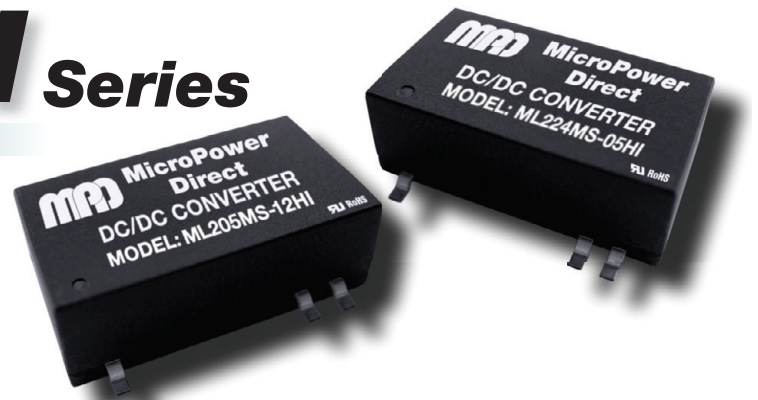


ML200MHI Series

Compact SMT, 2W Medical Approved DC/DC Converters



Key Features:

- 2W Output Power
- 4 kVAC rms Isolation
- Reinforced Insulation
- Meets 1xMOPP & 2xMOOP
- 2 μ A Leakage Current Max
- Compact SMT Case
- Single & Dual Outputs
- 2.0 MH MTBF
- Industry Standard Pin-Out
- EN 60601 Approved

RoHS



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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	$V_{IN} = \text{Min to Max}$		± 1.2	± 1.5	%
Load Regulation, See Note 2	See Model Selection Guide				
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, Rated	60 Seconds	4,000			VAC rms
Reinforced Insulation Working Voltage	300 Vrms				
Leakage Current				2.0	μ A
Isolation Resistance	500 VDC	10			G Ω
Isolation Capacitance	100 kHz, 1V		15	20	pF
Switching Frequency		50	80	100	kHz
EMC	Complies With EN 55011 4 th 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	0.14 Oz (3.75g)				

Reliability Specifications					
Parameter	Conditions	Min.	Typ.	Max.	Units
MTBF	MIL HDBK 217F, 25°C, Gnd Benign	2.0			MHours
Safety Approvals	UL 60601-1, EN 60601-1 3 rd Edition				
	UL 60950-1, EN 60950-1				
	ANSI/AAMI ES 60601-1 1xMOPP & 2XMOOP Recognition				
Moisture Sensitivity Level	IPC/JEDEC J-STD-020D.1 Level 2, See Note 4				

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.

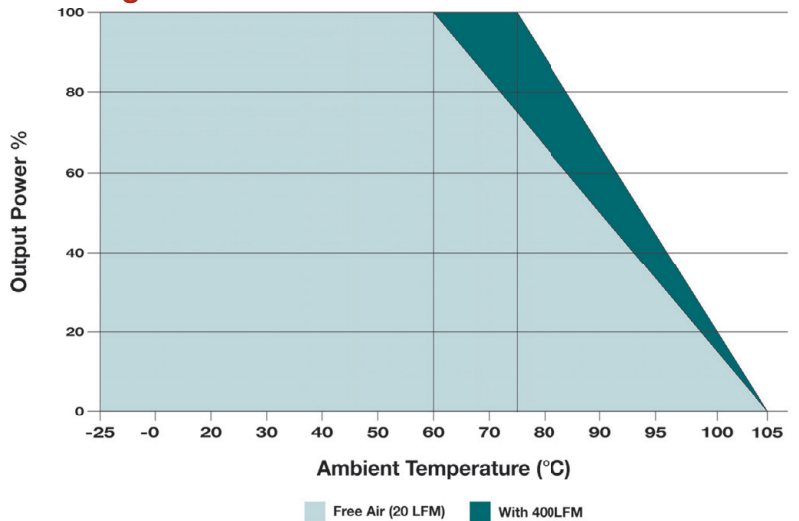
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Model Number	Input				Output			Capacitive Load (µF, Max)	Load Regulation (% , Max)	Efficiency (% , Typ)	Fuse Rating Slow-Blow (mA)
	Voltage (VDC)		Current (mA)		Voltage (VDC)	Current (mA, Max)	Current (mA, Min)				
	Nominal	Range	Full-Load	No-Load							
ML205MS-05HI	5	4.50 - 5.50	606	90	5.0	400.0	8.0	330	12	66	1,200
ML205MS-12HI	5	4.50 - 5.50	600	90	12.0	165.0	3.0	330	10	66	1,200
ML205MS-15HI	5	4.50 - 5.50	605	90	15.0	133.0	2.5	330	10	66	1,200
ML205MD-12HI	5	4.50 - 5.50	553	90	±12.0	±83.0	±1.5	100	10	72	1,200
ML205MD-15HI	5	4.50 - 5.50	542	90	±15.0	±66.0	±1.0	100	10	73	1,200
ML212MS-05HI	12	10.8 - 13.2	253	40	5.0	400.0	8.0	330	12	66	500
ML212MS-12HI	12	10.8 - 13.2	250	40	12.0	165.0	3.0	330	10	66	500
ML212MS-15HI	12	10.8 - 13.2	252	40	15.0	133.0	2.5	330	10	66	500
ML212MD-12HI	12	10.8 - 13.2	224	40	±12.0	±83.0	±1.5	100	10	74	500
ML212MD-15HI	12	10.8 - 13.2	220	40	±15.0	±66.0	±1.0	100	10	75	500
ML224MS-05HI	24	21.6 - 26.4	126	30	5.0	400.0	8.0	330	12	66	250
ML224MS-12HI	24	21.6 - 26.4	125	30	12.0	165.0	3.0	330	10	66	250
ML224MS-15HI	24	21.6 - 26.4	126	30	15.0	133.0	2.5	330	10	66	250
ML224MD-12HI	24	21.6 - 26.4	112	30	±12.0	±83.0	±1.5	100	10	74	250
ML224MD-15HI	24	21.6 - 26.4	110	30	±15.0	±66.0	±1.0	100	10	75	250

