

# MA300MRWRI5

## EN 60601 Approved 2:1 Input, DIP, 3.5W DC/DC Converters



### Key Features:

- EN 60601 3<sup>RD</sup> Ed. Approved
- 3.5W Output Power
- 5.0 kVrms Isolation
- Reinforced Insulation
- 2 x MOPP per EN 60601-1 3<sup>RD</sup> Edition & ANSI/AAMI ES 60601-1
- 2  $\mu$ A Leakage Current Max
- Wide 2:1 Input Range
- Compact 24 Pin DIP Case
- Single & Dual Outputs
- 5.81 MH MTBF



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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
Input Start Voltage	Parameter	5 VDC Input			4.5	VDC
		12 VDC Input			9.0	
		24 VDC Input			18.0	
		48 VDC Input			36.0	
Under Voltage Shutdown	Parameter	5 VDC Input		4.0		VDC
		12 VDC Input		8.0		
		24 VDC Input		16.0		
		48 VDC Input		34.0		
Input Filter		$\pi$ (Pi) Filter				
Start Up Time		Nominal VIN, Constant, Resistive Load			30	mS

Output		Conditions	Min.	Typ.	Max.	Units
Output Voltage Accuracy	Parameter	Dual Output , Balanced Loads			$\pm 1.0$	%
Output Voltage Balance				$\pm 0.5$	$\pm 2.0$	%
Line Regulation		VIN = Min to Max			$\pm 0.5$	%
Load Regulation		IOUT = 0% to 100%			$\pm 0.5$	%
Cross Regulation, Dual Output		See Note 2			$\pm 5.0$	%
Ripple & Noise (20 MHz)		See Note 3			70	mV P - P
Output Power Protection				150		%
Transient Recovery Time, See Note 4		25% Load Step Change		300		$\mu$ Sec
Transient Response Deviation				$\pm 3.0$	$\pm 5.0$	
Temperature Coefficient				$\pm 0.01$		%/°C
Output Short Circuit		Continuous (Autorecovery)				

General		Conditions	Min.	Typ.	Max.	Units
Isolation Voltage	Parameter	60 Seconds	5,000			Vrms
Reinforced Insulation Working Voltage			250			Vrms
Leakage Current		240 VAC, 60 Hz			2	$\mu$ A
Isolation Resistance		500 VDC	10			G $\Omega$
Isolation Capacitance		100 kHz, 1V			40	pF
Switching Frequency				330		kHz

EMI Characteristics		Standard	Criteria	Level
Parameter		See Page 3		

Environmental		Conditions	Min.	Typ.	Max.	Units
Operating Temperature Range	Parameter	Ambient	-40	+25	+97	°C
		Case			+105	
Storage Temperature Range			-50		+125	
Cooling		Free Air Convection				
Humidity		RH, Non-condensing			95	%

Physical		Conditions	Min.	Typ.	Max.	Units
Case Size	Parameter	See Mechanical Diagram (Page 3)				
Case Material		Non-Conductive Black Plastic (UL94-V0)				
Weight		0.55 Oz (15.5g)				

### Reliability Specifications

Parameter		Conditions	Min.	Typ.	Max.	Units
MTBF		MIL HDBK 217F, 25°C, Gnd Benign	5.81			MHours
Safety Standards		IEC/EN 60601-1, EN 60601-1 3 <sup>RD</sup> Edition, 2xMOPP				
		ANSI/AAMI ES 60601-1 2xMOPP Recognition (UL Certificate)				
		ANSI/AAMI ES 60601-1, CAN/CSA-C22.2 No.60601-1				

### Absolute Maximum Ratings

Parameter		Conditions	Min.	Typ.	Max.	Units
Input Voltage Surge (1.0 Sec)	Parameter	5 VDC Input			15.0	VDC
		12 VDC Input			25.0	
		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.

