MEDICAL, 2XMOOP/MOPP, CLASS I /II, 160W AC-DC POWER SUPPLY

MFA160 Series

Certifications

Applications

Medical

High Efficiency

2 YEARS Warranty

FEATURES

- Universal input voltage range (90 – 264 V_{AC})
- 160 W rated power (100 W natural convection cooling)
- Compact standard form factor (2 x 4 x 1 in)
- High efficiency (91% typical)
- 5, 12 or 24 V_{DC} standard output voltages
- Active PFC, EN61000-3-2 compliant (Class C, >50% load).
- Low earth / touch leakage current (<100 µA for Class II)
- Class I and Class II protection class variants
- Over temperature protection
- Output over current, short circuit, over voltage protection
- Auxiliary / fan 12 VDC, 0.5 A output.
- Medical safety approval to IEC 60601-1 3rd edition
- IEC 60601-1-2 4th edition EMC compliant (Class II variants)
- RoHS 3 compliant (Directive 2015/863/EU)
- 4000 m altitude operation

MARKET SEGMENTS AND APPLICATIONS

- Class I / Class II medical equipment
- Portable / Home health care equipment
- Laboratory / Analysis Equipment
- Electromagnetic / Laser aesthetical appliances

PRODUCT DESCRIPTION

The MFA160 is a series of high efficiency, small form factor single output AC-DC medical approved power supplies.
The 5V variant comes as IEC Class II and operator protection (MoOP), the 12V variant comes as IEC Class I and operator protection (MoOP), the 24V variant is available as Class I or Class II IEC installation classes, MoOP or MoPP protection degree and as pollution degree 2.

The series provide a steady 160 W of regulated DC power from an open-frame 2 x 4 x 1" standard form factor which makes easier its integration into space constrained systems.
By converting energy at 91% typical efficiency, the series generate less heat which facilitating thermal management into a system.
The series comes in 5, 12 or 24 V_{DC} standard output voltages and offers an auxiliary 12 V_{DC}, 0.5 A output. It can deliver full output power from -20 to 50 °C at 500 LFM airflow and can be operated up to 70 °C applying output power derating. When natural convection cooled, the 12, 24Vvariants can deliver a steady 100 W, and the 5V, 70 W up to 50 °C ambient.
All MFA160 variants can be operated up to 4000 m without de-rating thanks to PCB Creepage and clearance greater than 8 mm.
Protection features include fuses on both AC lines, output over-current, short-circuit, output over-voltage and over-temperature.
The MFA160 series comply with the 3rd edition of the IEC/EN 60601-1 and ANSI/AAMI ES60601-1 safety standards for medical equipment. It meets the EN 60601-1-2 EMC limits of Class B for conducted emissions, the IEC/EN 61000-3 for harmonic content and EN 55011 / EN 660601-2 4th edition for EMC immunity.

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Model Coding and Output Ratings

MFA	160	-USxx	-2 / -3	PP
Medical grade	160 W Rated Power	Output voltages: 5, 12, 24 V_{DC}	Class II installation	2xMoPP Patient protection

Available Model Numbers	V1 [V]	I1[1] Convection [A]	I1[1] Forced air [A]	V1[2] Ripple [mV]	V2 [V]	I2[1] Rated [A]	V2[2] Ripple [mV]
MFA160-US05-2	5	14	20	50	12	0.5	240
MFA160-US12	12	8.3	13.3	120	12	0.5	240
MFA160-US24	24	4.1	6.6	240	12	0.5	240
MFA160-US24-3 PP	24	4.1	6.6	240	12	0.5	240

1 The combined output power of V1 and V2 must not exceed 70 W for the 5V and 100 W for the other variants, when natural convection cooled, up to 50 °C ambient. The combined output power of V1 and V2 must not exceed 100 W for the 5V and 160 W for other variants when forced air cooled at 500 LFM, up to 50 °C ambient. In both convection or forced air cooling de-rating applies above 50 °C ambient (see output power – ambient temperature graphs below).
2 Peak-to-Peak measured at 20 MHz Bandwidth

Input Specifications

Specification	Test Conditions / Notes	Min.	Nominal	Max.	Units
AC Input Voltage	PS starts and operates at 90 V_{AC} at all load conditions	90	100/240	264	V_{AC}
Input Frequency		47	50/60	63	Hz
DC Input Voltage		170	-	300	V_{DC}
Input Current	RMS at 90 V_{AC} , maximum load	-	-	2.3	A
Inrush Current (peak)	No damage at 230 V_{AC} , cold start/hot start.				
Fusing	2.5 A, Time Lag, 250 V on L and N	-	2.5	-	A
Efficiency	115 V_{AC} , full load 230 V_{AC} , full load	- -	90 91	- -	%
No load Power Consumption	115 V_{AC} 230 V_{AC}	- -	2.5 2.3	- -	W
Power Factor	At full rated load, 115 V_{AC} , 60 Hz 230 V_{AC} , 50 Hz	 0.98 0.89	 - -	 - -	
Harmonic Current Fluctuations and Flicker	Complies with EN-61000-3-2 Class D at 230 V_{AC} 50 Hz. Complies with EN-61000-3-3 at nominal voltages and full load.				
Earth Leakage Current	264 V_{AC} , 60 Hz, normal condition, Class II 264 V_{AC} , 60 Hz, normal condition, Class I	- -	- -	100 200	µA

