

# FMC EMI Input Filters

## 28 VOLT INPUT – 2.7 AMP

### FEATURES

- -55°C to +125°C operation
- Up to 50 dB attenuation  
400 kHz to 50 MHz
- Transient suppression
- Compliant to  
MIL-STD-461C, CE03  
and MIL-STD-461D, CE102
- Compatible with  
MIL-STD-704 A-E  
DC power bus



### MODEL

FMC-461	2.7 Amp
FMC-461NT	2.7 Amp

### DESCRIPTION

The FMC-461™ and SFMC EMI filters have been specifically designed to reduce the input line reflected ripple current of Interpoint's MHF, MTR, MTO, MHV, MHF+, MHD, MTW, MHE, and MLP series of DC/DC converters including their space counterparts. The filter can be used to filter combinations of the lower power converters up to two MTR/SMTR series converters and a single MFL/SMFL series converters. They are intended for use in applications which have high frequency switch-mode DC/DC converters and which must meet MIL-STD-461C or MIL-STD-461C levels of conducted and radiated noise.

The FMC/SFC filters are built using thick-film hybrid technology and is hermetically sealed in metal packages for military, aerospace, and other high-reliability applications. The filters use only ceramic capacitors for reliable high temperature operation.

### MIL-STD NOISE MANAGEMENT

When used in conjunction with Interpoint converters, the FMC-461, FMC-461 NT and SFMC-461 filters reduce input ripple current within the frequency band of 100 kHz to 50 MHz. This gives the filter/converter combination a performance which exceeds the CE03 test of MIL-STD-461C and the CE102 test of MIL-STD-461D. Typical FMC-461 filter frequency response and output impedance behavior are shown in Figures 4 and 5. CE03 performance of a typical converter with the FMC-461 filter connected is shown in Figure 3.

### TRANSIENT SUPPRESSION - FMC-461 ONLY

The FMC-461 filter also features an optional fast-reacting (1 pico second) transient suppressor (transorb) which begins clamping the input voltage at approximately 47 VDC, protecting the DC/DC converter from damage from induced line transients.

*The FMC-461NT does not have the transorb option.*

### OPERATING TEMPERATURE

The filters are rated to operate, with no degradation of performance, over the temperature range of -55°C to +125°C (as measured at the baseplate). Above +125°C, current must be derated as specified on the following page.

### INSERTION LOSS

The maximum DC insertion loss for the FMC/SFMC filters (at a load of 22 watts) represents a power loss of less than 2% at typical input voltage.

### LAYOUT REQUIREMENT

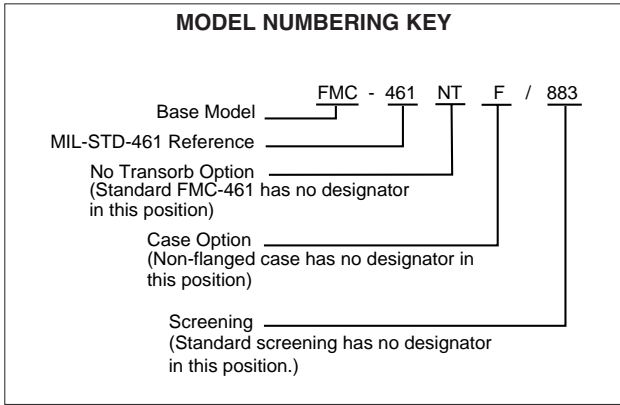
The case pin, and ideally the case, should be tied to the case of the converter through a low-inductance connection.





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**DSCC NUMBER**

DSCC DRAWING (5915)	FMC-461 FILTER SIMILAR PART
94010-01HXC	FMC-461/883
94010-01HZC	FMC-461F/883
94010-02HXC <sup>1</sup>	FMC-461NT/883 <sup>1</sup>
94010-02HZC <sup>1</sup>	FMC-461NTF/883 <sup>1</sup>

1. No transorb (NT)

Flanged SMDs have the suffix HZC instead of HXC.

