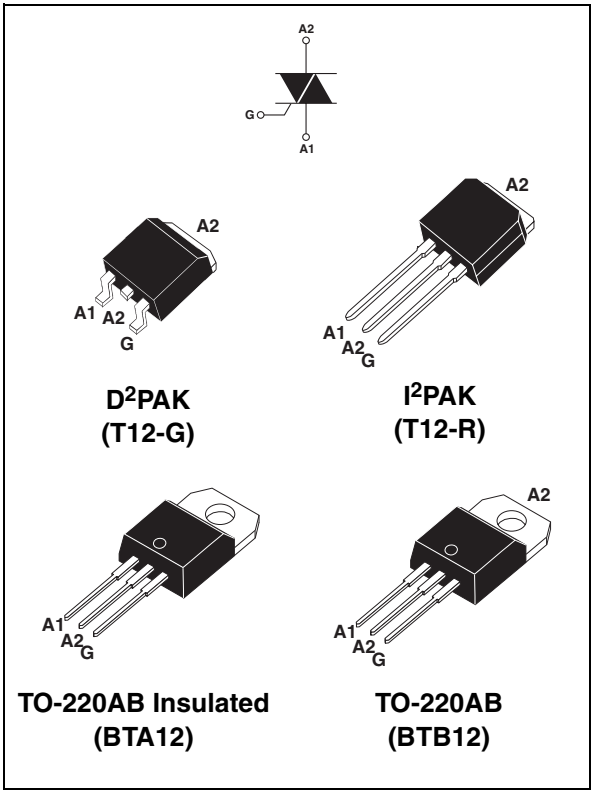
BTA12, BTB12 and T12 Series

SNUBBERLESS™, LOGIC LEVEL & STANDARD

12A TRIACs

Table 1: Main Features

Symbol	Value	Unit
$I_{T(RMS)}$	12	A
V_{DRM}/V_{RRM}	600 and 800	V
$I_{GT\ (Q_1)}$	5 to 50	mA



D²PAK (T12-G)

I²PAK (T12-R)

TO-220AB Insulated (BTA12)

TO-220AB (BTB12)

DESCRIPTION

Available either in through-hole or surface-mount packages, the **BTA12, BTB12** and **T12** triac series is suitable for general purpose AC switching. They can be used as an ON/OFF function in applications such as static relays, heating regulation, induction motor starting circuits... or for phase control operation in light dimmers, motor speed controllers,...

The snubberless versions (BTA/BTB...W and T12 series) are specially recommended for use on inductive loads, thanks to their high commutation performances.

Logic level versions are designed to interface directly with low power drivers such as microcontrollers.

By using an internal ceramic pad, the BTA series provides voltage insulated tab (rated at $2500V_{RMS}$) complying with UL standards (File ref.: E81734).

Table 2: Order Codes

Part Number	Marking
BTA12-xxxxxRG	See page table 8 on page 9
BTB12-xxxxxRG	
T12xx-xxxG	
T12xx-xxxG-TR	
T12xx-xxxR	

Table 3: Absolute Maximum Ratings

Symbol	Parameter			Value	Unit
$I_{T(RMS)}$	RMS on-state current (full sine wave)	I^2PAK/D^2PAK/ TO-220AB	T_c = 105°C	12	A
		TO-220AB Ins.	T_c = 90°C		
I_{TSM}	Non repetitive surge peak on-state current (full cycle, T_j initial = 25°C)	F = 50 Hz	t = 20 ms	120	A
		F = 60 Hz	t = 16.7 ms	126	
I^2t	I^2t Value for fusing	t_p = 10 ms		78	A^2s
dI/dt	Critical rate of rise of on-state current I_G = 2 x I_{GT} , $t_r \leq$ 100 ns	F = 120 Hz	T_j = 125°C	50	A/µs
V_{DSM}/V_{RSM}	Non repetitive surge peak off-state voltage	t_p = 10 ms	T_j = 25°C	V_{DRM}/V_{RRM} + 100	V
I_{GM}	Peak gate current	t_p = 20 µs	T_j = 125°C	4	A
$P_{G(AV)}$	Average gate power dissipation		T_j = 125°C	1	W
T_{stg} T_j	Storage junction temperature range Operating junction temperature range			- 40 to + 150 - 40 to + 125	°C

Tables 4: Electrical Characteristics (T_j = 25°C, unless otherwise specified)

