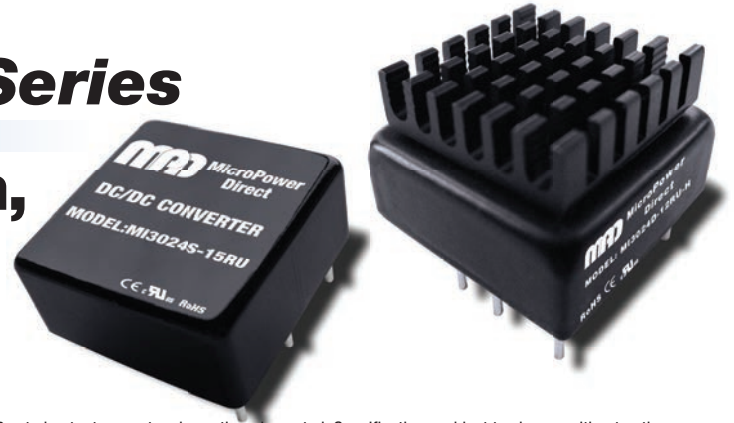


# MI3000RU Series

## Miniature 1 x 1 x 0.4 In, Wide 4:1 Input, 30W DC/DC Converters



### Key Features:

- 30W Output Power
- Miniature 1 x 1 In Case
- Wide 4:1 Input Range
- EN 60950 Approved
- 1,600 VDC Isolation
- High Efficiency
- Remote On/Off Control

2:1 Input  
Models  
Available



RoHS



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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		Conditions	Min.	Typ.	Max.	Units
Parameter	Input Voltage Range	24 VDC Input	9.0	24.0	36.0	VDC
		48 VDC Input	18.0	48.0	75.0	
Parameter	Undervoltage Shutdown	12 VDC Input		7.6	8.6	VDC
		24 VDC Input		16.5	17.5	
Parameter	Input Reflected Ripple Current			30		mA P - P
Parameter	Input Filter	π (Pi) Filter				
Output		Conditions	Min.	Typ.	Max.	Units
Parameter	Output Voltage Accuracy			±1.0		%
Parameter	Line Regulation	V <sub>IN</sub> = Min to Max			±0.5	%
		Single Output			±0.5	%
Parameter	Load Regulation, See Note 2	Dual Output			±1.0	%
		See Note 3		±5.0		%
Parameter	Cross Regulation	Single Output			75	mV P - P
		Dual Output			60	
Parameter	Ripple & Noise, See Note 4			±0.02		%/°C
Parameter	Temperature Coefficient			250		μSec
Parameter	Transient Recovery Time					%
Parameter	Transient Response Deviation, See Note 5	3.3 V <sub>OUT</sub> Models			±5.0	%
		All Other Models			±3.0	%
Parameter	Output Over Voltage Protection	See Model Selection Chart (Page 2)				
Parameter	Output Over Current Protection	Autorecovery		150		%I <sub>OUT</sub>
Parameter	Over Temperature Protection	Autorecovery		115		°C
Parameter	Output Short Circuit	Continuous (Autorecovery)				
General		Conditions	Min.	Typ.	Max.	Units
Parameter	Isolation Voltage, 60 Seconds	Input/Output	1,600			VDC
		Case/Input & Output	1,600			
Parameter	Isolation Resistance	1,000 VDC				MΩ
Parameter	Isolation Capacitance	10 kHz/1V			2,000	pF
Parameter	Switching Frequency	3.3 & 5 V <sub>OUT</sub> Models		270		kHz
		All Other Models		330		
Environmental		Conditions	Min.	Typ.	Max.	Units
Parameter	Operating Temperature Range	Ambient	-40	+25	+80	°C
		Case			+105	
Parameter	Thermal Impedance	See Note 6				
Parameter	Storage Temperature Range		-40		+125	°C
Parameter	Cooling	Free Air Convection				
Parameter	Humidity	RH, Non-condensing			95	%
Physical		See Mechanical Diagrams (Page 4)				
Parameter	Case Size	Copper With Non-Conductive Base (UL94-V0)				
Parameter	Case Material	See Mechanical Diagrams (Page 4)				
Parameter	Weight	See Mechanical Diagrams (Page 4)				
Reliability Specifications		Conditions	Min.	Typ.	Max.	Units
Parameter	MTBF	MIL HDBK 217F, 25°C, Gnd Benign	370			kHours
Parameter	Safety Standards	UL/cUL 60950-1 Recognition (UL certificate)				
Absolute Maximum Ratings		Conditions	Min.	Typ.	Max.	Units
Parameter	Input Voltage Surge (100 mSec)	24 VDC Input			50.0	VDC
		48 VDC Input			100.0	
		48 VDC Input			100.0	
Parameter	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.

