

MI1000ERU Series

Miniature 1" x 1" 10W, Ultra-Wide 4:1 Input DC/DC Converters



Key Features:

- 10W Output Power
- EN 60950 Approval
- 4:1 Input Voltage Range
- Miniature 1" x 1" Case
- 1,500 VDC Isolation
- Single & Dual Outputs
- -40°C to +85°C Operation
- Industry Standard Pin-Out
- Chassis & DIN Rail Mount



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



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	24 VDC Input	9.0	24.0	36.0	VDC	
	48 VDC Input	18.0	48.0	75.0		
Input Start Voltage	24 VDC Input			9.0	VDC	
	48 VDC Input			18.0		
Input Under Voltage Protection	24 VDC Input	5.5	6.5		VDC	
	48 VDC Input	12.0	15.5			
Reflected Ripple Current	24 VDC Input		40		mA	
	48 VDC Input		30			
Start Up Time	See Note 2		10		mS	
Input Filter	PI (π) Filter					
Output						
Parameter	Conditions	Min.	Typ.	Max.	Units	
Output Voltage Accuracy	I _{OUT} = 0% to 100%		±1.0	±3.0	%	
Line Regulation	V _{IN} = Min to Max	Positive Output	±0.2	±0.5	%	
		Negative Output	±0.5	±1.0		
Load Regulation	I _{OUT} = 5% to 100%	Positive Output	±0.5	±1.0	%	
		Negative Output	±0.5	±1.5		
Cross Regulation	See Note 3			±5.0	%	
Ripple & Noise (20 MHz)	See Note 4		40	80	mV P - P	
Transient Recovery Time			300	500	μSec	
Transient Response Deviation	See Note 5		±3.0	±5.0	%	
Temperature Coefficient				±0.03	%/°C	
Output Over Voltage Protection		110		160	%V _{OUT}	
Output Over Current Protection		110	140	190	%I _{OUT}	
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	Input/Output 100 KHz/0.1V		1,000		pF	
Switching Frequency			350		kHz	
Environmental						
Parameter	Conditions	Min.	Typ.	Max.	Units	
Operating Temperature Range	Ambient	-40	+25	+85	°C	
Operating Temperature Range	Case			+105	°C	
Storage Temperature Range		-55		+125	°C	
Cooling	Free Air Convection					
Humidity	RH, Non-condensing			95	%	
Remote On/Off						
Parameter	Conditions	Min.	Typ.	Max.	Units	
Unit On		3.5		12.0	VDC	
Unit Off	See Note 6	0		1.2	VDC	
Off Idle Current			6.0	10.0	mA	
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)					
Reliability Specifications						
Parameter	Conditions	Min.	Typ.	Max.	Units	
MTBF	MIL HDBK 217F, 25°C, Gnd Benign	1.0			MHours	
Safety Standards	UL/cUL 60950-1 recognition (UL certificate)					
Vibration	10-55 Hz, 10G, 7.5 mm, 30 Min along X, Y & Z Axis					
Absolute Maximum Ratings						
Parameter	Conditions	Min.	Typ.	Max.	Units	
Input Voltage Surge (1 Sec)	24 VDC Input			50.0	VDC	
	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.