■ **SNUBBERLESS and Logic Level (3 quadrants)**

Symbol	Test Conditions	Quadrant		T12	BTA12 / BTB12				Unit
				T1235	TW	SW	CW	BW	
I_{GT} (1)	V_D = 12 V R_L = 30 Ω	I - II - III	MAX.	35	5	10	35	50	mA
V_{GT}		I - II - III	MAX.	1.3					V
V_{GD}	V_D = V_{DRM} R_L = 3.3 kΩ T_j = 125°C	I - II - III	MIN.	0.2					V
I_H (2)	I_T = 100 mA		MAX.	35	10	15	35	50	mA
I_L	I_G = 1.2 I_{GT}	I - III	MAX.	50	10	25	50	70	mA
		II		60	15	30	60	80	
dV/dt (2)	V_D = 67 %V_{DRM} gate open T_j = 125°C		MIN.	500	20	40	500	1000	V/µs
(dI/dt)c (2)	(dV/dt)c = 0.1 V/µs T_j = 125°C		MIN.		3.5	6.5			A/ms
	(dV/dt)c = 10 V/µs T_j = 125°C				1	2.9			
	Without snubber T_j = 125°C			6.5			6.5	12	

■ **Standard (4 quadrants)**

Symbol	Test Conditions	Quadrant		BTA12 / BTB12		Unit
				C	B	
I_{GT} (1)	V_D = 12 V R_L = 30 Ω	I - II - III IV	MAX.	25 50	50 100	mA
V_{GT}		ALL	MAX.	1.3		V
V_{GD}	$V_D = V_{DRM}$ R_L = 3.3 kΩ T_j = 125°C	ALL	MIN.	0.2		V
I_H (2)	I_T = 500 mA		MAX.	25	50	mA
I_L	$I_G = 1.2\ I_{GT}$	I - III - IV	MAX.	40	50	mA
		II		80	100	
dV/dt (2)	V_D = 67 %V_{DRM} gate open T_j = 125°C		MIN.	200	400	V/µs
(dV/dt)c (2)	(dI/dt)c = 5.3 A/ms T_j = 125°C		MIN.	5	10	V/µs

Table 5: Static Characteristics

Symbol	Test Conditions			Value	Unit
V_T (2)	I_{TM} = 17 A t_p = 380 µs	T_j = 25°C	MAX.	1.55	V
V_{t0} (2)	Threshold voltage	T_j = 125°C	MAX.	0.85	V
R_d (2)	Dynamic resistance	T_j = 125°C	MAX.	35	mΩ
I_{DRM} I_{RRM}	$V_{DRM} = V_{RRM}$	T_j = 25°C	MAX.	5	µA
		T_j = 125°C		1	mA

Note 1: minimum I_{GT} is guaranted at 5% of I_{GT} max.

Note 2: for both polarities of A2 referenced to A1.

Table 6: Thermal resistance

Symbol	Parameter			Value	Unit
$R_{th(j-c)}$	Junction to case (AC)		I^2PAK / D^2PAK / TO-220AB	1.4	°C/W
			TO-220AB Insulated	2.3	
$R_{th(j-a)}$	Junction to ambient	S = 1 cm^2	D^2PAK	45	°C/W
			TO-220AB / I^2PAK TO-220AB Insulated	60	

S = Copper surface under tab.

Figure 1: Maximum power dissipation versus RMS on-state current (full cycle)

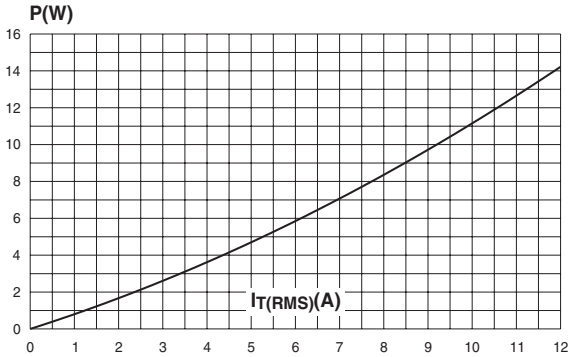


Figure 2: RMS on-state current versus case temperature (full cycle)

