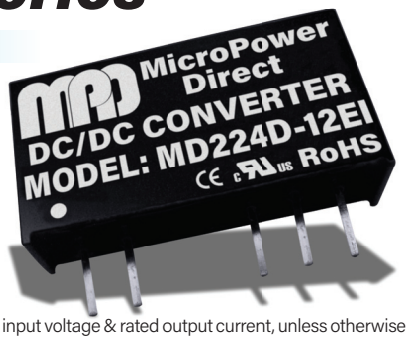
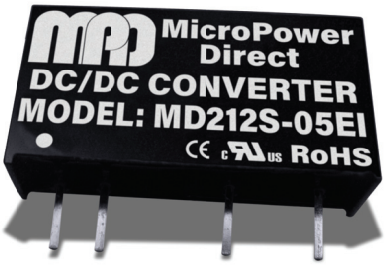
MD200EI Series

Miniature, 2W High Isolation SIP DC/DC Converters





Key Features:

- 2W Output Power
- 3,000 VDC Isolation
- Miniature SIP Case
- EN 62368 Approvals
- Short Circuit Protected
- Single & Dual Outputs
- -40°C to +105°C Operation
- >3.5 MHour MTBF
- 47 Standard Models
- Industry Standard Footprint
- *LOW COST!*

1.5 kV Isolation Models Available

MicroPower Direct
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Stoughton, MA 02072
USA

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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	
Reflected Ripple Current			15		mA
Input Filter	Internal Capacitor				

Output

Parameter	Conditions	Min.	Typ.	Max.	Units
Output Voltage Accuracy	See Tolerance Graphs (Page 3)				
Line Regulation, See Note 3	For VIN Change of 1%			±1.2	%
Load Regulation, See Note 4	See Model Selection Guide				
Ripple & Noise (20 MHz)	See Note 5		75	200	mV P - P
Temperature Coefficient			±0.02		%/°C
Output Short Circuit	Continuous (Autorecovery)				

General

Parameter	Conditions	Min.	Typ.	Max.	Units
Isolation Voltage	See Note 6	3,000			VDC
Isolation Resistance	500 VDC	1,000			MΩ
Isolation Capacitance	100 kHz, 1V		20		pF
Switching Frequency	See Note 7		260		kHz

EMI Characteristics

Parameter	Standard	Criteria	Level
Radiated Emissions, See Page 3	EN 55032		Class B
Conducted Emissions, See Page 3	EN 55032		Class B
ESD, Single Output Models	EN 61000-4-2	B	Contact ±8 kV
ESD, Dual Output Models	EN 61000-4-2	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	5		95	%

Physical

Case Size	See Mechanical Dimensions (Page 5)
Case Material	Non-Conductive Black Plastic (UL-94V0)
Weight	See Page 5

Reliability Specifications

Parameter	Conditions	Min.	Typ.	Max.	Units
MTBF	MIL HDBK 217F, 25°C, Gnd Benign	3.5			MHours
Safety Standards	UL/cUL 62368 recognition (UL certificate)				
Vibration	10 - 150 hZ, 5G, 0.75mm, along X,Y & Z				

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	
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.

