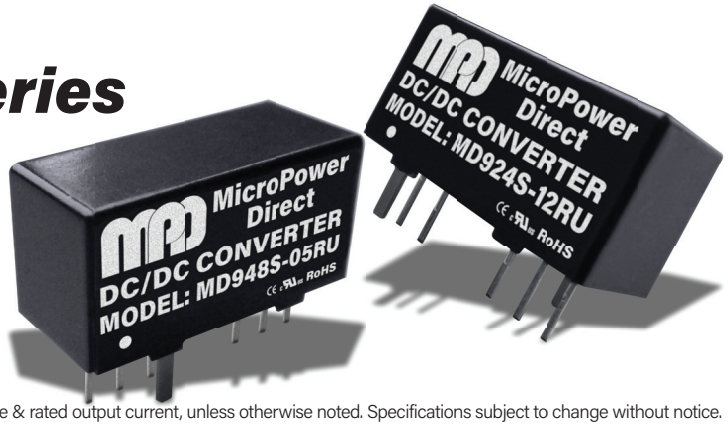
MD900RU Series

4:1 Input, 9W SIP, Single & Dual Output DC/DC Converters



Key Features:

- 9W Output Power
- Miniature SIP Case
- EN 62368 Approved
- 4:1 Input Voltage Range
- Short Circuit Protected
- 1,600 VDC Isolation
- Efficiency To 89%
- Over Voltage Protection
- Over Current Protection
- -40°C to +85°C Operation
- Industry Standard Pin-Out
- Low Cost

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	
Under Voltage Lockout	24 VDC Input		7.0	8.9	VDC
	48 VDC Input		14.0	16.0	
Start Up Time	See Note 2		50.0		mS
Input Reflected Ripple Current				30.0	mA P - P
Input Filter	Capacitor Filter				

Output

Parameter	Conditions	Min.	Typ.	Max.	Units
Output Voltage Accuracy				±1.0	%
Line Regulation	VIN = Min to Max			±0.2	%
Load Regulation, See Note 3	3.3 VOUT Models			±1.0	%
	Other Single Output Models			±0.5	
	Dual Output Models			±1.0	
Cross Regulation	See Note 4			±5.0	%
Ripple & Noise (20 MHz)	See Note 5			75	mV P - P
Transient Recovery Time, See Note 6	25% Load Step Change		250		µSec
Transient Response Deviation				±3.0	%
Temperature Coefficient				±0.02	%/°C
Over Voltage Protection			130		%
Over Current Protection			180		%
Output Short Circuit	Continuous (Autorecovery)				

General

Parameter	Conditions	Min.	Typ.	Max.	Units
Isolation Voltage, See Note 7	Input to Output	1,600			VDC
	Case To Input or Output	1,000			
Isolation Resistance		1,000			MΩ
Isolation Capacitance				50	pF
Switching Frequency	24 VIN Models		400		kHz
	48 VIN Models		500		

Environmental

Parameter	Conditions	Min.	Typ.	Max.	Units
Operating Temperature Range	Ambient	-40	+25	+85	°C
	Case			+100	
Storage Temperature Range		-55		+125	°C
Cooling	Free Air Convection				
Humidity	RH, Non-condensing			95	%

Physical

Case Size	See Mechanical Diagram (Page 4)
Case Material	Black, Anodized Copper (UL94-V0)
Weight	0.25 Oz (7.3g)

Reliability Specifications

Parameter	Conditions	Min.	Typ.	Max.	Units
MTBF	MIL HDBK 217F, 25°C, Gnd Benign	900			kHours
Safety Standards	UL/cUL 62368-1 recognition (UL certificate)				

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			260	°C

Caution: Exceeding Absolute Maximum Ratings may damage the module. These are not continuous operating ratings.

