

DESCRIPTION

The MFA160-US24-3 is a high efficiency, small form factor AC-DC power supplies for use in medical applications.

Offering 160 W of regulated DC power from an industry standard 2" x 4" footprint and 1" high open-frame, the MFA160-US24-3 offers designers of medical electronic equipment an extremely compact device approved for Class II applications.

The MFA160-US24-3 complies with IEC 60601-1 safety and meets EN55022 level B conducted emission with an extremely low leakage current of <math><100 \mu\text{A}</math> at 264 V_{AC}. Thanks to its enhanced creepage and clearance of >8 mm, it can be operated beyond 4000 m of altitude without de-rating.

The MFA160-US24-3 is equipped with an auxiliary low power 12 V 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 (2 x 4 x 1) in
High efficiency >90%
RoHS-6 Compliant (Directive 2002/95/EC)
Universal Input Voltage Range

Class II isolation
Extremely low leakage current
Over-Voltage and Short-Circuit Protection
Over-Temperature Protection
Auxiliary Fan +12 V Output

TARGET APPLICATIONS

Medical Electronics
Dental Electronics

Lab Equipment
Healthcare Diagnostics

MODELS AND OUTPUT SPECIFICATIONS

Model	V1	I1 Current ¹ Convection	I1 Current ^{2,3} Fan Cooled	V1 Ripple ⁴ Pk-Pk	V2	I2 Current ¹ Convection	I2 Current ^{2,3} Fan Cooled
MFA160-US24-3	24 V	4.2 A	6.66 A	240 mV	12 V	0.5 A	0.5 A

¹ The combined output power of V1 and V2 must not exceed 100 W when convection cooled.

² The combined output power of V1 and V2 must not exceed 160 W at 400 LFM.

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

⁴ Measured at 20 MHz Bandwidth.

INPUT SPECIFICATIONS

Specification	Test Conditions / Notes	Minimum	Nominal	Maximum	Units
AC Input Voltage		90	115/230	264	V _{AC}
DC Input Voltage		170		370	V _{DC}
Input Frequency		47		63	Hz
Input Current	100/200 V _{AC}			2.5/1.25	A
Inrush Current	230 V _{AC} , Cold start, No Damage				
Efficiency	50% load, 115 V _{AC}		90%		
	Convection Max load, 115 V _{AC}		89%		
	Forced air Max load, 115 V _{AC}		88%		
	50% load, 230 V _{AC}		91%		
	Convection Max load, 230 V _{AC}		91%		
	Forced air Max load, 230 V _{AC}		90%		
	Power Factor	At 115 V _{AC} , >50% max. load.	0.98		
	At 230 V _{AC} , >50% max. load.	0.88			
Harmonic Current Limit	Complies with EN-61000-3-2, Class D, 230 V _{AC} , at half and full load				
No Load Power Consumption	115 V _{AC}		2.5		W
	230 V _{AC}		2.3		W
Leakage Current	264 V _{AC} , 60 Hz			250	µA

OUTPUT SPECIFICATIONS

Specification	Test Conditions / Notes	Minimum	Nominal	Maximum	Units
Output voltage V1		23.76	24	24.24	V _{DC}
Output power V1 convection rating				100	W
Output power V1 500 LFM fan rating				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	%V _{NOM}
Voltage adjustment range	Main output (V1)			±5	%V _{NOM}
Line regulation	90 – 264 V _{AC} (V1)			±0,1	%V _{NOM}
Load regulation	V1			±1	%V _{NOM}
	V2 at 50% load			±20	%V2
Cross regulation	V1: test at 50% full load on V1 and 0-100% load swing on V2			±1	%V _{NOM}
Cross regulation	V2: test at 50% full load on V2 and 0-100% load swing on V1			±15%	%V2
Transient response (voltage deviation)	50% load changes at 0.1 A/µs 24 V at 470 µF load / I _{OUT} >0.5 A			±5	%V _{NOM}
Ripple and noise	Peak-peak 20 MHz bandwidth			1	%V _{NOM}
Rise time	230 V _{AC} at minimum load	0,2		20	ms
Start-up delay				500	ms
Turn-on overshoot	Percentage of V1		10%		
	Percentage of V2		30%		
Hold-up time	Full load	16			ms
Minimum load		0			A
Temperature drift		-1,2		+1,2	mV/°C