For exact specifications for a DSCC product, refer to the DSCC drawing. DSCC drawings can be downloaded from: <http://www.dsccl.dla.mil/programs/smcr>

**Model Selection**

FMC                      461                      \_\_\_\_\_                      \_\_\_\_\_                      \_\_\_\_\_  
*Base model*      *MIL-STD-461 ref.*      *No Transorb option*      *case option*      *Screening*

Choose one from each of the following rows

**No Transorb option**      NT or leave blank

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**Case option**                      non-flanged (case H1, leave blank)                      or F (flanged, case K2)

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**Screening**                      standard screening, leave blank                      /ES (ES screening), /883 (Class H, QML)

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# FMC EMI Input Filters

## 28 VOLT INPUT – 2.7 AMP

Electrical Characteristics: 25°C Tc, nominal Vin, unless otherwise specified.

PARAMETER	CONDITIONS	FMC-461			FMC-461NT <sup>1</sup>			UNITS
		MIN	TYP	MAX	MIN	TYP	MAX	
INPUT VOLTAGE	CONTINUOUS	0	28	40	0	28	40	VDC
INPUT CLAMPING VOLTAGE	-55°C	40.8	45.1	49.4	—	—	—	VDC
	25°C	44.7	47.0	49.4	—	—	—	
	125°C	44.7	49.5	54.2	—	—	—	
INPUT CURRENT		—	—	2.7	—	—	2.7	A
DIFFERENTIAL MODE NOISE REJECTION	200 kHz	40	—	—	40	—	—	dB
COMMON MODE NOISE REJECTION	400 kHz - 50 MHz	50	—	—	50	—	—	
COMMON MODE NOISE REJECTION	2 MHz - 50 MHz	40	—	—	40	—	—	dB
DC RESISTANCE (R <sub>DC</sub> )	TC = 25°C	—	—	0.20	—	—	0.20	Ω
OUTPUT VOLTAGE <sup>2</sup>	STEADY STATE	$V_{OUT} = V_{IN} - I_{IN} (R_{DC})$			$V_{OUT} = V_{IN} - I_{IN} (R_{DC})$			VDC
OUTPUT CURRENT	RIPPLE	—	—	1.0	—	—	1.0	A rms
	STEADY STATE	—	—	2.7	—	—	2.7	A
INTERNAL POWER DISSIPATION	MAXIMUM CURRENT	—	—	1.6	—	—	1.6	W

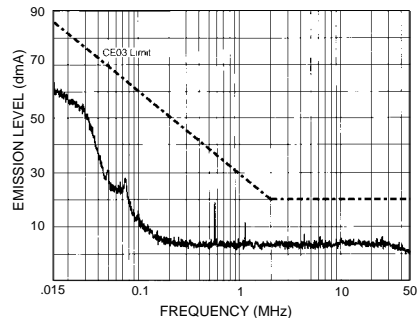
### Notes

1. The FMC-461NT does not have a transorb and does not clamp the input voltage
2. Typical applications result in Vout within 2% of Vin.

# FMC EMI Input Filters

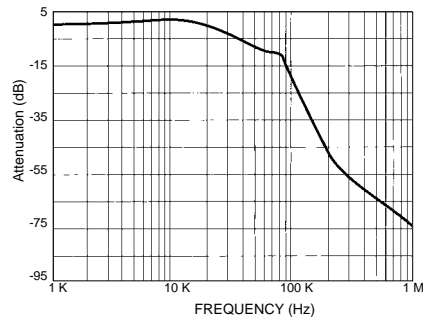
## 28 VOLT INPUT – 2.7 AMP

**Typical Performance Curves: 25°C Tc , nominal Vin, unless otherwise specified.**



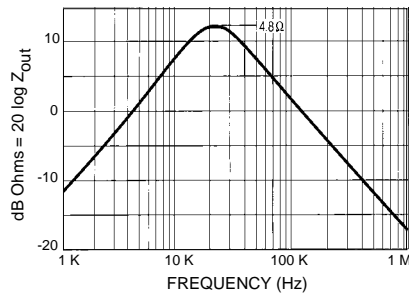
DC/DC Converter Typical Worst Case  
EMI With FMC-461 Filter

