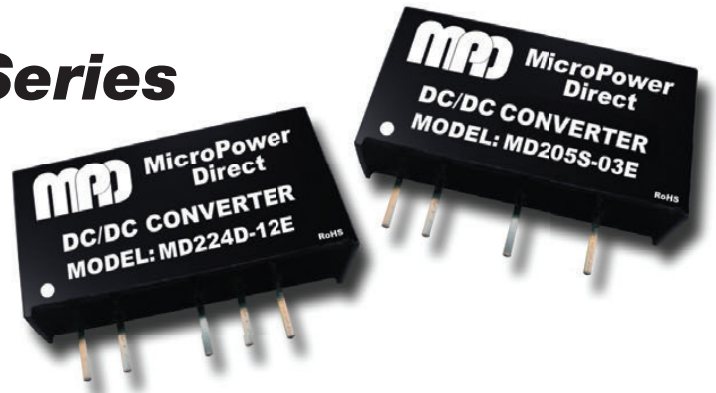


# MD200xE Series

## Low Cost, 2W Miniature SIP DC/DC Converters



### Key Features:

- 2W Output Power
- Miniature SIP Case
- Short Circuit Protected
- 1,500 VDC Isolation
- Single and Dual Outputs
- >3.5 MHour MTBF
- -40°C to +105°C Operation
- **LOW COST**

**3.0 kV Isolation  
Models  
Available**

**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	4.50	5.0	5.50	VDC
	12 VDC Input	10.80	12.0	13.20	
	15 VDC Input	13.50	15.0	16.50	
	24 VDC Input	21.60	24.0	26.40	
Input Filter	Internal Capacitor				

#### Output

Parameter	Conditions	Min.	Typ.	Max.	Units
Output Voltage Accuracy			±2.5		%
Line Regulation	3.3 VDC Output	For VIN Change of 1%		±1.5	%
	All Other Outputs			±1.2	
Load Regulation, See Note 1	See Model Selection Guide				
Ripple & Noise (20 MHz), See Note 2	Output Voltage ≤12 VDC		60		mV P - P
	15 VDC, 24 VDC Output		75		
Temperature Coefficient				±0.03	%/°C
Output Short Circuit	Continuous (Autorecovery)				

#### 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, 1V		20		pF
Switching Frequency			100	300	kHz

#### EMI Characteristics

Parameter	Conditions	Min.	Typ.	Max.	Units
EMI Compliance, See Note 4	Conducted	CISPR22/EN 55022 Level B			
	Radiated	CISPR22/EN 55022 Level B			
EMC Compliance, Single Output	Electrostatic Discharge (ESD)	EN 61000-4-2 Level B Contact ±8 kV			
EMC Compliance, Dual Output		EN 61000-4-2 Level B Contact ±6 kV			

#### 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	0.772 x 0.276 x 0.394 Inches (19.6 x 7.0 x 10.0 mm)				
Case Material	Non-Conductive Black Plastic (UL-94V0)				
Weight	0.08 Oz (2.4g)				

