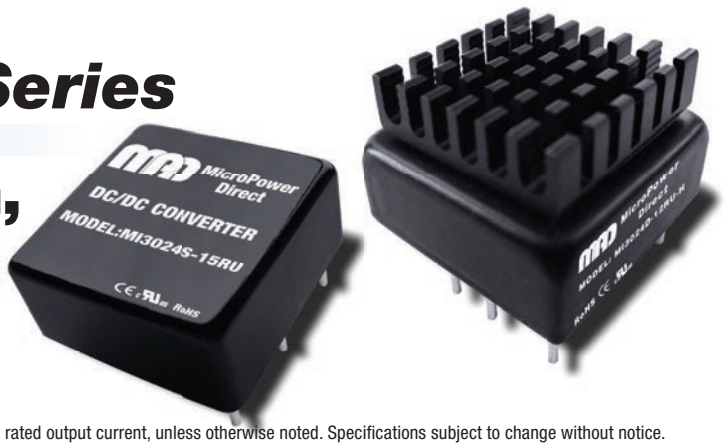
MI3000RU Series

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

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	
Undervoltage Shutdown	12 VDC Input		7.6	8.6	VDC
	24 VDC Input		16.5	17.5	
Input Reflected Ripple Current			30		mA P - P
Input Filter	π (Pi) Filter				

Output

Parameter	Conditions	Min.	Typ.	Max.	Units
Output Voltage Accuracy			±1.0		%
Line Regulation	VIN = Min to Max			±0.5	%
Load Regulation, See Note 2	Single Output			±0.5	%
	Dual Output			±1.0	
Cross Regulation	See Note 3		±5.0		%
Ripple & Noise, See Note 4	Single Output			75	mV P - P
	Dual Output			60	
Temperature Coefficient			±0.02		%/°C
Transient Recovery Time			250		μSec
Transient Response Deviation, See Note 5	3.3 VOUT Models			±5.0	%
	All Other Models			±3.0	
Output Over Voltage Protection	See Model Selection Chart (Page 2)				
Output Over Current Protection	Autorecovery		150		%IOUT
Over Temperature Protection	Autorecovery		115		°C
Output Short Circuit	Continuous (Autorecovery)				

General

Parameter	Conditions	Min.	Typ.	Max.	Units
Isolation Voltage, 60 Seconds	Input/Output	1,600			VDC
	Case/Input & Output	1,600			
Isolation Resistance	1,000 VDC	1,000			MΩ
Isolation Capacitance	10 kHz/1V			2,000	pF
Switching Frequency	3.3 & 5 VOUT Models		270		kHz
	All Other Models		330		

Environmental

Parameter	Conditions	Min.	Typ.	Max.	Units
Operating Temperature Range	Ambient	-40	+25	+80	°C
	Case			+105	
Thermal Impedance	See Note 6				
Storage Temperature Range		-40		+125	°C
Cooling	Free Air Convection				
Humidity	RH, Non-condensing			95	%

Physical

Case Size	See Mechanical Diagrams (Page 4)
Case Material	Copper With Non-Conductive Base (UL94-V0)
Weight	See Mechanical Diagrams (Page 4)

Reliability Specifications

Parameter	Conditions	Min.	Typ.	Max.	Units
MTBF	MIL HDBK 217F, 25°C, Gnd Benign	370			kHours
Safety Standards	UL/cUL 60950-1 Recognition (UL certificate)				

Absolute Maximum Ratings

Parameter	Conditions	Min.	Typ.	Max.	Units
Input Voltage Surge (100 mSec)	24 VDC Input			50.0	VDC
	48 VDC Input			100.0	
	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.