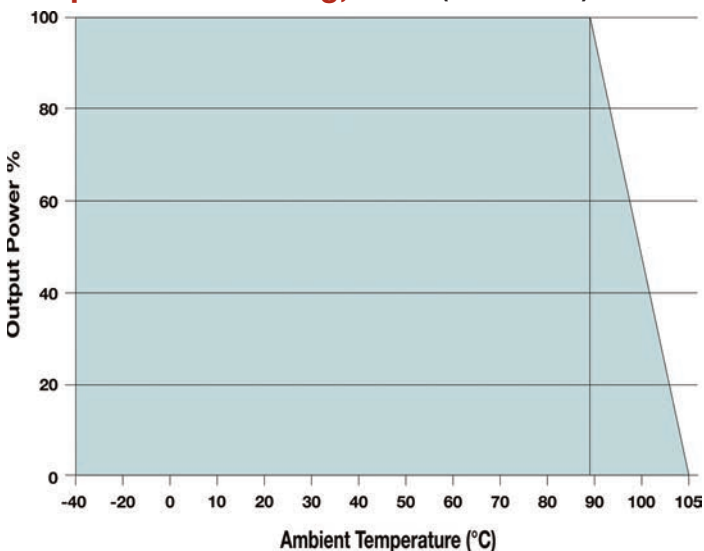
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Model Number	Input				Output			Efficiency (% Typ)	Capacitive Load (µF Max)	Fuse Rating Slow-Blow (mA)
	Voltage (VDC)		Current (mA)		Voltage (VDC)	Current (mA, Max)	Current (mA, Min)			
	Nominal	Range	Full-Load	No-Load						
MA305SMRW-05RI5	5.0	4.5 - 9.0	843	20	5.0	700	0.0	83	750	1,600
MA305SMRW-12RI5	5.0	4.5 - 9.0	829	20	12.0	290	0.0	84	130	1,600
MA305SMRW-15RI5	5.0	4.5 - 9.0	839	20	15.0	235	0.0	84	100	1,600
MA305DMRW-12RI5	5.0	4.5 - 9.0	829	35	±12.0	±145	0.0	84	75	1,600
MA305DMRW-15RI5	5.0	4.5 - 9.0	821	35	±15.0	±115	0.0	84	56	1,600
MA312SMRW-05RI5	12	9.0 - 18.0	351	8	5.0	700	0.0	83	750	800
MA312SMRW-12RI5	12	9.0 - 18.0	333	8	12.0	290	0.0	87	130	800
MA312SMRW-15RI5	12	9.0 - 18.0	338	8	15.0	235	0.0	87	100	800
MA312DMRW-12RI5	12	9.0 - 18.0	333	13	±12.0	±145	0.0	87	75	800
MA312DMRW-15RI5	12	9.0 - 18.0	330	13	±15.0	±115	0.0	87	56	800
MA324SMRW-05RI5	24	18.0 - 36.0	176	6	5.0	700	0.0	83	750	400
MA324SMRW-12RI5	24	18.0 - 36.0	169	6	12.0	290	0.0	86	130	400
MA324SMRW-15RI5	24	18.0 - 36.0	169	6	15.0	235	0.0	87	100	400
MA324DMRW-12RI5	24	18.0 - 36.0	167	6	±12.0	±145	0.0	87	75	400
MA324DMRW-15RI5	24	18.0 - 36.0	167	6	±15.0	±115	0.0	86	56	400
MA348SMRW-05RI5	48	36.0 - 75.0	88	4	5.0	700	0.0	83	750	200
MA348SMRW-12RI5	48	36.0 - 75.0	84	4	12.0	290	0.0	86	130	200
MA348SMRW-15RI5	48	36.0 - 75.0	86	4	15.0	235	0.0	85	100	200
MA348DMRW-12RI5	48	36.0 - 75.0	86	4	±12.0	±145	0.0	84	75	200
MA348DMRW-15RI5	48	36.0 - 75.0	86	4	±15.0	±115	0.0	84	56	200

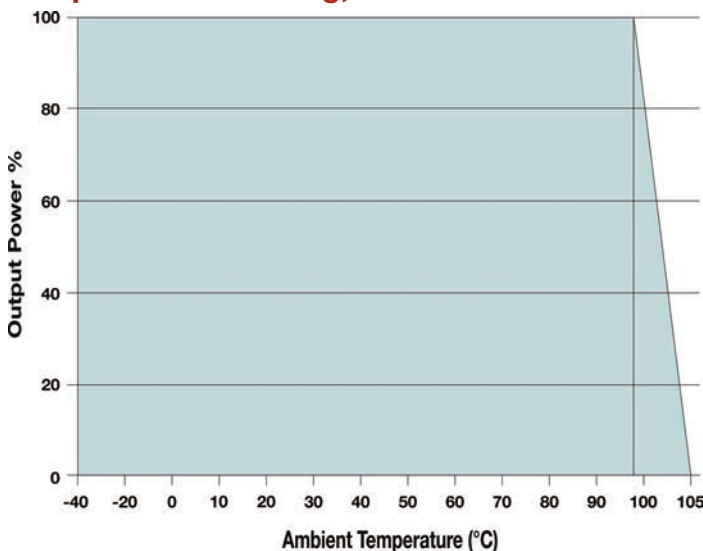
Notes:

- The specified maximum capacitive load is for each output.
- Cross regulation is measured with the +V<sub>OUT</sub> (pin 13) set to 50% load and the -V<sub>OUT</sub> (pin 12) varied from 25% to 100% load.
- When measuring output ripple, it is recommended that an external 4.7 µF ceramic capacitor be placed from the +V<sub>OUT</sub> pin to the -V<sub>OUT</sub> pin for single output units and from each output to common for dual output units.
- Transient recovery is measured to within a 1% error band for a load step change of 75% to 100%.
- Dual output units may be connected to provide a 24 VDC or 30 VDC output. To do this, connect the load across the positive (+V<sub>OUT</sub>) and negative (-V<sub>OUT</sub>) outputs and float the output common.
- The converter should be connected to a low ac-impedance source. An input source with a highly inductive impedance may affect the stability of the converter. In applications where the converter output loading is high and input power is supplied over long lines, it may be necessary to use a capacitor on the input to insure start-up. In this case, it is recommended that a low ESR (ESR <1.0Ω at 100 kHz) capacitor be mounted close to the converter. For 5V input units a 22 µF, for 12V a 10.0 µF is recommended, for 24V a 4.7 µF and for 48V units a 2.2 µF.
- It is recommended that a fuse be used on the input of a power supply for protection. See the table above for the correct rating.

