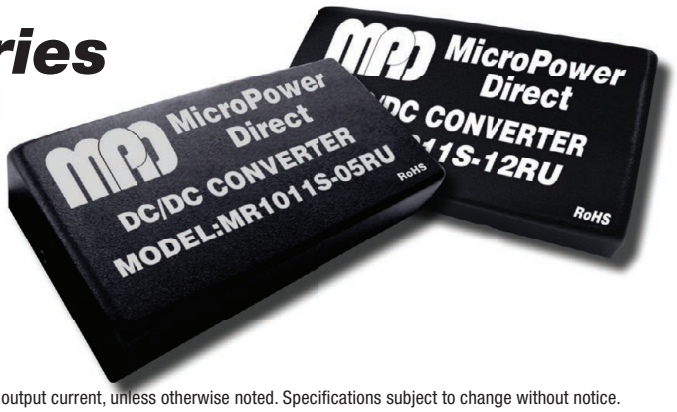
MR1011S Series

Ultra-Wide Input, 10W Compact, Railway DC/DC Converters



Key Features:

- 10W Output Power
- 40 - 160 VDC Input Range
- Meets EN 60950, EN 50155
- 1,500 VDC Isolation
- Efficiency to 86%
- Compact 1 x 2 Inch Case
- -40°C to +85°C Operation
- Industry Standard Pin-Out
- Chassis Mount Option
- DIN Rail Mount Option

RoHS

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		40.0	110.0	160.0	VDC
Input Start Voltage				40.0	VDC
Input Filter	π (Pi) Filter				

Output

Parameter	Conditions	Min.	Typ.	Max.	Units
Output Voltage Accuracy			±1.0	±2.0	%
Line Regulation	VIN = Min to Max		±0.2	±0.5	%
Load Regulation	IOUT = 10% to 100%		±0.5	±1.0	%
Ripple (20 MHz)	See Note 1		15	30	mV P - P
Noise (20 MHz)	See Note 1		60	100	mV P - P
Transient Recovery Time, See Note 2	25% Load Step Change		500	1,000	μS
Transient Response Deviation			±3.0	±5.0	%
Output Power Protection		110	120	140	%
Temperature Coefficient			±0.03		%/°C
Output Short Circuit, See Note 3	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	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	%

Physical

Case Size	See Mechanical Diagram (Page 2)
Case Material	Aluminum Alloy With Non-Conductive Base (UL94-V0)
Weight	0.77 Oz (22g)
Chassis Mount Adapter	See Mechanical Diagram (Page 4)
DIN Rail Mount Adapter	See Mechanical Diagram (Page 4)

Reliability Specifications

Parameter	Conditions	Min.	Typ.	Max.	Units
MTBF	MIL HDBK 217F, 25°C, Gnd Benign	1.0			MHours
Vibration, 5 - 150 Hz	Displacement Range	7.5 mm			
	Acceleration	2G			

Absolute Maximum Ratings

Parameter	Conditions	Min.	Typ.	Max.	Units
Input Voltage Surge (1 Sec)		-0.7		200.0	VDC
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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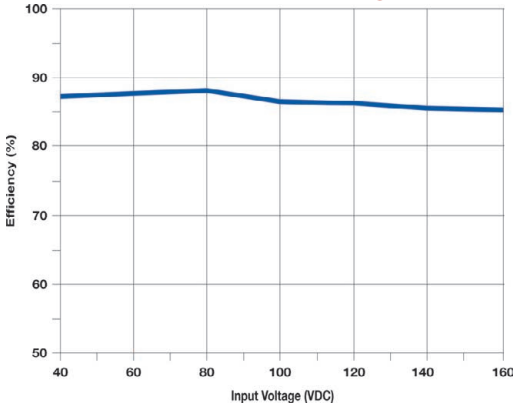
Model Selection Guide

