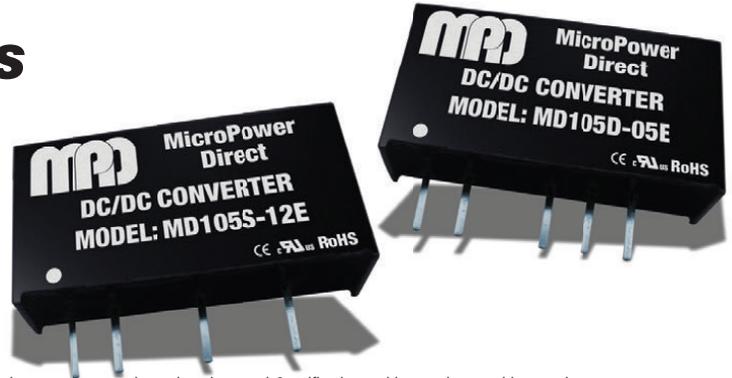


MD100E Series

Low Cost 1W SIP Single & Dual Output DC/DC Converters



Key Features:

- 1W Output Power
- Miniature SIP Case
- EN 62368 Approved
- 1,500 VDC Isolation
- Short Circuit Protected
- Single & Dual Output
- -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	3.3 VDC Input	2.97	3.3	3.63	VDC	
	5 VDC Input	4.5	5.0	5.5		
	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		
Reflected Ripple Current			15		mA	
Input Filter	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	5 VIN	24 VOUT	50	100	mV P - P	
		Other 5VIN Models	30	75		
		All Other Models	60	150		
Temperature Coefficient			±0.02	±0.03	% / °C	
Output Short Circuit, See Note 6	Continuous (Autorecovery)					
General						
Parameter	Conditions	Min.	Typ.	Max.	Units	
Isolation Voltage	See Note 7	1,500			VDC	
Isolation Resistance	500 VDC	1,000			MΩ	
Isolation Capacitance	100 kHz, 0.1V		20		pF	
Switching Frequency	5 VIN Models		270		kHz	
	All Other Models		100			
EMI Characteristics						
Parameter	Standard	Criteria	Level			
Radiated Emissions, See Page 4	CISPR32/EN 55032		Class B			
Radiated Emissions	CISPR32/EN 55032		Class B			
ESD EN 61000-4-2 EN 61000-4-2	5 VIN Models	EN 61000-4-2	B	±8 kV Air		
				±4 kV Contact		
	Other Models: Sing			±8 kV Contact		
				Other Models: Dual	±6 kV 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 5)					
Case Material	Flame Retardent, Non-Conductive, Black Plastic (UL94-V0)					
Weight	See Mechanical Drawing (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)					
Absolute Maximum Ratings						
Parameter	Conditions	Min.	Typ.	Max.	Units	
Input Voltage Surge (1 Sec)	3.3 VDC Input			5.0	VDC	
	5 VDC Input			9.0		
	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.