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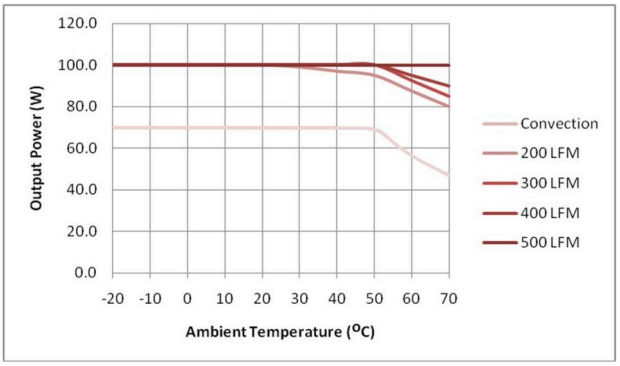
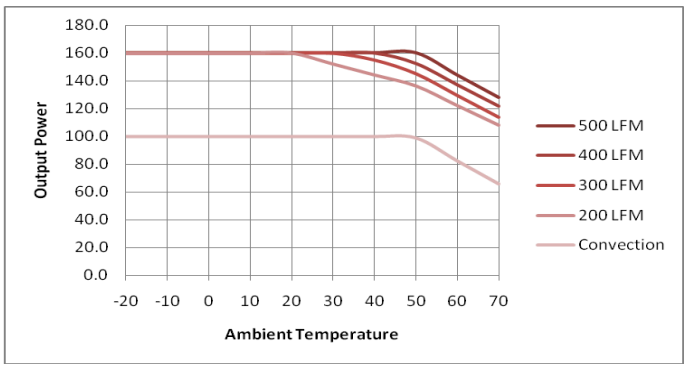
Output Specifications

Specification	Test Conditions / Notes	Min.	Nom.	Max.	Units
V1 Set Point Accuracy			±1	-	%
V1 Output Power Rating	Natural convection 500 LFM forced air	- -	- -	100 160	W
V2 Output Voltage	15% accuracy	10.2	12	13.8	V
V2 Output Current		-	-	0.5	A
V1 Voltage Adjustment Range		-	-	±5	%V1
Load Regulation	V_{AC}: nominal voltages V1 Load: 0 – 100% rated V2 Load: 0 – 0.5 A	- -	- -	±1 ±5	%V1 %V2
Load-Line Cross Regulation	V_{AC}: 90 – 264 V_{RMS} V1: 0 – 100% load (V2 at 50% load) V2: 0 – 0.5 A load (V1 at 50% load)	- -	- -	±1 ±15	%V1 %V2
V1 Line Regulation	V_{AC}: 90 – 264 V_{RMS}	-	-	±0.1	%V1
V1 Transient Response (Voltage Deviation)	50% load changes at 0.1 A/µs Recovery to regulation band within 1 ms	-	-	10	%V1
V1 Ripple and Noise	Peak-to-peak, 20 MHz BW.	-	-	1	%V1
Start-up Rise Time	90<V_{IN}<264, any load conditions.	0.2	-	5	ms
Start-up Delay	V1 in regulation after AC is applied	-	-	1000	ms
Turn-on Overshoot		-	10	-	%V1
Hold-up Time	At nominal V_{IN}, rated load, all models	16	-	-	ms
Minimum Load	V1, V2	0	-	-	A
Temperature Drift		-	±0.25	-	mV/°C

Output Power De-rating vs Ambient temperature. V_{IN}: 100 – 264 V_{RMS}

5 V **12, 24 V**





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Protection Features

Specification	Test Conditions / Notes	Min.	Nominal	Max.	Units
Input Fuse	Time Lag 2.5 A, 250 V on L and N				
Over Current	Hiccup mode, auto-recovery	110	-	150	$\%I_{1MAX}$
Short Circuit	Hiccup mode, auto-recovery				
Over Voltage	Shut down, latch off mode	110	-	130	$\%V_{NOM}$
Over Temperature	Shut-down, auto-recovery				
Isolation	I-to-O, Reinforced (-PP) V1-to-V2 I-to-PE (Class I), (-PP) O-to-PE (Class I), functional	4000 100 1500 500	- - - -	- - - -	V_{AC} V_{AC} V_{AC} V_{DC}
Creepage and Clearance		8	-	-	mm

