

# MI1000ERW Series

## Miniature 1" x 1", 2:1 Input, 10W DC/DC Converters



### Key Features:

- 10W Output Power
- 2:1 Input Voltage Range
- Miniature 1" x 1" Case
- 1,500 VDC Isolation
- Meets CISPR 32/EN 55032
- Remote On/Off Control
- -40°C to +85°C Operation
- Industry Standard Pin-Out
- Chassis & DIN Rail Mount

RoHS



### MicroPower Direct

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USA



### Electrical Specifications

Specifications typical @ +25°C, nominal input voltage & rated output current, unless otherwise noted. Specifications subject to change without notice.

Input		Min.	Typ.	Max.	Units
Parameter	Conditions				
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 Under Voltage Protection	12 VDC Input	5.5	6.5		VDC
	24 VDC Input	12.0	15.5		
	48 VDC Input	26.0	30.0		
Reflected Ripple Current			20		mA
Input Filter	Pi (π) Filter				
Output		Min.	Typ.	Max.	Units
Parameter	Conditions				
Output Voltage Accuracy	I <sub>OUT</sub> = 0% to 100%		±1.0	±3.0	%
Line Regulation	V <sub>IN</sub> = Min to Max		±0.2	±0.5	%
Load Regulation	I <sub>OUT</sub> = 5% to 100% 12 & 48V Inputs		±0.5	±1.0	%
	I <sub>OUT</sub> = 0% to 100% 24V Input		±0.5	±1.0	%
Cross Regulation	See Note 2			±5.0	%
Ripple & Noise (20 MHz)	See Note 3		40	100	mV P - P
Transient Recovery Time			300	500	μSec
Transient Response Deviation	See Note 4 3.3 & 5 V <sub>OUT</sub> Models		±5.0	±8.0	%
	All Other Models		±3.0	±5.0	%
Temperature Coefficient				±0.03	%/°C
Output Over Voltage Protection		110		160	%V <sub>OUT</sub>
Output Over Current Protection		110	140	190	%I <sub>OUT</sub>
Output Short Circuit	Continuous (Autorecovery)				
General		Min.	Typ.	Max.	Units
Parameter	Conditions				
Isolation Voltage	60 Seconds	1,500			VDC
Isolation Resistance	500 VDC	1,000			MΩ
Isolation Capacitance	Input/Output 100 KHz/0.1V		1,000		pF
Switching Frequency			350		kHz
Environmental		Min.	Typ.	Max.	Units
Parameter	Conditions				
Operating Temperature Range	Ambient	-40	+25	+85	°C
Storage Temperature Range		-55		+125	°C
Cooling	Free Air Convection				
Humidity	RH, Non-condensing			95	%
Physical					
Case Size, Module, Chassis /DIN Rail Mount	See Mechanical Drawings (Starting Page 4)				
Case Material	Aluminum (UL94-V0)				
Weight, Module, Chassis /DIN Rail Mount	See Mechanical Drawings (Starting Page 4)				
Remote On/Off		Min.	Typ.	Max.	Units
Parameter	Conditions				
Unit On	See Note 5	3.5		12.0	VDC
Unit Off		0		1.2	VDC
Off Idle Current			6.0	10.0	mA
Reliability Specifications		Min.	Typ.	Max.	Units
Parameter	Conditions				
MTBF	MIL HDBK 217F, 25°C, Gnd Benign	1.0			MHours
Vibration	10-55 Hz, 10G, 7.5 mm, 30 Min along X, Y & Z Axis				
Absolute Maximum Ratings		Min.	Typ.	Max.	Units
Parameter	Conditions				
Input Voltage Surge (1 Sec)	12 VDC Input			25.0	VDC
	24 VDC Input			50.0	
	48 VDC Input			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.

