FEATURES

- **–55°C to +125°C operation**
- **16 to 40 VDC input**
- Up to 60 dB attenuation at 500 kHz.
- Active transient suppression
- Undervoltage lockout
- Inhibit function
- Compliant to MIL-STD-461C, CE03

EMI INPUT FILTER AND TRANSIENT SUPPRESSION MODULE, 28 VOLT INPUT

FM-704A EMI FILTER 40 WATT

MODEL	
FM-704A	40 Watts

Size (max): 2.910 x 1.125 x 0.400 inches (73.91 x 28.58 x 10.16 mm)
See Section B8, case K1, for dimensions.
Weight: 40 grams maximum
Screening: Standard, ES, or 883 (Class H). See Section C2 for screening options, see Section A5 for ordering information.

DESCRIPTION

Interpoint's FM-704A™ EMI Filter and Transient Suppression Module combines EMI filtering and transient protection to handle the demanding requirements of military, aerospace and industrial applications. As an EMI filter the FM-704A filter reduces the reflected ripple current from DC/DC switching converters. As a protection module, it suppresses input transients on the power bus to protect the converter and other downstream components.

MIL-STD NOISE MANAGEMENT

When used in conjunction with Interpoint converters, the FM-704A EMI filter reduces reflected input ripple current by a minimum of 60 dB at 500 kHz and 55 dB at 1 MHz (see Figures and Electrical Characteristics table). This attenuation gives the converter/filter combination performance exceeding MIL-STD-461C's CE03 test. Although the FM-704A filter effectively attenuates the ripple generated by switching converters, it will not suppress RF applied to its input terminals.

TEMPERATURE OPERATION

FM-704A filters are rated to operate from -55°C to +125°C baseplate temperature. To meet MIL-STD-1275A and MIL-STD-704A requirements, derate output power linearly from 40 watts at 105°C to 25 watts at 125°C. See Figure 9.

PROTECTION

To provide protection for itself and converters, the FM-704A filter blocks transients as required by the following standards:

MIL-STD-704A	Panavia SP-P-90001
MIL-STD-461B&C	British Standard BS3G100
MIL-STD-1275	Civil Aircraft D0160B

Refer to the Electrical Characteristics table on the following page for more information.

Reverse polarity spikes of up to 100 V will not damage the filter, however the spikes will not be blocked by the filter.

INTERNAL POWER DISSIPATION

To keep internal power dissipation to safe operating levels, the input current should never exceed 2.5 amps at 16 Vin or 1.0 amp at 40 Vin. When the FM-704A filter is used with PWM (Pulse Width Modulated) converters, I_{line} will vary as Power / V_{line} and 2.5 amps maximum at 16 Vin will reduce to approximately 1 amp maximum at 40 Vin. The maximum value allowed may be less than 1 amp as determined by line transients and the safe operating area of Figure 9.

Figure 9 illustrates the maximum allowed internal dissipation for the FM-704A filter. To calculate watts dissipated, subtract 40 volts from the transient (VT) to determine the maximum voltage across the filter and multiply the result by the current (the filter's output power, Pout divided by 40).

$$W = (V_T - 40) \times P_{out} / 40$$

For example, with 20 watts output and a transient of 400 volts:

$$W = (400 - 40) \times 20/40 = 180$$

The curve of Figure 9 shows that 180 W can be dissipated for up to 4 milliseconds.

FEATURES

The inhibit function allows the FM-704A filter to be used as a high-side switch. When the inhibit terminal (pin 6) is left open or pulled high, the FM-704A filter is enabled. When the terminal is grounded, the filter shuts off output power.

A soft start function helps reduce inrush current and start-up overshoot when the filter is initially powered or when it is released from the inhibit mode.

An undervoltage lockout feature shuts off output power when input voltage falls below a specified level. Refer to Figure 8 for more information.