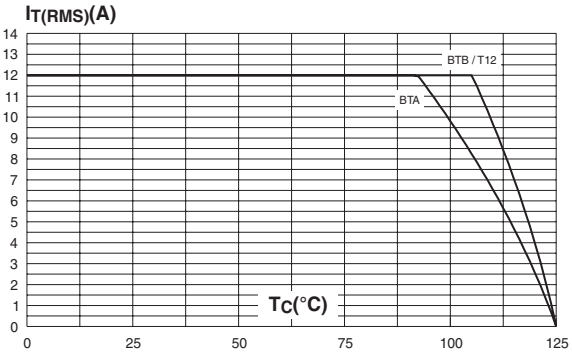


Figure 3: RMS on-state current versus ambient temperature (printed circuit board FR4, copper thickness: 35µm) (full cycle)

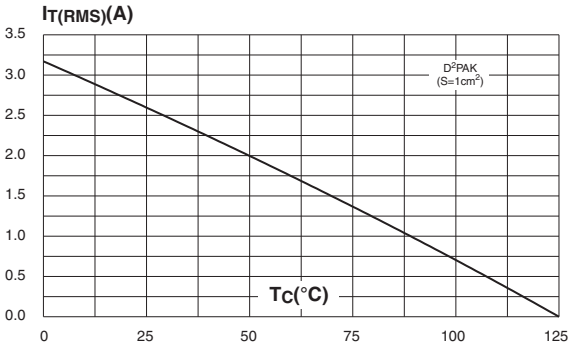


Figure 4: Relative variation of thermal impedance versus pulse duration

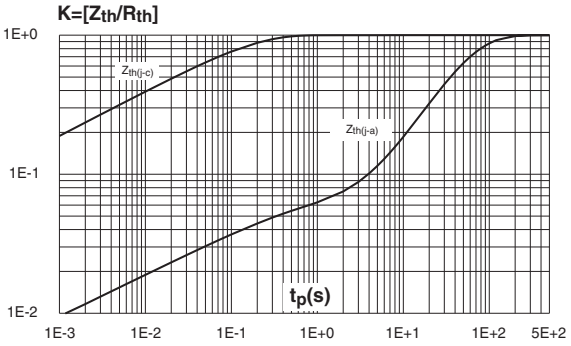


Figure 5: On-state characteristics (maximum values)

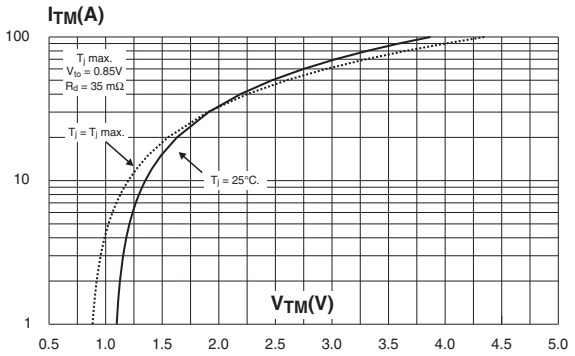


Figure 6: Surge peak on-state current versus number of cycles

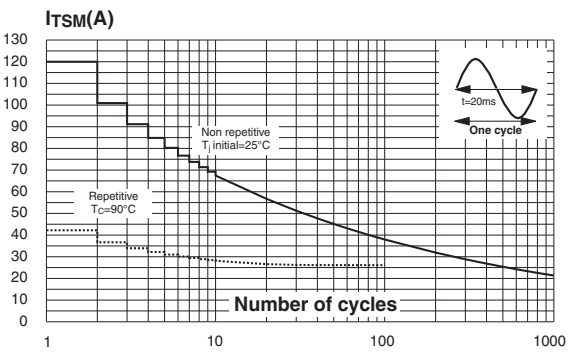


Figure 7: Non-repetitive surge peak on-state current for a sinusoidal pulse with width t_p < 10 ms and corresponding value of I^2t

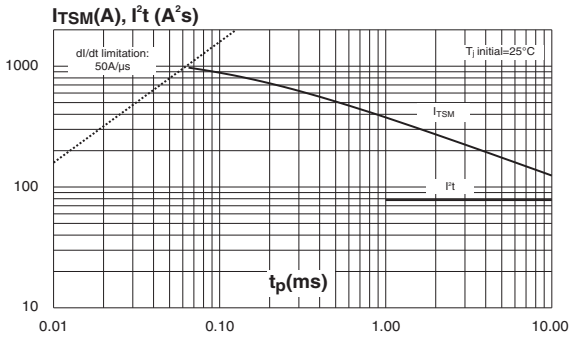


Figure 8: Relative variation of gate trigger current, holding current and latching current versus junction temperature (typical values)