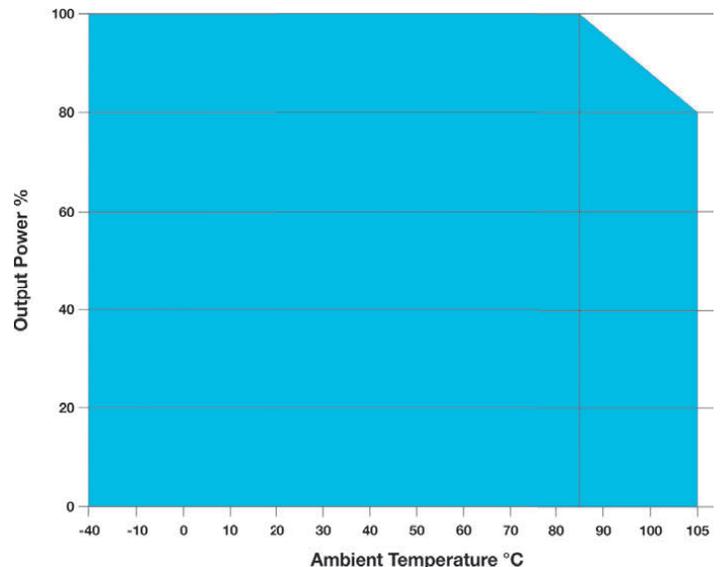
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Model Number	Input				Voltage (VDC)	Output		Load Regulation (% Typ)	Output Capacitive Load (µF Max)	Efficiency (% Typ)	Fuse Rating Slow-Blow (mA)
	Voltage (VDC)		Current (mA)			Current (mA)					
	Nominal	Range	Full-Load	No-Load			Max.				
MD103S-03E	3.3	2.97 - 3.63	426	30	3.3	303.0	31.0	±18.0	220	72	800
MD103S-05E	3.3	2.97 - 3.63	388	30	5.0	200.0	20.0	±12.0	220	78	800
MD103D-15E	3.3	2.97 - 3.63	398	30	±15.0	±34.0	±4.0	±7.0	100	76	500
UL MD105S-03E	5.0	4.5 - 5.5	270	5	3.3	303.0	30.0	±15.0	2,400	74	500
UL MD105S-05E	5.0	4.5 - 5.5	270	5	5.0	200.0	20.0	±10.0	2,400	82	500
UL MD105S-09E	5.0	4.5 - 5.5	241	12	9.0	111.0	12.0	±8.0	1,000	83	500
UL MD105S-12E	5.0	4.5 - 5.5	241	12	12.0	84.0	9.0	±7.0	560	83	500
UL MD105S-15E	5.0	4.5 - 5.5	241	18	15.0	67.0	7.0	±6.0	560	83	500
UL MD105S-24E	5.0	4.5 - 5.5	241	18	24.0	42.0	4.0	±5.0	220	85	500
MD105D-03E	5.0	4.5 - 5.5	270	5	±3.3	±152.0	±15.0	±15.0	1,200	74	500
UL MD105D-05E	5.0	4.5 - 5.5	270	5	±5.0	±100.0	±10.0	±10.0	1,200	82	500
UL MD105D-09E	5.0	4.5 - 5.5	241	12	±9.0	±56.0	±6.0	±8.0	470	83	500
UL MD105D-12E	5.0	4.5 - 5.5	241	12	±12.0	±42.0	±5.0	±7.0	220	83	500
UL MD105D-15E	5.0	4.5 - 5.5	241	18	±15.0	±34.0	±4.0	±6.0	220	83	500
UL MD105D-24E	5.0	4.5 - 5.5	241	18	±24.0	±21.0	±3.0	±5.0	100	85	500
MD112S-03E	12	10.8 - 13.2	110	15	3.3	303.0	31.0	±18.0	220	76	200
UL MD112S-05E	12	10.8 - 13.2	104	15	5.0	200.0	20.0	±12.0	220	80	200
UL MD112S-09E	12	10.8 - 13.2	104	15	9.0	111.0	11.0	±9.0	220	80	200
UL MD112S-12E	12	10.8 - 13.2	104	15	12.0	84.0	9.0	±8.0	220	80	200
UL MD112S-15E	12	10.8 - 13.2	104	15	15.0	67.0	7.0	±7.0	220	80	200
UL MD112S-24E	12	10.8 - 13.2	104	15	24.0	42.0	5.0	±6.0	220	80	200
MD112D-03E	12	10.8 - 13.2	110	15	±3.3	±152.0	±15.0	±18.0	100	76	200
UL MD112D-05E	12	10.8 - 13.2	104	15	±5.0	±100.0	±10.0	±12.0	100	80	200
UL MD112D-09E	12	10.8 - 13.2	104	15	±9.0	±56.0	±6.0	±9.0	100	80	200
UL MD112D-12E	12	10.8 - 13.2	104	15	±12.0	±42.0	±5.0	±8.0	100	80	200
UL MD112D-15E	12	10.8 - 13.2	104	15	±15.0	±34.0	±4.0	±7.0	100	80	200
UL MD112D-24E	12	10.8 - 13.2	104	15	±24.0	±21.0	±3.0	±6.0	100	80	200
MD115S-05E	15	13.5 - 16.5	84	10	5.0	200.0	20.0	±12.0	220	80	200
MD115S-12E	15	13.5 - 16.5	84	10	12.0	84.0	9.0	±8.0	220	80	200
MD115S-15E	15	13.5 - 16.5	84	10	15.0	67.0	7.0	±7.0	220	80	200
MD115D-05E	15	13.5 - 16.5	84	10	±5.0	±100.0	±10.0	±12.0	100	80	100
MD115D-12E	15	13.5 - 16.5	84	10	±12.0	±42.0	±5.0	±8.0	100	80	100
UL MD115D-15E	15	13.5 - 16.5	84	10	±15.0	±34.0	±4.0	±7.0	100	80	100
MD124S-03E	24	21.6 - 26.4	56	7	3.3	303.0	31.0	±18.0	220	74	220
UL MD124S-05E	24	21.6 - 26.4	52	7	5.0	200.0	20.0	±12.0	220	80	220
UL MD124S-09E	24	21.6 - 26.4	52	7	9.0	111.0	11.0	±9.0	220	80	220
UL MD124S-12E	24	21.6 - 26.4	52	7	12.0	84.0	9.0	±8.0	220	80	220
UL MD124S-15E	24	21.6 - 26.4	52	7	15.0	67.0	7.0	±7.0	220	80	100
UL MD124S-24E	24	21.6 - 26.4	52	7	24.0	42.0	5.0	±6.0	220	80	100
UL MD124D-05E	24	21.6 - 26.4	52	7	±5.0	±100.0	±10.0	±12.0	100	80	100
UL MD124D-09E	24	21.6 - 26.4	52	7	±9.0	±56.0	±6.0	±9.0	100	80	100
UL MD124D-12E	24	21.6 - 26.4	52	7	±12.0	±42.0	±5.0	±8.0	100	80	100
UL MD124D-15E	24	21.6 - 26.4	52	7	±15.0	±34.0	±4.0	±7.0	100	80	100
UL MD124D-24E	24	21.6 - 26.4	52	7	±24.0	±21.0	±3.0	±6.0	100	80	100

