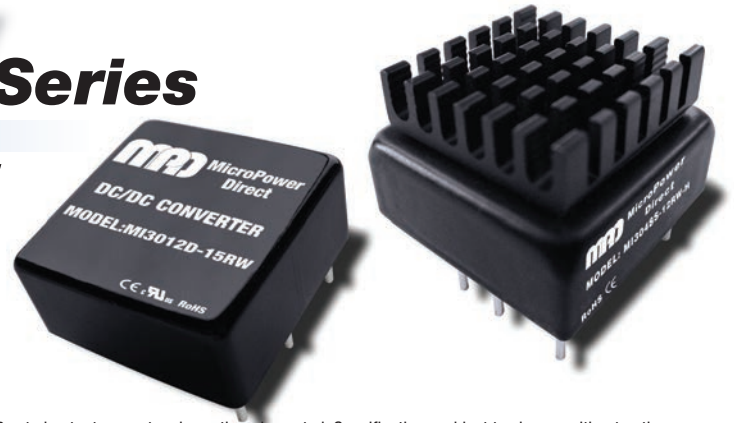


MI3000RW Series

Miniature 1 x 1" 30W Single & Dual Output DC/DC Converters



Key Features:

- 30W Output Power
- Miniature 1 x 1 In Case
- Wide 2:1 Input Range
- EN 60950 Approved
- 1,600 VDC Isolation
- High Efficiency
- Remote On/Off Control

4:1 Input Models Available



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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	12 VDC Input	9.0	12.0	18.0	VDC	
	24 VDC Input	18.0	24.0	36.0		
	48 VDC Input	36.0	48.0	75.0		
Undervoltage Shutdown	12 VDC Input		7.9	8.6	VDC	
	24 VDC Input		16.5	17.8		
	48 VDC Input		32.5	34		
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	V _{IN} = Min to Max			±0.5	%	
	Single Output			±0.5	%	
Load Regulation, See Note 2	Dual Output			±1.0	%	
	See Note 3		±5.0		%	
Cross Regulation	Single Output			75	mV P - P	
	Dual Output			60		
Ripple & Noise, See Note 4			±0.02		%/°C	
Temperature Coefficient			250		μSec	
Transient Recovery Time	3.3 V _{OUT} Models			±5.0	%	
	All Other Models			±3.0	%	
Transient Response Deviation, See Note 5	See Model Selection Chart (Page 2)					
Output Over Voltage Protection	Autorecovery		150		%I _{OUT}	
Output Over Current Protection	Autorecovery		115		°C	
Over Temperature Protection	Continuous (Autorecovery)					
Output Short Circuit						
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 V _{OUT} 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	%	
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)	12 VDC Input			25.0	VDC	
	24 VDC Input			50.0		
	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.

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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							
MI3012S-03RW	12	9.0 - 18.0	2,212	10	3.3	7,000	0.0	87	3.9	10,000	6,000
MI3012S-05RW	12	9.0 - 18.0	2,809	10	5.0	6,000	9.0	89	6.2	7,200	6,000
MI3012S-12RW	12	9.0 - 18.0	2,809	12	12.0	2,500	0.0	89	15.0	1,200	6,000
MI3012S-15RW	12	9.0 - 18.0	2,778	12	15.0	2,000	0.0	90	18.0	1,000	6,000
MI3012D-12RW	12	9.0 - 18.0	2,809	12	±12.0	±1,250	±0.0	89	±15.0	750	6,000
MI3012D-15RW	12	9.0 - 18.0	2,778	14	±15.0	±1,000	±0.0	90	±18.0	500	6,000
MI3024S-03RW	24	18.0 - 36.0	1,106	10	3.3	7,000	0.0	87	3.9	10,000	3,000
MI3024S-05RW	24	18.0 - 36.0	1,389	10	5.0	6,000	9.0	90	6.2	7,200	3,000
MI3024S-12RW	24	18.0 - 36.0	1,389	10	12.0	2,500	0.0	90	15.0	1,200	3,000
MI3024S-15RW	24	18.0 - 36.0	1,373	10	15.0	2,000	0.0	91	18.0	1,000	3,000
MI3024D-12RW	24	18.0 - 36.0	1,389	10	±12.0	±1,250	±0.0	90	±15.0	750	3,000
MI3024D-15RW	24	18.0 - 36.0	1,374	10	±15.0	±1,000	±0.0	91	±18.0	500	3,000
MI3048S-03RW	48	36.0 - 75.0	541	8	3.3	7,000	0.0	89	3.9	10,000	1,500
MI3048S-05RW	48	36.0 - 75.0	687	8	5.0	6,000	9.0	91	6.2	7,200	1,500
MI3048S-12RW	48	36.0 - 75.0	687	8	12.0	2,500	0.0	91	15.0	1,200	1,500
MI3048S-15RW	48	36.0 - 75.0	679	8	15.0	2,000	0.0	92	18.0	1,000	1,500
MI3048D-12RW	48	36.0 - 75.0	687	8	±12.0	±1,250	±0.0	91	±15.0	750	1,500
MI3048D-15RW	48	36.0 - 75.0	679	8	±15.0	±1,000	±0.0	92	±18.0	500	1,500