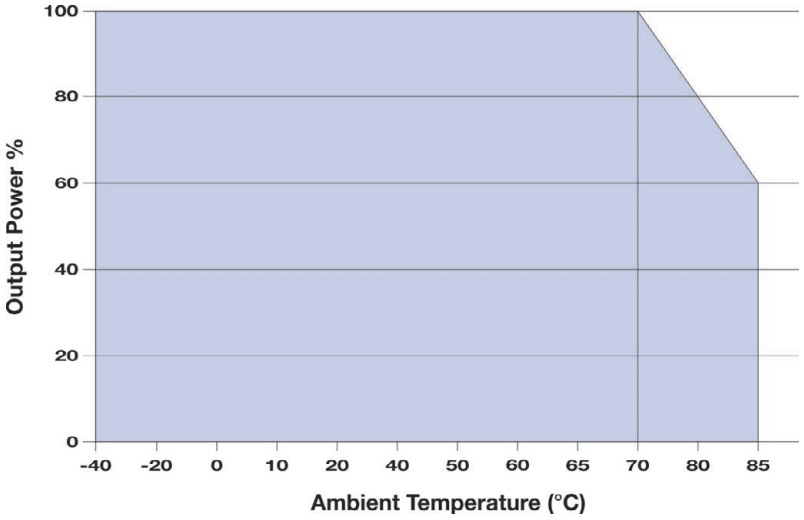
Model Number	Input				Output			Efficiency (%, Typ)	Over Voltage Protection (VDC Typ)	Capacitive Load (µF, Max)	Fuse Rating Slow-Blow (mA)
	Voltage (VDC)		Current (mA)		Voltage (VDC)	Current (mA, Max)	Current (mA, Min)				
	Nominal	Range	Full-Load	No-Load							
MR1011S-05RU	110	40 - 160	112	15	5.0	2,000	100	81	6.2	2,200	250
MR1011S-12RU	110	40 - 160	107	8	12.0	833	42	85	15.0	220	250
MB1011S-15RU	110	40 - 160	107	8	15.0	667	33	85	18.0	100	250
MB1011S-24RU	110	40 - 160	106	8	24.0	416	21	86	28.8	47	250

Notes:
1. When measuring output ripple, it is recommended that an external ceramic capacitor (approx 10 µF) be placed from the +VOUT to the -VOUT pins.
2. Transient recovery is measured to within a 1% error band for a load step change of 25%.
3. Short circuit protection is provided by a "hiccup mode" circuit.
4. These units should not be operated with a load under 5% of full load. Operation at no-load will not damage the unit, but they may not meet all specifications.
5. These units should not be operated over +85°C. Exceeding +85°C may damage the unit.
6. 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.

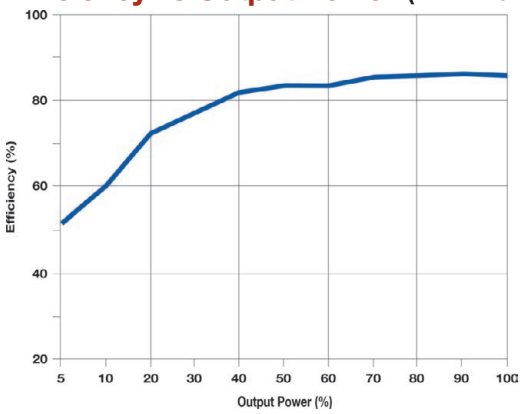
Efficiency vs Input Voltage (Full Load)