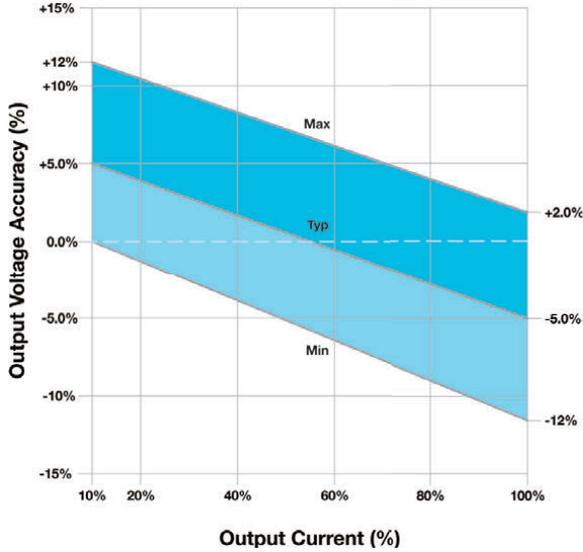
Notes:

- Units that are marked "UL" in the model selection table above are approved to EN 62368 (5 V_{IN} models) or EN 60950 (12 V_{IN} 15 V_{IN} & 24 V_{IN} models).
- Output capacitive load is specified for each output.
- Single & dual 3.3 V_{OUT} models have a specified line regulation of 1.5 %/ %.
- 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 & a 10µF electrolytic capacitor be placed in parallel from the +V_{OUT} pin to the -V_{OUT} pin for single output units or from each output to common for dual output models.
- The MD124x-xxE & MD103D-xxE models have momentary (1S) protection against short circuit faults.
- 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.

