

# ML200SE Series

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



### Electrical Specifications

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

### Key Features:

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



### 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			±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, See Note 3	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 55032		B
Conducted Emissions	EN 55032		B
ESD	EN 61000-4-2	B	±8kV Contact

### 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 4)				
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 4			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.

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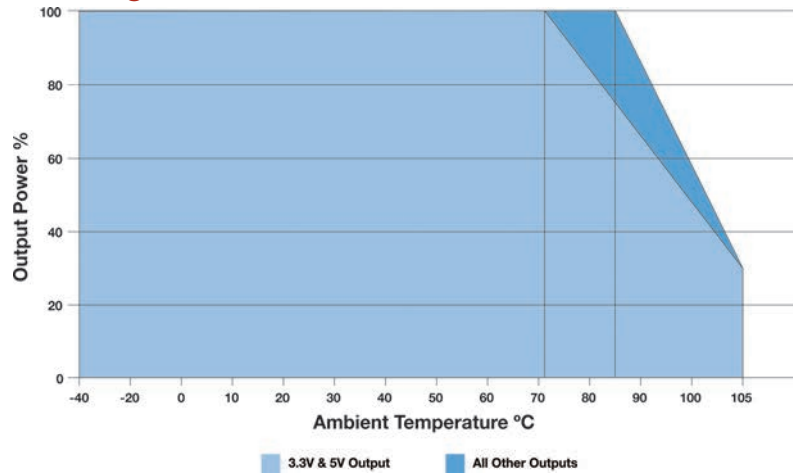
[www.micropowerelectronics.com](http://www.micropowerelectronics.com)

Model Number	Input				Output			Load Regulation	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				% Typ.		
ML205S-03E	5	4.50 - 5.50	366	30	3.3	400.0	40.0	18.0	72	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	99	15	24.0	83.0	8.0	6.0	84	250

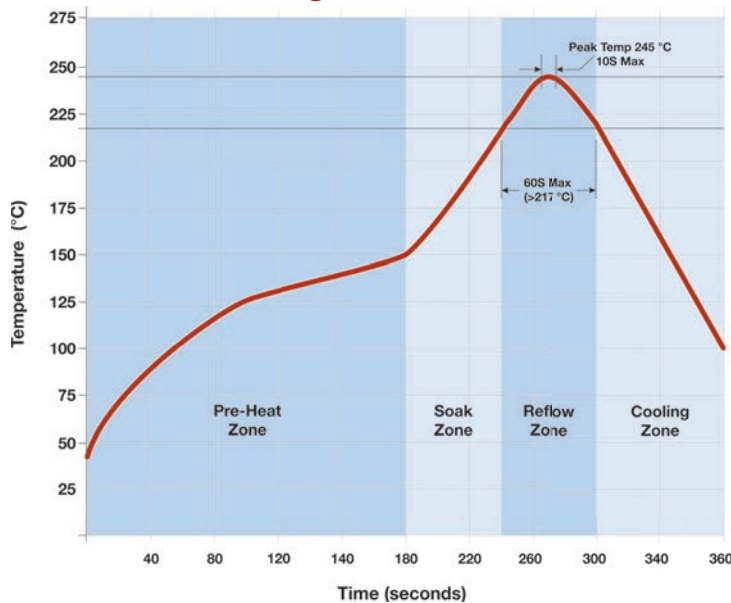
Notes:

1. Output load regulation is specified for a load change of 10% to 100%.
2. When measuring output ripple, it is recommended that a 1  $\mu$ F capacitor and a 10  $\mu$ F capacitor be placed in parallel from the +Vout pin to the -Vout pin.
3. Units must be restarted after a short circuit fault.
4. The recommended reflow settings are given below.
5. It is recommended that the minimum output load should be at least 10%. Continuous operation below this level could damage the unit.
6. 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 on page 3 will typically meet EN 55022 Class B.
7. The model ML215S-05E has not been tested to CE standards.
8. 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.

