

# MA600MRW15

## EN 60601 Approved 2:1 Input, DIP, 6W DC/DC Converters



### Key Features:

- EN 60601 3<sup>RD</sup> Ed. Approved
- 6W 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
- 4.667 MH MTBF



MicroPower Direct



### 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 Start Voltage	12 VDC Input			9.0	VDC	
	24 VDC Input			18.0		
	48 VDC Input			36.0		
Under Voltage Shutdown	12 VDC Input		8.0		VDC	
	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						
Parameter	Conditions	Min.	Typ.	Max.	Units	
Output Voltage Accuracy				$\pm 1.0$	%	
Output Voltage Balance	Dual Output, Balanced Loads		$\pm 0.5$	$\pm 2.0$	%	
Line Regulation	VIN = Min to Max			$\pm 0.5$	%	
Load Regulation, IOUT = 0% to 100%	Single Output			$\pm 0.5$	%	
	Dual Output			$\pm 1.0$	%	
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						
Parameter	Conditions	Min.	Typ.	Max.	Units	
Isolation Voltage	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						
Parameter	Standard	Criteria		Level		
	See Page 3					
Environmental						
Parameter	Conditions	Min.	Typ.	Max.	Units	
Operating Temperature Range	Ambient	-40	+25	+95	°C	
	Case			+105		
Storage Temperature Range		-50		+125		
Cooling	Free Air Convection					
Humidity	RH, Non-condensing			95	%	
Physical						
Case Size	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	4.667			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)	12 VDC Input			12.0	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.

# Model Selection Guide

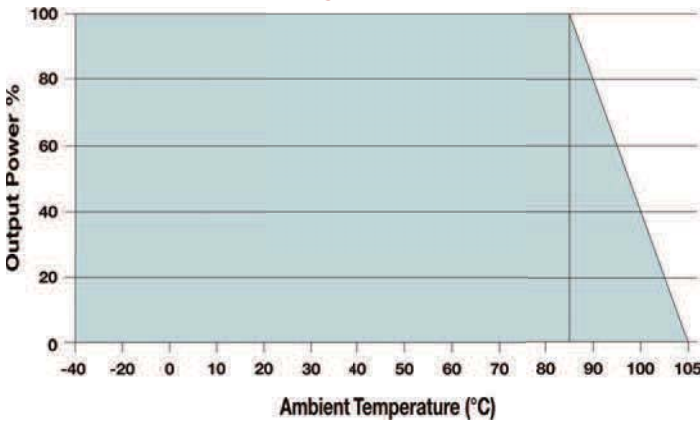
Model Number	Input				Output			Over Voltage Protection (VDC)	Efficiency (% Typ)	Capacitive Load (µF Max)	Fuse Rating Slow-Blow (mA)
	Voltage (VDC)		Current (mA)		Voltage (VDC)	Current (mA, Max)	Current (mA, Min)				
	Nominal	Range	Full-Load	No-Load							
MA612SMRW-05RI5	12	9.0 - 18.0	595	10	5.0	1,200	0.0	6.2	84	1,500	1,200
MA612SMRW-12RI5	12	9.0 - 18.0	575	10	12.0	500	0.0	15.0	87	260	1,200
MA612SMRW-15RI5	12	9.0 - 18.0	581	10	15.0	400	0.0	18.0	86	210	1,200
MA612DMRW-12RI5	12	9.0 - 18.0	575	10	±12.0	±250	0.0	±15.0	87	150	1,200
MA612DMRW-15RI5	12	9.0 - 18.0	575	10	±15.0	±200	0.0	±18.0	87	110	1,200
MA624SMRW-05RI5	24	18.0 - 36.0	298	8	5.0	1,200	0.0	6.2	84	1,500	600
MA624SMRW-12RI5	24	18.0 - 36.0	287	8	12.0	500	0.0	15.0	87	260	600
MA624SMRW-15RI5	24	18.0 - 36.0	287	8	15.0	400	0.0	18.0	87	210	600
MA624DMRW-12RI5	24	18.0 - 36.0	291	8	±12.0	±250	0.0	±15.0	86	150	600
MA624DMRW-15RI5	24	18.0 - 36.0	287	8	±15.0	±200	0.0	±18.0	87	110	600
MA648SMRW-05RI5	48	36.0 - 75.0	149	5	5.0	1,200	0.0	6.2	84	1,500	300
MA648SMRW-12RI5	48	36.0 - 75.0	144	5	12.0	500	0.0	15.0	87	260	300
MA648SMRW-15RI5	48	36.0 - 75.0	140	5	15.0	400	0.0	18.0	89	210	300
MA648DMRW-12RI5	48	36.0 - 75.0	144	5	±12.0	±250	0.0	±15.0	87	150	300
MA648DMRW-15RI5	48	36.0 - 75.0	142	5	±15.0	±200	0.0	±18.0	89	110	300