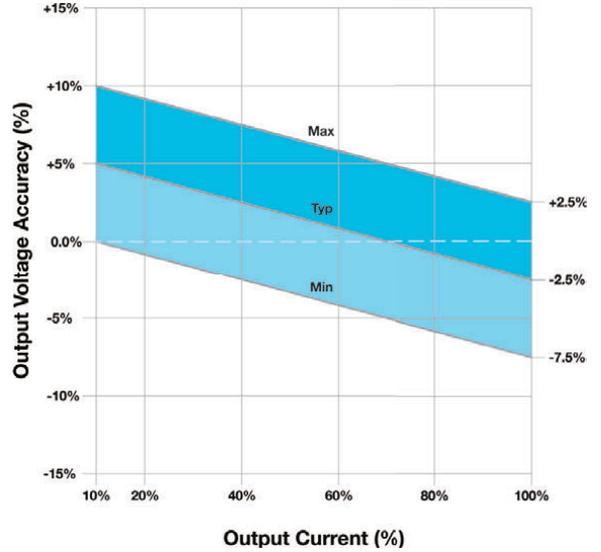
Temperature Derating Curve



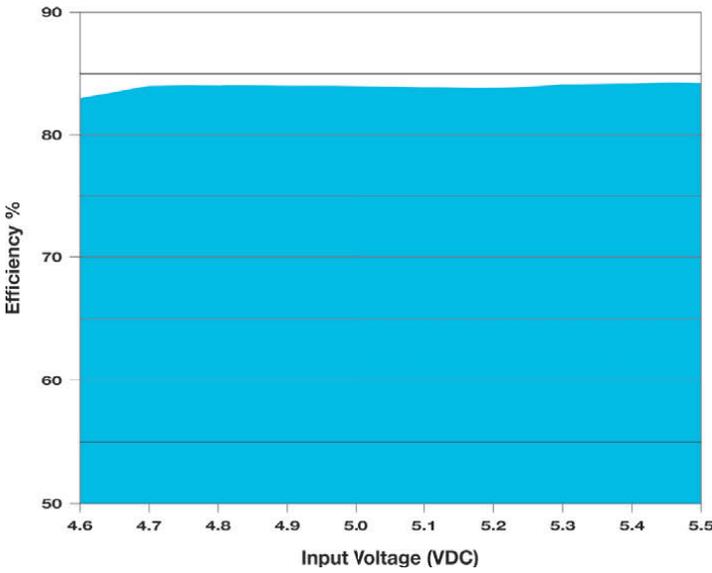
Output Voltage Tolerance: 5 VIN, 3.3 VOUT



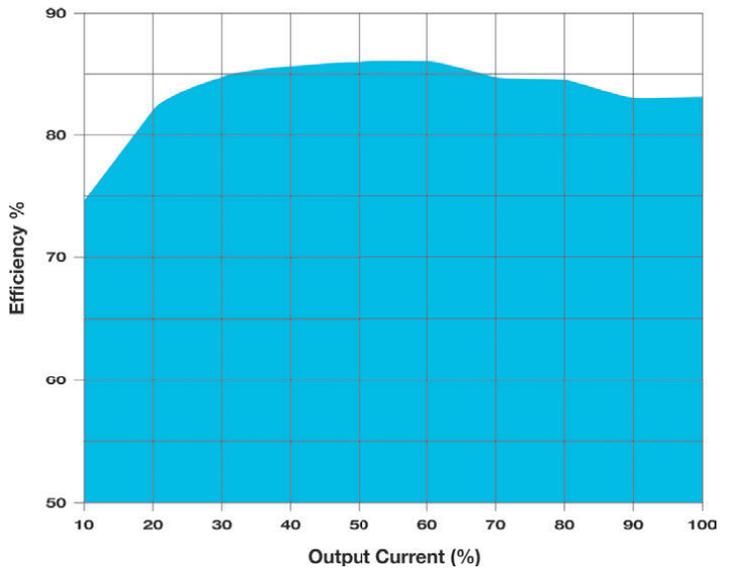
Output Voltage Tolerance: Other 5 VIN Models



