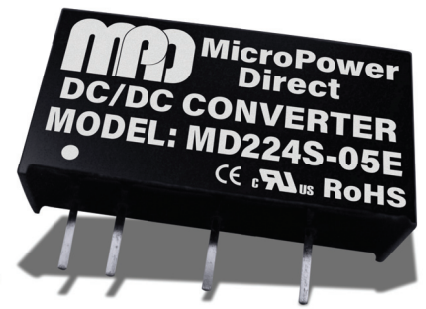
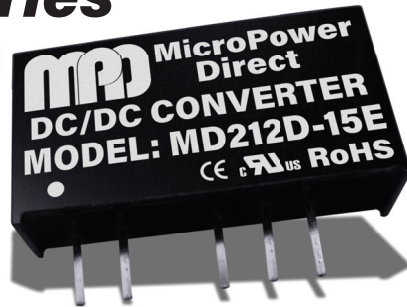


MD200E Series

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



Key Features:

- 2W Output Power
- 1,500 VDC Isolation
- Miniature SIP Case
- EN 62368 Approvals
- Short Circuit Protected
- Single & Dual Outputs
- -40°C to +105°C Operation
- >3.5 MHour MTBF
- 44 Standard Models
- Industry Standard Footprint
- **LOW COST!**

**3.0 kV Isolation
Models
Available**



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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	3.3 VDC Output	For VIN Change of 1%			±1.5	%
	All Other Outputs				±1.2	
Load Regulation, See Note 3		See Model Selection Guide				
Ripple & Noise (20 MHz)		See Note 4		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 5	1,500			VDC	
Isolation Resistance	500 VDC	1,000			MΩ	
Isolation Capacitance	100 kHz, 1V		20		pF	
Switching Frequency	See Note 6		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	EN 61000-4-2	B				Air ±8 kV
	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, See Note 1	UL/cUL 62368-1 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.