#### 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	-0.7		9.0	VDC
	12 VDC Input	-0.7		18.0	
	15 VDC Input	-0.7		21.0	
	24 VDC Input	-0.7		30.0	
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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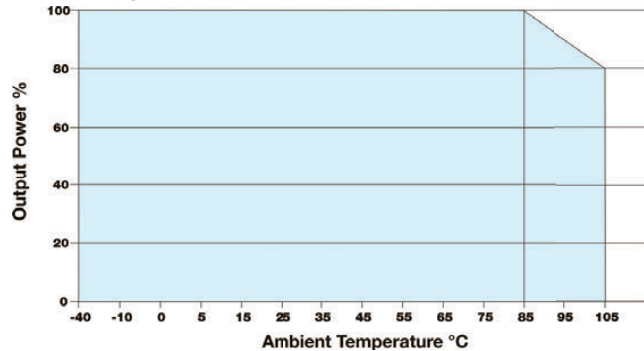
Model Number	Input				Output			Load Regulation % Typ.	Output Capacitive Load (μF Max)	Efficiency (% Typ)	Fuse Rating Slow-Blow (mA)
	Voltage (VDC)		Current (mA)		Voltage (VDC)	Current (mA, Max)	Current (mA, Min)				
	Nominal	Range	Full-Load	No-Load							
MD205S-03E	5	4.5 - 5.5	476	25	3.3	400	40.0	18.0	220	84	1,000
MD205S-05E	5	4.5 - 5.5	450	25	5.0	400	40.0	12.0	220	89	1,000
MD205S-12E	5	4.5 - 5.5	476	25	12.0	167	17.0	8.0	220	84	1,000
MD205S-15E	5	4.5 - 5.5	476	25	15.0	133	13.0	7.0	220	84	1,000
MD205S-24E	5	4.5 - 5.5	476	25	24.0	83	8.0	6.0	220	84	1,000
MD205D-03E	5	4.5 - 5.5	540	25	±3.3	±303	±30.0	18.0	100	74	1,000
MD205D-05E	5	4.5 - 5.5	500	25	±5.0	±200	±20.0	12.0	100	80	1,000
MD205D-12E	5	4.5 - 5.5	476	25	±12.0	±83	±8.0	8.0	100	84	1,000
MD205D-15E	5	4.5 - 5.5	476	25	±15.0	±67	±7.0	7.0	100	84	1,000
MD205D-24E	5	4.5 - 5.5	476	25	±24.0	±42	±4.0	6.0	100	84	1,000
MD212S-03E	12	10.8 - 13.2	198	15	3.3	400	40.0	18.0	220	84	500
MD212S-05E	12	10.8 - 13.2	198	15	5.0	400	40.0	12.0	220	84	500
MD212S-12E	12	10.8 - 13.2	198	15	12.0	167	17.0	8.0	220	84	500
MD212S-15E	12	10.8 - 13.2	198	15	15.0	133	13.0	7.0	220	84	500
MD212D-03E	12	10.8 - 13.2	208	15	±3.3	±303	±30.0	18.0	100	80	500
MD212D-05E	12	10.8 - 13.2	198	15	±5.0	±200	±20.0	12.0	100	84	500
MD212D-12E	12	10.8 - 13.2	196	15	±12.0	±83	±8.0	8.0	100	85	500
MD212D-15E	12	10.8 - 13.2	198	15	±15.0	±67	±7.0	7.0	100	84	500
MD215D-15E	15	13.5 - 16.5	157	10	±15.0	±67	±7.0	7.0	100	85	500
MD224S-03E	24	21.6 - 26.4	99	8	3.3	400	40.0	18.0	220	84	250
MD224S-05E	24	21.6 - 26.4	99	8	5.0	400	40.0	12.0	220	84	250
MD224S-12E	24	21.6 - 26.4	99	8	12.0	167	17.0	8.0	220	84	250
MD224S-15E	24	21.6 - 26.4	99	8	15.0	133	13.0	7.0	220	84	250
MD224S-24E	24	21.6 - 26.4	98	8	24.0	83	8.0	6.0	220	85	250
MD224D-03E	24	21.6 - 26.4	104	8	±3.3	±303	±30.0	18.0	100	80	250
MD224D-05E	24	21.6 - 26.4	99	8	±5.0	±200	±20.0	12.0	100	84	250
MD224D-12E	24	21.6 - 26.4	99	8	±12.0	±83	±8.0	8.0	100	84	250
MD224D-15E	24	21.6 - 26.4	99	8	±15.0	±67	±7.0	7.0	100	84	250

Notes:

- Output load regulation is specified for a load change of 10% to 100%.
- When measuring output ripple, it is recommended that an external 1 μF ceramic capacitor & 10 μF electrolytic capacitor be placed in parallel from the +Vout pin to the -Vout pin for single output models, or from each output to common for dual output models.
- Operation at no load will not damage these units, however, they may not meet all specifications.
- 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. For dual output units, a capacitor should be connected from each output to common.

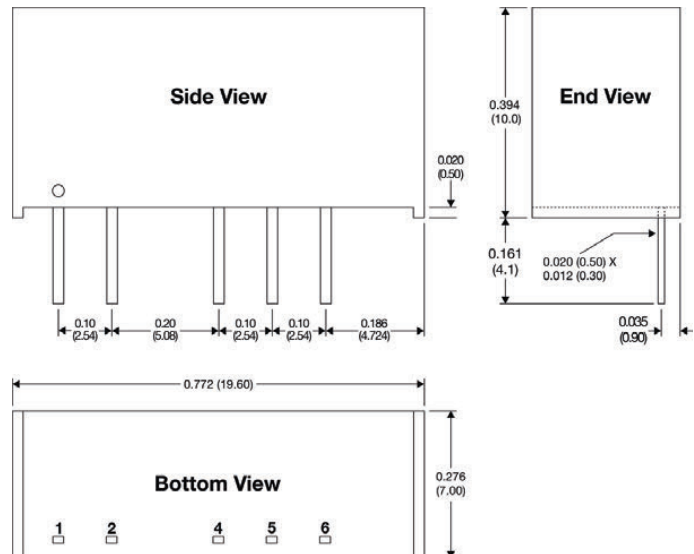


Derating Curve



V <sub>IN</sub>	C <sub>1</sub>	L <sub>1</sub>	V <sub>OUT</sub>	C <sub>2</sub>
5 VDC	4.7 μF/50V	6.8 μH	3.3 VDC	10 μF
12 VDC	4.7 μF/50V	6.8 μH	5 VDC	10 μF
15 VDC	4.7 μF/50V	6.8 μH	12 VDC	2.2 μF
24 VDC	4.7 μF/50V	6.8 μH	15 VDC	1.0 μF
			24 VDC	1.0 μF
			±3.3 VDC	4.7 μF
			±5 VDC	4.7 μF
			±12 VDC	1.0 μF
			±15 VDC	0.47 μF
			±24 VDC	0.47 μF

Mechanical Dimensions



- 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.

Pin Connections

Pin	Single	Dual	Pin	Single	Dual
1	+VIN	+VIN	5	No Pin	Common
2	-VIN	-VIN	6	+VOUT	+VOUT
4	-VOUT	-VOUT			



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Notes:

- All dimensions are typical in inches (mm)
- Tolerance x.xx = ±0.02 (±0.50)
- Pin 1 is marked by a "dot" or indentation on the unit