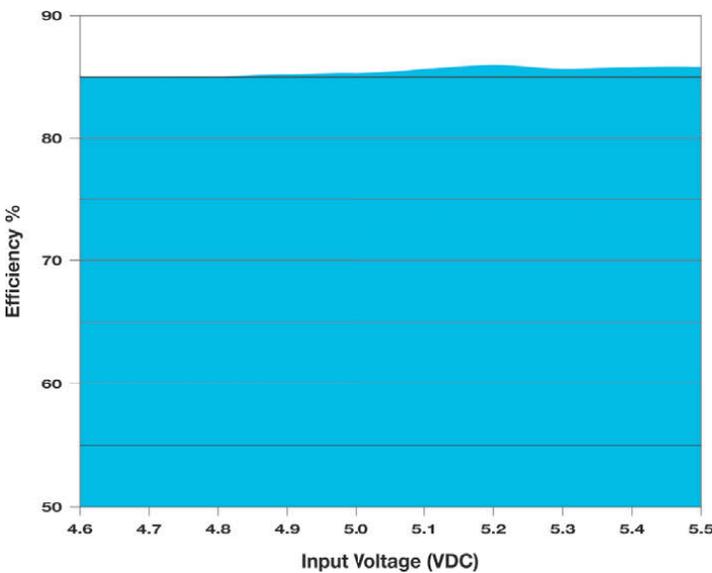
Efficiency vs Input: MD105S-05E



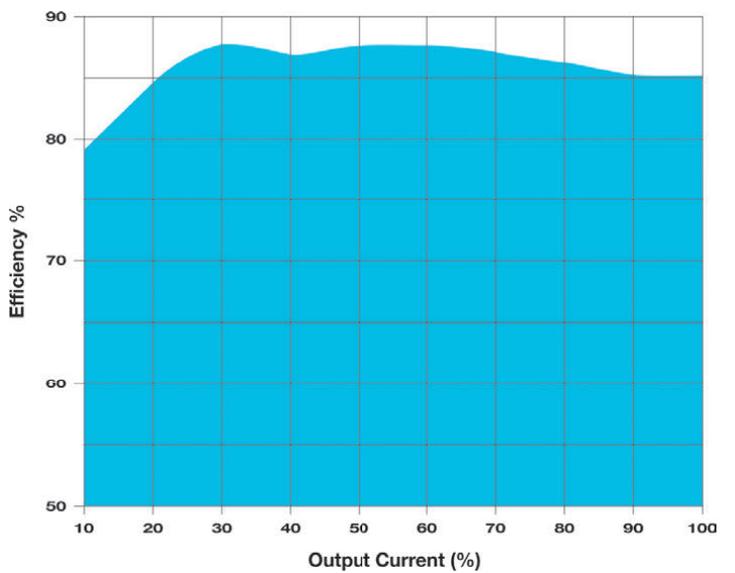
Efficiency vs Output Load: MD105S-05E



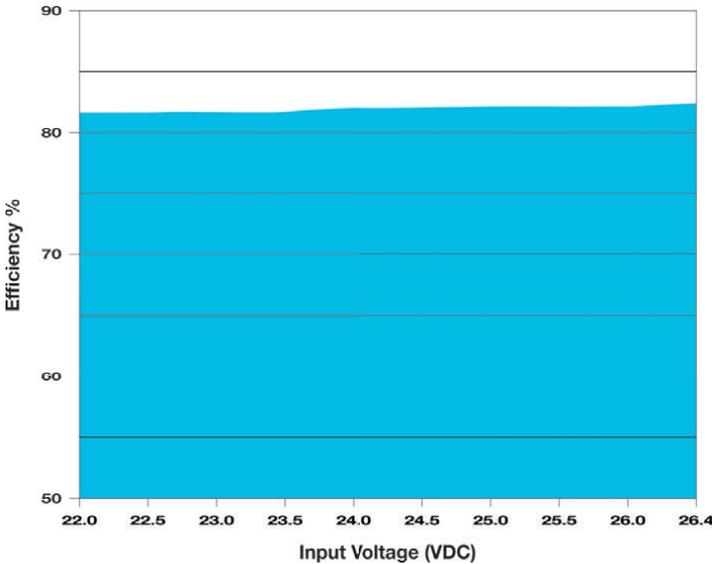
Efficiency vs Input: MD105D-05E



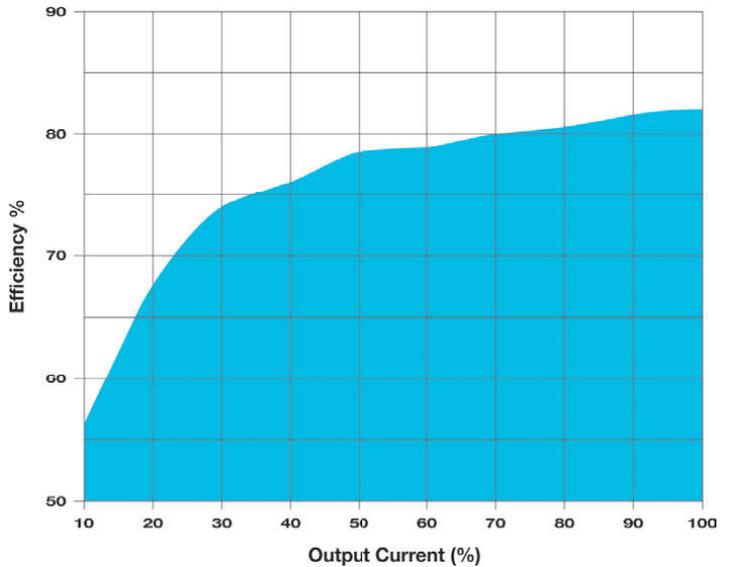
Efficiency vs Output Load: MD105D-05E



