

Features

Regulated Converters

- Reinforced Insulation for 250VAC Working Voltage
- Clearance and Creepage Distance: 8mm
- 5kVAC I/P to O/P 2MOPP Isolation
- 2µA Patient Leakage Current
- Industry Standard Pinout
- 2:1 and 4:1 Wide Input Range

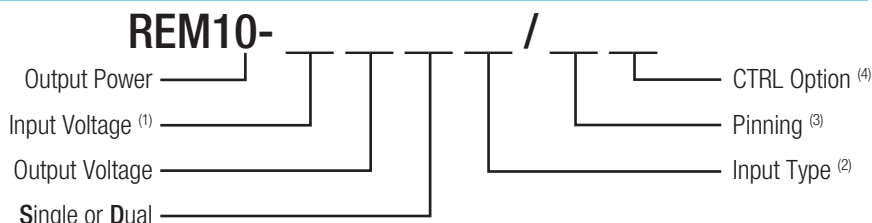
Description

The REM10 series of medical grade regulated DC/DC converters feature reinforced 5kVAC/1 minute isolation with low 2µA leakage and are 60601-1 3rd Ed. certified for 250VAC continuous working. The compact DIP24 package offers tightly regulated single and dual outputs, even under no-load conditions. The outputs are short circuit and overload protected. The converters are available in two different pinning options and optionally with an external control pin for standby consumption as low as 12.5mW. The converters are fully certified to CB, IEC/EN and ANSI/AAMI standards and carry the CE and UL marks.

Selection Guide

Part Number	Input Voltage Range (VDC)	Output Voltage (VDC)	Output Current (mA)	Efficiency typ. (%)	Max. Capacitive Load (µF)
REM10-xx3.3S/*	4.5-9 / 9-18 / 18-36 / 36-75	3.3	2500	80 / 83 / 83 / 82.5	3000
REM10-xx05S/*	4.5-9 / 9-18 / 18-36 / 36-75	5	2000	84 / 85.5 / 86.5 / 86.5	2500
REM10-xx12S/*	4.5-9 / 9-18 / 18-36 / 36-75	12	830	86.5 / 88 / 89 / 89	430
REM10-xx15S/*	4.5-9 / 9-18 / 18-36 / 36-75	15	670	87 / 89 / 89 / 89	350
REM10-xx24S/*	4.5-9 / 9-18 / 18-36 / 36-75	24	416	85.5 / 89 / 89 / 88.	125
REM10-xxx05D/*	4.5-9 / 9-18 / 18-36 / 36-75	±5	±1000	83 / 84 / 85 / 85	±1440
REM10-xx12D/*	4.5-9 / 9-18 / 18-36 / 36-75	±12	±416	85.5 / 89 / 89 / 88	±250
REM10-xx15D/*	4.5-9 / 9-18 / 18-36 / 36-75	±15	±333	86.5 / 88 / 89 / 88	±180
REM10-xx3.3SW/*	9-36 / 18-75	3.3	2500	83 / 82.5	3000
REM10-xx05SW/*	9-36 / 18-75	5	2000	86.5 / 86.5	2500
REM10-xx12SW/*	9-36 / 18-75	12	830	89 / 89	430
REM10-xx15SW/*	9-36 / 18-75	15	670	89 / 89	350
REM10-xx24SW/*	9-36 / 18-75	24	416	89 / 88.5	125
REM10-xx05DW/*	9-36 / 18-75	±5	±1000	85 / 85	±1440
REM10-xx12DW/*	9-36 / 18-75	±12	±416	89 / 88	±250
REM10-xx15DW/*	9-36 / 18-75	±15	±333	88 / 88	±180

Model Numbering



Notes:

Note1: for 4:1 Input Voltage Type add "W", see Note 2.

