

## DESCRIPTION

The MFA160 is a series of high efficiency, small form factor AC-DC power supplies for use in medical and dental applications.

Offering 160W of regulated DC power from in an industry standard 2x4x1 inch open-frame form factor, the MFA160 series offers designers of medical and dental electronic equipment the opportunity to reduce the system form factor and increase performance.

The MFA160 complies with IEC601 safety and EMC certification, offers a low leakage current of <200µA with a creepage and clearance of > 8mm.

The MFA160 series is available in four different high power output voltages at 5V, 12V, 24V or 48V and is equipped with an auxiliary low power 12V output, which can be used as the supply voltage for an external fan.



**2 YEAR WARRANTY**

## KEY FEATURES

160 W PFC Power Supply  
 Very small form factor of 2 x 4 x 1 in  
 Extremely high efficiency > 90% (typ.)  
 5, 12, 24 and 48 V standard output variants  
 RoHS-6 Compliant (Directive 2002/95/EC)

Universal Input Voltage Range  
 OVP and Short Circuit Protection  
 Over Temperature Protection  
 Auxiliary Fan + 12V Output

## TARGET APPLICATIONS

Medical Electronics  
 Dental Electronics

Lab Equipment  
 Healthcare Diagnostics

## MODELS AND OUTPUT SPECIFICATIONS

Model	V1	I1 Current <sup>1</sup> Convection	I1 Current <sup>2,3</sup> Fan Cooled	V1 Ripple <sup>4</sup> Pk-Pk	V2	I2 Current <sup>1</sup> Convection	I2 Current <sup>2,3</sup> Fan Cooled
<b>MFA160-US05</b>	5 V	14 A	20,6 A	50 mV	12 V	0.5 A	0.5 A
<b>MFA160-US12</b>	12 V	8,3 A	13,3 A	120 mV	12 V	0.5 A	0.5 A
<b>MFA160-US24</b>	24 V	4,2 A	6,66 A	240 mV	12 V	0.5 A	0.5 A
<b>MFA160-US48</b>	48 V	2,1 A	3,33 A	480 mV	12 V	0.5 A	0.5 A

<sup>1</sup> The combined output power of V1 and V2 must not exceed 70W for 5V model or 100W for 12, 24 and 48V models when convection cooled.

<sup>2</sup> The combined output power of V1 and V2 must not exceed 100W for 5V model or 160W for 12, 24 and 48V at 400LFM.

<sup>3</sup> The fan is rated at 200LFM for the 5V unit and 500LFM for 12, 24 and 48V units.

<sup>4</sup> Measured at 20MHz Bandwidth.

## INPUT SPECIFICATIONS

Specification	Test Conditions / Notes	Minimum	Nominal	Maximum	Units
AC Input Voltage		90	115/230	264	V <sub>AC</sub>
DC Input Voltage		170		370	V <sub>DC</sub>
Input Frequency		47		63	Hz
Input Current	100/200 V <sub>AC</sub>			2.5/1.25	A
Inrush Current	230 V <sub>AC</sub> Cold start, No Damage				
Efficiency	Rated at full load, Nominal V <sub>IN</sub>				
	5 V Unit		85%		
	12, 24, 48 V Units		90%		
Power Factor	90 V <sub>AC</sub>		0.98		
Harmonic Current Limit	Complies with EN-61000-3-2		D		
No Load Power Consumption	115 V <sub>AC</sub>		2.5		W
	230 V <sub>AC</sub>		2.3		W
Leakage Current	264 V <sub>AC</sub> , 60 Hz			250	µA

