

# ML200SE Series

## 2W, Single Output Ultra-Miniature SMT DC/DC Converters



### Key Features:

- 2W Output Power
- Ultra-Miniature SMT Case
- 1,500 VDC Isolation
- Single Output
- -40°C to +105°C Operation
- >3.5 MHour MTBF
- 17 Standard Models
- **LOW COST!**

**RoHS**



**Tape & Reel**

### 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

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	
	15 VDC Input	13.5	15.0	16.5	
	24 VDC Input	21.6	24.0	26.4	
Input Filter	Capacitor				

#### Output

Parameter	Conditions	Min.	Typ.	Max.	Units
Output Voltage Accuracy			±3.0		%
Capacitive Load				220	µF
Line Regulation	3.3 VOUT Models	For Vin Change of 1%		±1.5	%
	All Other Models			±1.2	
Load Regulation, See Note 1	See Model Selection Guide				
Ripple & Noise (20 MHz), See Note 2	24V Output Models		100	200	mV P - P
	All Other Models		100	150	
Temperature Coefficient				±0.03	%/°C
Output Short Circuit	Momentary (1S Max)				

#### General

Parameter	Conditions	Min.	Typ.	Max.	Units
Isolation Voltage	60 Seconds	1,500			VDC
Isolation Resistance	500 VDC	1,000			MΩ
Isolation Capacitance	100 kHz, 0.1V		20		pF
Switching Frequency			100	300	kHz

#### EMI Characteristics

Parameter	Standard	Criteria	Level
Radiated Emissions	EN 55022		B
Conducted Emissions	EN 55022		B
ESD	EN 61000-4-2	B	±8kV

#### Environmental

Parameter	Conditions	Min.	Typ.	Max.	Units
Operating Temperature Range	Ambient	-40	+25	+105	°C
Storage Temperature Range		-55		+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	0.05 Oz (1.52g)				

#### Reliability Specifications

Parameter	Conditions	Min.	Typ.	Max.	Units
MTBF	MIL HDBK 217F, 25°C, Gnd Benign	3.5			MHours

#### 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	
	15 VDC Input			21.0	
	24 VDC Input			30.0	
Peak Reflow Temperature	See Note 5			245	°C
Lead Temperature	1.5 mm From Case For 10 Sec			300	°C

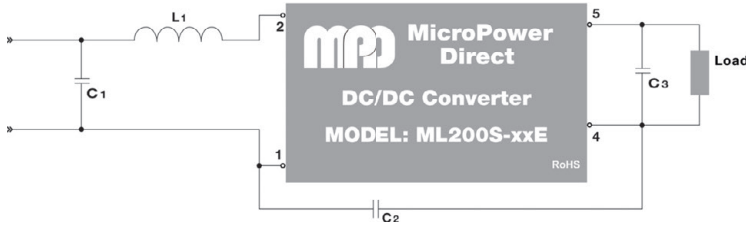
**Caution:** Exceeding Absolute Maximum Ratings may damage the module. These are not continuous operating ratings.

**www.micropowerdirect.com**

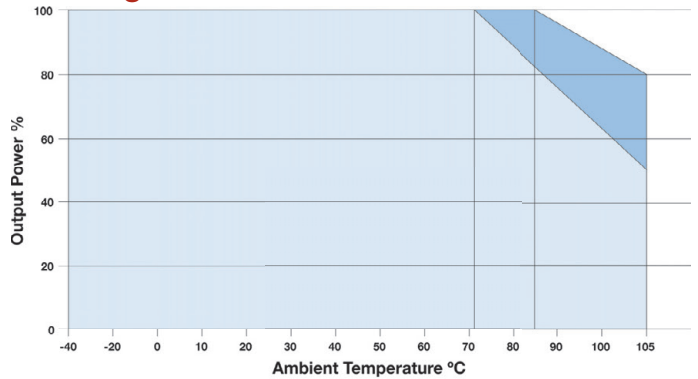
Model Number	Input				Output			Load Regulation % Typ.	Efficiency (% Typ)	Fuse Rating Slow-Blow (mA)
	Voltage (VDC)		Current (mA)		Voltage (VDC)	Current (mA, Max)	Current (mA, Min)			
	Nominal	Range	Full-Load	No-Load						
ML205S-03E	5	4.50 - 5.50	339	30	3.3	400.0	40.0	18.0	78	1,000
ML205S-05E	5	4.50 - 5.50	506	30	5.0	400.0	40.0	12.0	79	1,000
ML205S-09E	5	4.50 - 5.50	489	30	9.0	222.0	22.0	9.0	82	1,000
ML205S-12E	5	4.50 - 5.50	489	30	12.0	167.0	17.0	8.0	82	1,000
ML205S-15E	5	4.50 - 5.5	482	30	15.0	133.0	13.0	7.0	83	1,000
ML212S-05E	12	10.8 - 13.2	211	25	5.0	400.0	40.0	12.0	79	500
ML212S-09E	12	10.8 - 13.2	203	25	9.0	222.0	22.0	9.0	82	500
ML212S-12E	12	10.8 - 13.2	203	25	12.0	167.0	17.0	8.0	82	500
ML212S-15E	12	10.8 - 13.2	201	25	15.0	133.0	13.0	7.0	83	500
ML212S-24E	12	10.8 - 13.2	198	25	24.0	83.0	8.0	6.0	84	500
ML215S-05E	15	13.5 - 16.5	169	18	5.0	400.0	40.0	12.0	79	400
ML215S-15E	15	13.5 - 16.5	160	18	15.0	133.0	13.0	7.0	83	400
ML224S-05E	24	21.6 - 26.4	105	15	5.0	400.0	40.0	12.0	79	250
ML224S-09E	24	21.6 - 26.4	102	15	9.0	222.0	22.0	9.0	82	250
ML224S-12E	24	21.6 - 26.4	102	15	12.0	167.0	17.0	8.0	82	250
ML224S-15E	24	21.6 - 26.4	100	15	15.0	133.0	13.0	7.0	83	250
ML224S-24E	24	21.6 - 26.4	97	15	24.0	83.0	8.0	6.0	86	250

