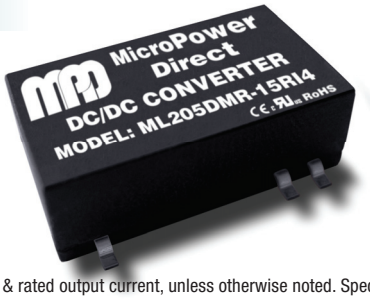
ML200MRRI4

Medical Approved Compact SMT, 2W DC/DC Converters



Key Features:

- EN 60601 3RD Ed. Approved
- 2W Output Power
- 4 kVrms Isolation
- Reinforced Insulation
- 1 x MOPP & 2 x MOOP per EN 60601-1 3RD Edition & ANSI/AAMI ES 60601-1
- 2 µA Max Leakage Current
- Compact SMT Case
- Single & Dual Outputs

RoHS

c UL us
ANSI/AAMI ES60601-1

CE

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Electrical Specifications

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

Input

Parameter	Conditions	Min.	Typ.	Max.	Units
Input Voltage Range	5 VDC Input	4.5	5.0	5.5	VDC
	12 VDC Input	10.8	12.0	13.2	
	24 VDC Input	21.6	24.0	26.4	
Input Filter	Internal Capacitor				

Output

Parameter	Conditions	Min.	Typ.	Max.	Units
Output Voltage Accuracy			±2.0	±4.0	%
Output Voltage Balance	Dual Outputs, Balanced Loads		±0.1	±1.0	%
Line Regulation	VIN = Min to Max		±1.2	±1.5	%
Load Regulation, See Note 2	5V Output Models			±12	%
	All Other Models			±10	
Ripple & Noise (20 MHz)	See Note 3			150	mV P - P
Temperature Coefficient			±0.01	±0.02	%/°C
Output Short Circuit	Momentary (0.5 Sec.)				

General

Parameter	Conditions	Min.	Typ.	Max.	Units
Isolation Voltage	60 Seconds	4,000			Vrms
	1 Second	6,000			VPk
Reinforced Insulation Working Voltage	300 Vrms				
Leakage Current	240 VAC, 60 Hz			2.0	µA
Isolation Resistance	500 VDC	10			GΩ
Isolation Capacitance	100 kHz, 1V		15	20	pF
Switching Frequency		50	80	100	kHz

EMI Characteristics

Parameter	Standard	Criteria	Level
EMC	Complies With EN 55011 4TH Edition		
EMS	Complies With EN 60601-1-2		

Environmental

Parameter	Conditions	Min.	Typ.	Max.	Units
Operating Temperature Range	Ambient	-25		+80	°C
	Case			+90	°C
Storage Temperature Range		-50		+125	°C
Cooling	Free Air Convection				
Humidity	RH, Non-condensing			95	%

Physical

Case Size	See Mechanical Drawing (Page 2)
Case Material	Non-Conductive Black Plastic (UL94-V0)
Weight	0.13 Oz (3.75g)

Reliability Specifications

Parameter	Conditions	Min.	Typ.	Max.	Units
MTBF	MIL HDBK 217F, 25°C, Gnd Benign	2.0			MHours
Safety Standards	IEC/EN 60601-1, EN 60601-1 3RD Edition, 1xMOPP & 2 x MOOP				
	ANSI/AAMI ES 60601-1, 1xMOPP& 2 x MOOP Recognition, (UL Certificate)				
	ANSI/AAMI ES 60601-1, CAN/CSA-C22.2 No.60601-1				
Moisture Sensitivity Level, See Note 4	IPC/JEDEC J-STD-020D.1 Level 2				

Absolute Maximum Ratings

Parameter	Conditions	Min.	Typ.	Max.	Units
Input Voltage Surge (1 Sec)	5 VDC Input			9.0	VDC
	12 VDC Input			18.0	
	24 VDC Input			30.0	
Peak Reflow Temperature	See Note 5			245	°C

