

# Features

- 2MOPP, 250VAC working voltage isolation
- Clearance and creepage distance >8mm
- Up to 10kVDC reinforced insulation
- IEC/EN/UL 60601 certified with CB Report (3rd Ed. Safety, 4th Ed. EMC)
- -40°C to +75°C operation, no derating
- 2:1 wide input range

# Regulated Converter

## Description

The REM6E series of medical grade regulated DC/DC converters feature reinforced 250VAC continuous working isolation with >8mm creepage/clearance. The compact DIP24 package offers industry standard pinouts with tightly regulated single/dual outputs and UVLO, SCP, OCP and OVP. The operating ambient temperature range is from -40°C to +75°C without derating. The converters are UL marked and certified to CB, IEC, EN and ANSI/AAMI 60601 3rd. Ed. Safety and 4th Ed. EMC medical standards. The low 1µA leakage current makes them suitable for medical B, BF and CF applications.

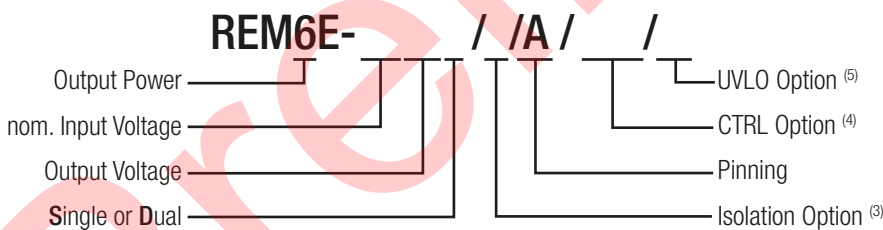
## Selection Guide

Part Number	nom. Input Voltage [VDC]	Output Voltage [VDC]	Output Current [mA]	Efficiency typ. <sup>(1)</sup> [%]	Max. Capacitive Load <sup>(2)</sup> [µF]
REM6E-xx09S/R <sup>(3)</sup> /A <sup>(4,5)</sup>	12 / 24 / 48	9	667	81 / 82 / 83	2200
REM6E-xx12S/R <sup>(3)</sup> /A <sup>(4,5)</sup>	12 / 24 / 48	12	500	82 / 83 / 84	2200
REM6E-xx15S/R <sup>(3)</sup> /A <sup>(4,5)</sup>	12 / 24 / 48	15	400	83 / 84 / 84	2200
REM6E-xx24S/R <sup>(3)</sup> /A <sup>(4,5)</sup>	12 / 24 / 48	24	250	83 / 84 / 85	1000
REM6E-xx09D/R <sup>(3)</sup> /A <sup>(4,5)</sup>	12 / 24 / 48	±9	±335	81 / 82 / 83	±2200
REM6E-xx12D/R <sup>(3)</sup> /A <sup>(4,5)</sup>	12 / 24 / 48	±12	±250	82 / 83 / 84	±2200
REM6E-xx15D/R <sup>(3)</sup> /A <sup>(4,5)</sup>	12 / 24 / 48	±15	±200	83 / 84 / 84	±2200

### Notes:

- Note1: Efficiency is tested at nominal input and full load at +25°C ambient  
 Note2: Max Cap Load is tested at nominal input and full resistive load

## Model Numbering



### Notes:

- Note3: add suffix „/R8“ for 8kVDC or „/R10“ for 10kVDC isolation  
 Note4: add suffix „/CTRL“ for fitted CTRL pin  
 Note5: add suffix „/X1“ for Under Voltage Lockout Option

### Ordering Examples

- REM6E-1209S/R8/A = 12Vin, 9Vout, single, 8kVDC isolation and „A“ pinning  
 REM6E-1212D/R8/A/CTRL = 12Vin, 12Vout, dual, 8kVDC isolation, „A“ pinning and with CTRL pin  
 REM6E-2448S/R8/A/X1 = 24Vin, 48Vout, single, 8kVDC isolation, „A“ pinning and with UVLO Option  
 REM6E-2424D/R10/A/CTRL/X1 = 24Vin, 24Vout, dual, 10kVDC isolation, „A“ pinning, CTRL pin and UVLO option