Environmental Specifications

Specification	Test Conditions / Notes	Min	Nominal	Max	Units
Operating Temperature[3]	No de-rating up to 50°C, 50% load at 70°C Linearly de-rate above 50 °C	-20	-	70	°C
Storage Temperature Range		-40	-	80	°C
Cooling[3]	5V: above 70 W output Other variants: above 100 W Output	200	-	500	LFM
Relative Humidity	Non-condensing	-	-	95	%
Operating Altitude		-	-	4000	m
Shock	**EN 60068-2-27** Operating: Half sine, 30 g, 18 ms, 3 axes, 6x each (3 positive and 3 negative). Non-Operating: Half sine, 50 g, 11 ms, 3 axes, 6x each (3 positive and 3 negative).				
Vibration	**EN 60068-2-64** Operating: Sine,10 – 500 Hz, 1 g, 3 axes, 1 oct/min., 60 min. Random, 5 – 500 Hz, 0.02 g2/Hz, 1 g_{RMS}, 3 axes, 30 min. Non-Operating: 5 – 500 Hz, 2.46 g_{RMS} (0.0122 g2/Hz), 3 axes, 30 min.				
Pollution Degree	PD 2				
MTBF	>200.000 hours (5V variant) at 75% Full Load, Nominal V_{AC}, 25 °C ambient MIL-HDBK-217-E-1				
Life Time	At 100 W, natural convection, 40 °C ambient, nominal VIN, 100% duty cycle (IPC 9592)	-	5	-	Years

3 See de-rating curves below

Electromagnetic Compatibility (EMC) – Emissions

Phenomenon	Conditions / Notes	Standard	Equipment/Performance Class
Conducted	115 V_{RMS}, 230 V_{RMS}. Maximum load.	EN 60601-1-2	B
Radiated	At 10 m distance	EN 60601-1-2	A
Line Voltage Fluctuation and Flicker	At 20%, 50% and 100% maximum load. Nominal input voltages.	EN 61000-3-3	
Harmonic Current Emission	Nominal input voltages. All load conditions.	EN 61000-3-2	D

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Electromagnetic Compatibility (EMC) – Immunity

Phenomenon	Conditions / Notes	Standard	Test Level	Performance criteria
	Reference standard for the medical version	**EN 60601-1-2, 4th Edition**		
ESD	15 kV air discharge, 8 kV contact, at any point of the system.	EN 61000-4-2	4	A
Radiated Field	3 V/m, 80-1000 MHz, 80% AM, 3 m distance	EN 61000-4-3	3	A
Electric Fast Transient	±2 kV on AC power port ±1 kV on signal/control lines	EN 61000-4-4	3	A
Surge	±1 kV line-to-line ±2 KV line to earth ±0.5 kV for outdoor cables	EN 61000-4-5	3	A
Conducted RF Immunity	3 V_{RMS}, 0,15-80 MHz, 80% AM	EN 61000-4-6	3	A
Magnetic Field Immunity	50 and 60 Hz, 3 A/m			
Dips and Interruptions	**At 100 V_{AC}** 100% dip (0 V_{AC}) for 10 ms 100% dip (0 V_{AC})) for 20 ms 60% dip (40 V_{AC}) for 100 ms 30% dip (70 V_{AC}) for 500 ms 100% dip (0 V_{AC}) for 5000 ms	EN61000-4-11		 A A B A B
	At 240 V_{AC} 100% dip (0 V_{AC}) for 10 ms 100% dip (0 V_{AC}) for 20 ms 60% dip (96 V_{AC}) for 100 ms 30% dip (168 V_{AC}) for 500 ms 100% dip (0 V_{AC}) for 5000 ms	EN61000-4-11		 A A A A B

Safety Agencies Approvals

Certification Body	Safety standards and file numbers	Agency files references
UL / CSA	ANSI AAMI ES60601-1:2005/(R)2012 and A1:2012, C1:2009/(R)2012 and A2:2010/(R)2012 CAN/CSA C22.2 NO. 60601-1:14 (R2018)	Ask Inission Power for reference
IEC IECE **CB Certification**	IEC 60601-1 edition 3.1 2012	Ask Inission Power for reference
CE	Directive 93/42/CEE: Safety Requirements of Medical Devices	
	Low Voltage Directive (LVD) 2014/35/EU	
	Electro-magnetic Compatibility (EMC) 2014/30/EU	
	RoHS 3 Directive 2015/863/EU	

