FMCE-0528 EMI Input Filters

28 VOLT INPUT – 5 AMP

FEATURES

- Attenuation 60 dB at 500 kHz, typical
- Operating temperature -55° to +125°C
- Nominal 28 volt input,
- -0.5 to 50 volt operation for FMCE-0528 [1]
- Transient rating -0.5 to 80 volt for 1 second FMCE-0528
- 5 amp throughput current
- Compliant to
  - MIL-STD-461C CE03
  - MIL-STD-461D, E and F CE102
  - MIL-STD-461C CS01
  - MIL-STD-461D, E, and F CS101
- Compatible with MIL-STD-704 A-E 28 VDC power bus [1]

MODEL	CURRENT (A)
FMCE-0528-TR [1]	5
FMCE-0528 [1]	5

DESCRIPTION

The Interpoint® FMCE-0528™ EMI filters have been specifically designed to reduce the input line reflected ripple current of Interpoint MFK, MFX, MWR, MHV and MHF+ Series of DC-DC converters. The filter can be used with combinations of the lower power converters; up to two MTR series converters or a single MFL series converter up to the rated current of the filter. These filters are intended for use in 28 volt applications which must meet MIL-STD-461C CE03 and CS01 and of MIL-STD-461D, E and F CE102 and CS101 levels of conducted emissions. The FMCE-0528 EMI filters provide up to 5 amps of throughput current in a low profile package. The 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.

The FMCE-0528 filters are built using thick-film hybrid technology and are hermetically sealed in metal packages for military, aerospace, and other high-reliability applications. Only ceramic capacitors are used in the filters to ensure reliable high temperature operation.

The filters are offered with standard screening, “ES” screening, or fully compliant to “883” MIL-PRF-38534 Class H screening. A DLA Drawing is available, see Table 2 on page 3.

MIL-STD Noise Management

When used in conjunction with Interpoint converters, the FMCE-0528 and FMCE-0528-TR filters reduce input ripple current within the frequency band of 100 kHz to 50 MHz. When used with an Interpoint converter, performance exceeds the CEO3 test of MIL-STD-461C and meets the requirements of CS01 of MIL-STD-461C. These filters also meet CE102 and CS101 of MIL-STD-461D, E and F.

Transient Suppression - FMCE-0528-TR only

The FMCE-0528-TR [1] filter also features an optional fast-reacting (1 pico second) transient suppressor (transorb SMCG40A) which begins clamping the input voltage at approximately 47 volts, protecting the DC-DC converter from damage from induced line transients.

The FMCE-0528 [1] does not have the transorb and is designed for those applications that require a wider input voltage range (-0.5 to 50 volts).

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 in Table 4 on page 4. A DLA Drawing is available, see Table 2 on page 3.

Insertion Loss

Low dc resistance design results in a maximum power loss of less than 3% with 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.

Note 1.
a) The FMCE-0528-TR has a transorb and will not protect against transients as defined in MIL-STD-704A Figures 8 and 9, curves 1 and 2. Operation beyond the defined specifications may damage the transorb.

b) The FMCE-0528 does not have a transorb and does not clamp the input voltage. Transients of higher than 40 volts will not harm the filter but will be passed to the converter.

FMCE-0528 EMI Input Filters

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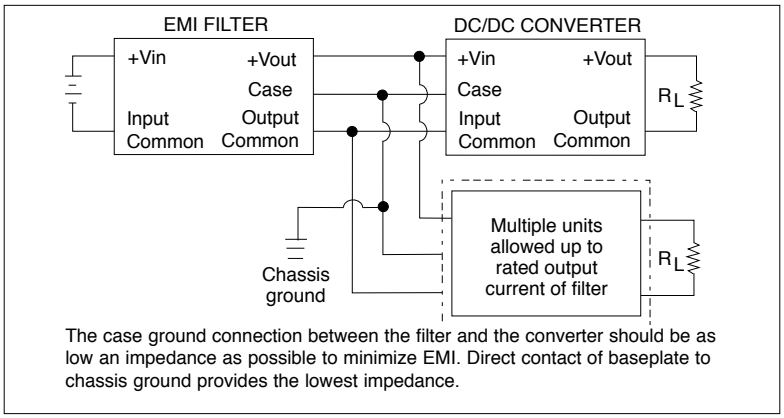