## REM6E

6 Watt  
 2:1 Input  
 DIP24  
 Single & Dual  
 Output



2MOPP  
250VAC



IEC60601-1 pending  
 EN60601-1 pending  
 IEC60601-1-2 pending

**Specifications** (measured @ Ta= 25°C, nom. Vin, full load and after warm-up unless otherwise stated)

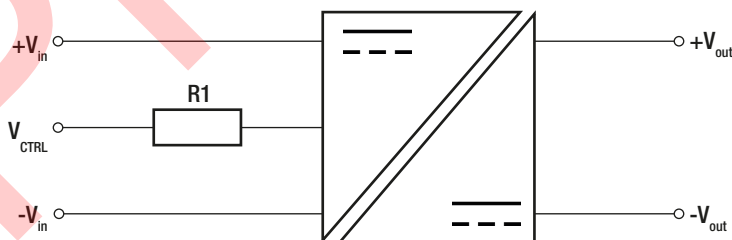
**BASIC CHARACTERISTICS**

Parameter	Condition		Min.	Typ.	Max.
Internal Input Filter			Pi-type		
Input Voltage Range	nom. Vin = 12VDC nom. Vin = 24VDC nom. Vin = 48VDC		9VDC 18VDC 36VDC	12VDC 24VDC 48VDC	18VDC 36VDC 75VDC
Under Voltage Lockout (UVLO) („/X1“ version)	nom. Vin= 12VDC	DC-DC ON DC-DC OFF		7.9VDC	9VDC
	nom. Vin= 24VDC	DC-DC ON DC-DC OFF		16.7VDC	18VDC
	nom. Vin= 48VDC	DC-DC ON DC-DC OFF		34.3VDC	36VDC
Input Current	nom. Vin = 12VDC nom. Vin = 24VDC nom. Vin = 48VDC			650mA 320mA 150mA	
Quiescent Current	nom. Vin = 12VDC nom. Vin = 24VDC nom. Vin = 48VDC				35mA 25mA 7mA
Minimum Load <sup>(7)</sup>				10%	
Start-up time				0.6ms	
Rise time				0.45ms	
Hold-up time				0.6ms	
ON/OFF CTRL	DC-DC ON DC-DC OFF		Open or $0V < V_{CTRL} < 1.2V$ Short or $4.8V < V_{CTRL} < 12VDC$		
Input Current of CTRL Pin	@5V $V_{CTRL}$			25mA	
Standby Current	DC-DC OFF				350µA
Internal Operating Frequency			120kHz		
Output Ripple and Noise <sup>(6)</sup>	20MHz BW				150mVp-p

**Notes:**

Note6: Measurements are made with a 1.0µF MLCC across output. (low ESR)

**ON/OFF CTRL Option**

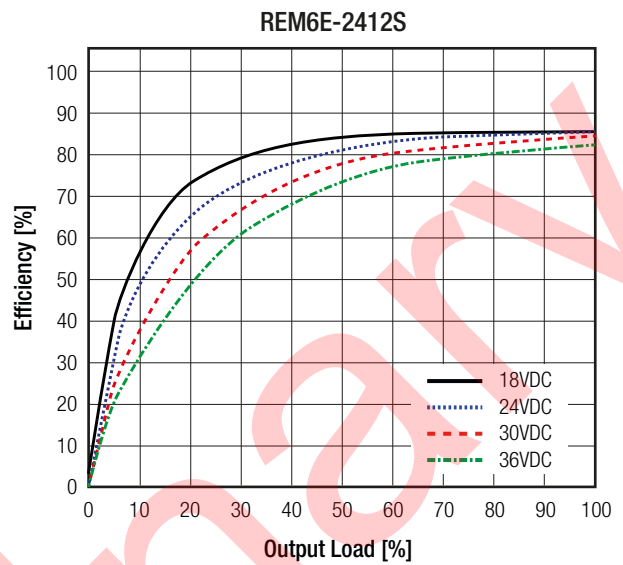
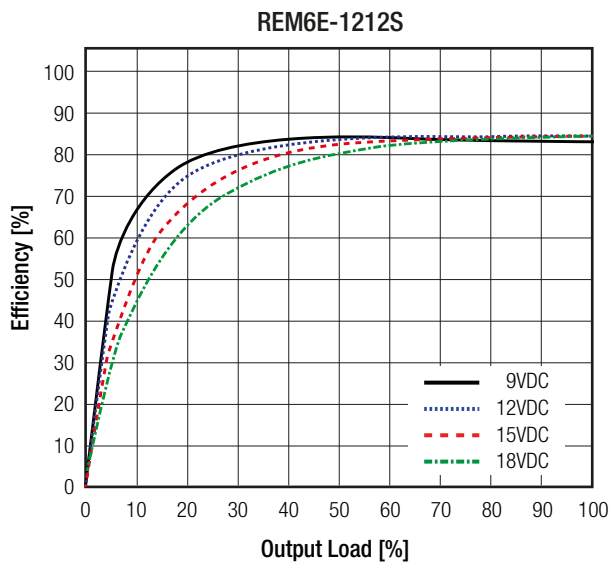


