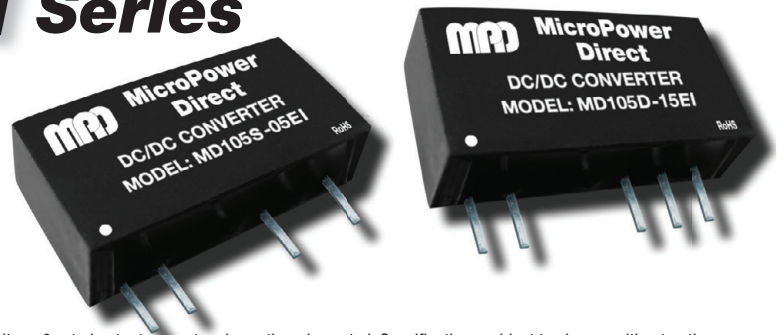


# MD100xEI Series

## Low Cost, 1W High Isolation, SIP DC/DC Converters



### Key Features:

- 1W Output Power
- Miniature SIP Case
- Short Circuit Protected
- 3,000 VDC Isolation
- EN 60950 Approved
- >3.5 MHour MTBF
- -40 to +105°C Operation
- LOW COST

1.5 kV Isolation  
Models  
Available



RoHS



### MicroPower Direct

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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	4.50	5.0	5.50		
	9 VDC Input	8.10	9.0	9.90		
	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	3.3 VDC Output Models		±3.5		%	
	All Other Models		±2.5			
Line Regulation	3.3 VOUT Models	For VIN Change of 1%		±1.5	%	
	All Other Models			±1.2		
Load Regulation, See Note 1	See Model Selection Guide					
Ripple & Noise (20 MHz), See Note 2	Output Voltage ≤12 VDC		30		mV P - P	
	15 VDC, 24 VDC Output		60			
Temperature Coefficient				±0.03	% / °C	
Output Short Circuit, See Note 3	Continuous (Autorecovery)					

General						
Parameter	Conditions	Min.	Typ.	Max.	Units	
Isolation Voltage	60 Seconds	3,000			VDC	
Isolation Resistance	500 VDC	1,000			MΩ	
Isolation Capacitance	100 kHz, 0.1V		20		pF	
Switching Frequency			100	300	kHz	

EMI Characteristics						
Parameter	Standard	Criteria	Level			
Radiated Emissions	EN 55022					Level B
Conducted Emissions	EN 55022					Level B
ESD, Single Output, See Note 4	EN 61000-4-2	B				±8 kV Contact
ESD, Dual Output, See Note 4	EN 61000-4-2	B				±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 Diagram (Page 4)					
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)	3.3 VDC Input			5.0	VDC	
	5 VDC Input			9.0		
	5 VDC Input			12.0		
	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.