MicroPower Direct

CompuMess Elektronik GmbH · Lise-Meitner-Straße 4 · D-85716 Unterschleißheim
Telefon (089) 321501-0 · Telefax (089) 321501-11
info@compumess.de · www.compumess.de · www.netzteile.de

CME CompuMess Elektronik Power mit System

CompuMess Elektronik GmbH · Lise-Meitner-Straße 4 · D-85716 Unterschleißheim
Telefon (089) 321501-0 · Telefax (089) 321501-11
info@compumess.de · www.compumess.de · www.netzteile.de

Model Selection Guide

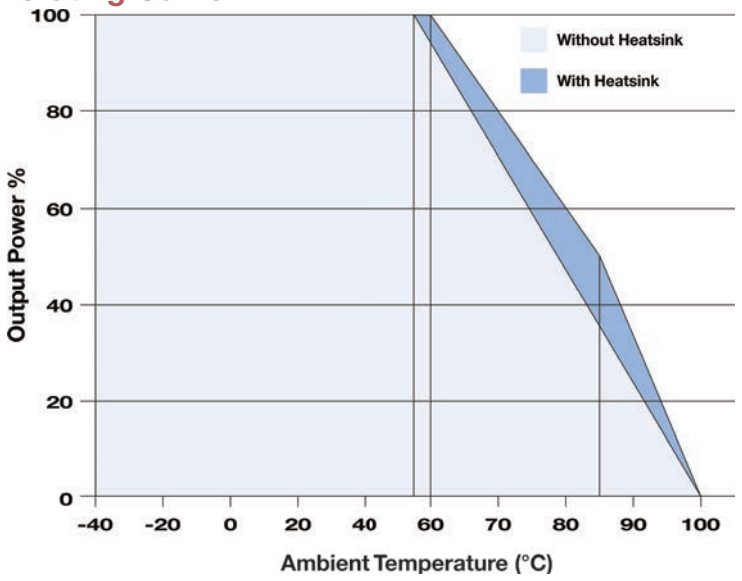
Model Number	Input				Output			Efficiency (%, Typ)	Over Voltage Protection (VDC Typ)	Capacitive Load (µF, Max)	Fuse Rating Slow-Blow (mA)
	Voltage (VDC)		Current (mA)		Voltage (VDC)	Current (mA, Max)	Current (mA, Min)				
	Nominal	Range	Full-Load	No-Load							
MI3024S-03RU	24	9.0 - 36.0	1,109	10	3.3	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**

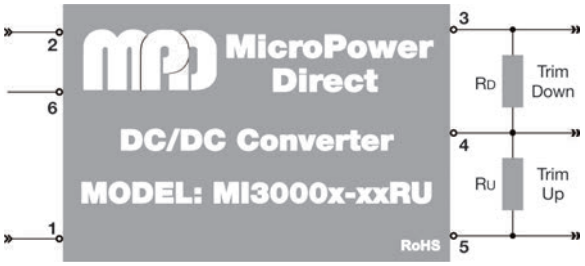
For the heatsink option, add suffix "-H" to the model number (i.e. **MI3024S-12RU-H**)

Notes:
1. The specified maximum capacitive load is for each output. Capacitive load is tested at minimum VIN and with a constant resistive load.
2. Load regulation is measured with the output power varied from 0% to 100%. Dual outputs are balanced.
3. 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.
4. 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.
5. Transient recovery is measured to within a 1% error band for a load step change of 25%.
6. Operation at no-load will not damage these units. However, they may not meet all specifications.
9. 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.
10. 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.
11. 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

CompuMess Elektronik GmbH · Lise-Meitner-Straße 4 · D-85716 Unterschleißheim
Telefon (089) 321501-0 · Telefax (089) 321501-11
info@compumess.de · www.compumess.de · www.netzteile.de

EMC Specifications

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:

2. 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.
3. 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