<b>R1</b>
470Ω

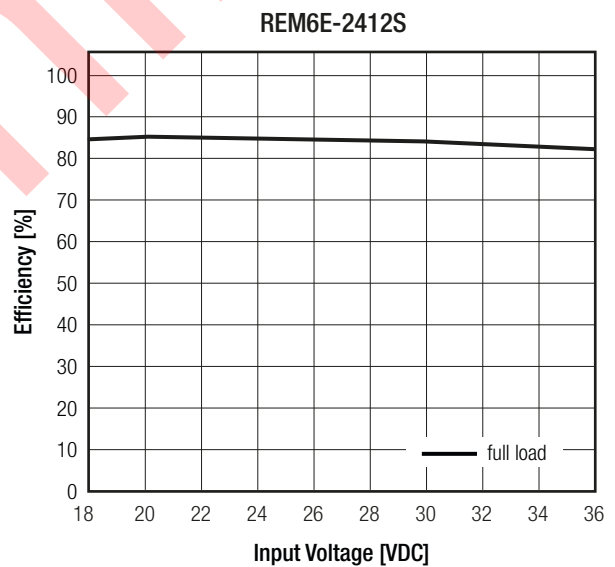
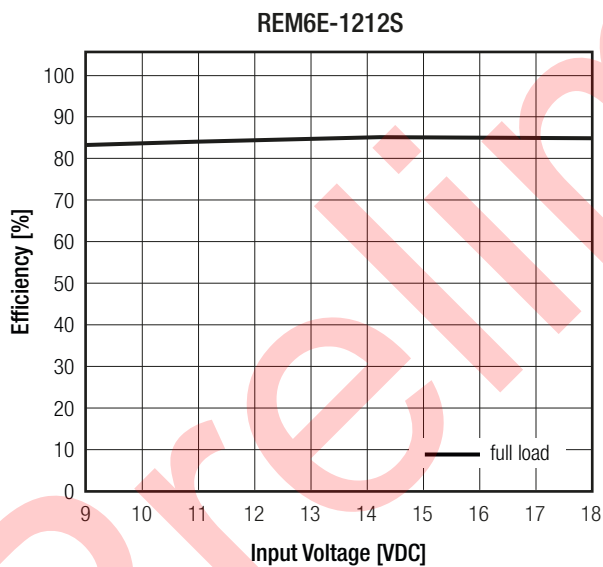
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Specifications (measured @ Ta= 25°C, nom. Vin, full load and after warm-up unless otherwise stated)

Efficiency vs. Output Load



Efficiency vs. Input Voltage



**REGULATIONS**

Parameter	Condition	Value
Output Accuracy		±1.5% typ.
Line Regulation	low line to high line, full load	±0.3% max.
Load Regulation <sup>(7)</sup>	10% to 100% load	0.5% typ.
Cross Regulation	dual output only	±5.0% max.
Transient Response	25% load step change	5ms

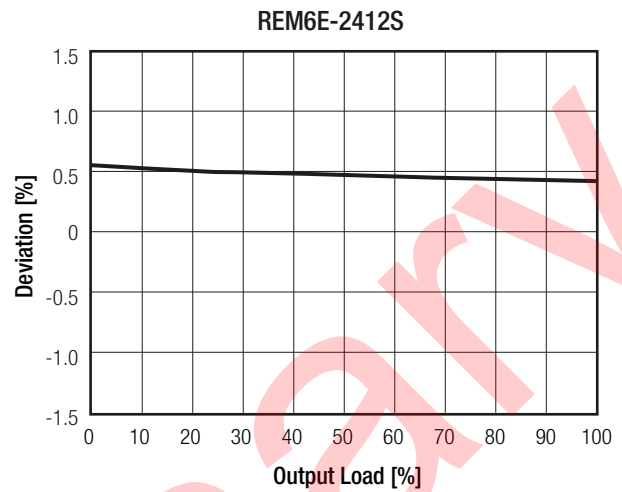
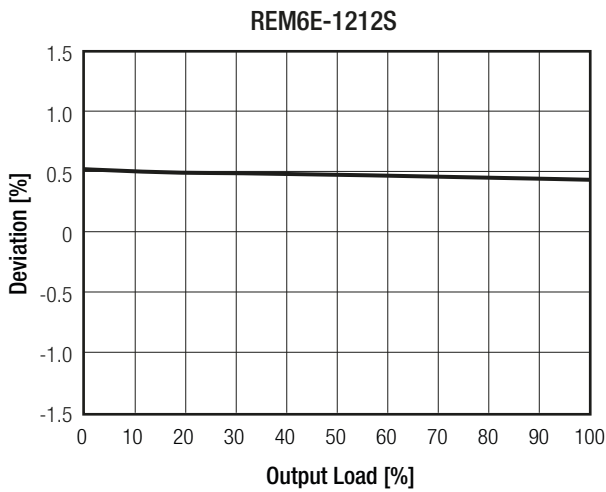
**Notes:**

