Lens: ABS Resin & Unbrushed Chrome Plating
Colors: JB HB
Series: YB2



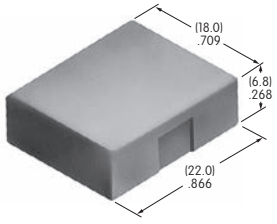
AT3019
Round Solid Cap for Nonilluminated
ABS Resin & Brushed Chrome Plating
Color: P (Brushed Chrome)
Series: YB2



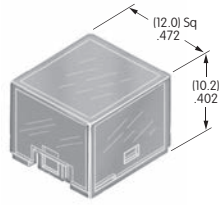
AT3020
Round Cap with Clear Illumination Ring for Bright or Super Bright LED
Lens: Polycarbonate
Insert: Polyester
Color: JS (Metallic Silver with Clear Ring)
Series: YB2



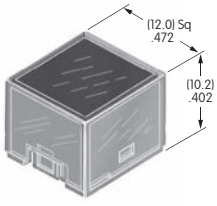
AT3021
Flat Cap for Barrier Flange
Polyphenylene oxide
Colors: A B C H
Series: JP



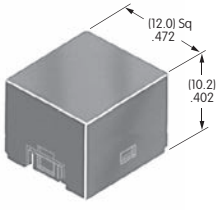
AT3022
Square Cap for Single or Bicolor LED
Polycarbonate Resin
Colors: JB JC JD JF
Series: NP01



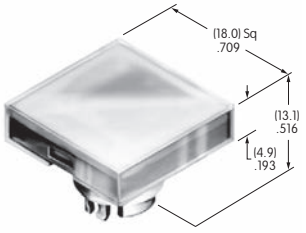
AT3023
Square Cap for Bicolor LED with Alternating Legends
Polycarbonate Resin
Color: J
Series: NP01



AT3024
Square Solid Cap
Polycarbonate Resin
Colors: A B C H
Series: NP01

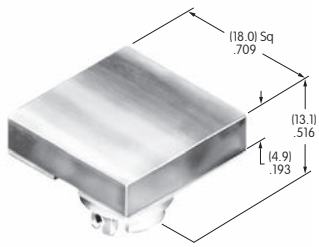


AT3025
Square Cap for Bright & Super Bright LED or Nonilluminated
Polycarbonate
Colors: JB CB EB FB HB
Series: YB2

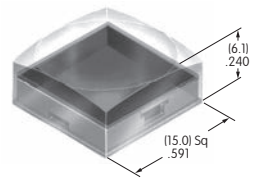


Color Codes: **A** Black **B** White **C** Red **D** Amber **E** Yellow **F** Green **G** Blue **H** Gray **J** Clear

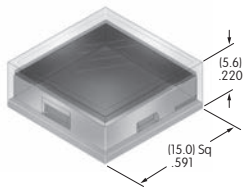
AT3027
Square Solid Cap for Nonilluminated
ABS Resin &
Brushed Chrome Plating
Color: P (Brushed Chrome)
Series: YB2



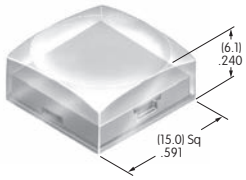
AT3069
Sculptured Cap with Alternating Legend for Illuminated
Polycarbonate
Color: J
Series: UB2



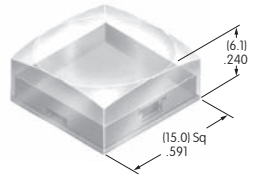
AT3070
Flat Cap with Alternating Legend for Illuminated
Polycarbonate
Color: J
Series: UB2



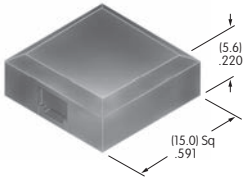
AT3073
Sculptured Cap for Nonilluminated
Polycarbonate
Colors: JA JB JC JD JF
Series: UB2



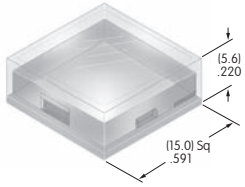
AT3074
Sculptured Cap for Illuminated
Polycarbonate
Colors: JB JC JD JF
Series: UB2



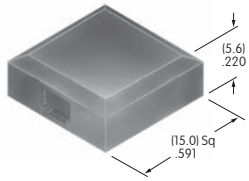
AT3075
Beveled Cap for Illuminated
Polycarbonate
Colors: B C D F
Series: UB2



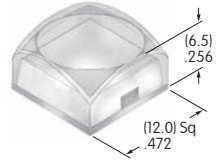
AT3076
Flat Cap for Illuminated with Lens/Diffuser
Polycarbonate
Colors: JB JC JD JF
Series: UB2



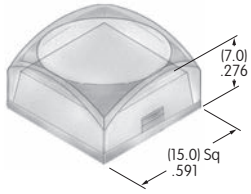
AT3077
Beveled Cap for Nonilluminated
Polycarbonate
Colors: A B C D F
Series: UB2



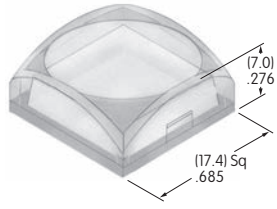
AT3078
12mm Sculptured Cap with Lens/Diffuser
Polycarbonate
Color: JB
Series: KP



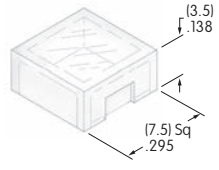
AT3079
15mm Sculptured Cap with Lens/Diffuser
Polycarbonate
Color: JB
Series: KP



AT3080
17.4mm Sculptured Cap with Lens/Diffuser
Polycarbonate
Color: JB
Series: KP



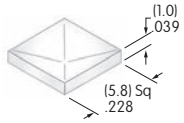
AT3081
Transparent Lens
Polycarbonate
Color: J
Series: HB2



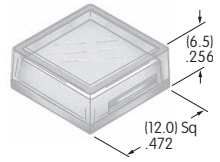
Color Codes: **A** Black **B** White **C** Red **D** Amber **E** Yellow **F** Green **G** Blue **H** Gray **J** Clear

Accessories & Hardware

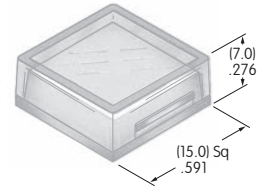
AT3082
Translucent Diffuser
Polycarbonate
Color: B
Series: HB2



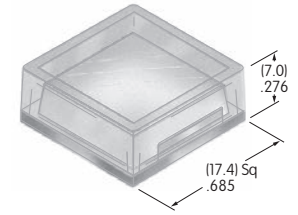
AT3083
12mm Flat Cap with Lens/Diffuser
Polycarbonate
Color: JB
Series: KP



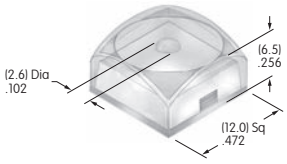
AT3084
15mm Flat Cap with Lens/Diffuser
Polycarbonate
Color: JB
Series: KP



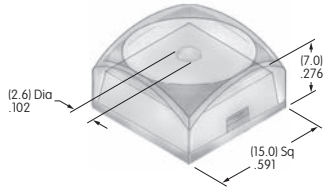
AT3085
17.4mm Flat Cap with Lens/Diffuser
Polycarbonate
Color: JB
Series: KP



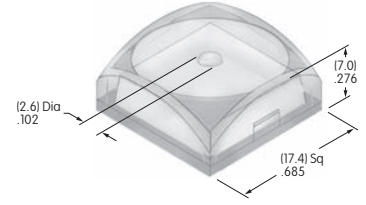
AT3086
12mm Home Key Cap with Lens/Diffuser
Polycarbonate
Color: JB
Series: KP



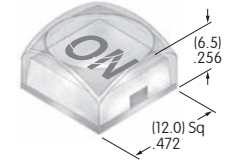
AT3087
15mm Home Key Cap with Lens/Diffuser
Polycarbonate
Color: JB
Series: KP



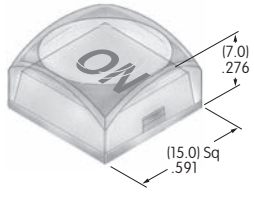
AT3088
17.4mm Home Key Cap with Lens/Diffuser
Polycarbonate
Color: JB
Series: KP



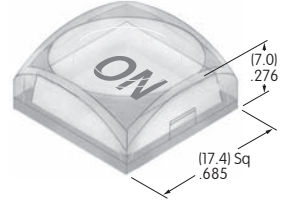
AT3090
12.0mm Square Sculptured Cap with Alternating Legends
Polycarbonate
Color: J
Series: KP



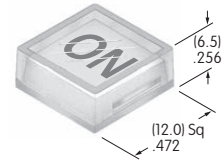
AT3091
15.0mm Square Sculptured Cap with Alternating Legends
Polycarbonate
Color: J
Series: KP



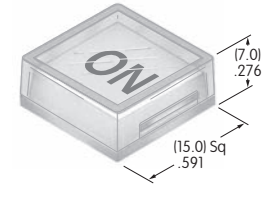
AT3092
17.4mm Square Sculptured Cap with Alternating Legends
Polycarbonate
Color: J
Series: KP



AT3093
12.0mm Square Flat Cap with Alternating Legends
Polycarbonate
Color: J
Series: KP

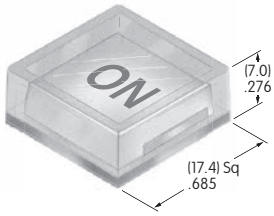


AT3094
15.0mm Square Flat Cap with Alternating Legends
Polycarbonate
Color: J
Series: KP

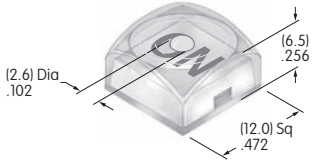


Color Codes: **A** Black **B** White **C** Red **D** Amber **E** Yellow **F** Green **G** Blue **H** Gray **J** Clear

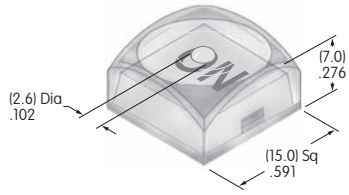
AT3095
17.4mm Square Flat Cap with Alternating Legends
Polycarbonate
Color: J
Series: KP



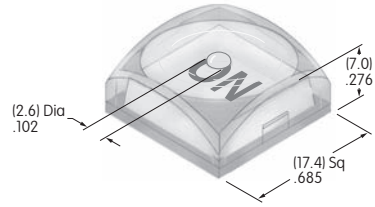
AT3096
12.0mm Square Home Key Cap with Alternating Legends
Polycarbonate
Color: J
Series: KP



AT3097
15.0mm Square Home Key Cap with Alternating Legends
Polycarbonate
Color: J
Series: KP

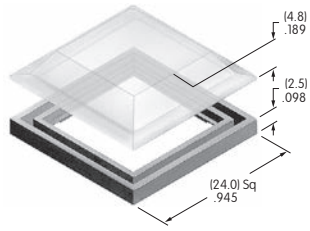


AT3098
17.4mm Square Home Key Cap with Alternating Legends
Polycarbonate
Color: J
Series: KP

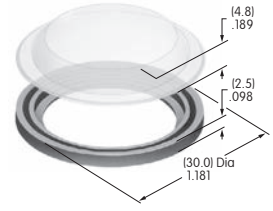


AT4000s

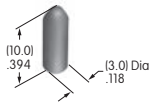
AT4001
Square Dust Cover
Lid: Polyvinyl chloride
Gasket: Polyethylene
Series: LB UB



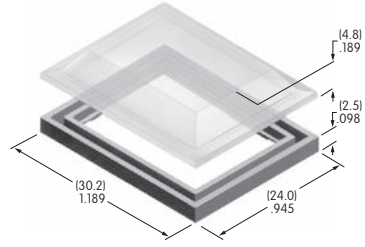
AT4002
Round Dust Cover
Lid: Polyvinyl chloride
Gasket: Polyethylene
Series: LB



AT4003
.394" Bat Lever Cap
Polyvinyl chloride
Colors: A B C
Series: A B



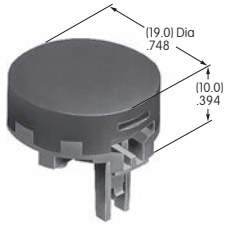
AT4011
Rectangular Dust Cover
Lid: Polyvinyl chloride
Gasket: Polyethylene
Series: LB UB



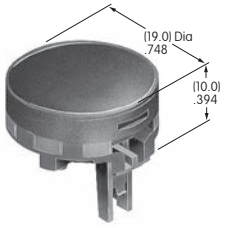
Color Codes: **A** Black **B** White **C** Red **D** Amber **E** Yellow **F** Green **G** Blue **H** Gray **J** Clear

Accessories & Hardware

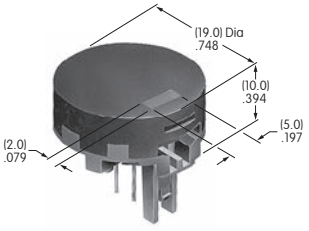
AT4012
Round Solid Colored Cap
Polycarbonate
Colors: BJ CJ EJ FJ GJ
Series: LB



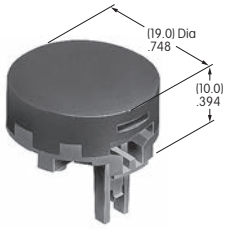
AT4013
Round Colored Insert Cap
Polycarbonate
Colors: JB JC JE JF JG
Series: LB



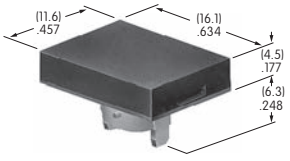
AT4016
Round Spot Illuminated Cap
Polycarbonate
Cap Colors: A B C F
LED Colors: C D F CF
Series: LB



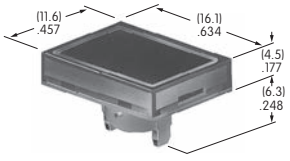
AT4017
Round Nonilluminated Cap
Polycarbonate
Colors: A B C E F G H
Series: LB



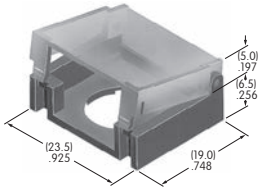
AT4021
Rectangular Solid Colored Cap
Polycarbonate
Colors: A BB CB CC EB
FB FF GB GG
Series: KB



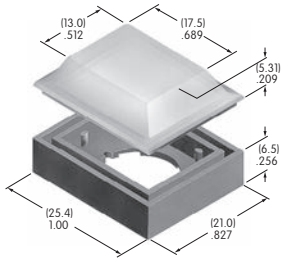
AT4022
Rectangular Colored Insert Cap
Polycarbonate
Cap Colors: JB JC JE JF JG
Series: KB



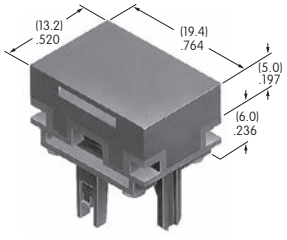
AT4024
Protective Guard
Cover: Polycarbonate
Base: Polyamide
Series: KB



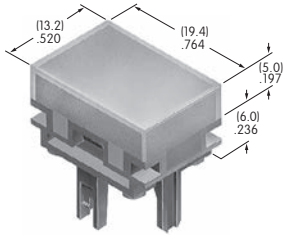
AT4025
Rectangular Dust Cover
Lid: Polyvinyl chloride
Base: Polyamide
Series: KB



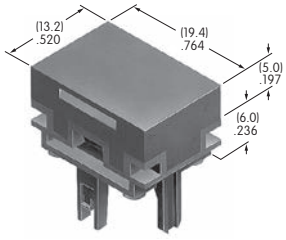
AT4026
Rectangular Solid Colored Cap
Polycarbonate
Colors: BJ CJ EJ FJ GJ
Series: LB



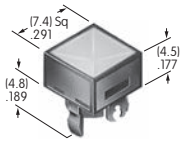
AT4027
Rectangular Colored Insert Cap
Polycarbonate
Colors: JB JC JE JF JG
Series: LB



AT4030
Rectangular Nonilluminated Cap
Polycarbonate
Colors: A B C E F G H
Series: LB

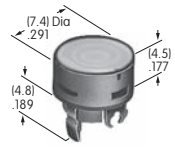


AT4031
Square Cap for Bright & Super Bright LED
Polycarbonate
Colors: JB
Series: HB

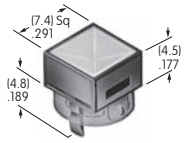


Color Codes: **A** Black **B** White **C** Red **D** Amber **E** Yellow **F** Green **G** Blue **H** Gray **J** Clear

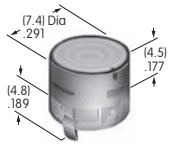
AT4032
Round Cap for Bright & Super Bright LED
Polycarbonate
Colors: JB
Series: HB



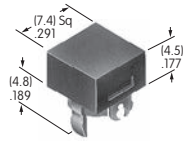
AT4033
Square Indicator Cap
Polycarbonate
Colors: JB
Series: HB



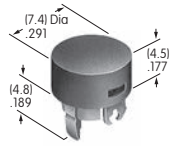
AT4034
Round Indicator Cap
Polycarbonate
Colors: JB
Series: HB



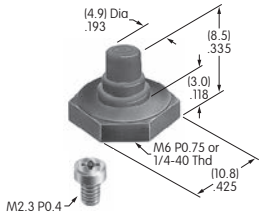
AT4035
Square Nonilluminated Cap
Polycarbonate
Colors: A B C E F G
Series: HB



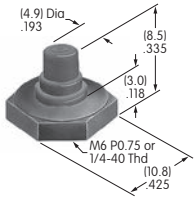
AT4036
Round Nonilluminated Cap
Polycarbonate
Colors: B C E F G
Series: HB



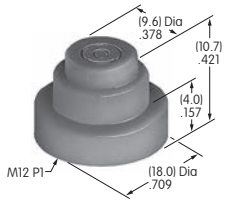
AT4041 (M-metric H-inch)
Splashproof Boot for Momentary
Black silicone rubber
Series: MB



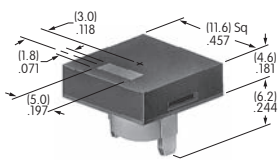
AT4042 (M-metric H-inch)
Splashproof Boot for Alternate
Black silicone rubber
Series: MB



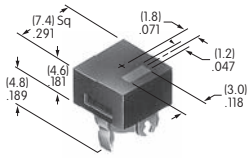
AT4043
Splashproof Boot
Black silicone rubber
Series: MB SB WB