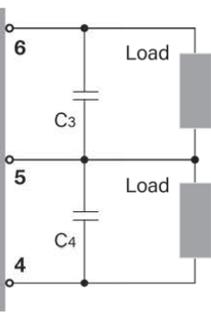
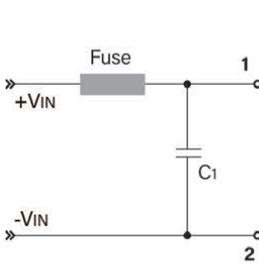
Efficiency vs Input: MD124S-15E



Efficiency vs Output Load: MD124S-15E



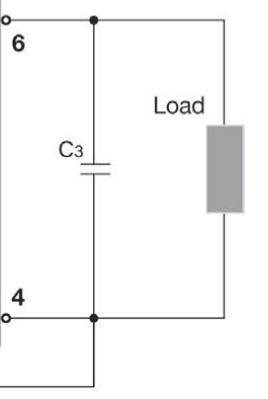
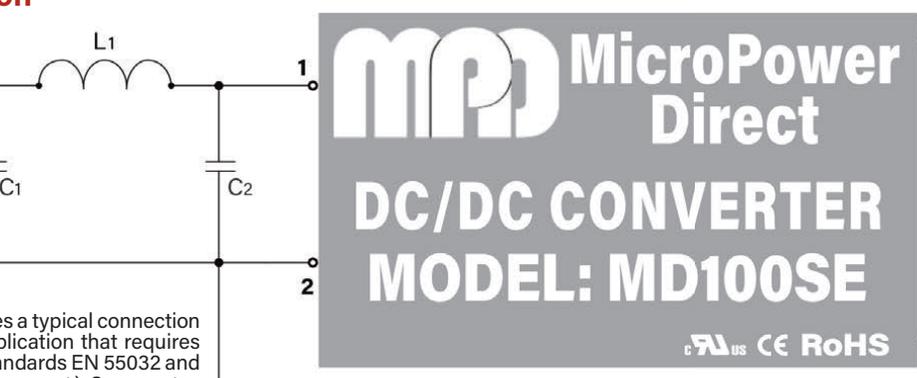
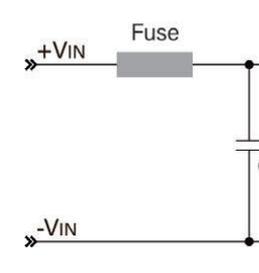
Simple Connection



