

MB2000MRWRI4



Medical Approved, 20W Compact 1 x 2 Inch DC/DC Converters

Key Features:

- EN 60601 3RD Ed. Approved
- 20W Output Power
- 4.2 kVrms Isolation
- Reinforced Insulation
- 2 x MOPP per EN 60601-1 3RD Edition & ANSI/AAMI ES 60601-1
- 5 μ A Max Leakage Current
- Wide 2:1 Input Range
- Compact 1 x 2 In Case
- Single & Dual Outputs
- 1.08 MH MTBF



MicroPower Direct

292 Page Street
Suite D
Stoughton, MA 02072
USA

T: (781) 344-8226
F: (781) 344-8481
E: sales@micropowerdirect.com
W: www.micropowerdirect.com



Electrical Specifications

Specifications typical @ +25°C, nominal input voltage & rated output current, unless otherwise noted. Specifications subject to change without notice.

Input		Conditions	Min.	Typ.	Max.	Units
Input Start Voltage	Parameter	12 VDC Input			9.0	VDC
		24 VDC Input			18.0	
		48 VDC Input			36.0	
Under Voltage Shutdown	Parameter	12 VDC Input		7.5		VDC
		24 VDC Input		15.0		
		48 VDC Input		33.0		
Input Filter		π (Pi) Filter				
Start Up Time		Nominal V_{IN} , Constant, Resistive Load			30	mS

Output		Conditions	Min.	Typ.	Max.	Units
Output Voltage Accuracy	Parameter	Dual Output , Balanced Loads			± 1.0	%
Output Voltage Balance					± 2.0	%
Line Regulation	Parameter	$V_{IN} = \text{Min to Max}$			± 0.5	%
		Single Output			± 0.5	%
Load Regulation, $I_{OUT} = 0\%$ to 100%	Parameter	Dual Output			± 1.0	%
		5V Output		50		
Ripple & Noise (20 MHz), See Note 2	Parameter	12V, 15V, $\pm 12V$, $\pm 15V$ Output		100		mV P - P
		24V Output		150		
		Output Power Protection		150		
Transient Recovery Time, See Note 3	Parameter	25% Load Step Change			300	μ Sec
Transient Response Deviation				± 3.0	± 5.0	%
Temperature Coefficient					± 0.02	%/ $^{\circ}$ C
Output Short Circuit		Continuous (Autorecovery)				

General		Conditions	Min.	Typ.	Max.	Units
Isolation Voltage, Rated	Parameter	60 Seconds	4,200			Vrms
Reinforced Insulation Working Voltage			300 Vrms			
Leakage Current	Parameter	240 VAC, 60 Hz			5	μ A
Isolation Resistance		500 VDC	10			G Ω
Isolation Capacitance	Parameter	100 kHz, 1V			80	pF
Switching Frequency				285		

Environmental		Conditions	Min.	Typ.	Max.	Units
Operating Temperature Range	Parameter	See Table on Page 3				
Cooling		Free Air Convection				
Humidity	Parameter	RH, Non-condensing			95	%
Altitude					4,000	m

Physical		Conditions	Min.	Typ.	Max.	Units
Case Size	Parameter	See Mechanical Diagram (Page 4)				
Case Material		Non-Conductive Black Plastic (UL94-V0)				
Weight						1.06 Oz (30g)

Reliability Specifications		Conditions	Min.	Typ.	Max.	Units
MTBF	Parameter	MIL HDBK 217F, 25°C, Gnd Benign	1.08			MHours
Safety Standards		IEC/EN 60601-1, EN 60601-1 3 RD Edition, 2xMOPP ANSI/AAMI ES 60601-1 2xMOPP Recognition, (UL Certificate) ANSI/AAMI ES 60601-1, CAN/CSA-C22.2 No.60601-1				

Absolute Maximum Ratings		Conditions	Min.	Typ.	Max.	Units
Input Voltage Surge (0.1 Sec)	Parameter	12 VDC Input			25.0	VDC
		24 VDC Input			50.0	
		48 VDC Input			100.0	
Lead Temperature		1.5 mm From Case For 10 Sec			260	$^{\circ}$ C

Caution: Exceeding Absolute Maximum Ratings may damage the module. These are not continuous operating ratings.

