

FMH-461 EMI Input Filters

0 TO 40 VOLT INPUT – 1.5 AMP NOT RECOMMENDED FOR NEW DESIGN

FEATURES

- Fully qualified to Class H
- -55 °C to +125 °C operation
- Nominal 28 volt input, 0 to 40 volt operation
- Up to 1.5 amps throughput current
- 60 dB attenuation typical at 500 kHz
- Compliant to MIL-STD-461C CE03
- Compatible with MIL-STD-704 A-E 28 volt power bus



INPUT (V)	CURRENT (A)
0 - 40	1.5

DESCRIPTION

The Interpoint® FMH-461 Series™ of EMI filters offers up to 1.5 amps of throughput current in a low profile package. The FMH-461 filters are manufactured in our fully certified and qualified MIL-PRF-38534 Class H production facility and packaged in hermetically sealed steel cases. They are ideal for use in programs requiring high reliability and small size. They have been specifically designed to reduce the input line reflected ripple current of Interpoint MFK, MHF+, MHV, MSA+¹, MSA¹, and MTR series converters. The filter can be used to filter combinations of the lower power converters up to the rated current of the filter. They are intended for use in applications which have high frequency switch-mode DC-DC converters and which must meet MIL-STD-461C levels of conducted electromagnetic interference (EMI). Throughput current is 1.5 amps. At 16 volts input (low line), the filter provides 24 watts of throughput power.

FILTER OPERATION

FMH-461 filters are rated for full power operation from -55 °C to +125 °C baseplate temperature. In The maximum DC insertion loss at full load and nominal input voltage (28 volts) represents a power loss of less than 2%.

LAYOUT REQUIREMENTS

The case of the filter must be connected to the case of the converter through a low impedance connection to minimize EMI.

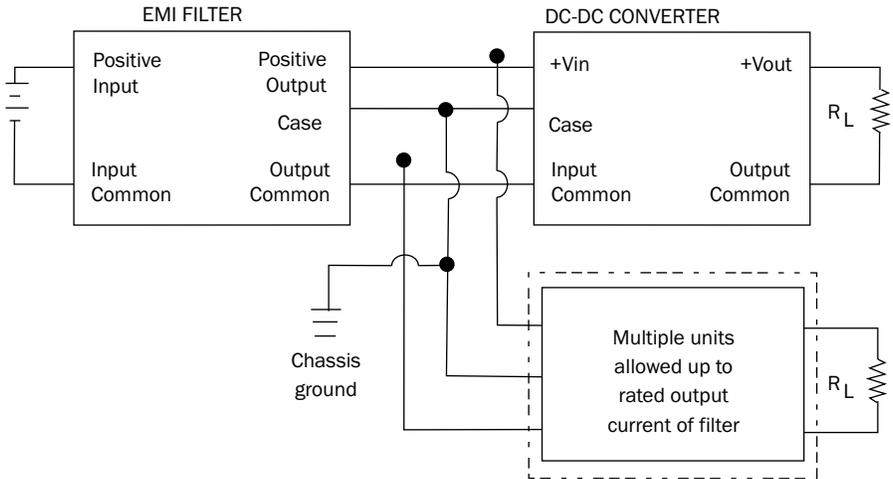
MIL-STD-461 ELECTROMAGNETIC INTERFERENCE

When used in conjunction with Interpoint converters, the FMH-461 EMI filter reduces input ripple current by 35 dB or greater at 200 kHz and by at least 50 dB at 500 kHz See Figure 6 and Figure 7 on page 5 and Table 5 and Table 6. This attenuation gives the converter/filter combination performance which exceeds MIL-STD-461C's CE03 test.

1. MSA+ Series™ and the MSA Series™ models require an inductor in series with the converter's positive input. 2 µH is the suggested value.

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The case ground connection between the filter and the converter should be as low an impedance as possible to minimize EMI. Direct contact of baseplate to chassis ground provides the lowest impedance.

