

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

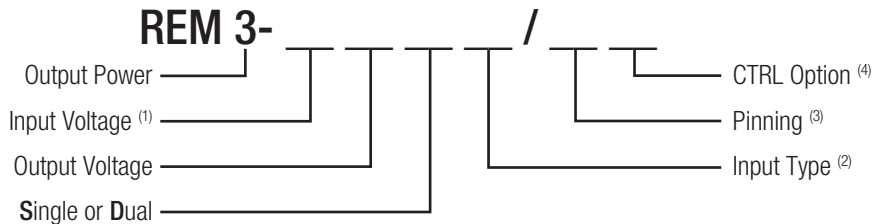
Description

The REM3 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)
REM3-xx3.3S/*	4.5-9 / 9-18 / 18-36 / 36-75	3.3	1000	81 / 82 / 82 / 81	1050
REM3-xx05S/*	4.5-9 / 9-18 / 18-36 / 36-75	5	600	84.5 / 84.5 / 84.5 / 84	780
REM3-xx12S/*	4.5-9 / 9-18 / 18-36 / 36-75	12	250	85.5 / 87 / 87 / 87	130
REM3-xx15S/*	4.5-9 / 9-18 / 18-36 / 36-75	15	200	87.5 / 87 / 87 / 86.5	100
REM3-xx24S/*	4.5-9 / 9-18 / 18-36 / 36-75	24	125	85.5 / 87 / 87 / 86.5	39
REM3-xx05D/*	4.5-9 / 9-18 / 18-36 / 36-75	±5	±300	83 / 83.5 / 83 / 83	±430
REM3-xx12D/*	4.5-9 / 9-18 / 18-36 / 36-75	±12	±125	86 / 87.5 / 86 / 86	±75
REM3-xx15D/*	4.5-9 / 9-18 / 18-36 / 36-75	±15	±100	86 / 86.5 / 86 / 86	±56
REM3-xx3.3SW/*	9-36 / 18-75	3.3	1000	82 / 81	1050
REM3-xx05SW/*	9-36 / 18-75	5	600	84.5 / 84	750
REM3-xx12SW/*	9-36 / 18-75	12	250	87 / 87	130
REM3-xx15SW/*	9-36 / 18-75	15	200	87 / 86.5	100
REM3-xx24SW/*	9-36 / 18-75	24	125	87 / 86.5	39
REM3-xx05DW/*	9-36 / 18-75	±5	±300	83 / 83	±430
REM3-xx12DW/*	9-36 / 18-75	±12	±125	87 / 86	±75
REM3-xx15DW/*	9-36 / 18-75	±15	±100	86 / 86	±56

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:

REM3-0512D/A	=	2:1 Input,	4.5-9Vin,	±12Vout,	pinout „A“,	without control pin
REM3-1215S/C	=	2:1 Input,	9-18Vin,	15Vout,	pinout „C“,	without control pin
REM3-4815SW/A/CTRL	=	4:1 Input,	36-75Vin,	15Vout,	pinout „A“	with control pin
REM3-243.3SW/C	=	4:1 Input,	9-36Vin,	3.3Vout,	pinout „C“,	without control pin

REM3

3 Watt

2:1 & 4:1

DIP24

Single and Dual Output



2MOPP 250VAC

- 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 TA= 25°C, nominal input voltage, full load and after warm-up)

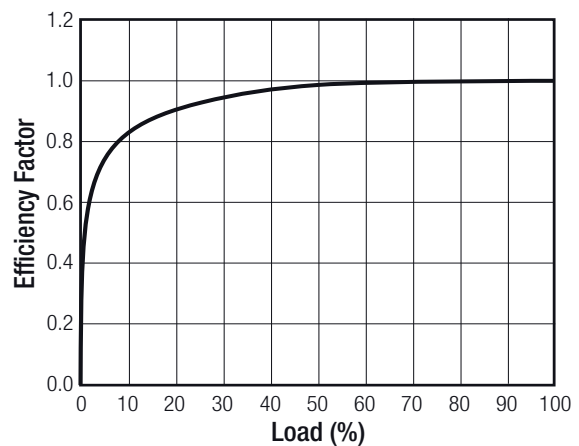
BASIC CHARACTERISTICS					
Parameter	Condition		Min.	Typ.	Max.
Absolute Maximum Input Voltage (3sec max.)	2:1	5Vin nom.			16VDC
		12Vin nom.			25VDC
	4:1	24Vin nom.			50VDC
		48Vin nom.			100VDC
Under Voltage Lockout	2:1	5Vin nom.	4VDC		4.5VDC
		12Vin nom.	8VDC		9VDC
	4:1	24Vin nom.	16VDC		18VDC
		48Vin nom.	33VDC		36VDC
	4:1	24Vin nom.	8VDC		9VDC
		48Vin nom.	16VDC		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			135kHz	150kHz	165kHz
Output Ripple and Noise (20MHz BW limited)	10µF/25V 7XR MLCC for 3.3, 5Vout	12, 15Vout		30mVp-p	
		4.7µF/50V X7R MLCC for 24Vout		40mVp-p	
				50mVp-p	

Efficiency

Table1 : Efficiency Crosstable

Graph1 : Efficiency Factor vs. Load

Efficiency Crosstable (%) @ full load							
		Input Voltage					
		5	12	24	48	24W	48W
Output Voltage	3.3S	81	82	82	81	82	81
	05S	84.5	84.5	84.5	84	84.5	84
	12S	85.5	87	87	87	87	87
	15S	87.5	87	87	86.5	87	86.5
	24S	85.5	87	87	86.5	87	86.5
	05D	83	83.5	83	83	83	83
	12D	86	87.5	86	86	87	86
	15D	86	86.5	86	86	86	86