2:1	4:1 "W"
xx= 4.5-9Vin = "05"	xx= 9-36Vin = "24"
xx= 9-18Vin = "12"	xx= 18-75Vin = "48"
xx= 18-36Vin = "24"	
xx= 36-75Vin = "48"	

Note2: Blank for Standard 2:1 Input Voltage Range; „W" suffix for 4:1 Input Voltage Range

Note3: „A" suffix for A pinning; „C" suffix for C pinning, for more details refer to Package Style and Pinning

Note4: „CTRL" suffix for control pin option, for A pinning only, for C pinning not available

Examples:

REM10-0512D/A	=	2:1 Input, 4.5-9Vin, ±12Vout, pinout „A", without control pin
REM10-1215S/C	=	2:1 Input, 9-18Vin, 15Vout, pinout „C", without control pin
REM10-4815SW/A/CTRL	=	4:1 Input, 36-75Vin, 15Vout, pinout „A" with control pin
REM10-243.3SW/C	=	4:1 Input, 9-36Vin, 3.3Vout, pinout „C", without control pin

RECOM
DC/DC Converter

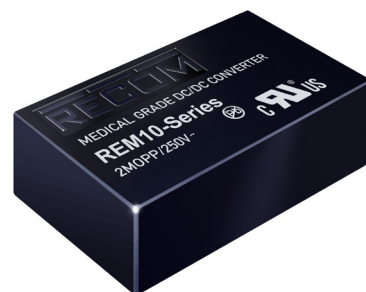
REM10

10 Watt

2:1 & 4:1

DIP24

Single and Dual Output



UL-60950-1 (Pending)
EN-55011 (Pending)
EN-55022 (Pending)
IEC/EN-60950-1 (Pending)
IEC/EN-60601-1 (Pending)

Refer to Applications Notes

Specifications (measured at T_A= 25°C, nominal input voltage, full load and after warm-up)

BASIC CHARACTERISTICS

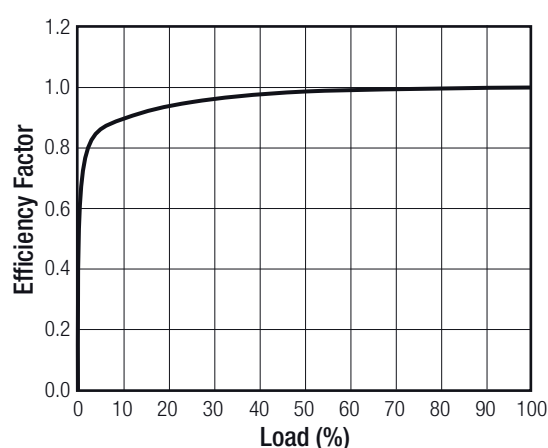
Parameter	Condition	Min.	Typ.	Max.
Absolute Maximum Input Voltage (3sec max.)	2:1 5Vin nom. 12Vin nom. 24Vin nom. 48Vin nom.			16VDC 25VDC 50VDC 100VDC
	4:1 24Vin nom. 48Vin nom.			50VDC 100VDC
Under Voltage Lockout	2:1 5Vin nom. 12Vin nom. 24Vin nom. 48Vin nom.	4VDC 8VDC 16VDC 33VDC		4.5VDC 9VDC 18VDC 36VDC
	4:1 24Vin nom. 48Vin nom.	8VDC 16VDC		9VDC 18VDC
Start-up Time	constant resistive load, Power up or Remote ON/OFF		30ms	
Remote ON/OFF (referenced to -Vin Pin)	DC-DC ON DC-DC OFF	Open or 0-1.2VDC 2.2-12VDC		
Current of CTRL Pin		-0.5mA		1mA
Remote OFF Input Current			2.5mA	
Operating Frequency		270kHz	300kHz	330kHz
Output Ripple and Noise (20MHz BW limited)	10µF/25V 7XR MLCC for 3.3, 5Vout		30mVp-p	
	12, 15Vout 4.7µF/50V X7R MLCC for 24Vout		40mVp-p 50mVp-p	

Efficiency

Table1 : Efficiency Crosstable

Efficiency Crosstable (%) @ full load								
		Input Voltage						
		5	12	24	48	24W	48W	
Output Voltage	3.3S	80	83	83	82.5	83	82.5	
	05S	84	85.5	86.5	86.5	86.5	86.5	
	12S	86.5	88	89	89	89	89	
	15S	87	89	89	89	89	89	
	24S	85.5	89	89	88.5	89	88.5	
	05D	83	84	85	85	85	85	
	12D	85.5	89	89	88	89	88	
	15D	86.5	88	88	88	88	88	

Graph1 : Efficiency Factor vs. Load



continued on next page

Specifications (measured at T_A= 25°C, nominal input voltage, full load and after warm-up)