LAYOUT REQUIREMENTS

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

FM-704A EMI FILTER 40 WATT

EMI INPUT FILTERS

ABSOLUTE MAXIMUM RATINGS

Input Voltage
- 16 to 40 VDC continuous for 40 W load

Lead Soldering Temperature (10 sec per lead)
- 300°C

Storage Temperature Range (Case)
- –65°C to +150°C

INHIBIT

Inhibit TTL Open Collector
- Logic low (output disabled)
  Logic low voltage ≤0.8 V
  Logic low inhibit pin current 0.6 mA max
- Referenced to input common
- Logic high (output enabled)
  Open collector

TYPICAL CHARACTERISTICS

Capacitance
- 0.017 µF max, any pin to case

Undervoltage lockout
- 7 VDC min, 15 VDC max

Isolation
- 100 megohm minimum at 500 V
- Any pin to case, except case pin

Inhibit Pin Voltage (unit enabled)
- 5.5 V max

RECOMMENDED OPERATING CONDITIONS

Input Voltage Range
- 16 to 40 VDC continuous for 40 W load

Case Operating Temperature (Tc)
- –55°C to +125°C

Derating Output Power
- Linearly from 40 W at 105°C to 25 W at 125°C to meet MIL-STD-1275A (AT) and MIL-STD-704A

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

PARAMETER	CONDITIONS	FM-704A MIN	FM-704A TYP	FM-704A MAX	UNITS
INPUT VOLTAGE	NO LOAD	0	28	40	VDC
	40 W LOAD	16	28	40	
	UNDERVOLTAGE LOCKOUT	7	—	15	
INPUT CURRENT	16 V_{IN}	—	—	2.5	A
	40 V_{IN}	—	—	1.0	
	NO LOAD	—	—	5	mA
	INHIBITED	—	—	2	
INPUT SURGE	40 W, 100 V, 0.5 Ω Z_S, 60 ms[1]	42	—	48	V_{OUT}
INPUT SPIKE	40 W, 400 V, 0.5 Ω Z_S, 5 µs[2]	—	—	48	V_{OUT}
	40 W, 600 V, 50 Ω Z_S, 10 µs[3]	—	—	48	
DIFFERENTIAL MODE	500 kHz	60	—	—	dB
NOISE REJECTION	1 MHz	55	—	—	
DC RESISTANCE (R_{DC})	Tc = 25°C	—	—	0.45	Ω
OUTPUT VOLTAGE	STEADY STATE	$V_{OUT} = V_{IN} - I_{IN} (R_{DC})$			VDC
	INHIBITED	—	—	1	
OUTPUT CURRENT	16 V_{IN}	—	—	2.5	A
	40 V_{IN}	—	—	1.0	
INTERNAL POWER DISSIPATION	PEAK				W
	105°C	—	—	1000	
	125°C	—	—	500	
	CONTINUOUS (> 10 SEC.)				
	105°C	—	—	30	
	125°C	—	—	15	

Notes
1. Meets MIL-STD-1275A (AT) Surge and Figure 8 and 9 of MIL-STD-704A. For these standards derate output power linearly from 40 W at 105°C to 25 W at 125°C.
2. Meets Panavia SP-P-90001, British Standard BS3G100 and Civil Aircraft D0160 Standards.
3. Meets MIL-STD-461C 1.2 CS06 limits.

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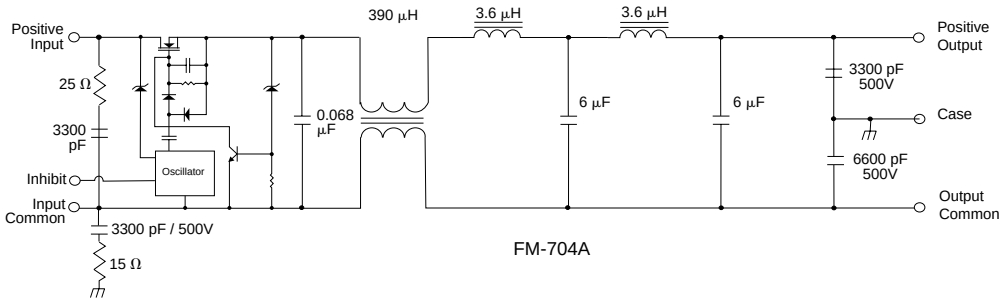


