

# MI600ERW Series

## 2:1 Input, 6W, Ultra-Miniature DC/DC Converters



### Key Features:

- 6W Output Power
- 2:1 Input Voltage Range
- Miniature 1" x 1" Case
- 1,500 VDC Isolation
- 24 Standard Models
- Single & Dual Outputs
- -40°C to +85°C Operation
- Industry Standard Pin-Out
- Chassis Mount Option
- DIN Rail Option

RoHS



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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	12 VDC Input	9.0	12.0	18.0	VDC	
	24 VDC Input	18.0	24.0	36.0		
	48 VDC Input	36.0	48.0	75.0		
Input Start Voltage	12 VDC Input			9.0	VDC	
	24 VDC Input			18.0		
	48 VDC Input			36.0		
Input Filter	PI (π) Filter					
Output						
Parameter	Conditions	Min.	Typ.	Max.	Units	
Output Voltage Accuracy			±1.0	±2.0	%	
Output Voltage Balance	Dual Outputs, Balanced Loads		±0.5	±1.5	%	
Line Regulation	V <sub>IN</sub> = Min to Max		±0.2	±0.5	%	
Load Regulation	I <sub>OUT</sub> = 5% to 100%		±0.5	±1.0	%	
Cross Regulation	See Note 1			±5.0	%	
Ripple (20 MHz)	See Note 2		15	25	mV P - P	
Noise (20 MHz)	See Note 2		50	75	mV P - P	
Transient Recovery Time, See Note 3			300	500	μSec	
Transient Response Deviation	25% Load Step Change		±3.0	±5.0	%	
Temperature Coefficient				±0.03	%/°C	
Output Over Voltage Protection		110	120	140	%V <sub>OUT</sub>	
Output Short Circuit	Continuous (Autorecovery)					
General						
Parameter	Conditions	Min.	Typ.	Max.	Units	
Isolation Voltage	60 Seconds	1,500			VDC	
Isolation Resistance	500 VDC	1,000			MΩ	
Isolation Capacitance			1,000		pF	
Switching Frequency			300		kHz	
EMI Characteristics						
Parameter	Standard		Level			
Radiated Emissions	See Note 4	EN 55022	Class A			
Conducted Emissions	See Note 4	EN 55022	Class A			
ESD		EN 61000-4-2	Criteria B; ±4 kV Contact			
RS		EN 61000-4-3	Criteria A; 10V/m			
EFT	See Note 5	EN 61000-4-4	Criteria B; ±2 kV			
	See Note 5	EN 61000-4-4	Criteria B; ±4 kV			
Surge	See Note 6	EN 61000-4-5	Criteria B; ±2 kV			
CS		EN 61000-4-6	Criteria A; 3 Vrms			
Voltage Dips		EN 61000-4-29	Criteria B; 0% - 70%			
Environmental						
Parameter	Conditions	Min.	Typ.	Max.	Units	
Operating Temperature Range	Ambient	-40	+25	+85	°C	
	Case			+105	°C	
Storage Temperature Range		-55		+125	°C	
Cooling	Free Air Convection					
Humidity	RH, Non-condensing			95	%	
Physical						
Case Size		1.00 x 1.00 x 0.461 Inches (25.4 x 25.4 x 11.7 mm)				
Case Material		Aluminum (UL94-V0)				
Weight		0.46 Oz (15g)				
Reliability Specifications						
Parameter	Conditions	Min.	Typ.	Max.	Units	
MTBF	MIL HDBK 217F, 25°C, Gnd Benign	1.0			MHours	
Absolute Maximum Ratings						
Parameter	Conditions	Min.	Typ.	Max.	Units	
Input Voltage Surge (1 Sec)	12 VDC Input	-0.7		25.0	VDC	
	24 VDC Input	-0.7		50.0		
	48 VDC Input	-0.7		100.0		
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.

