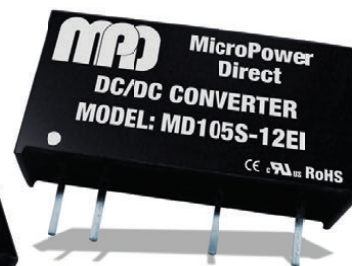


MD100EI Series

High Isolation 1W SIP Single & Dual Output DC/DC Converters



Key Features:

- 1W Output Power
- 3,000 VDC Isolation
- Miniature SIP Case
- EN 62368 Approved
- Short Circuit Protected
- Single & Dual Output
- -40°C to +105°C Operation
- >3.5 MHour MTBF
- 43 Standard Models
- Industry Standard Footprint
- **LOW COST!**

**1.5 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				

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 VIN	Output ≤12V	30		
		Output >12V	60		
Temperature Coefficient			±0.02	±0.03	%/°C
Output Short Circuit, See Note 6	Continuous (Autorecovery)				

Parameter	Conditions	Min.	Typ.	Max.	Units
Isolation Voltage	See Note 7	3,000			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	5 VIN Models Other Models: Sing Other Models: Dual	EN 61000-4-2	B	±8 kV Air	
				±4 kV Contact	
				±8 kV Contact	
				±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 Retardant, 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.