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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							
MI3024S-03RU	24	9.0 - 36.0	1,109	10	3.3	7,000	0.0	88	3.9	10,000	3,000
MI3024S-05RU	24	9.0 - 36.0	1,404	10	5.0	6,000	9.0	89	6.2	7,200	3,000
MI3024S-12RU	24	9.0 - 36.0	1,404	10	12.0	2,500	0.0	89	15.0	1,200	3,000
MI3024S-15RU	24	9.0 - 36.0	1,373	10	15.0	2,000	0.0	91	18.0	1,000	3,000
MI3024D-12RU	24	9.0 - 36.0	1,404	10	±12.0	±1,250	±0.0	89	±15.0	750	3,000
MI3024D-15RU	24	9.0 - 36.0	1,374	10	±15.0	±1,000	±0.0	91	±18.0	500	3,000
MI3048S-03RU	48	18.0 - 75.0	541	8	3.3	7,000	0.0	89	3.9	10,000	1,500
MI3048S-05RU	48	18.0 - 75.0	694	8	5.0	6,000	9.0	90	6.2	7,200	1,500
MI3048S-12RU	48	18.0 - 75.0	694	8	12.0	2,500	0.0	90	15.0	1,200	1,500
MI3048S-15RU	48	18.0 - 75.0	679	8	15.0	2,000	0.0	92	18.0	1,000	1,500
MI3048D-12RU	48	18.0 - 75.0	694	8	±12.0	±1,250	±0.0	90	±15.0	750	1,500
MI3048D-15RU	48	18.0 - 75.0	686	8	±15.0	±1,000	±0.0	91	±18.0	500	1,500

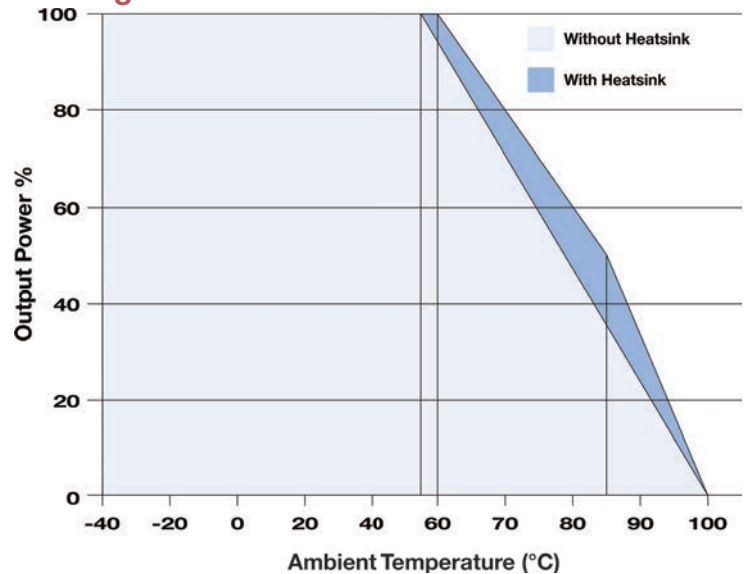
Models with a 2:1 input are also available. See the **MI30xxx-xxRW**

For the heatsink option, add suffix “-H” to the model number (i.e. **MI3024S-12RU-H**)

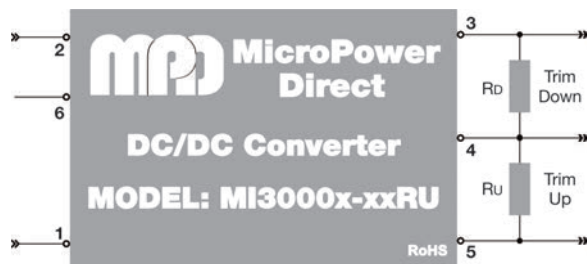
Notes:

- The specified maximum capacitive load is for each output. Capacitive load is tested at minimum VIN and with a constant resistive load.
- Load regulation is measured with the output power varied from 0% to 100%. Dual outputs are balanced.
- Cross regulation is measured on dual output models with one output at 100% load while the other output is varied from 25% load to 100% load.
- Output ripple & noise is measured with an external capacitor (10 µF/25V) connected from the +Vout to the -Vout pins for single output units and from each output to common for dual output models. See the typical connection diagram on page 3.
- Transient recovery is measured to within a 1% error band for a load step change of 25%.
- Operation at no-load will not damage these units. However, they may not meet all specifications.
- To meet the requirements of EN 61000-4-4, external components are needed. The connection diagrams on page 3 shows external components that would typically achieve this. Contact the factory for more information.
- To meet the requirements of EN 61000-4-5, external filter components are needed. This can be done as shown in the connection diagrams on page 3. Contact the factory for more information.
- 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



External Trim



External Trim Notes:

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.