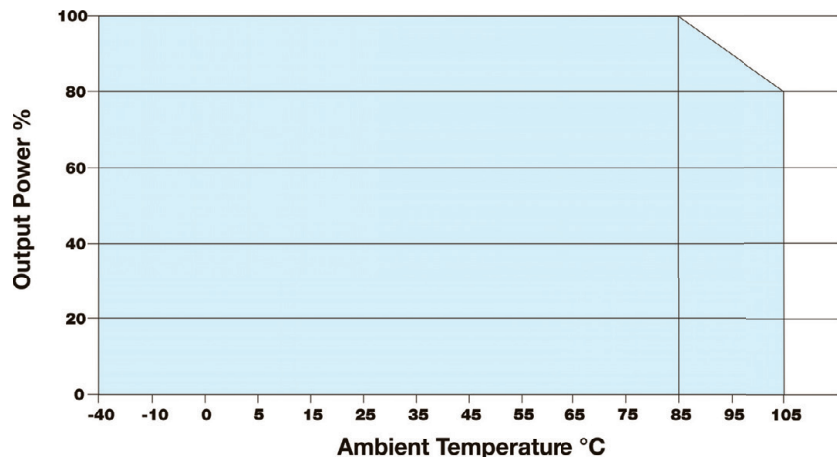
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Model Number	Input				Output			Load Regulation (% Typ)	Output Capacitive Load (µF Max)	Efficiency (% Typ)	Safety (EN 6950)	Fuse Rating Slow-Blow (mA)
	Voltage (VDC)		Current (mA)		Voltage (VDC)	Current (mA, Max)	Current (mA, Min)					
	Nominal	Range	Full-Load	No-Load								
MD103S-03EI	3.3	2.97 - 3.63	415	25	3.3	303.0	30.0	18.0	220	73	No	800
MD103S-05EI	3.3	2.97 - 3.63	388	25	5.0	200.0	20.0	12.0	220	78	No	800
MD103S-24EI	3.3	2.97 - 3.63	388	25	24.0	42.0	5.0	6.0	220	78	No	800
MD103D-12EI	3.3	4.5 - 5.5	250	20	±12.0	±42.0	±5.0	8.0	100	80	No	500
MD105S-03EI	5	4.5 - 5.5	267	20	3.3	303.0	30.0	18.0	220	75	No	500
MD105S-05EI	5	4.5 - 5.5	250	20	5.0	200.0	20.0	12.0	220	80	Yes	500
MD105S-09EI	5	4.5 - 5.5	250	20	9.0	111.0	12.0	9.0	220	80	Yes	500
MD105S-12EI	5	4.5 - 5.5	250	20	12.0	83.0	9.0	8.0	220	80	Yes	500
MD105S-15EI	5	4.5 - 5.5	247	20	15.0	67.0	7.0	7.0	220	81	Yes	500
MD105S-24EI	5	4.5 - 5.5	247	20	24.0	42.0	5.0	6.0	220	81	Yes	500
MD105D-05EI	5	4.5 - 5.5	250	20	±5.0	±100.0	±10.0	12.0	100	80	Yes	500
MD105D-09EI	5	4.5 - 5.5	250	20	±9.0	±56.0	±6.0	9.0	100	80	Yes	500
MD105D-12EI	5	4.5 - 5.5	250	20	±12.0	±42.0	±5.0	8.0	100	80	Yes	500
MD105D-15EI	5	4.5 - 5.5	247	20	±15.0	±33.0	±4.0	7.0	100	81	Yes	500
MD105D-24EI	5	4.5 - 5.5	247	20	±24.0	±21.0	±2.0	6.0	100	81	Yes	500
MD109S-09EI	9	8.1 - 9.9	250	20	9.0	111.0	12.0	9.0	220	80	No	500
MD109D-09EI	9	8.1 - 9.9	250	20	±9.0	±56.0	±6.0	9.0	100	80	No	500
MD112S-03EI	12	10.8 - 13.2	111	15	3.3	303.0	30.0	18.0	220	75	No	200
MD112S-05EI	12	10.8 - 13.2	104	15	5.0	200.0	20.0	12.0	220	80	Yes	200
MD112S-09EI	12	10.8 - 13.2	111	15	9.0	111.0	12.0	9.0	220	80	Yes	200
MD112S-12EI	12	10.8 - 13.2	104	15	12.0	83.0	9.0	8.0	220	80	Yes	200
MD112S-15EI	12	10.8 - 13.2	103	15	15.0	67.0	7.0	7.0	220	81	Yes	200
MD112S-24EI	12	10.8 - 13.2	103	15	24.0	42.0	5.0	6.0	220	81	Yes	500
MD112D-03EI	12	10.8 - 13.2	114	15	±3.3	±152.0	±15.0	18.0	100	73	Yes	200
MD112D-05EI	12	10.8 - 13.2	104	15	±5.0	±100.0	±10.0	12.0	100	80	Yes	200
MD112D-09EI	12	10.8 - 13.2	104	15	±9.0	±56.0	±6.0	9.0	100	80	Yes	200
MD112D-12EI	12	10.8 - 13.2	104	15	±12.0	±42.0	±5.0	8.0	100	81	Yes	200
MD112D-15EI	12	10.8 - 13.2	103	15	±15.0	±33.0	±4.0	7.0	100	81	Yes	200
MD112D-24EI	12	10.8 - 13.2	103	15	±24.0	±21.0	±2.0	6.0	100	81	Yes	200
MD115S-05EI	15	13.5 - 16.5	84	10	5.0	200.0	20.0	12.0	220	80	No	150
MD115S-15EI	15	13.5 - 16.5	83	10	15.0	67.0	7.0	7.0	220	81	No	150
MD115D-05EI	15	13.5 - 16.5	84	10	±5.0	±100.0	±10.0	12.0	100	80	No	150
MD115D-09EI	15	13.5 - 16.5	84	10	±9.0	±56.0	±6.0	9.0	100	80	No	150
MD115D-12EI	15	13.5 - 16.5	84	10	±12.0	±42.0	±5.0	8.0	100	80	No	150
MD115D-15EI	15	13.5 - 16.5	83	10	±15.0	±33.0	±4.0	7.0	100	81	No	150
MD124S-03EI	24	21.6 - 26.4	56	7	3.3	303.0	30.0	18.0	220	75	No	100
MD124S-05EI	24	21.6 - 26.4	53	7	5.0	200.0	20.0	12.0	220	79	Yes	100
MD124S-09EI	24	21.6 - 26.4	52	7	9.0	111.0	12.0	9.0	220	80	Yes	100
MD124S-12EI	24	21.6 - 26.4	51	7	12.0	83.0	9.0	8.0	220	81	Yes	100
MD124S-15EI	24	21.6 - 26.4	51	7	15.0	67.0	7.0	7.0	220	81	Yes	100
MD124S-24EI	24	21.6 - 26.4	51	7	24.0	42.0	5.0	6.0	220	81	Yes	100
MD124D-03EI	24	21.6 - 26.4	58	7	±3.3	±152.0	±15.0	18.0	100	73	Yes	100
MD124D-05EI	24	21.6 - 26.4	53	7	±5.0	±100.0	±10.0	12.0	100	80	Yes	100
MD124D-09EI	24	21.6 - 26.4	53	7	±9.0	±56.0	±6.0	9.0	100	80	Yes	100
MD124D-12EI	24	21.6 - 26.4	51	7	±12.0	±42.0	±5.0	8.0	100	81	Yes	100
MD124D-15EI	24	21.6 - 26.4	53	7	±15.0	±33.0	±4.0	7.0	100	79	Yes	100
MD124D-24EI	24	21.6 - 26.4	53	7	±24.0	±21.0	±2.0	6.0	100	80	Yes	100