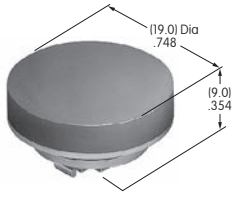
AT4051
Spot Illuminated Cap
Polycarbonate
Colors: AB
Series: KB



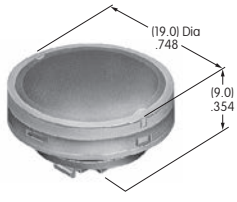
AT4052
Spot Illuminated Cap
Polycarbonate
Colors: AB
Series: HB



AT4054
Round Solid Colored Cap
Polycarbonate
Colors: BJ CJ EJ FJ GJ
Series: LB Panel Seal



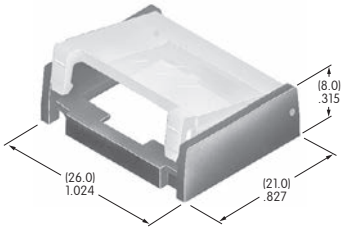
AT4055
Round Colored Insert Cap
Polycarbonate
Colors: JB JC JE JF JG
Series: LB Panel Seal



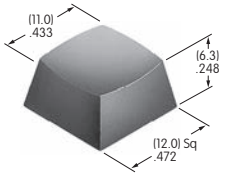
Color Codes: **A** Black **B** White **C** Red **D** Amber **E** Yellow **F** Green **G** Blue **H** Gray **J** Clear

Accessories & Hardware

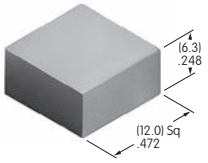
AT4057
Protective Guard
Polycarbonate
Series: LB



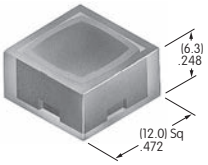
AT4058
Sculptured Cap
Polyamide
Colors: A B C E F G H
Series: JB



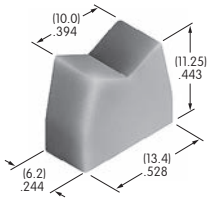
AT4059
Flat Cap
Polycarbonate
Colors: A B C E F G H
Series: JB



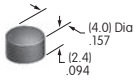
AT4060
Clear Cap with
Colored Diffuser
Polycarbonate
Colors: JB JC JE JF
Series: JB



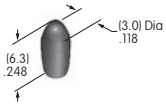
AT4062
Rocker
Polyamide
Colors: A B C
Series: G



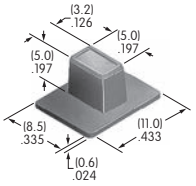
AT4063
.157" Diameter
Slip-on Cap
Polyamide
Colors: A B C
Series: GB G3B



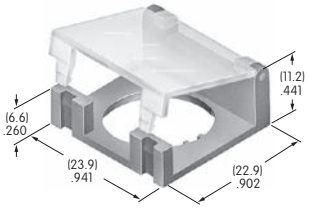
AT4064
.248" Bat Lever Cap
Polyvinyl chloride
Colors: A B C
Series: A B



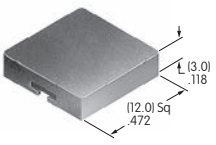
AT4065
Slide Cap
Polycarbonate
Cap Color: A
Window: C E F
Series: SS



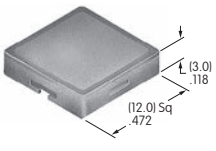
AT4072
Protective Guard
Lid: Polycarbonate
Base: Glass fiber
reinforced polycarbonate
Series: YB



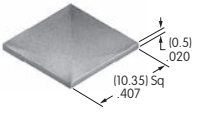
AT4073
Square Opaque Cap
for Nonilluminated
Polycarbonate
Colors: A B C E F G
Series: UB



AT4074
Square Transparent Cap
for Illuminated
Polycarbonate
Colors: C D F J
Series: UB

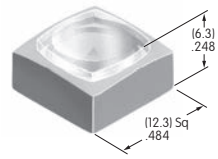


AT4075
Diffuser for
AT4074 Square Cap
Polycarbonate
Colors: B C D F
Series: UB



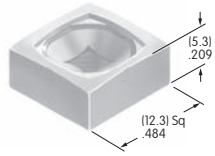
Color Codes: **A** Black **B** White **C** Red **D** Amber **E** Yellow **F** Green **G** Blue **H** Gray **J** Clear

AT4076
Button with Frame for Illuminated
Polycarbonate
Colors: BB BC BE BF BH
Series: JB

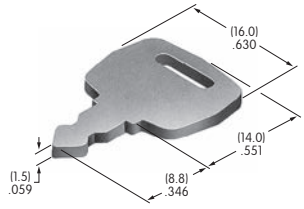


AT4077
Button for Nonilluminated
Polycarbonate
Colors: B C E F G H
Series: JB

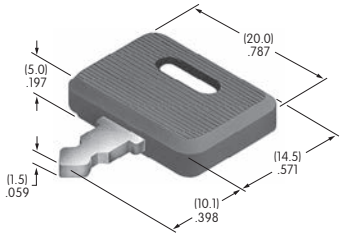
AT4078
Frame for AT4077
Polycarbonate
Colors: B C E F G H
Series: JB



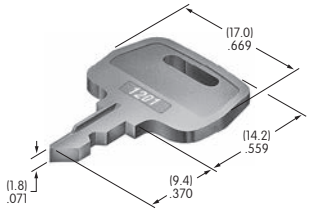
AT4079
Actuator Key
Brass alloy with
bright nickel plating
Series: SK



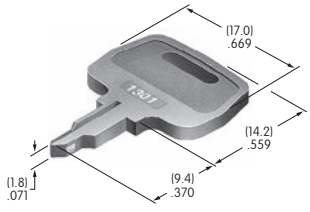
AT4080
Actuator Key
Brass alloy with
bright nickel plating
Antistatic ABS resin handle
Color: A
Series: SK



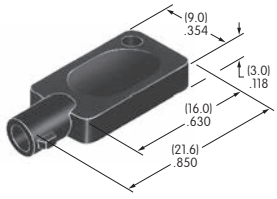
AT4081
Actuator Key
Zinc alloy with chrome plating
Series: SK



AT4082
Actuator Key
Zinc alloy with chrome plating
Series: SK

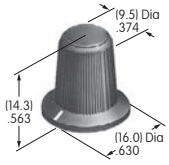


AT4094
Actuator Key
Polyacetal
Color: A
Series: SK

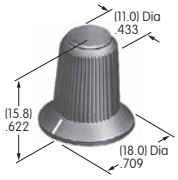


AT4100s

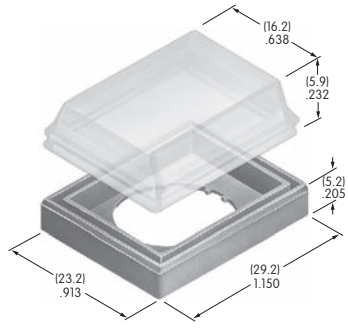
AT4103
Small Color Tipped Knob
Polyester with polyamide tip
Base Color: A
Tip Colors: A B C E F G H
Series: FR01 MR



AT4104
Large Color Tipped Knob
Polyester with polyamide tip
Base Color: A
Tip Colors: A B C E F G H
Series: FR01 MR



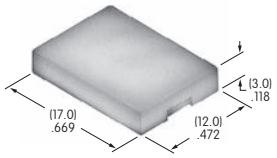
AT4115
Dust Cover
Lid: Polyvinyl chloride
Base: Polyamide
Series: YB



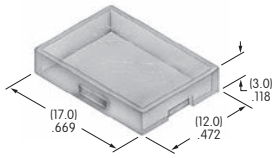
Color Codes: **A** Black **B** White **C** Red **D** Amber **E** Yellow **F** Green **G** Blue **H** Gray **J** Clear

Accessories & Hardware

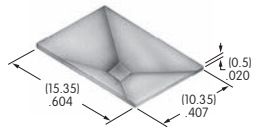
AT4116
Rectangular Opaque Cap for Nonilluminated
Polycarbonate
Colors: A B C E F G
Series: UB



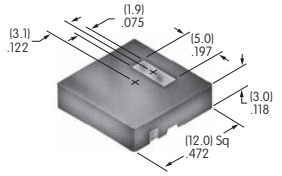
AT4117
Rectangular Transparent Cap for Illuminated
Polycarbonate
Colors: C D F J
Series: UB



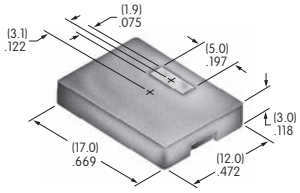
AT4118
Diffuser for AT4117 Rectangular Transparent Cap
Polycarbonate
Colors: B C D F
Series: UB



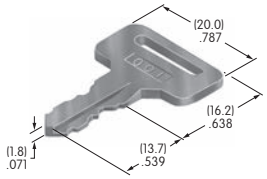
AT4119
Square Spot Illuminated Cap
Polycarbonate
Colors: AB
Series: UB



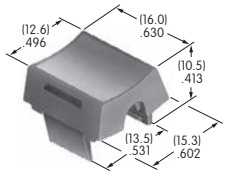
AT4120
Rectangular Spot Illuminated Cap
Polycarbonate
Colors: AB
Series: UB



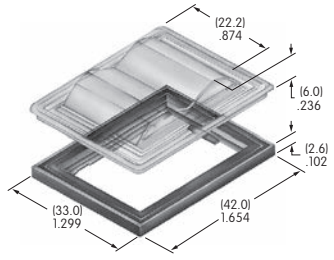
AT4124
Actuator Key
Brass with nickel plating
Series: SK



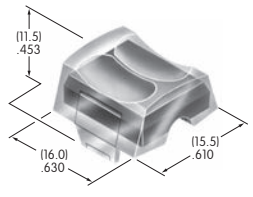
AT4125
LED Rocker
Polycarbonate
Colors: B C E F
Series: MLW



AT4126
Dust Cover
Polyvinyl chloride & polyamide
Color: A
Series: JWL

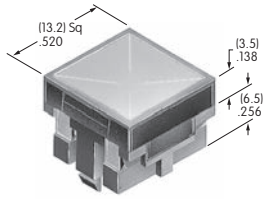


AT4127
Sculptured Rocker
Polycarbonate
Colors: B C E F
Series: MLW

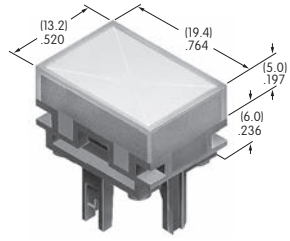


AT4128
Round Cap for Super Bright LED
Polycarbonate
Colors: JB
Series: LB

AT4129
Square Cap for Super Bright LED
Polycarbonate
Colors: JB
Series: LB



AT4130
Rectangular Cap for Super Bright LED
Polycarbonate
Colors: JB
Series: LB



Color Codes: **A** Black **B** White **C** Red **D** Amber **E** Yellow **F** Green **G** Blue **H** Gray **J** Clear

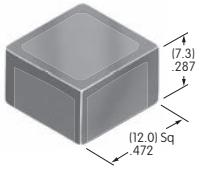
AT4131
Round Cap for Super Bright LED
Polycarbonate
Colors: JB
Series: LB Panel Seal

AT4132
Round Cap for Bright & Super Bright LED
Polycarbonate
Colors: JB
Series: KB

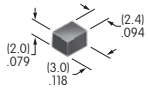
AT4133
Square Cap for Bright & Super Bright LED
Polycarbonate
Colors: JB
Series: KB

AT4134
Rectangular Cap for Bright & Super Bright LED
Polycarbonate
Colors: JB
Series: KB

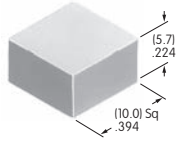
AT4135
Frosted Cap with White Base
Polycarbonate
Colors: B C E F
Series: JB



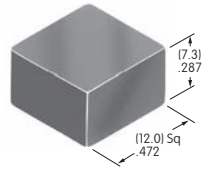
AT4137
Rectangular Cap
PBT
Colors: A B C
Series: GB2



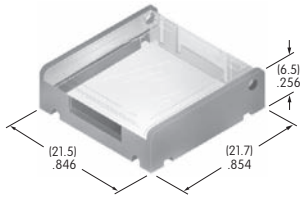
AT4139
Square Flat Cap
Polycarbonate
Colors: A B C H
Series: JB



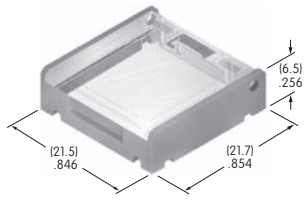
AT4140
Cap for Mounter AT547
Polycarbonate
Colors: A B C H
Series: JB



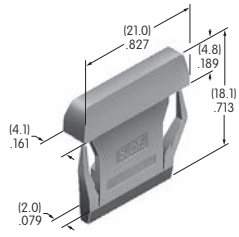
AT4141
Protective Guard
Cover: Polycarbonate
Base: GFR polyamide
Series: UB2



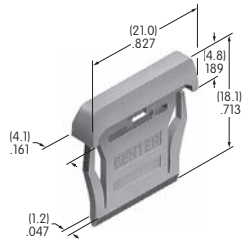
AT4142
Spring Loaded Protective Guard
Cover: Polycarbonate
Base: GFR polyamide
Coil spring: Stainless steel
Series: UB2



AT4143
End Barrier
Polyamide
Color: A
Series: UB2



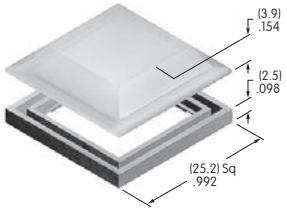
AT4144
Center Barrier
Polyamide
Color: A
Series: UB2



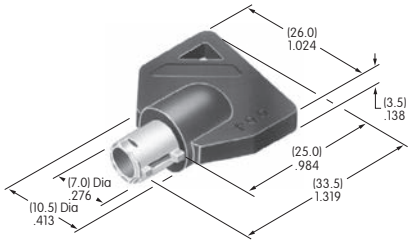
Color Codes: **A** Black **B** White **C** Red **D** Amber **E** Yellow **F** Green **G** Blue **H** Gray **J** Clear

Accessories & Hardware

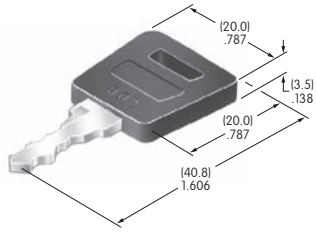
AT4145
Square Dust Cover
Lid: PVC
Gasket: Polyethylene
Series: UB2



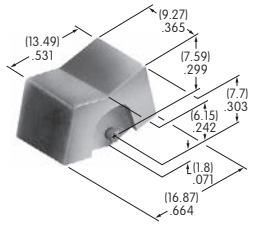
AT4146
Tubular Key
Brass with nickel plating
ABS handle
Color: A
Series: CKM



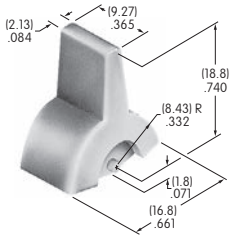
AT4147
Flat Key
Brass with nickel plating
ABS handle
Color: A
Series: CKM



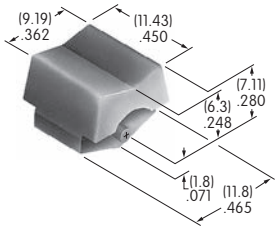
AT4148
.365" Wide Rocker
Polyamide
Colors: A B C E F G H
Series: M M2T P



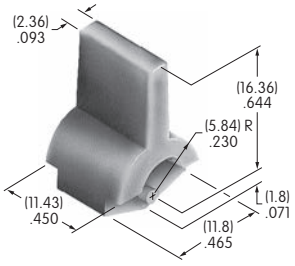
AT4149
.365" Wide Paddle
Polyamide
Colors: A B C E F G H
Series: M M2T P



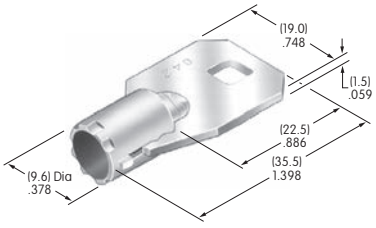
AT4150
.450" Wide Rocker
Polyamide
Colors: A B C E F G H
Series: M M2T



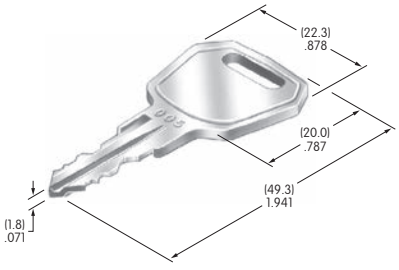
AT4151
.450" Wide Paddle
Polyamide
Colors: A B C E F G H
Series: M M2T



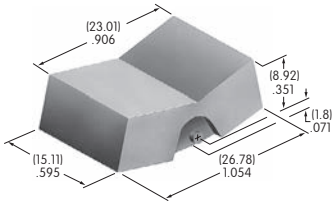
AT4152
Tubular Key
Brass with nickel plating
Series: CKL



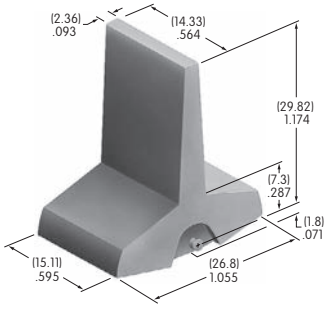
AT4153
Flat Key
Brass with chrome plating
Series: CKL



AT4156
.595" Wide Rocker
Polyamide
Colors: A B C E F G H
Series: M P



AT4157
.595" Wide Paddle
Polyamide
Colors: A B C E F G H
Series: M P



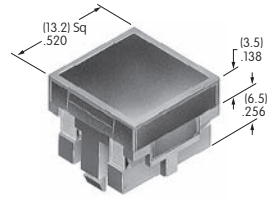
Color Codes: **A** Black **B** White **C** Red **D** Amber **E** Yellow **F** Green **G** Blue **H** Gray **J** Clear

AT4158
Square Cap
for Bright LED
Polycarbonate
Colors: JC JD JF
Series: KB

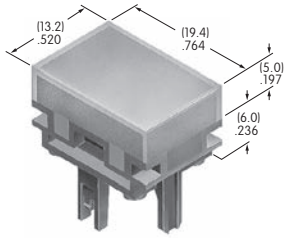
AT4159
Rectangular Cap
for Bright LED
Polycarbonate
Colors: JC JD JF
Series: KB