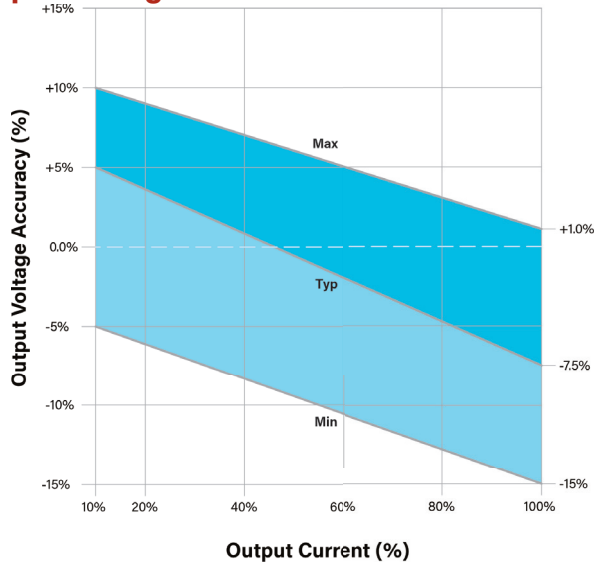
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	Model Number	Input				Output			Load Regulation (% Typ)	Output Capacitive Load (μF Max)	Efficiency (% Typ)	Fuse Rating Slow-Blow (mA)
		Voltage (VDC)		Current (mA)		Voltage (VDC)	Current (mA, Max)	Current (mA, Min)				
		Nominal	Range	Full-Load	No-Load							
UL	MD205S-03E	5	4.5 - 5.5	534	8	3.3	400	40.0	10.0	2,400	78	1,000
	MD205S-05E	5	4.5 - 5.5	477	8	5.0	400	40.0	8.0	2,400	84	1,000
	MD205S-07E	5	4.5 - 5.5	477	8	7.2	278	28.0	8.0	1,000	84	1,000
	MD205S-09E	5	4.5 - 5.5	471	8	9.0	222	22.0	7.0	1,000	85	1,000
	MD205S-12E	5	4.5 - 5.5	471	8	12.0	167	17.0	7.0	560	85	1,000
	MD205S-15E	5	4.5 - 5.5	466	8	15.0	133	13.0	7.0	560	86	1,000
	MD205S-24E	5	4.5 - 5.5	466	8	24.0	83	8.0	5.0	220	86	1,000
	MD205D-03E	5	4.5 - 5.5	500	35	±3.3	±303	±30.0	10.0	1,200	75	1,000
	MD205D-05E	5	4.5 - 5.5	500	35	±5.0	±200	±20.0	8.0	1,200	84	1,000
	MD205D-09E	5	4.5 - 5.5	476	35	±9.0	±111	±11.0	7.0	470	85	1,000
	MD205D-12E	5	4.5 - 5.5	476	35	±12.0	±83	±8.0	7.0	220	85	1,000
	MD205D-15E	5	4.5 - 5.5	487	35	±15.0	±67	±7.0	7.0	220	86	1,000
	MD205D-24E	5	4.5 - 5.5	476	35	±24.0	±42	±4.0	5.0	100	86	1,000
	MD212S-03E	12	10.8 - 13.2	223	8	3.3	400	40.0	15.0	2,400	79	500
	MD212S-05E	12	10.8 - 13.2	223	8	5.0	400	40.0	7.0	2,400	82	500
	MD212S-09E	12	10.8 - 13.2	223	8	9.0	222	22.0	5.0	1,000	82	500
UL	MD212S-12E	12	10.8 - 13.2	223	8	12.0	167	17.0	5.0	560	84	500
UL	MD212S-15E	12	10.8 - 13.2	223	8	15.0	133	13.0	4.0	560	85	500
UL	MD212S-24E	12	10.8 - 13.2	223	8	24.0	83	8.0	3.0	220	86	500
UL	MD212D-03E	12	10.8 - 13.2	223	8	±3.3	±303	±30.0	15.0	1,200	75	500
UL	MD212D-05E	12	10.8 - 13.2	223	8	±5.0	±200	±20.0	7.0	1,200	80	500
UL	MD212D-07E	12	10.8 - 13.2	223	8	±7.2	±139	±13.0	6.0	470	80	500
	MD212D-09E	12	10.8 - 13.2	223	8	±9.0	±111	±11.0	5.0	470	82	500
	MD212D-12E	12	10.8 - 13.2	223	8	±12.0	±83	±8.0	5.0	220	83	500
	MD212D-15E	12	10.8 - 13.2	223	8	±15.0	±67	±7.0	4.0	220	83	500
UL	MD212D-24E	12	10.8 - 13.2	223	8	±24.0	±42	±4.0	3.0	100	83	500
	MD215S-05E	15	13.5 - 16.5	167	8	5.0	400	40.0	7.0	2,400	80	400
	MD215S-15E	15	13.5 - 16.5	167	8	15.0	133	13.0	4.0	560	81	400
	MD215S-24E	15	13.5 - 16.5	167	8	24.0	83	8.0	3.0	220	81	400
UL	MD215D-05E	15	13.5 - 16.5	167	8	±5.0	±200	±20.0	7.0	1,200	80	400
	MD215D-15E	15	13.5 - 16.5	167	8	±15.0	±67	±7.0	4.0	220	82	400
	MD224S-03E	24	21.6 - 26.4	110	8	3.3	400	40.0	15.0	2,400	76	200
	MD224S-05E	24	21.6 - 26.4	110	8	5.0	400	40.0	7.0	2,400	80	200
UL	MD224S-09E	24	21.6 - 26.4	110	8	9.0	222	22.0	5.0	1,000	81	200
	MD224S-12E	24	21.6 - 26.4	110	8	12.0	167	17.0	5.0	560	84	200
	MD224S-15E	24	21.6 - 26.4	110	8	15.0	133	13.0	4.0	560	86	200
	MD224S-24E	24	21.6 - 26.4	110	8	24.0	83	8.0	3.0	220	86	200
UL	MD224D-03E	24	21.6 - 26.4	110	8	±3.3	±303	±30.0	15.0	1,200	76	200
	MD224D-05E	24	21.6 - 26.4	110	8	±5.0	±200	±20.0	7.0	1,200	80	200
	MD224D-07E	24	21.6 - 26.4	110	8	±7.2	±139	±13.0	6.0	470	80	200
	MD224D-09E	24	21.6 - 26.4	110	8	±9.0	±111	±11.0	5.0	470	81	200
UL	MD224D-12E	24	21.6 - 26.4	110	8	±12.0	±83	±8.0	5.0	220	83	200
	MD224D-15E	24	21.6 - 26.4	110	8	±15.0	±67	±7.0	4.0	220	83	200
	MD224D-24E	24	21.6 - 26.4	110	8	±24.0	±42	±4.0	3.0	100	83	200