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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							
MI1024S-03ERU	24	9.0 - 36.0	527	5	3.3	2,400	0.0	79	2,200	UL/CE	1,000
MI1024S-05ERU	24	9.0 - 36.0	502	5	5.0	2,000	0.0	83	2,200	UL/CE	1,000
MI1024S-09ERU	24	9.0 - 36.0	484	5	9.0	1,111	0.0	86	680	UL/CE	1,000
MI1024S-12ERU	24	9.0 - 36.0	478	5	12.0	833	0.0	87	470	UL/CE	1,000
MI1024S-15ERU	24	9.0 - 36.0	478	5	15.0	667	0.0	87	330	UL/CE	1,000
MI1024S-24ERU	24	9.0 - 36.0	473	5	24.0	416	0.0	88	100	UL/CE	1,000
MI1024D-05ERU	24	9.0 - 36.0	502	5	±5.0	±1,000	±0.0	83	1,000	UL/CE	1,000
MI1024D-09ERU	24	9.0 - 36.0	484	5	±9.0	±555	±0.0	86	680	UL/CE	1,000
MI1024D-12ERU	24	9.0 - 36.0	478	5	±12.0	±416	±0.0	87	470	UL/CE	1,000
MI1024D-15ERU	24	9.0 - 36.0	478	5	±15.0	±333	±0.0	87	330	UL/CE	1,000
MI1024D-24ERU	24	9.0 - 36.0	478	5	±24.0	±208	±0.0	87	100	UL/CE	1,000
MI1048S-03ERU	48	18.0 - 75.0	263	4	3.3	2,400	0.0	79	2,200	UL/CE	500
MI1048S-05ERU	48	18.0 - 75.0	251	4	5.0	2,000	0.0	83	2,200	UL/CE	500
MI1048S-12ERU	48	18.0 - 75.0	239	4	12.0	833	0.0	87	470	UL/CE	500
MI1048S-15ERU	48	18.0 - 75.0	239	4	15.0	667	0.0	87	330	UL/CE	500
MI1048S-24ERU	48	18.0 - 75.0	236	4	24.0	416	0.0	88	100	UL/CE	500
MI1048D-05ERU	48	18.0 - 75.0	251	4	±5.0	±1,000	±0.0	83	1,000	UL/CE	500
MI1048D-12ERU	48	18.0 - 75.0	239	4	±12.0	±416	±0.0	87	470	UL/CE	500
MI1048D-15ERU	48	18.0 - 75.0	239	4	±15.0	±333	±0.0	87	330	UL/CE	500
MI1048D-24ERU	48	18.0 - 75.0	239	4	±24.0	±208	±0.0	87	100	UL/CE	500

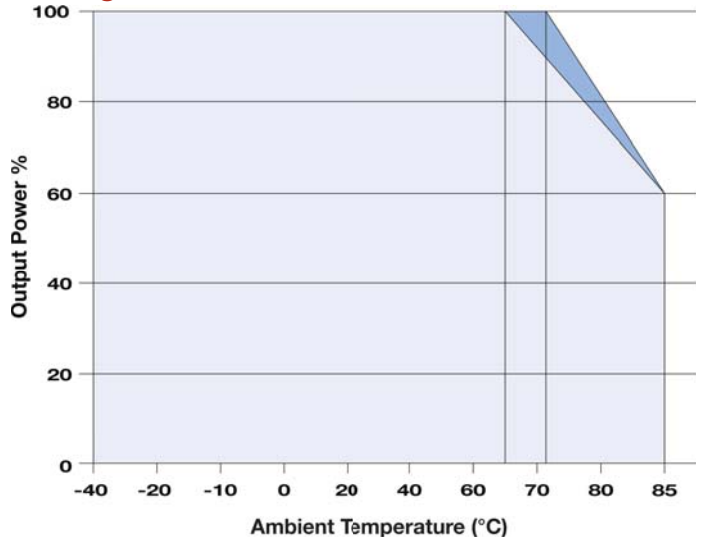
For the A2S adapter board option, add suffix "A2S" to the model no. (i.e. **MI1024D-05ERU-A2S**)

For the A4S adapter board option, add suffix "A4S" to the model no. (i.e. **MI1048S-24ERU-A4S**)

Notes:

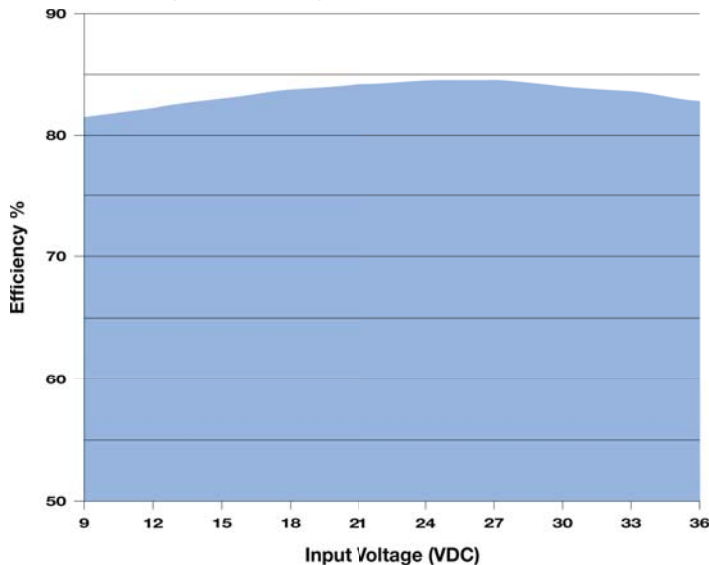
1. The specified maximum capacitive load is for each output.
2. Specified at nominal input voltage and a constant, resistive load.
3. Cross regulation is measured on dual output models with one output at 50% load while the other output is varied from 10% load to 100% load.
4. When measuring output ripple & noise, it is recommended that an external 10 µF capacitor 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.
5. Transient recovery is measured to within a 1% error band for a load step change of 25%.
6. 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.
7. Dual output units may be connected to provide a 10V, 24V, 30V or 48 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.
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

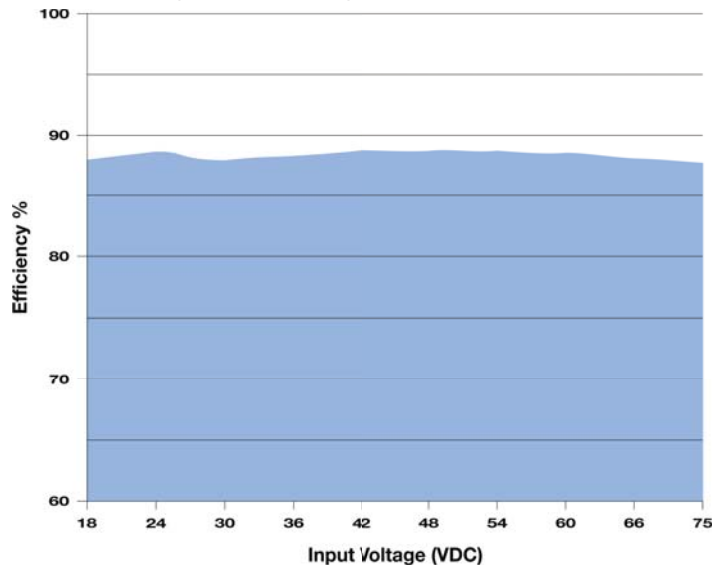


Efficiency Curves: Efficiency vs Input Voltage

MI1024S-05ERU (24 VIN - 5 Vout)

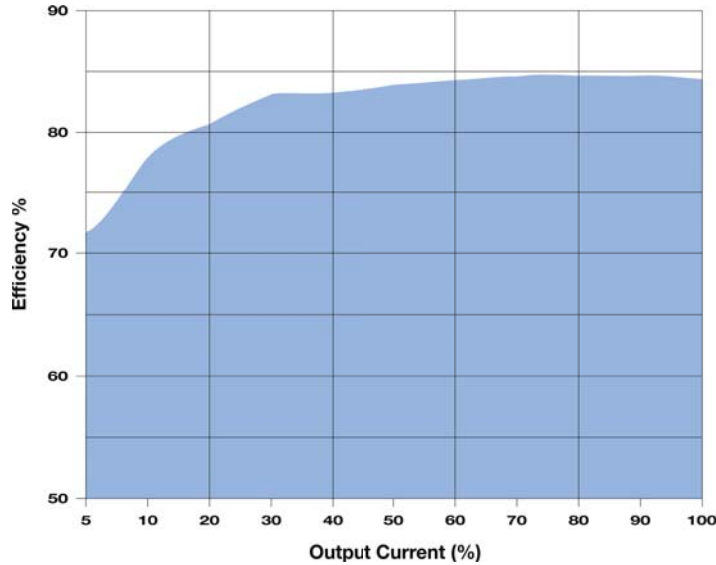


MI1048D-05ERU (48 VIN - ±15 Vout)