Values for Ru and Rd are given in the tables below.

Output Trim Resistor Values: (Trim Down)

Model	1%	2%	3%	4%	5%
MI30xxS-03RU	72.61 kΩ	32.55 kΩ	19.20 kΩ	12.52 kΩ	8.51 kΩ
MI30xxS-05RU	138.88 kΩ	62.41 kΩ	36.92 kΩ	24.18 kΩ	16.53 kΩ
MI30xxS-12RU	413.55 kΩ	184.55 kΩ	108.22 kΩ	70.05 kΩ	47.15 kΩ
MI30xxS-15RU	530.73 kΩ	238.61 kΩ	141.24 kΩ	92.56 kΩ	63.35 kΩ
Model	6%	7%	8%	9%	10%
MI30xxS-03RU	5.84 kΩ	3.94 kΩ	2.51 kΩ	1.39 kΩ	0.50 kΩ
MI30xxS-05RU	11.44 kΩ	7.79 kΩ	5.06 kΩ	2.94 kΩ	1.24 kΩ
MI30xxS-12RU	31.88 kΩ	20.98 kΩ	12.80 kΩ	6.44 kΩ	1.35 kΩ
MI30xxS-15RU	43.87 kΩ	29.96 kΩ	19.53 kΩ	11.44 kΩ	4.92 kΩ

Output Trim Resistor Values (Trim Up)

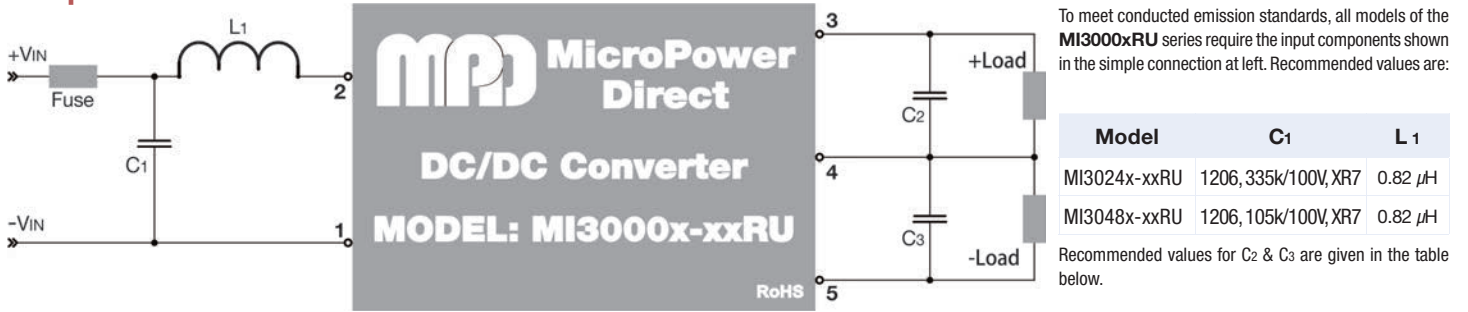
Model	1%	2%	3%	4%	5%
MI30xxS-03RU	60.84 kΩ	27.40 kΩ	16.25 kΩ	10.68 kΩ	7.34 kΩ
MI30xxS-05RU	106.87 kΩ	47.76 kΩ	28.06 kΩ	18.21 kΩ	12.30 kΩ
MI30xxS-12RU	351.00 kΩ	157.50 kΩ	93.00 kΩ	60.75 kΩ	41.40 kΩ
MI30xxS-15RU	422.77 kΩ	189.89 kΩ	112.26 kΩ	73.44 kΩ	50.15 kΩ
Model	6%	7%	8%	9%	10%
MI30xxS-03RU	5.11 kΩ	3.51 kΩ	2.32 kΩ	1.39 kΩ	0.65 kΩ
MI30xxS-05RU	8.36 kΩ	5.55 kΩ	3.44 kΩ	1.79 kΩ	0.48 kΩ
MI30xxS-12RU	28.50 kΩ	19.29 kΩ	12.37 kΩ	7.00 kΩ	2.70 kΩ
MI30xxS-15RU	34.63 kΩ	23.54 kΩ	15.22 kΩ	8.75 kΩ	3.58 kΩ

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	A	±6 kV Contact
			±8 kV Air
RS	EN 61000-4-3	A	20V/m
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