Calculation Example:

choose your model:

REM10-1212D

- Efficiency from Table1 (= 89% @ max Load / nom Vin)
- Loading conditions in application (= 50%)
- use Eff factor from Graph1 (= 0.99)

Calculation:

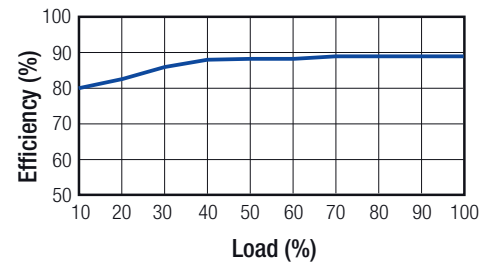
V_{in} = 12V
I_{out} = 50%
Eff_{100%} = 89%
Eff_{factor50%} = 0.99
R_{th} = 18°C/W
T_{CASEmax} = 105°C

$$Eff_{50\%} = Eff_{100\%} * Eff_{factor50\%} = 89 * 0.991 = \underline{88.19\%}$$

$$P_{DIS50\%} = P_{in50\%} - P_{out50\%} = \frac{P_{out100\%} * 0.5}{Eff_{50\%}} - (P_{out100\%} * 0.5) = 5.67 - 5 = \underline{0.67W}$$

$$T_{OVER} = R_{th} * P_{DIS50\%} = 18 * 0.67 = \underline{12.1^{\circ}C}$$

$$T_{AMBmax} = T_{CASEmax} - T_{OVER} = 105 - 12.1 = \underline{92.9^{\circ}C}$$



REGULATIONS

Parameter	Condition	Type	Value
Output Voltage Accuracy			±1%
Voltage Adjustability	Single	3.3, 5, 12Vout	±10%
	Dual	15, 24Vout	±10% min. / ±20% max.
Line Voltage Regulation	LL to HL Single		±0.2%
	LL to HL Dual		±0.5%
Load Voltage Regulation	no load to full load Single		±0.2%
	no load to full load Dual		±1%
Cross Regulation	asymmetrical load 25% / Full Load only Dual Output		±5%
Transient Response	25% load step change		250µs

PROTECTIONS

Parameter	Condition	Type	Value
Short Circuit Protection (SCP)			continuous, auto-recovery
Over Load Protection (OLP)	% of I _{out} rated		Hiccup mode, 150% typ.
Output Over Voltage Protection (OVP)		Single 3.3Vout	3.7VDC min. / 5VDC max.
		5Vout	5.6VDC / 7VDC max.
		12Vout	13.5VDC min. / 16VDC max.
		15Vout	18.3VDC min. / 22VDC max.
		24Vout	29.1VDC min. / 34.5VDC max.
		Dual 5Vout	5.6VDC min. / 7VDC max.
		12Vout	13.5VDC min. / 18.2VDC max.
		15Vout	17VDC min. / 22VDC max.
Isolation Voltage (2MOPP insulation)	I/P to O/P working voltage		5kVAC / 1 minute 250VAC / continuous
Leakage Current	240VAC, 60Hz		2µA
Clearance	I/P to O/P		8mm
Creepage	I/P to O/P		8mm
Isolation Capacitance			12pF typ. / 17pF max.

Specifications (measured at T_A= 25°C, nominal input voltage, full load and after warm-up)

ENVIRONMENTAL		
Parameter	Condition	Value
Relative Humidity		5% to 95% RH
Temperature Coefficient		±0.02% / °C
Thermal Impedance	natural convection (20LFM)	18°C / W
MTBF (+25°C)	according to MIL-HDBK-217F, full load	3849 x 10 ³ hours
max. Case Temperature Range		-40°C to +105°C
max. Ambient Temperature Range		see calculation example
Storage Temperature Range		-55°C to +125°C

SAFETY AND CERTIFICATIONS		
Agency	Report / File Number	Standard
CB		IEC-60950-1
CB Medical		IEC-60601-1
UL General Safety		UL-60950-1
ANSI/AAMI		ES60601-1
EN General Safety		EN-60950-1
EN Medical Safety		EN-60601-1
Certificate Type	Condition	Standard / Criterion
ESD	Air ±8kV; Contact ±6kV	EN61000-4-2, Criteria A
Radiated Immunity	10V/m	EN61000-4-3, Criteria A
Fast Transient ⁽¹⁾	±2kV	EN61000-4-4, Criteria A
Surge ⁽¹⁾	±2kV	EN61000-4-5, Criteria A
Conducted Immunity	10Vr.m.s	EN61000-4-6, Criteria A
EMI Standard ⁽²⁾		EN55011, Class A, B EN55022, Class A, B FCC Part 18
Thermal Shock		MIL-STD-810F
Vibration		MIL-STD-810F

Notes:

Note1: An external input filter capacitor is required if the model has to meet EN61000-4-4 or/and EN61000-4-5.