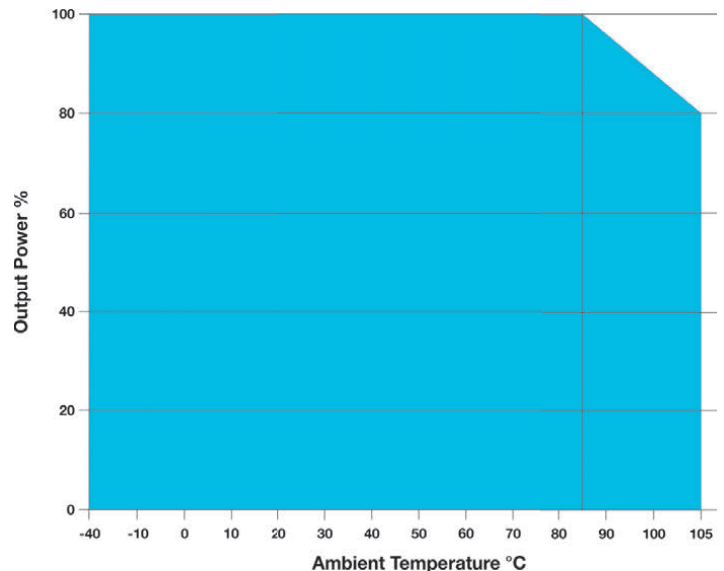
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	Model Number	Input				Output			Load Regulation (% Typ)	Output Capacitive Load (μF Max)	Efficiency (% Typ)	Fuse Rating Slow-Blow (mA)
		Voltage (VDC)		Current (mA)		Voltage (VDC)	Current (mA, Max)	Current (mA, Min)				
		Nominal	Range	Full-Load	No-Load							
UL	MD103S-03EI	3.3	2.97 - 3.63	415	25	3.3	303.0	31.0	±18.0	220	73	800
	MD103S-05EI	3.3	2.97 - 3.63	415	25	5.0	200.0	20.0	±12.0	220	78	800
	MD103S-24EI	3.3	2.97 - 3.63	415	25	24.0	42.0	5.0	±6.0	220	78	800
	MD103D-12EI	3.3	2.97 - 3.63	415	25	±12.0	±42.0	±5.0	±8.0	100	76	500
	MD105S-03EI	5.0	4.5 - 5.5	270	5	3.3	303.0	30.0	±15.0	2,400	74	500
	MD105S-05EI	5.0	4.5 - 5.5	270	5	5.0	200.0	20.0	±10.0	2,400	82	500
	MD105S-09EI	5.0	4.5 - 5.5	241	12	9.0	111.0	12.0	±8.0	1,000	83	500
	MD105S-12EI	5.0	4.5 - 5.5	241	12	12.0	84.0	9.0	±7.0	560	83	500
	MD105S-15EI	5.0	4.5 - 5.5	241	18	15.0	67.0	7.0	±6.0	560	83	500
	MD105S-24EI	5.0	4.5 - 5.5	241	18	24.0	42.0	4.0	±5.0	220	85	500
UL	MD105D-03EI	5.0	4.5 - 5.5	270	5	±3.3	±152.0	±15.0	±15.0	1,200	74	500
	MD105D-05EI	5.0	4.5 - 5.5	270	5	±5.0	±100.0	±10.0	±10.0	1,200	82	500
	MD105D-09EI	5.0	4.5 - 5.5	241	12	±9.0	±56.0	±6.0	±8.0	470	83	500
	MD105D-12EI	5.0	4.5 - 5.5	241	12	±12.0	±42.0	±5.0	±7.0	220	83	500
	MD105D-15EI	5.0	4.5 - 5.5	241	18	±15.0	±34.0	±4.0	±6.0	220	83	500
	MD105D-24EI	5.0	4.5 - 5.5	241	18	±24.0	±21.0	±3.0	±5.0	100	85	500
	MD112S-03EI	12	10.8 - 13.2	114	15	3.3	303.0	31.0	±18.0	220	75	250
	MD112S-05EI	12	10.8 - 13.2	114	15	5.0	200.0	20.0	±12.0	220	80	250
	MD112S-09EI	12	10.8 - 13.2	114	15	9.0	111.0	11.0	±9.0	220	80	250
	MD112S-12EI	12	10.8 - 13.2	114	15	12.0	83.0	9.0	±8.0	220	80	250
UL	MD112S-15EI	12	10.8 - 13.2	114	15	15.0	67.0	7.0	±7.0	220	81	250
	MD112S-24EI	12	10.8 - 13.2	114	15	24.0	42.0	5.0	±6.0	220	81	250
	MD112D-05EI	12	10.8 - 13.2	114	15	±5.0	±100.0	±10.0	±12.0	100	80	250
	MD112D-12EI	12	10.8 - 13.2	114	15	±12.0	±42.0	±5.0	±8.0	100	81	250
	MD112D-15EI	12	10.8 - 13.2	114	15	±15.0	±34.0	±4.0	±7.0	100	81	250
	MD112D-24EI	12	10.8 - 13.2	114	15	±24.0	±21.0	±3.0	±6.0	100	80	250
	MD115S-05EI	15	13.5 - 16.5	84	10	5.0	200.0	20.0	±12.0	220	80	200
	MD115S-12EI	15	13.5 - 16.5	84	10	12.0	83.0	9.0	±8.0	220	80	200
	MD115S-12EI	15	13.5 - 16.5	84	10	9.0	111.0	11.0	±9.0	220	80	200
	MD115S-15EI	15	13.5 - 16.5	84	10	15.0	67.0	7.0	±7.0	220	81	200
UL	MD115D-05EI	15	13.5 - 16.5	84	10	±5.0	±100.0	±10.0	±12.0	100	80	200
	MD115D-15EI	15	13.5 - 16.5	84	10	±15.0	±34.0	±4.0	±7.0	100	81	200
	MD124S-03EI	24	21.6 - 26.4	58	7	3.3	303.0	31.0	±18.0	220	75	100
	MD124S-05EI	24	21.6 - 26.4	58	7	5.0	200.0	20.0	±12.0	220	79	100
	MD124S-09EI	24	21.6 - 26.4	58	7	9.0	111.0	11.0	±9.0	220	80	100
	MD124S-12EI	24	21.6 - 26.4	58	7	12.0	83.0	9.0	±8.0	220	81	100
	MD124S-15EI	24	21.6 - 26.4	58	7	15.0	67.0	7.0	±7.0	220	81	100
	MD124S-24EI	24	21.6 - 26.4	58	7	24.0	42.0	5.0	±6.0	220	81	100
	MD124D-05EI	24	21.6 - 26.4	58	7	±5.0	±100.0	±10.0	±12.0	100	80	100
	MD124D-09EI	24	21.6 - 26.4	58	7	±9.0	±56.0	±6.0	±9.0	100	80	100
UL	MD124D-12EI	24	21.6 - 26.4	58	7	±12.0	±42.0	±5.0	±8.0	100	81	100
	MD124D-15EI	24	21.6 - 26.4	58	7	±15.0	±34.0	±4.0	±7.0	100	79	100
	MD124D-24EI	24	21.6 - 26.4	58	7	±24.0	±21.0	±3.0	±6.0	100	80	100