## Model Selection Guide

Model Number	Input				Output			Efficiency (% Typ)	Capacitive Load (μF, Max)	Certification	Fuse Rating Slow-Blow (mA)
	Voltage (VDC)		Current (mA)		Voltage (VDC)	Current (mA, Max)	Current (mA, Min)				
	Nominal	Range	Full-Load	No-Load							
MI1012S-05ERW	12	9.0 - 18.0	1,004	5	5.0	2,000	0.0	83	2,200	---	2,000
MI1024S-05ERW	24	18.0 - 36.0	502	5	5.0	2,000	0.0	83	2,200	CE	1,000
MI1024S-12ERW	24	18.0 - 36.0	479	5	12.0	833	0.0	87	470	CE	1,000
MI1024S-15ERW	24	18.0 - 36.0	473	5	15.0	667	0.0	88	330	CE	1,000
MI1024S-24ERW	24	18.0 - 36.0	473	5	24.0	416	0.0	88	100	CE	1,000
MI1048S-03ERW	48	36.0 - 75.0	263	4	3.3	2,400	0.0	79	2,200	---	500
MI1048S-05ERW	48	36.0 - 75.0	251	4	5.0	2,000	0.0	83	2,200	---	500
MI1048S-12ERW	48	36.0 - 75.0	239	4	12.0	833	0.0	87	470	---	500
MI1048S-15ERW	48	36.0 - 75.0	239	4	15.0	667	0.0	87	330	---	500
MI1048S-24ERW	48	36.0 - 75.0	237	4	24.0	416	0.0	88	100	---	500

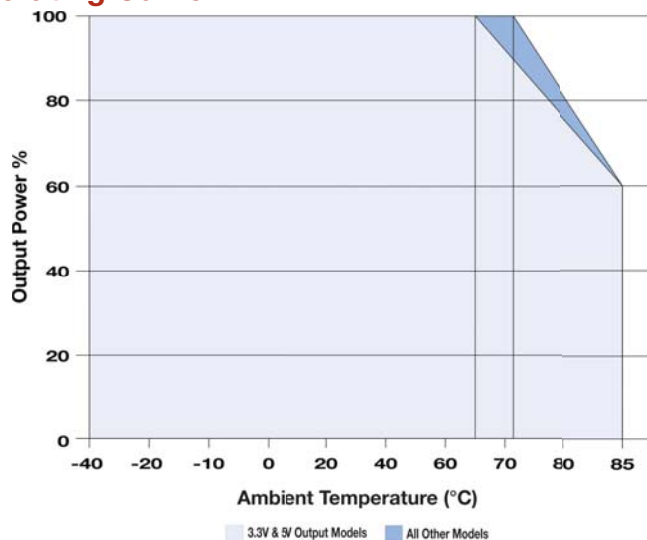
For the A2S adapter board option, add suffix "A2S" to the model no.  
(i.e. **MI1024S-05ERW-A2S**)

For the A4S adapter board option, add suffix "A4S" to the model no.  
(i.e. **MI1048S-12ERW-A4S**)

### Notes:

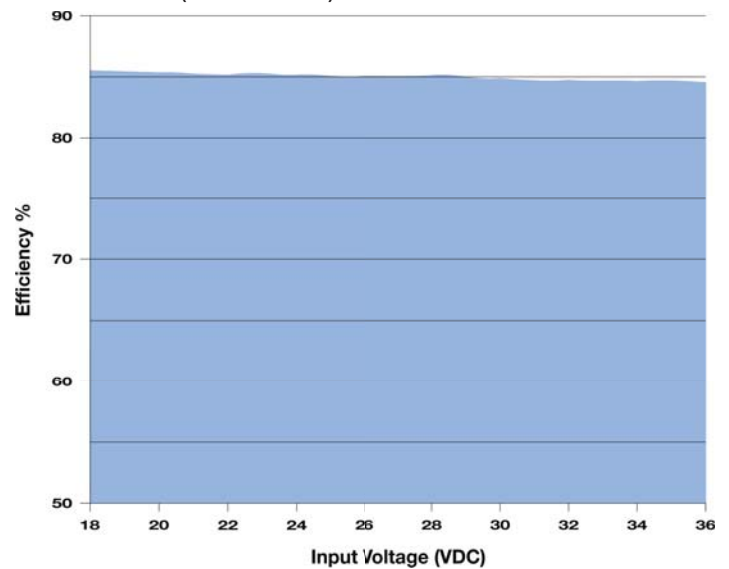
1. The specified maximum capacitive load is for each output.
2. Cross regulation is measured on dual output models with one output at 50% load while the other output is varied from 10% load to 100% load.
3. When measuring output ripple & noise, it is recommended that an external capacitor (10  $\mu$ F) be placed from the +Vout to the -Vout pins for single output units and from each output to common for dual output models. From 0% - 5% output load, ripple & noise is 5% max.
4. Transient recovery is measured to within a 1% error band for a load step change of 25%.
5. The voltage at the Remote On/Off pin (Pin 6) is referenced to the -VIN input (Pin 1). If the on/off pin is left open, the unit operates. If it is grounded, the unit will shut off.
6. 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.
7. Operation at no-load will not damage these units. However, they may not meet all specifications.
8. 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