Notes:

- Output load regulation is specified for a load change of 10% to 100%.
- When measuring output ripple, it is recommended that a 1  $\mu$ F capacitor be placed in parallel from the +Vout pin to the -Vout pin.
- It is recommended that the minimum output load should be at least 10%. Continuous operation below this level could damage the unit.
- These converters are specified for operation without external components. However, in some applications the addition of input/output capacitors will enhance stability and reduce output ripple. The simple connection shown below will typically meet EN 55022 Class B.



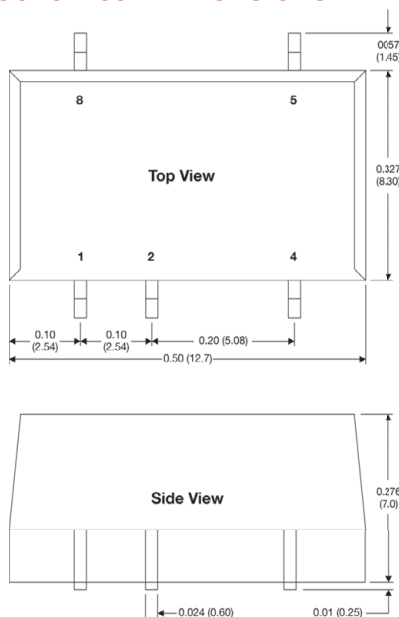
Derating Curve



V <sub>IN</sub>	C <sub>1</sub>	C <sub>2</sub>	L <sub>1</sub>	V <sub>OUT</sub>	C <sub>3</sub>
5 VDC	4.7 $\mu$ F/50V		6.8 $\mu$ H	3.3 VDC	10 $\mu$ F
12 VDC	2.2 $\mu$ F/50V		6.8 $\mu$ H	5 VDC	10 $\mu$ F
15 VDC	2.2 $\mu$ F/50V		6.8 $\mu$ H	9 VDC	4.7 $\mu$ F
24 VDC	1.0 $\mu$ F/50V	1 nF/2kV	6.8 $\mu$ H	12 VDC	2.2 $\mu$ F
				15 VDC	1.0 $\mu$ F
				24 VDC	0.47 $\mu$ F

Note: The 470 pF/2kV (C2) is only required on model ML224S-24E

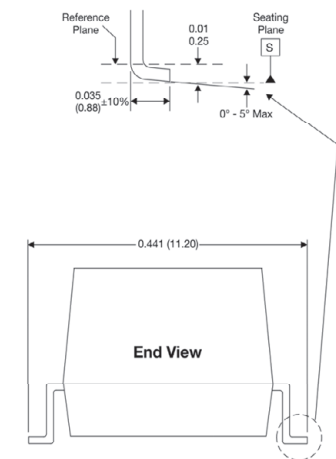
Mechanical Dimensions



Pin Connections

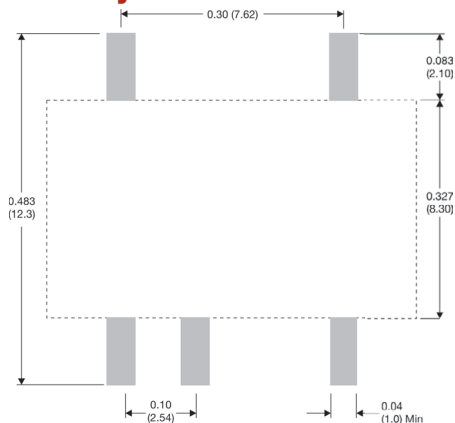
Pin	Description	Pin	Description
1	-V <sub>IN</sub>	4	-V <sub>OUT</sub>
2	+V <sub>IN</sub>	5	+V <sub>OUT</sub>
		8	NC

NC = No Connection



- The recommended reflow settings are a peak temperature of 245 °C for a maximum period (T<sub>P</sub>) of 10S and a time above liquidous (T<sub>L</sub>) of  $\leq$ 60 seconds at 217 °C. For more information, please contact the factory.
- It is recommended that a fuse be used on the input of a power supply for protection. See the Model Selection table above for the correct rating.

Board Layout



Notes:

- All dimensions are typical in inches (mm)
- Tolerance x.xx =  $\pm$ 0.01 ( $\pm$ 0.25)
- Pin 1 is marked by a "dot" or indentation on the unit