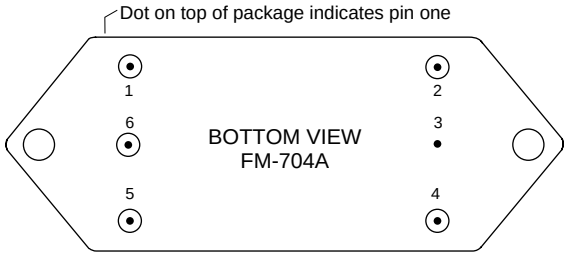
FM-704A

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: SCHEMATIC – TYPICAL VALUES

PIN OUT

Pin	Designation
1	Positive Input
2	Positive Output
3	Case Ground
4	Output Common
5	Input Common
6	Inhibit



See Section B8, case K1 for dimensions.

FIGURE 2: PIN OUT

DSCC NUMBER

DSCC DRAWING (5915)	FM-704A FILTER SIMILAR PART
94028-01HXC	FM-704A/883

For exact specifications for a DSCC product, refer to the DSCC drawing. See Section A3, "SMD/DSCC Lists", for more information.

MODEL NUMBERING KEY

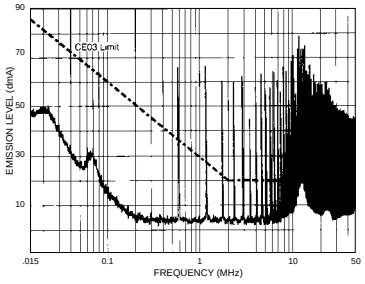
FM - 704A / 883

Base Model

MIL-STD-704A Reference

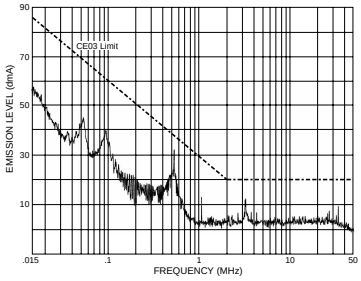
Screening
(Standard screening has no designator in this position.)

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



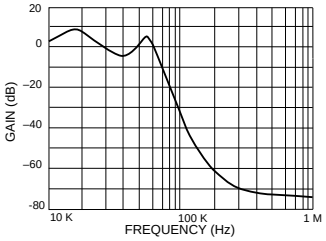
MHF+ Converter Without Filter

FIGURE 3



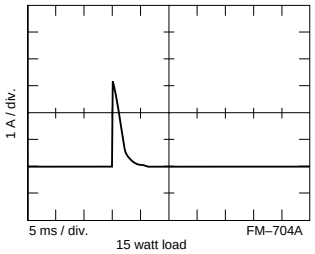
MHF+ Converter With
FM-704A Filter

FIGURE 4



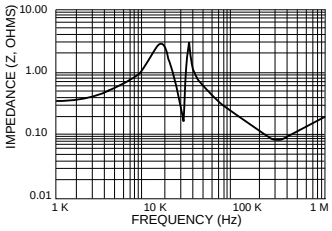
Differential Mode Response

FIGURE 5



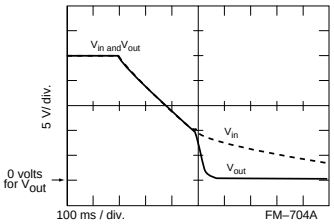
Inrush Current

FIGURE 6



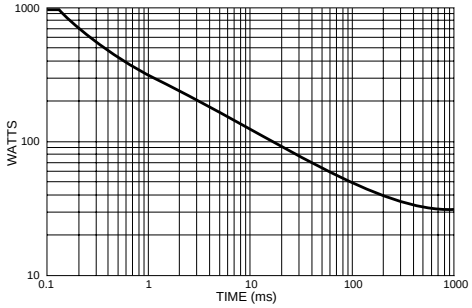
Typical Output Impedance (Z)
With Input Shorted

FIGURE 7



Undervoltage Lockout

FIGURE 8



Derate power linearly to 50% at 125°C. Operation below this curve ensures a maximum junction temperature rise of 40°C or less.