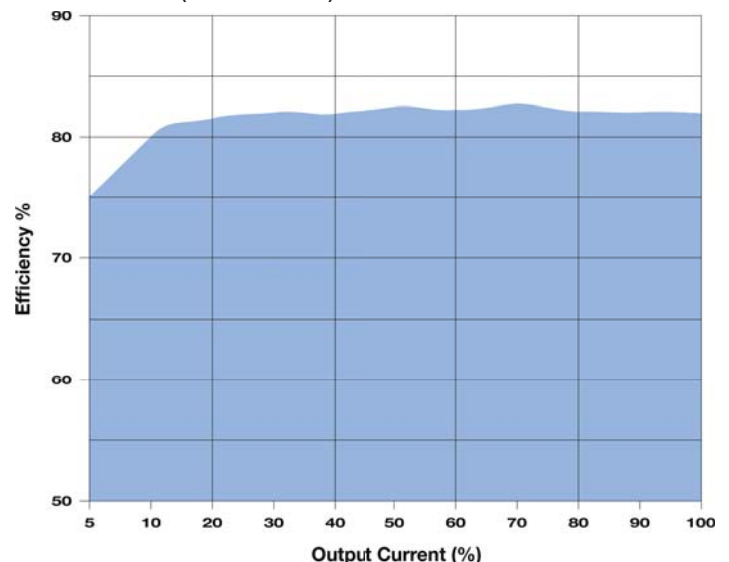
## Efficiency Curves: Efficiency vs Input Voltage

MI1024S-05ERW (24 VIN - 5 VOUT)



## Efficiency Curves: Efficiency vs Output Voltage

MI1024S-05ERW (24 VIN - 5 VOUT)



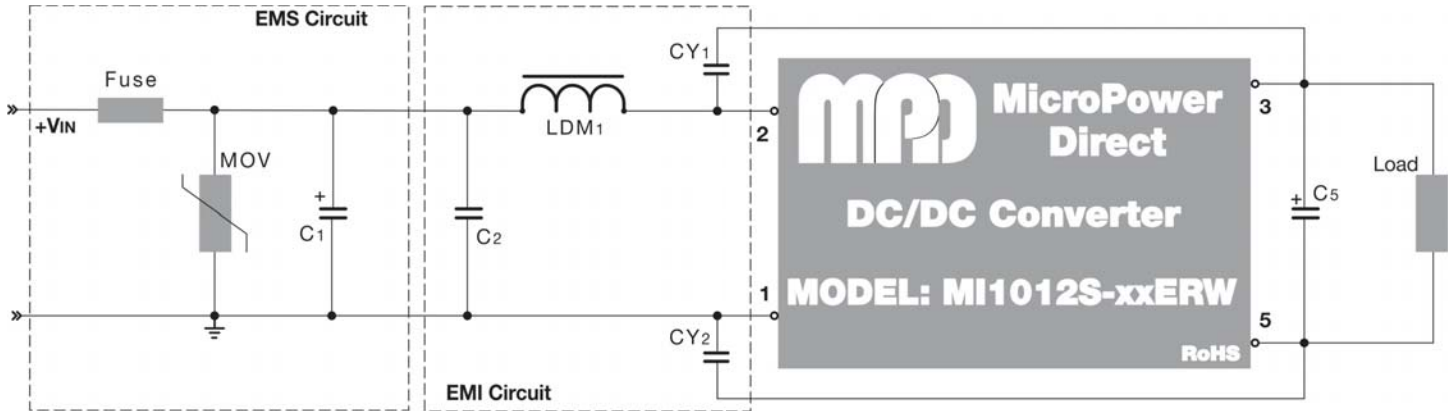
## EMI Characteristics

Parameter	Models	Standard	Criteria	Level
Radiated Emissions (See Note 1)	12V & 24V Input	CISPR 32/EN 55032		Class A (without external components)
	48V Input			Class B (See Typical Connection below)
				Class B (See Typical Connection below)
Conducted Emissions (See Note 1)	12V & 24V Input	CISPR 32/EN 55032		Class A (without external components)
	48V Input			Class B (See Typical Connection below)
				Class B (See Typical Connection below)
ESD		EN 61000-4-2	B	±4 kV Contact
RS		EN 61000-4-3	A	10V/m
EFT	See Note 2	EN 61000-4-4	B	±2 kV
Surge	See Note 3	EN 61000-4-5	B	±2 kV
CS		EN 61000-4-6	A	3 Vrms
Voltage Dips		EN 61000-4-29	B	0% - 70%