Model Selection Guide

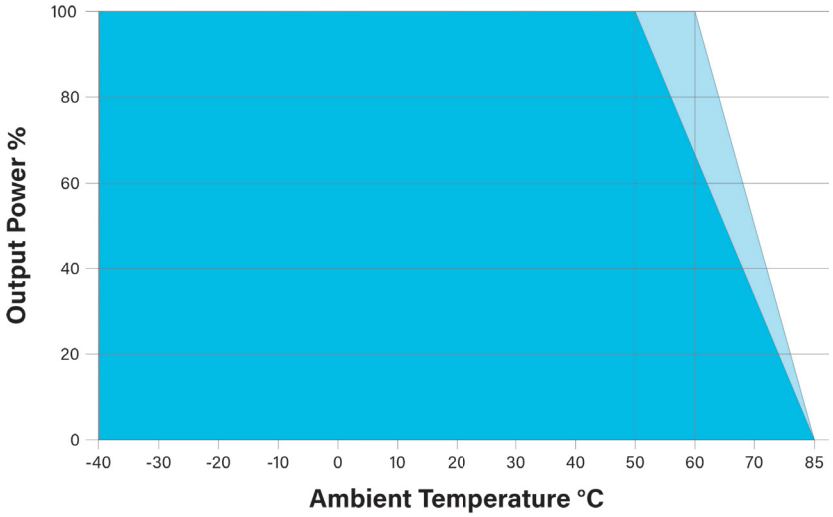
Model Number	Input				Output			Efficiency (%, Typ)	Capacitive Load (µF, Max)	Fuse Rating Slow-Blow (mA)
	Voltage (VDC)		Current (mA)		Voltage (VDC)	Current (mA, Max)	Current (mA, Min)			
	Nominal	Range	Full-Load	No-Load						
MD924S-03RU	24	9.0 - 36.0	335	9	3.3	2,000	0.0	82	2,600	2,000
MD924S-05RU	24	9.0 - 36.0	392	9	5.0	1,600	0.0	85	1,300	2,000
MD924S-09RU	24	9.0 - 36.0	426	9	9.0	1,000	0.0	88	800	2,500
MD924S-12RU	24	9.0 - 36.0	426	9	12.0	750	0.0	88	560	2,500
MD924S-15RU	24	9.0 - 36.0	421	9	15.0	600	0.0	89	560	2,500
MD924S-24RU	24	9.0 - 36.0	421	9	24.0	375	0.0	89	200	2,500
MD924D-05RU	24	9.0 - 36.0	392	9	±5.0	±800	±0.0	85	800	2,000
MD924D-12RU	24	9.0 - 36.0	426	9	±12.0	±375	±0.0	88	390	2,500
MD924D-15RU	24	9.0 - 36.0	431	9	±15.0	±300	±0.0	87	200	2,500
MD948S-03RU	48	18.0 - 75.0	168	5	3.3	2,000	0.0	82	2,600	1,000
MD948S-05RU	48	18.0 - 75.0	196	5	5.0	1,600	0.0	85	1,300	1,000
MD948S-09RU	48	18.0 - 75.0	216	5	9.0	1,000	0.0	87	800	1,500
MD948S-12RU	48	18.0 - 75.0	213	5	12.0	750	0.0	88	560	1,500
MD948S-15RU	48	18.0 - 75.0	211	5	15.0	600	0.0	89	560	1,500
MD948S-24RU	48	18.0 - 75.0	211	5	24.0	375	0.0	89	200	1,500
MD948D-05RU	48	18.0 - 75.0	196	5	±5.0	±800	±0.0	85	800	1,000
MD948D-12RU	48	18.0 - 75.0	216	5	±12.0	±375	±0.0	87	390	1,500
MD948D-15RU	48	18.0 - 75.0	216	5	±15.0	±300	±0.0	87	200	1,500

2:1 Input Models Are Also Available See The MD900xRW

Notes:

1. The specified maximum capacitive load is for each output.
2. Start up time is specified at the nominal Voltage input and with a constant resistive load.
3. Load regulation is specified for a load change of 0% to 100%.
4. Cross regulation is specified with one output at full load while the other output is varied from 25% to 100% load.
5. Output ripple is measured with a 1 µF ceramic capacitor and a 10 µF electrolytic capacitor connected in parallel.
6. Transient recovery is measured to within a 1% error band for a load step change of 25%. Single 3.3 & 5 VDC output models have a response deviation of ±5.0% Max.
7. Isolation voltage ratings are for 60 seconds.
8. With the addition of external filter and protection components, all models will meet the requirements of EN 55032 class A. Suggested input circuits are shown in the connection diagrams on page 3. Contact the factory for more information.
9. To meet the requirements of EN 61000-4-4 (±2 kV), external components are needed. The connection diagrams on page 3 shows external components that would typically achieve this. Contact the factory for more information.
10. To meet the requirements of EN 61000-4-5 (±2 kV), external components are needed. This can be done as shown in the connection diagrams on page 3. Contact the factory for more information.
11. Operation at no-load will not damage the unit, but they may not meet all specifications.
12. It's recommended that a fuse be used on the power supply input for protection. See the Model Selection table above for the correct rating.