### MicroPower Direct

292 Page Street  
Suite D  
Stoughton, MA 02072  
USA

T: (781) 344-8226

F: (781) 344-8481

E: sales@micropowerdirect.com

W: www.micropowerdirect.com



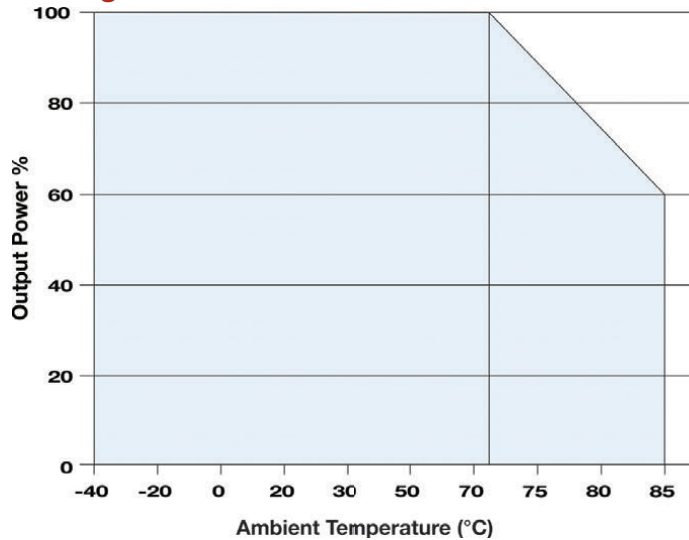
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Model Number	Input				Output			Efficiency (% Typ)	Reflected Ripple Current (mA Typ)	Capacitive Load (µF, Max)	Fuse Rating Slow-Blow (mA)
	Voltage (VDC)		Current (mA)		Voltage (VDC)	Current (mA, Max)	Current (mA, Min)				
	Nominal	Range	Full-Load	No-Load							
MI612S-03ERW	12	9.0 - 18.0	528	12	3.3	1,500	75.0	78	20.0	1,800	1,200
MI612S-05ERW	12	9.0 - 18.0	617	12	5.0	1,200	60.0	81	20.0	1,000	1,200
MI612S-12ERW	12	9.0 - 18.0	588	12	12.0	500	25.0	85	20.0	100	1,200
MI612S-15ERW	12	9.0 - 18.0	588	12	15.0	400	20.0	85	20.0	100	1,200
MI612S-24ERW	12	9.0 - 18.0	581	12	24.0	250	12.0	86	20.0	47	1,200
MI612D-05ERW	12	9.0 - 18.0	617	12	±5.0	±600	±30	81	20.0	470	1,200
MI612D-12ERW	12	9.0 - 18.0	588	12	±12.0	±250	±12	85	20.0	100	1,200
MI612D-15ERW	12	9.0 - 18.0	588	12	±15.0	±200	±10	85	20.0	100	1,200
MI624S-03ERW	24	18.0 - 36.0	261	7	3.3	1,500	75.0	79	20.0	1,800	600
MI624S-05ERW	24	18.0 - 36.0	301	7	5.0	1,200	60.0	83	20.0	1,000	600
MI624S-12ERW	24	18.0 - 36.0	287	7	12.0	500	25.0	87	20.0	100	600
MI624S-15ERW	24	18.0 - 36.0	287	7	15.0	400	20.0	87	20.0	100	600
MI624S-24ERW	24	18.0 - 36.0	287	7	24.0	250	12.0	87	20.0	47	600
MI624D-05ERW	24	18.0 - 36.0	301	7	±5.0	±600	±30	83	20.0	470	600
MI624D-12ERW	24	18.0 - 36.0	287	7	±12.0	±250	±12	87	20.0	100	600
MI624D-15ERW	24	18.0 - 36.0	287	7	±15.0	±200	±10	87	20.0	100	600
MI648S-03ERW	48	36.0 - 75.0	130	3	3.3	1,500	75.0	79	20.0	1,800	300
MI648S-05ERW	48	36.0 - 75.0	151	3	5.0	1,200	60.0	83	20.0	1,000	300
MI648S-12ERW	48	36.0 - 75.0	143	3	12.0	500	25.0	87	20.0	100	300
MI648S-15ERW	48	36.0 - 75.0	142	3	15.0	400	20.0	88	20.0	100	300
MI648S-24ERW	48	36.0 - 75.0	142	3	24.0	250	12.0	88	20.0	47	300
MI648D-05ERW	48	36.0 - 75.0	151	3	±5.0	±600	±30	83	20.0	470	300
MI648D-12ERW	48	36.0 - 75.0	143	3	±12.0	±250	±12	87	20.0	100	300
MI648D-15ERW	48	36.0 - 75.0	142	3	±15.0	±200	±10	88	20.0	100	300

Notes:

1. Cross regulation is measured on dual output models with one output at 50% load while the other output is varied from 10% load to 100% load.
2. When measuring output ripple & noise, it is recommended that an external capacitor (10 µF) be placed from the +Vout to the -Vout pins for single output units and from each output to common for dual output models.
3. Transient recovery is measured to within a 1% error band for a load step change of 25%.
4. With the addition of the **DCFM-0x** (or a similar discrete filter), all models will meet EN 55022 class B. Suggested input circuits are shown in the connection diagrams below & on page 3. Contact the factory for more information.
5. To meet the requirements of EN 61000-4-4 (±2 kV), external components are needed. The connection diagrams below & on page 3 shows an external input filter that would typically achieve this. With the addition of the **DCFM-0x**, EN 61000-4-4 (±4 kV) can be achieved. Contact the factory for more information.
6. To meet the requirements of EN 61000-4-5 (±2 kV), external components are needed. This can be done discretely (as shown in the connection diagrams below & on page 3), or with the addition of the **DCFM-0x**. Contact the factory for more information.
7. Dual output units may be connected to provide a 10V, 24V, or 30 VDC output. To do this, connect the load across the positive (+Vout) and negative (-Vout) outputs and float the output common.
8. Operation at no-load will not damage these units. However, they may not meet all specifications. The recommended minimum load is given in the model selection table above.
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.

Derating Curve

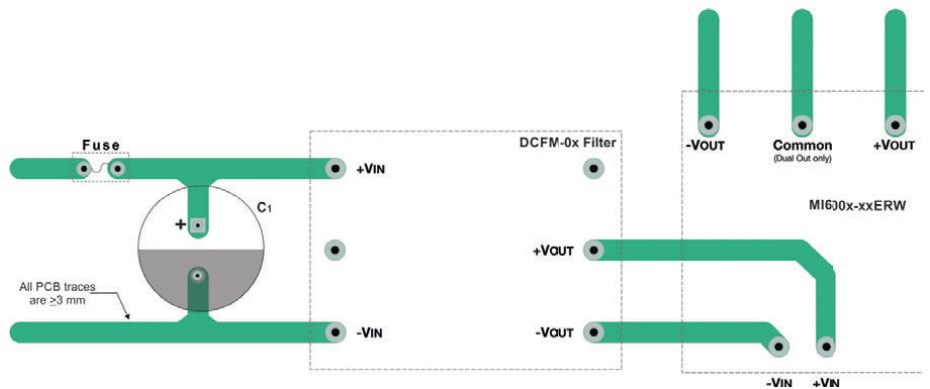


Typical Board Layout: With DCFM-01 Input Module (See note at left)

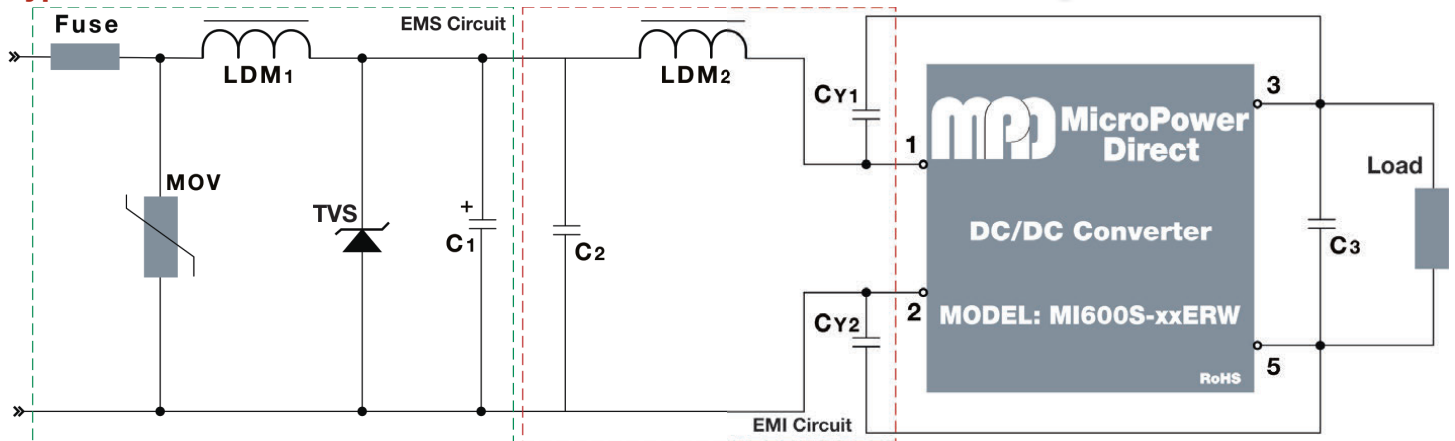
Input noise and surge suppression modules are available for a number of MPD DC/DC converters. An **MI600xERW** connection (with a **DCFM-01/02**) is illustrated in the diagram at right. With this connection, the converter will meet the specified EMI/EMS levels. Recommended values for the components shown are:

Output	<48VDC Input	>48VDC Input
Fuse	See Table Above	
C1	330 µF/50V	330 µF/100V

For pricing or full technical information on these modules (**DCFM-01** and **DCFM-02**) please contact the factory.



### Typical Connection



For applications that require meeting EMC standards, the diagram above illustrates a typical connection of the **MI600xERW** series. The units do not require external components to operate as specified. Some notes on this diagram (starting with the input circuit) are:

1. An external fuse should be used in all power module applications. The recommended fuse is shown in the model chart on page 2.
2. To protect against a surge, an external MOV is recommended on the input. A suggested value is given in the table at right.
3. To protect against voltage spikes, it is recommended that a TVS be used on the input. A suggested value is given in the table at right.
4. The output filtering capacitor (C<sub>3</sub>) 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 60% or greater.

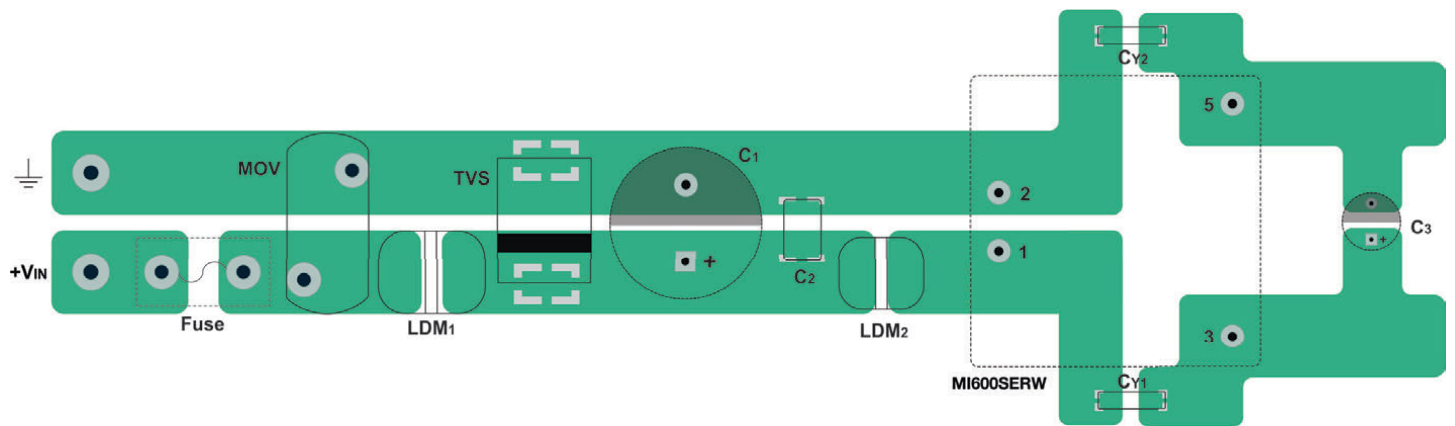
5. Recommended values for components are:

Component	12 V <sub>IN</sub>	24 V <sub>IN</sub>	48 V <sub>IN</sub>
MOV	---	S14K35	S14K60
LDM1	---	56 μH	56 μH
TVS	SMCJ28A	SMCJ48A	SMCJ90A
C <sub>1</sub>	680 μF/25V	330 μF/50V	330 μF/100V
C <sub>2</sub>	1 μF/50V	1 μF/50V	1 μF/100V
LDM <sub>2</sub>	4.7 μH	4.7 μH	4.7 μH
CY <sub>1</sub>	1nF/2 kV	1nF/2 kV	1nF/2 kV
CY <sub>2</sub>	1nF/2 kV	1nF/2 kV	1nF/2 kV
C <sub>3</sub>	10 μF	10 μF	10 μF
C <sub>4</sub>	10 μF	10 μF	10 μF