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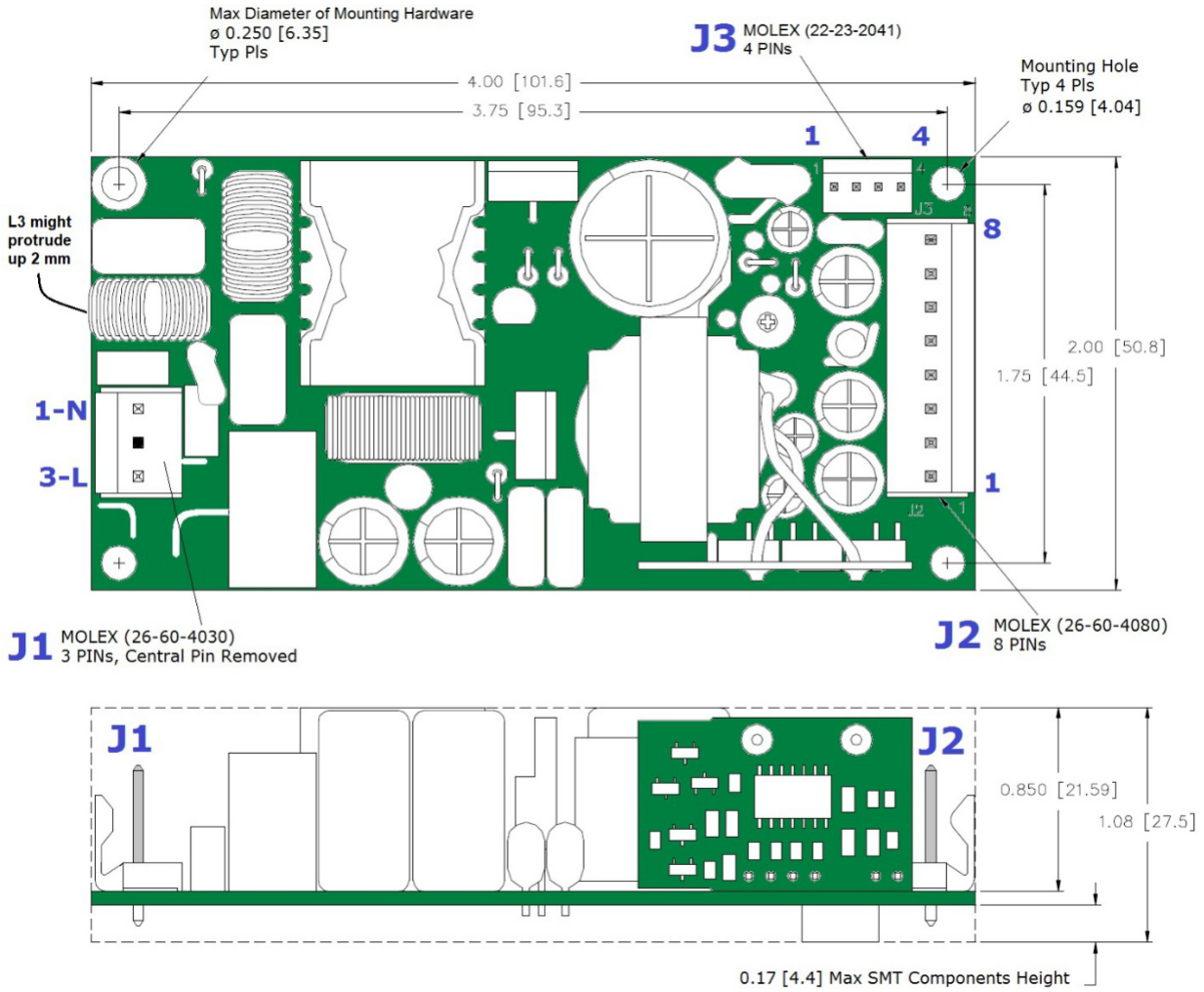
Outline Drawing and Connections

OVERALL DIMENSIONS: 50.8 x 101.6 x 27.5 mm (2.00 x 4.00 x 1.08 in)
WEIGHT: 160 g (0.35 lb)



Forced air cooling: Air flow direction, longitudinal or transverse, must be coplanar to the PCB no matter its orientation.

Connector	Manufacturer and Part Number	Pin Assignment
AC Input Connector J1	Molex 26-60-4030 or equivalent	**1: AC Line 1; 2:** Not present; **3:** AC Line 2
J1 Mating Connector	Molex 09-93-0300 (Crimp Terminal Housing) Molex 08-50-0105 (Crimp Terminal, 18-24 AWG)	
Output Connector J2	Molex 26-60-4080 or equivalent	**1 ÷ 4:** V1 RTN; **5 ÷ 8:** +V1
J2 Mating Connector	Molex 09-91-0800 (Crimp Terminal Housing) Molex 08-50-0105 (Crimp Terminal, 18-24 AWG)	
Auxiliary Connector J3	Molex 22-23-2041 or equivalent	**1, 2:** V2 RTN; **3, 4:** +V2
J3 Mating Connector	Molex 22-01-2047 (Crimp Terminal Housing) Molex 08-50-0113 (Crimp Terminal, 22-24 AWG)	

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