## OUTPUT SPECIFICATIONS

Specification	Test Conditions / Notes	Minimum	Nominal	Maximum	Units
Output Voltage V1	5 V	4.95	5	5.05	V
	12 V	11.88	12	12.12	V
	24 V	23.76	24	24.24	V
	48 V	47.52	48	48.48	V
Output Power V1	5 V Unit			70	W
Convection Rating	12, 24, 48 V Units			100	W
Output Power V1	5 V Unit			100	W
500 LFM Fan Rating	12, 24, 48 V Units			160	W
Output Voltage V2	All Models			12	V
Output Current V2	All Models, from convection to 500 LFM cooling			0.5	A
Voltage Set Point Accuracy	Main Output (V1)			± 1%	
Voltage Adjustment Range	Main Output (V1)			± 5%	
Line regulation	90-264 V <sub>AC</sub> (V1)			± 0,1%	
Load Regulation	V1			± 1%	
	V2 at 50% Load			± 20%	
Cross Regulation	V1: Test at 50% Full Load on V1 and 0-100% Load Swing on V2			± 1%	
Cross Regulation	V2: Test at 50% Full Load on V2 and 0-100% Load Swing on V1			± 15%	
Transient Response (Voltage Deviation)	50% Load Changes at 0.1A/µs 5V at 2000µF Load / I <sub>out</sub> > 1A 12V at 1000µF Load / I <sub>out</sub> > 1A 24V at 470µF Load / I <sub>out</sub> > 0.5A 48V at 220µF Load / I <sub>out</sub> > 0.5A			± 5%	
Ripple & Noise	Peak-to-peak 20MHz Bandwidth			1%	
Rise Time	230 V <sub>AC</sub> at Minimum Load	0,2		20	ms
Start-up Delay				1000	ms
Turn-on Overshoot	Percentage of V1		10%		
	Percentage of V2		30%		
Hold-up Time	5V Unit at Full Load	22			ms
	12, 24, 48 V Units at Full Load	16			ms
Minimum Load		0			A
Temperature Drift		-0,25		+ 0,25	mV/°C

## PROTECTION FEATURES, SAFETY APPROVALS

Specification	Test Conditions / Notes	Minimum	Nominal	Maximum	Units
<b>Input Fuse</b>	Line and Neutral		2.5		A
<b>Over Current Protection</b>	Auto Recovery, Hiccup Mode	110		150%	I <sub>max</sub>
<b>Over Voltage Protection</b>	Under fault conditions, the maximum voltage			130%	V <sub>1max</sub>
<b>Short Circuit Protection</b>	Auto Recovery, Hiccup Mode		Yes		
<b>Over Temperature Protection</b>	Shutdown with Auto Recovery			Yes	
<b>Isolation Input/ Output</b>		4000			V <sub>AC</sub>
<b>Isolation Input/ Ground</b>		1500			V <sub>AC</sub>
<b>Isolation V1/ V2</b>		100			V <sub>DC</sub>
<b>Isolation Output/ Ground</b>		500			V <sub>AC</sub>
<b>Creepage/ Clearance</b>		8			mm
<b>Safety Approvals</b>	cCSA <sub>US</sub> , Nemko, CB Certificate				
<b>Safety Standards</b>	IEC60601-1, EN60601-1, (3 <sup>rd</sup> Edition) UL60601-1, CSA22.2 No. 601				
<b>Agency File Numbers</b>	CSA: TBI Nemko: P12215393 CB: NO 68862 CB Report: 207331				

