

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

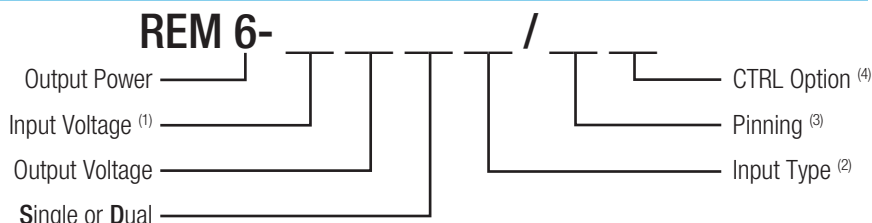
Description

The REM6 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)
REM6-xx3.3S/ ^(3,4)	4.5-9 / 9-18 / 18-36 / 36-75	3.3	1800	81.5 / 83.5 / 83 / 82.5	2100
REM6-xx05S/ ^(3,4)	4.5-9 / 9-18 / 18-36 / 36-75	5	1200	86 / 86 / 86 / 86.5	1500
REM6-xx12S/ ^(3,4)	4.5-9 / 9-18 / 18-36 / 36-75	12	500	86 / 89 / 89 / 88	260
REM6-xx15S/ ^(3,4)	4.5-9 / 9-18 / 18-36 / 36-75	15	400	87.5 / 88.5 / 88.5 / 88.5	210
REM6-xx24S/ ^(3,4)	4.5-9 / 9-18 / 18-36 / 36-75	24	250	87 / 88.5 / 88.5 / 88	75
REM6-xx05D/ ^(3,4)	4.5-9 / 9-18 / 18-36 / 36-75	±5	±600	84 / 85 / 85 / 85	±860
REM6-xx12D/ ^(3,4)	4.5-9 / 9-18 / 18-36 / 36-75	±12	±250	86.5 / 89 / 88.5 / 88	±150
REM6-xx15D/ ^(3,4)	4.5-9 / 9-18 / 18-36 / 36-75	±15	±200	87.5 / 88 / 88.5 / 87	±110
REM6-xx3.3SW/ ^(3,4)	9-36 / 18-75	3.3	1800	83 / 82.5	2100
REM6-xx05SW/ ^(3,4)	9-36 / 18-75	5	1200	86 / 86.5	1500
REM6-xx12SW/ ^(3,4)	9-36 / 18-75	12	500	89 / 88	260
REM6-xx15SW/ ^(3,4)	9-36 / 18-75	15	400	89 / 88.5	210
REM6-xx24SW/ ^(3,4)	9-36 / 18-75	24	250	88.5 / 88	75
REM6-xx05DW/ ^(3,4)	9-36 / 18-75	±5	±600	85 / 85	±860
REM6-xx12DW/ ^(3,4)	9-36 / 18-75	±12	±250	88.5 / 88	±150
REM6-xx15DW/ ^(3,4)	9-36 / 18-75	±15	±200	88.5 / 87	±110

Model Numbering



Notes:

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

2:1	4:1 "W"
xx= 4.5-9 Vin = "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:

REM6-0512D/A	=	2:1 Input, 4.5-9Vin, ±12Vout,	pinout „A", without control pin
REM6-1215S/C	=	2:1 Input, 9-18Vin, 15Vout,	pinout „C", without control pin
REM6-4815SW/A/CTRL	=	4:1 Input, 36-75Vin, 15Vout,	pinout „A" with control pin
REM6-243.3SW/C	=	4:1 Input, 9-36Vin, 3.3Vout,	pinout „C", without control pin

RECOM
DC/DC Converter

REM6

6 Watt

2:1 & 4:1

DIP24

Single and Dual Output



UL
E314885

2MOPP
250VAC

UL-60950-1 Certified
EN-55011 Certified
EN-55022 Certified
IEC-60601-1 Certified
ES-60601-1 Certified

Refer to Applications Notes

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

BASIC CHARACTERISTICS

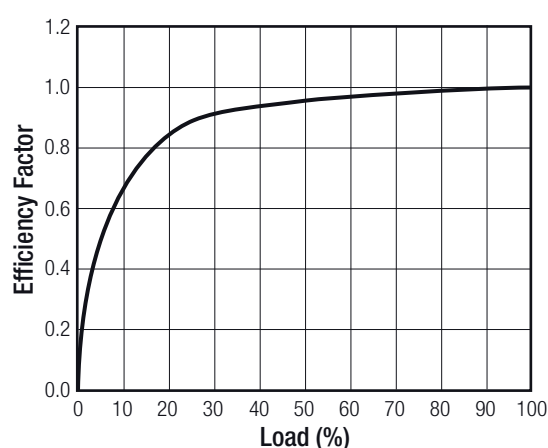
Parameter	Condition	Min.	Typ.	Max.
Absolute Maximum Input Voltage (3sec max.)	2:1 5Vin nom. 12Vin nom. 24Vin nom. 48Vin nom.			16VDC 25VDC 50VDC 100VDC
	4:1 24Vin nom. 48Vin nom.			50VDC 100VDC
Under Voltage Lockout	2:1 5Vin nom. 12Vin nom. 24Vin nom. 48Vin nom.	4VDC 8VDC 16VDC 33VDC		4.5VDC 9VDC 18VDC 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		225kHz	250kHz	275kHz
Output Ripple and Noise (20MHz BW limited)	10µF/25V 7XR MLCC for 3.3, 5Vout 10µF/25V 7XR MLCC for 12, 15Vout 4.7µF/50V X7R MLCC for 24Vout		30mVp-p 40mVp-p 50mVp-p	