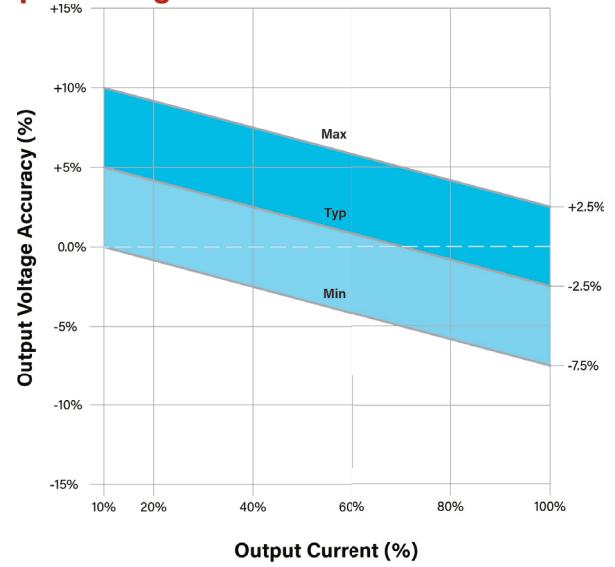
Notes:

- Units that are marked with the "UL" in the model selection table above are approved to EN 62368.
- Output capacitive load is specified for each output.
- Output load regulation is specified for a load change of 10% to 100%.
- When measuring output ripple, it is recommended that an external 1 μ F ceramic capacitor & 10 μ F electrolytic capacitor be placed in parallel from the +V_{OUT} pin to the -V_{OUT} pin for single output models, or from each output to common for dual output models.
- All 5V_{IN} models have a typical switching frequency of 220 kHz.
- Isolation voltage is specified for a period 60S with a leakage current lower than 1 mA.
- Operation at no load will not damage these units, however, they may not meet all specifications.
- 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.

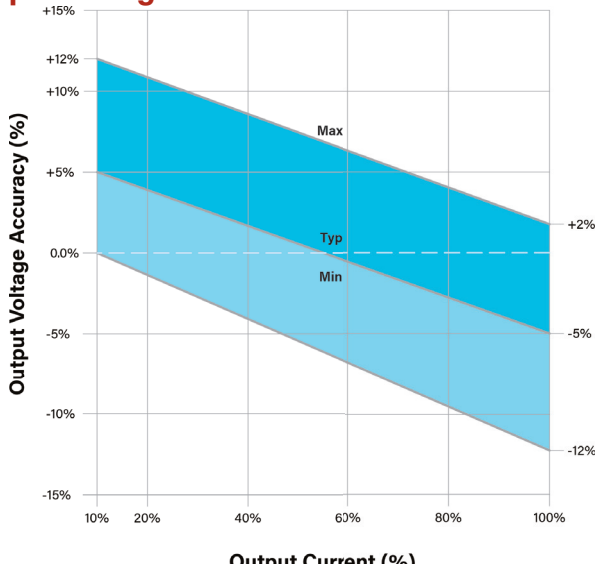
Output Voltage Tolerance: 5 VIN - 3.3 VOUT