Derating Curve



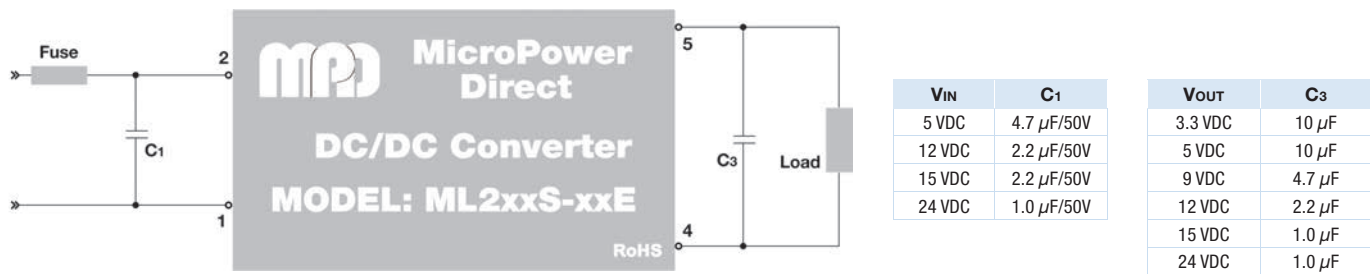
Reflow Solder Settings



The **ML200SE** series is designed to meet the IPC/JEDEC standard J-STD-020D.1 for reflow soldering. 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  $\leq$ 60 seconds at 217 °C, as illustrated at left.

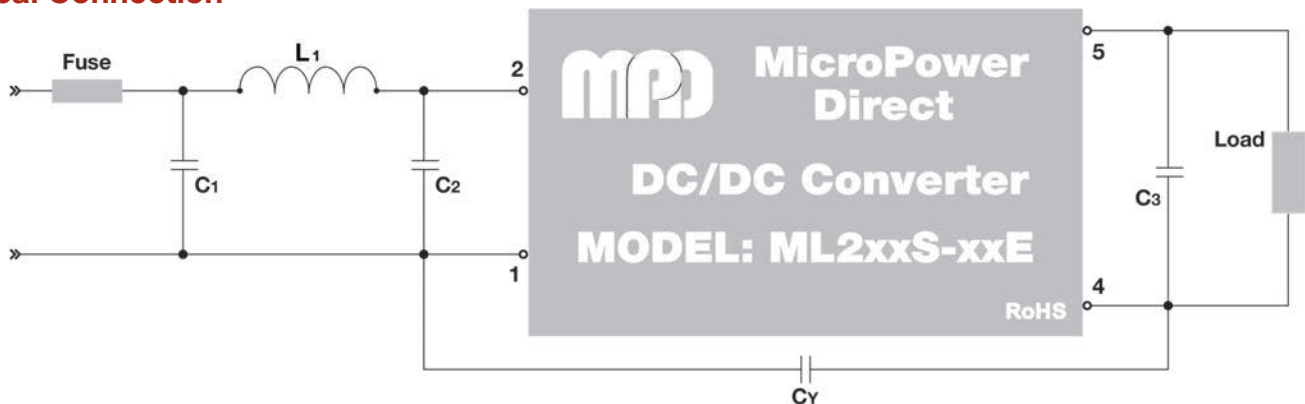
For more information, please contact the factory.

## Simple Connection



The diagram above illustrates a simple connection of the ML200SE series. For applications that do not require the circuit to meet EMI/EMC specifications, the capacitors C1, and C3 will reduce input/output ripple and improve the converter stability over time and temperature. The recommended component values are given in the table at right.