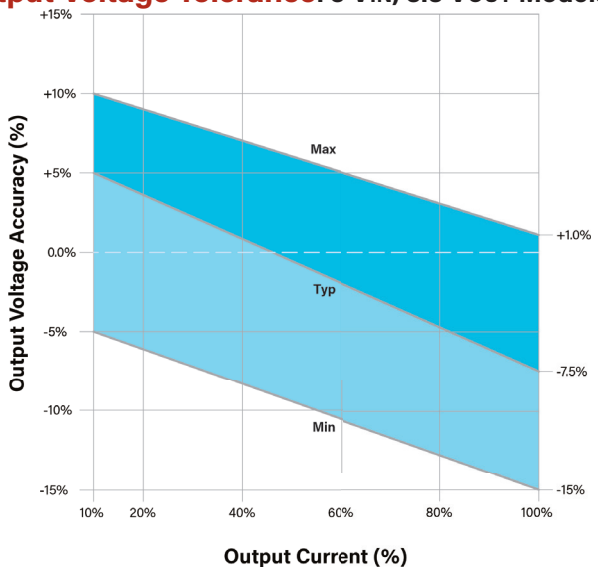
Model Selection Guide

	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-03EI	5	4.5 - 5.5	534	8	3.3	400	40.0	10.0	220	79	700
	MD205S-05EI	5	4.5 - 5.5	477	8	5.0	400	40.0	8.0	220	82	1,000
	MD205S-07EI	5	4.5 - 5.5	477	8	7.2	400	40.0	8.0	220	82	1,000
	MD205S-09EI	5	4.5 - 5.5	471	8	9.0	222	22.0	7.0	220	82	1,000
	MD205S-12EI	5	4.5 - 5.5	471	8	12.0	167	17.0	7.0	220	82	1,000
	MD205S-15EI	5	4.5 - 5.5	466	8	15.0	133	13.0	7.0	220	83	1,000
	MD205S-24EI	5	4.5 - 5.5	466	8	24.0	83	8.0	5.0	220	84	1,000
	MD205D-03EI	5	4.5 - 5.5	534	8	±3.3	±303	±30.0	10.0	100	72	1,000
	MD205D-05EI	5	4.5 - 5.5	477	8	±5.0	±200	±20.0	8.0	100	80	1,000
	MD205D-09EI	5	4.5 - 5.5	471	8	±9.0	±111	±11.0	7.0	100	84	1,000
	MD205D-12EI	5	4.5 - 5.5	471	8	±12.0	±83	±8.0	7.0	100	83	1,000
	MD205D-15EI	5	4.5 - 5.5	466	8	±15.0	±67	±7.0	7.0	100	82	1,000
	MD205D-24EI	5	4.5 - 5.5	466	8	±24.0	±42	±4.0	5.0	100	84	1,000
UL	MD212S-05EI	12	10.8 - 13.2	208	8	5.0	400	40.0	7.0	2,400	82	500
	MD212S-09EI	12	10.8 - 13.2	208	8	9.0	222	22.0	6.0	1,000	82	500
	MD212S-12EI	12	10.8 - 13.2	208	8	12.0	167	17.0	5.0	560	84	500
	MD212S-15EI	12	10.8 - 13.2	208	8	15.0	133	13.0	4.0	560	85	500
	MD212S-24EI	12	10.8 - 13.2	208	8	24.0	83	8.0	3.0	220	86	500
UL	MD212D-03EI	12	10.8 - 13.2	208	8	±3.3	±303	±30.0	15.0	1,200	75	500
UL	MD212D-05EI	12	10.8 - 13.2	208	8	±5.0	±200	±20.0	7.0	1,200	80	500
	MD212D-07EI	12	10.8 - 13.2	208	8	±7.2	±200	±20.0	6.0	1,200	80	500
	MD212D-09EI	12	10.8 - 13.2	208	8	±9.0	±111	±11.0	5.0	470	82	500
UL	MD212D-12EI	12	10.8 - 13.2	208	8	±12.0	±83	±8.0	5.0	220	83	500
UL	MD212D-15EI	12	10.8 - 13.2	208	8	±15.0	±67	±7.0	4.0	220	83	500
UL	MD212D-24EI	12	10.8 - 13.2	208	8	±24.0	±42	±4.0	3.0	100	83	500
	MD215S-05EI	15	13.5 - 16.5	167	8	5.0	400	40.0	7.0	2,400	80	400
	MD215S-09EI	15	13.5 - 16.5	167	8	9.0	222	22.0	5.0	1,000	80	400
	MD215S-12EI	15	13.5 - 16.5	167	8	12.0	167	17.0	5.0	560	81	400
	MD215S-15EI	15	13.5 - 16.5	167	8	15.0	133	13.0	4.0	560	81	400
	MD215S-24EI	15	13.5 - 16.5	167	8	24.0	83	8.0	3.0	220	81	400
	MD215D-05EI	15	13.5 - 16.5	167	8	±5.0	±200	±20.0	7.0	1,200	80	400
	MD215D-15EI	15	13.5 - 16.5	167	8	±15.0	±67	±7.0	4.0	220	82	400
	MD224S-03EI	24	21.6 - 26.4	104	8	3.3	400	40.0	15.0	2,400	76	200
UL	MD224S-05EI	24	21.6 - 26.4	104	8	5.0	400	40.0	7.0	2,400	80	200
	MD224S-07EI	24	21.6 - 26.4	104	8	7.2	278	27.0	6.0	2,400	80	200
	MD224S-09EI	24	21.6 - 26.4	104	8	9.0	222	22.0	5.0	1,000	81	200
UL	MD224S-12EI	24	21.6 - 26.4	104	8	12.0	167	17.0	5.0	560	84	200
UL	MD224S-15EI	24	21.6 - 26.4	104	8	15.0	133	13.0	4.0	560	86	200
	MD224S-18EI	24	21.6 - 26.4	104	8	18.0	111	11.0	3.0	220	86	200
UL	MD224S-24EI	24	21.6 - 26.4	104	8	24.0	83	8.0	3.0	220	86	200
	MD224D-03EI	24	21.6 - 26.4	104	8	±3.3	±300	±30.0	15.0	1,200	76	200
UL	MD224D-05EI	24	21.6 - 26.4	104	8	±5.0	±200	±20.0	7.0	1,200	80	200
	MD224D-07EI	24	21.6 - 26.4	104	8	±7.2	±139	±13.0	6.0	1,200	80	200
	MD224D-09EI	24	21.6 - 26.4	104	8	±9.0	±111	±11.0	5.0	470	83	200
UL	MD224D-12EI	24	21.6 - 26.4	104	8	±12.0	±83	±8.0	5.0	220	83	200
UL	MD224D-15EI	24	21.6 - 26.4	104	8	±15.0	±67	±7.0	4.0	220	83	200
	MD224D-24EI	24	21.6 - 26.4	104	8	±24.0	±42	±4.0	3.0	100	83	200

