

# MA400RW Series

## Wide 2:1 Input, 4W, High Performance, DIP DC/DC Converters



### Key Features:

- 4W Output Power
- 2:1 Input Voltage Range
- 1,500 VDC Isolation
- 30 Standard Models
- High Efficiency
- Compact DIP Case
- -40°C to +85°C Operation
- Metal Case Available
- Low Cost

Alternate Pin-Out Available

3.5 kV Isolation 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						
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	72.0		
Input Reflected Ripple Current			35		mA P - P	
Input Filter	π (Pi) Filter					

Output						
Parameter	Conditions	Min.	Typ.	Max.	Units	
Output Voltage Accuracy			±1.0		%	
Line Regulation	V <sub>IN</sub> = Min to Max		±0.5		%	
Load Regulation	I <sub>OUT</sub> = 25% to 100%		±0.5		%	
Load Regulation	See Note 1		±0.5		%	
Ripple & Noise (20 MHz)	See Note 2		60		mV P - P	
Temperature Coefficient			±0.02		%/°C	
Output Short Circuit	Continuous (Autorecovery)					

General						
Parameter	Conditions	Min.	Typ.	Max.	Units	
Isolation Voltage, See Note 3	3 Seconds	1,500			VDC	
Isolation Resistance	500 VDC	1,000			MΩ	
Isolation Capacitance	100 kHz/0.1V		60		pF	
Switching Frequency		100		400	kHz	

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

Physical						
Parameter	Conditions	Min.	Typ.	Max.	Units	
Case Size		1.25 x 0.80 x 0.40 Inches (31.75 x 20.32 x 10.16 mm)				
Case Material, Plastic		Non-Conductive Black Plastic (UL94-V0)				
Weight, Plastic Case		0.44 Oz (12.5g)				
Case Material, Metal		Nickel-Coated Copper With Non-Conductive Base (UL94-V0)				
Weight, Metal Case		0.53 Oz (15g)				

Reliability Specifications						
Parameter	Conditions	Min.	Typ.	Max.	Units	
MTBF	MIL HDBK 217F, 25°C, Gnd Benign	1.0			MHours	

Absolute Maximum Ratings						
Parameter	Conditions	Min.	Typ.	Max.	Units	
Input Voltage Surge (1 Sec)	12 VDC Input	-0.7		24.0	VDC	
	24 VDC Input	-0.7		40.0		
	48 VDC Input	-0.7		80.0		
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.