V _{IN}	C ₁	V _{OUT}	C ₃ /C ₄
3.3 VDC	4.7 μF/25V	3.3 VDC	10 μF
5 VDC	4.7 μF/25V	5 VDC	10 μF
12 VDC	2.2 μF/50V	9 VDC	2.2 μF
15 VDC	2.2 μF/50V	12 VDC	2.2 μF
24 VDC	1.0 μF/50V	15 VDC	1.0 μF
		24 VDC	1.0 μF
		±3.3 VDC	4.7 μF
		±5 VDC	4.7 μF
		±9 VDC	1.0 μF
		±12 VDC	1.0 μF
		±15 VDC	0.47 μF
		±24 VDC	0.47 μF

The diagram above illustrates a simple connection of the MD100DE. 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.

Typical Connection



The diagram above illustrates a typical connection of the MD100SE 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 a fault occurs on the input line. A recommended value is given in model selection table on page 2
2. The MD100E series does not include internal protection against voltage transients that might occur on the power line. If this is a concern, it is recommended that an external suppressor be used. Contact the factory for more information.
3. In many applications, the cap C2 may not be needed.
4. 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

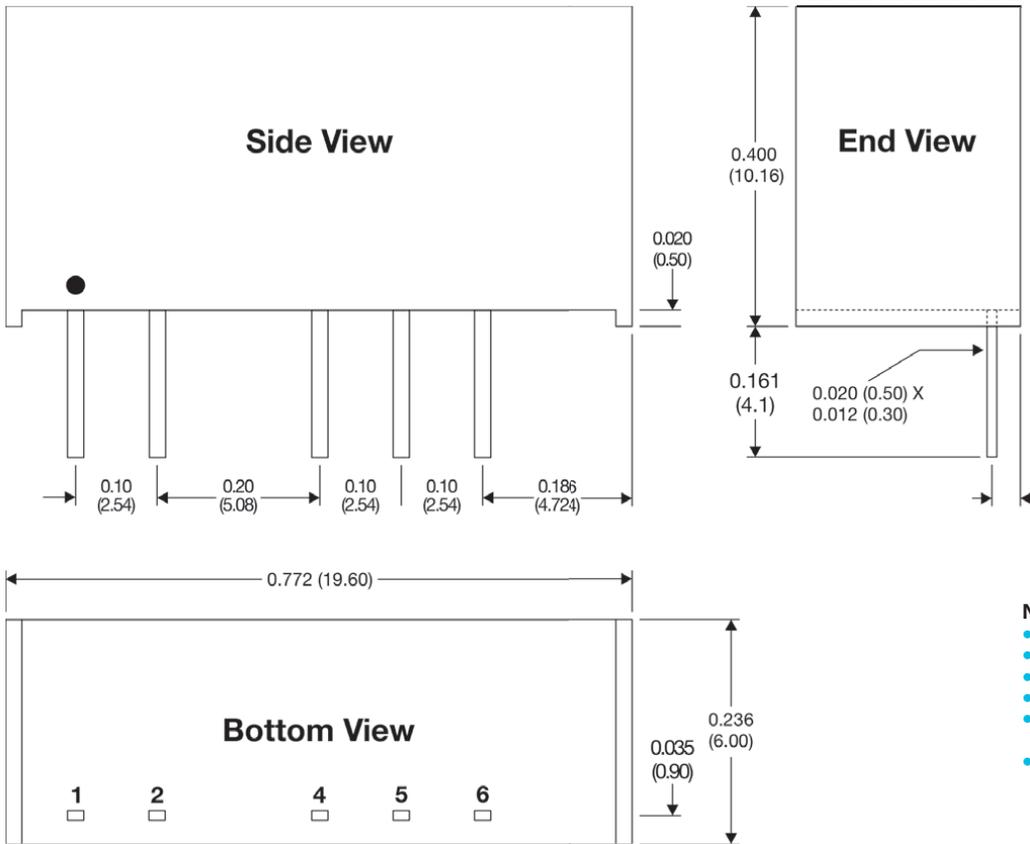
capacitive load specification for the unit. Voltage derating of capacitors should be 80% or above.