**Notes:**

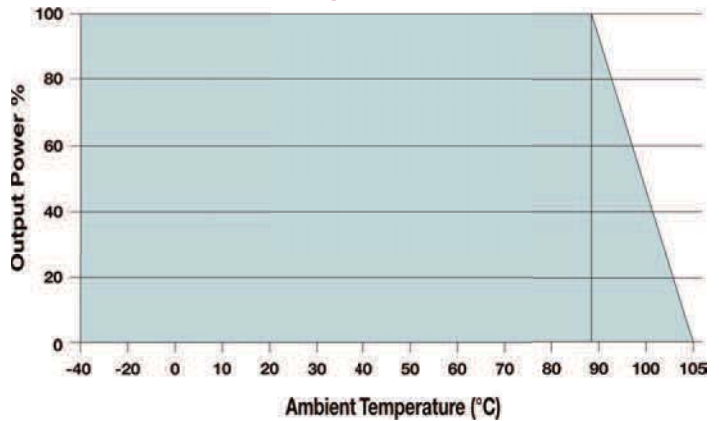
1. The specified maximum capacitive load is for each output.
2. Cross regulation is measured with the +Vout (pin 13) set to 50% load and the -Vout (pin 12) varied from 25% to 100% load.
3. Output ripple is measured with an external 1 µF/25V MLCC connected from the +Vout pin to the -Vout pin for single output units and from each output to common for dual output units.
4. Transient recovery is measured to within a 1% error band for a load step change of 75% to 100%.
5. Dual output units may be connected to provide a 24 VDC or 30 VDC output. To do this, connect the load across the positive (+Vout) and negative (-Vout) outputs and float the output common.

6. 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 12V input units a 10.0 µF is recommended, for 24V a 4.7 µF and for 48V units a 2.2 µF.
7. 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.

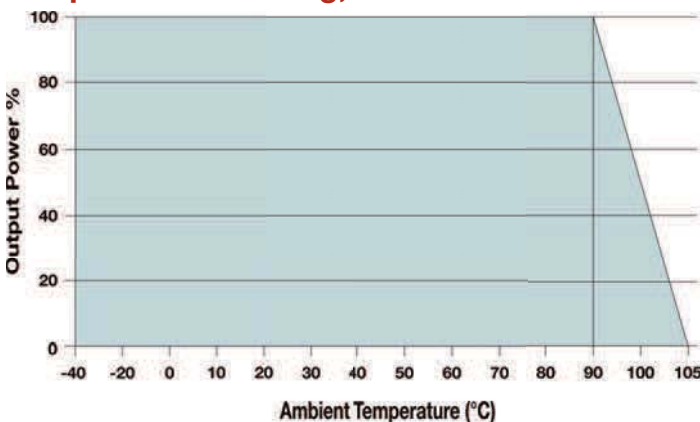
### Temperature Derating, 20 LFM (Ambient Air)