AT4160
Round Cap
for Bright LED
Polycarbonate
Colors: JC JD JF
Series: KB

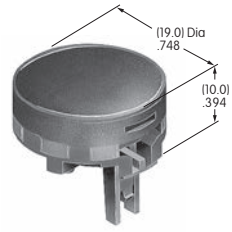
AT4162
Square Cap
for Bright LED
Polycarbonate
Colors: JB JC JD JF
Series: LB



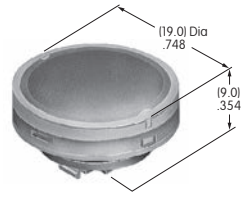
AT4163
Rectangular Cap
for Bright LED
Polycarbonate
Colors: JB JC JD JF
Series: LB



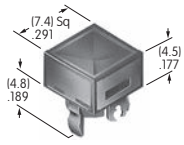
AT4164
Round Cap
for Bright LED
Polycarbonate
Colors: JB JC JD JF
Series: LB



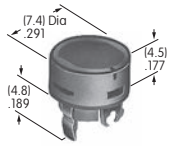
AT4165
Round Cap
for Bright LED
Polycarbonate
Colors: JB JC JD JF
Series: LB Panel Seal



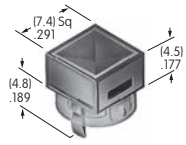
AT4166
Square Cap
for Bright LED
Polycarbonate
Colors: CB DB FB
Series: HB



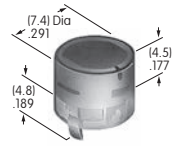
AT4167
Round Cap
for Bright LED
Polycarbonate
Colors: CB DB FB
Series: HB



AT4168
Square Indicator Cap
for Bright LED
Polycarbonate
Colors: CB DB FB
Series: HB



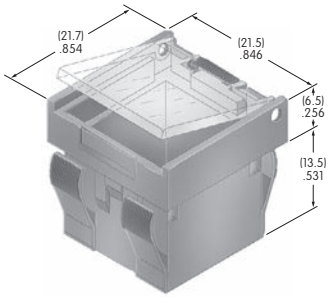
AT4169
Round Indicator Cap
for Bright LED
Polycarbonate
Colors: CB DB FB
Series: HB



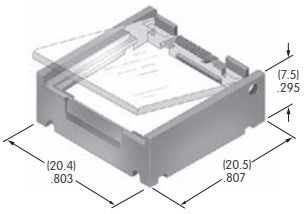
Color Codes: **A** Black **B** White **C** Red **D** Amber **E** Yellow **F** Green **G** Blue **H** Gray **J** Clear

Accessories & Hardware

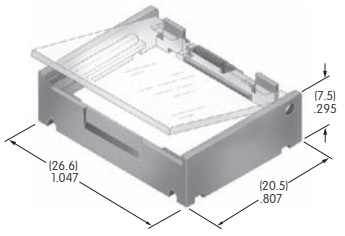
AT4170
Spring Loaded Protective Guard
Cover: Polycarbonate
Base: Polyamide
Coil spring: Stainless steel
Series: KP UB2



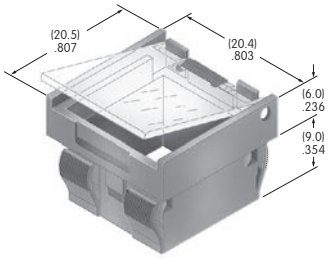
AT4171
Spring Loaded Protective Guard
Cover: Polycarbonate
Base: Polyamide
Coil spring: Stainless steel
Series: LB UB



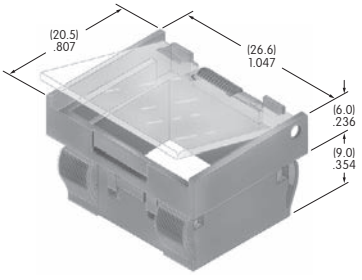
AT4172
Spring Loaded Protective Guard
Cover: Polycarbonate
Base: Polyamide
Coil spring: Stainless steel
Series: LB UB



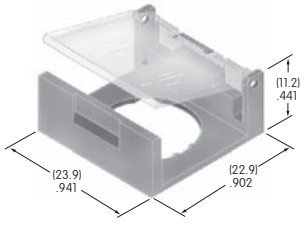
AT4173
Spring Loaded Protective Guard
Cover: Polycarbonate
Base: Polyamide
Coil spring: Stainless steel
Series: UB



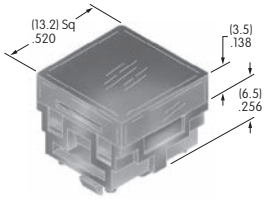
AT4174
Spring Loaded Protective Guard
Cover: Polycarbonate
Base: Polyamide
Coil spring: Stainless steel
Series: UB



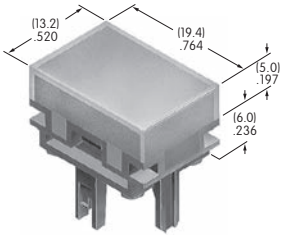
AT4175
Spring Loaded Protective Guard
Cover: Polycarbonate
Base: Glass fiber reinforced polyamide
Coil spring: Stainless steel
Series: YB



AT4176
Square Cap for Bright LED
Polycarbonate
Colors: JB JC JD JF
Series: LB

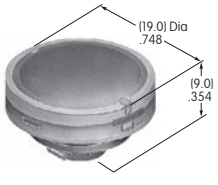


AT4177
Rectangular Cap for Bright LED
Polycarbonate
Colors: JB JC JD JF
Series: LB

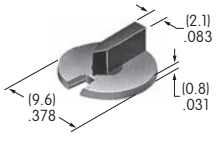


AT4178
Round Cap for Bright LED
Polycarbonate
Colors: JB JC JD JF
Series: LB

AT4179
Round Cap for Bright LED
Polycarbonate
Colors: JB JC JD JF
Series: LB Panel Seal



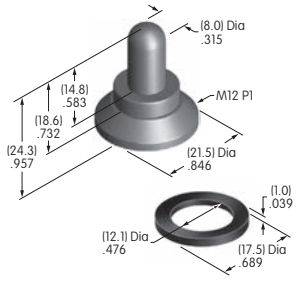
AT4180
Snap-on Knob
Polyamide
Knob: Black
Flange: Transparent brown
Series: FR01



Color Codes: **A** Black **B** White **C** Red **D** Amber **E** Yellow **F** Green **G** Blue **H** Gray **J** Clear

AT4181

Splashproof Boot Assembly
Boot Material: Black silicon rubber
Hex Nut Material & Finish: Nickel plated brass
O-ring Material: Nitrile butadiene rubber
Series: M P S WT



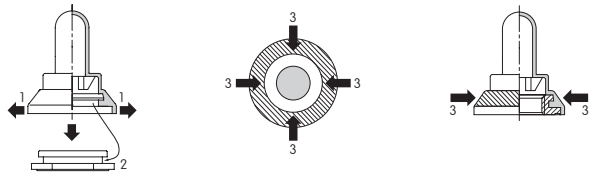
Switch Installation Instructions

1. Install switch bushing into mounting hole of panel from the back and adjust bushing to protrude 3.5 ~ 5.5mm (.138 ~ .217″).
2. Install o-ring on bushing and tighten nut from above.
3. Insert boot onto nut. Be sure the boot and nut are a firm, secure fit.

For 12mm Bushings in M, P, S & WT Toggles

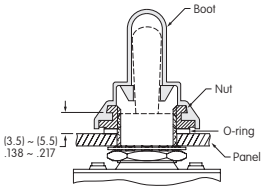
Boot & Nut Assembly Instructions

1. Stretch base of the boot to fit around outer edges of the nut.
2. The ridge inside of boot must be firmly seated in groove of the nut.
3. Moving all around perimeter, push (with about 10N of force) toward center to assure boot seals tightly into groove (with no air pockets).



Non-Splashproof Switches

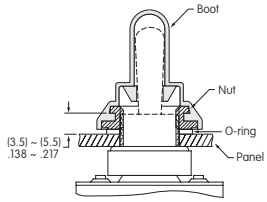
M, P or S Toggles with 12mm Bushings



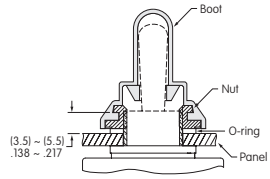
Use boot, nut and o-ring as shown. Use lockwasher and hexagon nut (from standard switch hardware) behind panel.

Splashproof Switches

S1AW ~ S29AW S Toggles



WT Toggle or M Toggle with B3 Bushing

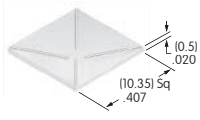


Use boot, nut and o-ring as shown. Use o-ring only (from standard switch hardware) behind panel.

Series or Part Numbers	Panel Thickness (Maximum)
• M Series B2 Toggles with 12mm B1 & B3 Bushings • P Series B Toggles with 12mm Bushing • S31 ~ 39, S41 ~ 49, S31F ~ 33F, S41F ~ S43F, S31T ~ 33T, S41T ~ 43T • S301 ~ 309, S331 ~ 339, S301F, S331F ~ 333F, S335F, S301T ~ 309T, S331T ~ 339T • S421 ~ 429, S421T ~ 429	5.0mm (.197″)
• WT11S ~ 29S, WT11T ~ 29T, WT11L ~ 29L	3.5mm (.138″)
• S1A ~ 7A, S21A, S1F ~ 7F, S21F • S114, S116 • S1AW ~ 9AW, S21AW, S25AW ~ 29AW	3.0mm (.118″)

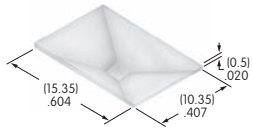
AT4188

Diffuser for AT4074
Square Cap
Polycarbonate
Color: B
Series: UB



AT4189

Diffuser for AT4117
Rectangular Cap
Polycarbonate
Color: B
Series: UB

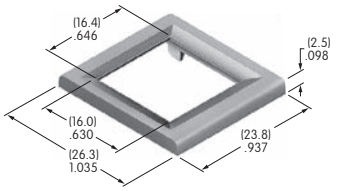


Color Codes: **A** Black **B** White **C** Red **D** Amber **E** Yellow **F** Green **G** Blue **H** Gray **J** Clear

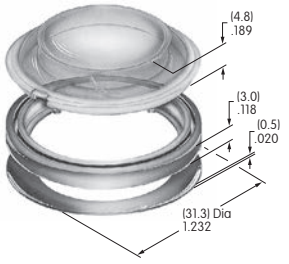
Accessories & Hardware

AT9000s

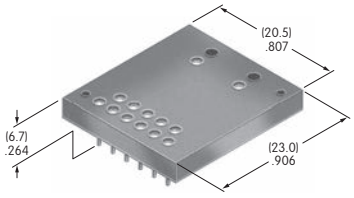
AT9201
Bezel
Polycarbonate
Colors: A B C D E F G H
Series: MLW



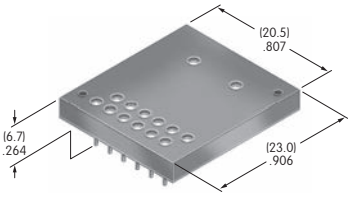
AT9410
Round Splash Cover
Lid: Polyvinyl chloride
Base: Polyethylene
O-ring: Nitrile butadiene rubber
Series: LB Panel Seal



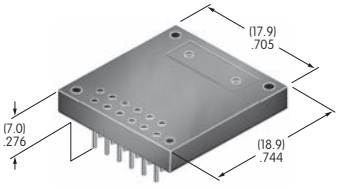
AT9704-02YC
Socket for LCD 36 x 24
Single & Bicolor Pushbutton
Base: Glass fiber reinforced PBT
Terminals: Brass/beryllium copper
Series: SmartSwitch



AT9704-065E
Socket for LCD 36 x 24
RGB Pushbutton
Base: Glass fiber reinforced PBT
Terminals: Brass/beryllium copper
Series: SmartSwitch

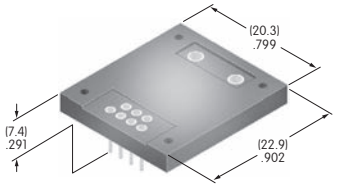


AT9704-065F
Socket for LCD 36 x 24
Compact Pushbutton
Base: Glass fiber reinforced PBT
Terminals: Brass/beryllium copper
Series: SmartSwitch

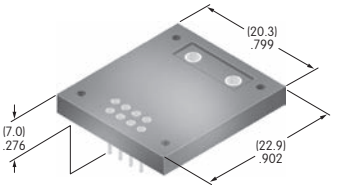


Note: By extracting some of the pins, socket may be used for the **64 x 32 Compact Pushbutton**

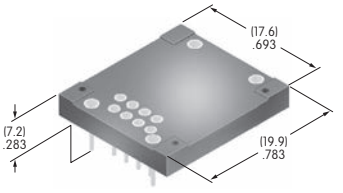
AT9704-085K
Socket for LCD 64 x 32 Pushbutton
Base: Glass fiber reinforced PBT
Terminals: Brass/beryllium copper
Series: SmartSwitch



AT9704-085L
Socket for OLED 64 x 48 Pushbutton
Base: Glass fiber reinforced PBT
Terminals: Brass/beryllium copper
Series: SmartSwitch



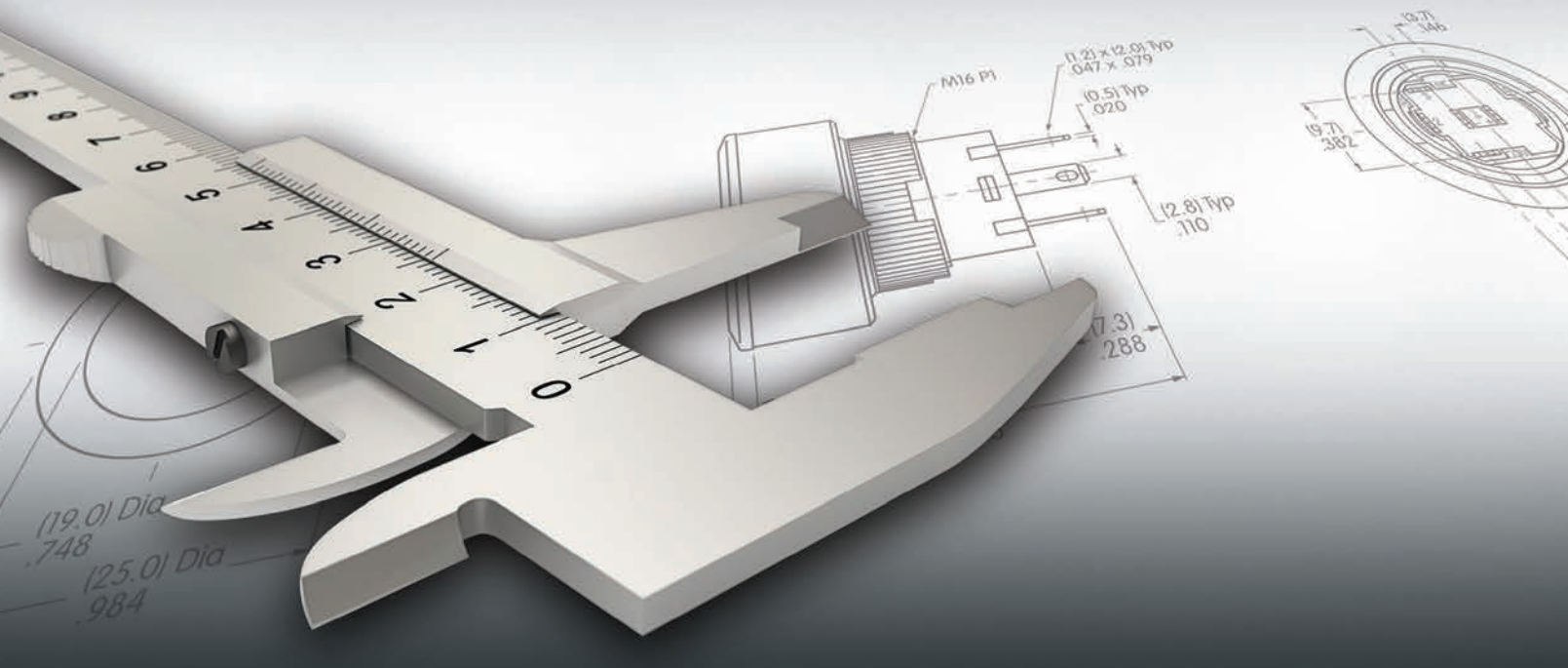
AT9704-085M
Socket for OLED 52 x 36 Display
Base: Glass fiber reinforced PBT
Terminals: Brass/beryllium copper
Series: SmartSwitch



Color Codes: **A** Black **B** White **C** Red **D** Amber **E** Yellow **F** Green **G** Blue **H** Gray **J** Clear

NKK SWITCHES

Supplement



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NKK SWITCHES PRODUCT SAFETY PRECAUTIONS

Read all specifications, instructions and precautions to ensure proper use when selecting and using products. NKK Switches does not accept liability for any problems due to incorrect usage.

Although NKK Switches' products are designed and manufactured in accordance with the highest quality standards, it is nevertheless possible for switch failure to occur as a result of improper or unintended use that could result in performance degradation, short circuits, open circuit failure, and semiconductor failures. To prevent possible injury or property damage, it is recommended to incorporate circuits or devices to protect against the failure of products and the malfunction of equipment design. Confirm that NKK Switches' products are wired and installed properly.

1. Voltages and Current

Check the specifications provided for the selected series and do not exceed the parameters for rated voltages and current recommendations.

Certain types of load may lead to large surge currents or reverse voltages. Select switches with the appropriate ratings to suit the type of load. Using an incorrect switch may result in abnormal wear, seizing, or contact failure.

Do not use switches under conditions that exceed their rated voltage or current specifications, as it may result in smoke, fire, or other malfunction. If there is a risk of exceeding rated voltage or current, precautions should be in place, such as appropriate protective circuits.

2. Usage Environment

Take account of the particular environment and conditions before selecting products.

Products do not feature sealed construction unless specified as waterproof. Sealed, or waterproof products are intended as panel sealed and cannot be used underwater or submersed in oil. Use in environments where the product may be subject to splashing liquids or dust may result in contact failure.

The use of waterproof caps is recommended where dirt, water, oil, or other substances may accumulate on the moving parts of panel surfaces.

Switches that are rarely operated should be actuated periodically to prevent potential problems, such as lubricants hardening and contact degradation.

Do not use switches in an environment where flammable gases are present. Heat generated by switch operation may lead to ignition or explosion.