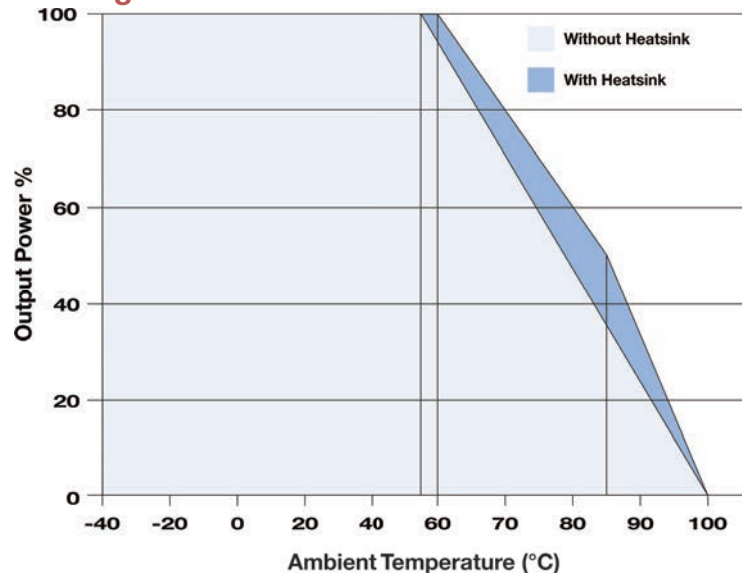
Models with a 4:1 input are also available. See the MI30xxx-xxRU

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

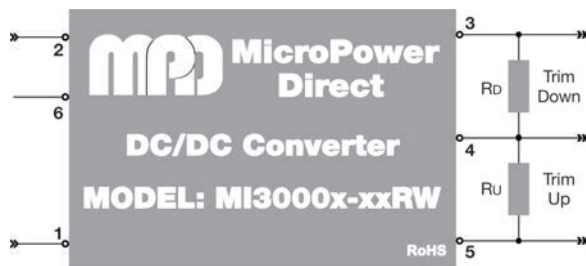
Notes:

- 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) 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-03RW	817.5 kΩ	362.2 kΩ	215.4 kΩ	143.0 kΩ	99.7 kΩ
MI30xxS-05RW	119.9 kΩ	63.6 kΩ	40.4 kΩ	27.7 kΩ	19.7 kΩ
MI30xxS-12RW	345.0 kΩ	164.8 kΩ	98.9 kΩ	64.6 kΩ	43.7 kΩ
MI30xxS-15RW	174.3 kΩ	91.1 kΩ	56.6 kΩ	37.7 kΩ	25.8 kΩ
Model	6%	7%	8%	9%	10%
MI30xxS-03RW	71.1 kΩ	50.6 kΩ	35.3 kΩ	23.4 kΩ	14.0 kΩ
MI30xxS-05RW	14.2 kΩ	10.2 kΩ	7.1 kΩ	4.7 kΩ	2.7 kΩ
MI30xxS-12RW	29.6 kΩ	19.4 kΩ	11.7 kΩ	5.7 kΩ	0.87 kΩ
MI30xxS-15RW	17.6 kΩ	11.6 kΩ	7.0 kΩ	3.5 kΩ	0.55 kΩ