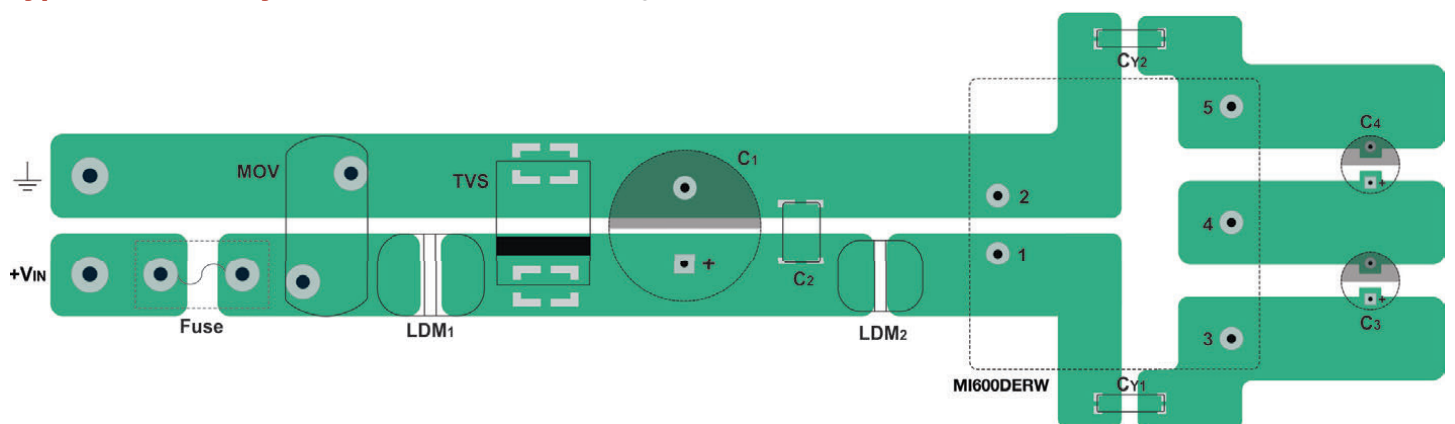
6. The drawings below show typical board layouts for the EMC/EMI circuit shown above (one for single output models and one for dual output units).

7. In many applications simply adding input/output capacitors will enhance the input surge protection and reduce output ripple sufficiently. The value of the input capacitor can range from 10 μF to 330 μF, depending on the needs of the application. The output capacitor would typically be 10 μF.

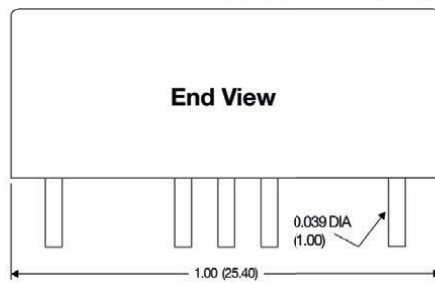
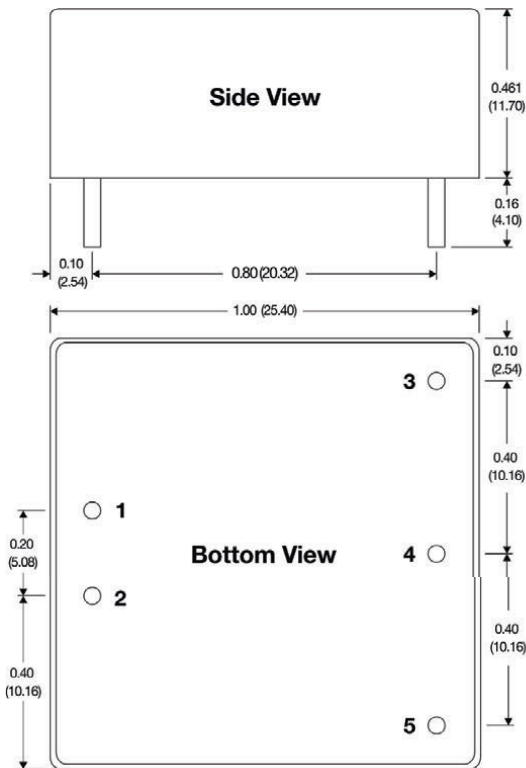
### Typical Board Layout: With External Filter/Surge Components for Single Output Unit



