

FMCE-1528 EMI Input Filters

28 VOLT INPUT – 15 AMP

FEATURES

- Attenuation to 70 dB at 500 kHz, typical
- Operating temperature -55° to +125°C
- Nominal 28 volt input, -0.5 to 50 volt operation
- Transient rating -0.5 to 80 volts for 1 second
- Up to 15 amps throughput current over the full input voltage range of -0.5 to 50 volts
- 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 dc voltage transient surges



FMCE-1528	
INPUT (V)	CURRENT (A)
-0.5 to 50	15

DESCRIPTION

The Interpoint® FMCE-1528 Series™ of EMI filters offers up to 15 amps of throughput current in a low profile package. The FMCE-1528 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-1528 filter is specifically designed to reduce the input line reflected ripple current of Interpoint high frequency DC-DC converters such as MOR, MFX, MTR, MWR, MFK, MHF+ and MHV Series. The FMCE-1528 can be used up to the rated current of 15 amps.

INPUT RIPPLE AND EMI

Switching DC-DC converters naturally generate two noise components on the power input line: differential noise and common mode noise. Input ripple current refers to both of these components. Differential noise occurs between the positive input and input common. Most Interpoint converters have an input filter that reduces differential noise which is sufficient for many applications. Common mode noise occurs across stray capacitances between the converter's power train components and the baseplate (bottom of the package) of the converter.

Where low noise currents are required to meet MIL-STD-461, a power line filter is needed for a converter. The FMCE-1528 EMI power line filters reduce the common mode and differential noise generated by the converters. FMCE-1528 filters reduce input ripple current by 70 dB typical at 500 kHz and 1 MHz when used in conjunction with Interpoint DC-DC converters.

Place the filter as close as possible to the converter for optimum performance. The baseplates of the filter and the converter should be connected with the shortest and widest possible conductors.

These filters are intended for use in 28 volt applications which must meet MIL-STD-461 levels of conducted emissions. The filters meet all the requirements of MIL-STD-461C CE03 and CS01 and of MIL-STD-461D, E and F CE102 and CS101 levels of conducted emissions.

TRANSIENTS

A transient of -0.5 to +80 volts (0.5 ohm source impedance) will not damage the filter but will be passed on to the converter:

OPERATION OVER TEMPERATURE

The FMCE-1528 Series filters are rated for full power operation from -55°C to +125°C case temperature. Current is derated linearly to 80% at +135°C case temperature.

INSERTION LOSS

The maximum dc insertion loss at full load and nominal input voltage represents a power loss of less than 4%.

PACKAGING

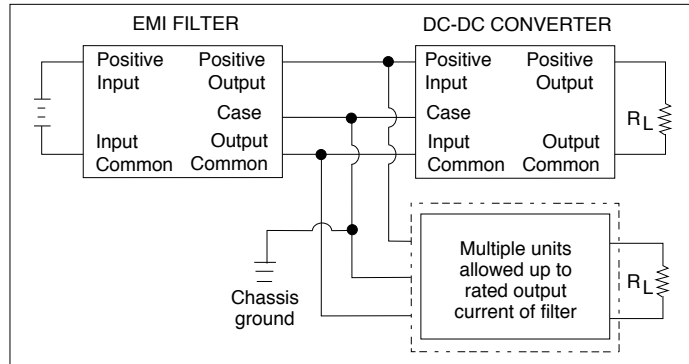
FMCE-1528 filters are sealed in metal hermetic side-leaded packages. See figures 10-14 for cases U, V, W, Y, and Z.

SCREENING

FMCE-1528 EMI filters are available screened to Class H of MIL-PRF-38534. See Table 7 on page 11 and Table 8 on page 12 for more information.

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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