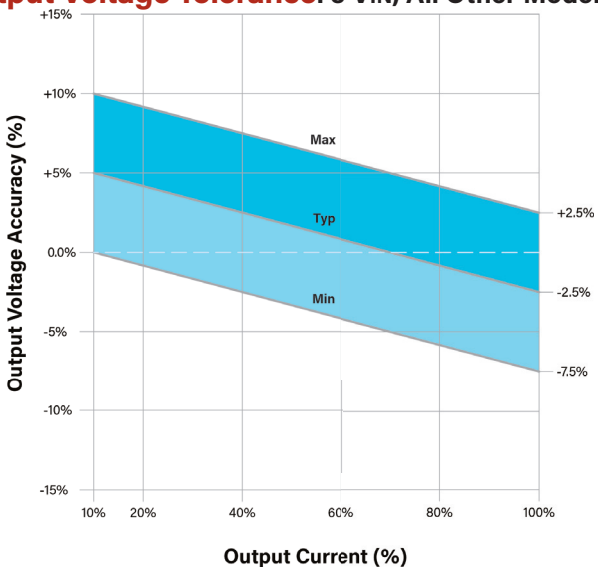
Notes:

1. Units that are marked with the "*UL*" in the model selection table above are approved to EN 62368.
2. Output capacitive load is specified for each output.
3. Single & dual 3.3 VOUT models have a specificed line regulation of 1.5 %/%.
4. Output load regulation is specified for a load change of 10% to 100%.
5. 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.
6. Isolation voltage is specified for a period 60S with a leakage current lower than 1 mA.
7. Switching frequency of 5 VIN models is typically 220 kHz
8. Operation at no load will not damage these units, however, they may not meet all specifications.
9. 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.

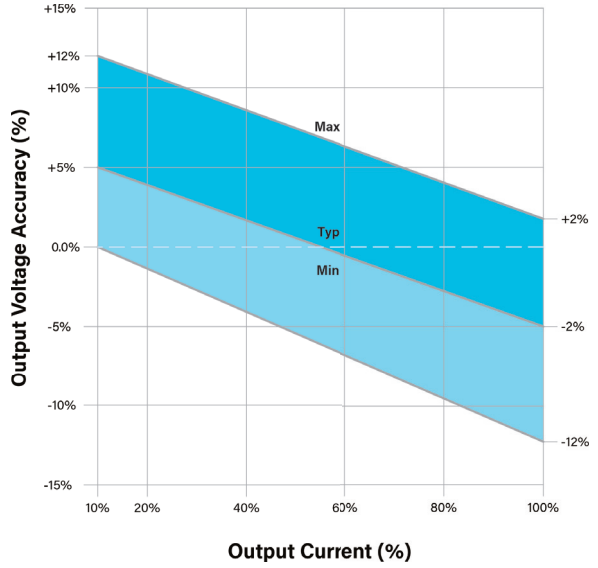
Output Voltage Tolerance: 5 VIN, 3.3 VOUT Models