Maximum Allowed Internal Power Dissipation
105°C case temperature

FIGURE 9

25021-001-DTS Rev A DQ# 4001

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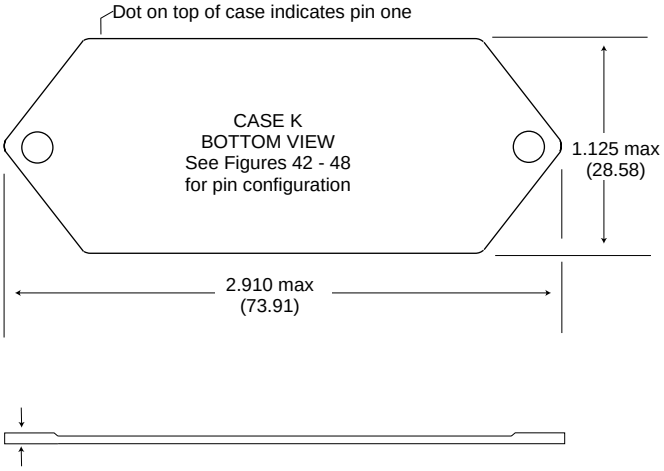
CASES



Flange Thickness:

Cases K1, K2, K3 and MLP Series (K5)
0.060 (1.52)
Cases K4, K5 (except MLP Series), K6, K7, and K8
0.067 +0.005/-0.007 (1.70 +0.13/-0.8)

Materials

Header Case K1 - K3
Cold Rolled Steel/Nickel/Gold
Cases K4 - K8
Cold Rolled Steel/Nickel/Tin
Cover Case K1 - K3
Kovar/Nickel
Case K4 - K8
Cold Rolled Steel/Nickel/Tin
Pins #52 alloy (all cases)
Case K1, K2, and K3 (except MHV Series Single and Dual)
ceramic seal
Cases K4 - K8 and MHV Series Single and Dual (K3)
compression glass seal

Case dimensions in inches (mm)

Tolerance ±0.005 (0.13) for three decimal places
±0.01 (0.2) 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.

FIGURE 41: CASE K MAXIMUM DIMENSIONS

BOTTOM VIEW CASE K1

Flanged case
FM-704A EMI Filter: Screening – Standard, ES, or 883

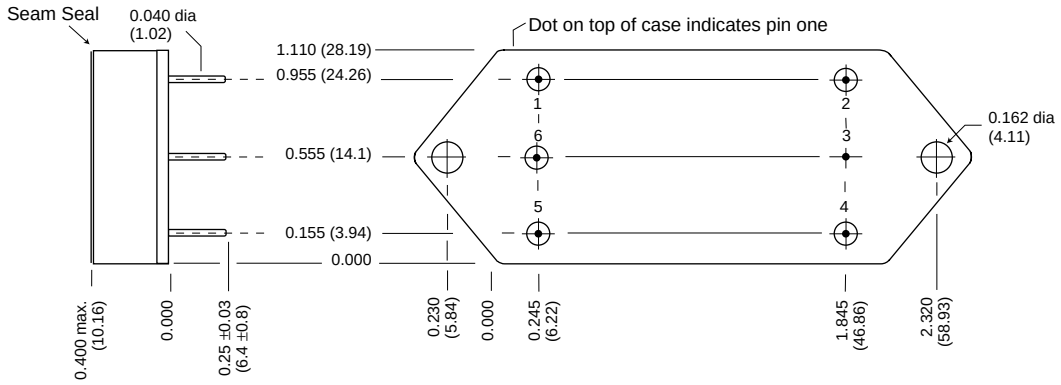


FIGURE 42: CASE K1

BOTTOM VIEW CASE K2

Flanged cases: Designator required in Case Option position of model number.
FMC EMI Filter: Screening – Standard, ES, or 883
SFMC EMI Filter: Screening – Space Standard, H, or K