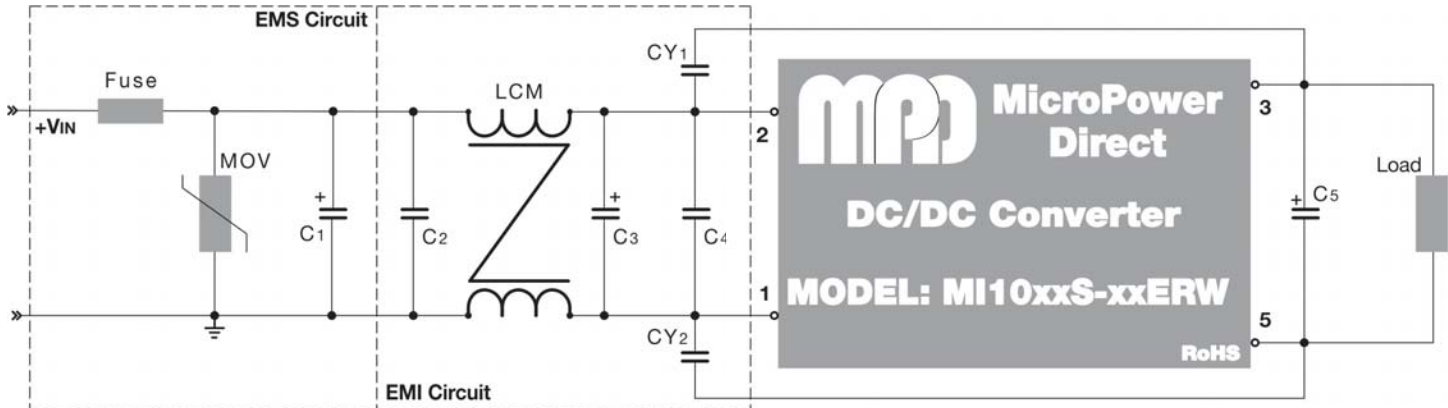
### Notes:

1. If the application does not require that emissions meet international standards, simply adding capacitors to the input and output circuits may be sufficient to reduce ripple & noise. See note 5 below.
2. To meet the requirements of EN 61000-4-4, external components are needed. The connection diagrams below show an external input filter that would typically achieve this. Contact the factory for more information.
3. To meet the requirements of EN 61000-4-5, external components are needed. This can be done as shown in the connection diagrams below. Contact the factory for more information.

## Typical Connection: 12 VDC Input Models



## Typical Connection: 24/48 VDC Input Models



For applications that require meeting EMC standards, the diagram above illustrates a typical connection of the **MI1000xERW** 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. All input/output filtering capacitors should have a low equivalent impedance. Any output capacitors used should be high frequency, low resistance electrolytic capacitors. Care must be taken in choosing this capacitor not to exceed the capacitive load specification for the unit. Voltage derating of all capacitors should be 60% or greater.

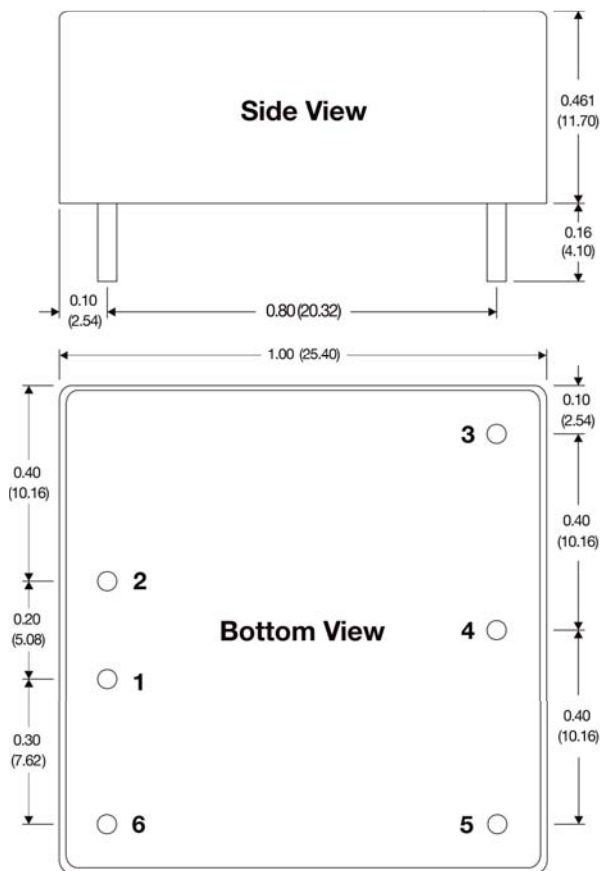
### 4. Recommended values for components are:

Component	12 V <sub>IN</sub>	24 V <sub>IN</sub>	48 V <sub>IN</sub>
MOV	20D470K	S20K30	14D101K
C <sub>1</sub>	330 $\mu$ F/50V	680 $\mu$ F/50V	680 $\mu$ F/100V
C <sub>2</sub>	1 $\mu$ F/50V	1 $\mu$ F/50V	1 $\mu$ F/100V
LCM	---	4.7 mH	4.7 mH
LDM <sub>1</sub>	4.7 $\mu$ H	---	---
C <sub>3</sub>	---	330 $\mu$ F/50V	330 $\mu$ F/100V
C <sub>4</sub>	---	4.7 $\mu$ F/50V	4.7 $\mu$ F/100V
CY <sub>1</sub>	1 nF/2 kV	1 nF/2 kV	1 nF/2 kV
CY <sub>2</sub>	1 nF/2 kV	1 nF/2 kV	1 nF/2 kV
C <sub>5</sub>	10 $\mu$ F	100 $\mu$ F	100 $\mu$ F

5. In many applications simply adding input/output capacitors will enhance the input surge protection and reduce output ripple sufficiently. Suggested capacitor values are:

Input Voltage	12 V <sub>IN</sub>	24 V <sub>IN</sub>	48 V <sub>IN</sub>
C <sub>IN</sub>	100 $\mu$ F	100 $\mu$ F	100 $\mu$ F
C <sub>OUT</sub>	10 $\mu$ F	10 $\mu$ F	10 $\mu$ F

## Mechanical Dimensions



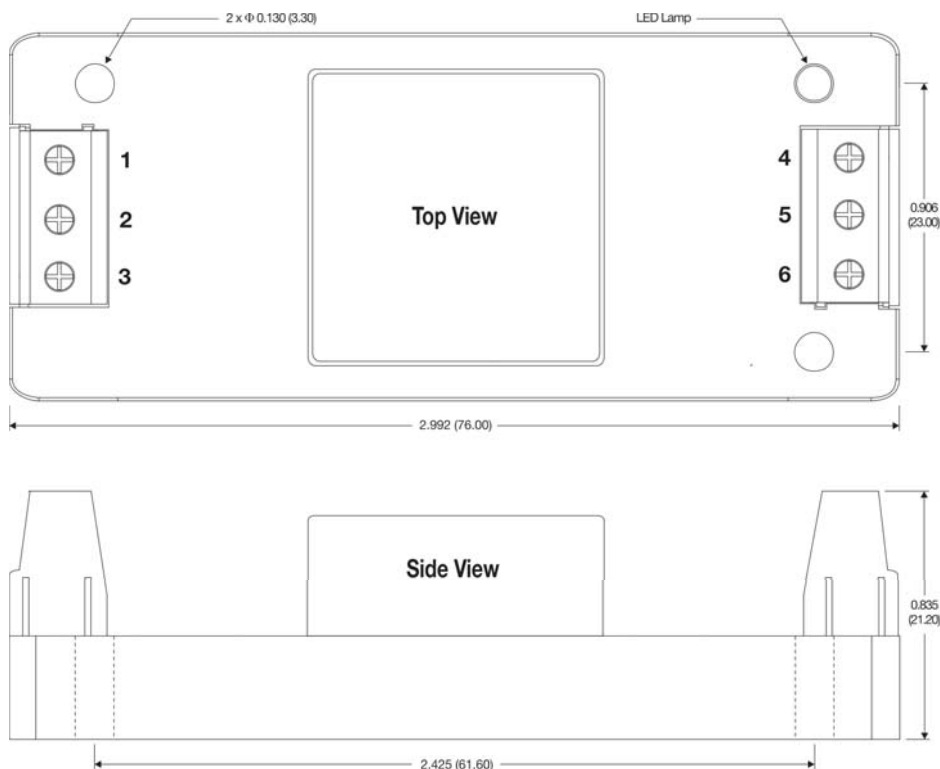
## Pin Connections

Pin	Function
1	-VIN
2	+VIN
3	+VOUT
4	No Pin
5	-VOUT
6	Remote On/Off

### Notes:

- All dimensions are typical in inches (mm)
- Pin Section Tolerance x.xxx =  $\pm 0.004$  ( $\pm 0.100$ )
- General Tolerance x.xx =  $\pm 0.01$  ( $\pm 0.25$ )
- Weight: 0.49 Oz (14g)