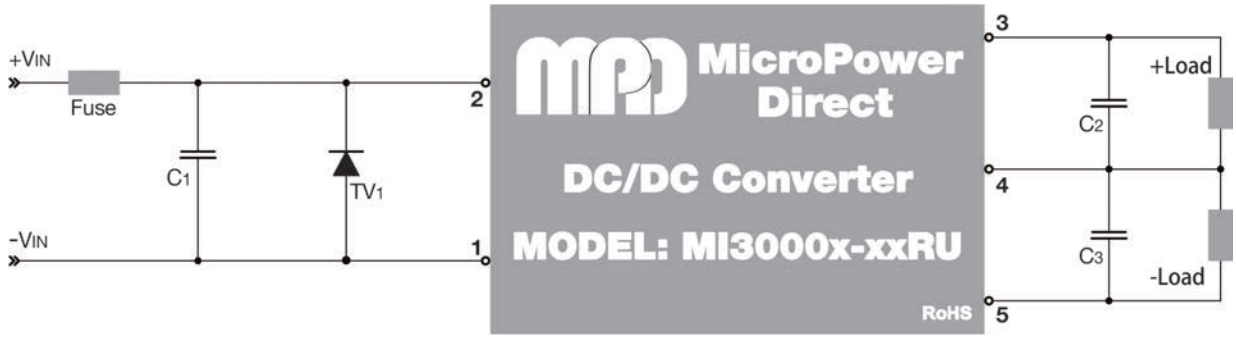


To meet conducted emission standards, all models of the **MI3000xRU** series require the input components shown in the simple connection at left. Recommended values are:

Model	C_1	L_1
MI3024x-xxRU	1206, 335k/100V, XR7	0.82 µH
MI3048x-xxRU	1206, 105k/100V, XR7	0.82 µH

Recommended values for C_2 & C_3 are given in the table below.

Typical Connection: With External EMC Components

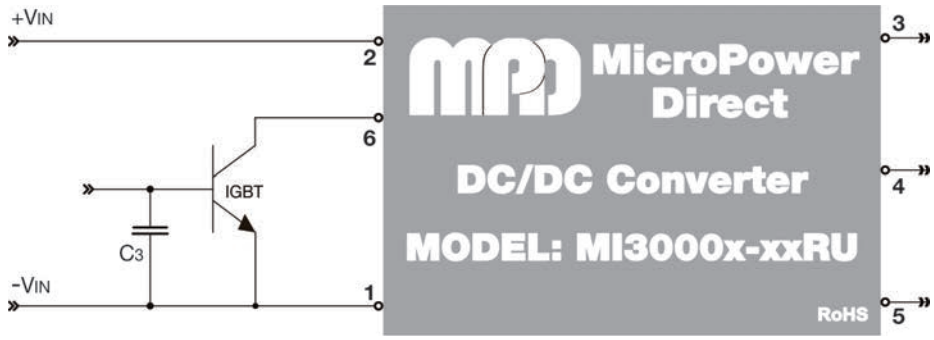


Model Number	External Components				
	Fuse	C_1	TVS	C_2	C_3
MI3024x-xxRU	3A/1 kV	330 µF/100V	SMDJ58A	10 µF	10 µF
MI3048x-xxRU	1.5A/1 kV	330 µF/100V	SMDJ120A	10 µF	10 µF

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:

1. It is recommended that an external fuse be used. The fuse should be a slow blow type.
2. Capacitor C_1 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.
3. All models require a TVS (TV_1) 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.
6. Capacitors C_2 & C_3 are high frequency ceramic disc capacitors.
7. Derating on all capacitors should be 80% or more.