FIGURE 1: CONNECTION DIAGRAM

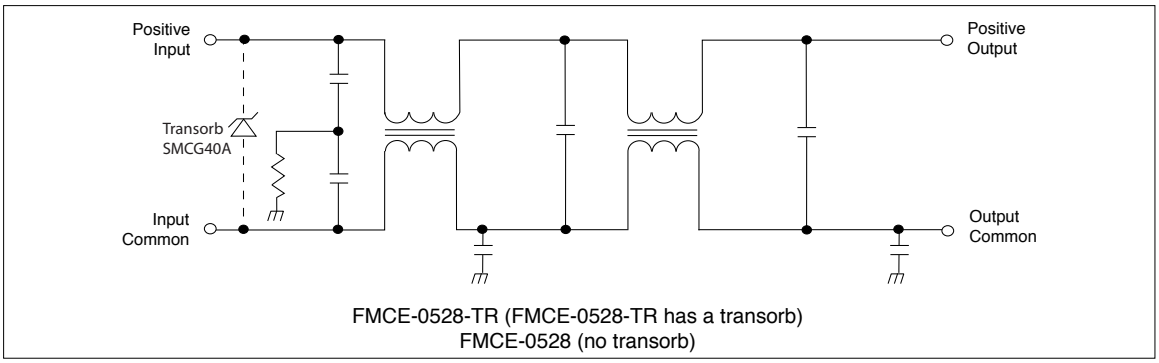
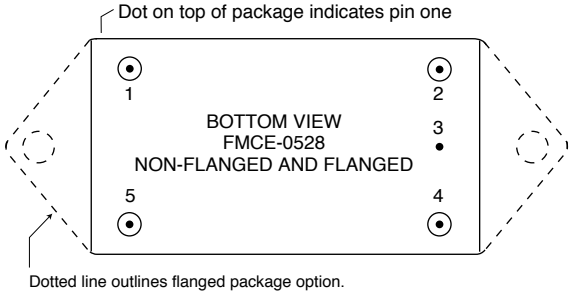


FIGURE 2: BLOCK DIAGRAM FMCE-0528

PIN OUT	
Pin [1]	**Designation**
1	Positive Input
2	Positive Output
3	Case Ground
4	Output Common
5	Input Common

Notes
1. All pins must be connected.

TABLE 1: PIN OUT



See Figure 10 on page 6 and Figure 11 on page 7 for dimensions.

FIGURE 3: PIN OUT

FMCE-0528 EMI Input Filters

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MODEL NUMBERING KEY

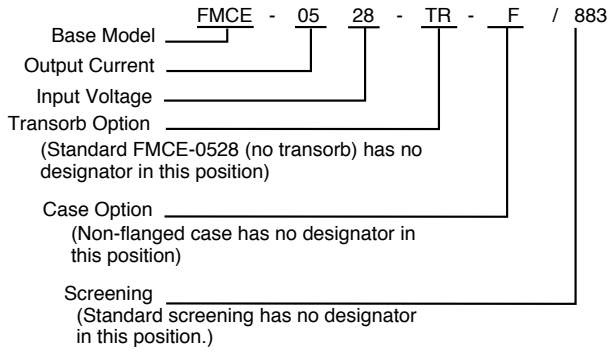

FIGURE 4: MODEL NUMBERING KEY

DLA NUMBERS	
DLA DRAWING (5915)	**FMCE-0528 SIMILAR PART**
10016-01HXC	FMCE-0528-TR/883 [1]
10016-01HZC	FMCE-0528-TR-F/883 [1]
10016-02HXC	FMCE-0528/883
10016-02HZC	FMCE-0528-F/883

1. Models with "TR" have a transorb (-01 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 2: 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	Transorb [2]	Case Option [3]	Screening [4]
OPTIONS	FMCE-0528	-TR (with transorb) (no transorb, leave blank)	(standard, leave blank) -F (Flanged)	(standard, leave blank) ES 883
FILL IN FOR MODEL # [5]	FMCE-0528	_____	_____	/ _____

Notes
1. See Figure 4, above, for an example of a model number.
2. The FMCE-0528 does not have a transorb. The FMCE-0528-TR has a transorb for transient suppression (see page 1).
3. Case Options: For the standard case, Figure 10 on page 6, leave the case option blank. For the flanged case option, Figure 11 on page 7, insert the letter F in the Case Option position.
4. Screening: For standard screening leave the screening option blank. For other screening options, insert the desired screening level. For more information see Table 6 on page 8 and Table 7 on page 9.
5. If ordering by model number add a "-Q" to request solder dipped leads (FMCE-0528/883-Q). Available only for Class H.