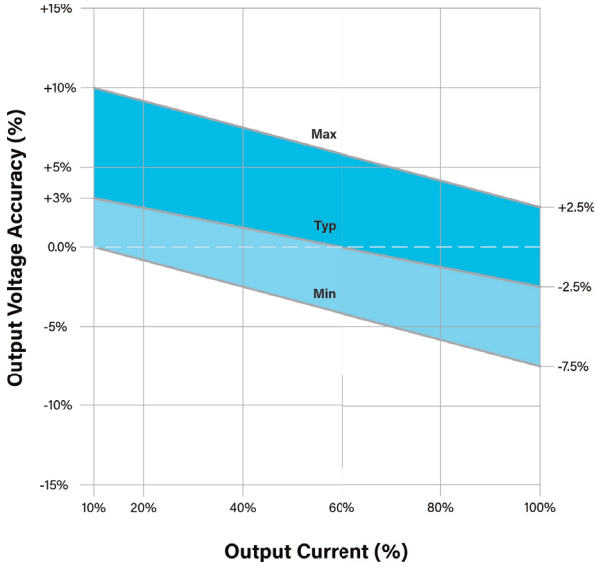
Output Voltage Tolerance: 5 VIN, All Other Models



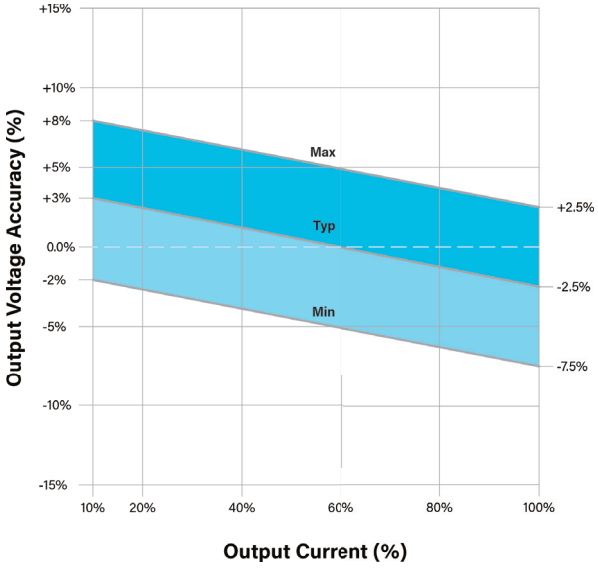
Output Voltage Tolerance: Other VIN, 3.3 VOUT Models



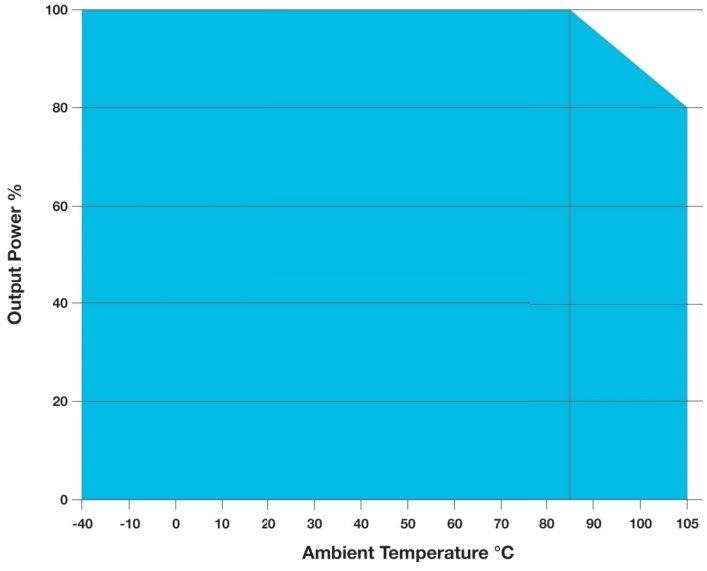
Output Voltage Tolerance: Other VIN, 5/7.2 VOUT Models