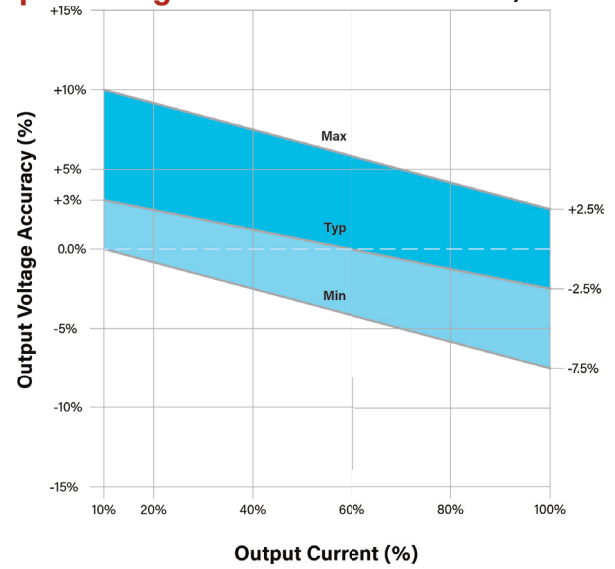
Output Voltage Tolerance: 5 VIN - All Other Models



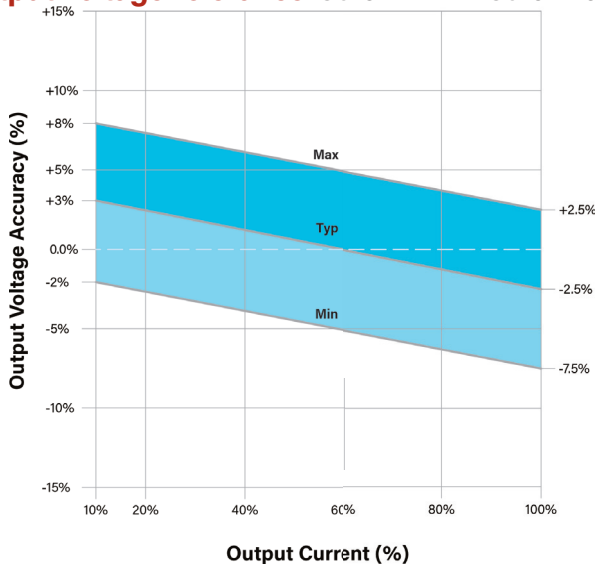
Output Voltage Tolerance: Other VIN - 3.3 VOUT



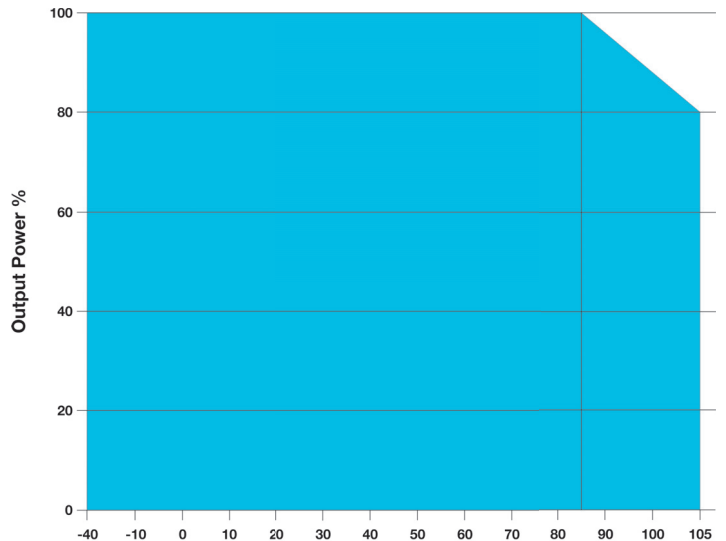
Output Voltage Tolerance: Other VIN - 5, 7.2 VOUT



