

MI1500ERU Series

Miniature 1" x 1" 15W, Ultra-Wide 4:1 Input DC/DC Converters



Key Features:

- 15W Output Power
- 4:1 Input Voltage Range
- Miniature 1" x 1" Case
- 1,500 VDC Isolation
- Meets CISPR 32/EN 55032
- Single & Dual Outputs
- -40°C to +95°C Operation
- Industry Standard Pin-Out
- Chassis & DIN Rail Mount



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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	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			30		mA		
Start Up Time	See Note 1		10		mS		
Input Filter	PI (π) Filter						
Output							
Parameter	Conditions	Min.	Typ.	Max.	Units		
Output Voltage Accuracy	Single Output I _{OUT} = 0% to 100%		±1.0	±3.0	%		
	Dual Output I _{OUT} = 5% to 100%						
Line Regulation	V _{IN} = Min to Max	Positive Output	±0.2	±0.5	%		
		Negative Output	±0.4	±1.0			
Load Regulation	I _{OUT} = 5% to 100%		±0.5	±1.0	%		
Cross Regulation	See Note 2			±5.0	%		
Ripple & Noise (20 MHz)	See Note 3	Single Output	50	100	mV P - P		
		Dual Output	100	200			
Transient Recovery Time			300	500	μSec		
Transient Response Deviation	See Note 4	3.3 & 5V Output	±3.0	±8.0	%		
		All Other Models	±3.0	±5.0			
Temperature Coefficient				±0.03	% / °C		
Output Over Voltage Protection		110		160	%V _{OUT}		
	Single Output	110	150	190	%I _{OUT}		
Output Over Current Protection		Dual Output	110	200	270	%I _{OUT}	
		Continuous (Autorecovery)					
Output Short Circuit							
General							
Parameter	Conditions	Min.	Typ.	Max.	Units		
Isolation Voltage, See Note 5	60 Seconds	1,500			VDC		
Isolation Resistance	500 VDC	1,000			MΩ		
Isolation Capacitance	Input/Output 100 KHz/0.1V		2,000		pF		
Switching Frequency			350		kHz		
Environmental							
Parameter	Conditions	Min.	Typ.	Max.	Units		
Operating Temperature Range	Ambient	-40	+25	+95	°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			2.0	7.0	mA		
Physical							
Case Size, Module, Chassis /DIN Rail Mount					See Mechanical Drawings (Starting Page 6)		
Case Material					Aluminum (UL94-V0)		
Weight, Module, Chassis /DIN Rail Mount					See Mechanical Drawings (Starting Page 6)		
Reliability Specifications							
Parameter	Conditions	Min.	Typ.	Max.	Units		
MTBF	MIL HDBK 217F, 25°C, Gnd Benign	1.0			MHours		
Vibration	10-55 Hz, 5G, 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							
MI1524S-03ERU	24	9.0 - 36.0	625	30	3.3	4,000	0.0	88	4,700	CE	1,400
MI1524S-05ERU	24	9.0 - 36.0	694	30	5.0	3,000	0.0	90	4,700	CE	1,400
MI1524S-12ERU	24	9.0 - 36.0	694	6	12.0	1,250	0.0	90	1,000	CE	1,400
MI1524S-15ERU	24	9.0 - 36.0	686	6	15.0	1,000	0.0	91	820	CE	1,400
MI1524S-24ERU	24	9.0 - 36.0	686	10	24.0	625	0.0	91	270	CE	1,400
MI1524D-05ERU	24	9.0 - 36.0	718	10	±5.0	±1,500	±0.0	87	1,500	CE	1,400
MI1524D-12ERU	24	9.0 - 36.0	694	10	±12.0	±625	±0.0	90	470	CE	1,400
MI1524D-15ERU	24	9.0 - 36.0	694	10	±15.0	±500	±0.0	90	330	CE	1,400
MI1524D-24ERU	24	9.0 - 36.0	702	10	±24.0	±312	±0.0	89	200	CE	1,400
MI1548S-03ERU	48	18.0 - 75.0	312	15	3.3	4,000	0.0	88	4,700	CE	700
MI1548S-05ERU	48	18.0 - 75.0	347	15	5.0	3,000	0.0	90	4,700	CE	700
MI1548S-12ERU	48	18.0 - 75.0	343	15	12.0	1,250	0.0	91	1,000	CE	700
MI1548S-15ERU	48	18.0 - 75.0	343	15	15.0	1,000	0.0	91	820	CE	700
MI1548S-24ERU	48	18.0 - 75.0	343	15	24.0	625	0.0	91	270	CE	700
MI1548D-05ERU	48	18.0 - 75.0	363	5	±5.0	±1,500	±0.0	86	1,500	CE	700
MI1548D-12ERU	48	18.0 - 75.0	347	5	±12.0	±625	±0.0	90	470	CE	700
MI1548D-15ERU	48	18.0 - 75.0	347	5	±15.0	±500	±0.0	90	330	CE	700
MI1548D-24ERU	48	18.0 - 75.0	347	5	±24.0	±312	±0.0	90	200	CE	700

For the A2S adapter board option, add suffix "A2S" to the model no. (i.e. MI1524D-05ERU-A2S)

For the A4S adapter board option, add suffix "A4S" to the model no. (i.e. MI1548S-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 capacitor (10 µF) be placed from the +V_{OUT} to the -V_{OUT} 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 insulation level from Input/Output to case is 1 kVDC. This is measured with a test time of 60 Sec and a leakage current of 1 mA max.
7. The voltage at the Remote On/Off pin (Pin 6) is referenced to the -V_{IN} input (Pin 1). If the on/off pin is left open, the unit operates. If it is grounded, the unit will shut off.
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.