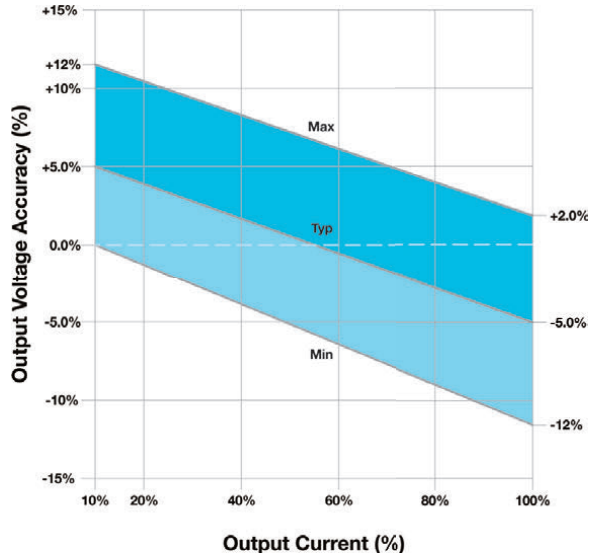
Notes:

- Units that are marked "UL" in the model selection table above are approved to EN 62368 (5 VIN models) or EN 60950 (12 VIN 15 VIN & 24 VIN models).
- Output capacitive load is specified for each output.
- Single & dual 3.3 VOUT 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 10 μF electrolytic capacitor be placed in parallel from the +VOUT pin to the -VOUT pin for single output units or from each output to common for dual output models.
- The MD124x-xxEI & MD103x-xxEI 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.