**FIGURE 3**



FMC-461 Typical Amplitude  
Response vs. Frequency

**FIGURE 4**



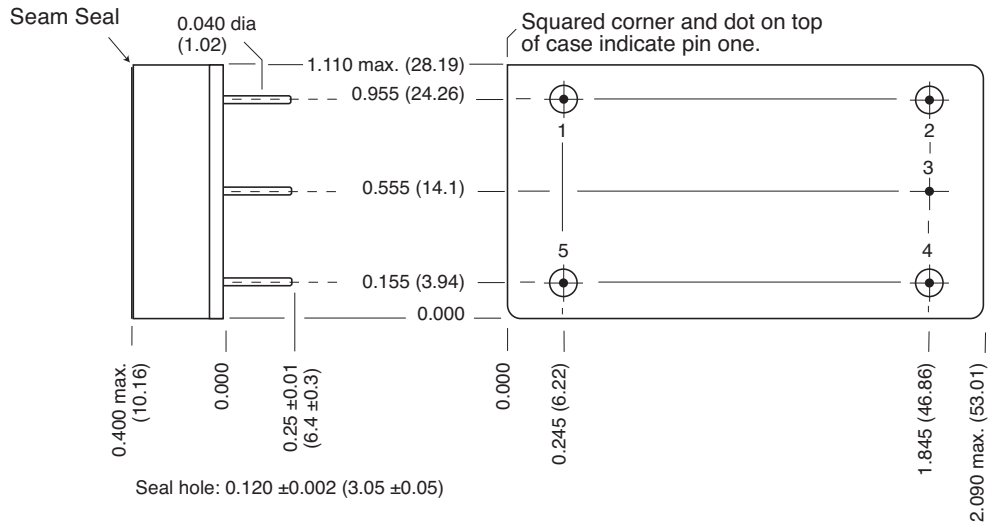
Typical Output Impedance (Z)  
With Input Shorted

**FIGURE 5**

# FMC EMI Input Filter Cases

## 28 VOLT INPUT – 2.7 AMP

### BOTTOM VIEW CASE H1



#### Case dimensions in inches (mm)

Tolerance  $\pm 0.005$  (0.13) for three decimal places  
 $\pm 0.01$  (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 ceramic seal

Case H1, Rev C, 20060110

Please refer to the numerical dimensions for accuracy. All information is believed to be accurate, but no responsibility is assumed for errors or omissions. Interpoint reserves the right to make changes in products or specifications without notice.