External Trim

On single output units, an external resistor can be used to adjust the converter output up/down by about 10%. The connection is shown in the diagram at left. The required resistor value is calculated by the formulas:

$$\text{Trim Up} = R_{\text{TRIM}} = \frac{A \times R_2}{R_2 - A} - R_3 \quad \text{Where } A = \frac{V_{\text{REF}}}{V_{\text{OUT}} - V_{\text{REF}}} \times R_1$$

$$\text{Trim Down} = R_{\text{TRIM}} = \frac{A \times R_1}{R_1 - A} - R_3 \quad \text{Where } A = \frac{V_{\text{OUT}} - V_{\text{REF}}}{V_{\text{REF}}} \times R_2$$

Where R_{TRIM} = The value of the external trim resistor
A = A is defined as shown above

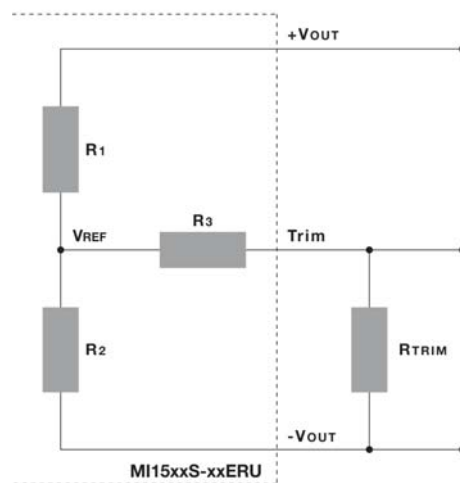
The values of R₁, R₂, R₃ and V_{REF} are given in the table below.

Output Trim Resistor Values

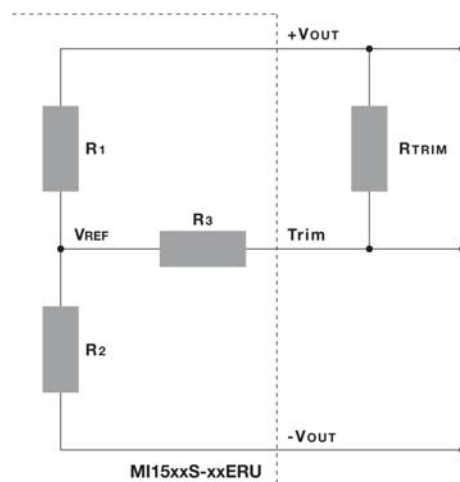
Parameter	Output Voltage (VDC)				
	3.3	5.0	12	15	24
R ₁ (kΩ)	4.801	2.894	11.000	14.494	24.872
R ₂ (kΩ)	2.870	2.870	2.870	2.870	2.870
R ₃ (kΩ)	15.00	10.00	17.40	17.40	20.00
V _{REF} (V)	1.24	2.50	2.50	2.50	2.50

External Trim

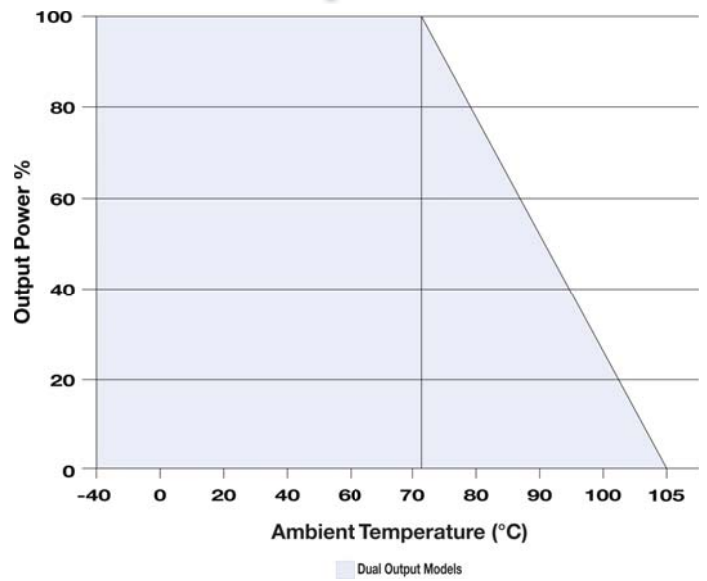
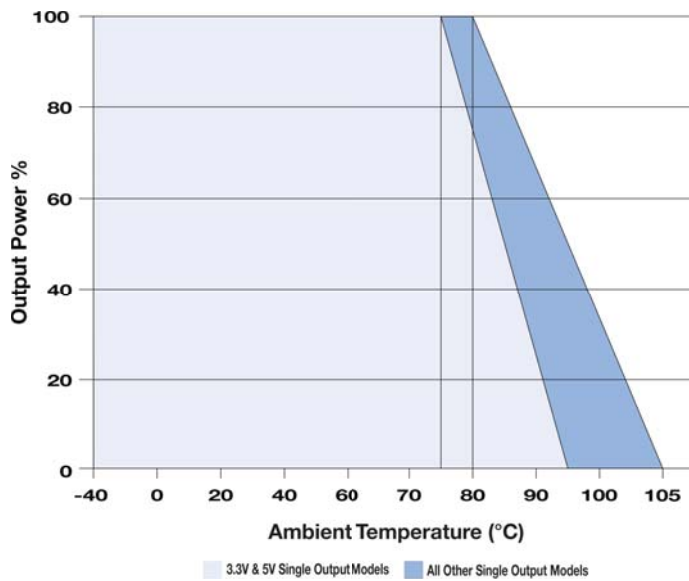
Trim Up