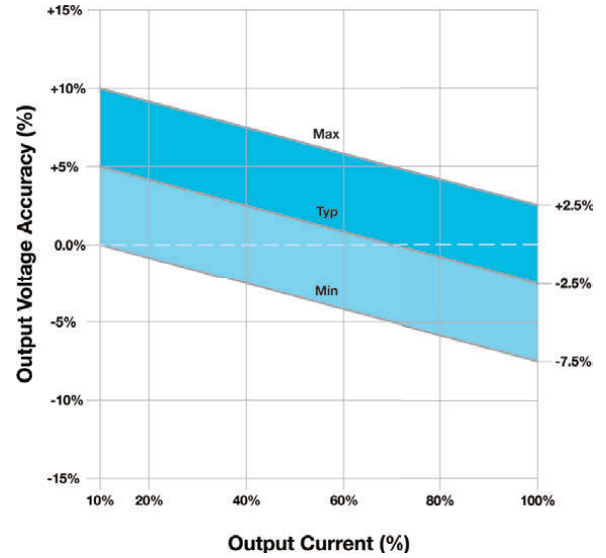
Temperature Derating Curve



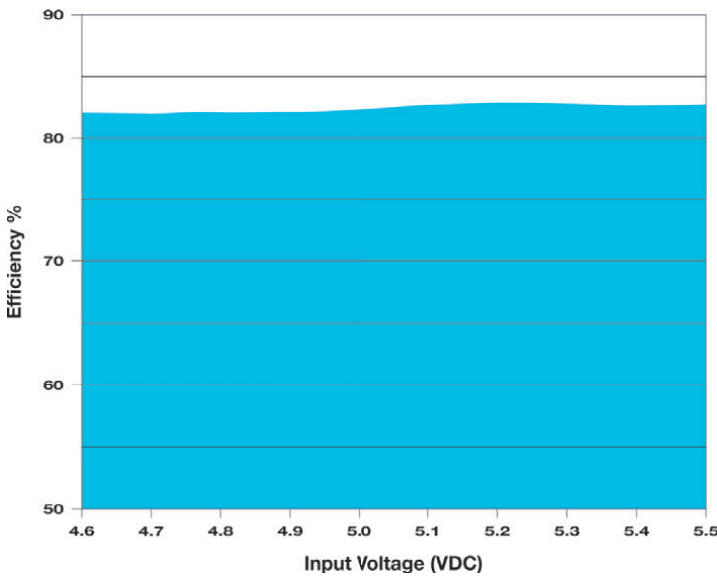
Output Voltage Tolerance: 5 VIN, 3.3 VOUT



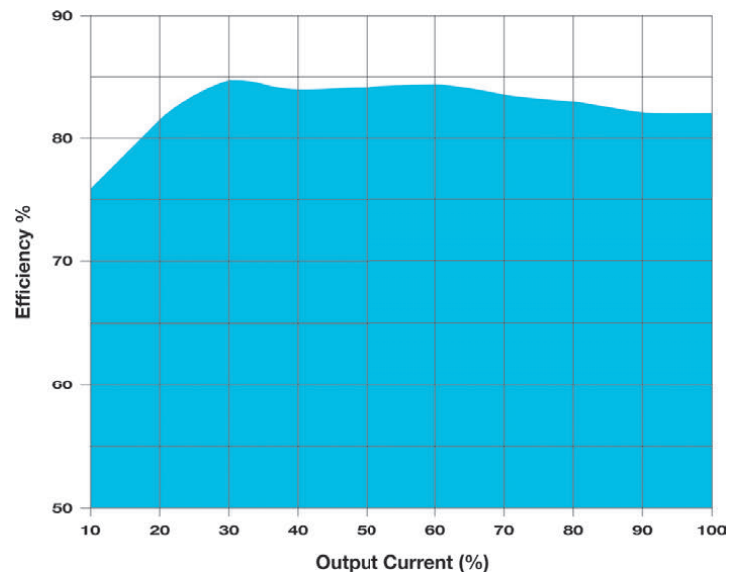
Output Voltage Tolerance: Other 5 VIN Models