## ELECTRO-MAGNETIC COMPATABILITY EMC

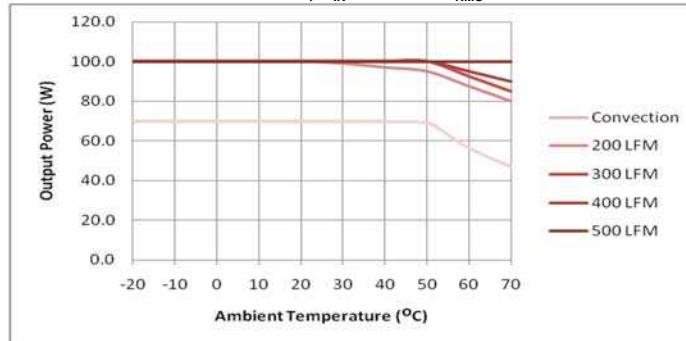
Specification	Test Conditions / Notes	Standard	Performance criteria
<b>Conducted EMI</b>	Class B	EN 55022 EN 60601-1-2	B
<b>Radiated EMI</b>	At 10m distance	EN 55022	A
<b>Line Voltage Fluctuation &amp; Flicker</b>	At 20%, 50% and 100% Maximum Load	EN 61000-3-3	A
<b>ESD</b>	15kV air discharge, 8kV contact at any point of System Level 4	EN 61000-4-2	A
<b>Harmonic Current Emission</b>	All Load Conditions	EN 61000-3-2	D
<b>Radiated Field</b>	3V/m, 80-2500MHz, 1KHz/2Hz 80% AM modulation. Dwell time is 3 sec for 2 Hz modulation Dwell time is 1 sec for 1KHz modulation	EN 61000-4-3	A
<b>EFT</b>	2KV on AC and DC 5KHz repetition 1KV on I/O	EN 61000-4-4	A
<b>Surge</b>	2KV CM, 1KV DM (5min surges at each phase angle)	EN 61000-4-5	A
<b>Conducted RF Immunity</b>	3 V <sub>RMS</sub> , 0,15 - 80 MHz, 1 KHz/2 Hz 80% AM modulation.	EN 61000-4-6	A
<b>Magnetic Field Immunity</b>	50 and 60 Hz, 3 A/m	EN 61000-4-8	A
<b>Dips and Interruptions</b>	Dip to 40% for 5 cycles (100ms) Dip to 70% for 25 cycles (500ms) Drop-out to 5% for 10 ms Interrupts > 95% for 5 s	EN 61000-4-11 EN 61000-4-11 EN 61000-4-11 EN 61000-4-11	B B B C

## ENVIRONMENTAL SPECIFICATIONS

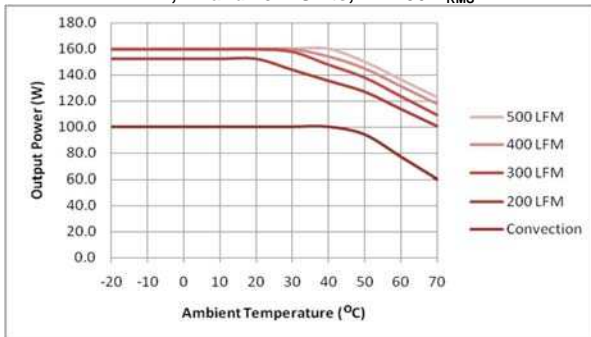
Specification	Test Conditions / Notes	Min	Nominal	Max	Units
<b>Operating Temperature Range</b>	No de-rating up to 50°C	-20		50	°C
<b>De-rated Operating Temperature Range</b>	Linearly de-rate from full load at 50°C to 60% load at 70°C			70	°C
<b>Storage Temperature Range</b>		-40		85	°C
<b>Humidity</b>	RH, Non-condensing Operating			90	%
	Non-operating			95	%
<b>Operating Altitude</b>				3000	m
<b>Shock</b>	Operating: Half-sine 11ms, 2 shock on each axis			10	G
	Non-operating: Half-sine 2ms, 2 shock on each axis			140	G
<b>Vibration</b>	Operating: 5-500Hz, 3 axis			2	G
<b>MTBF</b>	75% Full Load, Nominal $V_{IN}$ , 25°C, MIL-HDBK-217-E-1	235000			Hours
<b>Cooling</b>	See Graph and Application Notes	Convection		500	LFM