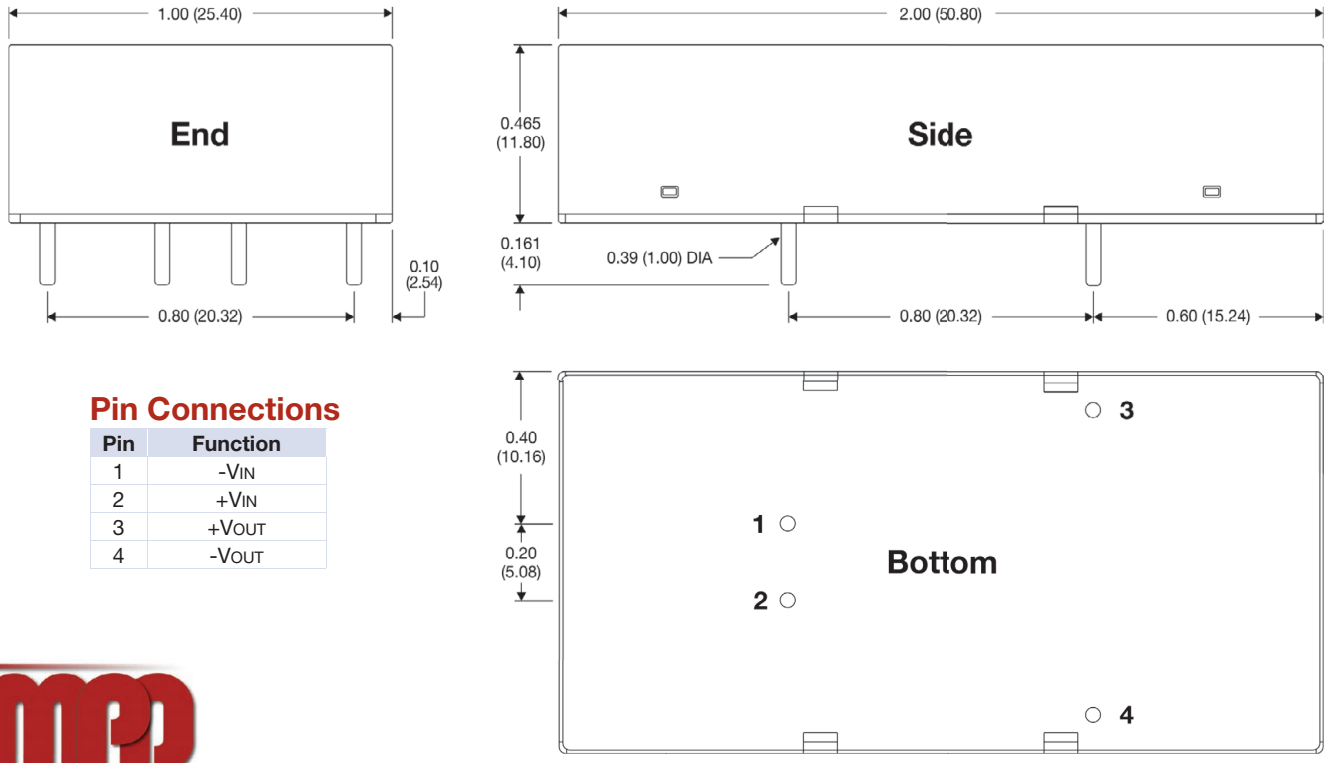
Derating Curve



Efficiency vs Output Power (VIN= 110 VDC)



Mechanical Dimensions



Pin Connections

Pin	Function
1	-VIN
2	+VIN
3	+VOUT
4	-VOUT

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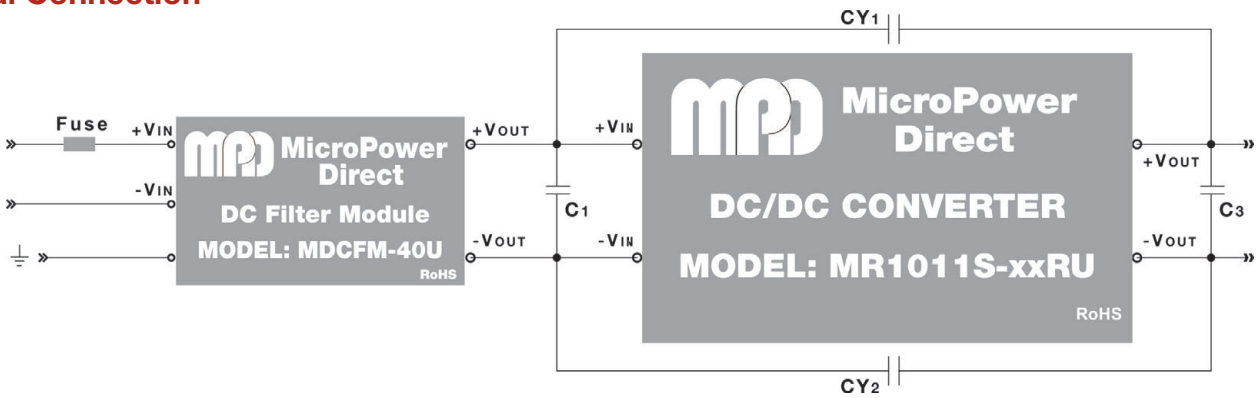
EMC Specifications