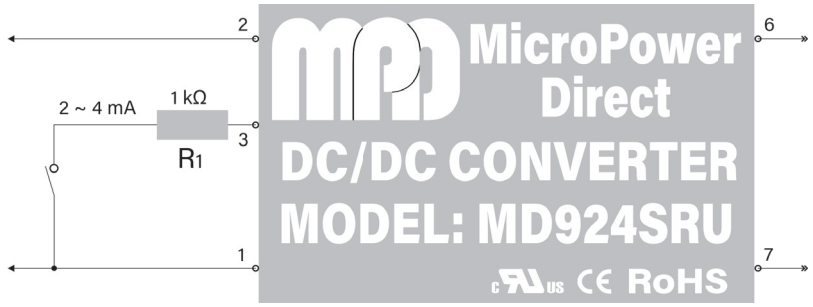
Derating Curve



Remote ON/OFF Control

The **MD900RU** may be started or shutdown by the control pin input (pin 3). This input is current controlled. The unit operates when this input is left open. When the input is "high" (current is flowing into the pin), the converter shuts down. The input current to this pin must be kept between 2 mA to 4 mA.

The diagram at right shows a simple input circuit for the control pin. Closing the switch causes 2 - 4 mA to flow through the 1 kV resister, shutting the unit off.



EMC Characteristics

Parameter	Standard	Criteria	Level
Radiated Emissions, See Note 1	EN 55032		Class A
Conducted Emissions, See Note 1	EN 55032		Class A
ESD	EN 61000-4-2	B	±6 kV Contact, ±8 kV Air
RS	EN 61000-4-3	A	20V/rms
EFT, See Note 2	EN 61000-4-4	A	±2 kV
Surge, See Note 3	EN 61000-4-5	A	±2 kV
CS	EN 61000-4-6	A	10 Vrms
PFMF	EN 61000-4-8	A	100 A/m

Notes:

1. With the addition of external filter and protection components, all models will meet the requirements of EN 55032 class A. Suggested input circuits are shown in the connection diagrams on this page and the next. Contact the factory for more information.
2. To meet the requirements of EN 61000-4-4 (±2 kV), external components are needed. The connection diagrams on this page and the next show external components that would typically achieve this. Contact the factory for more information.
3. To meet the requirements of EN 61000-4-5 (±2 kV), external components are needed. This can be done as shown in the connection diagrams on this page and the next. Contact the factory for more information.

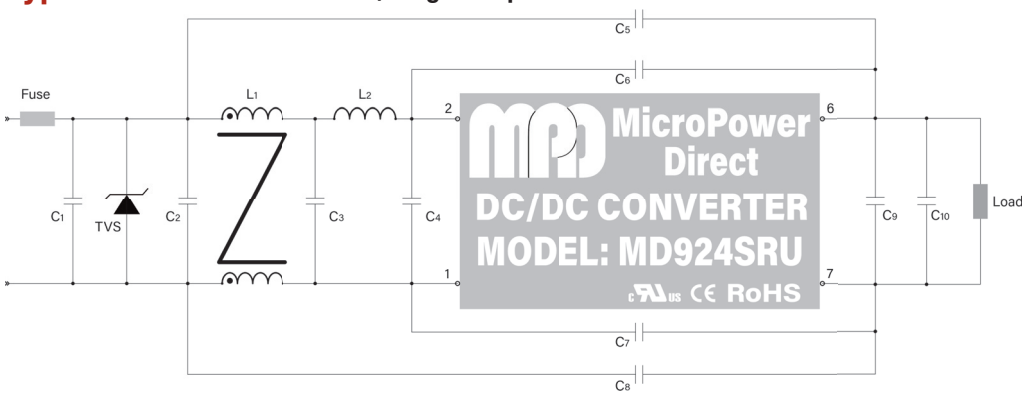
For applications that require meeting EMC standards, the diagrams below illustrate typical connections of the MD900xRU series. Some notes on this diagram (starting with the input circuit) are:

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 voltage spikes, it is recommended that a TVS be used on the input. A suggested value is given in the tables below.
3. The output filtering components C9 & C11 are high frequency, low ESR electrolytic capacitors. Capacitors C10 & C12 are ceramic. Care must be taken in choosing these capacitors not to exceed the capacitive load specification for the unit. Voltage derating of capacitors should be 80% or above.