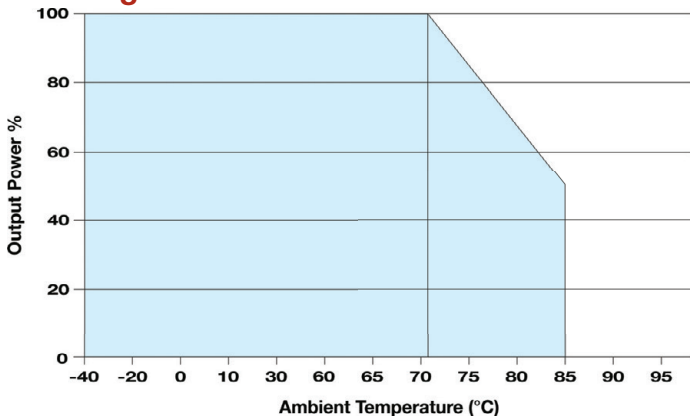
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Model Number	Input				Output			Efficiency (% Typ)	Reflected Ripple Current (mA Typ)	Capacitive Load (µF Max)	Fuse Rating Slow-Blow (mA)
	Voltage (VDC)		Current (mA)		Voltage (VDC)	Current (mA, Max)	Current (mA, Min)				
	Nominal	Range	Full-Load	No-Load							
MA412S-05RW-xx	12	9.0 - 18.0	463	20	5.0	800.0	200.0	72	35.0	2,200	1,000
MA412S-09RW-xx	12	9.0 - 18.0	427	20	9.0	444.0	111.0	78	35.0	470	1,000
MA412S-12RW-xx	12	9.0 - 18.0	427	20	12.0	333.0	83.3	78	35.0	470	1,000
MA412S-15RW-xx	12	9.0 - 18.0	433	20	15.0	267.0	66.8	77	35.0	470	1,000
MA412S-24RW-xx	12	9.0 - 18.0	439	20	24.0	167.0	42.0	76	35.0	220	1,000
MA412D-05RW-xx	12	9.0 - 18.0	433	20	±5.0	±400.0	±100.0	77	35.0	±1,000	1,000
MA412D-09RW-xx	12	9.0 - 18.0	433	20	±9.0	±222.0	±56.0	77	35.0	±220	1,000
MA412D-12RW-xx	12	9.0 - 18.0	427	20	±12.0	±167.0	±42.0	78	35.0	±220	1,000
MA412D-15RW-xx	12	9.0 - 18.0	427	20	±15.0	±133.0	±33.0	78	35.0	±220	1,000
MA412D-24RW-xx	12	9.0 - 18.0	433	20	±24.0	±83.0	±21.0	77	35.0	±100	1,000
MA424S-05RW-xx	24	18.0 - 36.0	216	12	5.0	800.0	200.0	77	35.0	2,200	500
MA424S-09RW-xx	24	18.0 - 36.0	214	12	9.0	444.0	111.0	78	35.0	470	500
MA424S-12RW-xx	24	18.0 - 36.0	211	12	12.0	333.0	83.3	79	35.0	470	500
MA424S-15RW-xx	24	18.0 - 36.0	208	12	15.0	267.0	66.8	80	35.0	470	500
MA424S-24RW-xx	24	18.0 - 36.0	216	12	24.0	167.0	42.0	77	35.0	220	500
MA424D-05RW-xx	24	18.0 - 36.0	225	12	±5.0	±400.0	±100.0	77	35.0	±1,000	500
MA424D-09RW-xx	24	18.0 - 36.0	225	12	±9.0	±222.0	±56.0	77	35.0	±220	500
MA424D-12RW-xx	24	18.0 - 36.0	219	12	±12.0	±167.0	±42.0	78	35.0	±220	500
MA424D-15RW-xx	24	18.0 - 36.0	216	12	±15.0	±133.0	±33.0	79	35.0	±220	500
MA424D-24RW-xx	24	18.0 - 36.0	219	12	±24.0	±83.0	±21.0	76	35.0	±100	500
MA448S-05RW-xx	48	36.0 - 72.0	108	8	5.0	800.0	200.0	77	35.0	2,200	250
MA448S-09RW-xx	48	36.0 - 72.0	108	8	9.0	444.0	111.0	77	35.0	470	250
MA448S-12RW-xx	48	36.0 - 72.0	107	8	12.0	333.0	83.3	78	35.0	470	250
MA448S-15RW-xx	48	36.0 - 72.0	107	8	15.0	267.0	66.8	77	35.0	470	250
MA448S-24RW-xx	48	36.0 - 72.0	111	8	24.0	167.0	42.0	75	35.0	220	250
MA448D-05RW-xx	48	36.0 - 72.0	114	8	±5.0	±400.0	±100.0	73	35.0	±1,000	250
MA448D-09RW-xx	48	36.0 - 72.0	108	8	±9.0	±222.0	±56.0	77	35.0	±220	250
MA448D-12RW-xx	48	36.0 - 72.0	108	8	±12.0	±167.0	±42.0	77	35.0	±220	250
MA448D-15RW-xx	48	36.0 - 72.0	107	8	±15.0	±133.0	±33.0	78	35.0	±220	250
MA448D-24RW-xx	48	36.0 - 72.0	110	8	±24.0	±83.0	±21.0	76	35.0	±100	250