TABLE 3: MODEL NUMBER OPTIONS

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TABLE 4: OPERATING CONDITIONS: 28 VIN, UNLESS OTHERWISE SPECIFIED.

MODEL		FMCE-0528			
PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
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	
DERATE I^2 (R_{DC}) [1]	LINEARLY	From 100% at 125°C to 0% at 135°C			
ESD RATING [1] MIL-PRF-38534, 3.9.5.8.2	MIL STD 883 METHOD 3015 CLASS 3B	—	—	≥8000	V
ISOLATION, ANY PIN TO CASE EXCEPT CASE PIN	500 VDC AT 25°C	100	—	—	Megohms

TABLE 5: ELECTRICAL CHARACTERISTICS: -55°C TO +125°C CASE, 28 VIN, UNLESS OTHERWISE SPECIFIED.

MODEL		FMCE-0528-TR			FMCE-0528			
PARAMETER	CONDITIONS	MIN	TYP	MAX	MIN	TYP	MAX	UNITS
INPUT VOLTAGE [1, 2]	CONTINUOUS	-0.5	28	40	-0.5	28	50	V
	TRANSIENT 50 ms [3]	—	47	—	—	—	80	
INPUT CLAMPING VOLTAGE [4]	T_C = -55°C	40.8	45.1	49.4	—	—	—	V
	T_C = 25°C	44.7	47.0	49.4	—	—	—	
	T_C = 125°C	44.7	49.5	54.2	—	—	—	
NOISE REJECTION	500 kHz	55	60	—	55	60	—	
DIFFERENTIAL NOISE	1 MHz	60	—	—	60	—	—	dB
DC RESISTANCE (R_{DC})	T_C = 25°C	—	—	0.13	—	—	0.13	Ω
CAPACITANCE 25°C	ANY PIN TO CASE EXCEPT CASE PIN	—	44,000	48,000	—	44,000	48,000	pF
OUTPUT VOLTAGE [1, 5]	STEADY STATE	$V_{OUT} = V_{IN} - I_{IN} (R_{DC})$			$V_{OUT} = V_{IN} - I_{IN} (R_{DC})$			V
OUTPUT CURRENT [1,]	STEADY STATE	—	—	5	—	—	5	A
POWER DISSIPATION [1]	T_C = 25°C	—	2.8	3.0	—	2.8	3.1	W
MAXIMUM CURRENT	T_C = 125°C	—	—	3.8	—	—	3.8	

Notes Table 4 and Table 5
1. Guaranteed by characterization test and/or analysis. Not a production test.
2. Transients:
   a) The FMCE-0528-TR has a transorb and will not protect against transients as defined in MIL-STD-704A Figures 8 and 9, curves 1 and 2. Operation beyond the defined specifications may damage the transorb. It will begin to clamp the voltage at approximately 47 volts.
   b) The FMCE-0528 does not have a transorb and does not clamp the input voltage. Transients of higher than 40 volts will not harm the filter but will be passed to the converter.
3. 0.5 ohm source impedance
4. The FMCE-0528 does not have a transorb and does not clamp the input voltage.
5. Typical applications result in V_{OUT} within 2% of V_{IN}.