Remote On/Off



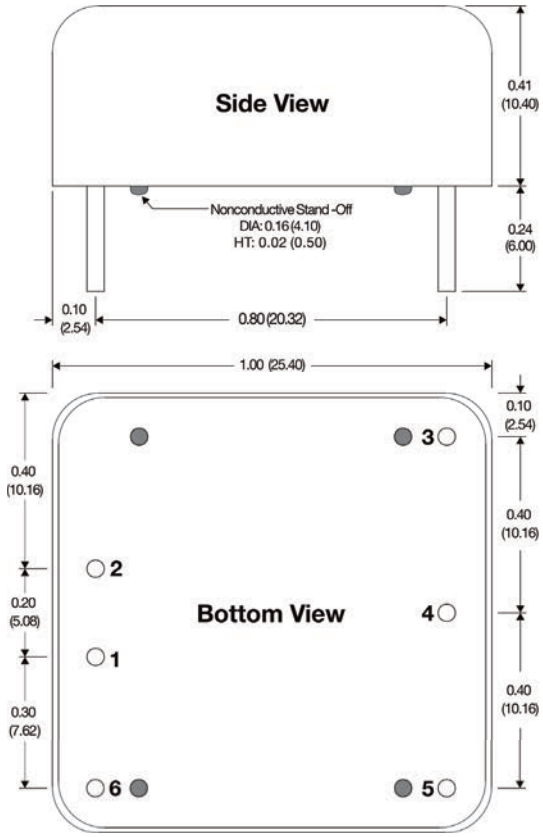
Remote On/Off

Parameter	Min.	Typ.	Max.	Units
Unit On	3.0		12.0	VDC
Unit Off	0		1.2	VDC
Off Idle Current		2.0		mA

A positive logic Remote On/Off input (Pin 6) can be used to control the converter. An open collector (or open drain) switch (Q_1) is placed between the control input (Pin 6) and the -V Input (Pin 2).

If not being used, the control input should be left open.

Mechanical Dimensions



Pin Connections

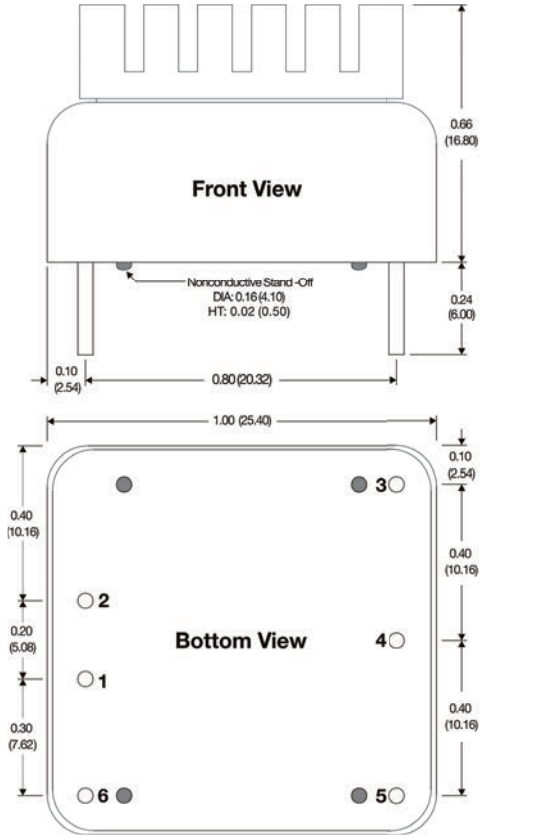
Pin	Single Output
1	-VIN
2	+VIN
3	+VOUT
4	Trim
5	-VOUT
6	Remote On/Off

Pin	Dual Output
1	-VIN
2	+VIN
3	+VOUT
4	Common
5	-VOUT
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

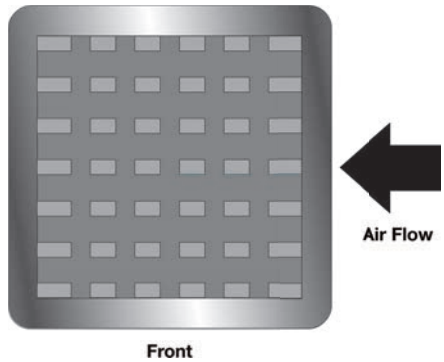


For the heatsink option, add suffix "-H" to the model number (i.e. **MI3024S-05RU-H**)

Pin Connections

Pin	Single Output
1	-VIN
2	+VIN
3	+VOUT
4	Trim
5	-VOUT
6	Remote On/Off

Pin	Dual Output
1	-VIN
2	+VIN
3	+VOUT
4	Common
5	-VOUT
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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