Output Trim Resistor Values (Trim Up)

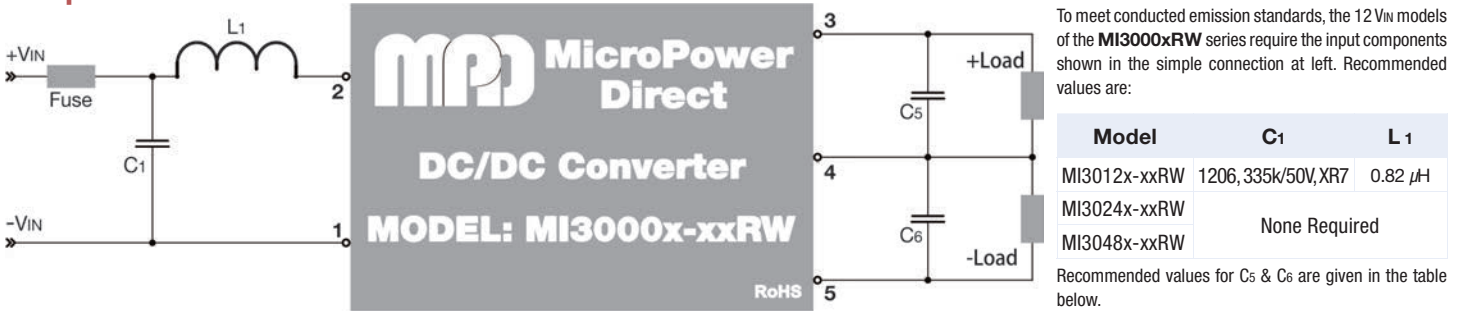
Model	1%	2%	3%	4%	5%
MI30xxS-03RW	567.6 kΩ	263.2 kΩ	158.5 kΩ	105.5 kΩ	73.5 kΩ
MI30xxS-05RW	618.0 kΩ	223.4 kΩ	133.3 kΩ	93.4 kΩ	70.9 kΩ
MI30xxS-12RW	1,015.7 kΩ	448.9 kΩ	280.6 kΩ	199.8 kΩ	152.4 kΩ
MI30xxS-15RW	661.5 kΩ	231.3 kΩ	134.0 kΩ	91.0 kΩ	66.8 kΩ
Model	6%	7%	8%	9%	10%
MI30xxS-03RW	52.1 kΩ	36.8 kΩ	25.2 kΩ	16.3 kΩ	9.1 kΩ
MI30xxS-05RW	56.4 kΩ	46.4 kΩ	38.9 kΩ	33.2 kΩ	28.7 kΩ
MI30xxS-12RW	121.2 kΩ	99.1 kΩ	82.6 kΩ	69.9 kΩ	59.7 kΩ
MI30xxS-15RW	51.3 kΩ	40.4 kΩ	32.5 kΩ	26.4 kΩ	21.5 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

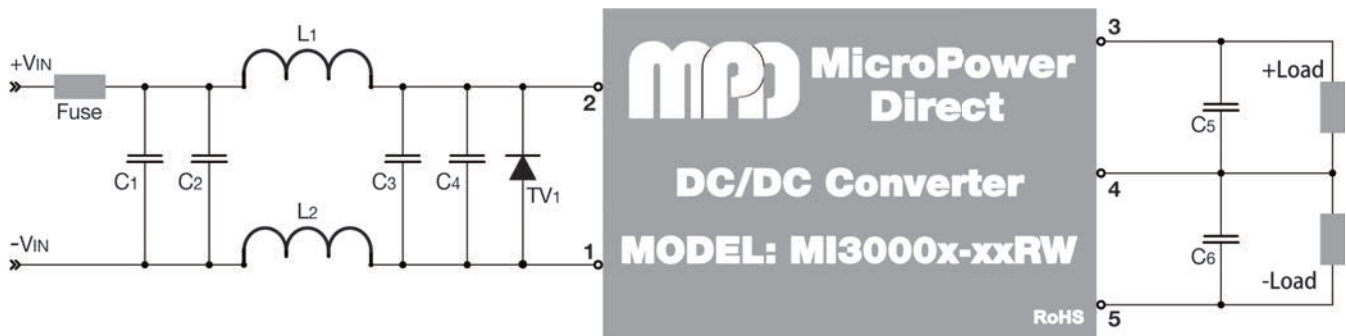
Notes:

- To meet conducted emission limits, 12VDC input models require C₁ & L₁ be connected as shown in the simple connection diagram below. Contact the factory for more information.
- 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



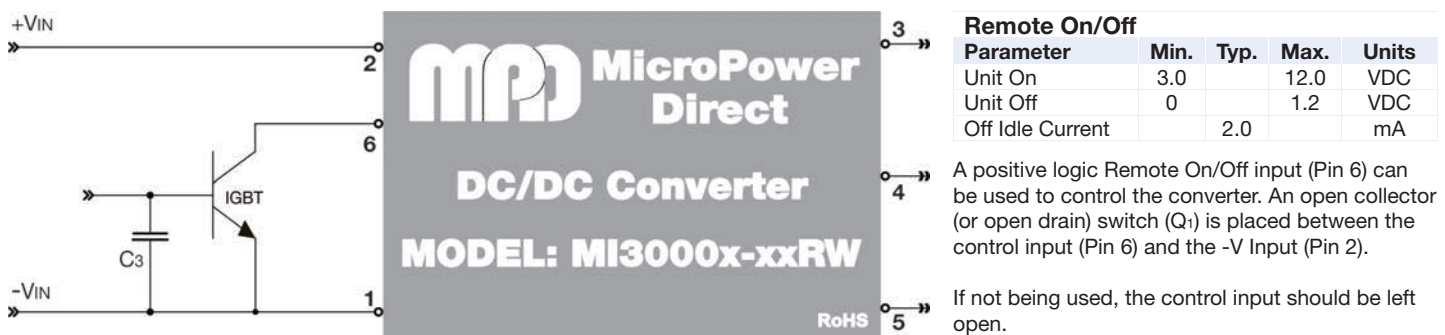
Model Number	External Components									
	Fuse	C ₁	C ₂	L ₁	L ₂	C ₃	C ₄	TVS	C ₅	C ₆
MI3012x-xxRW	6A/1 kV	330 μF/100V	470 μF/100V	1.0 μH	1.0 μH	330 μF/100V	470 μF/100V	---	10 μF	10 μF
MI3024x-xxRW	3A/1 kV	330 μF/100V	---	---	---	---	---	SMDJ58A	10 μF	10 μF
MI3048x-xxRW	1.5A/1 kV	330 μF/100V	---	---	---	---	---	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:

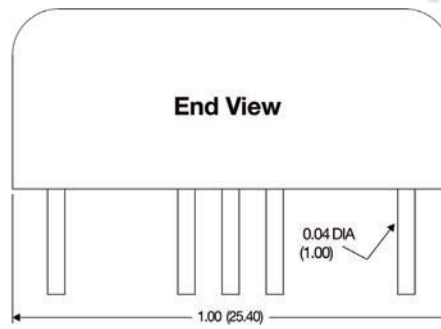
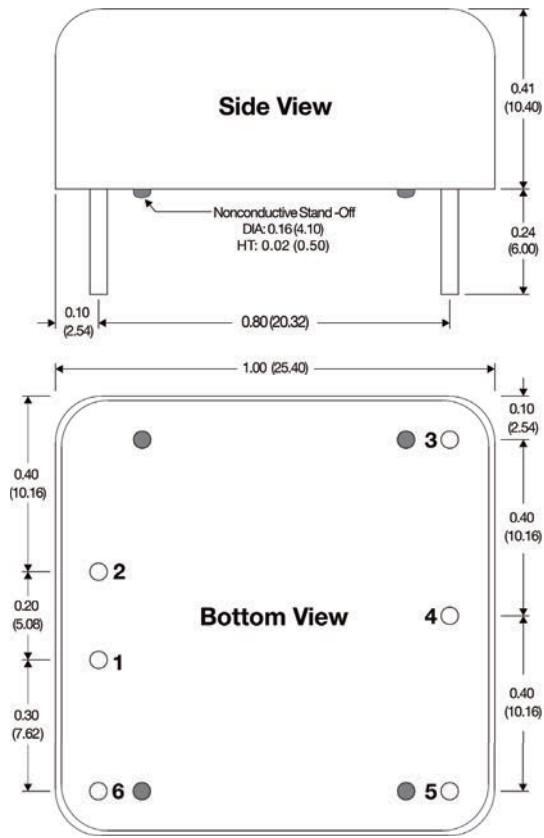
- It is recommended that an external fuse be used. The fuse should be a slow blow type.
- Capacitors C₁, and C₃ are aluminum electrolytic capacitors. C₁ is needed to meet EN 61000-4-4 and EN 61000-4-5 on all models. Capacitor C₃ is also required on 12V input models.
- Capacitors C₂, and C₄ are aluminum electrolytic capacitors. Both capacitors are needed to meet EN 61000-4-4 & EN 61000-4-5 on 12V input models. The 24V_{IN} and 48V_{IN} models do not require these capacitors.