Switch durability (service life) may vary significantly, depending on operating conditions. Before use, confirm compatibility of the switch selected for the application under actual usage conditions. Do not exceed the number of recommended operation cycles. Continuing to use switches with degraded performance may result in insulation failure, contact seizing, contact failure, damage, or burnout.

The resin used for products has been specially selected in accordance with the standards of NKK Switches. Do not use where there may be a risk of combustion unless appropriate fire prevention measures have been taken.

3. Soldering Temperature

Soldering times and temperatures should not exceed recommended ranges for each specific series.

Do not operate switches during or immediately after soldering (within 1 to 2 minutes), as it may lead to melting of resin components. Do not apply force to the terminals or lead wires.

4. External Force

Handle switches with care, as they may become damaged if impacted or dropped, whether loose or in packaging.

Operate switches by applying force in the correct direction.

Do not apply excessive force. Note that subjecting products to undue force may deform the terminals or cause contact failures or malfunctions. Do not subject the operating parts to impact – for example, with use of screwdrivers, wrenches, or other tools.

Safety Precautions

5. Storage

Avoid storing devices in hot or humid locations. Products should be stored at temperatures of about 25°C (15°C – 35°C) and relative humidity of about 55% (25% – 85%).

Avoid storing in locations where corrosive gases are present. Store products away from exposure to direct sunlight.
Products should be stored in original packaging to prevent sulfurization of terminals. Use products as soon as possible (within one year of delivery).
Avoid placing parts under heavy objects.

In-House Standard Test Methods

Ratings and performance figures provided in this catalog are based on NKK's In-House Standard Test Methods. Unless specifically stated otherwise, they are derived from tests performed within the standard atmospheric conditions described below. Note that these do not constitute guarantees for all standard atmospheric condition ranges.

Initial Values

- Ambient temperature: 15°C – 35°C (59°F – 95°F)
- Relative humidity (RH): 25% – 85%
- Atmospheric pressure (kPa): 86 – 106

Ratings and performance figures are concluded from individual tests and do not authorize warrantees if the switches experience extended continuous operation at either extreme high or extreme low ends of the ranges. Optimal performance falls within the range of environmental tests. Contact factory if more details are needed.
For specifications not described in this catalog or for using NKK Switches' products in special environments, contact the factory.

Contact Resistance (Initial Values)

At a value determined by the individual specification, voltage declines and resistances are calculated.
The resistance value shall be at the maximum value of the individual specification.

Insulation Resistance (Initial Values)

A voltage of the individual specification shall be applied. The resistance value is at the maximum value of the individual specification. Devices shall be tested between terminals and between individual terminals and frame.

Dielectric Strength (Initial Values)

Voltage of the individual specification shall be applied. There shall be no abnormality such as short-circuit, dielectric breakdown, or leakage of current, etc. Devices shall be tested between terminals and between individual terminals and frame.

Vibration

Testing shall be executed with conditions that include a vibration frequency and amplitude outlined by the individual specification. There shall be no mechanical failure, no looseness of any part, no disassembled parts, with no electrical interruption.

Shock

Testing shall be executed with conditions to include a shock wave, shock wave time outlined by the individual specification. There shall be no mechanical failure, no looseness of any part, no disassembled parts, with no electrical interruption.

Corrosion

Testing shall be executed with the conditions outlined by the individual specification. There shall be no impairment or deterioration. Insulation resistance and dielectric strength must meet the requirement defined by the individual specification.

Moisture Proof

Testing shall be executed with conditions including temperature and relative humidity outlined by the individual specification. There shall be no failure of mechanical operation immediately after the test. Insulation resistance and dielectric strength must meet the requirement defined by the individual specification.

Heat Resistance (Operating)

Test parts are kept in a thermostatic oven at a temperature and condition outlined by the individual specification and shall make and break the electrical endurance test up to maximum number of operations. There shall be no failure of operation. Contact resistance, insulation resistance and dielectric strength must meet the requirement defined in the individual specification.

Heat Resistance (Storage)

Test parts are kept in the thermostatic oven at a temperature determined by the individual specification. There shall be no electrical or mechanical failure. Contact resistance, insulation resistance and dielectric strength must meet the requirement outlined by the individual specification.

Cold Proof (Operating)

Test parts shall make and break the operational test without load, in the thermostatic oven at a temperature defined by the individual specification. There shall be no electrical or mechanical failure. Contact resistance, insulation resistance and dielectric strength must meet the requirement outlined by the individual specification.

Cold Proof (Storage)

Test parts are kept in the thermostatic oven at a temperature determined by the individual specification. There shall be no electrical and mechanical failure. Contact resistance, insulation resistance and dielectric strength must meet the requirement outlined by the individual specification.

Electrical Endurance

Test parts shall make and break the operational test at voltage, current and load determined by the individual specification. There shall be no electrical or mechanical failure. Contact resistance, insulation resistance and dielectric strength must meet the requirement outlined by the individual specification.

Mechanical Endurance

Test parts shall make and break the operational test at a voltage and current determined by the individual specification without load. There shall be no electrical or mechanical failure. Contact resistance, insulation resistance and dielectric strength must meet the requirement outlined by the individual specification.

Usage Precautions

The operating temperature (humidity) ranges are guaranteed by evaluations based on the individual series specifications, and do not constitute warranties for extended continuous operation at either extreme high or low ends of the operating temperature range, or for constant operation at that temperature (or humidity).

During actual use, switches may be subjected to circumstances not tested in the laboratory. Before operating, confirm that actual usage will occur within operating environments and load conditions as outlined in recommended criteria.

Operation frequency and speed will affect switch performance. Switches may exhibit contact failure, seize, or sustain damage if operated too infrequently, very slowly or very quickly. Optimum performance may not be achieved for certain operating frequencies or operating speeds. Contact the factory if more details are needed.

GENERAL TOLERANCES

	Range	Dimensions
General Tolerances Unless Otherwise Specified	Up to 6mm	±0.3
	Over 6mm & up to 30mm	±0.5
	Over 30mm & up to 50mm	±0.8

Materials & Conversions

PLASTICS

Specific Name	Acronym or Abbreviation	Generic Name
Acrylonitrile butadiene styrene	ABS	Shatterproof thermoplastic composed of styrene and acrylic resin; ABS provides resilience, shiny appearance, and stable base for metal plating
Carbon blended polyamide		Polyamide blended with carbon for antistatic property
Carbon composite polyacetal		Polyacetal
Diallyl phthalate	DAP	Diallyl phthalate; a thermosetting resin
Ethylene Propylene Terpolymer	EPT	Ozone resistant plastic
Glass fiber reinforced diallyl phthalate	GFR DAP	Diallyl phthalate
Glass fiber reinforced polyamide	GFR PA	Polyamide
Glass fiber reinforced polybutylene terephthalate	GFR PBT	Polyester
Liquid crystal polymer	LCP	Liquid crystal polymer
Nitrile butadiene rubber	NBR	NBR; mainly used where oil-proof is required
Phenolic resin		Phenol plus aldehydes; used extensively as thermosetting plastic
Polyacetal		Polyacetal
Polyamide	PA	Nylon 6/6; Polyamide; always a nylon resin
Polybutylene terephthalate	PBT	Polyester
Polycarbonate	PC	Lexan; Polycarbonate; damaged by tricholoethylene solvent and so changes to polyamide
Polyethylene	PE	Polyethylene
Polyphenylene sulfide	PPS	Polyphenylene sulfide
Polyoxymethylene	POM	Polyoxymethylene
Polypropylene	PP	Polypropylene; more elastic than polycarbonate
Polyvinyl chloride	PVC	Polyvinyl chloride; loses pliability below 0°C (32°F)
Resin		Polymer
Silicone		Silicone

ELEMENTS

Ag	silver	**Cr**	chromium	**Pb**	lead
Al	aluminum	**Cu**	copper	**Sn**	tin
Au	gold	**Ni**	nickel	**Zn**	zinc

TEMPERATURE

Fahrenheit
Thermometric scale with fixed points marked 32°F for freezing point and 212°F for boiling of water.

Celsius
International thermometric scale with fixed points marked 0°C for freezing point and 100°C for boiling of water.

(Fahrenheit – 32) x .555 = Celsius

(Celsius x 1.8) + 32 = Fahrenheit

°C	°F	°C	°F
–40	–40	0	+32
–30	–22	+50	+122
–25	–13	+55	+131
–20	–4	+70	+158
–10	+14	+85	+185
		+100	+212

LINEAR DIMENSIONS

Formulas for Conversion

millimeter x .03937 = inch

inch x 25.4 = millimeter

Fraction	Inch	Millimeter	Fraction	Inch	Millimeter
	.100	2.54		.394	10.0
	.150	3.81	15/32	.469	11.9
	.197	5.0		.472	12.0
	.236	6..0	1/2	.500	12.7
1/4	.250	6.35			

FORCE

Formulas for Conversions

ounce•force	x	.2780139	=	newton
pound-force	x	4.4482220	=	newton
kilogram-force	x	9.8066500	=	newton
newton	x	.1019716	=	kilogram-force
newton	x	.2248089	=	pound-force
newton	x	3.5969420	=	ounce•force

TORQUE

Formulas for Conversions

kg/cm	x	2.2046 x .3937	=	lb/in
newton•meter	x	.7375621	=	pound-foot
newton•meter	x	.1019716	=	kilogram-meter
newton•meter	x	141.6119	=	ounce-inch
newton•meter	x	8.8507	=	pound-inch
pound-foot	x	1.355818	=	newton•meter

PLATING THICKNESS

Micron
One millionth of a meter; a micrometer

1 micron = 1 thousandth of 1 millimeter
1 micron ÷ .0254 = 39.37 millionths of an inch
Example: 3 microns ÷ .0254 = 118.11 millionths of an inch

WEIGHT

1 gram = .03527 ounce
1 kilogram = 35.27 ounces
1 kilogram = 2.2 pounds
1 ounce = 31.10348 grams
1 ounce = .03110348 kilogram
1 pound = .4539 kilogram

RERATING CURRENT FOR SWITCHES WITH 125V AC RATINGS

Generally, most switch applications can be classified into one of the below load categories. Switch capacities can be mathematically rerated when the application calls for a category or voltage other than the switch standard general specification ratings, meaning original current ratings at 125V AC. NKK has not conducted life tests at these rerated voltages and currents so it is important to contact the factory in such cases. The candidate switch should be tested in the actual application in which it is intended to function.

Factors for Calculating Rerated Current at Various Loads

New Voltage Rating	Resistive Load Multiply by:	Inductive Load Multiply by:	Lamp Load Multiply by:	Motor Load Multiply by:	Capacitive Load Multiply by:
125VAC	1	0.50 ~ 0.66 (PF 0.6)	0.20 ~ 0.25	0.33	0.25
250VAC	0.50 ~ 0.66	0.25 ~ 0.33 (PF 0.6)	0.10 ~ 0.16	0.16 ~ 0.22	0.12 ~ 0.16
12VDC	1	0.75 ~ 1	0.20 ~ 0.25	0.33	0.25
30VDC	0.50 ~ 1	0.25 ~ 0.50	0.10 ~ 0.25	0.16 ~ 0.33	0.12 ~ 0.25
48VDC	0.25 ~ 0.33	0.20 ~ 0.25	0.05 ~ 0.08	0.08 ~ 0.11	0.06 ~ 0.08
125VDC	0.05	0.02 ~ 0.03	N/A	N/A	N/A

Sample Calculation for Model M2012SS1W01
with 6A @ 125VAC resistive rating.
To use at 48V DC inductive, multiply
6A x 0.25 = 1.5A @ 48VDC

Sample Calculation for Model JWL22RCA
with 16A @ 125/250VAC resistive rating.
To use at 30V DC motor load, multiply
16A x 0.33 = 5.28A @ 30VDC

Resistive Load

Resistive loads can be purely resistive or of the tungsten-heater load type. A resistive load that has no heating element is the easiest for a switch to handle, and the switch's rating is based on this type of load. A resistive load is one in which 100% of the load is composed of resistive devices. The power factor is high (PF = 1) and contact erosion is low. Consequently, the switch's electrical life can be anticipated with some certainty.

Lamp Load

When a switch closes on a resistive lamp load, the switch sees a short circuit because the cold resistance of the lamp filament is near zero. The surge current as the switch closes can be many times the steady state current. As the lamp filament heats up to operating temperature, the resistance of the filament increases and the current decreases to the lamp's steady state.

Motor

Motor loads present yet another brutal environment for switch contacts. Closing the switch contact on a motor start-up load causes very large current surges of about 3 to 8 times the running current. When the switch is opened and the current decreases, the magnetic field of the inductor collapses and an electromotive force is induced. The polarity of the induced voltage is such as to oppose any change in current flow. This induced voltage aids the source voltage in striking an arc and maintaining it as the contacts separate.

Inductive Load

Non-motor inductive loads, such as those seen in switching power supplies, have inrush currents that greatly exceed the normal operating currents of the equipment. This inrush current can easily reach 8 to 10 times the steady state current. As a switch on an inductive load is opened, the inductor, or transformer, induces a counter option "voltage" in the circuit. This voltage opposes any change in the circuit current and can reach hundreds of volts. This extremely high voltage can restrike the arc as the switch contacts open resulting in severely eroded or welded contacts.

Capacitive

With such loads as DC power supplies, welding machines, and strobe charging units the inrush current is even more damaging than with inductive loads. To the switch a capacitive load appears as a dead short as the switch closes. In the first few milliseconds the inrush current can sometimes reach 100 times the steady state current of the circuit. Even worse for the switch, this inrush occurs before the contact bounce has subsided. This produces severe arcing and massive contact erosion. Often the contacts weld upon closure preventing the switch from ever opening. In an emergency the operator of the equipment would know he could not open the circuit.

Electrical Ratings

INDUCTIVE LOADS

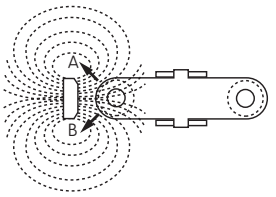
In AC circuits the voltage and current are varying in a sinusoidal pattern; both the voltage and current cross the zero reference 120 times per second for 60Hz. Therefore, the chances of closing or opening a switch when the voltage and current are at their maximum in AC circuits is remote.

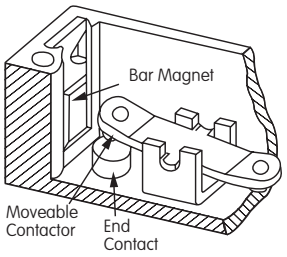
In DC circuits the voltage and current do not vary and are always at their rated levels. Compared to AC circuits with the same voltage and current, DC circuits handle 1.414 times the power. Therefore, when opening or closing a switch on a DC load, the arc developed is more severe, more energetic, and lasts longer causing more contact erosion and a shorter switch life. A switch intended for a DC circuit should have its AC capacity rerated for DC. See previous page for rerating current.

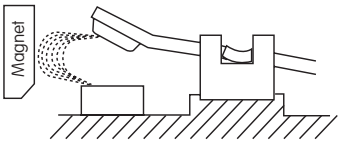
DESIGN FOR INDUCTIVE DC LOAD MODELS S800D & SW3800D

Bar magnets are placed at each end of high capacity switches, and their magnetic field opposes the field created by the arcing current, thereby extinguishing the arc and protecting the contacts.

Positive (+) must be connected to end terminals and negative (–) to common terminals.







TV RATINGS

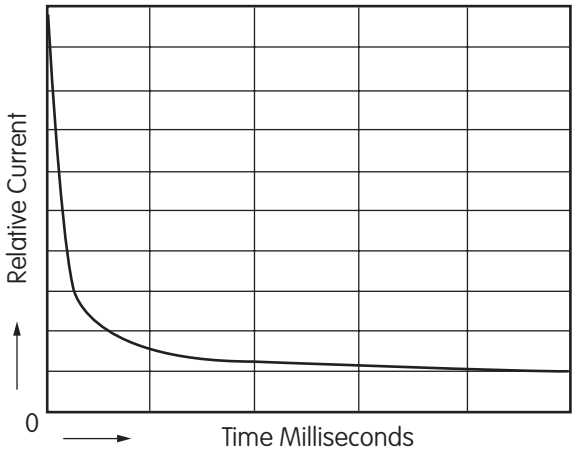
The TV5 and TV8 ratings are tested and assigned by the Underwriters Laboratory. The switches are intended to be used as "Power ON" devices in equipment where a high tungsten inrush current is anticipated, such as tungsten-filament lamp loads or entertainment equipment like sound systems and monitors.

An example is the TV8 test which consists of an overload test and an endurance test. The overload test consists of a switch closing on a minimum inrush current of 163 amps with 50 consecutive operations at a rate of 10 cycles per minute. The test must be conducted without any failures. In the endurance test the current is reduced to 117 amps, and the same switch is subjected to another 25,000 operations.

The JWL is a product example that has been tested and meets the TV8 rating.

In addition to the electrical testing, the switch enclosure (housing) must comply with the requirements for classifying materials as UL94V-0. The insulation material must have arc-tracking characteristics with a minimum arcing time of 180 seconds when tested in accordance with the Standard Test Methods for High-Voltage, Low-Current Arc Resistance of Solid Electrical Insulation.

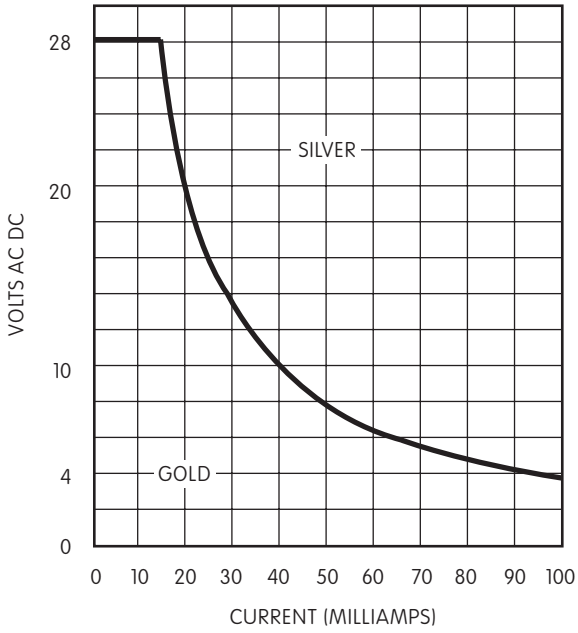
The JWM and JWL switches are rugged, dependable, and well suited to high inrush circuits.



Typical Tungsten Inrush Curve

OPERATING RANGE

Three contact materials are commonly used in NKK switches: gold, silver, and gold over silver. These materials give the options of low level, power level, plus combined power and low level ratings.