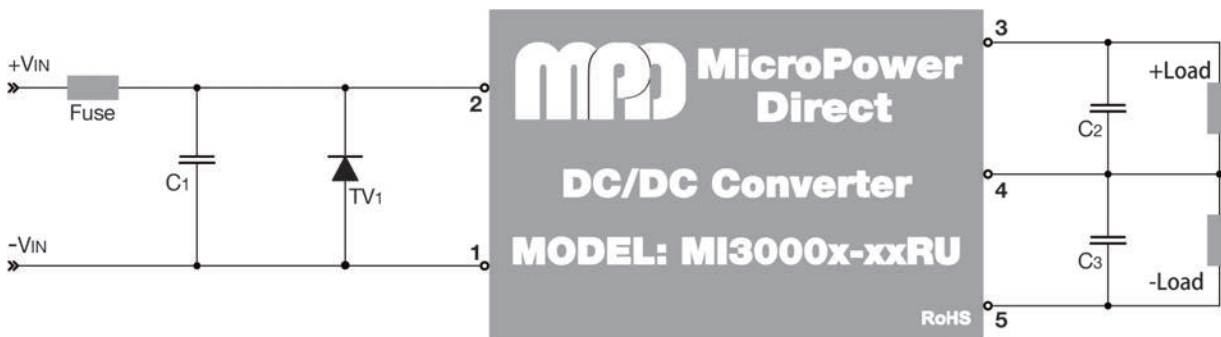
**Notes:**

- To meet the requirements of EN 61000-4-4 (±2 kV), external components are needed. This can be done discretely, as shown in the typical connection diagram below. Contact the factory for more information.
- To meet the requirements of EN 61000-4-5 (±2 kV), external components are needed. This can be done discretely, as shown in the typical connection diagram below. Contact the factory for more information.

## Simple Connection



## Typical Connection: With External EMC Components

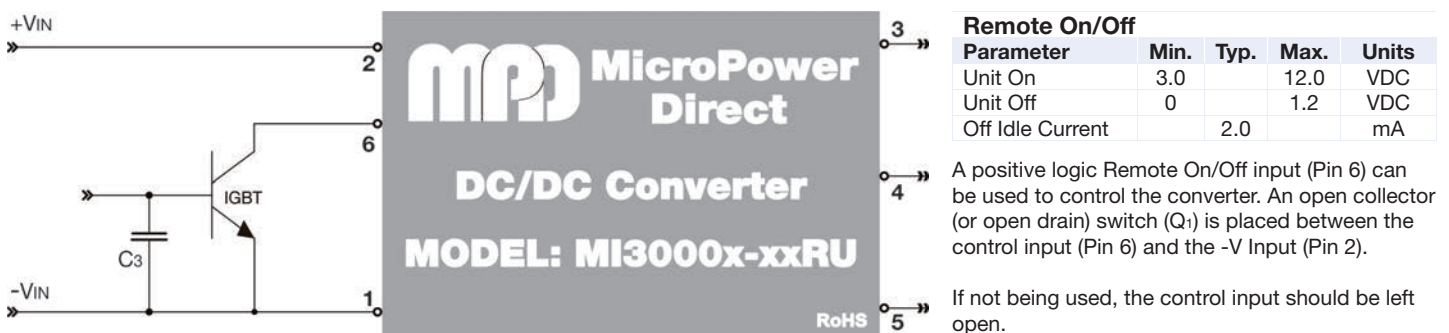


Model Number	External Components				
	Fuse	C1	TVS	C2	C3
MI3024x-xxRU	3A/1 kV	330 μF/100V	SMDJ58A	10 μF	10 μF
MI3048x-xxRU	1.5A/1 kV	330 μF/100V	SMDJ120A	10 μF	10 μF