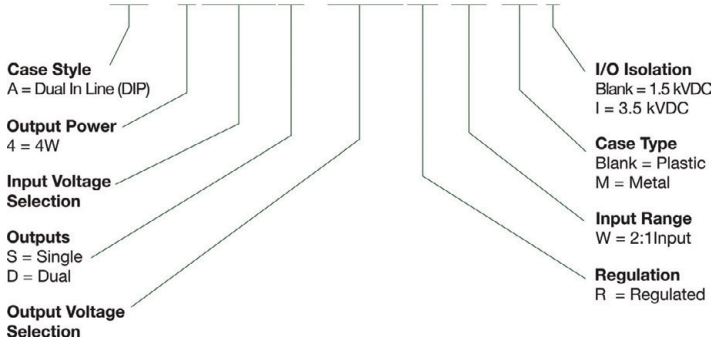
- Notes:
1. Cross regulation is measured with the output being tested at 100% load while the other output is varied from 25% to 100% load.
  2. See the typical connection circuit on page three for typical external filtering components. For help with a specific model or layout issue, contact the factory.
  3. Isolation voltage is specified for Input to output. On units with the optional metal case, the isolation voltage for Input - Case and Output - Case is 1,000 VDC.
  4. Operation at no-load will not damage the unit, but they may not meet all specifications. To meet all specifications, a minimum load of 25% should be maintained.
  5. 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.

For the alternate pin-out (see page 4) , add suffix "P2" to model number (i.e. MA424S-05RW-P2)