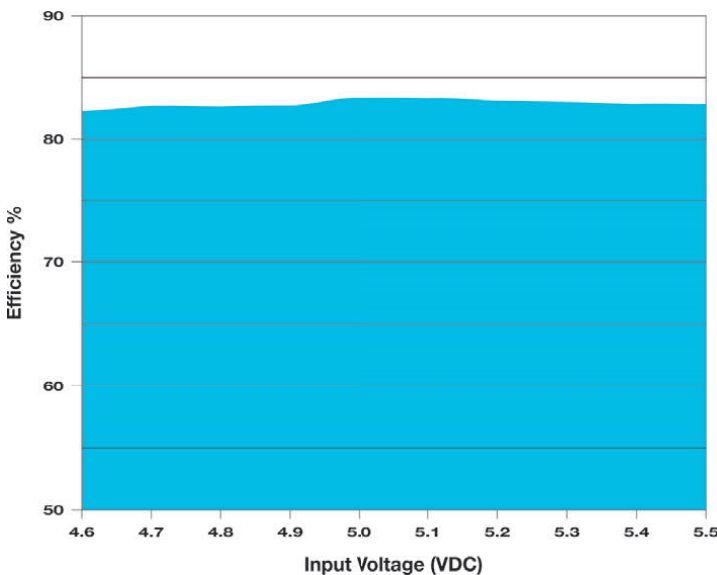
Efficiency vs Input: MD105S-05EI



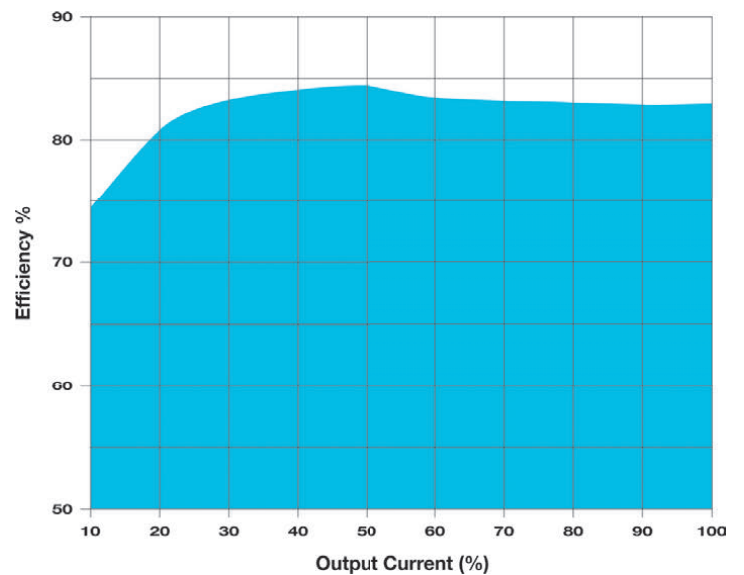
Efficiency vs Output Load: MD105S-05EI



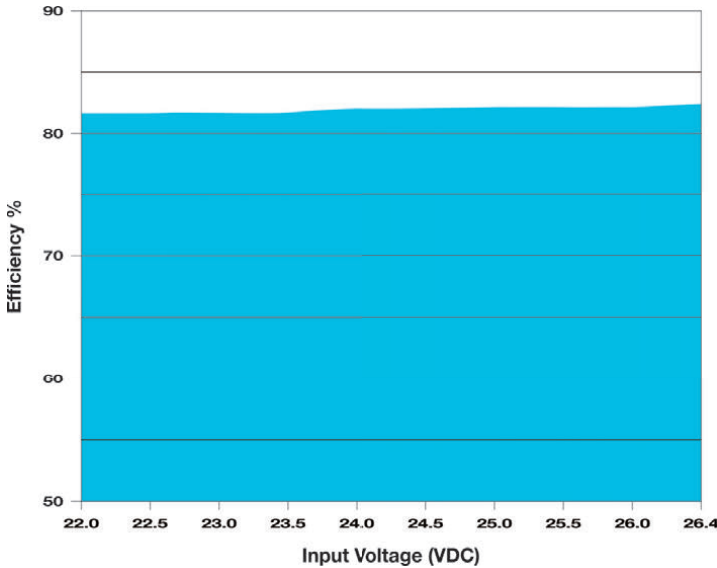
Efficiency vs Input: MD105D-05EI



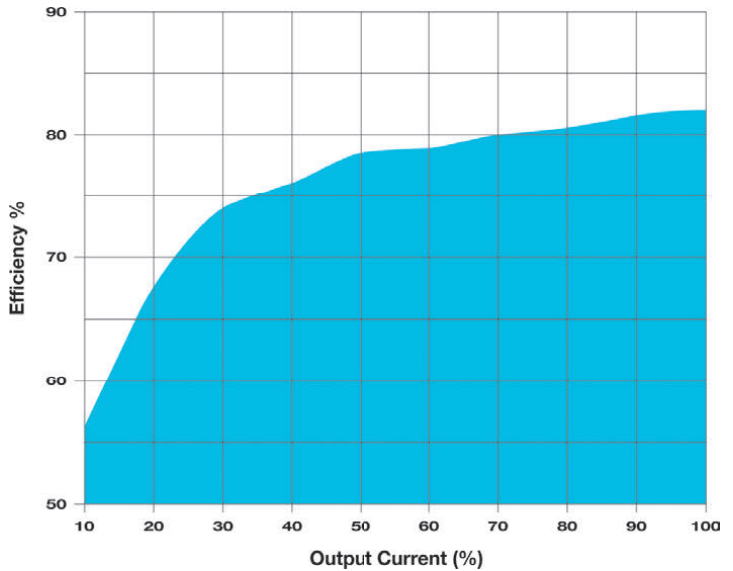
Efficiency vs Output Load: MD105D-05EI