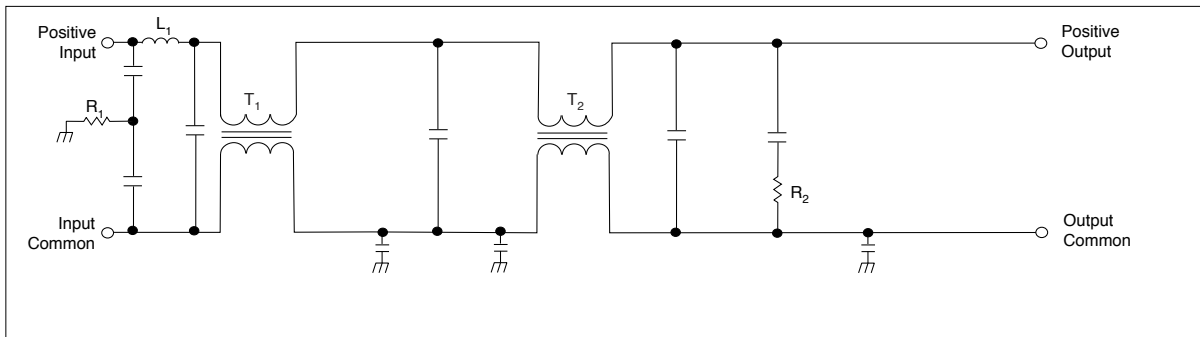


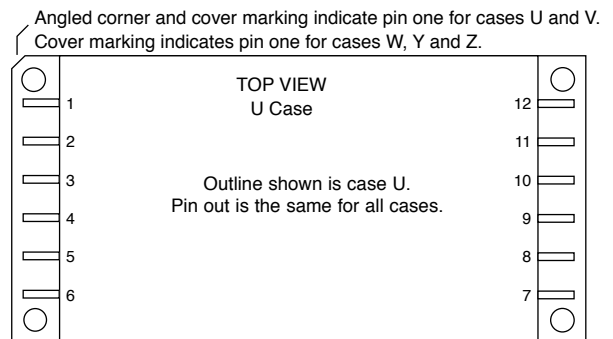
FIGURE 2: SCHEMATIC FMCE-1528

PIN OUT 1, 2	
Pin	Designation
1, 2, 3	Positive Input
4, 5, 6	Input Common
7, 8, 9	Output Common
10, 11, 12	Positive Output
Bottom of case	Case Ground

Notes

1. All pins must be connected.
2. The baseplate is the only case ground connection and should directly contact chassis ground.

TABLE 1: PIN OUT



For U, V, W, Y, and Z case dimensions see figures 10-14.

FIGURE 3: PIN OUT

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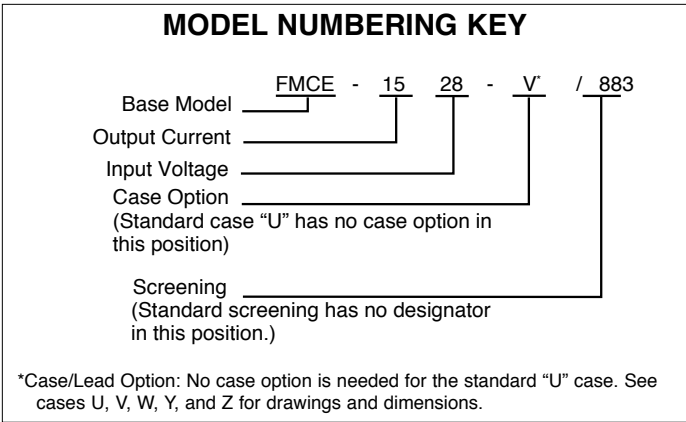


FIGURE 4: MODEL NUMBERING KEY

DLA NUMBERS	
DLA DRAWING (5915)	FMCE-1528 SIMILAR PART
10018-01HTC	FMCE-1528-W/883
10018-01HUC	FMCE-1528-V/883
10018-01HXC	FMCE-1528/883
10018-01HYC	FMCE-1528-Y/883
10018-01HZC	FMCE-1528-Z/883

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 NUMBER CROSS REFERENCE

Case Options: DLA Cases Cross Referenced to Interpoint Cases	
DLA Case Option	Interpoint Case Option
T	W
U	V
X	(standard case, no option required)
Y	Y
Z	Z

TABLE 3: DLA CASE 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	FMCE-1528		(“U” standard, leave blank) V W Y Z	(standard, leave blank) ES 883
FILL IN FOR MODEL # ⁴	FMCE-1528	-	_____	/ _____

- Notes
- See Figure 4 above for an example of a model number.
 - Case Options: For the standard case, Figure 10 on page 6, leave the case option blank. See figures 10-14 for cases U, V, W, Y, and Z for other case options.
 - Screening: See Table 7 on page 11 and Table 8 on page 12 for more information. Use “ES” for “ES” screening and “883” for Class H (MIL-PRF-38534) screening.
 - If ordering by model number add a “-Q” to request solder dipped leads (FMCE-1528/883-Q). Available only for “883” (Class H).