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

Model Selection Guide

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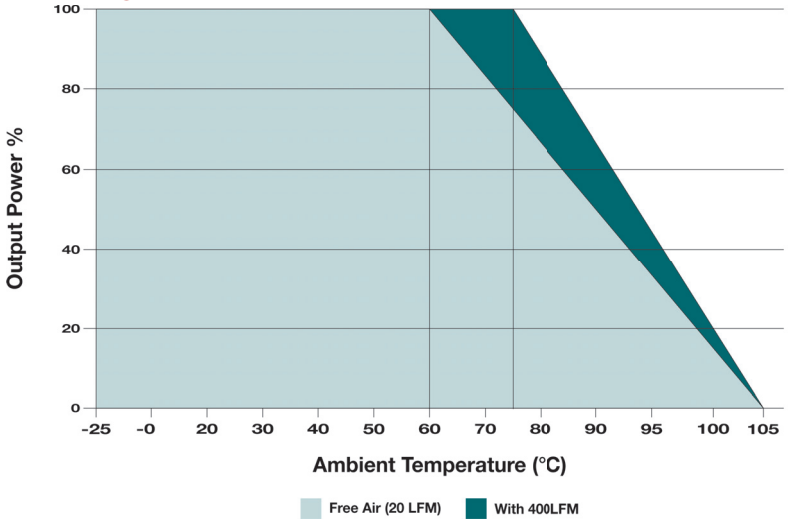
Model Number	Input				Output			Capacitive Load (µF, Max)	Efficiency (%, Typ)	Fuse Rating Slow-Blow (mA)
	Voltage (VDC)		Current (mA)		Voltage (VDC)	Current (mA, Max)	Current (mA, Min)			
	Nominal	Range	Full-Load	No-Load						
ML205SMR-05RI4	5	4.50 - 5.50	606	90	5.0	400.0	8.0	330	66	1,200
ML205SMR-12RI4	5	4.50 - 5.50	600	90	12.0	165.0	3.0	330	66	1,200
ML205SMR-15RI4	5	4.50 - 5.50	605	90	15.0	133.0	2.5	330	66	1,200
ML205DMR-12RI4	5	4.50 - 5.50	553	90	±12.0	±83.0	±1.5	100	72	1,200
ML205DMR-15RI4	5	4.50 - 5.50	542	90	±15.0	±66.0	±1.0	100	73	1,200
ML212SMR-05RI4	12	10.8 - 13.2	253	40	5.0	400.0	8.0	330	66	500
ML212SMR-12RI4	12	10.8 - 13.2	250	40	12.0	165.0	3.0	330	66	500
ML212SMR-15RI4	12	10.8 - 13.2	252	40	15.0	133.0	2.5	330	66	500
ML212DMR-12RI4	12	10.8 - 13.2	224	40	±12.0	±83.0	±1.5	100	74	500
ML212DMR-15RI4	12	10.8 - 13.2	220	40	±15.0	±66.0	±1.0	100	75	500
ML224SMR-05RI4	24	21.6 - 26.4	126	30	5.0	400.0	8.0	330	66	250
ML224SMR-12RI4	24	21.6 - 26.4	125	30	12.0	165.0	3.0	330	66	250
ML224SMR-15RI4	24	21.6 - 26.4	126	30	15.0	133.0	2.5	330	66	250
ML224DMR-12RI4	24	21.6 - 26.4	112	30	±12.0	±83.0	±1.5	100	74	250
ML224DMR-15RI4	24	21.6 - 26.4	110	30	±15.0	±66.0	±1.0	100	75	250

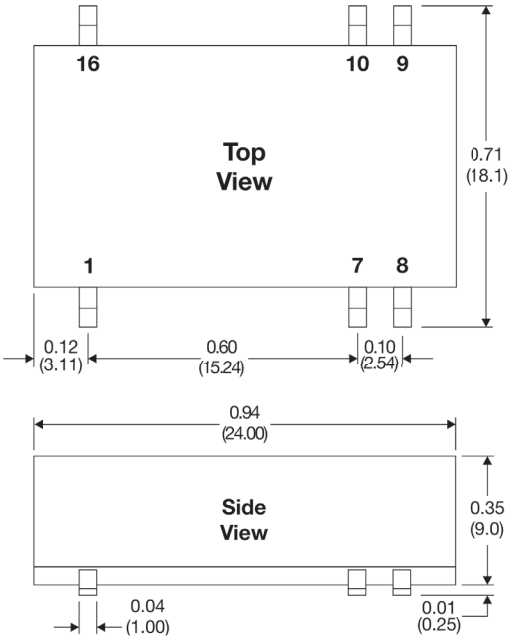
Notes:

1. The specified maximum capacitive load is for each output.
2. Load regulation is measured for a load change of 20% to 100%.
3. 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.
4. Any units that are not packaged in a vacuum sealed container should be stored in a controlled environment. Contact the factory for more information.
5. The recommended reflow settings are a peak temperature of 245 °C for a maximum period (TPK) of 10S and a time above liquidous (TL) of ≤60 seconds at 217 °C. For more information, please contact the factory.
6. Operation at no-load will not damage these units. However, they may not meet all specifications.
7. 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.
8. 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 5V input units a 2.2 µF is recommended, for 12V input units, a 1.0 µF; and for 24V units a 0.47 µF.
9. 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.

Derating Curve



Mechanical Dimensions

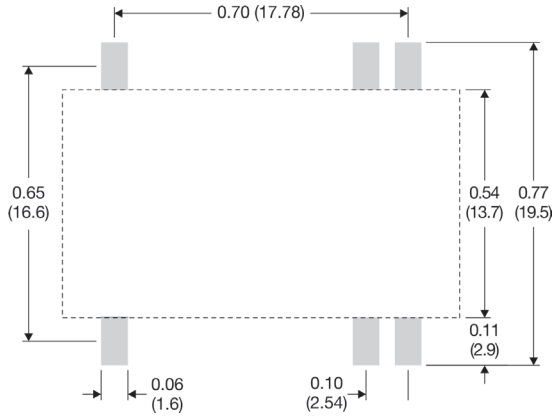


Pin Connections

Pin	Single	Dual
1	-VIN	-VIN
7	NC	NC
8	NC	Common
9	+VOUT	+VOUT
10	-VOUT	-VOUT
16	+VIN	+VIN

NC = No Connection

Solder Layout



Mechanical Notes:

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

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