Trim Down



Derating Curves



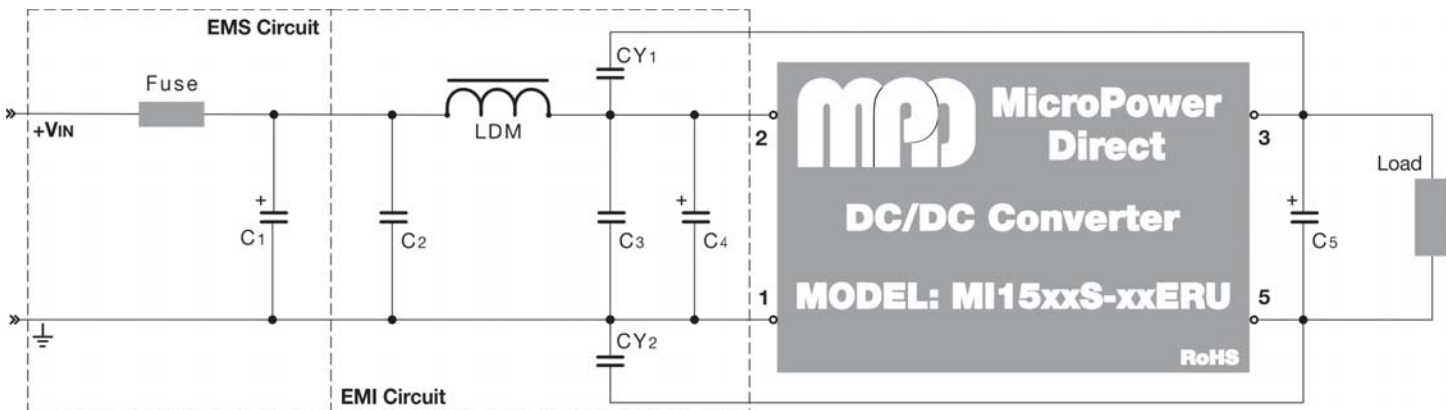
EMI Characteristics

Parameter	Standard	Criteria	Level
Radiated Emissions, See Note 1	CISPR 32/EN 55032		Class A (without external components)
			Class B (See Typical Connection below)
Conducted Emissions, See Note 1	CISPR 32/EN 55032		Class A (without external components)
			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

Notes:

- 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.
- 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.
- 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 **MI1500xERU** series. The units do not require external components to operate as specified. Some notes on this diagram (starting with the input circuit) are:

- An external fuse should be used in all power module applications. The recommended fuse is shown in the model chart on page 2.
- To protect against a surge, an external MOV is recommended on the input. A suggested value is given in the table at right.
- 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:

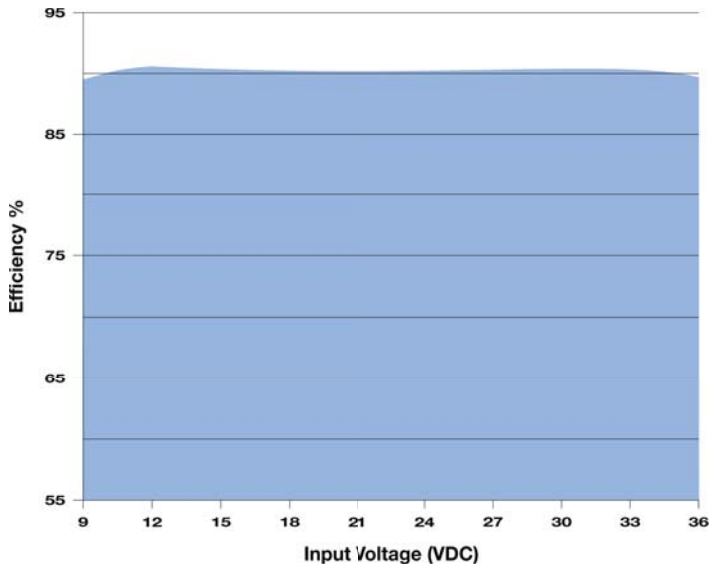
Component	24 VIN	48 VIN
C1	330 μ F/50V	330 μ F/100V
C2	4.7 μ F/50V	4.7 μ F/100V
LDM (Single Out.)	2.2 μ H	2.2 μ H
LDM (Dual Out.)	4.7 μ H	4.7 μ H
C3	4.7 μ F/50V	4.7 μ F/100V
C4	330 μ F/50V	330 μ F/100V
CY1	1 nF/2 kV	1 nF/2 kV
CY2	1 nF/2 kV	1 nF/2 kV
C5	See Note 5	