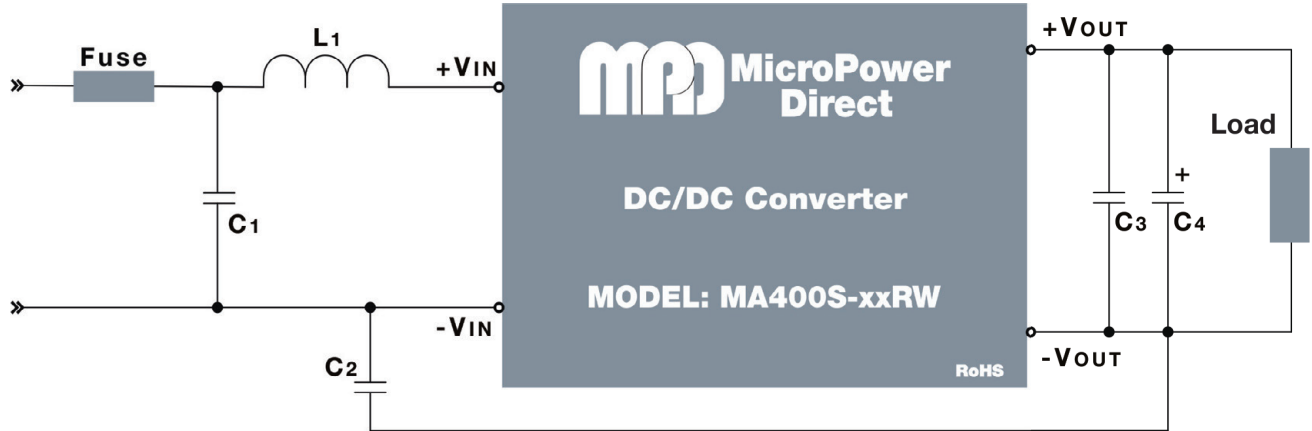
Derating Curve



Model Number MA-4XXx-XXRWMI



Typical Connection

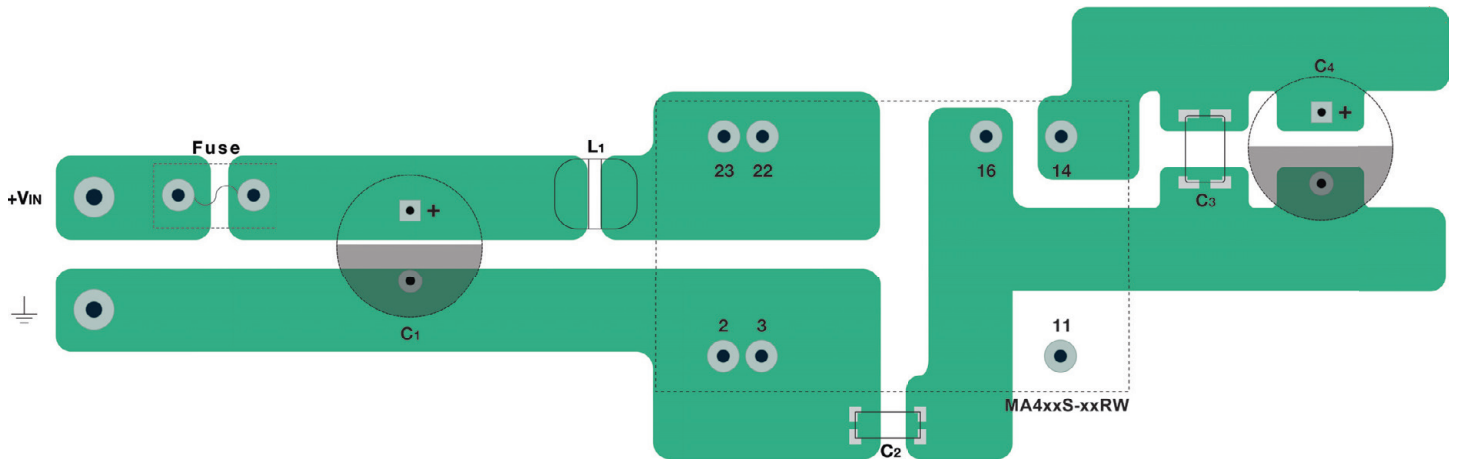


The diagram above illustrates a typical connection of the **MA400RW** series for applications that require meeting conducted EMC standards. The units do not require external components to operate as specified. For applications requiring very low output noise levels, the output filtering capacitors (C<sub>3</sub> is a low ESR electrolytic & C<sub>4</sub> is a ceramic) will often be sufficient. Care must be taken in choosing output capacitors not to exceed the capacitive load specification for the unit. For dual output units, output capacitors should be connected from each output to common. All external components should be mounted as close to the unit as possible.

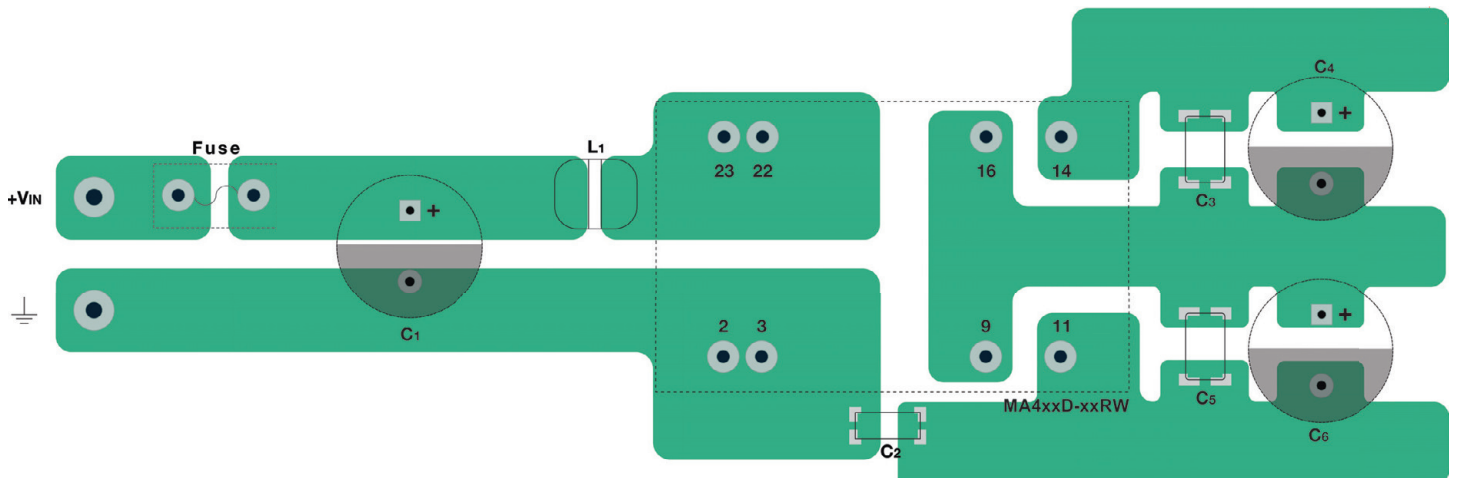
The recommended values for components are:

Component	12 V <sub>IN</sub>	24 V <sub>IN</sub>	48 V <sub>IN</sub>
C <sub>1</sub>	220 μF/50V	220 μF/100V	220 μF/100V
LCM	12 μH	12 μH	12 μH
C <sub>2</sub>	---	470 pF/2kV MLCC	470 pF/2kV MLCC
C <sub>3</sub>	100 μF	100 μF	100 μF
C <sub>4</sub>	4.7 - 10 μF	4.7 - 10 μF	4.7 - 10 μF

Typical Board Layout: With External Filter Components, Single Output

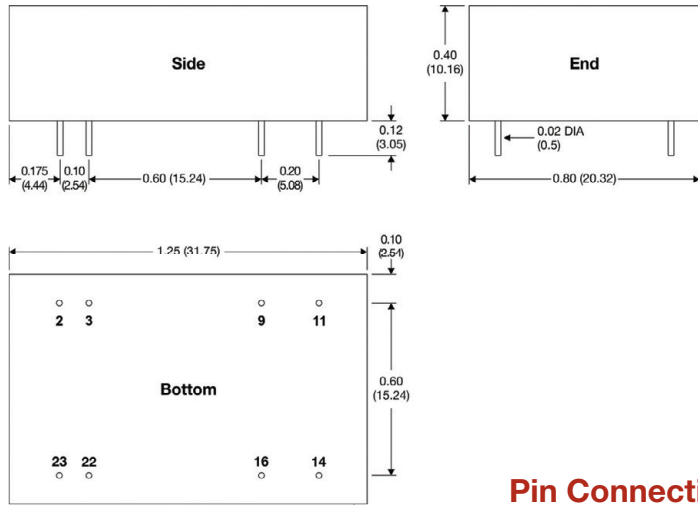


Typical Board Layout: With External Filter Components, Dual Output

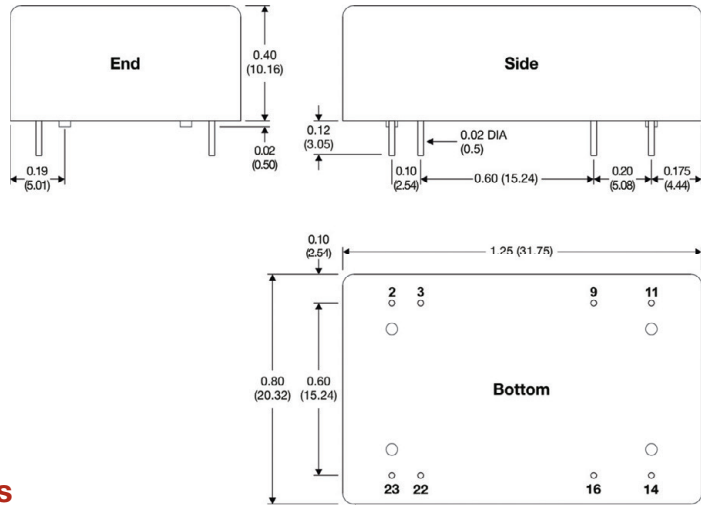


Input noise and surge suppression modules are available for a number of MPD DC/DC power supplies. Contact the factory for more information.