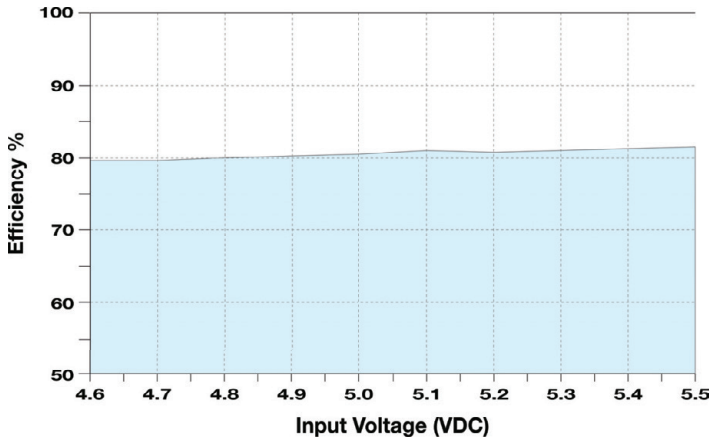
Notes:

- Output load regulation is specified for a load change of 10% to 100%.
- When measuring output ripple, it is recommended that an external 1.0µF ceramic capacitor and a 10µF ceramic capacitor be connected in parallel from the +Vout pin to the -Vout pin for single output models, or from each output to common for dual output models.
- The MD105x-24E & MD124x-xxE models have momentary (1S) protection against short circuit. All others have continuous protection.
- These converters are specified for operation without external components. However, to meet specific EMC standards, some external components may be required. Typical connections are shown on page three.
- 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 tables for the correct rating.