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Model Number	Input				Reflected Ripple Current (mA, Typ)	Output			Efficiency (% , Typ)	Capacitive Load (µF Max)	Fuse Rating Slow-Blow (mA)
	Voltage (VDC)		Current (mA)			Voltage (VDC)	Current (mA, Max)	Current (mA, Min)			
	Nominal	Range	Full-Load	No-Load							
MB2012SMRW-05RI4	12	9.0 - 18.0	1,938	20	100	5.0	4,000	0.0	86	6,800	4,000
MB2012SMRW-12RI4	12	9.0 - 18.0	1,876	20	100	12.0	1,670	0.0	89	1,160	4,000
MB2012SMRW-15RI4	12	9.0 - 18.0	1,893	20	100	15.0	1,333	0.0	88	750	4,000
MB2012SMRW-24RI4	12	9.0 - 18.0	1,888	20	100	24.0	840	0.0	89	295	4,000
MB2012DMRW-12RI4	12	9.0 - 18.0	1,888	20	100	±12.0	±840	0.0	89	590	4,000
MB2012DMRW-15RI4	12	9.0 - 18.0	1,882	20	100	±15.0	±670	0.0	89	380	4,000
MB2024SMRW-05RI4	24	18.0 - 36.0	947	15	50	5.0	4,000	0.0	88	6,800	2,000
MB2024SMRW-12RI4	24	18.0 - 36.0	938	15	50	12.0	1,670	0.0	89	1,160	2,000
MB2024SMRW-15RI4	24	18.0 - 36.0	936	15	50	15.0	1,333	0.0	89	750	2,000
MB2024SMRW-24RI4	24	18.0 - 36.0	933	15	50	24.0	840	0.0	90	295	2,000
MB2024DMRW-12RI4	24	18.0 - 36.0	933	15	50	±12.0	±840	0.0	90	590	2,000
MB2024DMRW-15RI4	24	18.0 - 36.0	931	15	50	±15.0	±670	0.0	90	380	2,000
MB2048SMRW-05RI4	48	36.0 - 75.0	473	10	30	5.0	4,000	0.0	88	6,800	1,000
MB2048SMRW-12RI4	48	36.0 - 75.0	469	10	30	12.0	1,670	0.0	89	1,160	1,000
MB2048SMRW-15RI4	48	36.0 - 75.0	463	10	30	15.0	1,333	0.0	90	750	1,000
MB2048SMRW-24RI4	48	36.0 - 75.0	472	10	30	24.0	840	0.0	89	295	1,000
MB2048DMRW-12RI4	48	36.0 - 75.0	472	10	30	±12.0	±840	0.0	89	590	1,000
MB2048DMRW-15RI4	48	36.0 - 75.0	465	10	30	±15.0	±670	0.0	90	380	1,000

Notes:

- The specified maximum capacitive load is for each output.
- When measuring output ripple, it is recommended that an external 0.47 µF ceramic capacitor be placed from the +Vout pin to the -Vout pin for single output units and from each output to common for dual output units. For noise sensitive applications, the use of 3.3 µF capacitors will reduce the output ripple. The factory tests output ripple on these units with a MLCC 4.7 µF capacitor connected.
- Transient recovery is measured to within a 1% error band for a load step change of 75% to 100%.
- Dual output units may be connected to provide a 24 VDC or 30 VDC output. To do this, connect the load across the positive (+Vout) and negative (-Vout) outputs and float the output common.
- The converter should be connected to a low ac-impedance source. An input source with a highly inductive impedance may affect the stability of the converter. In applications where the converter output loading is high and input power is supplied over long lines, it may be necessary to use a capacitor on the input to insure start-up. In this case, it is recommended that a low ESR (ESR <1.0Ω at 100 kHz) capacitor be mounted close to the converter. For 12V input units a 10.0 µF is recommended, for 24V a 4.7 µF and for 48V units a 2.2 µF.
- It is recommended that a fuse be used on the input of a power supply for protection. See the table above for the correct rating.