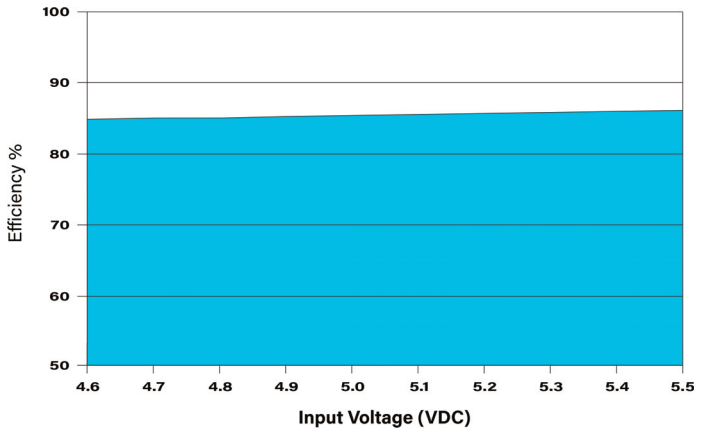
Output Voltage Tolerance: Other VIN, All Other Models



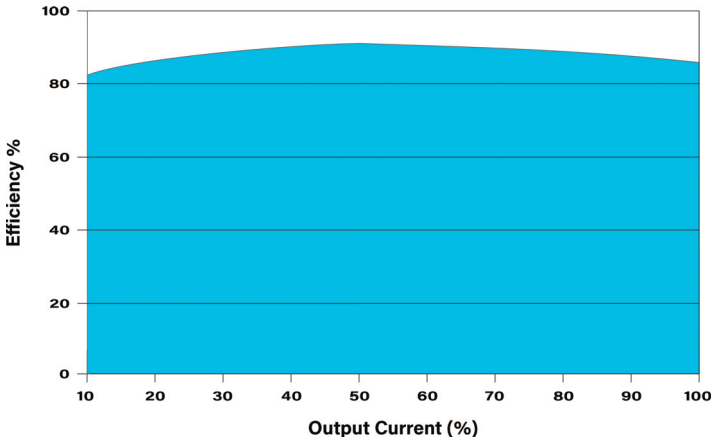
Temperature Derating Curve



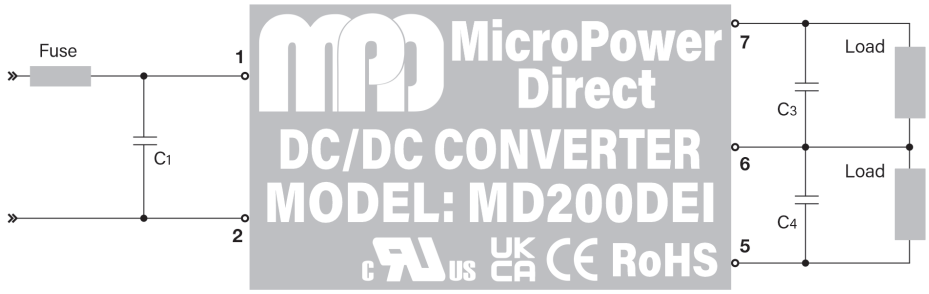
Efficiency vs Input Voltage (5 VIN, Full Load)



Efficiency vs Output Power (VIN = 5 VDC)