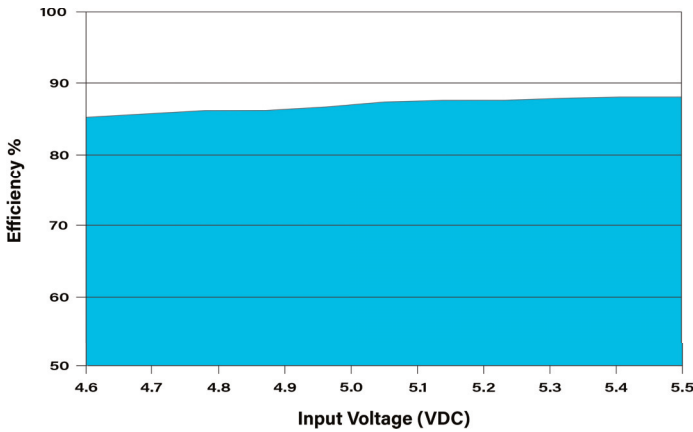
Output Voltage Tolerance: Other VIN - All Other Models



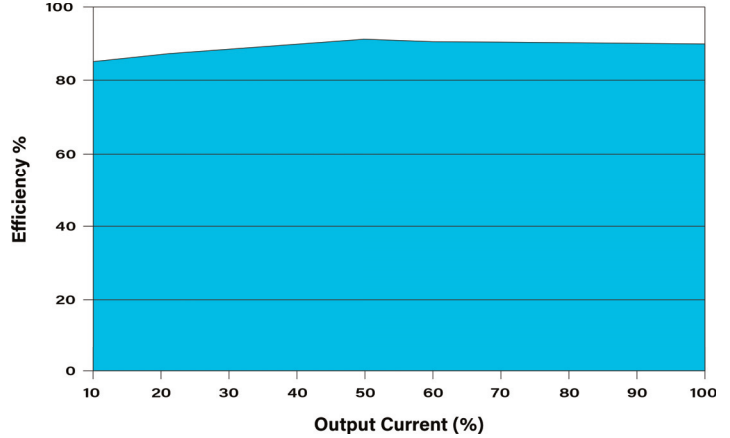
Temperature Derating Curve



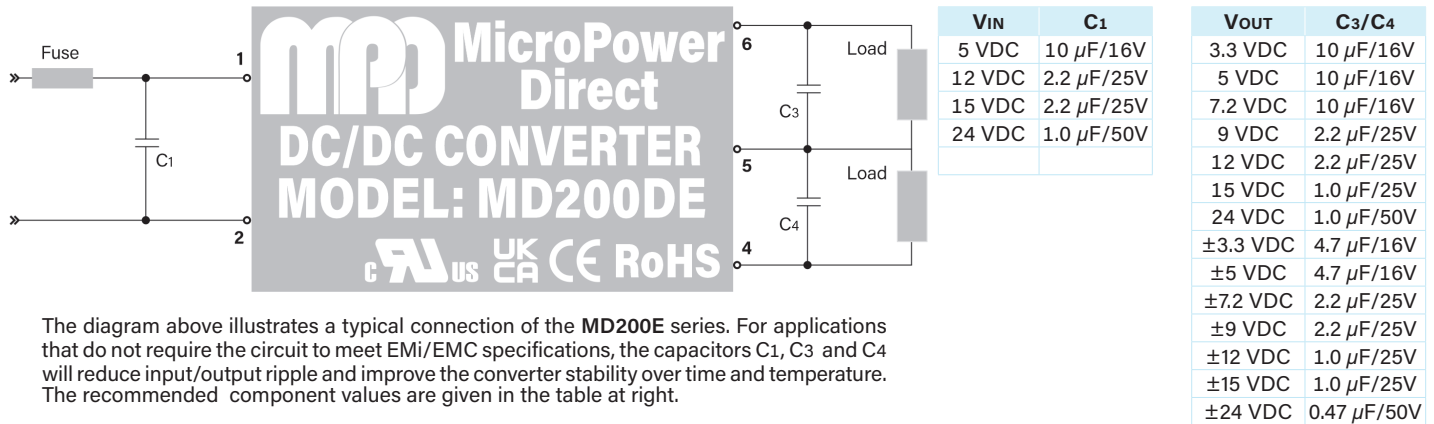
Efficiency vs Input Voltage (5 VIN, Full Load)