TABLE 4: MODEL NUMBER OPTIONS

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TABLE 5: OPERATING CONDITIONS

MODEL		FMCE-1528			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			
ESD RATING ^{1, 2}	MIL-STD-883, METHOD 3015	≥8000			V
MIL-PRF-38534, 3.9.5.8.2	CLASS 3B				
ISOLATION, ANY PIN TO CASE EXCEPT CASE PIN	500 VDC AT 25°C	100	–	–	Megohms

Notes

1. Guaranteed by characterization test and/or analysis. Not a production test.
2. Passes 8000 volts.

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

MODEL		FMCE-1528			UNITS
PARAMETER	CONDITIONS	MIN	TYP	MAX	
INPUT VOLTAGE ¹	CONTINUOUS	-0.5	28	50	V
	TRANSIENT, 1 sec ²	-0.5	–	80	V
NOISE REJECTION	500 kHz	60	70	–	dB
	1 MHz	60	70	–	
DC RESISTANCE (R _{DC})	T _C = 25°C	–	–	0.06	Ω
	T _C = 125°C ¹	–	–	0.07	
CAPACITANCE T _C = 25°C	ANY PIN TO CASE EXCEPT CASE PIN	50,000	60,000	70,000	pF
OUTPUT VOLTAGE ³	STEADY STATE	$V_{OUT} = V_{IN} - I_{IN} (R_{DC})$			V
OUTPUT CURRENT ¹	STEADY STATE V _{IN} = -0.5 - 50 volts	–	–	15	A
POWER DISSIPATION ¹	T _C = 25°C	–	–	13.5	W
	T _C = 125°C	–	–	15.75	

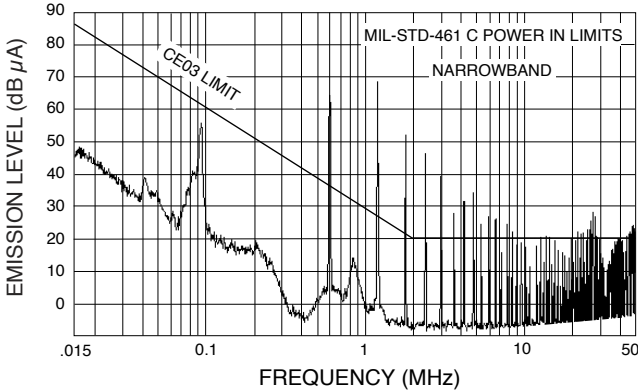
Notes

1. Guaranteed by characterization test and/or analysis. Not a production test.
2. 0.5 ohm source impedance. The transient voltage can be present at the filter's output.
3. Typical applications result in V_{out} within 4% of V_{in}.

FMCE-1528 EMI Input Filters

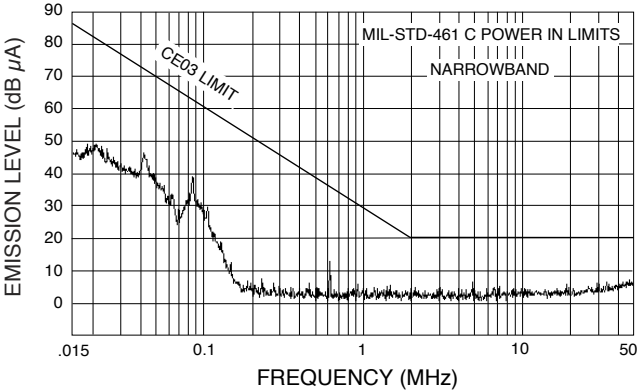
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TYPICAL PERFORMANCE PLOTS: 25°C CASE, UNLESS OTHERWISE SPECIFIED.
FOR REFERENCE ONLY, NOT GUARANTEED SPECIFICATIONS.



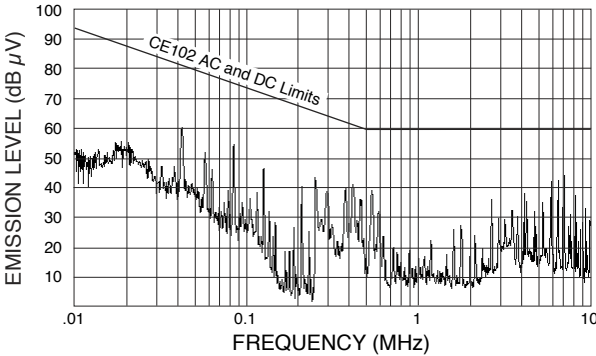
Three paralleled and synchronized MFL2815D converters without filtering.