Recommended component values are:

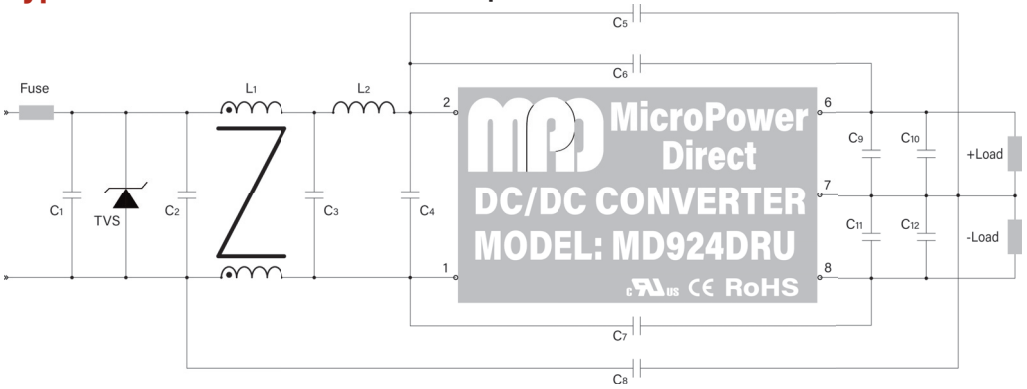
Typical Connection: 24 VIN, Single Output Models

Component	Value
C1	330 µF/100V
TVS	3KW, 70V
C2, C3, C4	1210 10 µF/100V
L1	20 µH
L2	20 µH
C5, C6, C7, C8	1808 220 pF/3kV
C9	10 µF
C10	1 µF



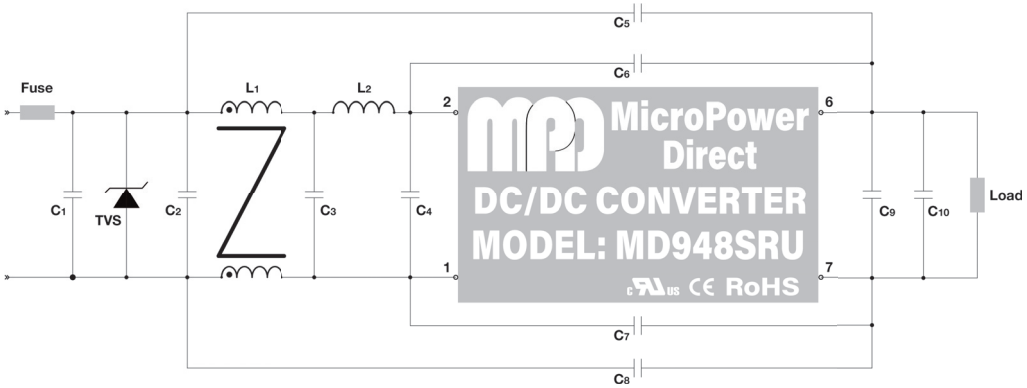
Typical Connection: 24 VIN, Dual Output Models

Component	Value
C1	330 µF/100V
TVS	3KW, 70V
C2, C3, C4	1210 10 µF/100V
L1	20 µH
L2	20 µH
C6, C7, C8	1808 220 pF/3kV
C5	1808 1,000 pF/3kV
C9, C11	10 µF
C10, C12	1 µF



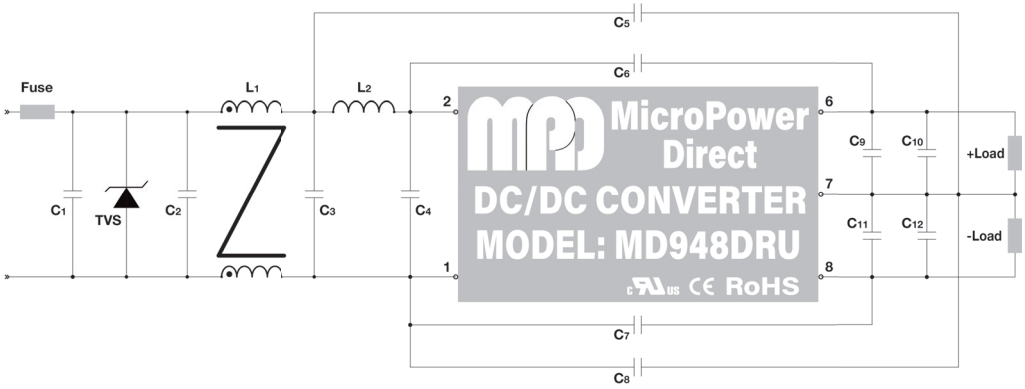
Typical Connection: 48 VIN, Single Output Models

Component	Value
C1	330 µF/100V
TVS	3KW, 120V
C2, C3, C4	1210 4.7 µF/100V
L1	132.8 µH
L2	10 µH
C5, C6, C7, C8	1808 1,000 pF/3kV
C9	10 µF
C10	1 µF