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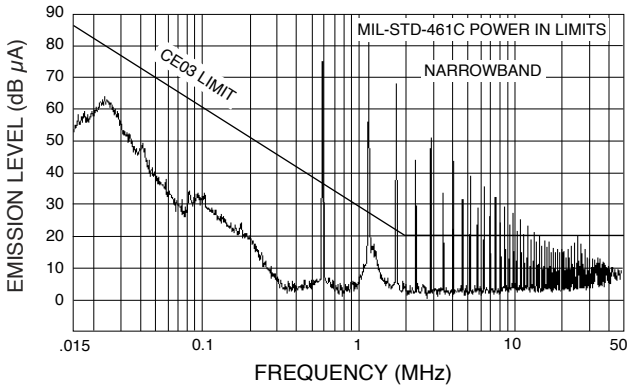
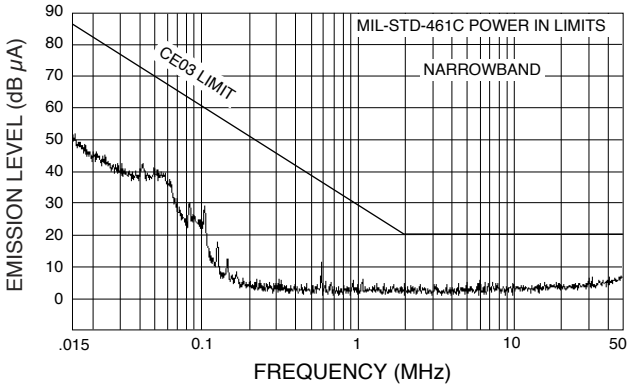
TYPICAL PERFORMANCE PLOTS: 25°C CASE, UNLESS OTHERWISE SPECIFIED.
FOR REFERENCE ONLY, NOT GUARANTEED SPECIFICATIONS.



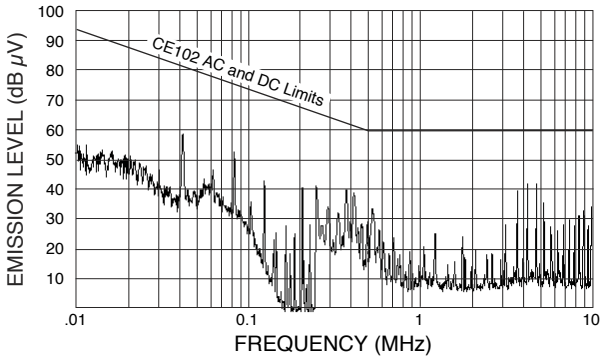
High power DC-DC converter without filtering.

FIGURE 5



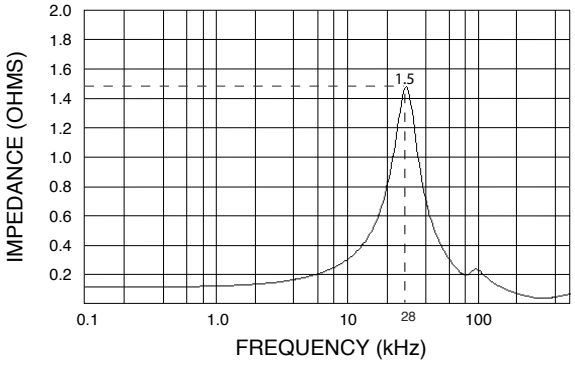
CE03: High power DC-DC converter filtered with an FMCE-0528

FIGURE 6



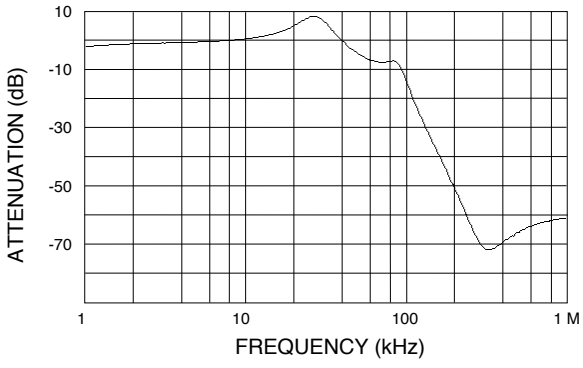
CE102: High power converter filtered with an FMCE-0528.