FIGURE 5



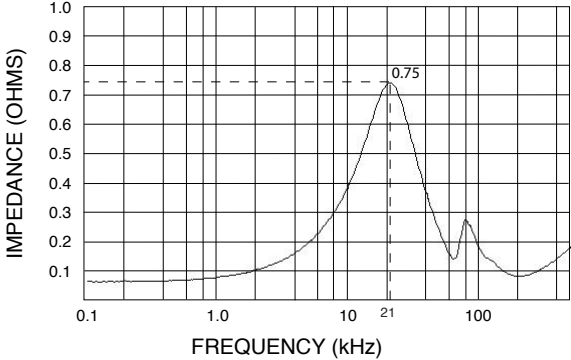
CE03: Three paralleled and synchronized MFL2815D converters with an FMCE-1528.

FIGURE 6



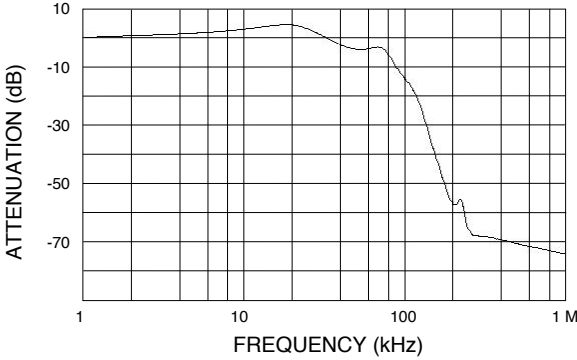
CE102: Three paralleled and synchronized MFL2815D converters with an FMCE-1528.

FIGURE 7



FMCE-1528 Output Impedance (measured at the output with input pins shorted)

FIGURE 8



FMCE-1528 Attenuation

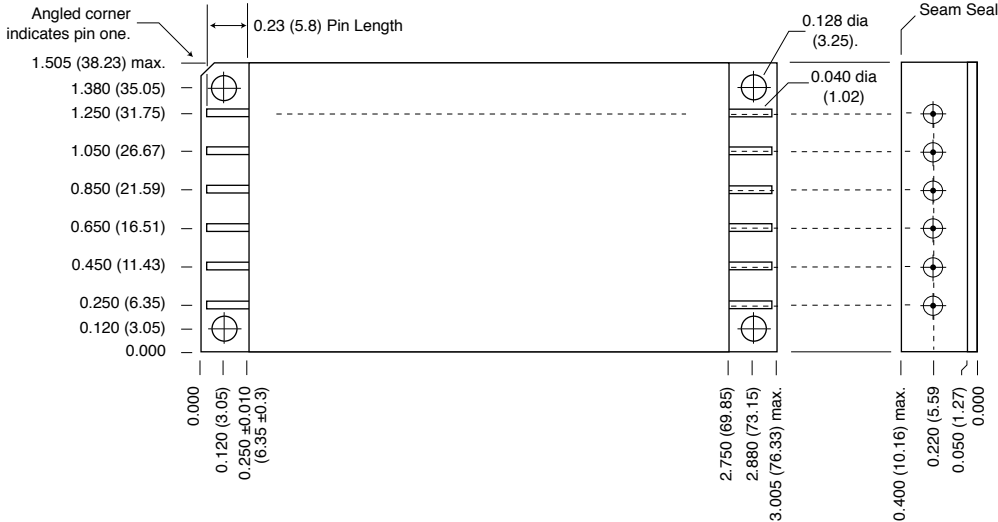
FIGURE 9

FMCE-1528 EMI Input Filters

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TOP VIEW CASE U Flanged case, short leads

Case "U" does not require an option in the Case Option position of the model number.



Weight: 86 grams maximum

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
Gold plating of 50 - 150 microinches is included in pin diameter
Seal Hole: 0.120 ±0.002 (3.05 ±0.05)

Please refer to the numerical dimensions for accuracy.