Efficiency

Table1 : Efficiency Crosstable

Efficiency Crosstable (%) @ full load								
		Input Voltage						
		5	12	24	48	24W	48W	
Output Voltage	3.3S	81.5	83.5	83	82.5	83	82.5	
	05S	86	86	86	86.5	86	86.5	
	12S	86	89	89	88	89	88	
	15S	87.5	88.5	89	88.5	89	88.5	
	24S	87	88.5	88.5	88	88.5	88	
	05D	84	85	85	85	85	85	
	12D	86.5	89	88.5	88	88.5	88	
	15D	87.5	88	88.5	87	88.5	87	

Graph1 : Efficiency Factor vs. Load



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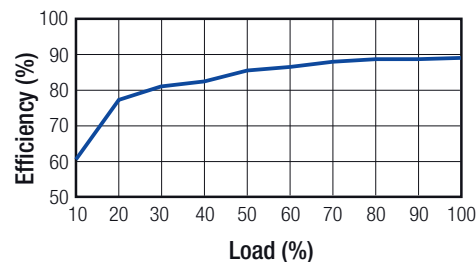
Specifications (measured at T_A= 25°C, nominal input voltage, full load and after warm-up)

Calculation Example:

choose your model:

REM6-1212D

- Efficiency from Table1 (= 89% @ max Load / nom Vin)
- Loading conditions in application (e.g. 50%)
- use Eff factor from Graph1 (= 0.96 @50%)



Calculation:

V_{in} = 12V
 I_{out} = 50%
 Eff_{100%} = 89%
 Eff_{factor50%} = 0.96
 R_{th} = 18°C/W
 T_{CASEmax} = 105°C

$$Eff_{50\%} = Eff_{100\%} * Eff_{factor50\%} = 89 * 0.960 = \underline{85.44\%}$$

$$P_{DIS50\%} = P_{in50\%} - P_{out50\%} = \frac{P_{out100\%} * 0.5}{Eff_{50\%}} - (P_{out100\%} * 0.5) = 3.51 - 3 = \underline{0.51W}$$

$$T_{OVER} = R_{th} * P_{DIS50\%} = 18 * 0.51 = \underline{9.2^{\circ}C}$$

$$T_{AMBmax} = T_{CASEmax} - T_{OVER} = 105 - 9.2 = \underline{95.8^{\circ}C}$$

REGULATIONS

Parameter	Condition	Type	Value
Output Voltage Accuracy			±1%
Voltage Adjustability	Single	3.3, 5, 12Vout	±10%
	Dual	15, 24Vout	±10% min. / ±20% max. ±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 min. / 7VDC max.
		12Vout	13.5VDC min. / 16VDC max.
	Dual	15Vout	18.3VDC min. / 22VDC max.
		24Vout	29.1VDC min. / 34.5VDC max.
		5Vout	5.6VDC min. / 7VDC max.
		12Vout	13.5VDC min. / 18.2VDC max.
		15Vout	17VDC min. / 22VDC max.

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

Isolation Voltage (2MOPP insulation)	I/P to O/P working voltage		5kVAC / 1 minute 250VAC / continuous
Leakage Current	240VAC, 60Hz		2 μ A
Clearance	I/P to O/P		8mm
Creepage	I/P to O/P		8mm
Isolation Capacitance			12pF typ. / 17pF max.

Notes:

Note5: This Power module is not internally fused. A input line fuse must be always used.

Recommended Fuse:

2:1 Input Voltage	Fuse (slow blow)
5V	T2.5A
12V	T1.25A
24V	T0.63A
48V	T0.315A

4:1 Input Voltage	Fuse (slow blow)
24V	T1.25A
48V	T0.63A

ENVIRONMENTAL

Parameter	Condition	Value
Relative Humidity		5% to 95% RH
Temperature Coefficient		$\pm 0.02\%$ / $^\circ\text{C}$
Thermal Impedance	natural convection (20LFM)	18 $^\circ\text{C}$ / W
max. Case Temperature Range		-40 $^\circ\text{C}$ to +105 $^\circ\text{C}$
max. Ambient Temperature Range		see calculation example
Storage Temperature Range		-55 $^\circ\text{C}$ to +125 $^\circ\text{C}$
MTBF (+25 $^\circ\text{C}$)	according to MIL-HDBK-217F, full load	4718 x 10 ³ hours