### Typical Board Layout: With External Filter/Surge Components for Dual Output Unit



**Mechanical Dimensions**



**Pin Connections**

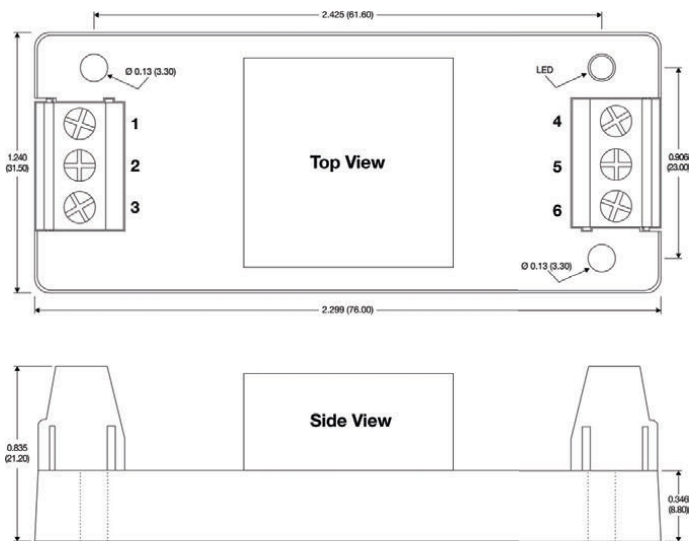
Pin	Single Output	Pin	Dual Output
1	+VIN	1	+VIN
2	-VIN	2	-VIN
3	+VOUT	3	+VOUT
4	No Pin	4	Common
5	-VOUT	5	-VOUT

**Notes:**

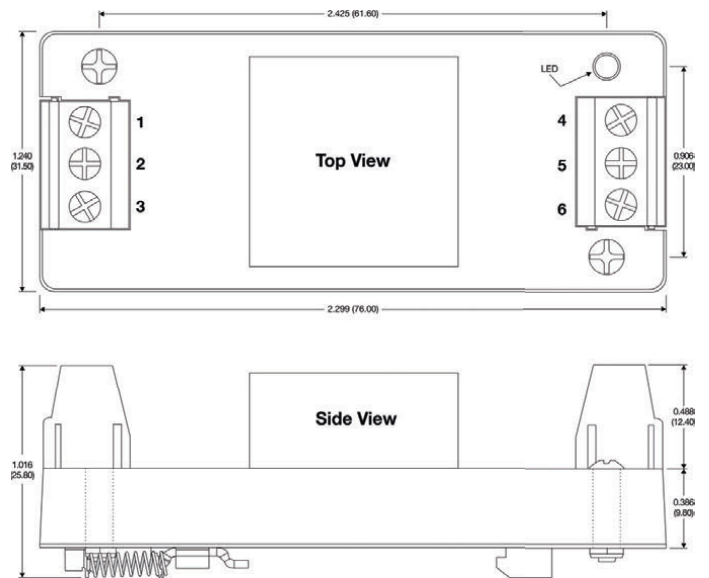
- All dimensions are typical in inches (mm)
- Pin Section Tolerance x.xxx = ±0.004 (±0.100)
- General Tolerance x.xx = ±0.01 (±0.25)
- Pin 1 is marked by a "dot" or indentation on the top of the unit

All M1600xERW models are available on adapters for chassis or DIN RAIL mounting. Specifications for these adapters are shown in the diagrams below. Contact the factory for more information.

**Chassis Mount Option: (-A2 added to Model No.)**



**DIN Rail Option: (-A4 added to Model No.)**



**Pin Connections**

Pin	Single Output	Pin	Dual Output
1	No Connection	1	No Connection
2	-VIN	2	-VIN
3	+VIN	3	+VIN
4	-VOUT	4	-VOUT
5	No Connection	5	Common
6	+VOUT	6	+VOUT

**Pin Connections**

Pin	Single Output	Pin	Dual Output
1	No Connection	1	No Connection
2	-VIN	2	-VIN
3	+VIN	3	+VIN
4	-VOUT	4	-VOUT
5	No Connection	5	Common
6	+VOUT	6	+VOUT

**Notes:**

- All dimensions are typical in inches (mm)
- General Tolerance x.xx = ±0.02 (±0.50)
- Wire Range is 24 AWG to 12 AWG



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