Note7: Operation below 10% load will not harm the converter, but specifications may not be met

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**Specifications** (measured @ Ta= 25°C, nom. Vin, full load and after warm-up unless otherwise stated)

**Deviation vs. Load**



**PROTECTIONS**

Parameter	Type			Value
Short Circuit Protection (SCP)	below 100mΩ			continuous, hiccup mode, automatic recovery
Isolation Voltage <sup>(8)</sup>	"/R8" suffix	I/P to O/P	tested for 1 second rated for 1 minute	8kVDC 4kVAC/60Hz
	"/R10" suffix	I/P to O/P	tested for 1 second rated for 1 minute	10kVDC 5kVAC/60Hz
Isolation Resistance				10GΩ min.
Isolation Capacitance				20pF typ.
Insulation Grade				reinforced
Leakage Current				0.8μA typ. / 1μA max.
Means of Protection				2MOPP
Medical Device Classification				built-in power supply
Internal	clearance/creepage			>8mm
External	clearance/creepage			>8mm

**Notes:**

Note8: For repeat Hi-Pot testing, reduce the time and/or the test voltage

Note9: Refer to local safety regulations if input over-current protection is also required. Recommended fuse: slow blow type

**ENVIRONMENTAL**

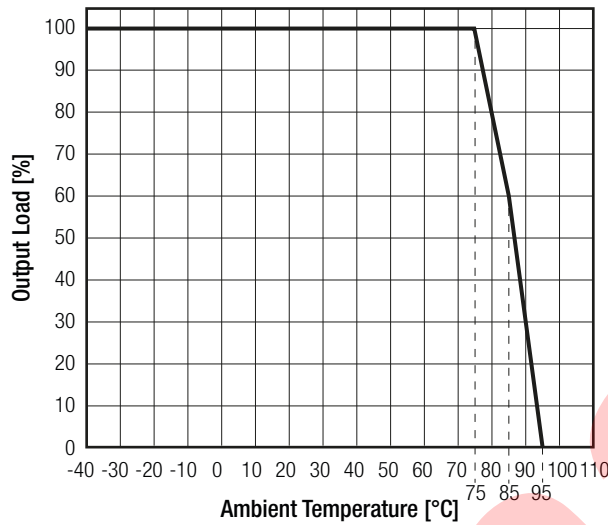
Parameter	Condition		Value
Operating Temperature Range	full load @ natural convection 0.1m/s (see graph)		-40°C to +75°C
Maximum Case Temperature			+105°C
Temperature Coefficient			±0.02%/K typ. / ±0.05%/K max.
Thermal Impedance	0.1m/s, horizontal		20K/W
Operating Altitude			3000m
Operating Humidity	non-condensing		5% - 95% RH max.
Pollution Degree			PD2
MTBF	according to MIL-HDBK-217F, G.B.	+25°C + 75°C	2100 x 10 <sup>3</sup> hours 620 x 10 <sup>3</sup> hours

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**Specifications** (measured @ Ta= 25°C, nom. Vin, full load and after warm-up unless otherwise stated)

**Derating Graph**

(@ Chamber and natural convection 0.1m/s)



**SAFETY AND CERTIFICATIONS**

Certificate Type (Safety)	Report / File Number	Standard
Medical Electric Equipment, General Requirements for Safety and Essential Performance	pending	CAN/CSA-C22.2 No. 60601-1:14, 3rd Edition: 2014 ANSI/AAMI ES60601-1:2012
Medical Electric Equipment, General Requirements for Safety and Essential Performance	pending	EN60601-1:2006 + A12:2014
Medical Electric Equipment, General Requirements for Safety and Essential Performance (CB Scheme)	pending	IEC60601-1:2005, 3rd Edition + AM1:2012
RoHS 2+		RoHS 2011/65/EU + AM2015/863