Typical Connection



EMI Characteristics			
Parameter	Standard	Criteria	Level
Conducted Emissions	EN 55011		Class A
Radiated Emissions	EN 55011		Class A
ESD	EN 61000-4-2	A	±15 kV Air
			±8 kV Contact
RS	EN 61000-4-3	A	10V/m
EFT, See Note at right	EN 61000-4-4	A	±2 kV
Surge, See Note at right	EN 61000-4-5	A	±1 kV
CS	EN 61000-4-6	A	10 Vrms
PFMF	EN 61000-4-8	A	30A/m

These converters are specified for operation without external components. However, in some applications the addition of input/output capacitors, as shown in the typical connection diagram above, will enhance stability and reduce output ripple. This simple connection includes a low ESR (<1.0Ω at 100 kHz) capacitor connected across the input (C1). It is recommended that a 10 µF be used for 12V input models, a 4.7 µF for 24V and a 2.2 µF for 48V input units. To improve the output ripple performance, a 4.7 µF is connected across the output. For dual output units, a 4.7 µF capacitor should be connected from each output to common.

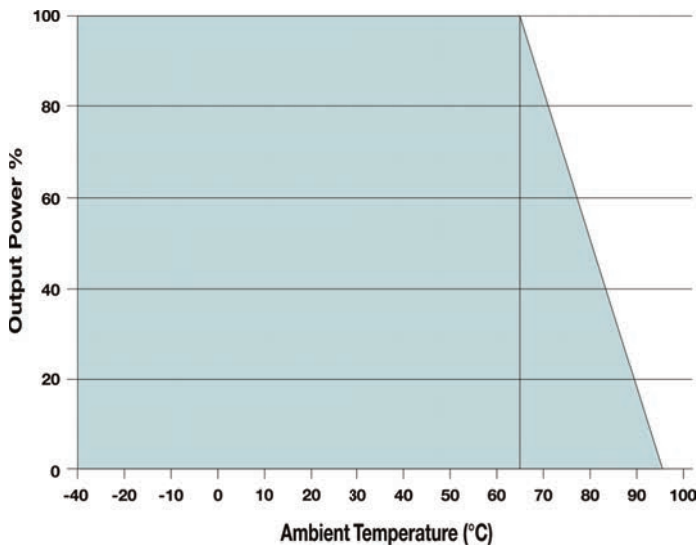
To meet the specified EN 61000-4-4 and EN 61000-4-5 limits, an external capacitor must be connected across the input pins of the module (C1). A 330 µF/100V capacitor is recommended. This capacitor should be mounted as close to the module as possible.

Operating Temperature Range

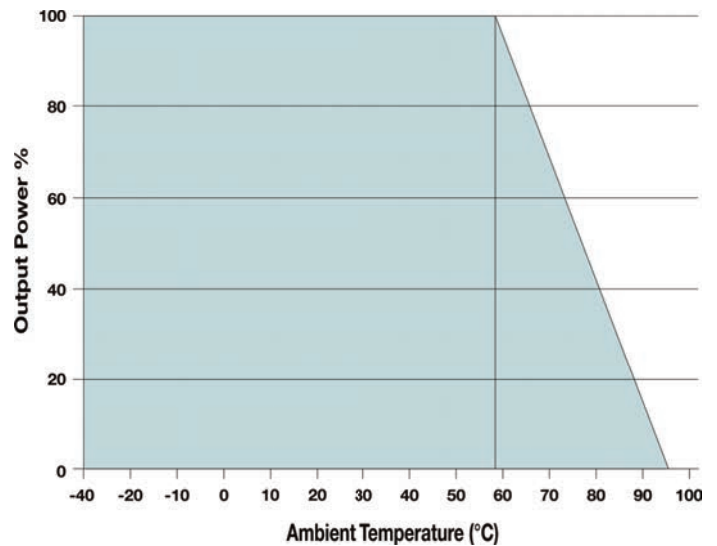
Parameter	Model Number	Min	Typ	Max	Units
Operating Temp Range	MB2024SMRW-24RI4	-40	+25	+66	°C
	MB2024DMRW-12RI4				
	MB2024DMRW-15RI4				
	MB2048SMRW-15RI4				
	MB2048SMRW-15RI4				
Operating Temp Range	MB2012SMRW-15RI4	-40	+25	+58	°C
	MB2024DMRW-05RI4				
	MB2048SMRW-05RI4				
Operating Temp Range	MB2012MS-05RWHI	-40	+25	+51	°C