Low Level ~ 0.4VA maximum @ 28V AC or DC maximum

Gold plated contacts are recommended for dry circuits, which are defined as very low energy. In circuits where the voltage is below 28 volts DC and current is below 100 milliamps (dry circuits), no arc develops as the contacts open or close. So, the tarnish remains. Eventually without the arc, the contacts become so encrusted that the switch is unable to close the circuit due to the high contact resistance.

The solution to this is plating the contacts with gold, which does not tarnish, thus assuring the full electrical life of the switch.

Power Level ~ 100mA to 10 amps @ 125V AC

Silver contacts are recommended for electrical levels above 0.4VA. Although silver tarnishes, it is a good conductor and this electrical energy is sufficient to break through the tarnish to give reliable performance. The oxidation which coats the contact surfaces with a hard layer of insulative contamination is removed by arcing. In circuits where the voltage is above about 12 volts DC and the current above .5 amps, an arc develops during opening or closing of the contacts. This arc keeps the oxidation cleaned off.

Power or Low Level

Gold over silver contacts are used in applications requiring both dry and power circuits. NKK's gold over silver contacts have dual ratings as further described below.

DUAL RATINGS

The dual rated option is suitable where identical switches are used in both a logic and a power level circuit within the same application.

Dual rated switches enable the user to install the same switch in both a logic level (dry circuit) and a power level circuit. However, once a code "A" rated contact switch has been used at a power level, it cannot then be used at a logic level.

There may be advantages to stocking only a single switch for use in both a logic level and a power level circuit. Our dual rated contact material option allows this advantage. However, once a dual rated contact material switch has been used at a power level it cannot then be used at a logic level.

The gold over silver contact material provides a reliable, tarnish free, contact surface for logic level switching. When this same contact material switch is used in power level circuit, the gold plating is removed by contact arcing. If an attempt is then made to use this same switch in a logic level circuit (where no arcing occurs). The low current condition cannot provide adequate contact wiping or cleaning.

RERATING

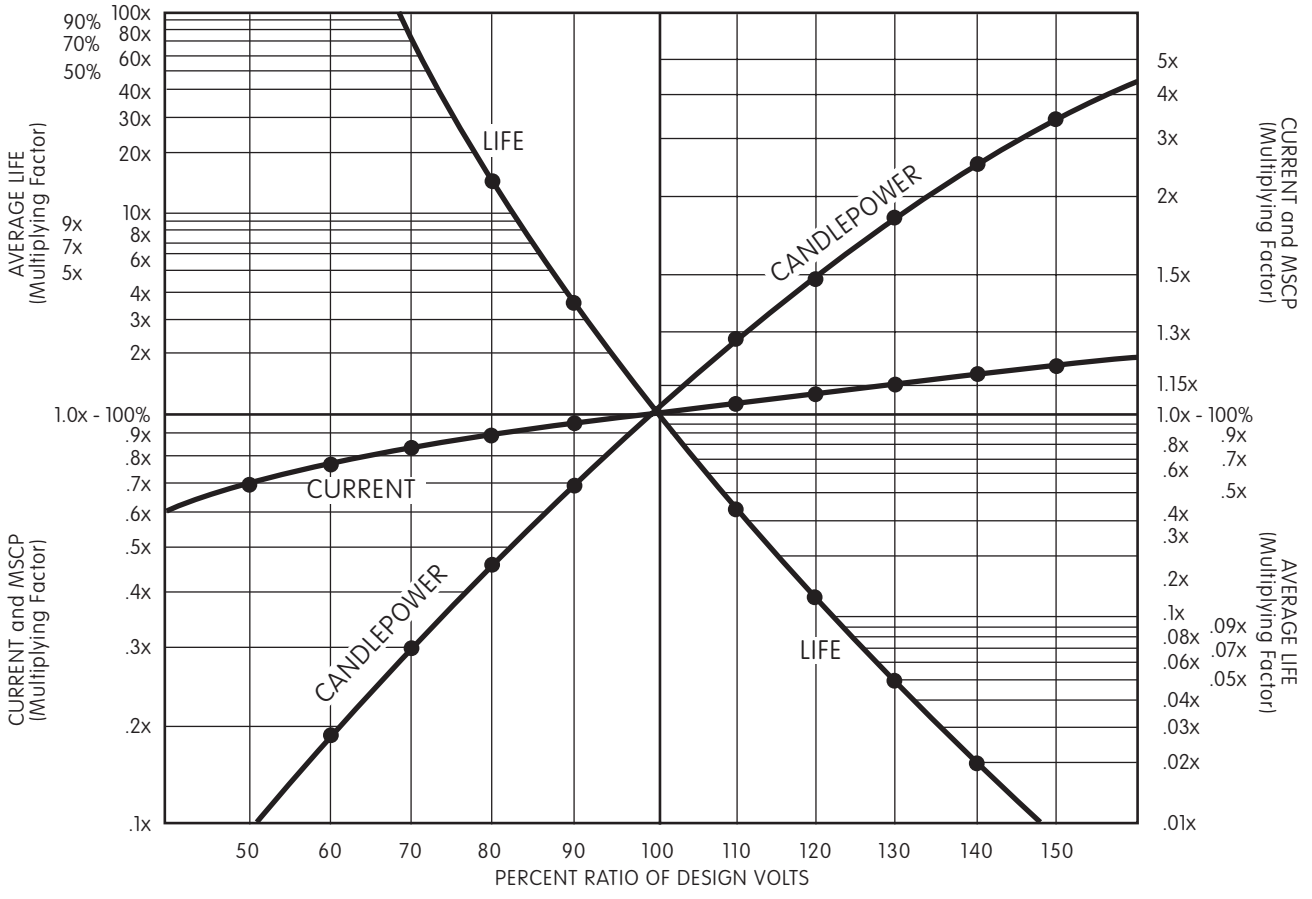
When a lamp is to be operated at a voltage other than the rated or design voltage, the rerated lamp specifications should be calculated to determine suitability for the user's application. The following formulas assist in predicting the rerated effect on luminous intensity, endurance and current. Results are most reliable for applied voltages close to the rated voltage.

$$\text{Rerated MSCP} = \text{Rated MSCP} \times \left[\frac{\text{Applied Voltage}}{\text{Rated Voltage}}\right]$$

$$\text{Rerated Life} = \text{Rated Life} \times \left[\frac{\text{Rated Voltage}}{\text{Applied Voltage}}\right]$$

$$\text{Rerated Current} = \text{Rated Current} \times \left[\frac{\text{Applied Voltage}}{\text{Rated Voltage}}\right]$$

For your convenience, the graph below illustrates the way current, candlepower, and life performance vary with percent changes in applied voltage. The graphed values are typical for miniature and subminiature lamps with the average life based on rated voltages at 60 cycles AC, in room temperature, and under static conditions.



Source: General Instrument Chicago Miniature Brand Incandescent and Neon Lamps, Catalog No. 8400-Rev 1, (Chicago, Illinois: General Instrument Corporation), page 3.

APPLICATION CONSIDERATIONS

LEDs

Light emitting diodes (LEDs) operate at relatively low current and DC voltage levels and have comparatively unlimited service life. Their characteristics do not change significantly with age, and they are not easily damaged by shock or vibration. A variety of NKK's switches and indicators are offered with red, green, yellow, amber, blue, white, or bicolor (red/green) LEDs.

Most of the LEDs used in our products require a ballast resistor connected in series with the LED. In addition, we offer 5-, 12-, and 24-volt lamps with internal resistors in the YB series.

Incandescent Lamps

Lamp life is determined in a laboratory environment where conditions are near perfect. Actual applications, unlike the test environment, involve many factors which can greatly affect the values listed in lamp specifications. Of all the operating characteristics, lamp life is the least predictable. The lamp filament must deteriorate to produce illumination, and actual life is a function of this unpredictable rate of deterioration. Thus, exact life performance cannot be determined for any incandescent lamp under any set of conditions.

Lamps perform at their maximum when used at their rated AC voltages or below. There are many known conditions or factors that affect lamp life. Using the lamp in abusive environments such as high ambient temperatures, high shock and/or vibration, constant illumination, and DC voltage accelerates deterioration of the tungsten filament.

Neon Lamps

Neon lamps are low-current, long-life sources limited by the high ionization voltage of neon (≥80 volts) for use in line voltage circuits. A series resistor is required in all neon lamps for current limiting. Larger lamps often include an integral resistor sized for a specific voltage.

Neon lamps glow with a low intensity, amber light. Bright light and vivid colors are not obtainable with neon lamps. Their typical 1.5mA current drain, better than 25,000-hour service life, and good resistance to shock and vibration make them an excellent alternative in many line voltage applications. For best visibility they should be used with clear lenses and diffusers. Other suitable colors are red, orange, yellow, or white.

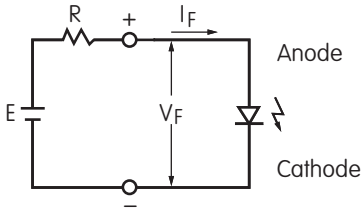
LED & Lamp Part Numbers for Each Series

PN	Type	Series	PN	Type	Series	PN	Type	Series
AT070	LED	EB M MB24	AT618	LED	EB M MB24	AT630	LED	HB
AT602	Incand.	LW MLW	AT621	LED	YB	AT631	LED	KB LB YB YB2
AT602N	Neon	LW MLW	AT622	LED	MLW	AT632	LED	KB LB YB YB2
AT607	Incand.	LB	AT624	LED	HB	AT633	LED	HB
AT607N	Neon	LB	AT625	LED	KB LB YB YB2	AT634	LED	KB YB YB2
AT611	Incand.	KB YB	AT627	LED	LB	AT635	LED	KB LB
AT615	Neon	KB	AT628	LED	YB YB2	AT636	LED	KB YB YB2
AT617	LED	EB M MB24	AT629	LED	HB			

Ballast Resistors

BALLAST RESISTOR CALCULATIONS & RECOMMENDATIONS

If the source voltage is greater than the rated voltage of a lamp or LED, a ballast resistor must be connected in series with the lamp. The following circuit diagram and formula will assist in calculating the value of the required ballast resistor.



$$R = \frac{E - V_F}{I_F}$$

Where: R = Resistor Value (Ohms)
E = Source Voltage (V)
V_F = Forward Voltage (V)
I_F = Forward Current (A)

Watt recommendations provide a margin to reduce heat rise and increase life.

FORWARD VOLTAGE	FORWARD CURRENT	SOURCE VOLTAGE E																	
V_F	I_F	5V		6V		9V		12V		14V		16V		18V		22V		24V		28V	
V	mA	Ω	W	Ω	W	Ω	W	Ω	W	Ω	W	Ω	W	Ω	W	Ω	W	Ω	W	Ω	W
1.65	25	130	1/4	180	1/2	300	1/2	430	1	510	1	560	1	680	2	820	2	910	2	1.1K	2
1.70	30	110	1/2	150	1/2	240	1	360	1	430	1	470	2	560	2	680	2	750	2	910	3
1.75	40	82	1/2	110	1/2	180	1	270	1	300	2	360	2	430	2	510	3	560	3	680	3
1.77	20	160	1/4	220	1/4	360	1/2	510	1/2	620	3/4	750	3/4	820	1	1.0K	1	1.1K	1	1.3K	1.5
1.80	48	68	1/2	91	1/2	150	1	220	2	240	2	300	2	330	2	430	3	470	3	560	3
1.85	20	160	1/4	220	1/4	360	1/2	510	1	620	1	750	1	820	1	1.0K	1	1.2K	2	1.5K	2
1.90	8	390	1/8	510	1/8	910	1/4	1.2K	1/4	1.5K	1/4	1.8K	1/4	2.0K	1/2	2.4K	1/2	2.7K	1/2	3.3K	1/2
	15	220	1/8	270	1/4	470	1/2	680	1/2	820	1/2	1.0K	1	1.1K	1	1.5K	1	1.5K	1	1.8K	2
	16	200	1/4	220	1/4	430	1/2	620	1/2	750	1	910	1	1.0K	1	1.2K	1	1.3K	1	1.6K	1
	20	150	1/4	200	1/4	360	1/2	510	1/2	620	3/4	750	1	820	1	1.0K	1	1.1K	1	1.3K	2
	26	120	1/4	160	1/2	300	1/2	390	1	470	1	560	1	620	1	820	2	910	2	1.1K	2
1.95	15	220	1/8	270	1/4	470	1/2	680	1/2	820	1/2	1.0K	1	1.1K	1	1.5K	1	1.5K	1	1.8K	2
	20	150	1/4	200	1/4	360	1/2	510	1/2	620	3/4	680	3/4	820	1	1.0K	1	1.1K	1	1.3K	2
	24	130	1/4	160	1/2	300	1/2	430	1	510	1	560	1	680	2	820	2	910	2	1.1K	2
1.96	16	200	1/4	240	1/4	430	1/2	620	1/2	750	1/2	910	1	1.0K	1	1.3K	1	1.3K	1	1.6K	1
2.00	15	200	1/8	270	1/4	470	1/2	680	1/2	820	1	910	1	1.1K	1	1.3K	1	1.5K	1	1.8K	1
	20	150	1/4	200	1/4	360	1/2	510	1	620	1	750	1	820	1	1.0K	1	1.1K	2	1.3K	2
	24	120	1/4	160	1/2	300	1/2	430	1	510	1	560	1	680	2	820	2	910	2	1.1K	2
	25	120	1/4	160	1/2	270	1/2	390	1	470	1	560	1	620	2	820	2	910	2	1.1K	2
	26	120	1/4	160	1/2	270	1/2	390	1	470	1	560	1	620	1	820	2	910	2	1.0K	2
	48	62	1/2	82	1/2	150	1	200	1	240	1	300	2	330	2	430	3	470	3	560	3
2.07	16	180	1/8	240	1/4	430	1/2	620	1/2	750	1/2	910	3/4	1.0K	3/4	1.3K	1	1.3K	1	1.6K	1
2.10	15	200	1/8	270	1/4	470	1/2	680	1/2	820	1/2	1K	1	1.1K	1	1.3K	1	1.5K	1	1.8K	1
	20	150	1/4	200	1/4	360	1/2	510	1	620	1	680	1	820	1	1.0K	1	1.1K	1	1.3K	1
	24	120	1/4	160	1/2	300	1/2	430	1	510	1	560	1	680	2	820	2	910	2	1.1K	2
	25	120	1/4	160	1/2	270	1/2	390	1	470	1	560	1	620	2	820	2	910	2	1.1K	2
	30	100	1/4	130	1/2	240	1	330	1	390	1	470	2	510	2	680	2	750	2	910	2
	40	75	1/2	100	1/2	180	1	270	1.5	300	1.5	360	1.5	430	2	510	2	560	3	680	3
	45	68	1/2	91	1/2	160	1	220	2	270	2	330	2	360	2	430	3	510	3	620	3
2.15	16	180	1/8	240	1/4	430	1/2	620	1/2	750	1/2	910	3/4	1.1K	3/4	1.2K	1	1.3K	1	1.6K	1
	20	150	1/4	200	1/4	360	1/2	510	1	620	1	680	1	820	1	1.0K	1	1.1K	1	1.3K	1
2.16	16	180	1/8	240	1/4	430	1/2	620	1/2	750	1/2	910	3/4	1.0K	3/4	1.2K	1	1.3K	1	1.6K	1

BALLAST RESISTOR CALCULATIONS & RECOMMENDATIONS

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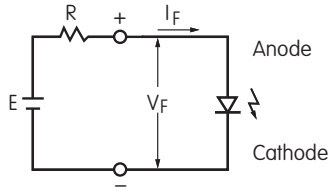

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Where: R = Resistor Value (Ohms)
E = Source Voltage (V)
V_F = Forward Voltage (V)
I_F = Forward Current (A)

Watt recommendations provide a margin to reduce heat rise and increase life.

FORWARD VOLTAGE	FORWARD CURRENT	SOURCE VOLTAGE E																	
V_F	I_F	5V		6V		9V		12V		14V		16V		18V		22V		24V		28V	
V	mA	Ω	W	Ω	W	Ω	W	Ω	W	Ω	W	Ω	W	Ω	W	Ω	W	Ω	W	Ω	W
2.20	20	150	1/4	200	1/4	360	1/2	510	1	620	1	750	1	820	1	1.0K	1	1.1K	2	1.3K	2
	26	110	1/4	160	1/2	270	1/2	390	1	470	1	560	1	620	1	820	2	910	2	1.0K	2
	30	91	1/2	130	1/2	220	1	330	1	390	1	470	2	510	2	680	2	750	2	820	3
2.25	20	150	1/4	200	1/4	360	1/2	510	1	620	1	750	1	820	1	1.0K	1	1.1K	2	1.3K	2
2.27	20	150	1/4	200	1/4	330	1/2	510	1/2	620	3/4	750	3/4	820	1	1.0K	1	1.0K	1	1.2K	1
2.30	20	130	1/4	180	1/4	330	1/2	510	1/2	620	3/4	680	3/4	820	1	1.0K	1	1.0K	1	1.2K	1
2.35	40	68	1/4	91	1/2	160	1	240	1	300	2	330	2	390	2	510	3	560	3	620	3
2.80	20	110	1/4	160	1/4	330	1/2	470	1/2	560	1	680	1	750	1	1.0K	1	1.1K	1	1.3K	1
3.20	20	91	1/8	150	1/4	300	1/2	470	1/2	560	1/2	680	3/4	750	3/4	1.0K	1	1.0K	1	1.2K	1
3.30	20	91	1/8	150	1/4	300	1/2	430	1/2	560	1/2	680	3/4	750	3/4	1.0K	1	1.0K	1	1.2K	1
3.40	20	82	1/8	130	1/4	300	1/2	430	1/2	560	1/2	680	3/4	750	3/4	1.0K	1	1.0K	1	1.2K	1
3.50	20	75	1/4	120	1/8	270	1/4	430	1/2	560	1	620	1	750	1	1.0K	1	1.1K	2	1.3K	2
3.60	20	68	1/4	120	1/8	270	1/4	430	1/2	560	1	620	1	750	1	1.0K	1	1.1K	2	1.3K	2
	30	47	1/8	82	1/4	180	1/2	270	1	360	1	430	1	470	2	620	2	680	2	820	2
3.80	26	47	1/8	91	1/4	200	1/2	300	1/2	390	1	470	1	560	1	750	1.5	820	1.5	1.0K	2
	30	39	1/8	75	1/4	180	1/2	270	1	330	1	430	1	470	2	620	2	680	2	820	2
3.90	30	36	1/8	68	1/4	180	1/2	270	1	330	1	390	1	470	2	620	2	680	2	820	2
4.00	26	39	1/8	82	1/4	200	1/2	330	1/2	390	1	470	1	560	1	750	1.5	820	1.5	1.0K	2
	30	33	1/8	68	1/4	130	1/2	270	1	330	1	390	1	470	2	620	2	680	2	820	2
4.20	20	39	1/8	91	1/8	240	1/4	390	1/2	510	1	620	1	680	1	910	1	1.0K	1	1.2K	1
	30	27	1/8	62	1/4	160	1/2	270	1	330	1	390	1	470	2	620	2	680	2	820	2
4.30	20	36	1/8	82	1/8	240	1/4	390	1/2	470	1/2	560	1	680	1	910	1	1.0K	1	1.2K	1
4.40	26	24	1/8	62	1/4	180	1/2	300	1/2	390	1	470	1	560	1	680	1.5	750	1.5	910	1.5
5.00	25	—	—	47	1/8	160	1/2	300	1	360	1	470	1.5	560	1.5	680	2	820	2	1.0k	2.5
5.50	12.5	—	—	82	1/8	330	1/2	160	1	560	1/4	910	1/2	1.1K	1	1.5K	1	1.6K	1	1.8K	1
	25	—	—	43	1/8	160	1/4	300	1/2	360	1/2	470	1	560	1	680	1	820	1.5	1.0K	1.5
	45	—	—	24	1/8	91	1/2	160	1	200	1	270	1.5	300	1.5	390	2	430	3	560	3
	52	—	—	20	1/8	82	1/2	150	1	180	1.5	220	1.5	270	3	330	3	390	3	470	3
12.00	12.5	—	—	—	—	—	—	—	—	160	1/8	330	1/8	510	1/4	820	1/2	1K	1/2	1.3K	1
	15	—	—	—	—	—	—	—	—	150	1/8	270	1/8	400	1/4	680	1/2	820	1/2	1.5K	1
	20	—	—	—	—	—	—	—	—	100	1/8	200	1/4	300	1/2	510	1	620	1	820	1
	26	—	—	—	—	—	—	—	—	82	1/8	160	1/4	240	1	390	1	470	1	620	1
24.00	10	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	400	1/8
	13	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	330	1/2