Parameter	Standard	Criteria	
Transient Input Voltage, See Note 1	RIA 12	A	385V/20mS Criteria A
Maximum Input Voltage, See Note 2	EN 50155	B	1,800V (5/50 μS, 50 OR 100Ω
		B	8,400V (0.05/0.1 μS, 100Ω
Radiated Emissions, See Note 3	EN 55022		Class B
Conducted Emissions, See Note 3	EN 55022		Class B
ESD	EN 61000-4-2	B	±6 kV Contact
RS	EN 61000-4-3	A	10V/m
EFT, See Note 4	EN 61000-4-4	B	±2 kV
Surge, See Note 5	EN 61000-4-5	B	±2 kV/ ±4 kV
CS	EN 61000-4-6	A	3 Vrms
Voltage Dips	EN 61000-4-29	B	0% - 70%

Notes:

1. With a pulse interval that is >60S. Requires the addition of the filter module **MDCFM-40U** (or a similar discrete filter circuit) as shown in the circuit/board layout diagrams below. Contact the factory for more information.
2. With a pulse interval that is >60S. Requires the addition of the filter module **MDCFM-40U** (or a similar discrete filter circuit) as shown in the circuit/board layout diagrams below. Contact the factory for more information.
3. All units will meet class B with the addition of the **MDCFM-40U** (or a similar discrete filter circuit) as shown in the circuit/board layout diagrams below. Contact the factory for more information.
4. To meet the requirements of EN 61000-4-4 (±2 kV), external components are needed. This can be done discretely, or with the addition of the **MDCFM-40U**. Contact the factory for more information.
5. To meet the requirements of EN 61000-4-5 (±2 kV/±4 kV), external components are needed. This can be done discretely, or with the addition of the **MDCFM-40U**. Contact the factory for more information.

Typical Connection



The diagram above illustrates a typical connection of the **MR1011S** series The **MDCFM-40U** filter module is used to make the circuit compliant with input surge and EMC standards EN 55022, EN61000 and EN 50155. This can also be accomplished by using external filter components as shown in the board layout drawing below. Some notes on these components are:

1. It is recommended that an external fuse be used. The recommended fuse is shown in the model chart on page 2.
2. An external MOV is recommended on the input to protect the unit in the event of a surge. A recommended value is given in the table at right.
3. An external TVS is recommended on the input to protect the unit in the event of a voltage spike. A recommended value is given in the table at right.
4. The output filtering capacitor (C_3) 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 80% or above.
5. Suggested component values are:

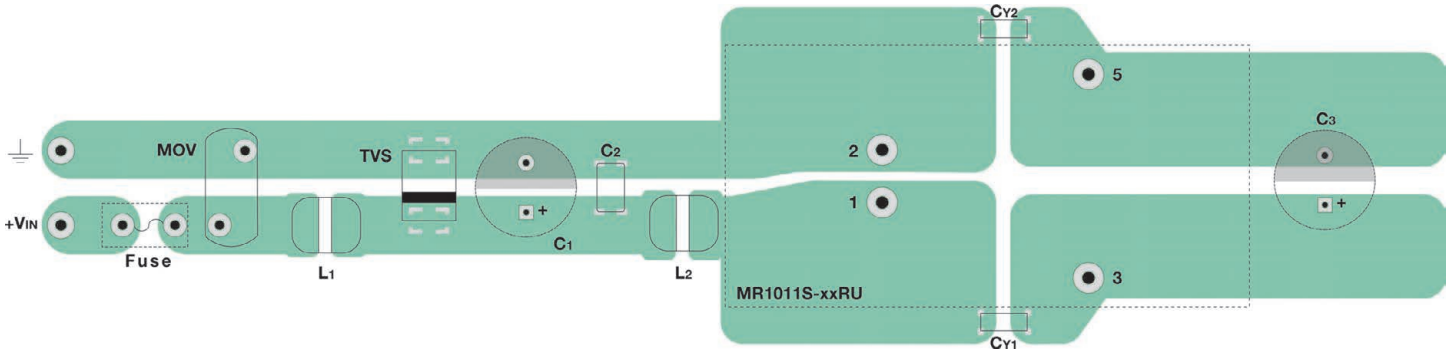
Component	Value
MOV	S14K130
L_1	56 μH
TVS	SMCJ170A
C_1	100 μF/200V
C_3	1.0 μF/50V
L_2	4.7 μH
C_{Y1}, C_{Y2}	1,000 pF/2 kV

6. Input noise and surge suppression modules are available for a number of **MPD** DC/DC power supplies. For use with the **MRxx11S** product series, the **MDCFM-40U** DC filter modules are recommended. For pricing or full technical information, please contact the factory.