FIGURE 1: CONNECTION DIAGRAM

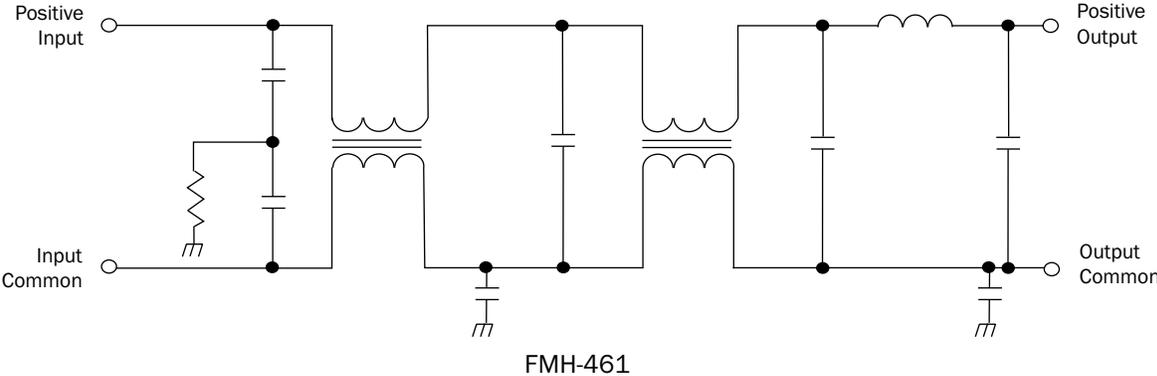


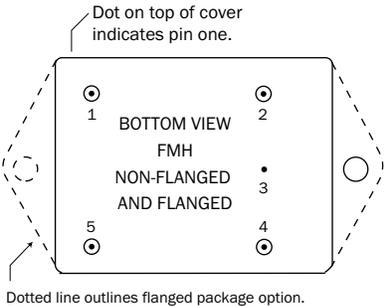
FIGURE 2: SCHEMATIC

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PIN OUT	
Pin	Single Output
1	Positive Input
2	Positive Output
3	Case Ground
4	Output Common
5	Input Common

TABLE 1: PIN OUT



See Figure 8 on page 6 and Figure 9 on page 7 for dimensions.

FIGURE 4: PIN OUT

PINS NOT IN USE	
Case Ground Pin 3	Connect case ground for optimum filtering

TABLE 2: PINS NOT IN USE

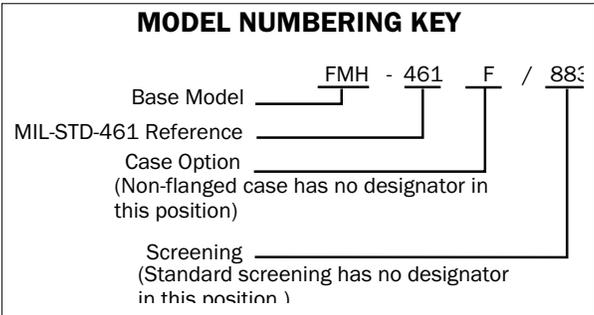


FIGURE 3: MODEL NUMBERING KEY

DLA NUMBERS	
DLA DRAWING (5915)	FMH-461 SIMILAR PART
95003-01HXC	FMH-461/883
95003-01HZC	FMH-461F/883
Models with "NT" have no transorb (-02 in the DLA numbers). For exact specifications for a DLA product, refer to the DLA drawing. DLA drawings can be downloaded from: https://landandmaritimeapps.dla.mil/programs/smcr	