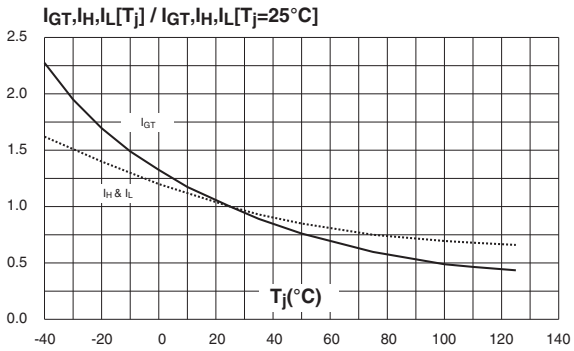


Figure 9: Relative variation of critical rate of decrease of main current versus (dV/dt)c (typical values) (BW/CW/T1210/T1235)

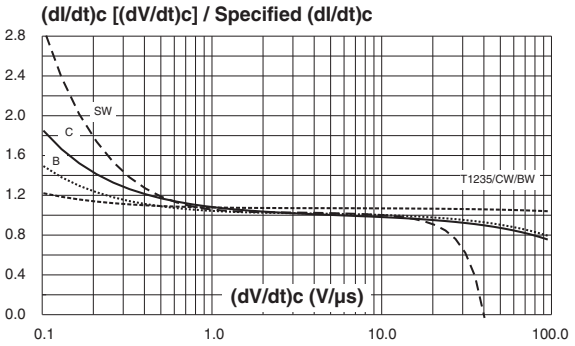


Figure 10: Relative variation of critical rate of decrease of main current versus (dV/dt)c (typical values) (TW)

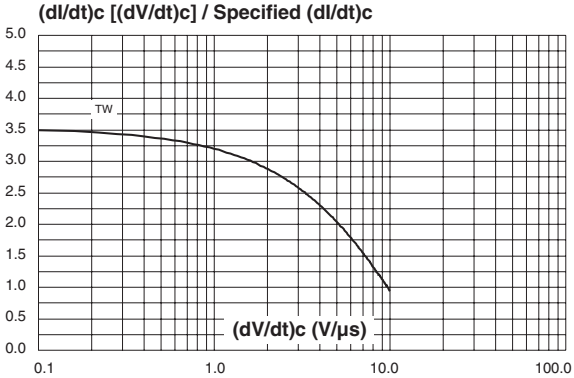


Figure 11: Relative variation of critical rate of decrease of main current versus junction temperature

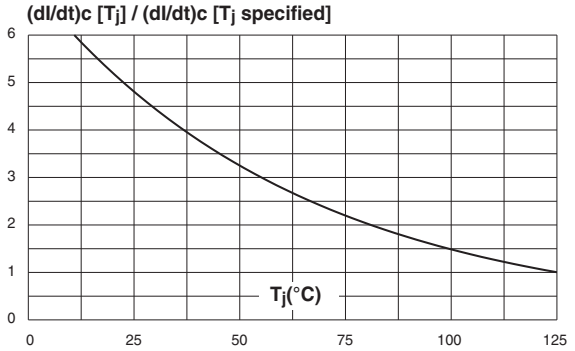


Figure 12: D^2PAK Thermal resistance junction to ambient versus copper surface under tab (printed circuit board FR4, copper thickness: 35 µm)

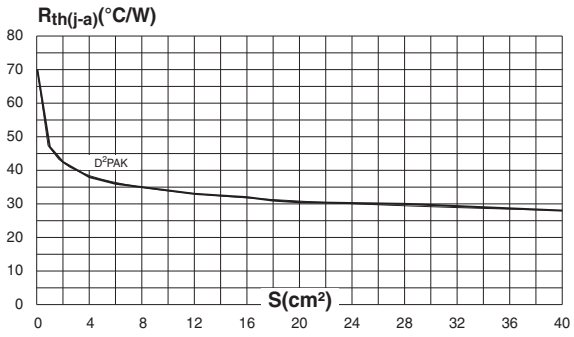


Figure 13: Ordering Information Scheme (BTA and BTB series)