## Typical Connection

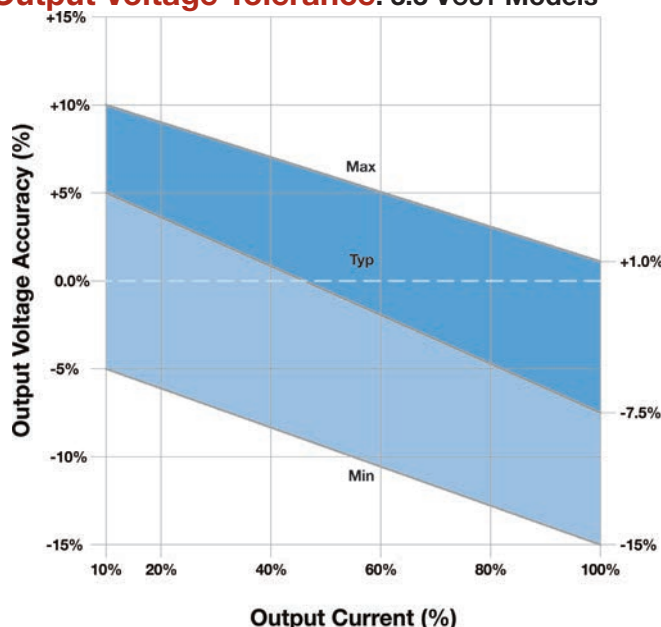


The diagram above illustrates a typical connection of the ML200SE series for an application that requires compliance to EMI/EMC standards EN 55032 and EN 61000-4 (as specified on page 1). Some notes on these components are:

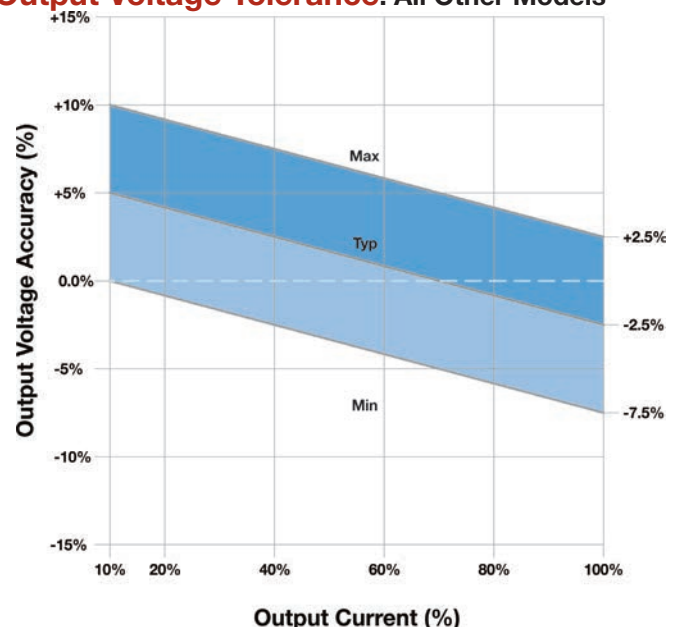
1. An external fuse is recommended to protect the unit in the event of a fault on the input line. A recommended value is given in model selection table on page 2.
2. The output filtering capacitor (C3) is a high frequency, low resistance electrolytic capacitor. Care must be taken in choosing this capacitor not to exceed the capacitive load specification for the unit. Voltage derating of capacitors should be 80% or above.
3. Suggested component values are:
4. In many applications, simply adding input/output capacitors will enhance the input surge protection & and reduce output ripple sufficiently. In this case, capacitors C1 and C3 could be connected as shown in the simple connection above, without the other filter components. Recommended capacitor values are given in the table above.