Processing Data

PROCESSING RECOMMENDATION GUIDE

Series & Type	PCB		SMT		Cleaning	
	Wave Solder	Manual Solder	IR Reflow	Vapor Phase	Auto-matic	Manual
A Rockers	x	x			x	
A Toggles	x	x			x	
AB Pushbuttons	x	x			x	
AS Slides	x	x				x
B Illuminated Toggles	x	x			x	
B Toggles	x	x			x	
BB Pushbuttons	x	x			x	
CB Tactiles	x	x			x	
CB3 SMT Tactiles		x	x		x	
CS Slides	x	x				x
D2 Toggles	x					x
DB Pushbuttons	x	x				x
DSA Tilt	x	x				x
DSB Tilt	x	x			x	
EB Pushbuttons (PCB)	x	x				x
FR01 DIP Rotaries	x	x				x
FR02 SMT DIP Rotaries		x	x			x
FS Slides	x	x				x
G Illuminated Toggles	x	x			x	
G Rockers	x	x			x	
G Toggles	x	x			x	
G3B SMT Pushbuttons		x	x		x	
G3T SMT Toggles		x	x		x	
GB Illuminated Plunger	x	x			x	
GB Pushbuttons	x	x			x	
GB2 Pushbuttons	x	x				x
GW Illum. Paddles	x	x				x
GW Rockers/Paddles	x	x				x
HB2 Illum. Pushbuttons	x	x				x
HP02 Tactiles	x	x				x
HP03 SMT Tactiles		x	x			x
IS LCD PB & Display	x	x				x
IS OLED PB & Display	x	x				x
JB Illuminated Tactiles	x	x			x	

Series & Type	PCB		SMT		Cleaning	
	Wave Solder	Manual Solder	IR Reflow	Vapor Phase	Auto-matic	Manual
JB Tactiles	x	x			x	
JF Illuminated Tactiles	x	x			x	
JF Tactiles	x	x			x	
JL Illuminated Tactiles	x	x				x
JS DIP Slides	x	x				x
JS SMT DIP Slides		x	x			x
KP Illum. Pushbuttons	x	x				x
M Rockers (PCB)	x	x				x
M Toggles (PCB)	x	x				x
M2B Pushbuttons	x	x			x	
M2T Rockers	x	x			x	
M2T Toggles	x	x			x	
M2100 Illum Act's (PCB)	x	x				x
MB2000 PBs (PCB)	x	x				x
MB2400 PBs (PCB)	x	x				x
MB2500 PBs (PCB)	x	x				x
MRA Rotaries	x	x			x	
MRB Rotaries	x	x			x	
MRF Rotaries	x	x			x	
MRK Rotaries	x	x			x	
MS Illuminated Slides	x	x				x
MS Slides	x	x				x
ND Rotaries	x	x			x	
ND3 SMT Rotaries		x	x		x	
NP01 Pushbuttons	x	x				x
P Rockers (PCB)	x	x				x
P Toggles (PCB)	x	x				x
SK Keylocks (PCB)	x	x			x	
SM Slides	x	x				x
SS Illuminated Slides	x	x				x
SS Slides	x	x				x
SS3 SMT Slides		x	x			x
UB Pushbuttons (PCB)	x	x				x
UB2 Pushbuttons (PCB)	x	x				x

PROCESS SEALED SWITCHES

NKK, a pioneer in the development of process sealed switches, is ahead of its time as a manufacturer. These process sealed switches are increasingly in demand because of the advancements in automated PC board processing. NKK's expansive family of process compatible devices includes toggles, rockers, pushbuttons, tactiles, rotaries, keylocks and slides in a variety of sizes.

Over 50 years of quality design experience produced the first process sealed switches to satisfy the process requirements of PC board soldering and cleaning techniques. As the cutaway drawings on our Distinctive Characteristics pages illustrate, our process sealed switches incorporate all the features necessary to accomplish their process compatibility: epoxy sealed terminals, heat resistant resins, interior rubber o-rings, seals, and sleeves, plus ultrasonic welding. The following data has been developed from a comprehensive study of test data, technical literature, and industry practice.

Automated Cleaning Specifications

Temperature Stabilization

To minimize the thermal shock, switches should be allowed to cool to 38°C or to the temperature of the hand or machine cleaning.

Flux

NKK Switches recommends a no-clean (low residue) flux that can be either left on the board or cleaned with a mild organic solvent. A second choice is a synthetic flux that can be effectively removed with an alcohol-based solvent. A water soluble flux is not recommended because of the corrosive nature of the flux residue. The relatively high temperature and energetic cleaning methods needed to ensure complete removal of all flux residues could also be hazardous to the switch.

Flux Removal

Cleaning should take place at a slightly elevated room temperature between 38°C and 52°C. Spray pressure should not exceed 25psi. See table of Flux Removal Conditions below to determine recommended depth of submersion, time and temperature.

Drying

Drying time should be extended to a one-hour bake at 52°C maximum. This step will eliminate any condensation.

Flux Removal Conditions

Series	Depth (mm)	Time (Minutes)	Temperature (°C)
A, B	100	5	—
AB, BB, G, GB, SK-B	50	5	—
CB, CB3, JB, JF, M2B, M2T	50	1	50
G3B, G3T, ND, ND3	100	1	70
MRA, MRB, MRF	50	3	—
SK-E	50	1	60

Manual Solder Profiles

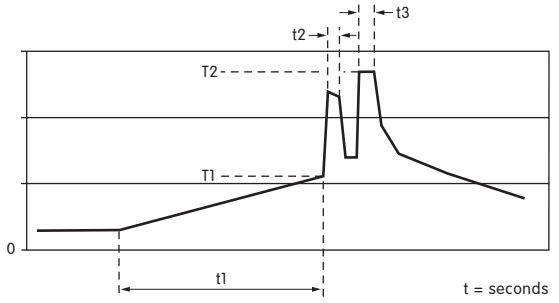
Manual Solder Profile	Profile A High Temperature	Profile B Low Temperature
Solder Iron Tip Temperature	390°C	350°C
Time on Terminal	4 seconds	3 seconds
Cycles	2	1

Notes:

Profiles A and B are for lead-free.
Do not exceed these specifications.

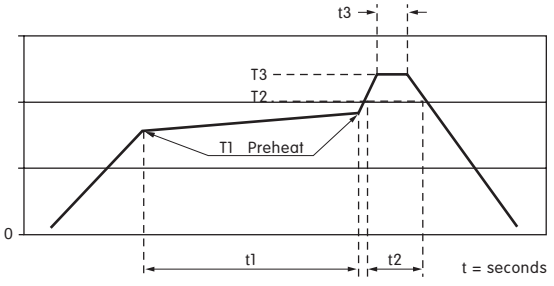
Processing Data

Wave Solder Profiles for Through Hole



Wave Solder Profile	Symbol	Profile A High Temperature	Profile B Low Temperature
Preheat Temperature	T1	110°C	110°C
Preheat Time	t1	40 seconds	30 seconds
Peak Temperature	T2	270°C	270°C
Peak Time	t2 + t3	6 seconds	5 seconds
Thickness of PCB		1.6mm	1.6mm
Cycles		2	2
Comments		PCB with no Lead	PCB with no Lead

Reflow Solder Profiles for SMT



Reflow Solder Profile	Symbol	Profile A High Temperature	Profile B Low Temperature
Preheat Temperature	T1	180°C ~ 200°C	150°C ~ 170°C
Preheat Time	t1	120 seconds	90 seconds
Heating Temperature	T2	230°C	200°C
Heating Time	t2	60 seconds	30 seconds
Peak Temperature (Surface)	T3	250°C	240°C
Peak Time	t3	Not Specified	Not Specified
Thickness of PCB		1.6mm	1.6mm
Cycles		2	2
Comments		PCB with no Lead	PCB with no Lead

Notes:

The Reflow Solder profile above describes the printed circuit board (PCB) surface temperature. Since the PCB surface temperature and the switch surface temperature will vary depending on the height of the switch, the PCB material, and PCB thickness, ensure that the switch surface temperature does not exceed 250°C for high temperature (column A), or 240°C for low temperature (column B). Contact the factory if your conditions are more severe than the above specifications.

Standards & Approvals

Underwriters Laboratories Inc.
Find certifications at www.ul.com
File No. E44145
Class Description:
Switches, Special Use – Component. Switches are supplied without marking unless specified. See General Specifications page of each series for ordering instructions.

Underwriters Laboratories Inc.
Find certifications at www.ul.com
File No. E44145
Class Description:
Switches, Special Use – Certified for Canada. Switches are supplied without marking unless specified. See General Specifications page of each series for ordering instructions.

Canadian Standards Association
Online at www.csa-international.org
File No. 023535_0_000
Class No. 6241-10; Class Description:
C22.2 No. 55: Switches-Snap-Special Use. Switches are supplied without marking unless specified. See General Specifications page of each series for ordering instructions.

UL, cULus recognized & CSA certified only when ordered with marking on the switch.

See details regarding specific options in each switch section.

Basic NKK Part No.	Rating Amps@Volts	UL	cULus	CSA
CWSA	6A @ 250V AC	•	•	
CWSB	6A @ 250V AC	•	•	
CWSB (illum.)	9A @ 125V AC	•		•
CWSC (illum.)	9A @ 125V AC	•		
	6A @ 250V AC	•		
CWT12	6A @ 125V AC	•	•	
	3A @ 250V AC	•		
EB2011	3A @ 125V AC	•	•	•
EB2065		•	•	•
EB2061	3A @ 125V AC	•	•	•
EB2085		•	•	•
FB15ANEP2	0.5A @ 125V AC	•	•	
HB15	0.1A @ 30V AC/DC	•	•	
HB16		•	•	
HS16-1	12A @ 125V AC 6A @ 250V AC	•	•	
HS16-2		•	•	
HS16-3		•	•	
HS16-4		•	•	
HS16-5		•	•	
HS16-6		•	•	
JPL	TV8, 125V AC	•	•	
JPM	TV5, 125V AC	•	•	
JWL11	TV8, 16A @ 250V AC 5A @ 72V DC (UL)	•	•	•
JWL12		•	•	•
JWL21		•	•	•
JWL22		•	•	•
JWM11	TV5, 10A @ 250V AC 10A @ 30V DC	•	•	•
JWM12		•	•	•
JWM21		•	•	•
JWM22		•	•	•
JWLW11	16A @ 250V AC	•		
JWLW12		•		
JWLW21		•		
JWLW22		•		
JWMW11	10A @ 250V AC 10A @ 30V DC	•		•
JWMW12		•		•
JWMW21		•		•
JWMW22		•		•
JWS11	6A @ 125/250V AC (illum. & nonilluminated)	•	•	•
JWS21		•	•	•

Basic NKK Part No.	Rating Amps@Volts	UL	cULus	CSA
KB15	1A @ 125/250V AC 1A @ 30V DC 0.4VA @ 28V DC	•	•	•
KB16		•	•	•
KB25		•	•	•
KB26		•	•	•
LB15	3A @ 125/250V AC 0.4VA @ 28V DC	•	•	•
LB16		•	•	•
LB25		•	•	•
LB26		•	•	•
LP0125	3A @ 125V AC 3A @ 250V AC 3A @ 30V DC	•	•	
		•	•	
		•	•	
LW3122	10A @ 125V AC 6A @ 250V AC	•	•	
LW3123		•	•	
LW3125		•	•	
LW3128		•	•	
LW3129		•	•	
Toggles				
M2011	6A @ 125V AC 3A @ 250V AC 0.4VA @ 28V DC	•	•	•
M2012		•	•	•
M2013		•	•	•
M2015		•	•	•
M2018		•	•	•
M2019		•	•	•
M2021		•	•	•
M2022		•	•	•
M2023		•	•	•
M2024		•	•	•
M2025		•	•	•
M2026		•	•	•
M2027		•	•	•
M2028		•	•	•
M2029		•	•	•
M2032	6A @ 125V AC 3A @ 250V AC 0.4VA @ 28V DC	•	•	•
M2033		•	•	•
M2035		•	•	•
M2038		•	•	•
M2039		•	•	•
M2042		•	•	•
M2043		•	•	•
M2044		•	•	•
M2045		•	•	•
M2046		•	•	•
M2047	6A @ 125V AC 3A @ 250V AC 0.4VA @ 28V DC	•	•	•
M2048		•	•	•
M2049		•	•	•

Standards & Approvals

See details regarding specific options in each switch section.

Basic NKK Part No.	Rating Amps@Volts	UL	cULus	CSA
Rockers				
M2011	6A @ 125V AC 3A @ 250V AC 0.4VA @ 28V DC	•	•	•
M2012	6A @ 125V AC 3A @ 250V AC 0.4VA @ 28V DC	•	•	•
M2013		•	•	•
M2015		•	•	•
M2018		•	•	•
M2019		•	•	•
M2021	6A @ 125V AC 3A @ 250V AC 0.4VA @ 28V DC	•	•	•
M2022	6A @ 125V AC 3A @ 250V AC 0.4VA @ 28V DC	•	•	•
M2023		•	•	•
M2024		•	•	•
M2025		•	•	•
M2026		•	•	•
M2027		•	•	•
M2028		•	•	•
M2029		•	•	•
M2032	6A @ 125V AC 3A @ 250V AC 0.4VA @ 28V DC	•	•	•
M2033		•	•	•
M2035		•	•	•
M2038		•	•	•
M2039		•	•	•
M2042	6A @ 125V AC 3A @ 250V AC 0.4VA @ 28V DC	•	•	•
M2043		•	•	•
M2045		•	•	•
M2048		•	•	•
M2049		•	•	•
M2044	6A @ 125V AC 3A @ 250V AC 0.4VA @ 28V DC	•	•	•
M2046		•	•	•
M2047		•	•	•
M2112	6A @ 125V AC	•	•	•
M2113		•	•	•
UL & cULus for M2112 & M2113: Only Synchronous Toggles & Rockers with Solder Lug or Straight PC				
M2112	6A @ 125V AC			•
M2113				•
CSA for M2112 & M2113: Only Synchronous Toggles & Rockers				
M2B15	1A @ 125V AC 1A @ 30V DC 0.4VA @ 28V DC	•	•	•
M2B25		•	•	•
M2T12	6A @ 125V AC 3A @ 250V AC 4A @ 30V DC	•	•	•
M2T13		•	•	•
M2T15		•	•	•
M2T18		•	•	•
M2T19		•	•	•
M2T12	0.4VA @ 28V DC	•	•	
M2T13		•	•	
M2T15		•	•	
M2T18		•	•	
M2T19		•	•	

Basic NKK Part No.	Rating Amps@Volts	UL	cULus	CSA
M2T22	6A @ 125V AC 3A @ 250V AC 4A @ 30V DC	•	•	•
M2T23		•	•	•
M2T25		•	•	•
M2T28		•	•	•
M2T29		•	•	•
M2T22	0.4VA @ 28V DC	•	•	
M2T23		•	•	
M2T25		•	•	
M2T28		•	•	
M2T29		•	•	
MB2011	6A @ 125V AC 3A @ 250V AC 0.4VA @ 28V DC	•	•	•
MB2065		•	•	•
MB2061		•	•	
MB2085		•	•	•
MB2181		•	•	•
MB2185		•	•	•
MB2411	3A @ 125V AC 0.4VA @ 28V DC	•	•	•
MB2461		•	•	•
MB2511	3A @ 125V AC 0.4VA @ 28V DC	•	•	•
MB2521		•	•	•
MLW3012	5A @ 125V AC 3A @ 250V AC	•	•	
MLW3013		•	•	
MLW3015		•	•	
MLW3018		•	•	
MLW3019		•	•	
MLW3022	5A @ 125V AC 3A @ 250V AC	•	•	•
MLW3023		•	•	•
MLW3025		•	•	•
MLW3028		•	•	•
MLW3029		•	•	•
MLW3020		•	•	
MRT22	10A @ 125V AC 5A @ 125V AC	•	•	
MRT23		•	•	
MS12	6A @ 125V AC 3A @ 250V AC (nonilluminated)	•	•	
MS13		•	•	
MS22		•	•	
MS23		•	•	
MS12	6A @ 125V AC 3A @ 250V AC 0.4VA @ 28V DC (nonilluminated)			•
MS13				•
MS20				•
MS22				•
MS23				•
P2011	10A @ 125V AC 6A @ 250V AC	•	•	•
P2012		•	•	•
P2013		•	•	•
P2021		•	•	•
P2022		•	•	•
P2023		•	•	•
S1A	10A @ 125V AC 5A @ 250V AC	•	•	
S2A		•	•	
S3A		•	•	
S1A	15A @ 125V AC 6A @ 250V AC			•
S2A				•
S3A				•

See details regarding specific options in each switch section.