FIGURE 7



FMCE-0528 Output Impedance
(measured at the output with input pins shorted)

FIGURE 8



FMCE-0528 Attenuation

FIGURE 9

FMCE-0528 EMI Input Filters

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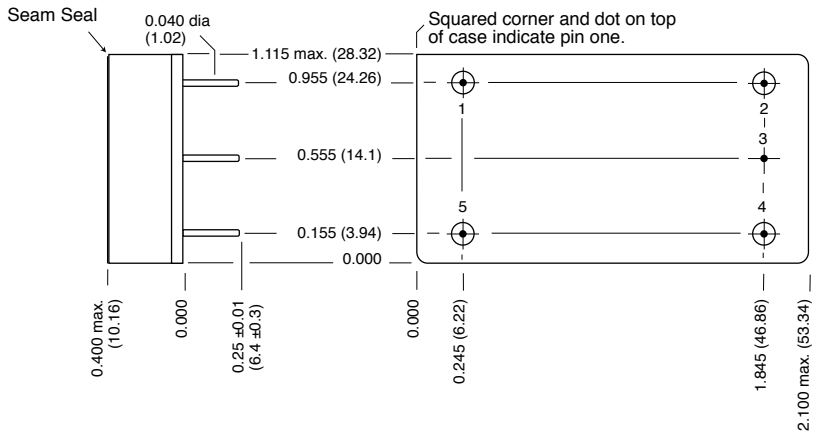
BOTTOM VIEW CASE H1



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
	Seal hole 0.120 ±0.002 (3.05 ± 0.05)

Please refer to the numerical dimensions for accuracy.

FIGURE 10: CASE H1

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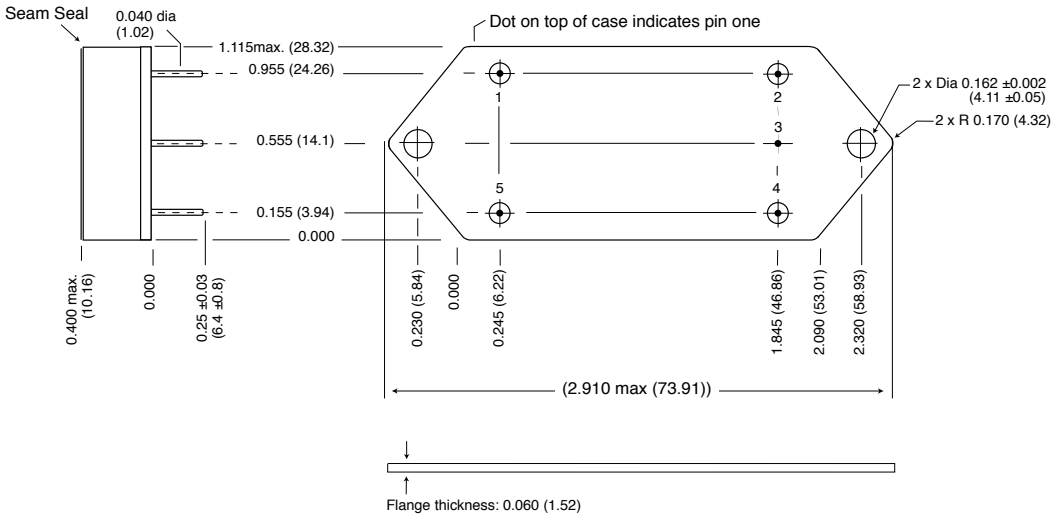
BOTTOM VIEW CASE K2

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.
	Seal Hole: 0.120 ±0.002 (3.05 ±0.05)

Please refer to the numerical dimensions for accuracy.

FIGURE 11: CASE K2

FMCE-0528 EMI Input Filters

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ELEMENT EVALUATION [1] HIGH RELIABILITY /883 (CLASS H)

	QML	
	CLASS H /883	
COMPONENT-LEVEL TEST PERFORMED	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 6: ELEMENT EVALUATION

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Environmental Screening High Reliability Standard, /ES and /883 (Class H)

Test Performed	non-QML [1]		Class H [2, 3]	
	Standard	/ES	/883 CH [4]	/883 QML
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			■ [5]	■ [5]
Burn-in Method 1015, +125°C case, typical [6]				
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				
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. Screened to MIL-PRF-38534.
4. Class H QML products with no SMD number are marked “CH” per MIL-STD-38534 Rev J, 3.9.5.8.3, Table III.
5. Not required by DLA but performed to assure product quality.
6. Burn-in temperature designed to bring the case temperature to +125°C minimum. Burn-in is a powered test

Table 7: Environmental Screening