PROTECTION FEATURES AND SAFETY APPROVALS

Specification	Test Conditions / Notes	Minimum	Nominal	Maximum	Units
Input fuse	Live and neutral		2.5		A
Over-current protection	Auto recovery, hiccup mode	110		130%	I _{RATED}
Over-voltage protection	Under fault conditions, the maximum voltage			130%	V _{1NOM}
Short-circuit protection	Auto recovery, hiccup mode				
Over-temperature Protection	Shutdown with auto recovery				
Isolation input-output		4000			V _{AC}
Isolation input-ground	Class II rated				
Isolation V1-V2		100			V _{DC}
Isolation output-ground		500			V _{AC}
Creepage and clearance		8			mm
Safety approvals	cCSAus, Nemko, CB Certificate				
Safety standards	IEC60601-1, EN60601-1, UL60601-1, CSA22.2 No. 601				
Agency file numbers	CSA File No: Pending Nemko Certificate: P08209295/A2 CB Cert: NO 59656				

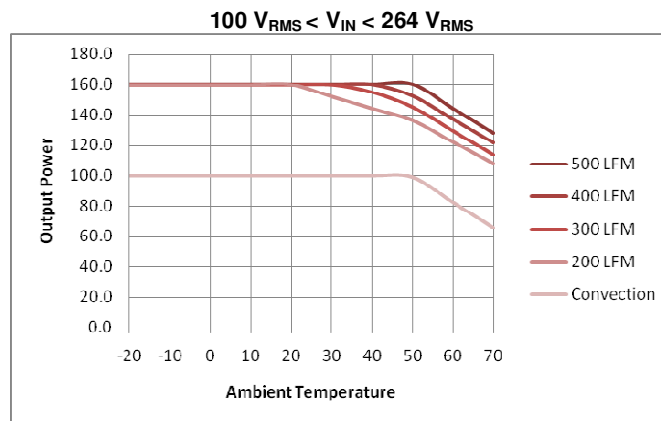
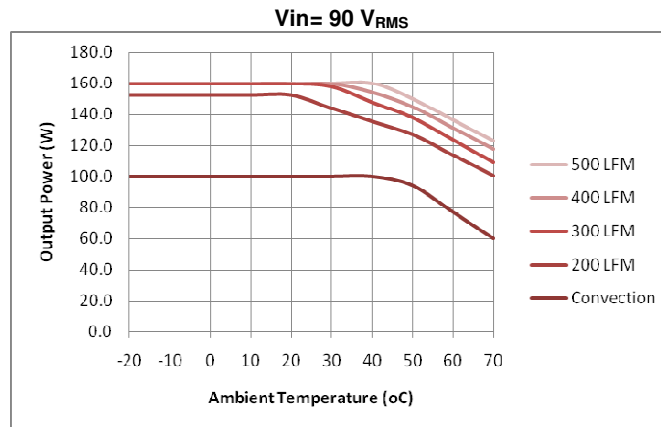
ELECTROMAGNETIC COMPATIBILITY EMC

Specification	Test conditions / Notes	Standard	Performance criteria
Conducted EMI	Class B	EN55022 EN60601-1-2	
Radiated EMI	Class A at 10 m distance	EN55022	
Harmonic current emission	All load conditions	EN61000-3-2	D
Line voltage fluctuation and flicker	At 20%, 50% and 100%, maximum load.	EN61000-3-3	A
IMMUNITY			
ESD	15 kV air discharge, 8 kV contact at any point of system, level 4.	EN61000-4-2	A
Radiated field	3 V/m, 80-2500 MHz, 1 KHz/2 Hz 80% AM. Dwell time is 3 sec for 2 Hz modulation Dwell time is 1 sec for 1 KHz modulation	EN61000-4-3	A
EFT	2 KV on AC and DC 5 KHz repetition 1 KV on I/O	EN61000-4-4	A
Surge	2 KV CM, 1 KV DM (5 min surges at each phase angle)	EN61000-4-5	A
Conducted RF immunity	3Vrms, 0.15-80 MHz, 1 KHz/2 Hz 80% AM	EN61000-4-6	A
Magnetic field immunity	50 and 60 Hz, 3 A/m	EN61000-4-8	A
Dips and interruptions	Dip to 40% for 5 cycles (100 ms) Dip to 70% for 25 cycles (500 ms) Drop-out to 5% for 10 ms Interrupts > 95% for 5 s	EN61000-4-11 EN61000-4-11 EN61000-4-11 EN61000-4-11	B B B C