TABLE 3: DLA CROSS REFERENCE

MODEL NUMBER OPTIONS ¹			
TO DETERMINE THE MODEL NUMBER ENTER ONE OPTION FROM EACH CATEGORY IN THE FORM BELOW.			
CATEGORY	Base Model and Input Voltage	Case Option ²	Screening ³
OPTIONS	FMH-461	(standard, leave blank) F (Flanged)	(standard, leave blank) ES 883
FILL IN FOR MODEL # ⁴	_FMH-461_	_____	/ _____
<p>Notes</p> <p>1. See Figure 3, above, for an example of a model number.</p> <p>2. Case Options: For the standard case, , leave the case option blank. For the flanged case option, 1, insert the letter F in the Case Option position.</p> <p>3. Screening: For standard screening leave the screening option blank. For other screening options, insert the desired screening level. For more information see.</p> <p>4. If ordering by model number add a "-Q" to request solder dipped leads (FMH-461/883-Q). Available only for Class H.</p>			

TABLE 4: MODEL NUMBER OPTIONS

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TABLE 5: OPERATING CONDITIONS - ALL MODELS, 25 °C CASE, 28 VIN, UNLESS OTHERWISE SPECIFIED.

MODEL		FMH-461			UNITS
PARAMETER	CONDITIONS	MIN	TYP	MAX	
LEAD SOLDERING TEMPERATURE ¹	10 seconds max.	–	–	300	°C
STORAGE TEMPERATURE ¹		-65	–	+150	°C
CASE OPERATING TEMPERATURE ¹	FULL POWER	-55	–	+125	°C
	ABSOLUTE	-55	–	+135	
DERATING OUTPUT POWER/CURRENT ¹	LINEARLY	From 100% at 125 °C to 80% at 135 °C			
ISOLATION, ANY PIN TO CASE EXCEPT CASE PIN	500 VOLTS AT 25 °C	100	–	–	Megohms

Notes

1. Guaranteed by characterization test and/or analysis. Not a production test.

TABLE 6: ELECTRICAL CHARACTERISTICS: -55 °C TO +125 °C CASE, UNLESS OTHERWISE SPECIFIED.

MODEL		FMH-461			UNITS
PARAMETER	CONDITIONS	MIN	TYP	MAX	
INPUT VOLTAGE	CONTINUOUS	0	28	40	V
INPUT CURRENT ¹		–	–	1.5	A
AUDIO REJECTION	200 kHz	35	40	–	dB
	500 kHz	50	60	–	
DC RESISTANCE (R _{DC})	TC = 25 °C	–	0.20	0.35	Ω
OUTPUT VOLTAGE ²	STEADY STATE	$V_{OUT} = V_{IN} - I_{IN}(R_{DC})$			V
OUTPUT CURRENT ¹	RIPPLE	–	–	0.3	A rms
	STEADY STATE	–	–	1.5	A
POWER DISSIPATION ¹		–	0.5	0.8	W

Notes

1. Guaranteed by characterization test and/or analysis. Not a production test.

2. Typical applications result in V_{out} within 2% of V_{in}.

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Typical Performance Plots: 28 Vin, 25°C Case, 100% load, unless otherwise specified.
These are examples for reference only and are not guaranteed specifications.