Basic NKK Part No.	Rating Amps@Volts	UL	cULus	CSA
S6A S6AL	20A @ 125V AC 10A @ 250V AC	• •	• •	• •
S7A	20A @ 125V AC 10A @ 250V AC			•
S31 S31F	18A @ 125V AC 9A @ 250V AC	• •	• •	
S31 S31F	25A @ 125V AC 9A @ 250V AC			• •
S32 S32F	18A @ 125V AC 9A @ 250V AC	• •	• •	
S32 S32F	25A @ 125V AC 9A @ 250V AC			• •
S33 S33F	18A @ 125V AC 9A @ 250V AC	• •	• •	
S33 S33F	25A @ 125V AC 9A @ 250V AC			• •
S31T S32T S33T	15A @ 125V AC 6A @ 250V AC	• • •	• • •	• • •
S35 S38 S39	15A @ 125V AC 6A @ 250V AC	• • •	• • •	• • •
S41 S41F S41R	18A @ 125V AC 9A @ 250V AC	• • •	• • •	
S41 S42 S43	25A @ 125V AC 9A @ 250V AC			• • •
S41T S42T S43T	15A @ 125V AC 6A @ 250V AC	• • •	• • •	• • •
S42 S42F S42R	18A @ 125V AC 9A @ 250V AC	• • •	• • •	
S42	25A @ 125V AC 9A @ 250V AC			•
S43 S43F S43R	18A @ 125V AC 9A @ 250V AC	• • •	• • •	
S43	25A @ 125V AC 9A @ 250V AC			•
S45 S48 S48R S49 S49R	15A @ 125V AC 6A @ 250V AC	• • • • •	• • • • •	
S114 S116	5A @ 125V AC 2A @ 250V AC			• •

Basic NKK Part No.	Rating Amps@Volts	UL	cULus	CSA
S301 S302 S303	15A @ 125V AC 6A @ 250V AC	• • •	• • •	• • •
S301F	15A @ 125V AC 6A @ 250V AC	•	•	•
S301T S302T S303T	15A @ 125V AC 6A @ 250V AC	• • •	• • •	• • •
S305 S305T S308 S308T S309 S309T	15A @ 125V AC 6A @ 250V AC		• • • 	• • • • • •
S331	25A @ 125V AC 9A @ 250V AC	•	•	•
S331F	25A @ 125V AC 25A @ 250V AC	•	•	
S331R	25A @ 125V AC 9A @ 250V AC	•	•	
S331T	15A @ 125V AC 15A @ 250V AC	•	•	
S332	25A @ 125V AC 9A @ 250V AC			•
S332 S332F S332R	25A @ 125V AC 15A @ 250V AC	• • •	• • •	
S332T	15A @ 125V AC 15A @ 250V AC	•	•	
S333	25A @ 125V AC 9A @ 250V AC			•
S333 S333F S333R	25A @ 125V AC 15A @ 250V AC	• • •	• • •	
S333T	15A @ 125V AC 15A @ 250V AC	•	•	
S335	15A @ 125V AC 6A @ 250V AC	•	•	•
S335F	25A @ 125V AC 15A @ 250V AC	•	•	
S335T	15A @ 125V AC 6A @ 250V AC	•	•	
S338 S338R S338T	15A @ 125V AC 6A @ 250V AC	• • •	• • •	
S339 S339R S339T	15A @ 125V AC 6A @ 250V AC	• • •	• • •	

Standards & Approvals

See details regarding specific options in each switch section.

Basic NKK Part No.	Rating Amps@Volts	UL	cULus	CSA
S821 S822 S823	30A @ 125V AC 30A @ 250V AC	• • •	• • •	• • •
S821D S822D S823D	30A @ 30V DC 15A @ 125V DC	• • •	• • •	• • •
S831 S832 S833	30A @ 125V AC 30A @ 250V AC	• • •	• • •	• • •
S831D S832D S833D	30A @ 30V DC 15A @ 125V DC	• • •	• • •	• • •
SB25	15A @ 125V AC 9A @ 250V AC	•	•	•
SB61A	10A @ 125V AC 5A @ 250V AC	•	•	
SB221NC SB221TNC	3A @ 125V AC 1.5A @ 250V AC	• •	• •	• •
SB221NO SB221TNO	3A @ 125V AC 1.5A @ 250V AC			• •
SB265	6A @ 125V AC 3A @ 250V AC	•	•	•
SB4011NC SB4011NO	3A @ 125V AC 2A @ 250V AC	• •	• •	• •
Low Security SK12AA SK12BA SK13DA SK13EA	3A @ 125V AC 1A @ 250V AC	 • • • •	 • • • •	 • • • •
Medium Security SK12AD SK12BD SK13ED	3A @ 125V AC	 • • •	 • • •	

Basic NKK Part No.	Rating Amps@Volts	UL	cULus	CSA
SW3001A SW3002A SW3003A	15A @ 125V AC 6A @ 250V AC 15A @ 30V DC 10A @ 125V AC (Inductive)	• • •		
SW3001A SW3002A SW3003A	15A @ 125V AC 6A @ 250V AC			• • •
SW3006A	20A @ 125V AC 10A @ 250V AC	•	•	•
SW3007A	15A @ 125V AC 6A @ 250V AC			•
SW3821 SW3822 SW3823	30A @ 125V AC 30A @ 250V AC	• • •	• • •	• • •
SW3821D SW3822D SW3823D	30A @ 30V DC 15A @ 125V DC	• • •	• • •	• • •
SW3831 SW3832 SW3833	30A @ 125V AC 30A @ 250V AC	• • •	• • •	• • •
SW3831D SW3832D SW3833D	30A @ 30V DC 15A @ 125V DC	• • •	• • •	• • •
UB15 UB16 UB25 UB26	5A @ 125V AC 5A @ 250V AC 0.014A @ 28V DC	• • • •	• • • •	
UB15 UB16 UB25 UB26	5A @ 125V AC 5A @ 250V AC 0.4VA @ 28V DC 5A @ 30V DC			• • • •
UB215 UB216 UB225 UB226	5A @ 125V AC 5A @ 250V AC 0.014A @ 28V DC	• • • •	• • • •	
WR11 WR12 WR13 WR15 WR18 WR19	15A @ 125V AC 15A @ 250V AC 15A @ 30V DC	• • • • • •	• • • • • •	
YB15 YB16 YB25 YB26	3A @ 125/250V AC 0.4VA @ 28V AC/DC (Solder Lug only)	• • • •	• • • •	• • • •
YB15 YB16 YB25 YB26	3A @ 125/250V AC 0.4VA @ 28V AC/DC	• • • •	• • • •	• • • •
YB215 YB216 YB225 YB226	3A @ 125/250V AC 0.4VA @ 28V AC/DC	• • • •	• • • •	

Standards & Approvals

VDE (Verband Deutscher Elektrotechniker/Germany)

VDE Approved

Models	Approved Ratings	File or License Numbers	Marking on Case
JPL	8A/128A @ 250V AC 16A (8A) @ 250V AC	097579	Standard
JPM	5A/80A @ 250V AC 10A (6A) @ 250V AC	113494	Standard
JWL	8A/128A @ 250V AC 16A (8A) @ 250V AC	115637	Standard
JWM	5A/80A @ 250V AC 10A (6A) @ 250V AC	115637	Standard

VDE Approved

Models	Approved Ratings	File or License Numbers	Marking on Case
JWS	5A (3A) @ 125/250V AC	119153	Standard
P	10A (6A) @ 125V AC 6A (6A) @ 250V AC	119174	Standard
SW3006A	20A @ 125V AC 10A @ 250V AC	119189	On Request
WR	15A (8A) @ 250V AC	126501	On Request

ISO (International Organization for Standardization)

ISO 9001

ISO 9000 is a set of international standards on quality management and quality assurance. It is not a set of product specifications but requirements for building a quality system with documented and repeatable procedures.

NKK has received the certificate of registration for the ISO 9001 standard, which is for business operations that design, produce, install, and service products.

ISO 14001

ISO 14000 is a new series of voluntary international standards governing environmental management. ISO 14001 is the first of some 20 standards to be developed.

NKK, being a corporation mindful of environmental concerns, has obtained a certificate of registration for ISO 14001. This standard seeks to balance socio-economic and business needs with support of environmental protection and pollution prevention within reach of businesses large and small.

IP Code for Degrees of Protection Provided by Enclosures

The IP code is part of the IEC60529 (International Organization for Standardization) standard recommending the degree of protection of enclosures for low-voltage switch gear; specifically, concerned with protection of persons against contact with live or moving parts and the prevention of ingress of solid foreign bodies and liquid.

The IP code is an industrial specification used internationally and is similar to the NEMA standard.

IP60 dust tight but not protected from water.

IP65 dust tight and protected against water jets.

IP67 dust tight and protected against effects of temporary immersion.

Terms & Acronyms

A

AC Alternating Current; electric current that continually reverses direction at a fixed frequency

alloy A metal created by combining two or more different metals to obtain a desired physical property

alternate action Commonly describing pushbutton switches; remaining in a given circuit condition after removal of actuating force; when actuating force is applied a second time, the opposite circuit is engaged; also known as push-push switching action; may or may not be latchdown

ambient temperature range Operating temperature range

angle of throw Used with rockers and toggles to indicate total travel arc measured in degrees

annealed Relieved of mechanical stress through the application of heat and gradual cooling; for example, annealed copper is less brittle

ANSI American National Standards Institute; a standard-setting agency of the United States which approves the design and/or performance of electrical/electronic components that are distributed in the world market

arcing The flow of electric current between opening or closing switch contacts

AWG American Wire Gauge. Sizes may be determined by measuring the diameter of the conductor (the bare wire) with the insulation removed.

B

bifurcated contact A two-pronged, wiping movable contact

bounce The repeated rebounding of the movable contact during the transfer from one throw to the next; measured in milliseconds

brass An alloy of zinc and copper

break before make Interrupting one circuit of a pole before completing another of the same pole (nonshorting contact)

C

capacitive load A load in which the initial current on make is higher than steady state; upon break it is less than steady state. Current leads voltage in capacitive loads

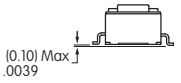
clad The joining of two dissimilar materials by welding or bonding

cleaning Automated cleaning for process sealed devices, manual cleaning for unsealed devices. Cleaning is needed to remove flux from terminals and PC boards

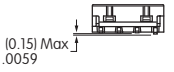
contact resistance The resistance across a pair of closed contacts which is in series with the load; this resistance increases with the age of the switch at a rate varied by environment, frequence of use, voltage, and load conditions; measured in milliohms

convection reflow Automated soldering of surface mount devices by running the PC board with the attached components through a soldering convection oven

coplanarity The profile of the surface tolerance establishes a tolerance zone defined by two parallel planes some distance apart within which all considered surfaces must lie



HP03 Series



All other SMTs

creepage The unwanted flow of electrical current from one conductive part to another

CSA Canadian Standards Association

cULus Underwriters Laboratories Inc. - indicates compliance with both Canada and US requirements

cycle The complete sequence of indexing through all successive switch positions and returning to the original position

D

DC Direct Current; electric current that flows only in one direction

detent A mechanical positioning device for stopping actuator travel at each successive electrical circuit; for example, a spring-operated ball and groove

dielectric strength The ability of an insulating material to withstand high voltage without electrical degradation

differential travel The distance an actuator moves between the point where contacts snap over and where they snap back, or where a contact makes and then breaks

DIP Dual Inline Package, indicating .100" center-to-center terminal spacing and .300" row-to-row spacing

double break Having two pairs of contacts (shorting bar) that open the circuit at two places; having this added contact material improves heat dissipation and increases life; desirable in DC circuit applications

DP Double Pole; see pole

dry circuit A low energy circuit condition where no arcing occurs during contact switching; for example, 0.4VA maximum @ 28V AC/DC maximum; see logic level

DSP National Defense Standards of Japan; NKK file numbers C 6310B & C 6313

DT Double Throw; see throw

dust cover Protects switch in an environment where small particles and dust exist; switch is operable with dust cover in place

E

environmentally sealed Protected for use in harsh environments

F

flash plating A very thin or "instant plating" of usually less than 10 microinches in thickness

flow soldering Automated soldering of through-hole devices on PC boards, also known as wave soldering

flux Chemical used for cleaning metal surfaces so that solder will flow out on the metal; fluxes change a passive, contaminated metal surface into an active, clean, solderable surface

forward voltage (V_F) The typical voltage drop across the LED at the typical forward current.

G

gull wing A type of surface mount terminal which extends from side of switch and has an L-shaped bend at the end

H

horsepower Horsepower, a unit of work, is often found as a rating on electrical motors. One horsepower is equal to 746 watts.

I

inductive load A load in which the initial current on make is lower than steady state and upon break is greater than steady state. The long arcing time, due to stored energy in the inductor at the time of breaking, is severe on the switch contacts.

IEC International Electrotechnical Commission
3 Rue de Varembe
P. O. Box 131
1211 Geneva 20, Switzerland

Terms & Acronyms

IECQ IEC's Quality Assessment System for Electronic Components, created in 1983 to facilitate national and international trade in certified electronic components; a worldwide certification system which provides a method whereby electronic components made and handled by approved manufacturers and distributors can be used anywhere without further testing.

infrared reflow A method of mass soldering surface mount devices with some form of infrared (IR) thermal radiation, such as a lamp IR system where PCB and components are heated largely by radiant energy from IR lamps

inrush The initial, transitory high-level of current through contacts upon making (closing); can cause severe degradation of contacts; applicable to resistive and capacitive loads

insulation resistance The electrical resistance between two normally insulated parts; measured at a specific high potential; usually greater than 1 megohm

IP Ingress Protection (IP) rating system for definition of level of water and dust protection

ISO ISO, International Standards Organization, is a network of the national standards institutes of 146 countries, on the basis of one member per country, with a Central Secretariat in Geneva, Switzerland, that coordinates the system

isolated lamp circuit Independent of switching circuit; lamp is operated on a circuit separate from the switch circuit

J

JEITA Japan Electronics and Information Technology Industries Association

JETL Japan Electrical Testing Laboratory

JIS Japan Industrial Standard; Japan Industrial Standards Committee (JISC) Agency of Industrial Science and Technology

L

lamp load (tungsten) Most notably characterized by the high inrush current at make (approximately 10 to 16 times the steady state)

latchdown One type of alternate action in which the pushbutton is mechanically fastened in the down position; the pushbutton is at "normal" position for one circuit and latched down position for the other circuit condition

LED Light Emitting Diode; provides illumination with advantages of long life and low power consumption

logic level An application in which power levels do not cause arcing, melting, or softening of contacts; also referred to as dry circuit or low energy; specified 0.4VA maximum @ 28V AC/DC maximum; typically requiring gold contacts for reliability

low level Devices that are used in a low level circuit (low voltage and low current) have not been tested by UL and/or CSA. When used as intended in a low level circuit, the results do not produce hazardous energy.

luminous intensity The luminous intensity is the luminous flux emitted from a point per unit solid angle into a particular direction. Standard unit of luminous intensity is Candela (cd), also expressed as Lumen per Steradian (lm/sr).

M

maintained action Remaining in a given circuit condition until actuated to the opposite circuit condition where it is again maintained; opposite momentary action

make before break Completing one circuit of a pole before interrupting another of the same pole (shorting contact)

maximum forward current (I_{FM}) The maximum continuous operating current at 25°C that the LED can withstand. Exceeding the recommended voltage results in serious degrading or destruction of the LED. Operation should be well below the limit.

maximum reverse voltage (V_{RM}) The maximum voltage in the opposite direction that the LED can withstand. Exceeding the recommended voltage results in serious degrading or destruction of the LED. Operation should be well below the limit.

MITI Ministry of Industry & Trade Institute (Japan)

momentary action Mechanically returning from a temporary circuit condition to the normal circuit condition as soon as the actuating force is removed

motor load — Most electric motors are designed to run at 50% to 100% of rated load. Maximum efficiency is usually near 75% of rated load. Thus, a 10-horsepower (hp) motor has an acceptable load range of 5 to 10 hp; peak efficiency is at 7.5 hp. A motor's efficiency tends to decrease dramatically below about 50% load.