## Mechanical Dimensions, A2S: With Chassis Mount & Power Good LED



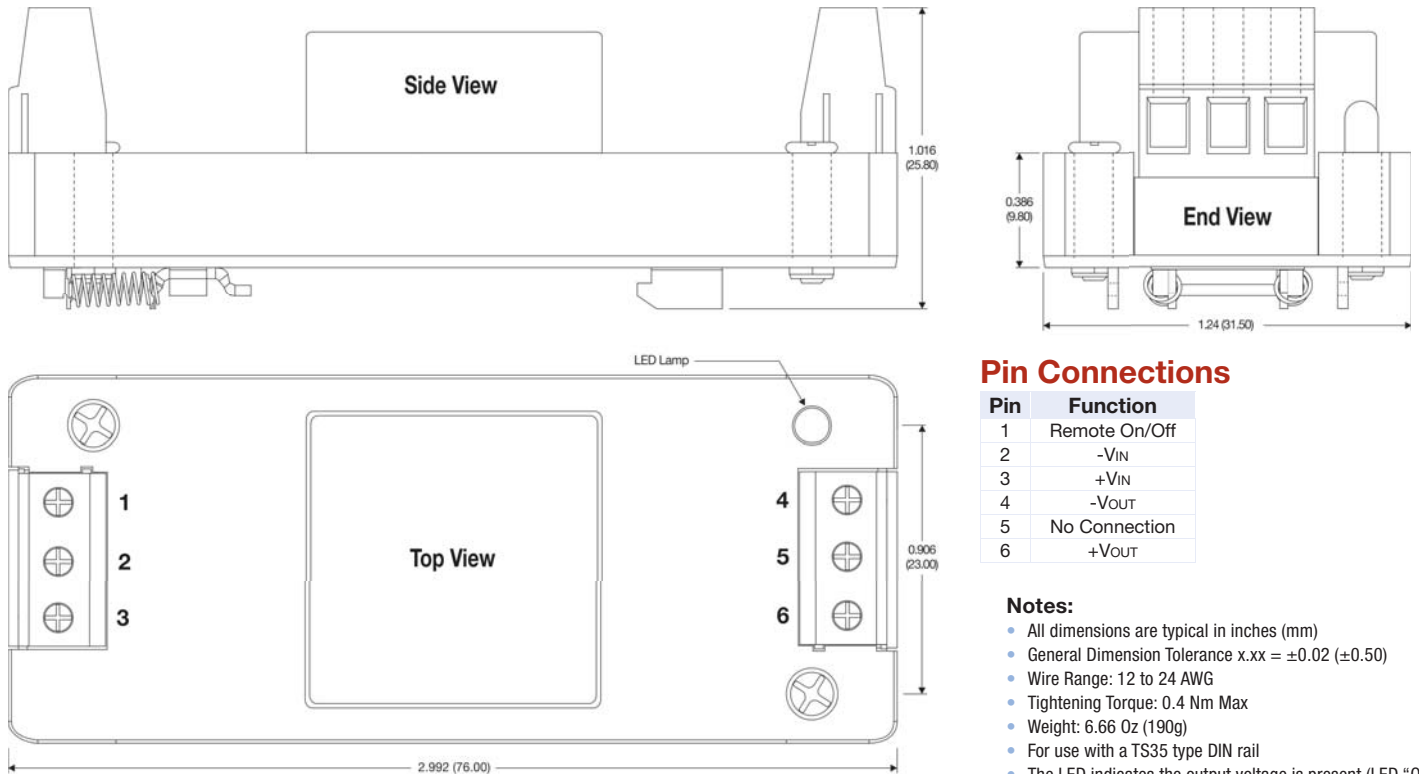
## Pin Connections

Pin	Function
1	Remote On/Off
2	-VIN
3	+VIN
4	-VOUT
5	No Connection
6	+VOUT

### Notes:

- All dimensions are typical in inches (mm)
- General Dimension Tolerance x.xx =  $\pm 0.02$  ( $\pm 0.50$ )
- Wire Range: 12 to 24 AWG
- Tightening Torque: 0.4 Nm Max
- Weight: 1.26 Oz (36g)
- The LED indicates the output voltage is present (LED "On")

## Mechanical Dimensions, A4S: With DIN Rail Mount Option & Power Good LED



## Power Products

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