5. Suggested component values are:

Component	V _{IN} : 3.3V, 5V, 12V	V _{IN} : 15V, 24V
C1	4.7μF/25V	4.7μF/50V
C2	4.7μF/25V	4.7μF/50V
L1	6.8 μH	6.8 μH
C3	See C3/C4 in Table Above	
CY	---	1 nF/4 kV

6. 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 simple connection above, without the other filter components. Recommended capacitor values are given in the table above.

Mechanical Dimensions, 5VIN Models



Pin Connections

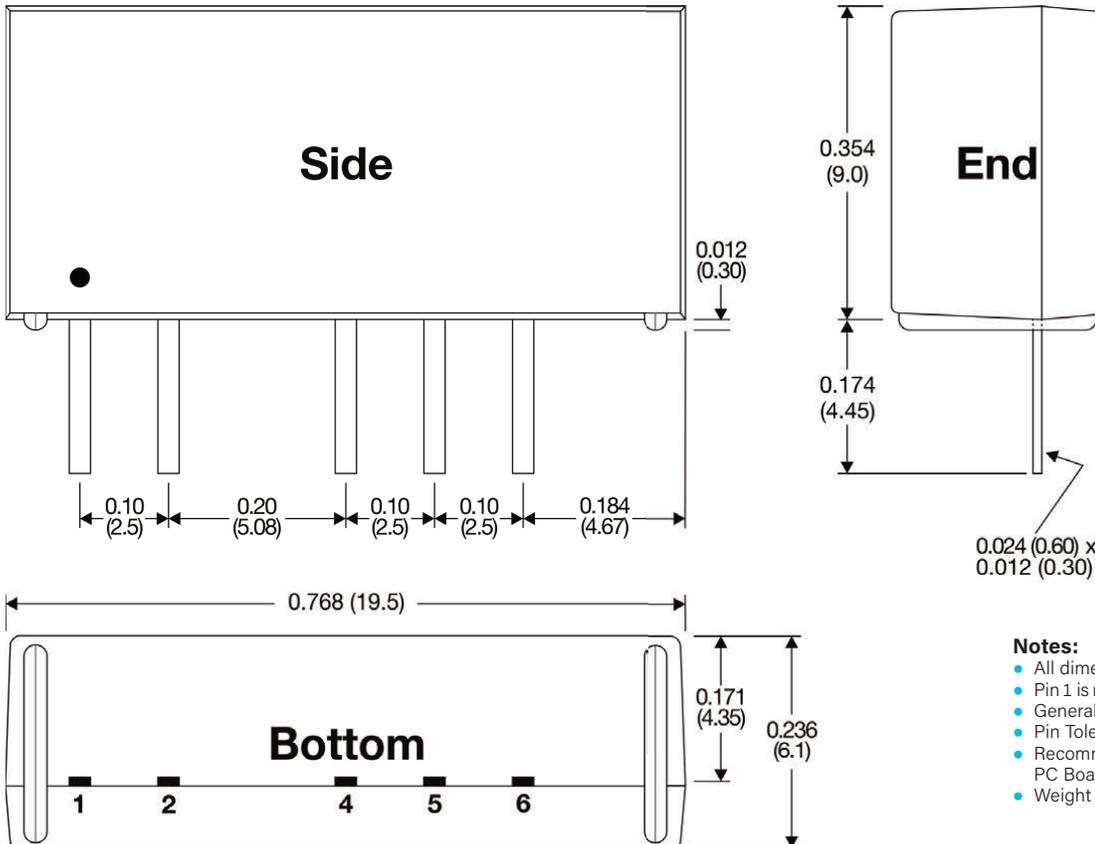
Pin	Single Output
1	+VIN
2	-VIN
4	-VOUT
5	No Pin
6	+VOUT

Pin	Dual Output
1	+VIN
2	-VIN
4	-VOUT
5	Common
6	+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)

Mechanical Dimensions, All Other Models



Pin Connections

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

Pin	Dual Output
1	+VIN
2	-VIN
4	-VOUT
5	Common
6	+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)