Component	V <sub>IN</sub> : 5V, 12V, 15V	V <sub>IN</sub> : 24V
C1	4.7 $\mu$ F/50V	4.7 $\mu$ F/50V
C2	4.7 $\mu$ F/50V	4.7 $\mu$ F/50V
L1	6.8 $\mu$ H	6.8 $\mu$ H
C3	See C3 in Table Above	
CY	---	1 nF/2 kV

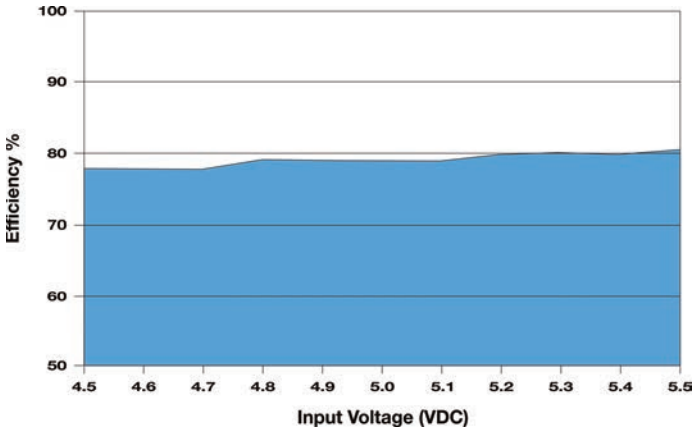
## Output Voltage Tolerance: 3.3 V<sub>OUT</sub> Models



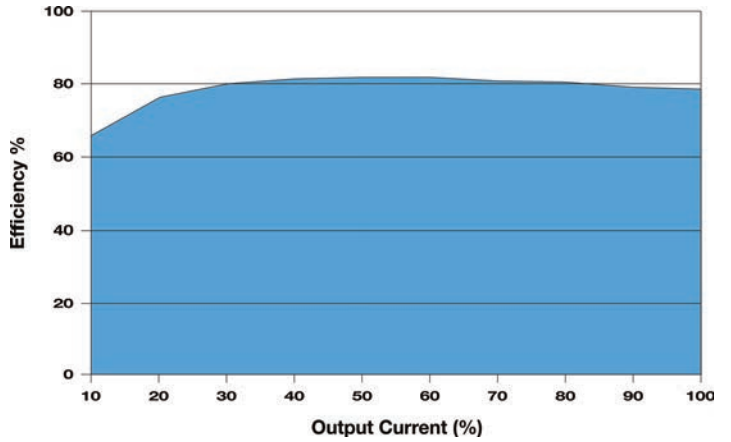
## Output Voltage Tolerance: All Other Models



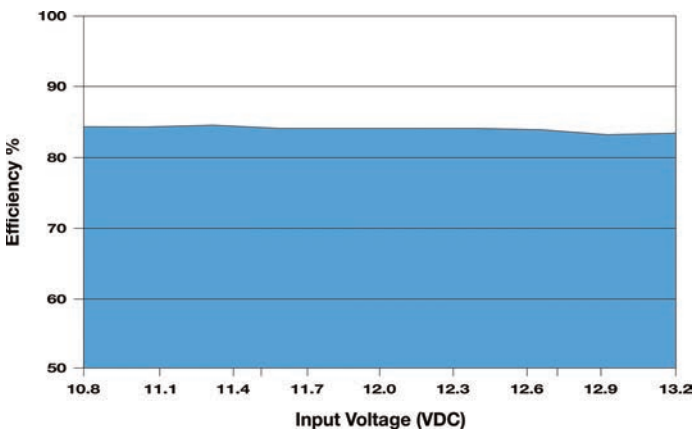
Efficiency vs Input Voltage (5VIN, Full Load)



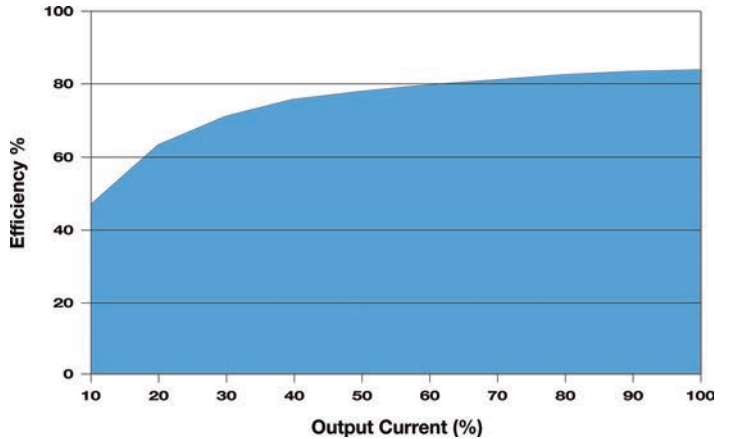
Efficiency vs Output Power (VIN = 5 VDC)