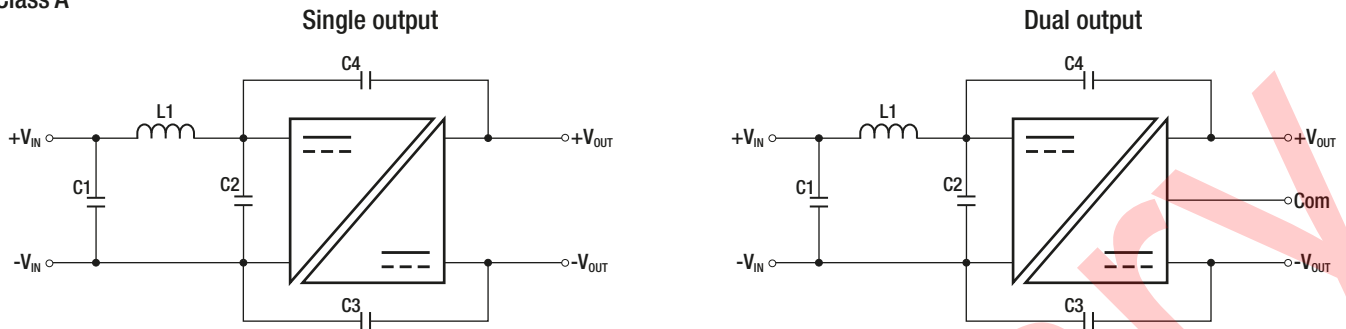
EMC Compliance	Condition	Standard / Criterion
Medical electrical equipment Part 1-2: Electromagnetic disturbances – Requirements and tests	pending	IEC60601-1-2
Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement	with external filter	EN55032, Class A and B
ESD Electrostatic discharge immunity test	Air±15kV; Contact±8kV	EN61000-4-2, Criteria A
Radiated, radio-frequency, electromagnetic field immunity test	10V/m	EN61000-4-3, Criteria A
Fast Transient and Burst Immunity	DC Port: ±2kV	EN61000-4-4, Criteria A
Surge Immunity	DC Port: ±1kV	EN61000-4-5, Criteria A
Immunity to conducted disturbances, induced by radio-frequency fields	10Vr.m.s	EN61000-4-6, Criteria A

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Specifications (measured @ Ta= 25°C, nom. Vin, full load and after warm-up unless otherwise stated)