Recommended components:	5Vin	aluminium capacitor (Nippon Chemi-con KY series, 1000µF/25V) and a reverse diode (Vishay V10P45) to connect in parallel
	12Vin, 24Vin	aluminium capacitor (Nippon Chemi-con KY series, 470µF/50V)
	48Vin	aluminium capacitor (Nippon Chemi-con KY series, 330µF/100V)

Note2: The REM3 (W) with 4:1 input voltage can meet EMI Class A with no external filter. And Class B only with external components.

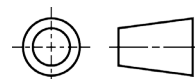
Note3: This Power module is not internally fused. A input line fuse must be always used.

Specifications (measured at T_A= 25°C, nominal input voltage, full load and after warm-up)

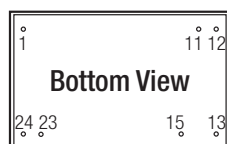
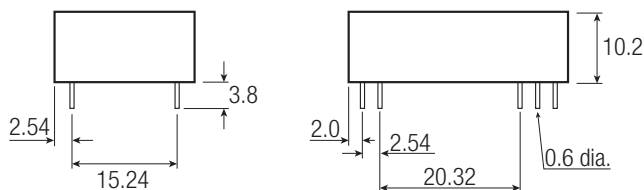
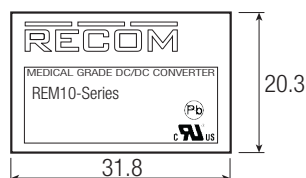
DIMENSIONS and PHYSICAL CHARACTERISTICS

Parameter	Type	Value
Material	Case Potting	non-conductive black plastic Silicone (UL94-V0)
Package Dimensions (LxWxH)		31.80 x 20.30 x 10.20mm
Package Weight		14g
Packaging Dimensions (LxWxH)	Tube	225 x 21.80 x 16.50mm
Packaging Quantity		7pcs

Mechanical Dimensions



“C” Pinning

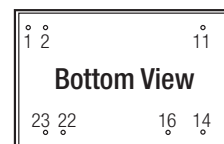
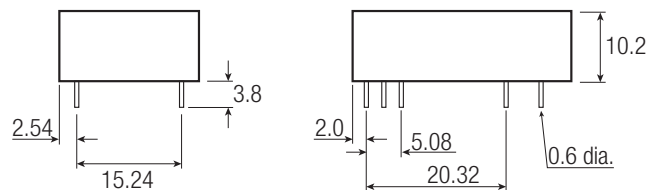
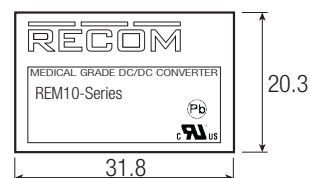


Pin Connections

Pin #	Single	Dual
1	+Vin	+Vin
11	No Pin	Com
12	-Vout	No Pin
13	+Vout	-Vout
15	No Pin	+Vout
23	-Vin	-Vin
24	-Vin	-Vin

Tolerance: xx.x= ±0.5mm
xx.xx= ±0.25mm

“A” Pinning (Standard)



Pin Connections

Pin #	Single	Dual
1	CTRL*	CTRL*
2	-Vin	-Vin
11	No Pin	-Vout
14	+Vout	+Vout
16	-Vout	Com
22	+Vin	+Vin
23	+Vin	+Vin

* If don't choose CTRL option, there is no pin on the corresponding pin number

Tolerance: xx.x= ±0.5mm
xx.xx= ±0.25mm

The product information and specifications are subject to change without prior notice. All products are designed for non-safety critical commercial and industrial applications.
The buyer agrees to implement safeguards that anticipate the consequences of any failures that might cause harm, loss of life and/or property damage.