Typical Connection

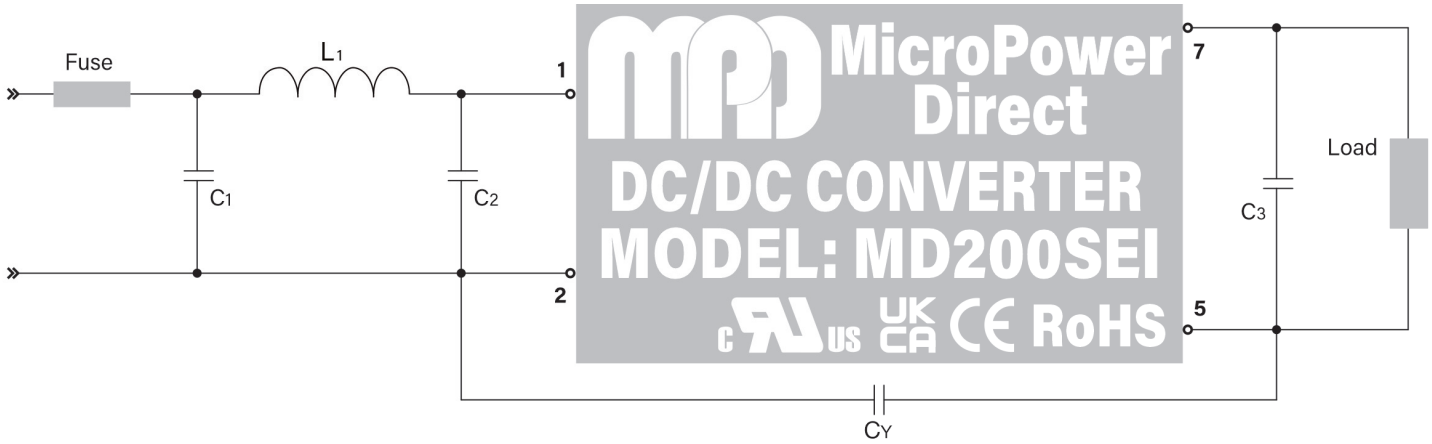


VIN	C1
5 VDC	10 µF/16V
12 VDC	2.2 µF/25V
15 VDC	2.2 µF/25V
24 VDC	1.0 µF/50V

VOUT	C3/C4
3.3 VDC	10 µF/16V
5 VDC	10 µF/16V
7.2 VDC	10 µF/16V
9 VDC	2.2 µF/25V
12 VDC	2.2 µF/25V
15 VDC	1.0 µF/25V
24 VDC	1.0 µF/50V
±3.3 VDC	4.7 µF/16V
±5 VDC	4.7 µF/16V
±7.2 VDC	2.2 µF/25V
±9 VDC	2.2 µF/25V
±12 VDC	1.0 µF/25V
±15 VDC	1.0 µF/25V
±24 VDC	0.47 µF/50V

The diagram above illustrates a typical connection of the **MD200EI** series. For applications that do not require the circuit to meet EMi/EMC specifications, the capacitors C1, C3 and C4 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.

EMI Connection



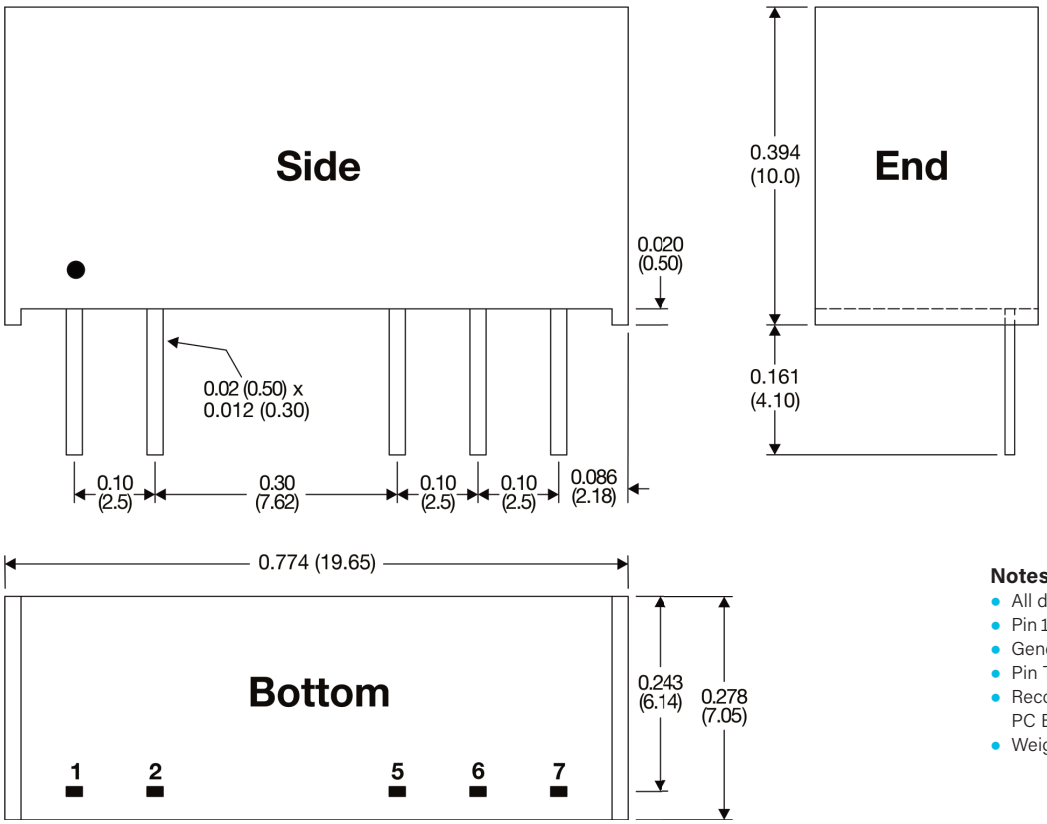
The diagram above illustrates a connection of the **MD200EI** series for an application that requires compliance to EMI/EMC standards EN 55032 and EN 61000-4 (as specified on page 1). Some notes on these components are:

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:

Component	VIN: 5V	VIN: 12,15,24V
C1	4.7µF/16V	4.7µF/50V
C2	4.7µF/16V	4.7µF/50V
L1	6.8 µH	6.8 µH
C3	See C3/C4 in Table Above	
CY	270 pF/4 kV	270 pF/3 kV

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, C3 and C4 could be connected as shown in the typical connection above, without the other filter components. Recommended capacitor values are given in the table above.

Mechanical Dimensions



Pin Connections

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

Notes:

- All dimensions are typical in inches (mm)
- Pin 1 is marked by a "dot" or indentation on the unit
- General Tolerance = ±0.01 (±0.25)
- Pin Tolerance = ±0.004 (±0.10)
- Recommended pin hole size (on the application PC Board) is Ø 0.039 (Ø1.00)
- Weight (Typ) = 0.08 Oz (2.4g)

MPD offers a very wide variety of DC/DC converters. Our standard product line includes SMT, SIP, and DIP potted modules, industry standard 1 x 1" & 1 x 2" modules, as well as new models in an ultra miniature DFN package. Our units are used in applications ranging from high speed gate drive circuits to instrumentation to industrial equipment and medical equipment/instrumentation. Units are available over a power range of 0.25 to 60W. Most models meet international EMC/EMI standards and many are fully approved to EN 62368. Call today, or go to our website to find the right DC/DC power module for your application.

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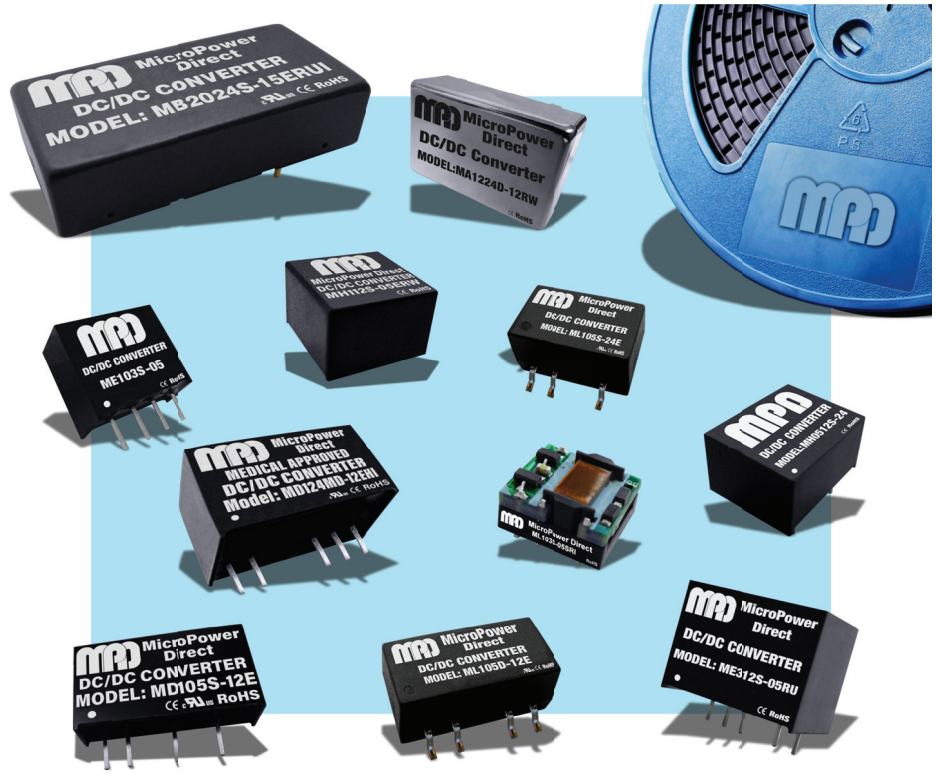

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