### EMC Filtering Suggestions according to EN55032

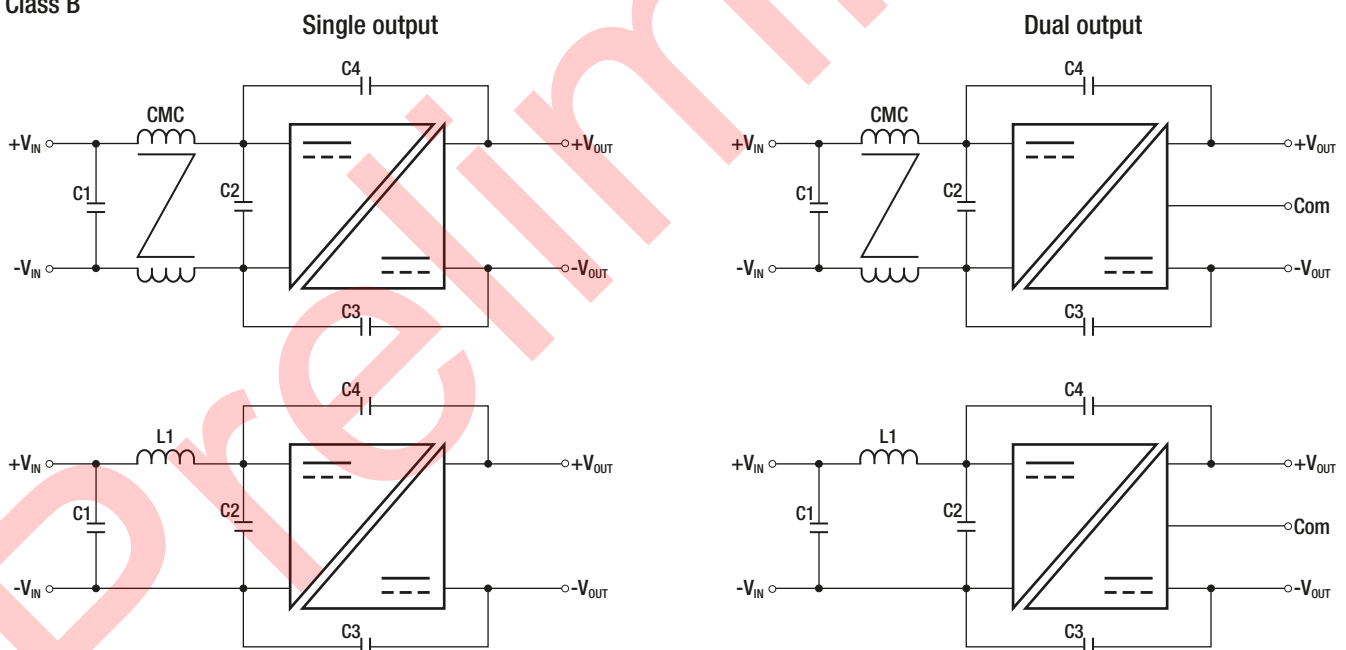
#### Class A



#### Component List Class A

MODEL	C1	C2	C3	C4	L1
REM6E-12xxS/R/A	4.7µF/50V	N/A	100pF/12kV	N/A	3.3µH
REM6E-24xxS/R/A	10µF/100V		150pF/12kV		
REM6E-48xxS/R/A			100pF/12kV	100pF/12kV	
REM6E-12xxD/R/A	4.7µF/50V		150pF/12kV	150pF/12kV	
REM6E-24xxD/R/A	10µF/100V				
REM6E-48xxD/R/A					

#### Class B



#### Component List Class B

MODEL	C1	C2	C3	C4	L1	CMC
REM6E-12xxS/R/A	4.7µF/50V	4.7µF/50V	220pF/12kV	N/A	50µH	N/A
REM6E-24xxS/R/A	10µF/100V	10µF/100V	220pF/12kV		N/A	N/A
REM6E-48xxS/R/A				330pF/12kV		1mH
REM6E-12xxD/R/A	4.7µF/50V	4.7µF/50V	220pF/12kV	220pF/12kV	50µH	N/A
REM6E-24xxD/R/A	10µF/100V	10µF/100V	220pF/12kV	220pF/12kV		
REM6E-48xxD/R/A					330pF/12kV	330pF/12kV

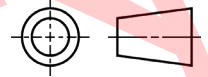
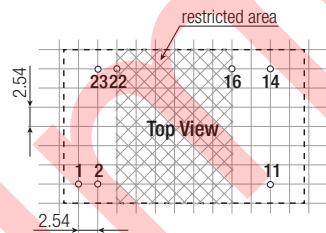
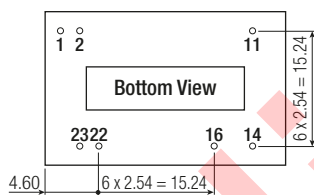
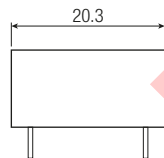
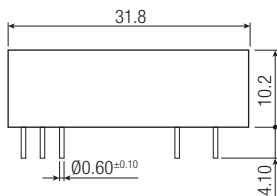
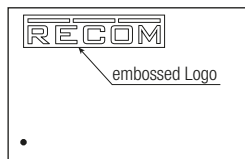
**Specifications** (measured @ Ta= 25°C, nom. Vin, full load and after warm-up unless otherwise stated)

**DIMENSION and PHYSICAL CHARACTERISTICS**

Parameter	Type	Value
Material	base	non-conductive black plastic, (UL94 V-0)
	case	non-conductive black plastic, (UL94 V-0)
	potting	silicone, (UL94 V-0)
Dimension (LxWxH)		31.8 x 20.3 x 10.2mm
Weight		14g typ.

**Dimension Drawing (mm)**

**"A" Pinning**



**Pin Connections**

Pin #	Single	Dual
1	CTRL (option)	CTRL (option)
2	-Vin	-Vin
11	NC	-Vout
14	+Vout	+Vout
16	-Vout	Com
22	+Vin	+Vin
23	+Vin	+Vin

Tolerance:  
XX.X ± 0.5mm  
XX.XX ± 0.25mm

**PACKAGING INFORMATION**

Parameter	Type	Value
Packaging Dimension (LxWxH)	tube	530.0 x 22.7 x 18.3mm
Packaging Quantity	tube	15pcs
Storage Temperature Range		-55°C to +125°C
Storage Humidity		95% RH max.

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