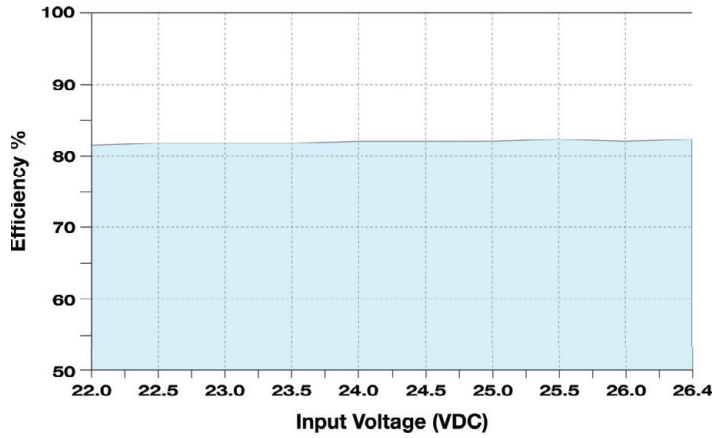
Derating Curve



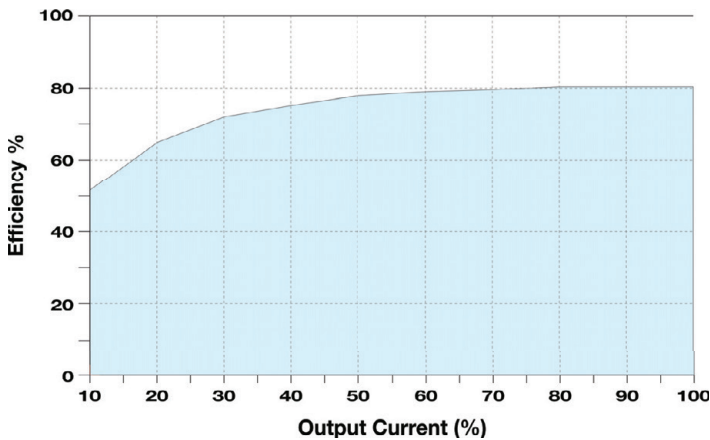
Typical Efficiency vs Input, 5 VIN Models



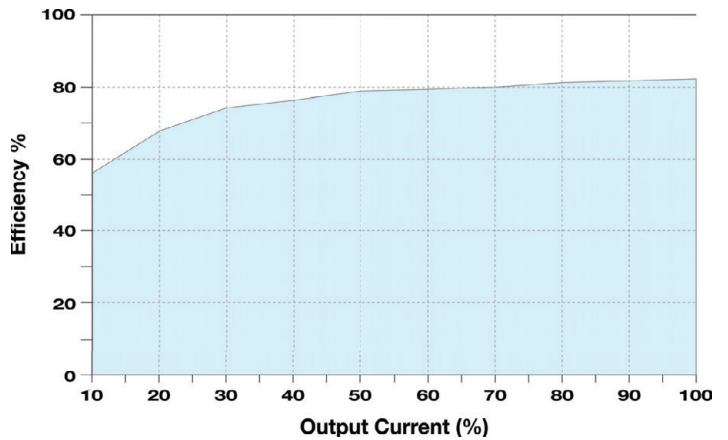
Typical Efficiency vs Input, 24 VIN Models



Typical Efficiency vs Output, 5 VIN Models



Typical Efficiency vs Output, 24 VIN Models



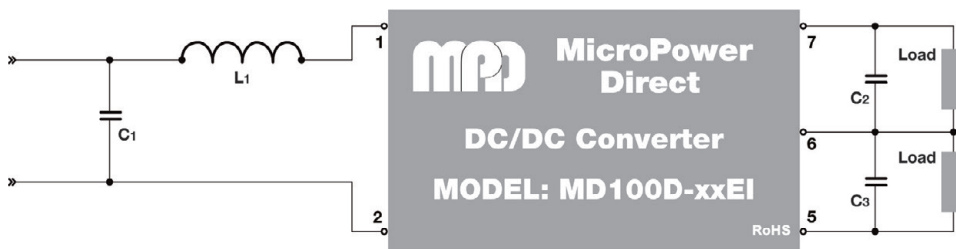
Efficiency vs input is plotted with the unit at full load. Efficiency vs output is plotted with the unit at nominal input.