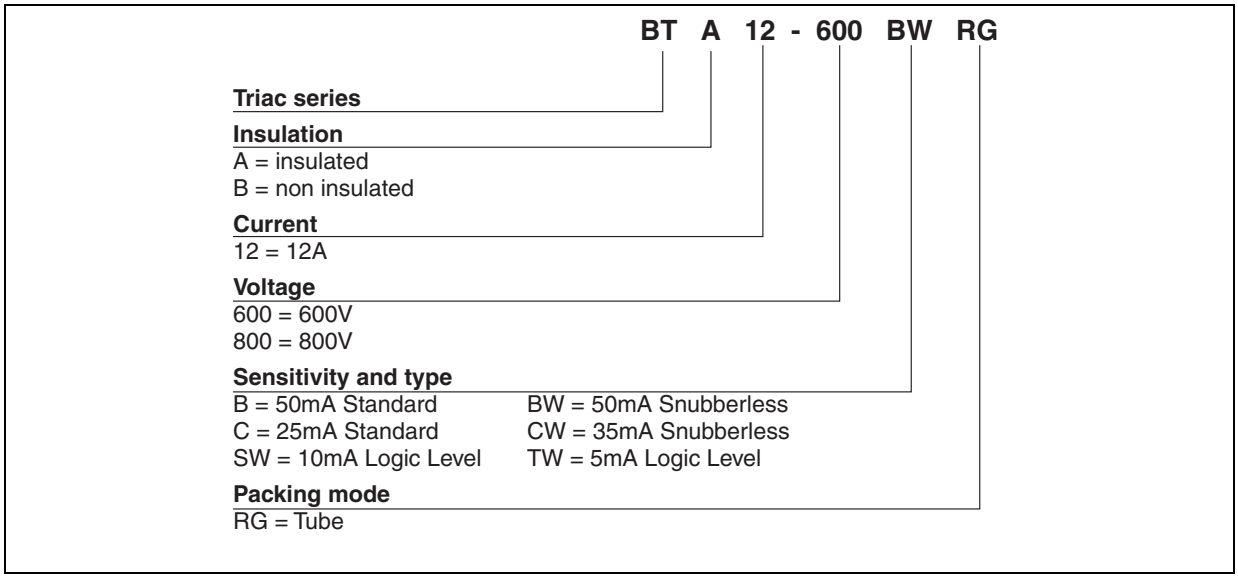


Figure 14: Ordering Information Scheme (T12 series)

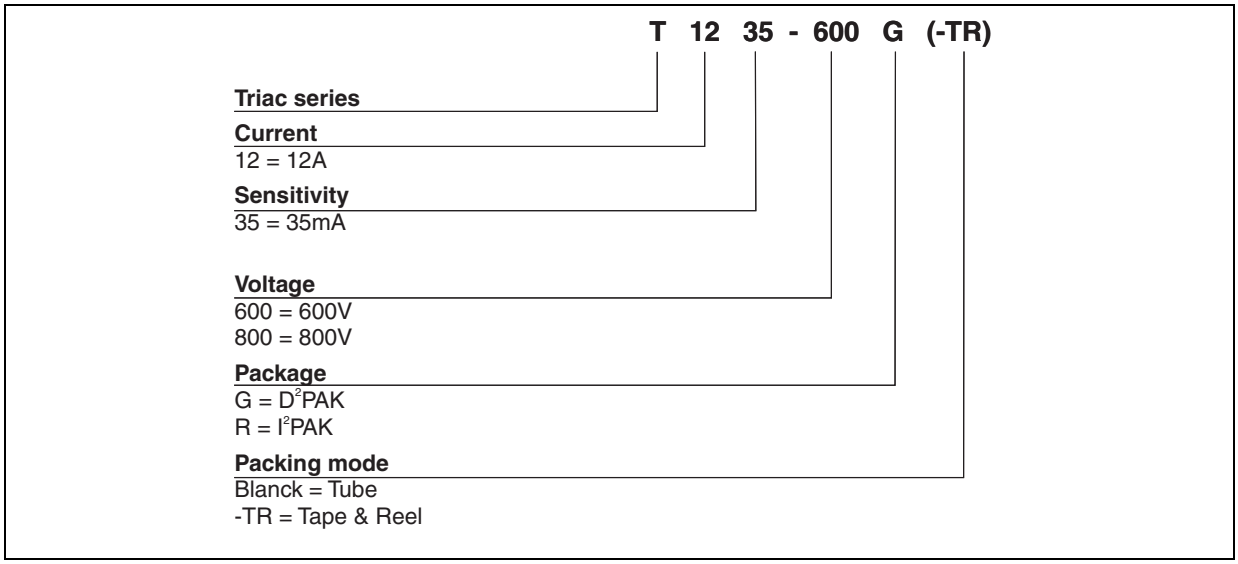
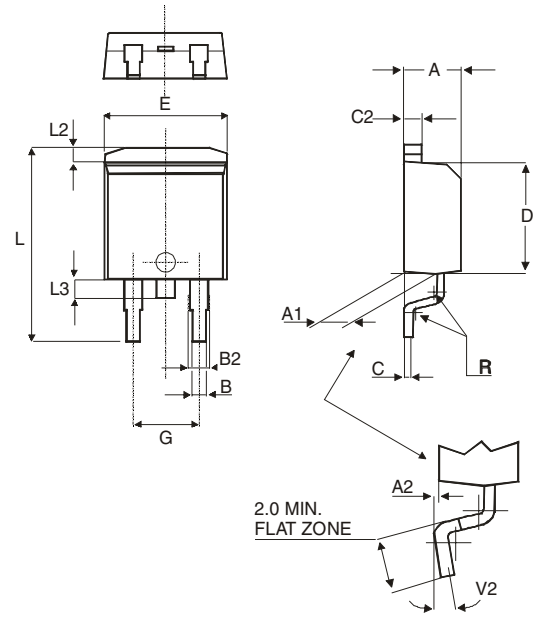