## COOLING, POWER DE-RATING CURVES

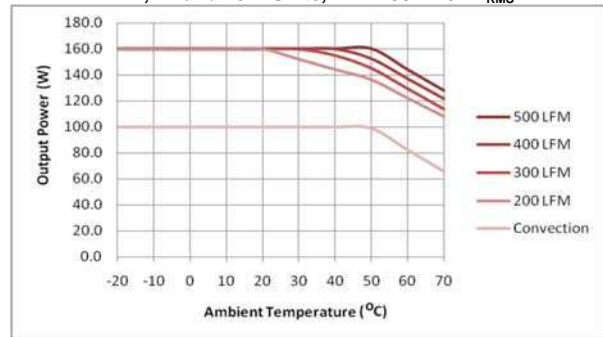
5 V Units,  $V_{IN}$ : 90 – 264  $V_{RMS}$



12, 24 and 48 V Units,  $V_{IN}$ : 90  $V_{RMS}$

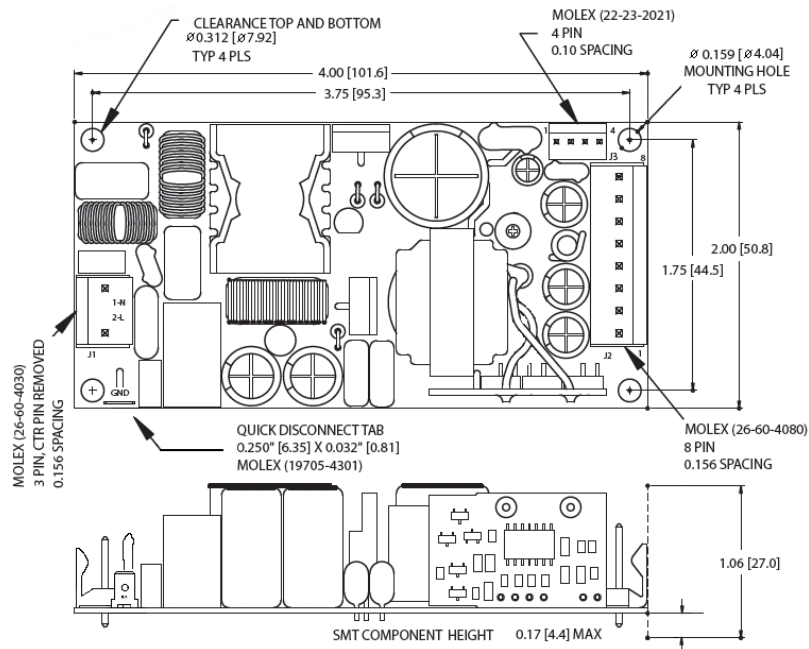


12, 24 and 48 V Units,  $V_{IN}$ : 100 – 264  $V_{RMS}$



## MECHANICAL SPECIFICATION

Connector	Manufacturer and Part Number
<b>Input Connector J1</b>	Molex 26-60-4030 or equivalent
<b>J1 Mating Connector</b>	Molex 09-91-0300 (Crimp Terminal Housing) Molex 08-50-0105 (Crimp Terminal, 18-24 AWG)
<b>Ground Connector GND</b>	Molex 19705-4301 or equivalent
<b>Ground Mating Connector</b>	Molex 0190030001 or equivalent
<b>Output Connector J2</b>	Molex 26-60-4080 or equivalent
<b>J2 Mating Connector</b>	Molex 09-91-0800 (Crimp Terminal Housing) Molex 08-50-0105 (Crimp Terminal, 18-24 AWG)
<b>Output Connector J3</b>	Molex 22-23-2041 or equivalent
<b>J3 Mating Connector</b>	Molex 22-01-2047 (Crimp Terminal Housing) Molex 08-50-0113 (Crimp Terminal, 22-30 AWG)



Input Connector J1	
Pin Number	Pin Function
1	AC Neutral
2	AC Line

Input Ground Connector GND	
Pin Number	Pin Function
GND	AC Ground

Output Connector J2	
Pin Number	Pin Function
1	DC Return
2	DC Return
3	DC Return
4	DC Return
5	V1
6	V1
7	V1
8	V1

Output Connector J3	
Pin Number	Pin Function
1	Ground
2	Ground
3	12V (Fan)
4	12V (Fan)



Recommended Air Flow Direction

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