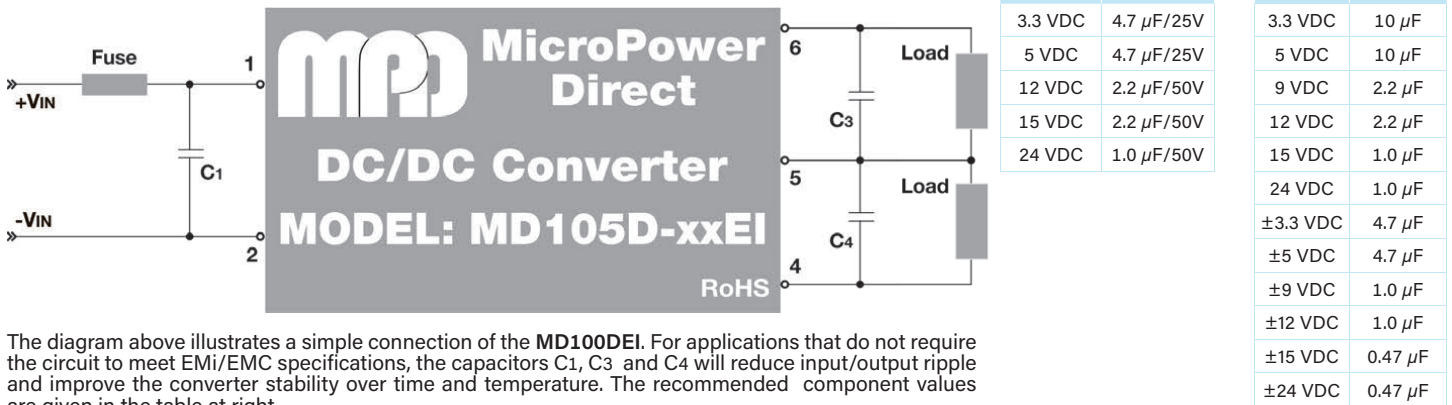
Efficiency vs Input: MD124S-15EI



Efficiency vs Output Load: MD124S-15EI

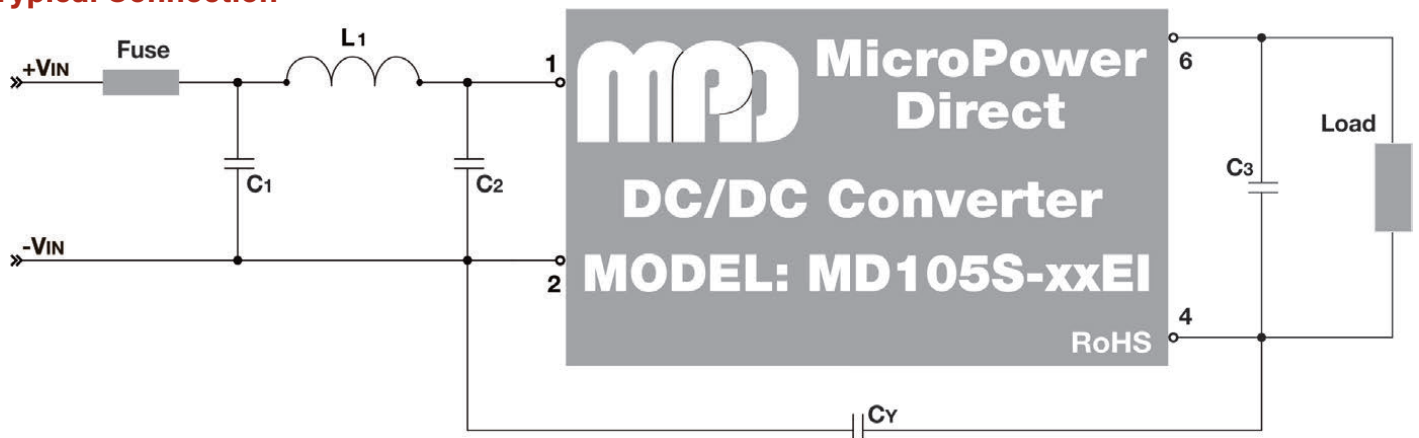


Simple Connection



The diagram above illustrates a simple connection of the MD100DEI. 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 