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	Single Output		Dual Output	
	24 VIN	48 VIN	24 VIN	48 VIN
CIN	100 μ F	100 μ F	100 μ F	10 - 47 μ F
COU				
3.3 VDC	100 μ F	100 μ F		
5 VDC	100 μ F	100 μ F		
12 VDC	100 μ F	100 μ F		
15 VDC	100 μ F	100 μ F		
24 VDC	47 μ F	47 μ F		
±5 VDC			10 μ F	10 μ F
±12 VDC			10 μ F	10 μ F
±15 VDC			10 μ F	10 μ F
±24 VDC			10 μ F	10 μ F

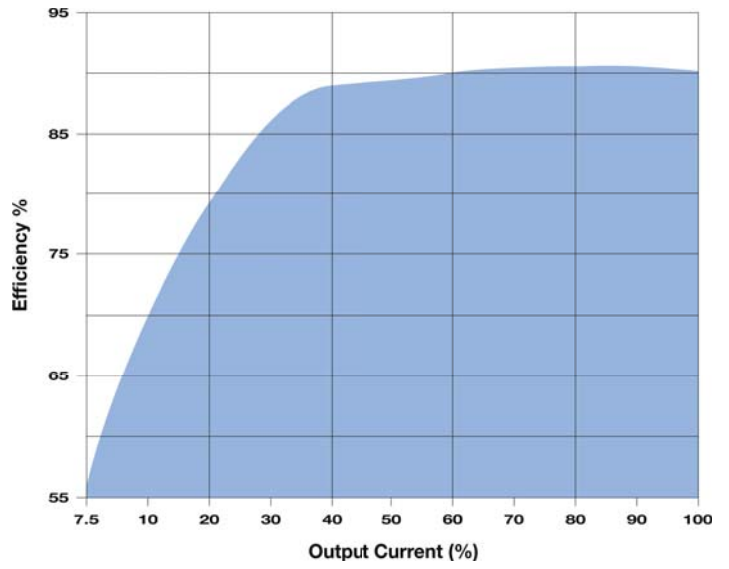
Efficiency Curves: Efficiency vs Input Voltage

MI1524S-05ERU (24 V_{IN} - 5 V_{OUT})