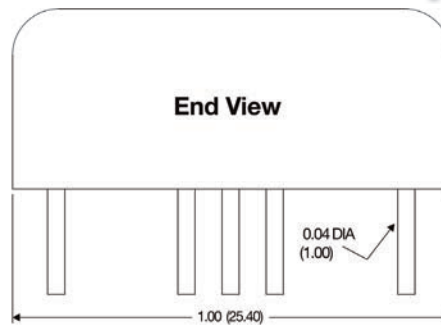
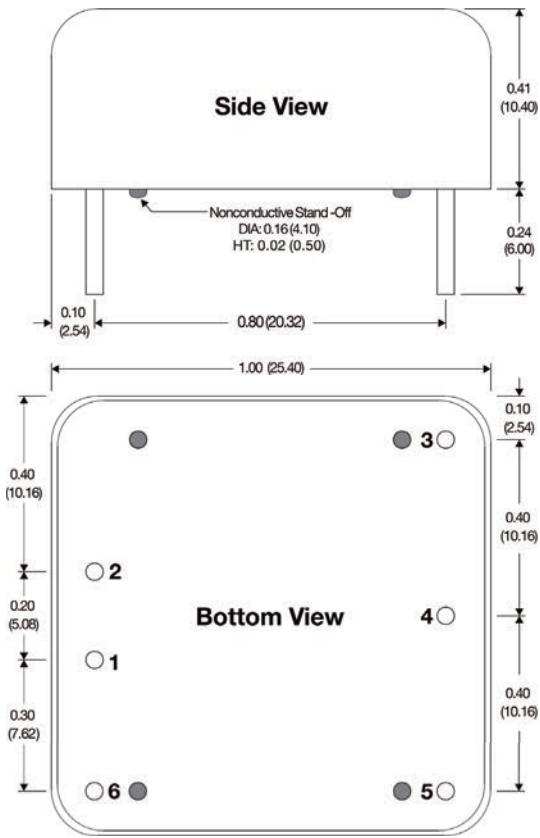
For applications that require meeting higher EMC standards, the circuit shown above is recommended. Some notes on this diagram (starting with the input circuit) are:

- It is recommended that an external fuse be used. The fuse should be a slow blow type.
- Capacitor C1 is an aluminum electrolytic capacitor. It is needed to meet the requirements of EN 61000-4-4 and EN 61000-4-5 on all models.
- All models require a TVS (TV1) connected in parallel with the input capacitor to meet EN 61000-4-4 and EN 61000-4-5. For the 24VIN models a device specified at 58V with 3 kW peak pulse power is recommended. For the 48 VIN models a device specified at 120V with 3 kW peak pulse power is recommended.
- Capacitors C2 & C3 are high frequency ceramic disc capacitors.
- Derating on all capacitors should be 80% or more.

## Remote On/Off



**Mechanical Dimensions**



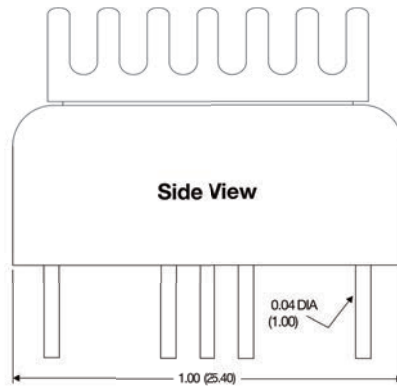
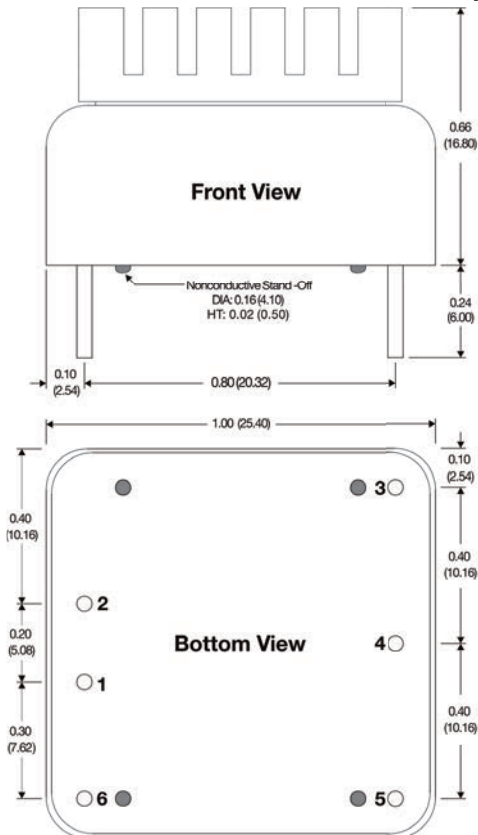
**Pin Connections**

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: 0.42 Oz (19g)

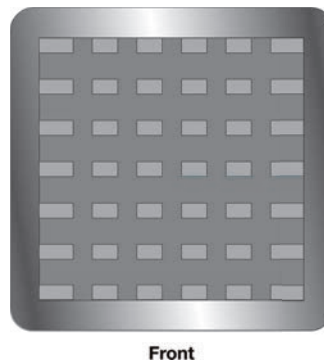
**Mechanical Dimensions: With Optional Heatsink**



For the heatsink option, add suffix "-H" to the model number (i.e. MI3024S-05RU-H)

**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



Air flow is not required to meet the specified performance of the MI30xxx-xxRU series. However, if it is used, directing the flow into the side of the heatsink will provide optimum benefit. This is illustrated at left.

**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: 0.52 Oz (21.9g)



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