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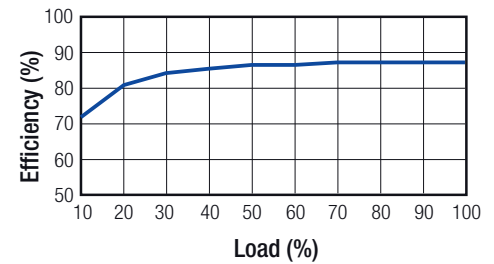
Specifications (measured at T_A= 25°C, nominal input voltage, full load and after warm-up)

Calculation Example:

choose your model:

REM3-1212D

- Efficiency from Table1 (= 87.5% @ max Load / nom Vin)
- Loading conditions in application (e.g. 50%)
- use Eff factor from Graph1 (= 0.98 @50%)



Calculation:

$$\begin{aligned} V_{in} &= 12V \\ I_{out} &= 50\% \\ \text{Eff}_{100\%} &= 87.5\% \\ \text{Eff}_{\text{factor}50\%} &= 0.98 \\ R_{th} &= 18^{\circ}\text{C/W} \\ T_{\text{CASEmax}} &= 105^{\circ}\text{C} \end{aligned}$$

$$\text{Eff}_{50\%} = \text{Eff}_{100\%} * \text{Eff}_{\text{factor}50\%} = 87.5 * 0.98 = \mathbf{85.75\%}$$

$$P_{\text{DIS}50\%} = P_{\text{in}50\%} - P_{\text{out}50\%} = \frac{P_{\text{out}100\%} * 0.5}{\text{Eff}_{50\%}} - (P_{\text{out}100\%} * 0.5) = 1.75 - 1.5 = \mathbf{0.25W}$$

$$T_{\text{OVER}} = R_{th} * P_{\text{DIS}50\%} = 18 * 0.25 = \mathbf{4.5^{\circ}\text{C}}$$

$$T_{\text{AMBmax}} = T_{\text{CASEmax}} - T_{\text{OVER}} = 105 - 4.5 = \mathbf{100.5^{\circ}\text{C}}$$

REGULATIONS

Parameter	Condition	Type	Value
Output Voltage Accuracy			±1%
Voltage Adjustability	Single	3.3, 5, 12Vout 15, 24Vout	±10%
	Dual		±10% min. / ±20% max. ±10%
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 $T_A = 25^\circ\text{C}$, nominal input voltage, full load and after warm-up)

ENVIRONMENTAL		
Parameter	Condition	Value
Relative Humidity		5% to 95% RH
Temperature Coefficient		$\pm 0.02\% / ^\circ\text{C}$
Thermal Impedance	natural convection (20LFM)	$18^\circ\text{C} / \text{W}$
max. Case Temperature Range max. Ambient Temperature Range		-40°C to $+105^\circ\text{C}$ see calculation example
Storage Temperature Range		-55°C to $+125^\circ\text{C}$
MTBF ($+25^\circ\text{C}$)	according to MIL-HDBK-217F, full load	6444×10^3 hours

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 $\pm 8\text{kV}$; Contact $\pm 6\text{kV}$	EN61000-4-2, Criteria A
Radiated Immunity	10V/m	EN61000-4-3, Criteria A
Fast Transient ⁽¹⁾	$\pm 2\text{kV}$	EN61000-4-4, Criteria A
Surge ⁽¹⁾	$\pm 2\text{kV}$	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, $1000\mu\text{F}/25\text{V}$) and a reverse diode (Vishay V10P45) to connect in parallel
12Vin, 24Vin	aluminium capacitor (Nippon Chemi-con KY series, $470\mu\text{F}/50\text{V}$)
48Vin	aluminium capacitor (Nippon Chemi-con KY series, $330\mu\text{F}/100\text{V}$)

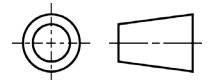
Note2: The REM3 (W) with 4:1 input voltage can meet EMI Class A with no external filter. And Class B only with external components.

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

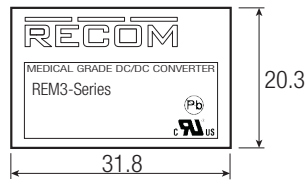
Specifications (measured at $T_A=25^\circ\text{C}$, nominal input voltage, full load and after warm-up)

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

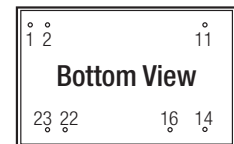
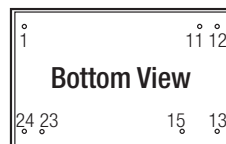
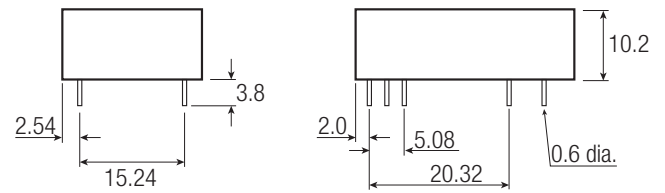
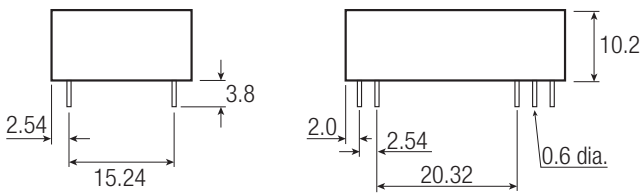
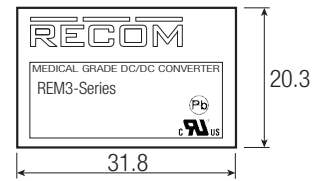
Mechanical Dimensions



“C” Pinning



“A” Pinning (Standard)



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

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.