Parameter	Model Number	Min	Typ	Max	Units
Operating Temp Range	MB2012SMRW-12RI4	-40	+25	+62	°C
	MB2012SMRW-24RI4				
	MB2012DMRW-12RI4				
	MB2012DMRW-15RI4				
	MB2024SMRW-12RI4				
	MB2024SMRW-15RI4				
	MB2048SMRW-12RI4				
	MB2048SMRW-24RI4				
	MB2048DMRW-12RI4				

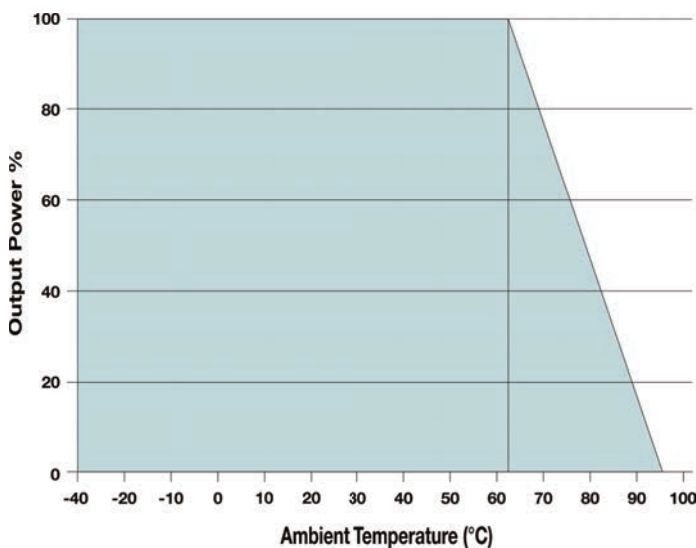
Temperature Derating Curves



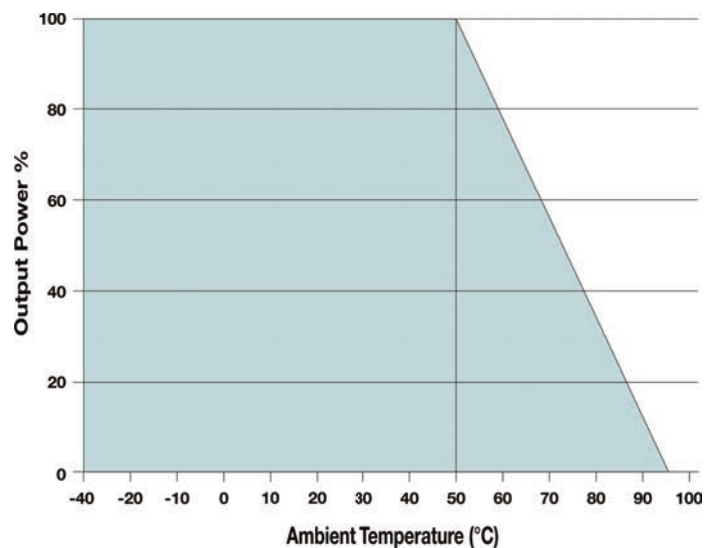
MB2024SMRW-24RI4, MB2024DMRW-12RI4
MB2048SMRW-15RI4, MB2048DMRW-15RI4