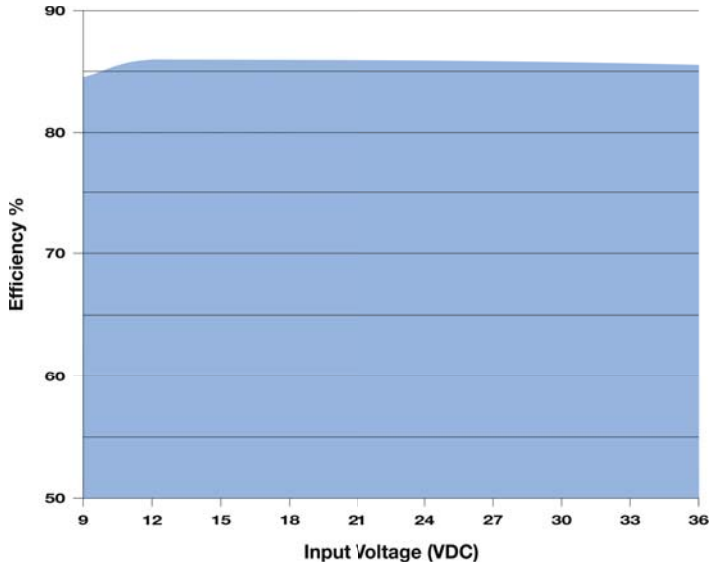


Efficiency Curves: Efficiency vs Output Voltage

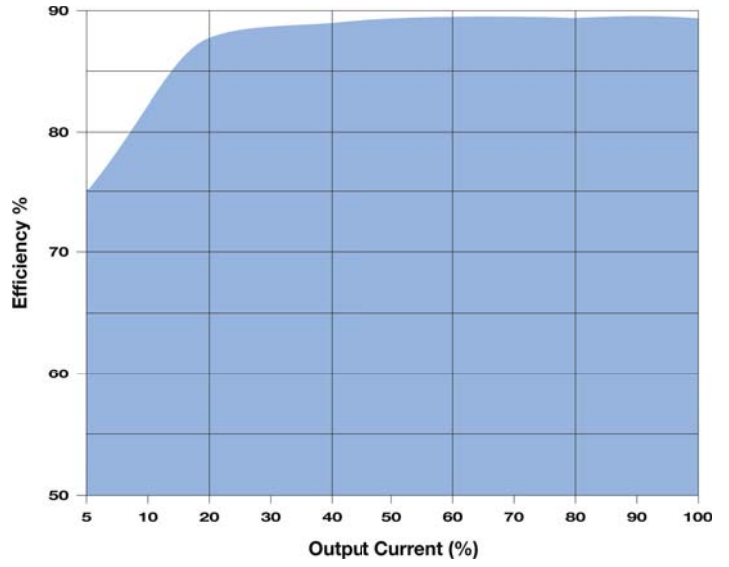
MI1524S-05ERU (24 V_{IN} - 5 V_{OUT})



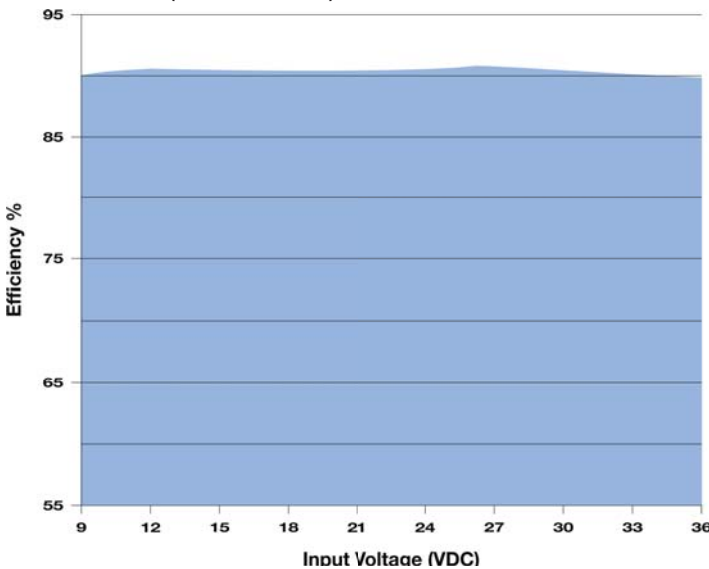
MI1524D-05ERU (24 V_{IN} - ±5 V_{OUT})



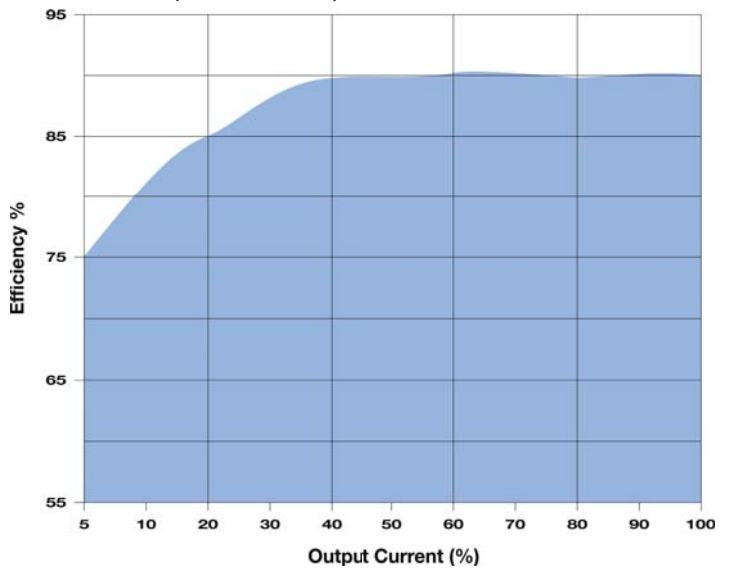
MI1524D-05ERU (24 V_{IN} - ±15 V_{OUT})



MI1524S-15ERU (24 V_{IN} - 15 V_{OUT})

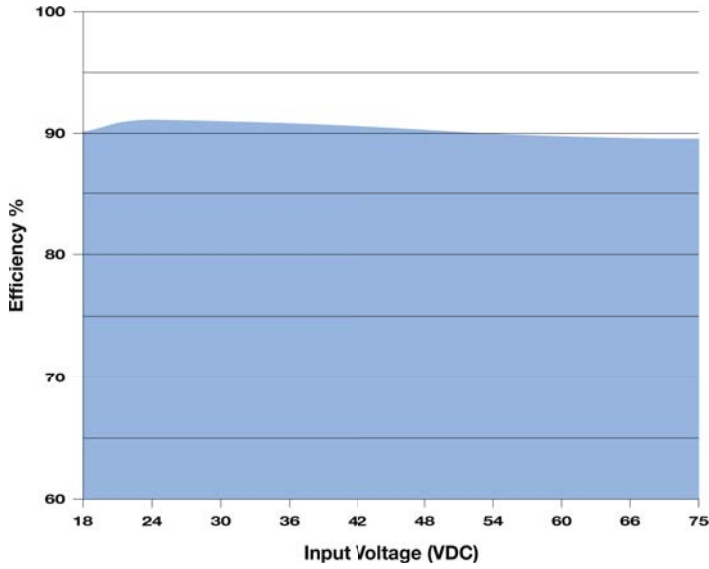


MI1524S-15ERU (24 V_{IN} - 15 V_{OUT})