SAFETY AND CERTIFICATIONS

Certificate Type	Report / File Number	Standard
CB Medical	E314885-A6	IEC-60601-1 Medical Report + ISO14971 Risk Assessment
ANSI/AAMI	E314885-A6	ES60601-1
CAN/CSA Medical	E314885	C22.2 No. 60601-1:08

Certificate Type (Environmental)	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 ⁽⁶⁾	$\pm 2\text{kV}$	EN61000-4-4, Criteria A
Surge ⁽⁶⁾	$\pm 2\text{kV}$	EN61000-4-5, Criteria A
Conducted Immunity	10Vr.m.s	EN61000-4-6, Criteria A
EMI Standard ⁽⁷⁾		EN55011, Class A, B EN55022, Class A, B FCC Part 18
Thermal Shock		MIL-STD-810F
Vibration		MIL-STD-810F

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

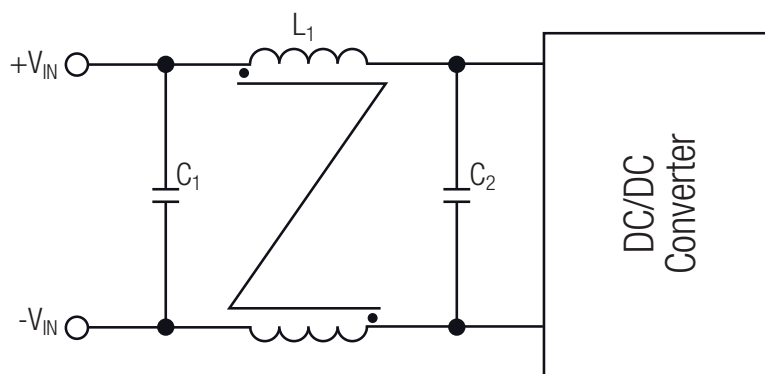
Notes:

Note6: An external input filter capacitor is required if the model has to meet EN61000-4-4 or/and EN61000-4-5.

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

Note7: The whole REM6 series can meet EMI Class A with no external filter. And Class B only with external components.

EMC Filter Suggestion for Class B



MODEL	C1	C2	L1
REM6-05xxS_D	22 μF /16V MLCC	22 μF /16V MLCC	137 μH ⁽⁸⁾
REM6-12xxS_D REM6-24xxS_D REM6-24xxS_D/W	4.7 μF /50V MLCC	4.7 μF /50V MLCC	227 μH ⁽⁸⁾
REM6-48xxS_D REM6-48xxS_D/W	2.2 μF /100V MLCC	1 μF /100V MLCC	419 μH ⁽⁸⁾

Notes:

Note8: For more details, please contact our technical support service at info@recom-development.at

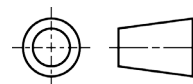
DIMENSIONS and PHYSICAL CHARACTERISTICS

Parameter	Type	Value
Material	Case Potting	non-conductive black plastic Silicone (UL94-V0)
Package Dimensions (LxWxH)		31.80 x 20.30 x 10.40mm
Package Weight		14g
Packaging Dimensions (LxWxH)	Tube	225 x 21.80 x 16.50mm
Packaging Quantity		7pcs

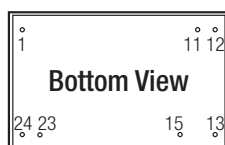
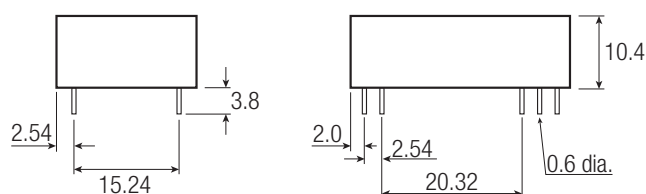
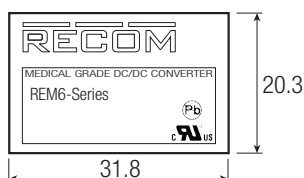
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Specifications (measured at $T_A = 25^\circ\text{C}$, nominal input voltage, full load and after warm-up)

Mechanical Dimensions (mm)



"C" Pinning

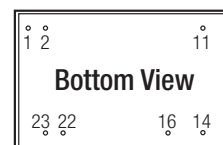
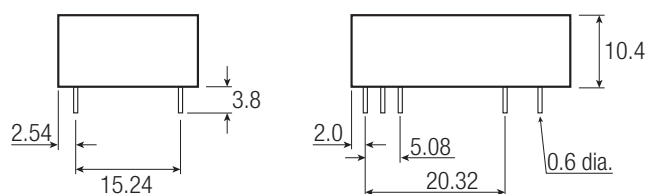
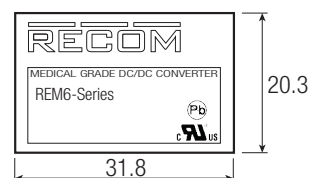


Pin Connections

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= $\pm 0.5\text{mm}$
xx.xx= $\pm 0.25\text{mm}$

"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= $\pm 0.5\text{mm}$
xx.xx= $\pm 0.25\text{mm}$