- The inductors, L₁ and L₂ are required on 12V_{IN} models to meet EN 61000-4-4 and EN 61000-4-5. They are not needed for 24V_{IN} and 48V_{IN} models.
- The 24V_{IN} & 48V_{IN} 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 24V_{IN} models a device specified at 58V with 3 kW peak pulse power is recommended. For the 48V_{IN} models a device specified at 120V with 3 kW peak pulse power is recommended.
- Capacitors C₅ & C₆ are high frequency ceramic disc capacitors.
- Derating on all capacitors should be 80% or more.

Remote On/Off



Mechanical Dimensions



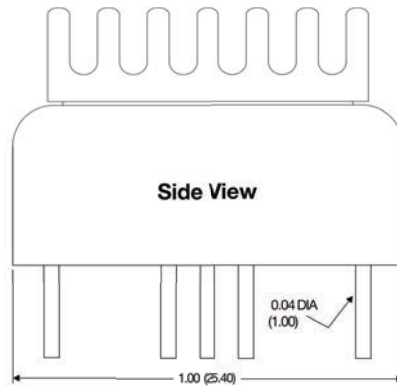
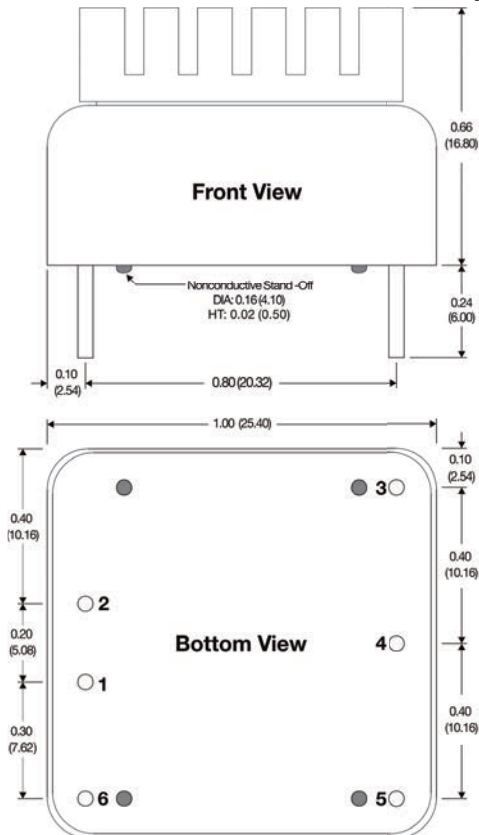
Pin Connections

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)

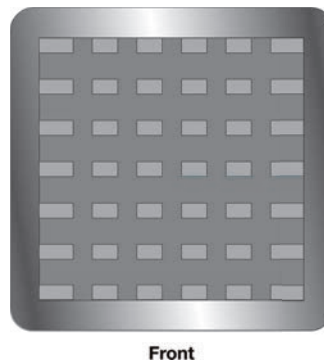
Mechanical Dimensions: With Optional Heatsink



For the heatsink option, add suffix "-H" to the model number (i.e. MI3024S-05RW-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 MI30xx-xxRW 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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