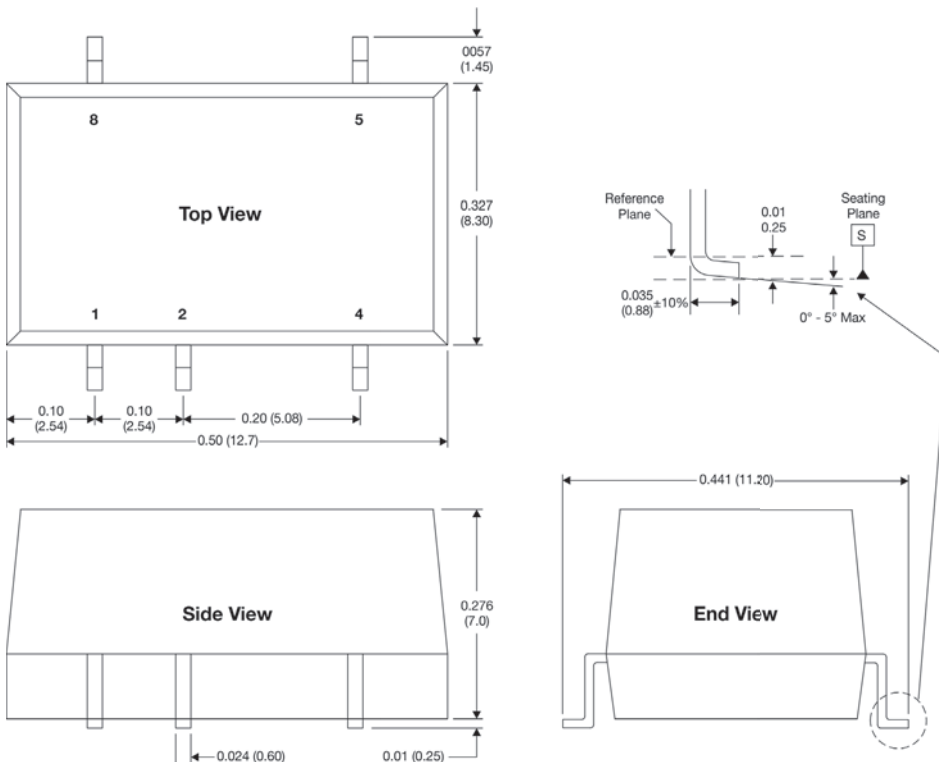
Efficiency vs Input Voltage (12VIN, Full Load)



Efficiency vs Output Power (VIN = 12 VDC)



Mechanical Dimensions

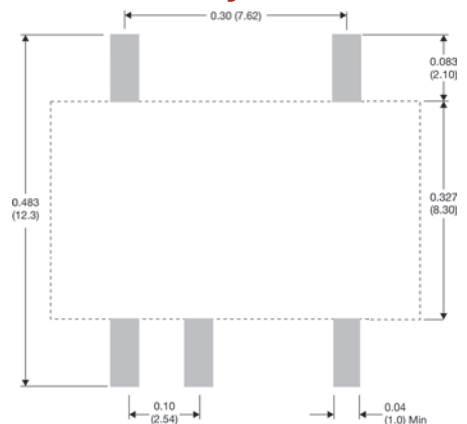


Pin Connections

Pin	Description	Pin	Description
1	-VIN	4	-VOUT
2	+VIN	5	+VOUT
		8	NC

NC = No Connection

Solder Pad Layout



Notes:

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