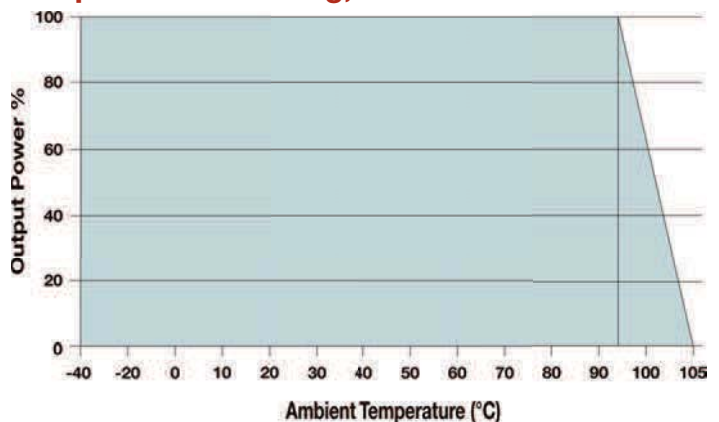
### Temperature Derating, 100 LFM



### Temperature Derating, 200 LFM



### Temperature Derating, 400 LFM



## Typical Connection/ EMI Characteristics

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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 ( $C_1$ ). 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.

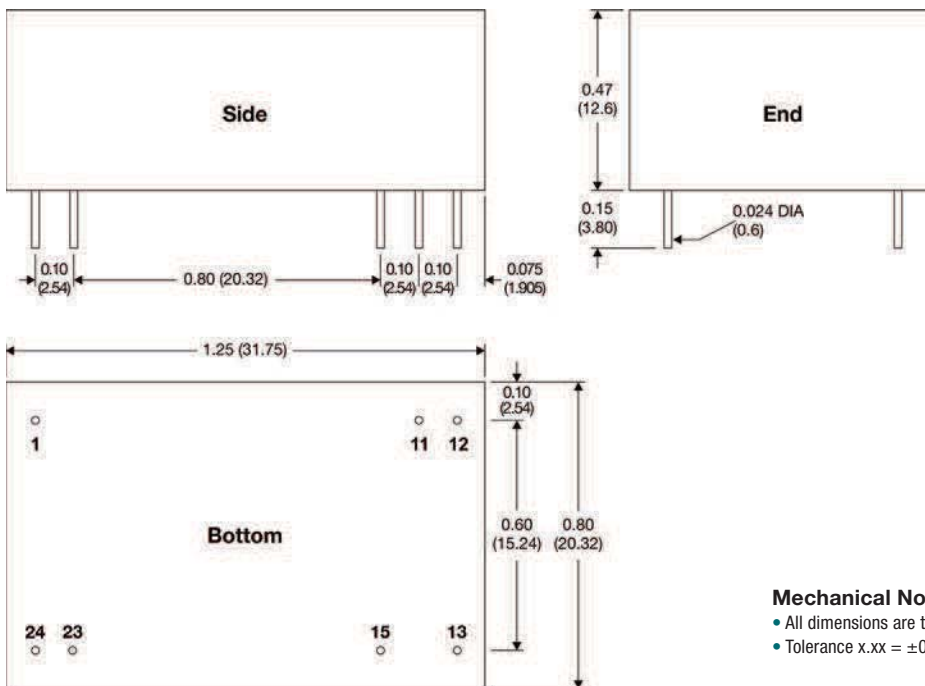
To meet the EN 61000-4-4 and EN 61000-4-5 limits, the components in the table at right must be connected across the input pins of the module. These components should be mounted as close to the module as possible.

### Input Component Values

Model	$C_1$
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

Thousands of standard power products ranging from 0.5W to 500W are available from MPD in a wide variety of packages and pin-outs. This includes many more DC/DC and AC/DC product families with EN 60601 medical approval. Go to [micropowerelectronics.com](http://micropowerelectronics.com) for full information.