Standard Units - Plastic Case



Standard Units - Metal Case

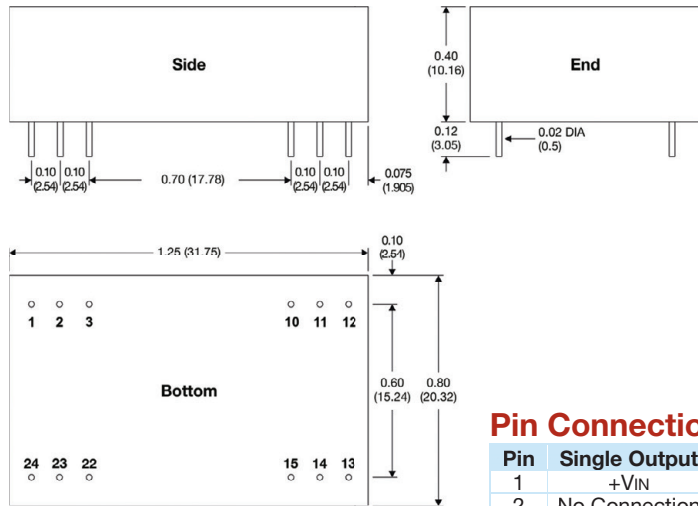


Pin Connections

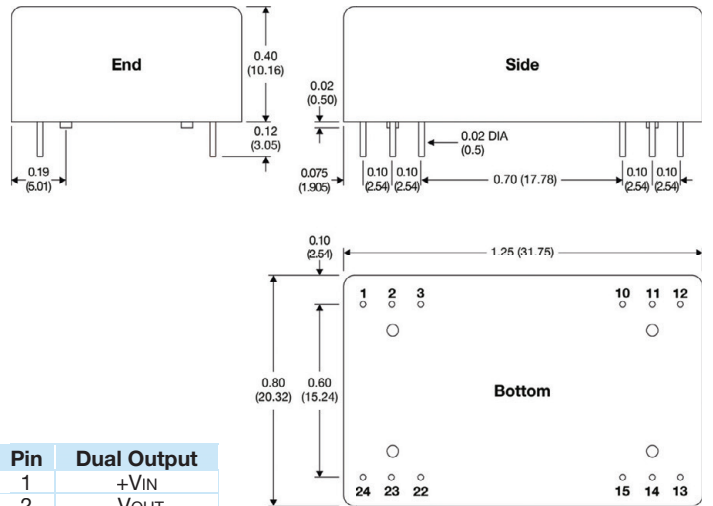
Pin	Single Output	Pin	Dual Output
2	-VIN	2	-VIN
3	-VIN	3	-VIN
9	No Pin	9	Common
11	No Connection	11	-VOUT
14	+VOUT	14	+VOUT
16	-VOUT	16	Common
22	+VIN	22	+VIN
23	+VIN	23	+VIN

For the alternate pin-out, add suffix "P2" to model number (i.e. MA424S-05RW-P2)

Alternate Pin-Out Units - Plastic Case



Alternate Pin-Out Units - Metal Case



Pin Connections

Pin	Single Output	Pin	Dual Output
1	+VIN	1	+VIN
2	No Connection	2	-VOUT
3	No Connection	3	Common
10	-VOUT	10	Common
11	+VOUT	11	+VOUT
12	-VIN	12	-VIN
13	-VIN	13	-VIN
14	+VOUT	14	+VOUT
15	-VOUT	15	Common
22	No Connection	22	Common
23	No Connection	23	-VOUT
24	+VIN	24	+VIN

Notes:

- All dimensions are typical in inches (mm)
- Tolerance x.xx = ±0.02 (±0.50)
- Pin 1 is marked by a "dot" or indentation on the top of the unit



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