ENVIRONMENTAL SPECIFICATIONS

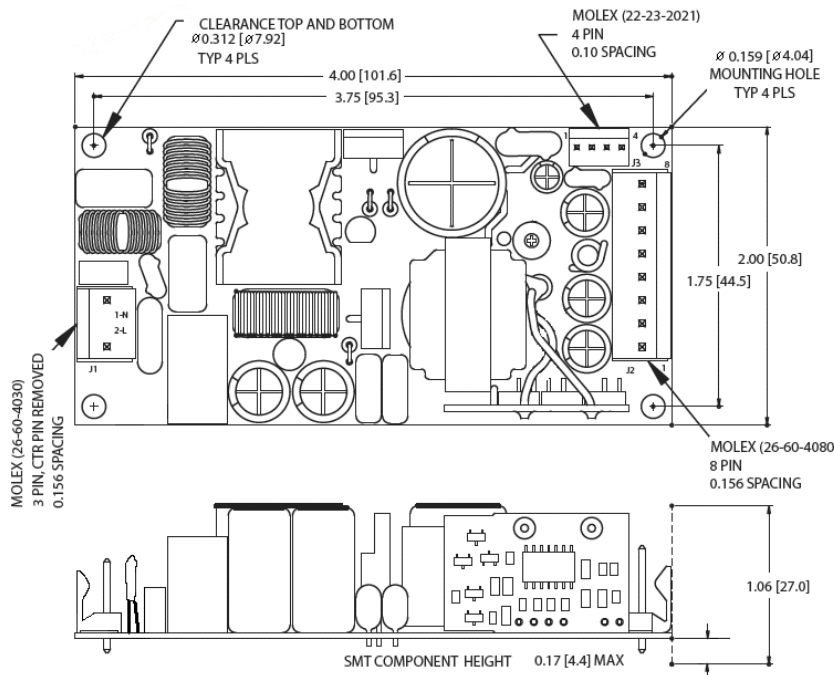
Specification	Test Conditions / Notes	Min	Nominal	Max	Units
Operating temperature range	No de-rating up to 50 °C	-20		50	°C
De-rated operating temperature range	Linearly de-rate from full load at 50 °C to 60% load at 70 °C			70	°C
Storage temperature range		-40		85	°C
Humidity	RH, Non-condensing operating			90	%
	non-operating			95	%
Operating altitude	No De-rating			4000	m
Shock	Operating: Half-sine 11ms, 2 shock on each axis			10	g
	Non-operating: Half-sine 2ms, 2 shock on each axis			140	g
Vibration	Operating: 5-500Hz, 3 axis			2	g
MTBF	75% full load, nominal V_{IN} , 25 °C, MIL-HDBK-217-E-1	235000			Hours
Cooling	See graph and application notes	Convection		500	LFM

COOLING AND POWER DE-RATING CURVES



MECHANICAL SPECIFICATION

Connector	Manufacturer and Part Number
Input connector J1	Molex 26-60-4030 or equivalent
J1 mating connector	Molex 09-91-0300 (Crimp Terminal Housing) Molex 08-50-0105 (Crimp Terminal, 18-24 AWG)
Output connector J2	Molex 26-60-4080 or equivalent
J2 mating connector	Molex 09-91-0800 (Crimp Terminal Housing) Molex 08-50-0105 (Crimp Terminal, 18-24 AWG)
Output connector J3	Molex 22-23-2041 or equivalent
J3 mating connector	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

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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