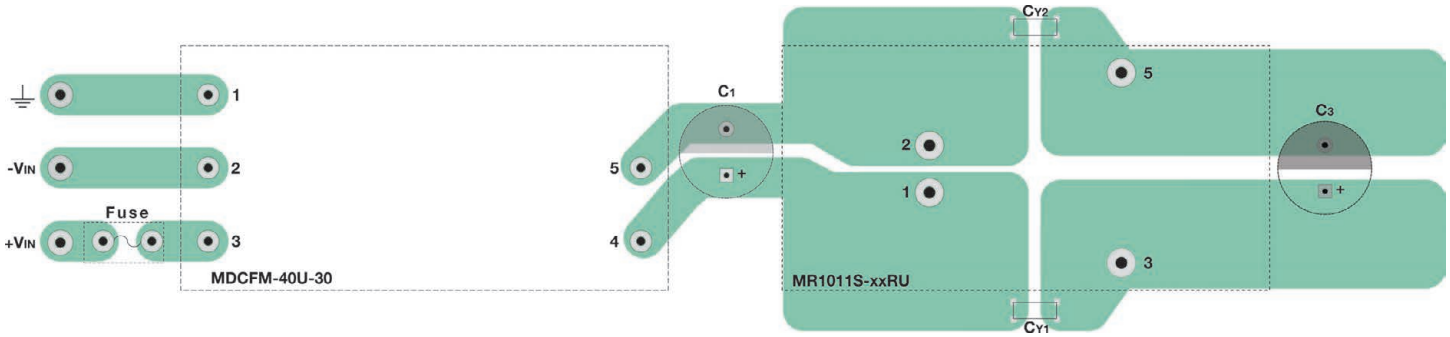
Vin (VDC)	Input Capacitor	Vout (VDC)	Output Capacitor
110	100 μF	5	470 μF
		12	220 μF
		15	220 μF
		24	100 μF

7. In many applications simply adding input/output capacitors will enhance the input surge protection and reduce output ripple sufficiently. In this case, the capacitors C_1 and C_3 would be connected as shown without the other filter components. Recommended capacitor values are given in the table above..

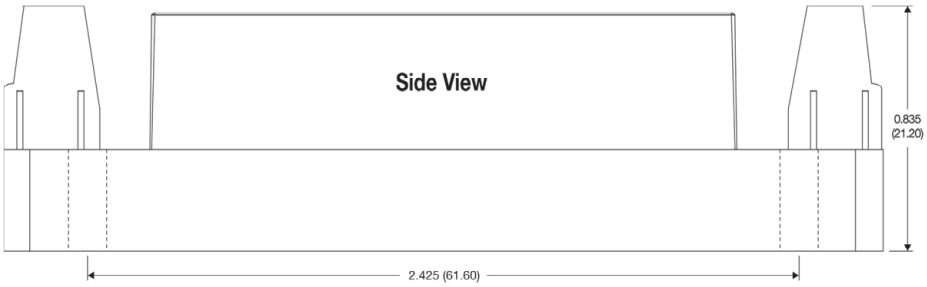
Typical Board Layout: With External Filter/Surge Components

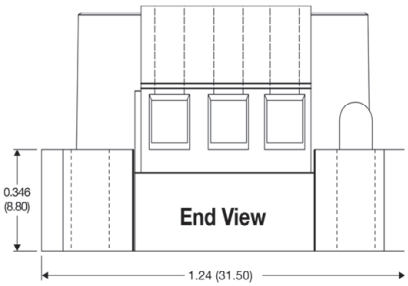


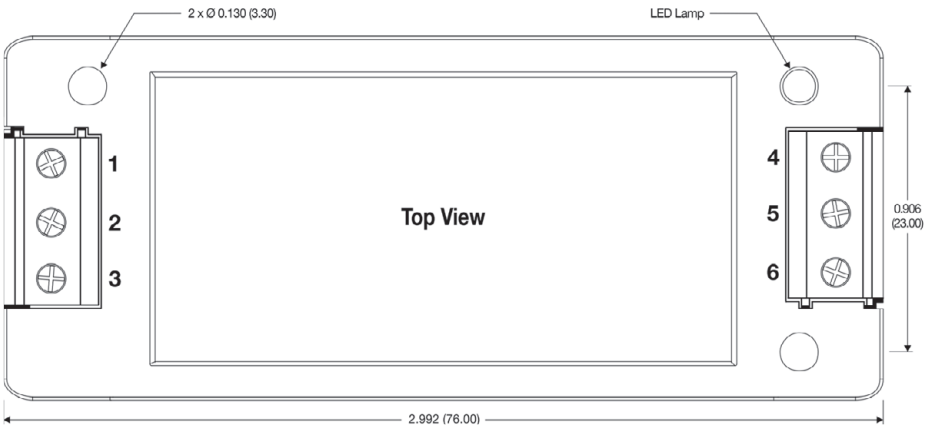
Typical Board Layout: With External Filter Module