Typical Connection, Single Output Models



V <sub>IN</sub>	C <sub>1</sub>	L <sub>1</sub>
3.3 VDC	4.7 μF/50V	6.8 μH
5 VDC	4.7 μF/50V	6.8 μH
9 VDC	4.7 μF/50V	6.8 μH
12 VDC	4.7 μF/50V	6.8 μH
15 VDC	4.7 μF/50V	6.8 μH
24 VDC	4.7 μF/50V	6.8 μH

Typical Connection, Dual Output Models

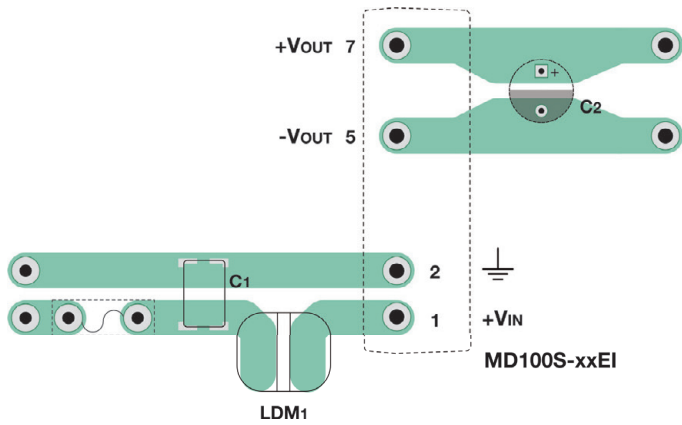


V <sub>OUT</sub>	C <sub>2</sub>	C <sub>3</sub>
3.3 VDC	10 μF	---
5 VDC	10 μF	---
9 VDC	10 μF	---
12 VDC	2.2 μF	---
15 VDC	1.0 μF	---
24 VDC	1.0 μF	---
±3.3 VDC	4.7 μF	4.7 μF
±5 VDC	4.7 μF	4.7 μF
±9 VDC	1.0 μF	1.0 μF
±12 VDC	1.0 μF	1.0 μF
±15 VDC	0.47 μF	0.47 μF
±24 VDC	0.47 μF	0.47 μF

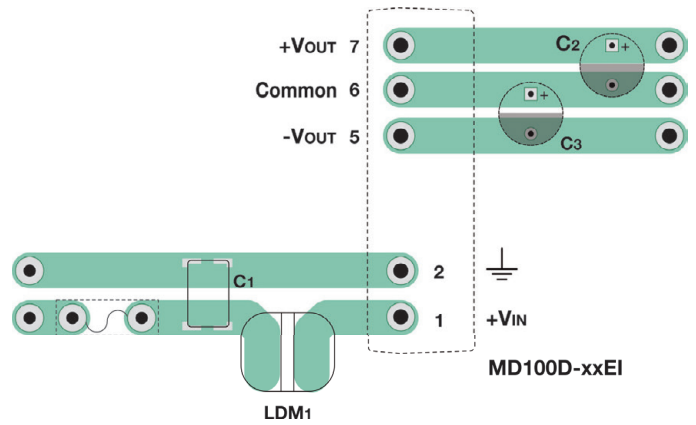
These converters are specified for operation without external components. However, in some applications the addition of input/output capacitors will enhance stability and reduce output ripple. For applications that require meeting EMC standards, the diagrams above illustrates a typical connection of the MD100x-xxEI series. Suggested component values are given in the table at right.

Capacitors C<sub>2</sub> and C<sub>3</sub> are not required to meet specifications, but may be used if a lower level of output ripple is required.