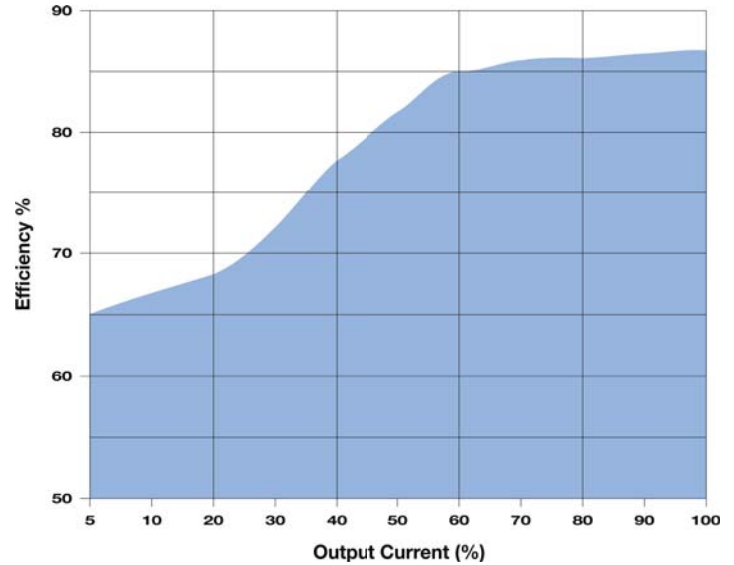


Efficiency Curves: Efficiency vs Output Voltage

MI1024S-05ERU (24 VIN - 5 Vout)



MI1048D-15ERU (48 VIN - ±15 Vout)



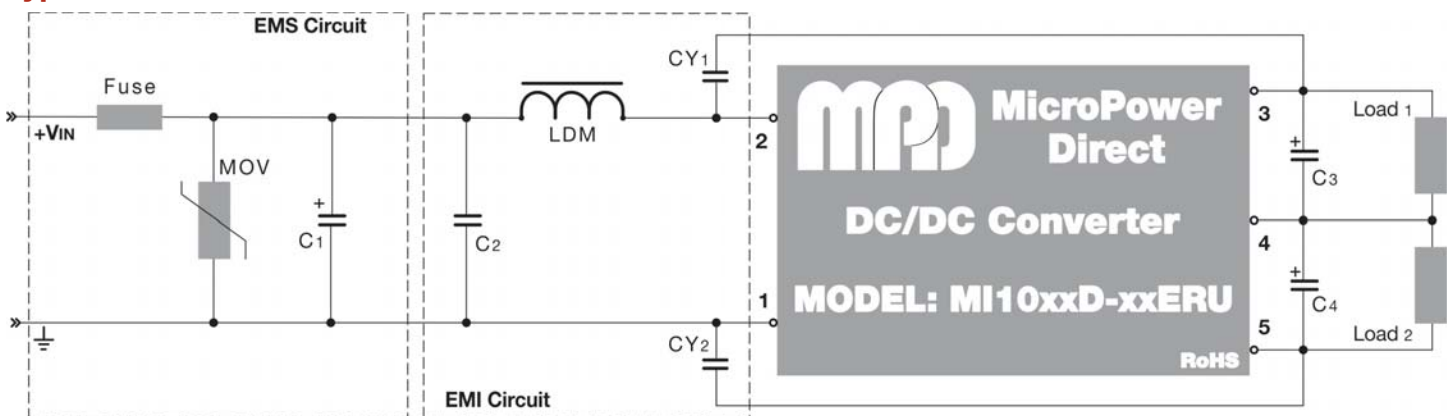
EMI Characteristics

Parameter	Standard	Criteria	Level
Radiated Emissions, See Note 1	CISPR 22/EN 55022		Class A (without external components)
Conducted Emissions, See Note 1			Class B (See Typical Connection below)
ESD	EN 61000-4-2	B	±4 kV Contact
RS	EN 61000-4-3	A	10 V/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 diagram below shows 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 diagram below. Contact the factory for more information.