Mechanical Dimensions: Chassis Mount Option (A2)







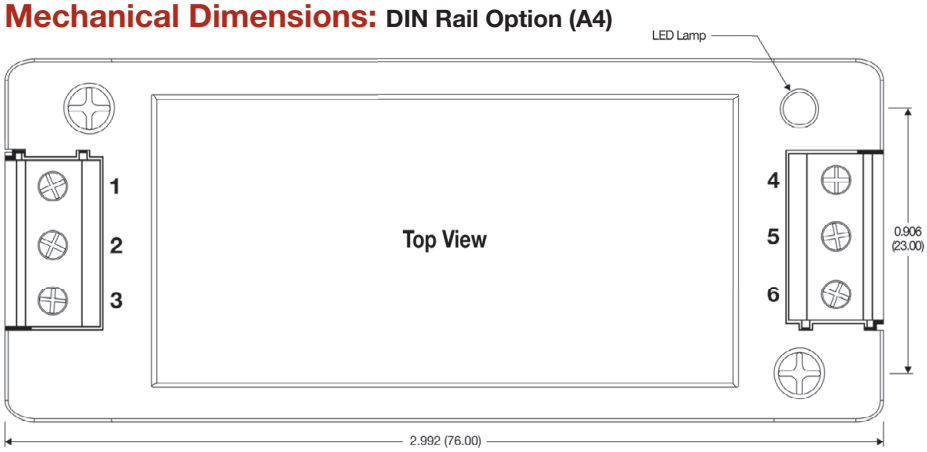
Adapter Plate

All models of the **MR1011S-xxRU** series are available mounted on an adapter plate similar to the one pictured above. The adapter plate makes it easier to mount the unit to a chassis or to a standard DIN rail. Please contact the factory for more information.

Pin Connections

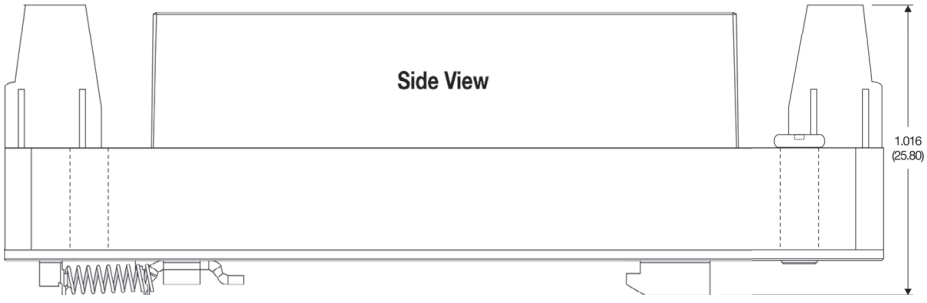
Pin	Function
1	No Connection
2	-VIN
3	+VIN
4	-VOUT
5	No Connection
6	+VOUT

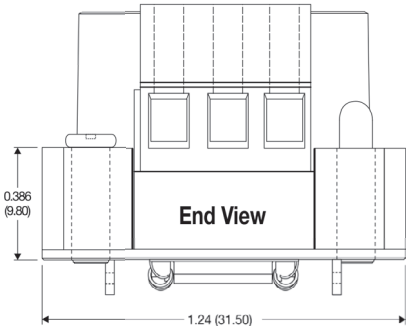
Mechanical Dimensions: DIN Rail Option (A4)



For the chassis mount option, add suffix "A2" to the model number (i.e. **MR1011S-05RU-A2**)

For the DIN rail mount option, add suffix "A4" to the model number (i.e. **MR1011S-24RU-A4**)





Notes:

- All dimensions are typical in inches (mm)
- Tolerance x.xx = ±0.02 (±0.50)

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