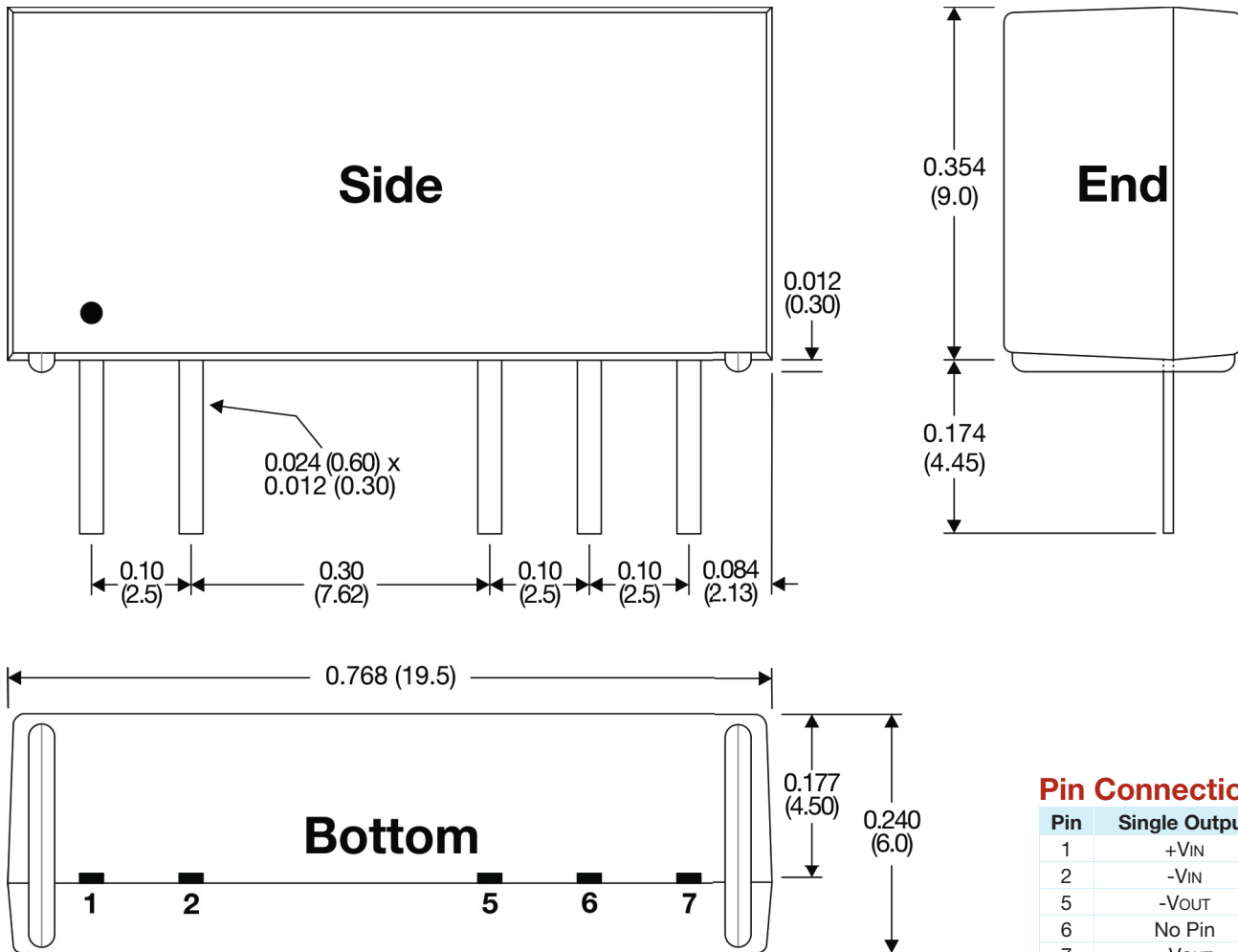
**Typical Board Layout, Single Output Models**



**Typical Board Layout, Dual Output Models**



**Mechanical Dimensions**



**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)
  - General Tolerance x.xx = ±0.02 (±0.5)
  - Pin 1 is marked by a "dot" or indentation on the unit