Typical Connection



For applications that require meeting EMC standards, the diagram above illustrates a typical connection of the MI1000xERU 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.

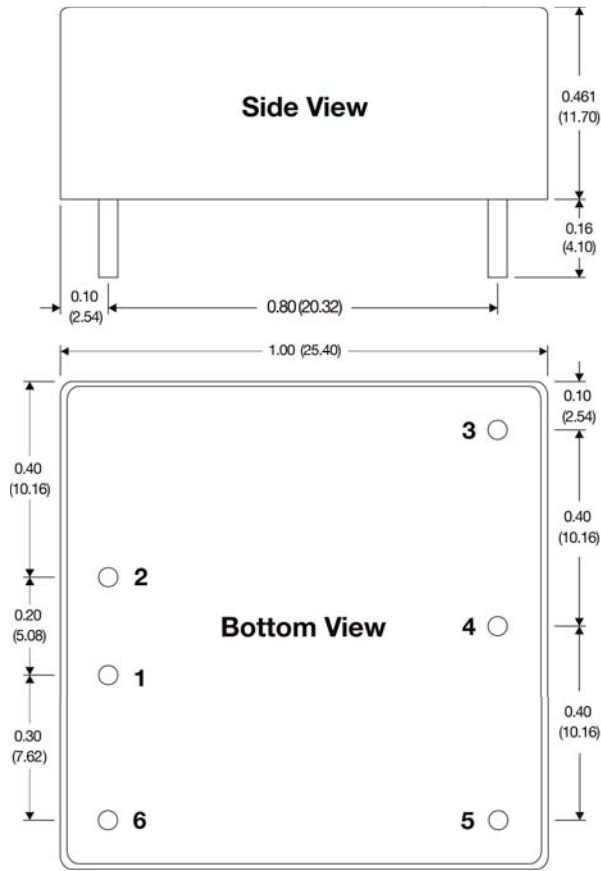
4. Recommended values for components are:

Component	24 VIN	48 VIN
MOV	S20K30	S14K60
C1	330 μF/50V	330 μF/100V
C2	1 μF/50V	1 μF/100V
LDM	4.7 μH	4.7 μH
CY1	1 nF/2 kV	1 nF/2 kV
CY2	1 nF/2 kV	1 nF/2 kV
C3	10 μF	10 μF
C4	10 μF	10 μF

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	24 VIN	48 VIN
CIN	100 μF	10 - 47 μF
COU	10 μF	10 μF