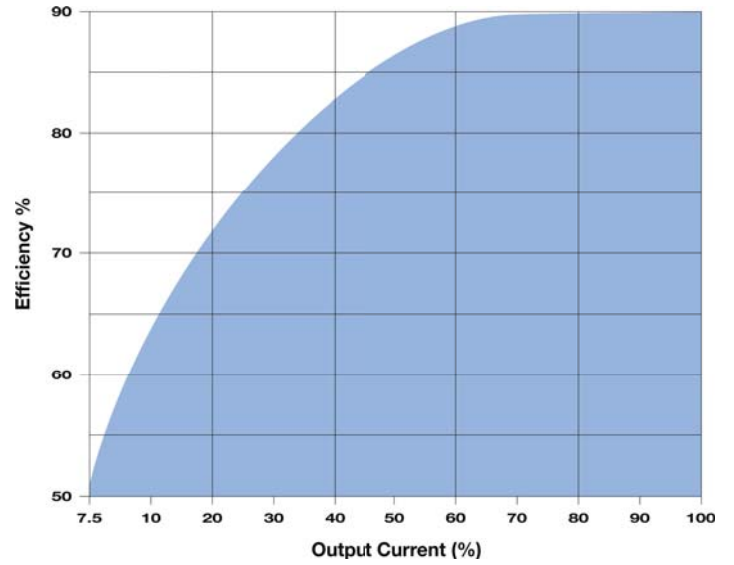
Efficiency Curves: Efficiency vs Input Voltage

MI1548S-05ERU (48 VIN - 5 VOUT)

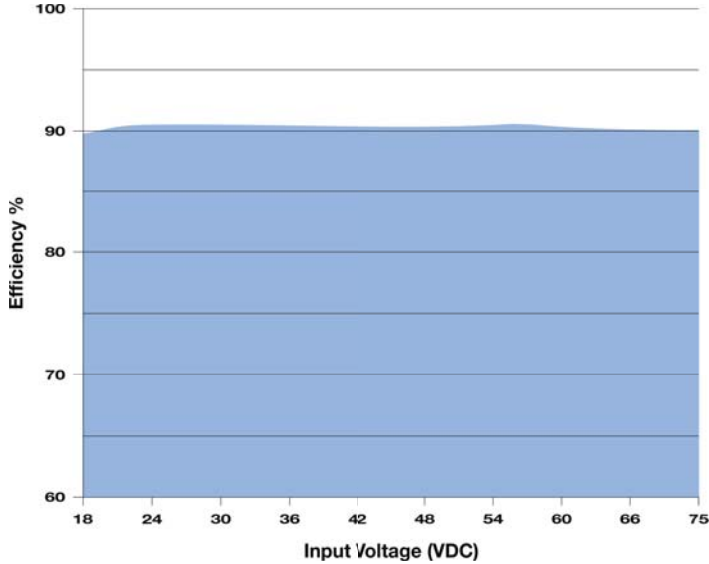


Efficiency Curves: Efficiency vs Output Voltage

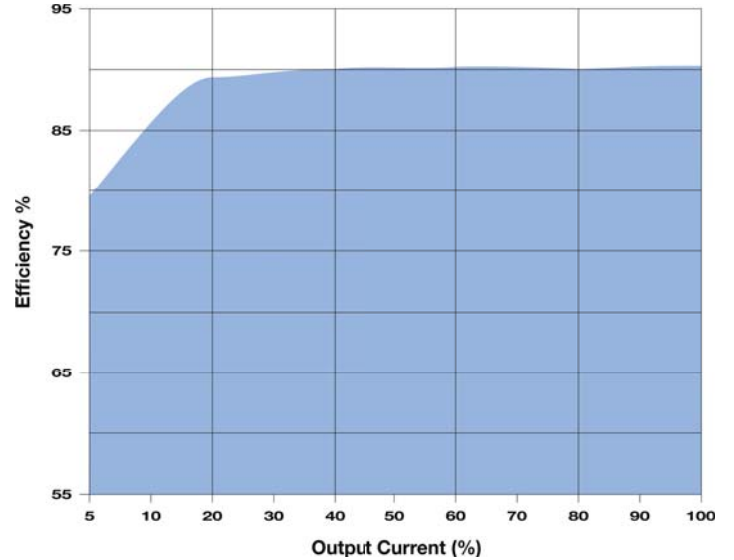
MI1548S-05ERU (48 VIN - 5 VOUT)