Table 7: Product Selector

Part Number	Voltage (xxx)		Sensitivity	Type	Package
	600 V	800 V			
BTA/BTB12-xxxBRG	X	X	50 mA	Standard	TO-220AB
BTA/BTB12-xxxBWRG	X	X	50 mA	Snubberless	TO-220AB
BTA/BTB12-xxxCRG	X	X	25 mA	Standard	TO-220AB
BTA/BTB12-xxxCWRG	X	X	35 mA	Snubberless	TO-220AB
BTA/BTB12-xxxSWRG	X	X	10 mA	Logic Level	TO-220AB
BTA/BTB12-xxxTWRG	X	X	5 mA	Logic Level	TO-220AB
T1235-xxxG	X	X	35 mA	Snubberless	D^2PAK
T1235-xxxR	X	X	35 mA	Snubberless	I^2PAK

BTB: non insulated TO-220AB package

Figure 15: D²PAK Package Mechanical Data



REF.	DIMENSIONS					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	4.30		4.60	0.169		0.181
A1	2.49		2.69	0.098		0.106
A2	0.03		0.23	0.001		0.009
B	0.70		0.93	0.027		0.037
B2	1.25	1.40		0.048	0.055	
C	0.45		0.60	0.017		0.024
C2	1.21		1.36	0.047		0.054
D	8.95		9.35	0.352		0.368
E	10.00		10.28	0.393		0.405
G	4.88		5.28	0.192		0.208
L	15.00		15.85	0.590		0.624
L2	1.27		1.40	0.050		0.055
L3	1.40		1.75	0.055		0.069
R		0.40			0.016	
V2	0°		8°	0°		8°

Figure 16: D²PAK Foot Print Dimensions
(in millimeters)