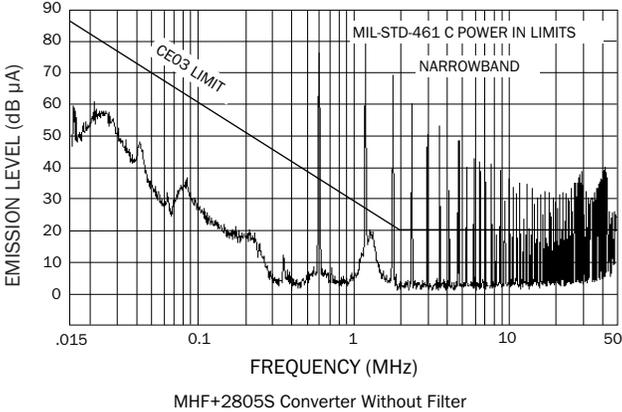


FIGURE 5

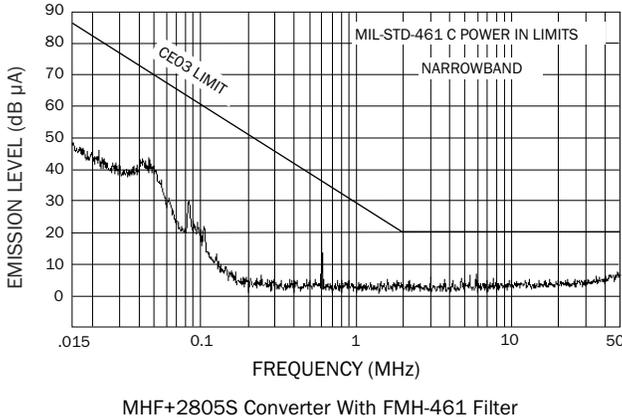
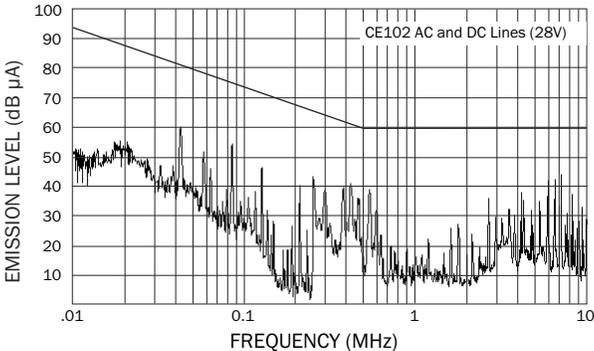


FIGURE 6



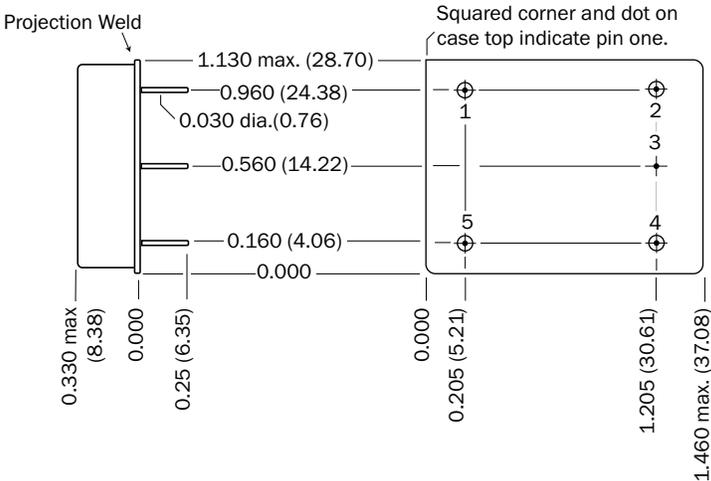
Typical Output Impedance (Z) With Input Shorted FMH-461

FIGURE 7

FMH-461 EMI Input Filters

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BOTTOM VIEW CASE E3



Weight: 22 grams typical

Case dimensions in inches (mm)
Tolerance ±0.005 (0.13) for three decimal places
±0.01 (0.3) for two decimal places
unless otherwise specified

CAUTION
Heat from reflow or wave soldering may damage the device. Solder pins individually with heat application not exceeding 300°C for 10 seconds per pin.

Materials
Header Cold Rolled Steel/Nickel/Gold
Cover Kovar/Nickel
Pins #52 alloy/Gold compression glass seal.
Seal Hole: 0.080 ±0.002 (2.03 ±0.05)

Please refer to the numerical dimensions for accuracy.