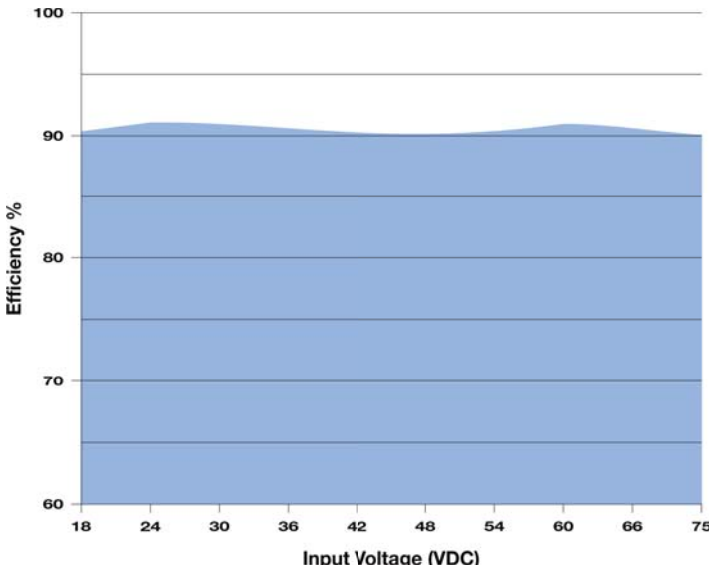
MI1548S-12ERU (48 VIN - 12 VOUT)



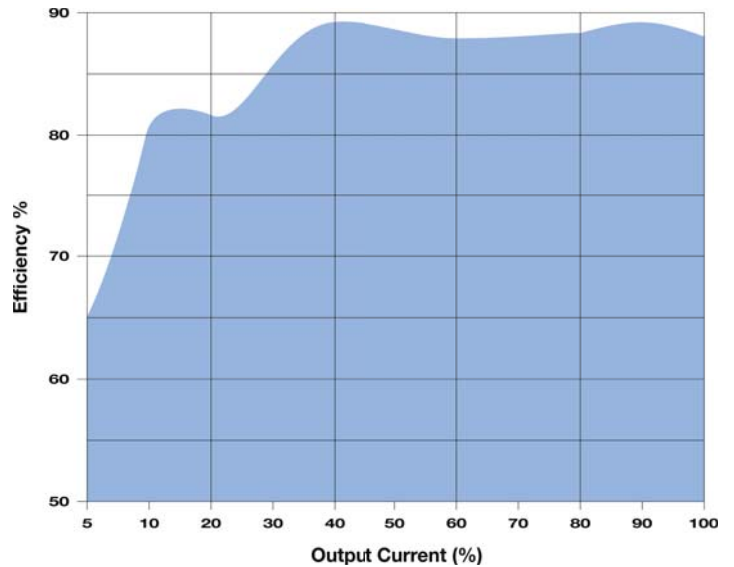
MI1548S-12ERU (48 VIN - 12 VOUT)



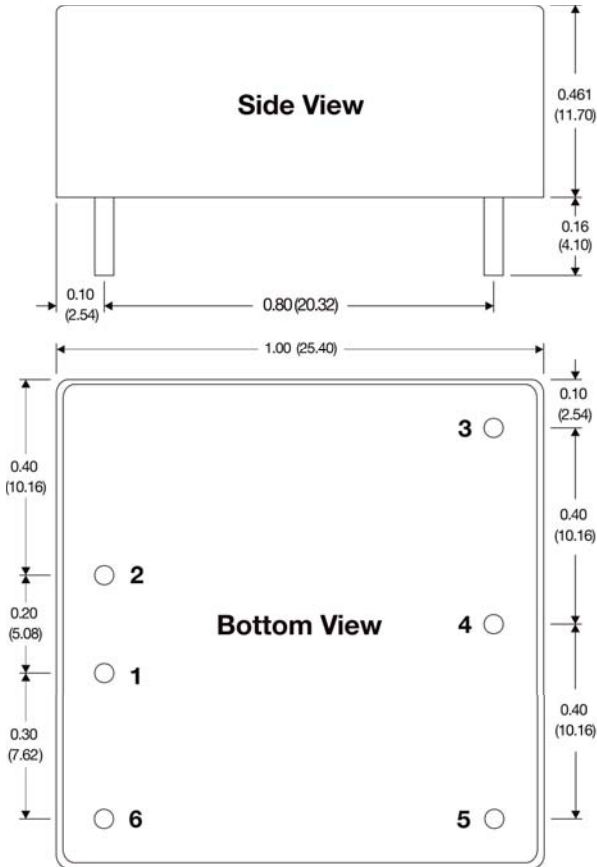
MI1548D-24ERU (48 VIN - ±24 VOUT)



MI1548D-24ERU (48 VIN - ±24 VOUT)