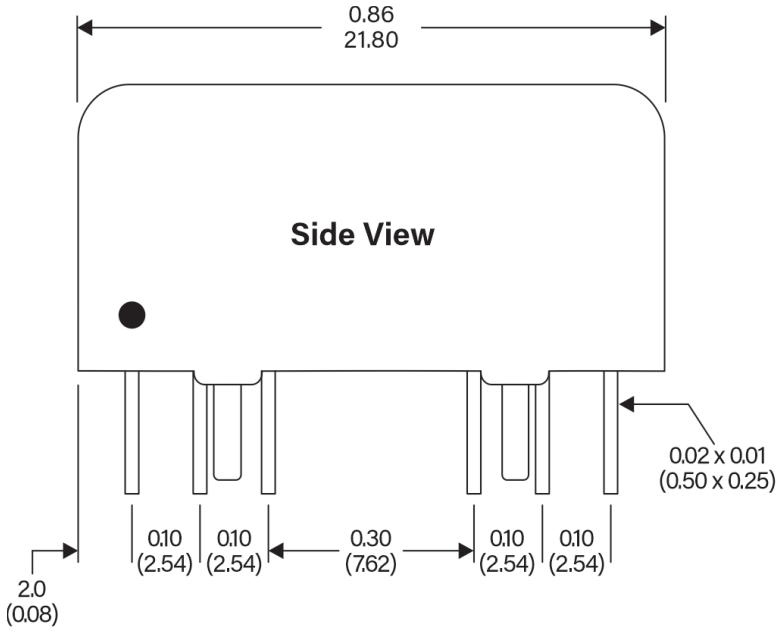


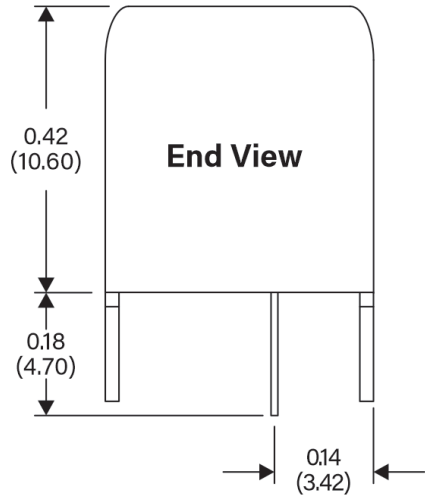
Typical Connection: 48 VIN, Dual Output Models

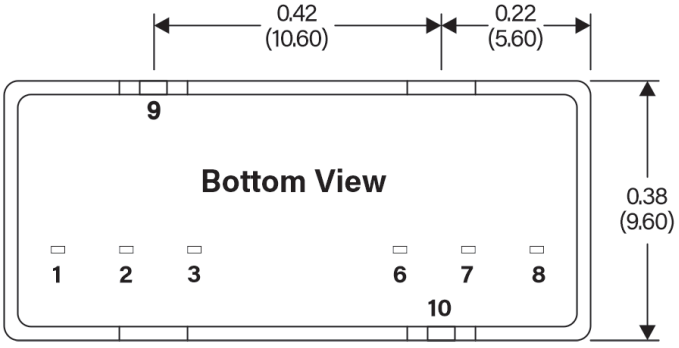
Component	Value
C1	330 µF/100V
TVS	3KW, 120V
C2, C3, C4	1210 4.7 µF/100V
L1	132.8 µH
L2	10 µH
C5, C8	1808 220 pF/3kV
C6, C7	1808 1,000 pF/3kV
C9, C11	10 µF
C10, C12	1 µF



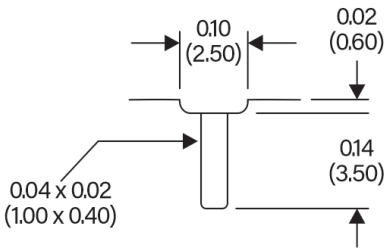
Mechanical Dimensions







Case Ground Tab



It is not required that the user connect the case ground tabs (9 & 10 on the mechanical diagram) to the PCB. However, connecting one or both tabs to a ground plane on the PCB will help:

- Improve the unit's resistance to vibration
- Improve the unit's ability to dissipate heat
- Improve the unit's resistance to ESD

Call the factory for more information

Pin Connections

Pin	Single Output
1	-VIN
2	+VIN
3	Remote On/Off
6	+VOUT
7	-VOUT
8	No Connection
9	Case
10	Case

Pin	Dual Output
1	-VIN
2	+VIN
3	Remote On/Off
6	+VOUT
7	Common
8	-VOUT
9	Case
10	Case

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

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