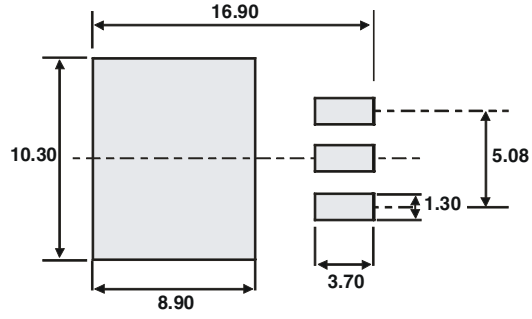
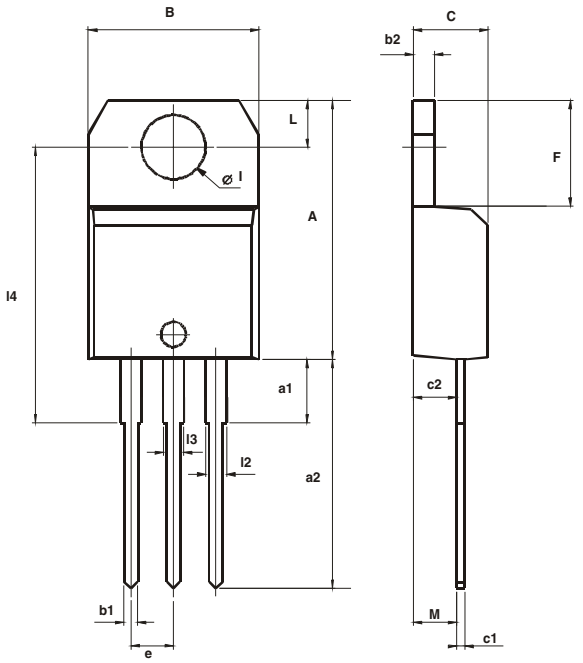
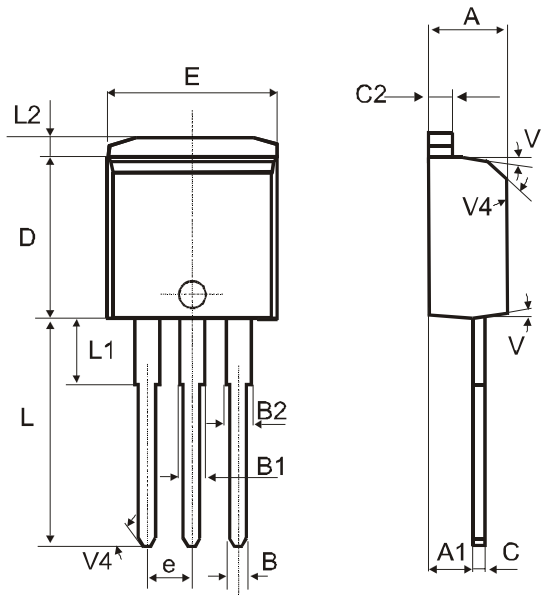


Figure 17: TO-220AB Insulated and non insulated) Package Mechanical Data



REF.	DIMENSIONS					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	15.20		15.90	0.598		0.625
a1		3.75			0.147	
a2	13.00		14.00	0.511		0.551
B	10.00		10.40	0.393		0.409
b1	0.61		0.88	0.024		0.034
b2	1.23		1.32	0.048		0.051
C	4.40		4.60	0.173		0.181
c1	0.49		0.70	0.019		0.027
c2	2.40		2.72	0.094		0.107
e	2.40		2.70	0.094		0.106
F	6.20		6.60	0.244		0.259
I	3.75		3.85	0.147		0.151
l4	15.80	16.40	16.80	0.622	0.646	0.661
L	2.65		2.95	0.104		0.116
l2	1.14		1.70	0.044		0.066
l3	1.14		1.70	0.044		0.066
M		2.60			0.102	

Figure 18: I²PAK Package Mechanical Data



REF.	DIMENSIONS					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	4.30		4.60	0.169		0.181
A1	2.49		2.69	0.098		0.106
B	0.70		0.93	0.028		0.037
B1	1.20		1.38	0.047		0.054
B2	1.25	1.40		0.049	0.055	
C	0.45		0.60	0.018		0.024
C2	1.21		1.36	0.048		0.054
D	8.95		9.35	0.352		0.368
e	2.44		2.64	0.096		0.104
E	10.00		10.28	0.394		0.405
L	13.10		13.60	0.516		0.535
L1		3.75			0.147	
L2	1.27		1.40	0.050		0.055
V		5°			5°	
V4		45°			45°	

Table 8: Ordering Information

Ordering type	Marking	Package	Weight	Base qty	Delivery mode
BTA/BTB12-xxxyzRG	BTA/BTB12-xxxyz	TO-220AB	2.3 g	50	Tube
T1235-xxxG	T1235xxxG	D^2PAK	1.5 g	50	Tube
T1235-xxxG-TR	T1235xxxG			1000	Tape & reel
T1235-xxxR	T1235-xxxR	I^2PAK	1.5 g	50	Tube

Note: xxx = voltage, yy = sensitivity, z = type

Table 9: Revision History

Date	Revision	Description of Changes
Sep-2002	6A	Last update.
01-Jun-2005	7	1. I^2PAK package added. 2. TO-220AB delivery mode changed from bulk to tube.