Efficiency vs Output Power (VIN = 5 VDC)

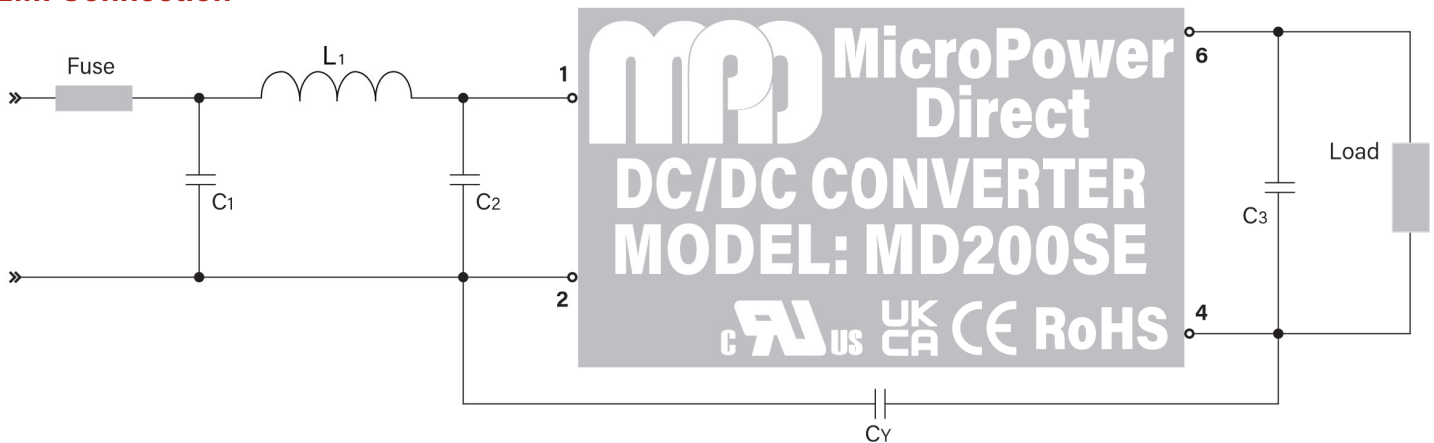


Typical Connection



The diagram above illustrates a typical connection of the **MD200E** 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 **MD200E** 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.

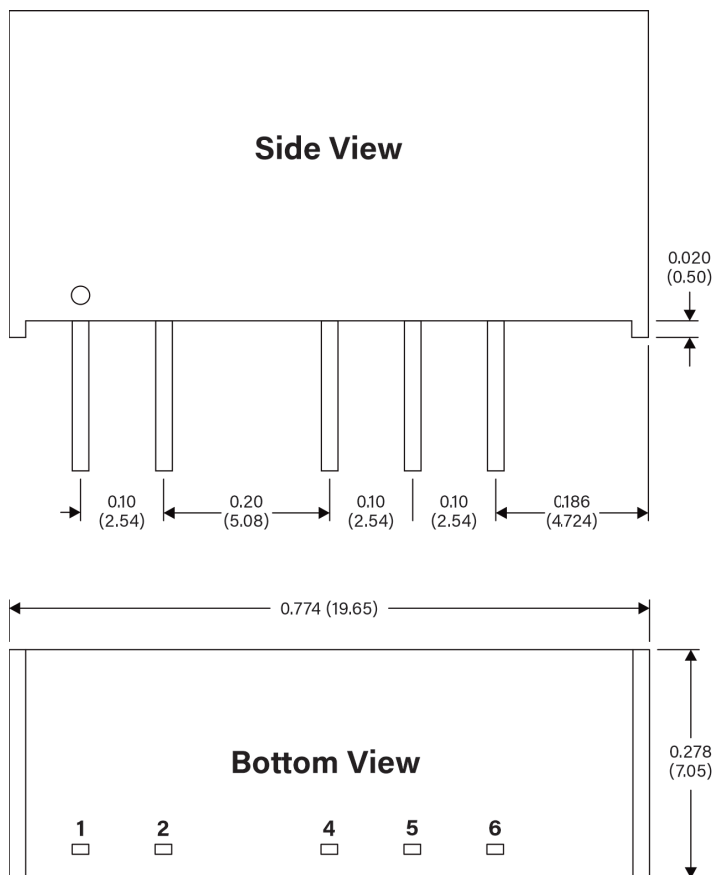
3. Suggested component values are:

Component	VIN: 5V	VIN: 12,15,24V
C1	4.7 μ F/16V	4.7 μ F/50V
C2	4.7 μ F/16V	4.7 μ F/50V
L1	6.8 μ H	6.8 μ H
C3	See C3/C4 in Table Above	
CY	270 pF/2 kV	270 pF/2 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

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Pin Connections

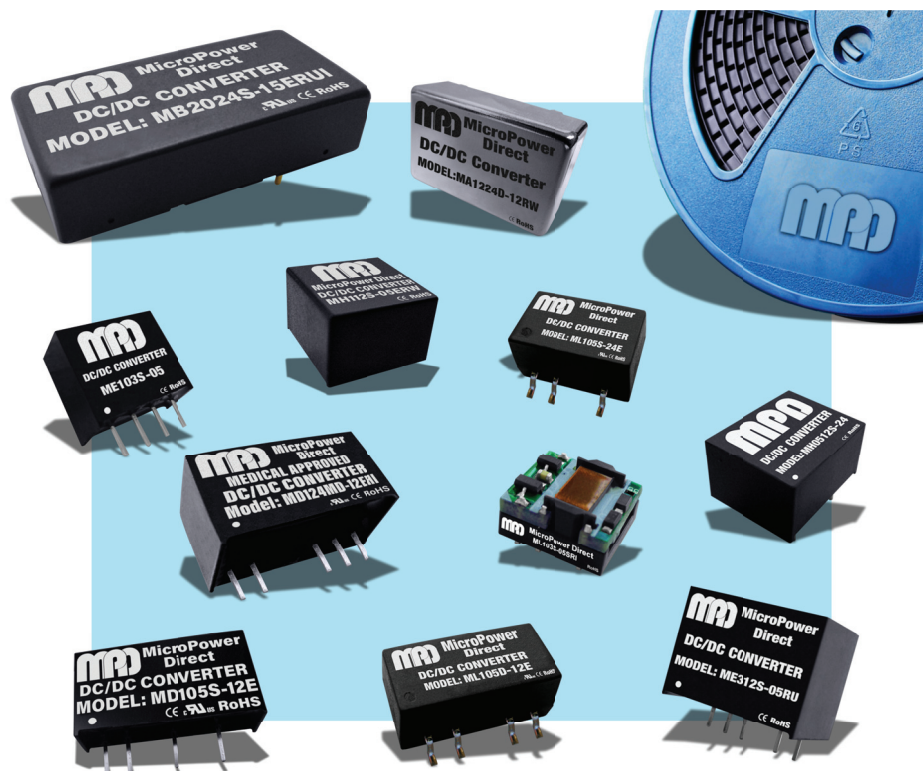
Pin	Single	Dual
1	+VIN	+VIN
2	-VIN	-VIN
4	-VOUT	-VOUT
5	No Pin	Common
6	+VOUT	+VOUT

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 $\varnothing 0.039$ ($\varnothing 1.00$)
- 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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