MD100SEI 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. In many applications, the cap C2 may not be needed.
3. 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

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

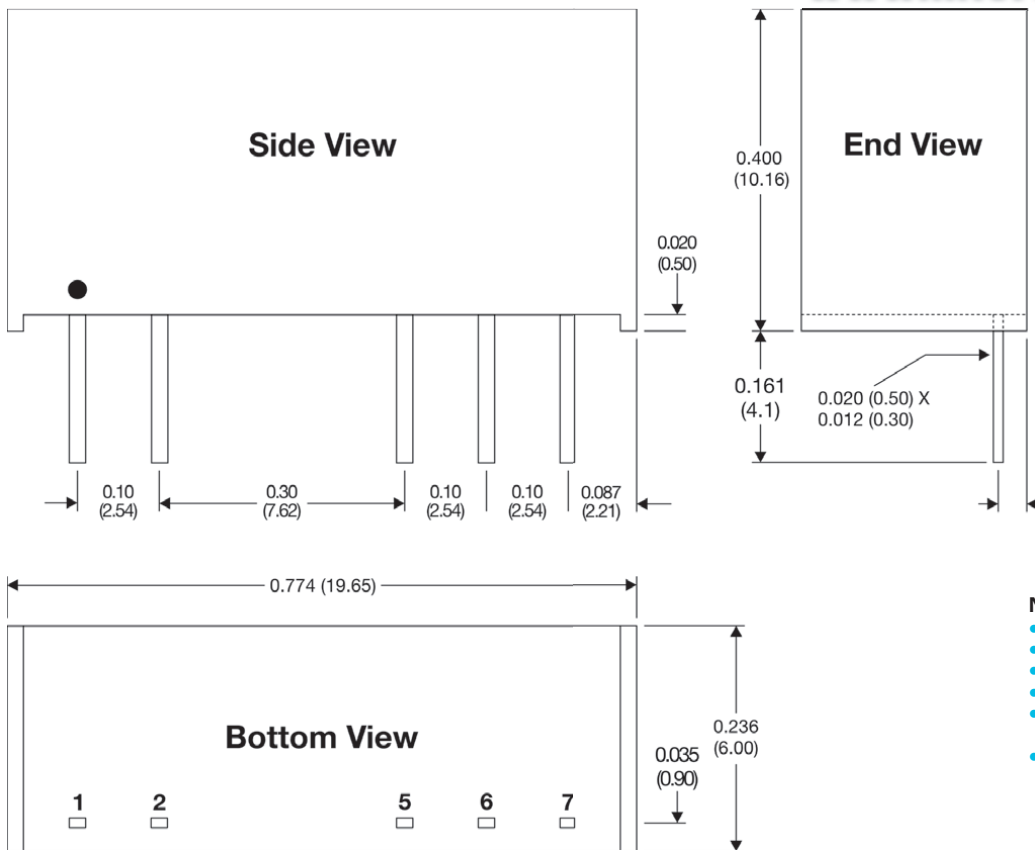
4. Suggested component values are:

Component	VIN: 3.3V, 5V, 12V	VIN: 15V, 24V
C1	4.7 μ F/25V	4.7 μ F/50V
C2	4.7 μ F/25V	4.7 μ F/50V
L1	6.8 μ H	6.8 μ H
C3	See C3/C4 in Table Above	
CY	---	1 nF/4 kV

5. 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

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Pin Connections

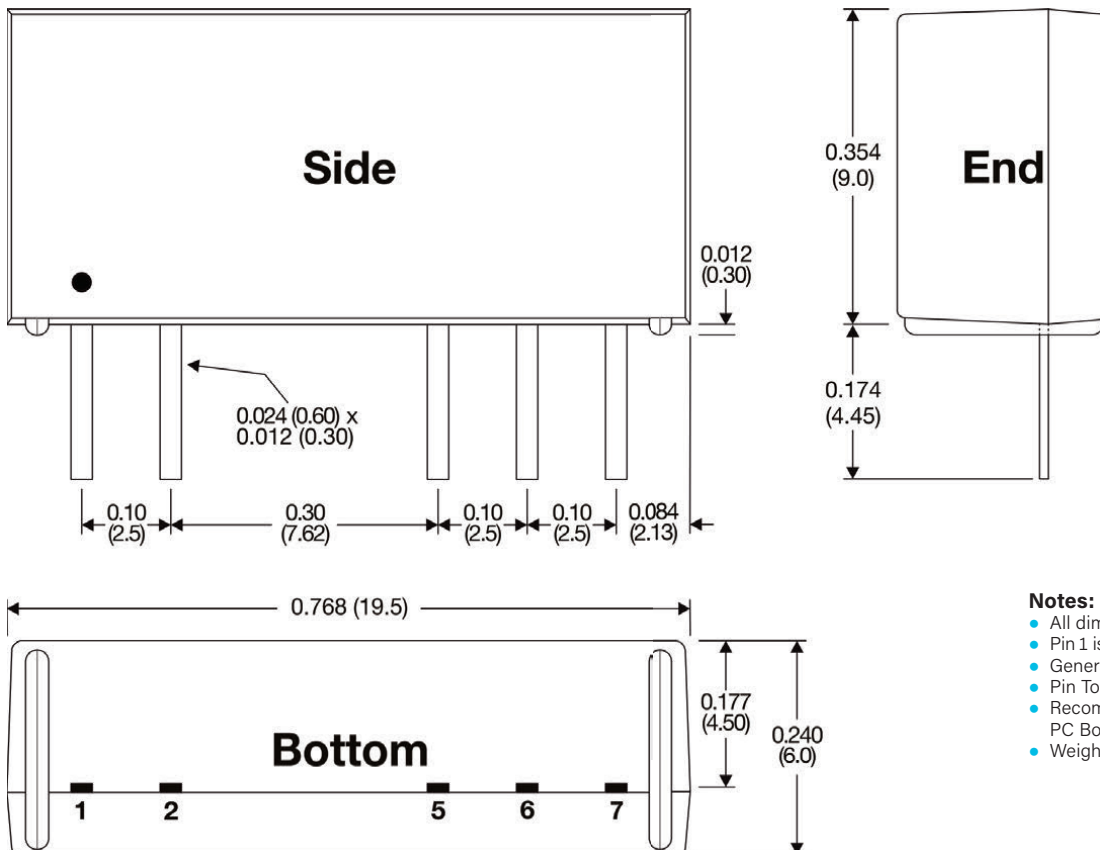
Pin	Single Output
1	+VIN
2	-VIN
5	-VOUT
6	No Pin
7	+VOUT

Pin	Dual Output
1	+VIN
2	-VIN
5	-VOUT
6	Common
7	+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 $\varnothing 0.059$ ($\varnothing 1.50$)
- Weight (Typ) = 0.07 Oz (2.1g)

Mechanical Dimensions, All Other Models



Pin Connections

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

Pin	Dual Output
1	+VIN
2	-VIN
5	-VOUT
6	Common
7	+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)

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