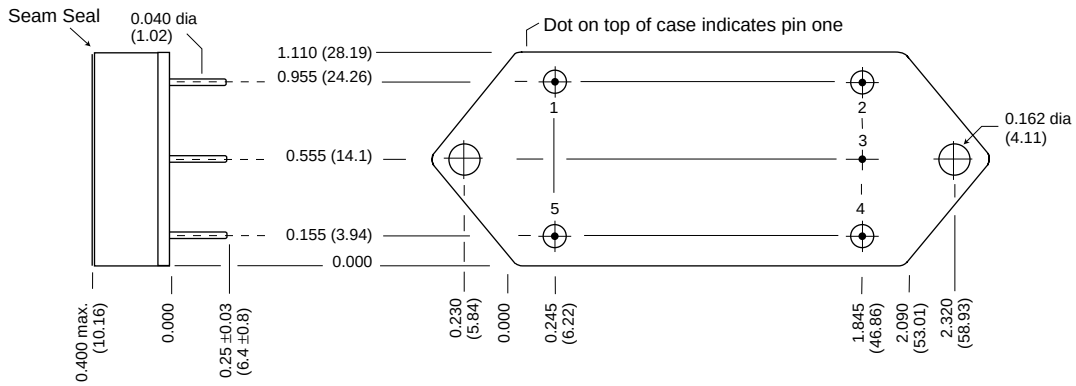


FIGURE 43: CASE K2

125°C PRODUCTS

TEST (125°C Products)	STANDARD	/ES	/883 (Class H)*
PRE-CAP INSPECTION			
Method 2017, 2032	yes	yes	yes
TEMPERATURE CYCLE (10 times)			
Method 1010, Cond. C, -65°C to 150°C	no	no	yes
Method 1010, Cond. B, -55°C to 125°C	no	yes	no
CONSTANT ACCELERATION			
Method 2001, 3000 g	no	no	yes
Method 2001, 500 g	no	yes	no
BURN-IN			
Method 1015, 160 hours at 125°C	no	no	yes
96 hours at 125°C case (typical)	no	yes	no
FINAL ELECTRICAL TEST MIL-PRF-38534, Group A			
Subgroups 1 through 6: -55°C, +25°C, +125°C	no	no	yes
Subgroups 1 and 4: +25°C case	yes	yes	no
HERMETICITY TESTING			
Fine Leak, Method 1014, Cond. A	no	yes	yes
Gross Leak, Method 1014, Cond. C	no	yes	yes
Gross Leak, Dip (1×10^{-3})	yes	no	no
FINAL VISUAL INSPECTION			
Method 2009	yes	yes	yes

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

*883 products are built with element evaluated components and are 100% tested and guaranteed over the full military temperature range of –55°C to +125°C.

Applies to the following products

MOR Series	MHD Series	MGH Series	FMGA EMI Filter
MFLHP Series	MHV Series	MCH Series	FMSA EMI Filter
MFL Series	MHF+ Series	FM-704A EMI Filter	HUM Modules**
MHP Series	MHF Series**	FMD**/FME EMI Filter	LCM Modules**
MTR Series	MGA Series	FMC EMI Filter	LIM Modules
MQO Series**	MSA Series	FMH EMI Filter	

**MFLHP Series, MQO Series, MHF Series, FMD EMI Filters, Hum Modules, and LCM Modules do not offer ‘883” screening.

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