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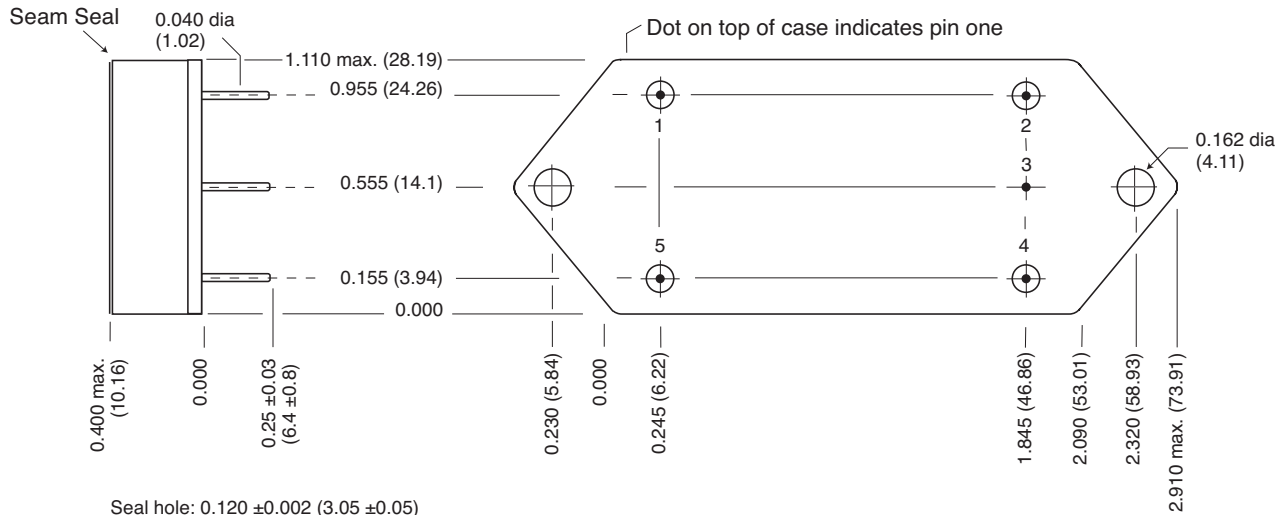
**FIGURE 6: CASE H1**

# FMC EMI Input Filter Cases

## 28 VOLT INPUT – 2.7 AMP

### BOTTOM VIEW CASE K2

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



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 ceramic seal

Case K2, Rev C, 20060110

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**FIGURE 7: CASE K2**



## FMC EMI Input Filters

**28 VOLT INPUT – 2.7 AMP**

# 883, CLASS H, QML PRODUCTS – ELEMENT EVALUATION

ELEMENT EVALUATION  TEST PERFORMED (COMPONENT LEVEL)	STANDARD (NON-QML) <sup>1</sup>		CLASS H, QML	
	M/S <sup>2</sup>	P <sup>3</sup>	M/S <sup>2</sup>	P <sup>3</sup>
Element Electrical (probe)	yes	no	yes	yes
Element Visual	no	no	yes	yes
Internal Visual	no	no	yes	no
Final Electrical	no	no	yes	yes
Wire Bond Evaluation <sup>4</sup>	no	no	yes	yes
SLAM™/C-SAM: Input Capacitors only (Add'l test, not req. by H or K)	no	no	no	yes

**Definitions:**

Element Evaluation: Component testing/screening per MIL-STD-883 as determined by MIL-PRF-38534

SLAM™: Scanning Laser Acoustic Microscopy

C-SAM: C - Mode Scanning Acoustic Microscopy

**Notes:**

1. Non-QML products do not meet all of the requirements of MIL-PRF-38534
2. M/S = Active components (Microcircuit and Semiconductor Die)
3. P = Passive components
4. Not applicable to EMI filters that have no wire bonds

# FMC EMI Input Filters

## 28 VOLT INPUT – 2.7 AMP

# 883, CLASS H, QML PRODUCTS – ENVIRONMENTAL SCREENING

TEST	125°C STANDARD non-QML	125°C /ES non-QML	Class H /883 QML
Pre-cap Inspection Method 2017, 2032	yes	yes	yes
Temperature Cycle (10 times) Method 1010, Cond. C, -65°C to 150°C, ambient Method 1010, Cond. B, -55°C to 125°C, ambient	no no	no yes	yes no
Constant Acceleration Method 2001, 3000 g Method 2001, 500g	no no	no yes	yes no
Burn-In Method 1015, 160 hours at 125°C case, typical 96 hours at 125°C case, typical	no no	no yes	yes no
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	no yes	no yes	yes no
Hermeticity Test Fine Leak, Method 1014, Cond. A Gross Leak, Method 1014, Cond. C Gross Leak, Dip (1 x 10 <sup>-3</sup> )	no no yes	yes yes no	yes yes no
Final Visual Inspection Method 2009	yes	yes	yes

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