Temperature Derating, 20LFM (Ambient Air)



Temperature Derating, 400 LFM





These converters are specified for operation without external components. However, in some applications the addition of input/output capacitors, as shown in the typical connection diagram above, will enhance stability and reduce output ripple. This simple connection includes a low ESR (<math><1\Omega</math> at 100 kHz) capacitor connected across the input (C<sub>1</sub>). It is recommended that a 22  $\mu\text{F}$  be used for 5V input models, a 10  $\mu\text{F}$  for 12V input models, a 4.7  $\mu\text{F}$  for 24V and a 2.2  $\mu\text{F}$  for 48V input units. To improve the output ripple performance, a 4.7  $\mu\text{F}$  is connected across the output. For dual output units, a 4.7  $\mu\text{F}$  capacitor should be connected from each output to common.

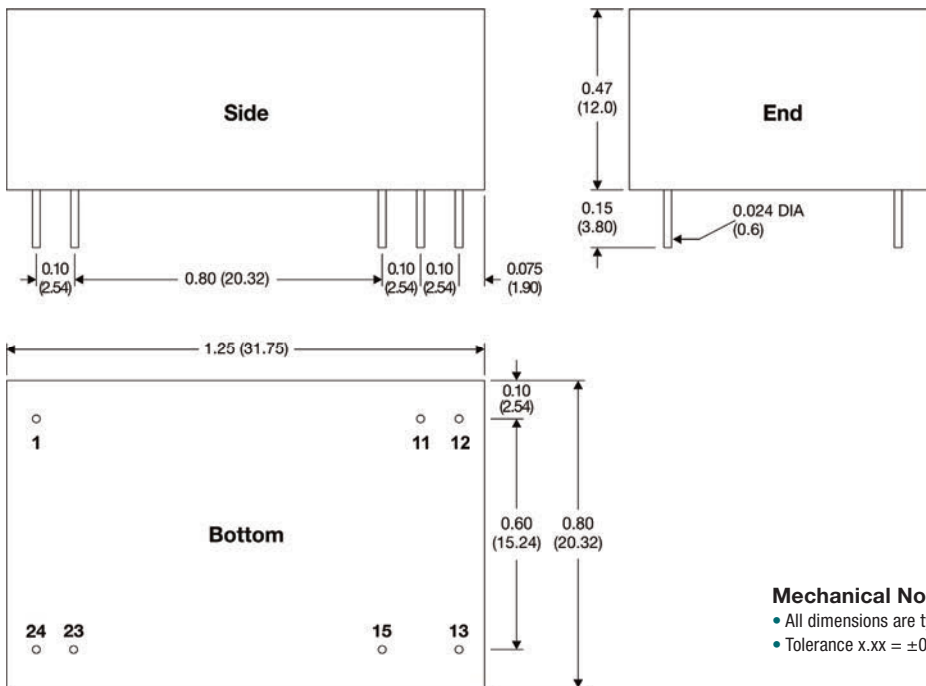
To meet the EN 61000-4-4 and EN 61000-4-5 limits, the components in the table at right must be connected across the input pins of the module. These components should be mounted as close to the module as possible.

**Input Component Values**

Model	D1	C1
5V Input	V10P45	1,000 $\mu\text{F}/100\text{V}$
12V Input	---	470 $\mu\text{F}/100\text{V}$
24V Input	---	330 $\mu\text{F}/100\text{V}$
48V Input	---	220 $\mu\text{F}/100\text{V}$

EMI Characteristics			
Parameter	Standard	Criteria	Level
Conducted Emissions	EN 55011 4 <sup>TH</sup> Edition		Class A
Radiated Emissions	EN 55011 4 <sup>TH</sup> Edition		Class A
ESD	EN 61000-4-2	A	$\pm 15$ kV Air
			$\pm 8$ kV Contact
RS	EN 61000-4-3	A	10V/m
EFT, See Note at right	EN 61000-4-4	A	$\pm 2$ kV
Surge, See Note at right	EN 61000-4-5	A	$\pm 2$ kV
CS	EN 61000-4-6	A	10 Vrms
PFMF	EN 61000-4-8	A	30A/m

**Mechanical Dimensions**



**Pin Connections**

Pin	Single	Dual
1	+VIN	+VIN
11	No Pin	Common
12	-VOUT	No Pin
13	+VOUT	-VOUT
15	No Pin	+VOUT
23	-VIN	-VIN
24	-VIN	-VIN

**Mechanical Notes:**

- All dimensions are typical in inches (mm)
- Tolerance x.xx =  $\pm 0.01$  ( $\pm 0.25$ )

# Medical Approved Power Products

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