Mechanical Dimensions



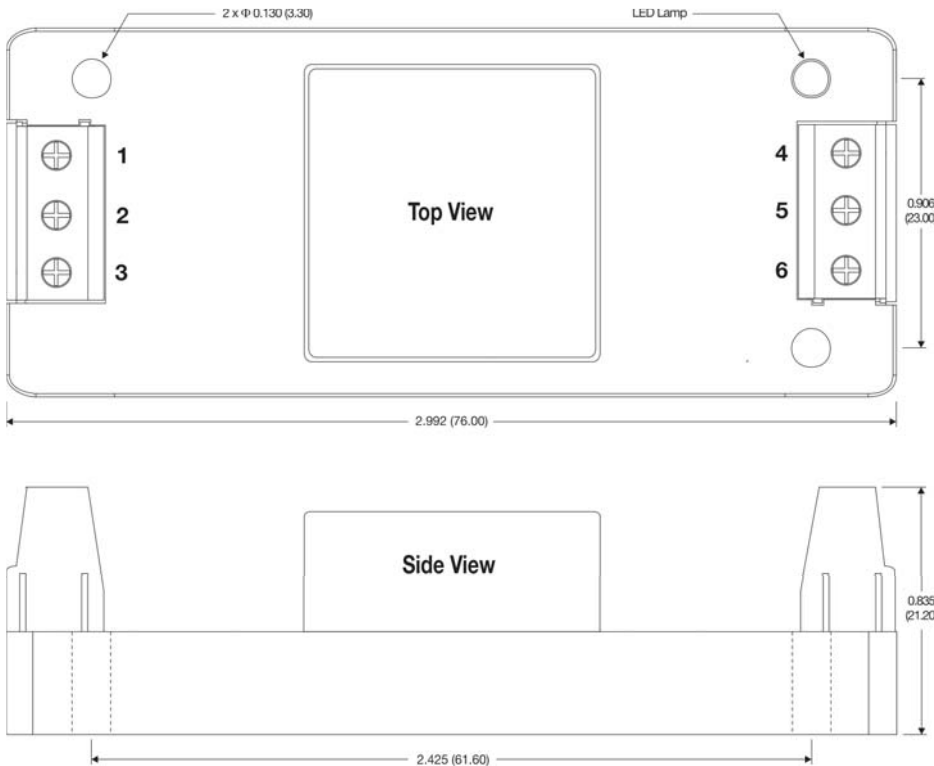
Pin Connections

Pin	Single Output	Pin	Dual Output
1	-VIN	1	-VIN
2	+VIN	2	+VIN
3	+VOUT	3	+VOUT
4	Trim	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



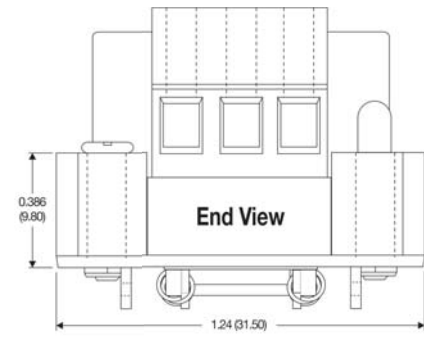
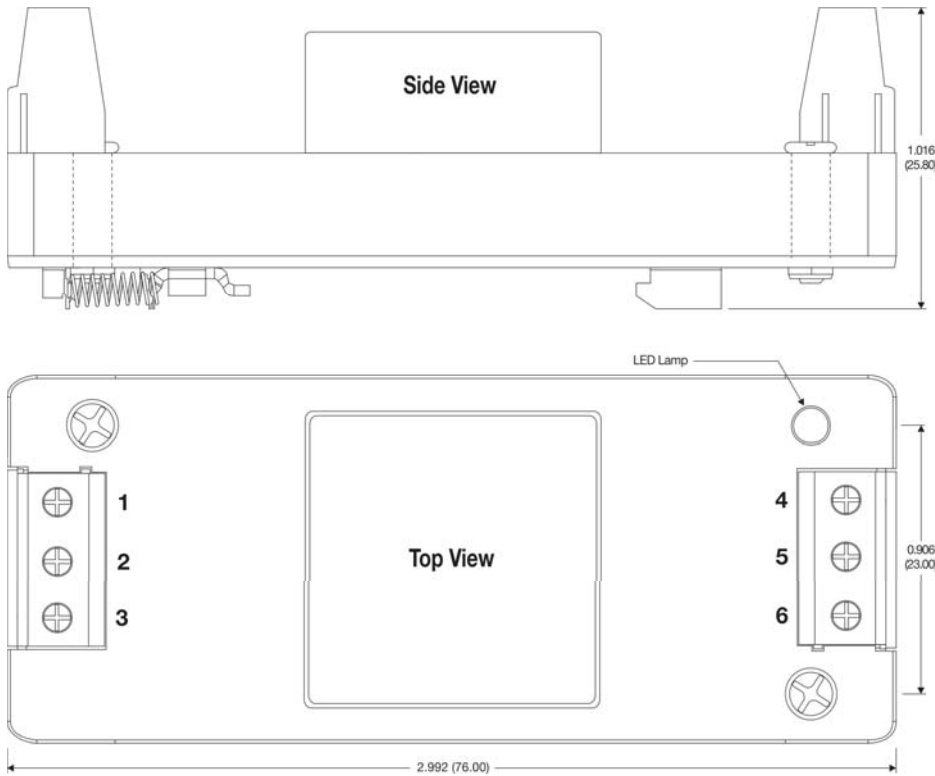
Pin Connections

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	Trim	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	Trim	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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