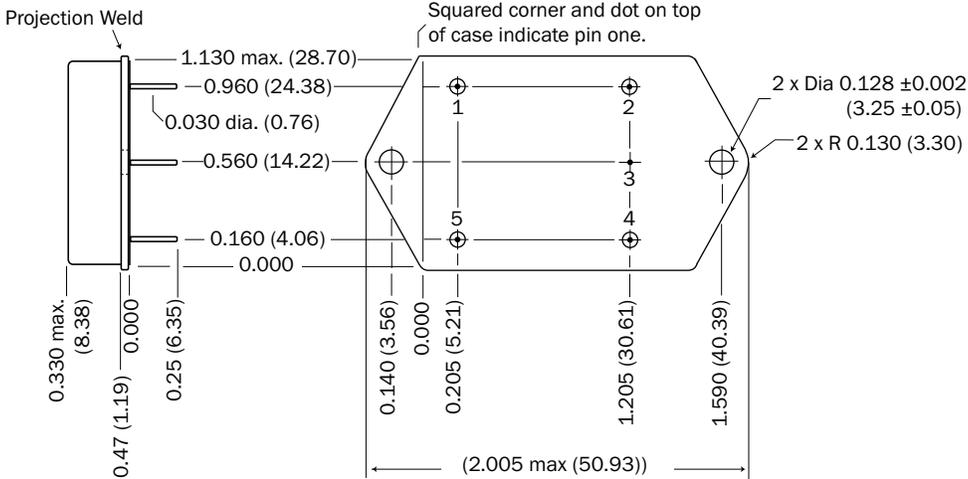
FIGURE 8: CASE E3

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BOTTOM VIEW CASE G3

Flanged cases: Designator "F" required in Case Option position of model number



Weight: 28 grams typical

Case dimensions in inches (mm)
Tolerance ±0.005 (0.13) for three decimal places
±0.01 (0.3) for two decimal places
unless otherwise specified

CAUTION
Heat from reflow or wave soldering may damage the device. Solder pins individually with heat application not exceeding 300 °C for 10 seconds per pin.

Materials
Header Cold Rolled Steel/Nickel/Gold
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FIGURE 9: CASE G3

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ELEMENT EVALUATION ¹ HIGH RELIABILITY DC-DC CONVERTERS AND EMI FILTERS /883 (CLASS H)

COMPONENT-LEVEL TEST PERFORMED	QML	
	CLASS H /883	
	M/S ²	P ³
Element Electrical	■	■
Visual	■	■
Internal Visual	■	
Final Electrical	■	■
Wire Bond Evaluation	■	■

Notes

1. Element evaluation does not apply to standard and /ES product.
2. M/S = Active components (microcircuit and semiconductor die).
3. P = Passive components, Class H element evaluation. Not applicable to standard and /ES element evaluation.

TABLE 7: ELEMENT EVALUATION

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ENVIRONMENTAL SCREENING HIGH RELIABILITY DC-DC CONVERTERS AND EMI FILTERS STANDARD, /ES AND /883 (CLASS H)

TEST PERFORMED	NON-QML ¹		CLASS H QML ²
	STANDARD	/ES	/883 QML ³
Pre-cap Inspection, Method 2017, 2032	■	■	■
Temperature Cycle (10 times)			
Method 1010, Cond. C, -65°C to +150°C, ambient			■
Method 1010, Cond. B, -55°C to +125°C, ambient		■	
Constant Acceleration			
Method 2001, 3000 g			■
Method 2001, 500 g		■	
PIND, Test Method 2020, Cond. A			■ ⁴
Burn-in Method 1015, +125°C case, typical ⁵			
96 hours		■	
160 hours			■
Final Electrical Test, MIL-PRF-38534, Group A,			
Subgroups 1 through 6, -55°C, +25°C, +125°C case			■
Subgroups 1 and 4, +25°C case	■	■	
Hermeticity Test, Method 1014			
Gross Leak, Cond. C ₁ , fluorocarbon		■	■
Fine Leak, Cond. A ₂ , helium		■	■
Gross Leak, Dip	■		
Final visual inspection, Method 2009	■	■	■

Test methods are referenced to MIL-STD-883 as determined by MIL-PRF-38534.

Notes

1. Non-QML products may not meet all of the requirements of MIL-PRF-38534.
2. All processes are QML qualified and performed by certified operators.
3. Class H QML products have an SMD number
4. Not required by DLA but performed to assure product quality.
5. Burn-in temperature designed to bring the case temperature to +125°C minimum. Burn-in is a powered test.

TABLE 8: ENVIRONMENTAL SCREENING