Mechanical Dimensions



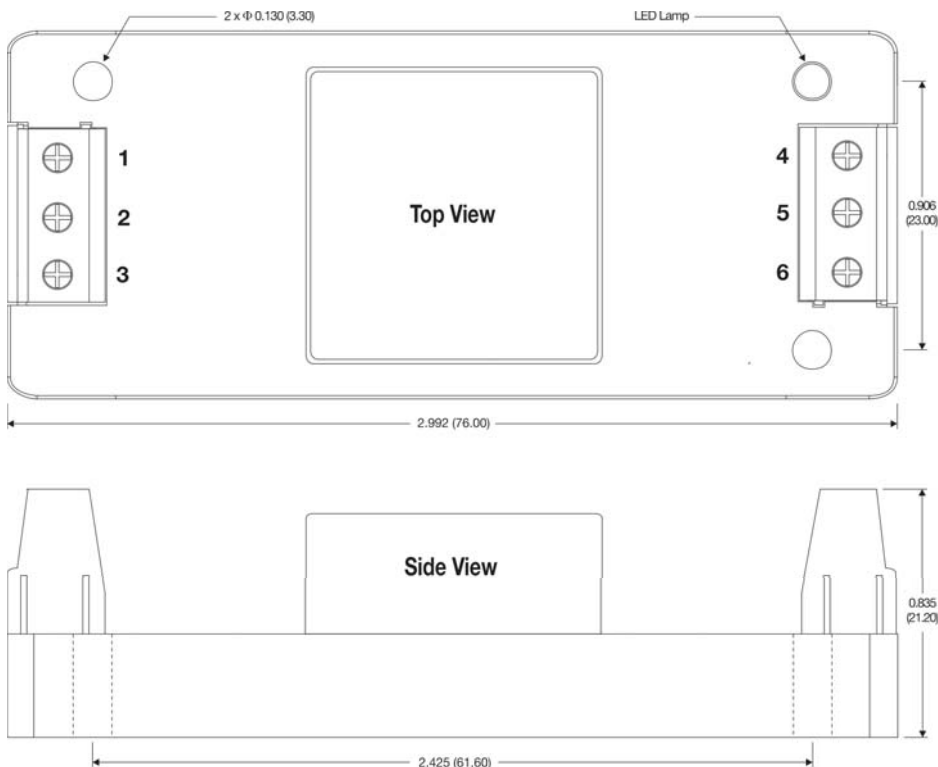
Pin Connections

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
6	Remote On/Off	6	Remote On/Off

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)
- Weight: 0.49 Oz (14g)

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



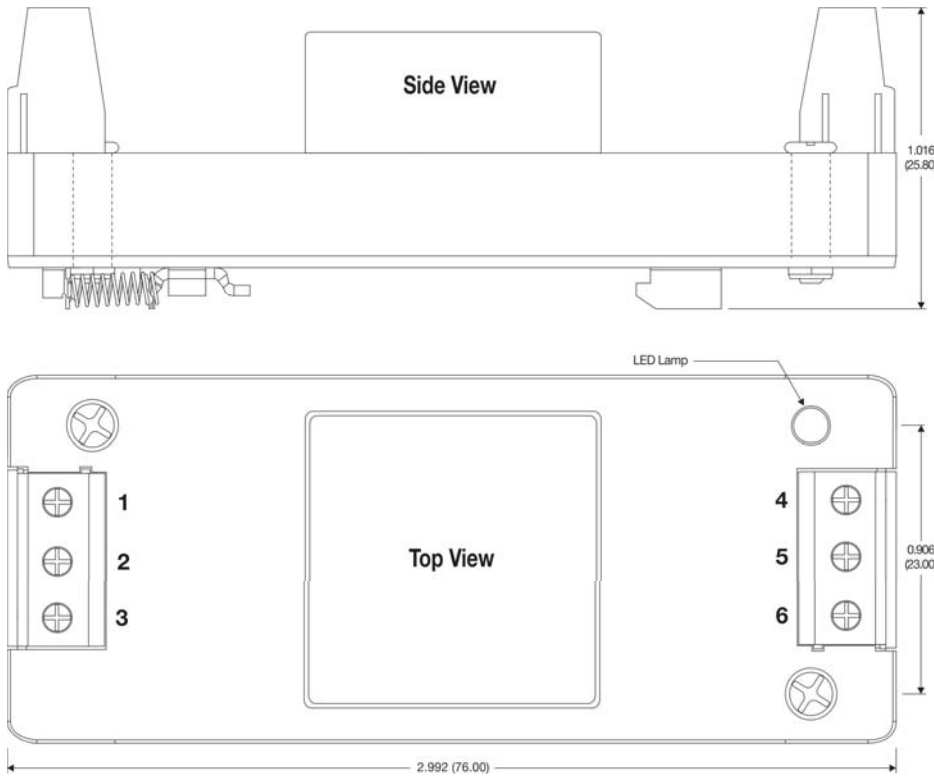
Pin Connections

Pin	Single Output	Pin	Dual Output
1	Remote On/Off	1	Remote On/Off
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 Dimension Tolerance x.xx = ±0.02 (±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



Pin Connections

Pin	Single Output	Pin	Dual Output
1	Remote On/Off	1	Remote On/Off
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 Dimension Tolerance x.xx = ±0.02 (±0.50)
- Wire Range: 12 to 24 AWG
- Tightening Torque: 0.4 Nm Max
- Weight: 6.66 Oz (190g)
- For use with a TS35 type DIN rail
- The LED indicates the output voltage is present (LED "On")

Power Products

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