MSCP — Mean Spherical Candle Power; a unit of measure of light intensity

N

NC — Normally Closed contacts; circuit is closed when actuator is in relaxed or normal position

NEMA — National Electrical Manufacturers Association, an agency of the United States setting standards for products distributed worldwide; applied to switches in their degrees of protection against the intrusion of liquids, dust, other contaminants

Newton — The unit of measure for operating force abbreviated N; see the conversion tables in the previous section

NO — Normally Open contacts; circuit is open when actuator is in relaxed or normal position; applies to momentary or alternate action switches

nominal — The result of the calculated actual value range

nonshorting contacts — Contacts which break before make

nonswitching rating — The power carrying capability of a switch after contact closure and at the end of contact bounce; usually much higher than the switching rating

O

opaque — Condition that prevents the passage of light

overtravel — The distance an actuator moves beyond the point at which electrical contacts transfer

P

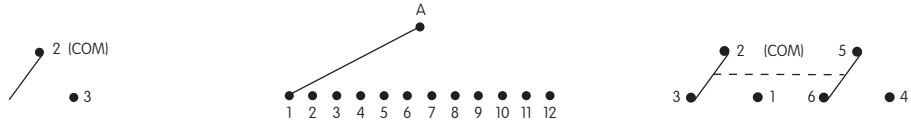
panel seal — Liquid is prevented from reaching the switch contacts from front of the panel if panel is subjected to spills orsplashing

PCB — Printed Circuit Board; thin copper traces on a plastic laminate providing low cost, low current mass wiring

PF — Power Factor; a means of determining contact capability when used with inductive loads relative to the standard resistive load rating; for example, if PF = 1.0 the inductive load is 100% of the resistive load, or if PF = 0.6 the inductive load is 60% of the resistive load

photo interrupter — Light source being interrupted and thus changing the status of an electrical circuit

pole — A single common electrical input having one or more outputs



Single Pole (with 1 output) **Single Pole** (with 12 outputs) **Double Pole** (with 2 outputs)

position — The mechanical detents of a switch actuator

PPS — Polyphenylene sulfide; a thermoplastic resin which is chemical and flame resistant

pretravel — The distance an actuator moves before a change in the electrical condition is made

process compatible — Capable of subjection to automated cleaning procedures after wave soldering; often noted as "washable"

process sealed — Sealed to withstand the entire automated processing including the final cleaning

protective guard — Prevents accidental actuation; switch is not operable when protective guard is in place

push-push — Also known as alternate action; is not latchdown

Terms & Acronyms

R

RCJ Reliability Center for Electronic Components of Japan, member of EXACT (International Exchange of Authenticated Electronic Component Performance Test Data)

resistive load The easiest load to switch because current and voltage are in a steady state on make and drop instantly to zero on break; produces minimal arcing which maximizes contact life

RMS Root Mean Square

RoHS Restriction of Hazardous Substances in Electrical and Electronic Equipment directive restricting the use of lead, cadmium, mercury, hexavalent chromium and PBB/PBDE flame retardant materials in electrical and electronic products sold in Europe beginning July 1, 2006

S

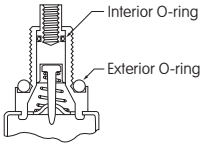
shorting contacts Contacts which make before break

silicone rubber Rubber made from silicone elastomers and noted for its retention of flexibility, resilience, and tensile strength over a wide temperature range

SIP Single Inline Package, indicating .100" center-to-center terminal spacing with terminals aligned in one row

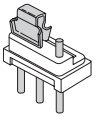
snap action The abrupt transfer of contacts from one position to another; this action is relatively independent of the speed of actuator travel

splashproof Prevents entry of liquids at front panel generally by means of one or two internal o-rings, as illustrated here



SPST Single Pole Single Throw; see pole, also throw

STC Sliding Twin Contact, a mechanism with two movable contact surfaces which pinch the stationary contacts. The STC contact mechanism provides smooth, positive detent actuation, unparalleled logic-level reliability, and more contact stability than conventional mechanisms. Continued reliability is assured since the gold-plated contacts are wiped clean with each actuation. Furthermore, if one side of the twin contacts should fail to conduct, the other side functions as a backup or a fail-safe path for the current. The combination of rounded movable and stationary contacts provides the smooth contact feel not found previously in sliding contact type mechanisms.



surface mount SMD or SMT Component terminals are soldered to pads on the surface of the PC boards as opposed to using holes for mounting; terminal shapes vary – gull wing, J-bend, and others

synchronous lamp circuit Lamp is operated on a circuit in phase with the switch; the switch contains a separate circuit to open or close the lamp circuit simultaneously with the switching circuit

T

tactile feedback The switching action felt by an operator

tamperproof Designed to prevent tampering or provide evidence of tampering; impervious to tampering

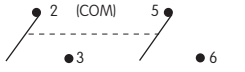
tamper resistant Designed to make tampering difficult or resistive

thermal shock The state of a component that is undergoing an excessive temperature change, particularly in reference to movement from one process to another in soldering and cleaning

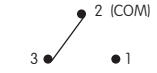
thermoplastic A plastic which is flexible and easily molded when heated and which becomes hard and regid when cooled

thermoset A plastic which becomes hard and rigid when heated or cured

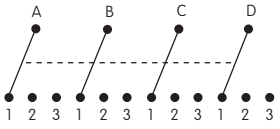
throw The number of electrical circuits within a pole



Single Throw (with 2 poles)



Double Throw (with 1 pole)



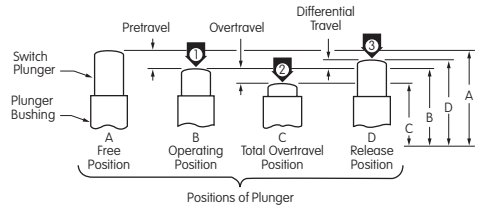
Three Throw (with 4 poles)

total travel — Sum of pretravel and overtravel; full distance an actuator moves from relaxed position past the point of electrical contact and to the end of travel

translucent — Transmitting and diffusing light so that objects beyond cannot be seen clearly

transparent — Transmitting light without appreciably scattering so that objects lying beyond are entirely visible

travel — The distance the actuator moves to effect the change of electrical circuits; see also differential travel, pretravel, overtravel, and total travel



two circuit — Circuit in which one circuit is completed in one position and another separate circuit is completed in the other position

typical forward current (I_F) — The test condition at 25°C. It is recommended that the current be at or below the Typical Forward Current.

U

UL — Underwriters Laboratories Inc.; many of NKK's switches are UL Recognized

undercoating — A coating used for preparation of a surface for plating or used to prevent corrosion when the finish plating develops pinholes; thickness of an undercoating is determined by its purpose

V

vapor phase — A process well-suited to soldering surface mount devices; it combines infrared preheating with condensation heating for reflow, advantageous for eliminating overheating of components and PCB

VDE — Verband Deutscher Elektrotechniker of Germany

W

watertight — Impermeable to water except when subjected to immersion; not waterproof

wavelength — The color of visable light is measured by its wavelength. The Greek symbol "lambda"is used to represent wavelength, the unit of measure is nm.

wave soldering — A method of soldering in which a wave of molten solder contacts surfaces as the PC board with components is conveyed through the process; wave width, travel speed, dwell time, etc. are varied to achieve desired results

WEEE — Waste Electrical and Electronic Equipment
Directive aims at prevention of WEEE and its reuse, recycling and recovery, so as to reduce the disposal of this type of waste. The directive sets targets for the separate collection of WEEE, along with standards for treatment and targets for recycling and recovery.

wiping action — Sliding of contacts over one another resulting in cleaning of the surfaces

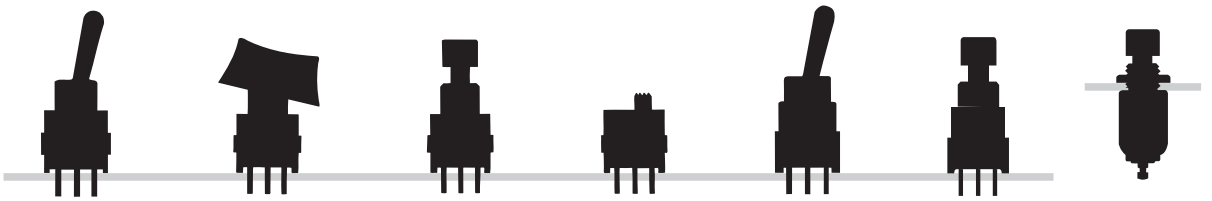
FEDERAL SUPPLY CODE

NKK Switches has been assigned the
FSC Number 63426
and is classified as a
Commercial and Governmental Entity (CAGE)
by the Defense Logistics Agency
in Battle Creek, Michigan.

Product Overview

Ultra-Miniature & Subminiature

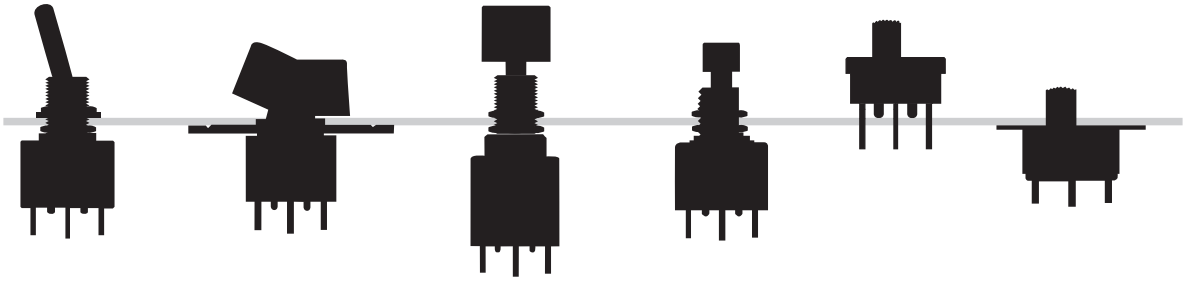
Toggles
Rockers
Pushbuttons
Slides



A Toggles | A Rockers | A Pushbuttons | A Slides | B Toggles | B Pushbuttons | FB Pushbuttons

Miniature

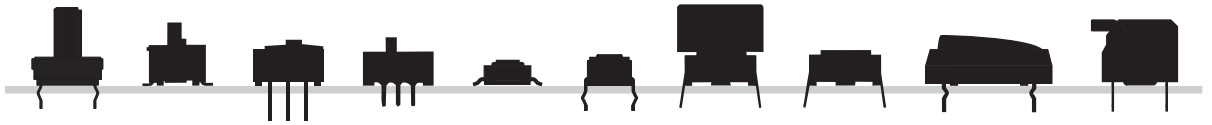
Toggles
Rockers
Pushbuttons
Slides



M Toggles | M Rockers | MB2000 | MB2400 | CS Slides | MS Slides

Specialty

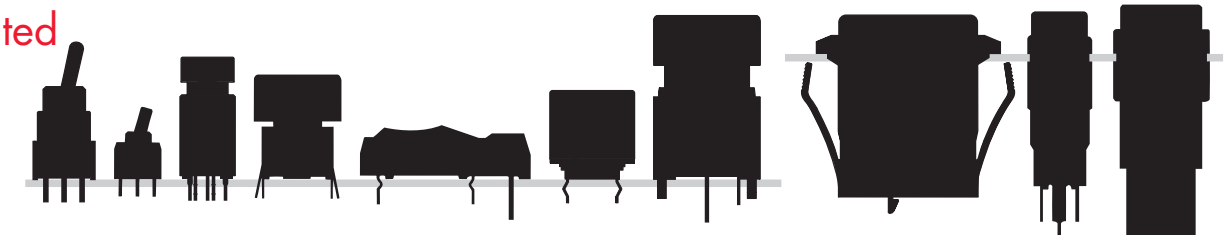
Rotaries
DIP Rotaries
Tactiles
Slides
Keylocks
Tilt Switches



FR01 FR02 | ND ND3 | SM | SS SS3 | CB CB3 | HP02 HP03 | JB | JB | JF | JS

Illuminated

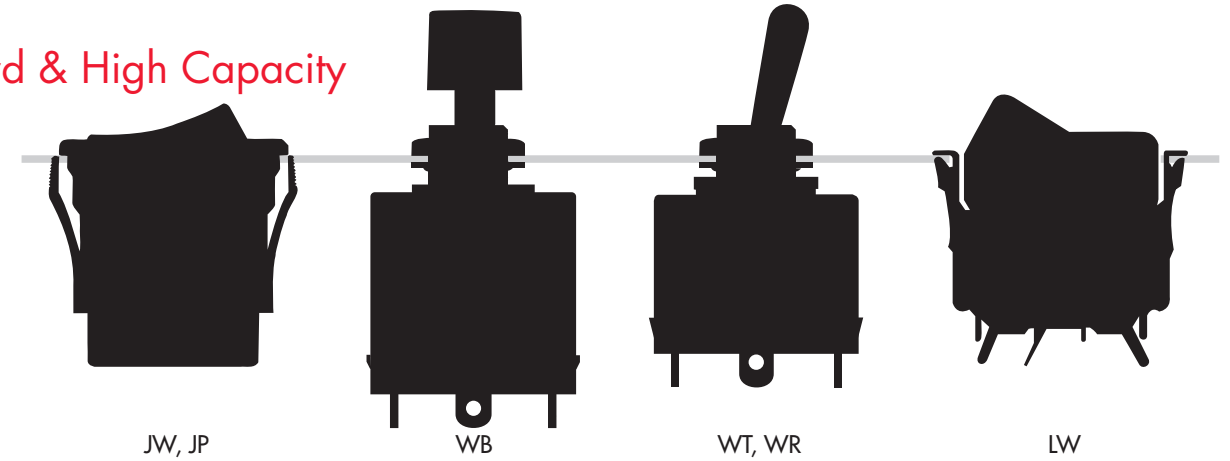
Toggles
Rockers
Pushbuttons
Tactiles
Slides



B Toggles | G GB GW | HB2 | JB | JF | NP01 | KP | FP | HB | KB

Standard & High Capacity

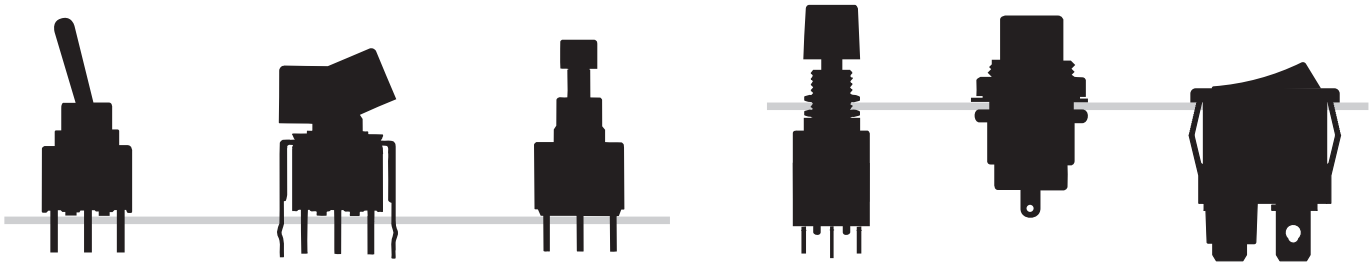
Toggles
Rockers
Pushbuttons
Rotaries



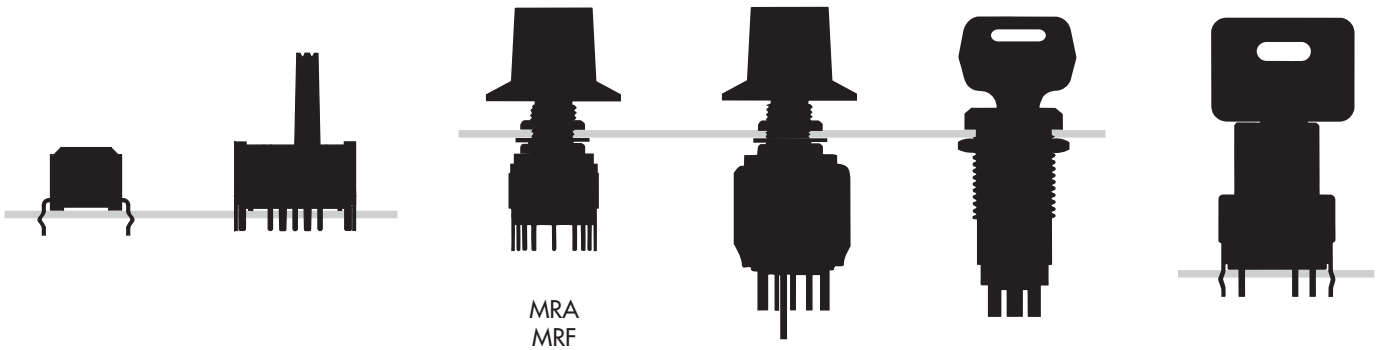
JW, JP | WB | WT, WR | LW

Product Overview

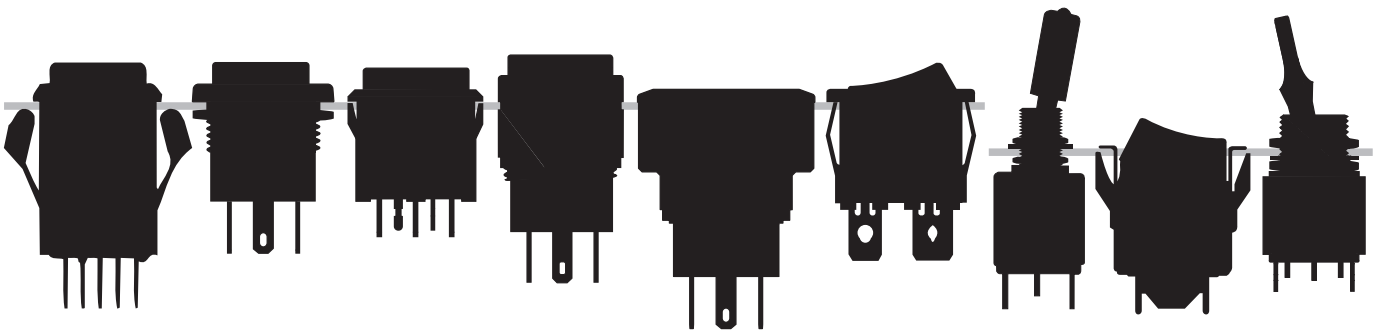
G Toggles | G Rockers | GB | G3T | G3B | GW | GB2



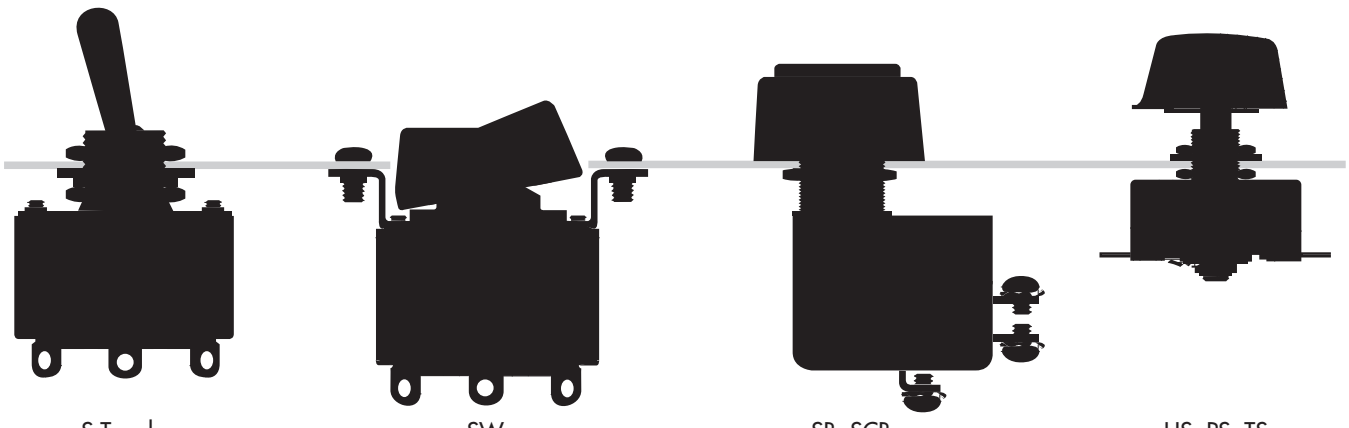
M2T Toggles | M2T Rockers | M2B | EB | SB40 | CW



DS Tilt | FS | MRA, MRF, MRK | MRX, MRY, MRT | CK, SK | SK



LB | LP | UB, UB2 | YB | YB2 | CW | M2100 | MLW | TL



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Warranty: All NKK products are warranted against defects in workmanship, material and construction for a period of one (1) year from the date of shipment if the products have been properly installed, used, and maintained. There are no express warranties of merchantability or fitness for a particular purpose. Materials, finishes, and component parts are subject to change without notification.

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