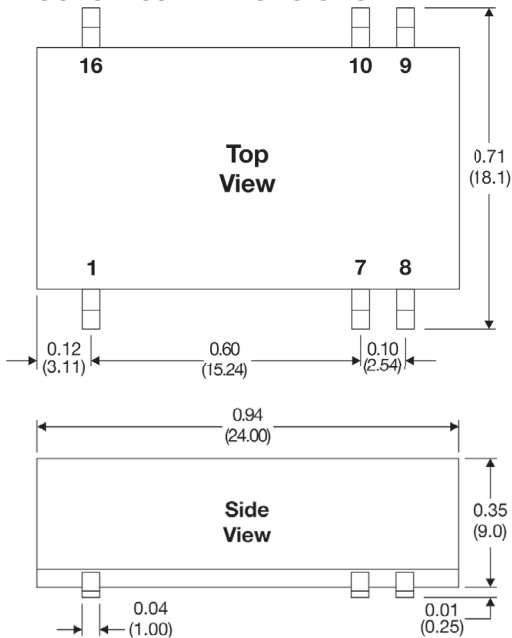
Notes:

- The specified maximum capacitive load is for each output.
- Load regulation is measured for a load change of 20% to 100%.
- 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.
- Any units that are not packaged in a vacuum sealed container should be stored in a controlled environment. Contact the factory for more information.
- The recommended reflow settings are a peak temperature of 245 °C for a maximum period (T_{PK}) of 10S and a time above liquidous (T_L) of ≤60 seconds at 217 °C. For more information, please contact the factory.
- Operation at no-load will not damage these units. However, they may not meet all specifications.
- 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 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.
- 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



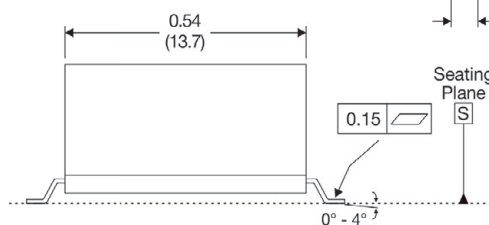
Mechanical Dimensions



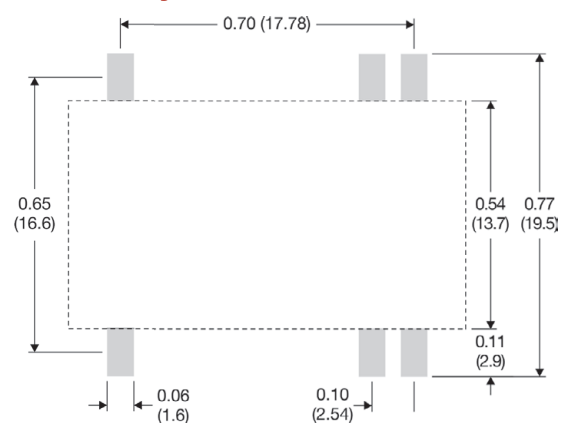
Pin Connections

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)