MB2012SMRW-15RI4, MB2024SMRW-05RI4
MB2048SM-05RI4



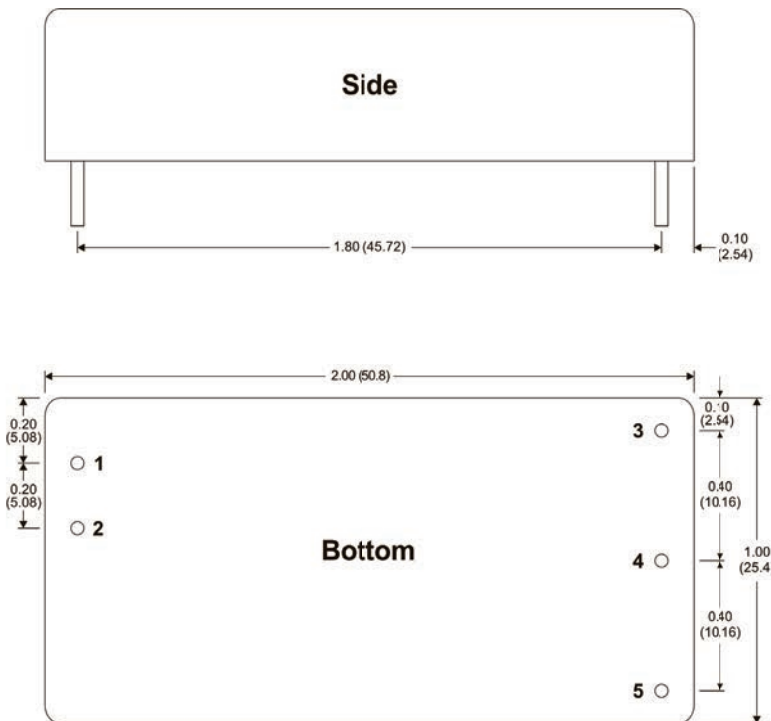
MB2012SMRW-12RI4, MB2012SMRW-24RI4
MB2012DMRW-12RI4, MB2012DMRW-15RI4
MB2024SMRW-12RI4, MB2024SMRW-15RI4
MB2048SMRW-12RI4, MB2048SMRW-24RI4
MB2048DMRW-12RI4



MB2012SMRW-05RI4

Mechanical Dimensions

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Pin Connections

Pin	Single	Dual	Pin	Single	Dual
1	+VIN	+VIN	4	No Pin	Comm.
2	-VIN	-VIN	5	-VOUT	-VOUT
3	+VOUT	+VOUT			

Mechanical Notes:

- All dimensions are typical in inches (mm)
- Tolerance x.xx = ±0.01 (±0.25)

Related Products

Medical Approved DC/DC's



MA600MRWRI5 Series

- 6W Output Power
- 5 kVrms Isolation
- Reinforced Insulation
- Meets 2xMOPP
- 2 μ A Leakage Current Max
- Wide 2:1 Input Range
- Compact DIP Case
- Single & Dual Outputs
- 1.0 MH MTBF
- EN 60601 Approved



MB1000MRWRI4 Series

- 10W Output Power
- 4.2 kVrms Isolation
- Reinforced Insulation
- Meets 1xMOPP & 2xMOOP
- 10 μ A Leakage Current Max
- Wide 2:1 Input Range
- Compact 1 x 2 In Case
- Single & Dual Outputs
- 1.0 MH MTBF
- EN 60601 Approved



ML200MRR14 Series

- 2W Output Power
- 4 kVrms Isolation
- Reinforced Insulation
- Meets 1xMOPP & 2xMOOP
- 2 μ A Leakage Current Max
- Compact SMT Case
- Available on Tape/Reel
- 2.0 MH MTBF
- EN 60601 Approved

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