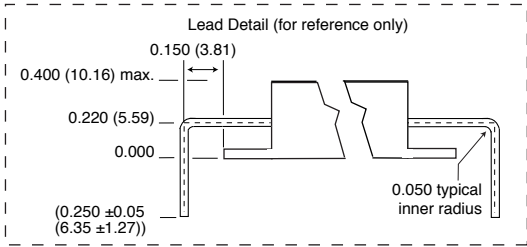
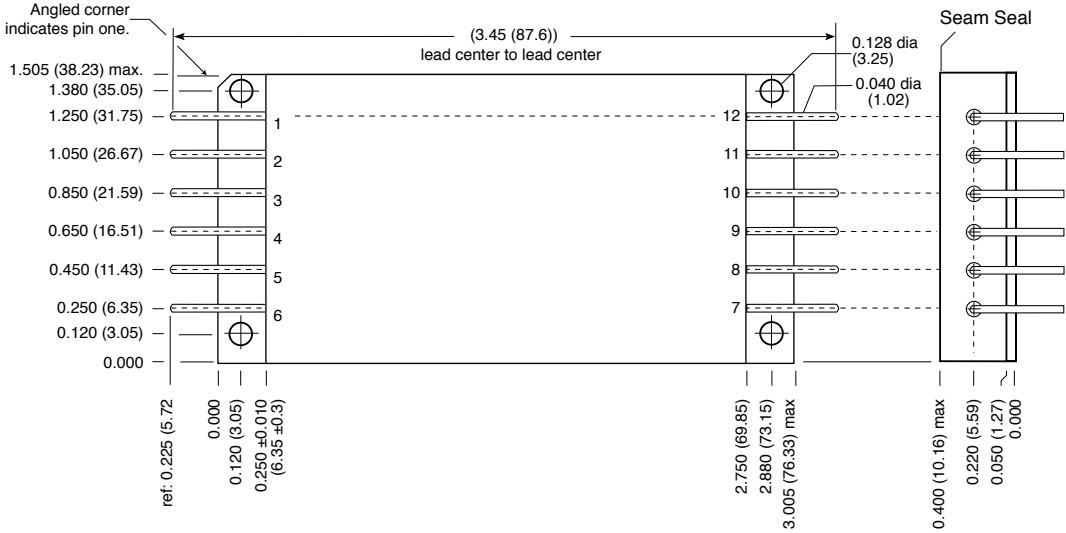
FIGURE 10: CASE U

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TOP VIEW CASE V Flanged case, down leaded

Case "V" requires a "V" in the Case Option position of the model number.



Weight: 86 grams maximum

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 OFHC copper/gold, compression glass seal
 Gold plating of 50 - 150 microinches
 Included in pin diameter
 Seal Hole: 0.120 ±0.002 (3.05 ±0.05)

Please refer to the numerical dimensions for accuracy.

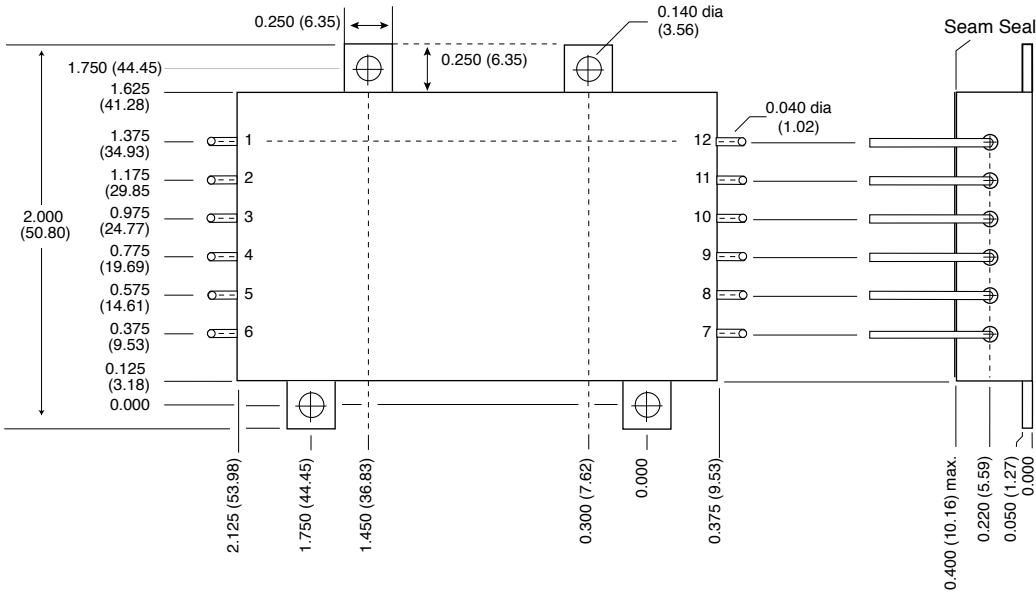
FIGURE 11: CASE V

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TOP VIEW CASE W Tabbed case, up-led

Case "W" requires a "W" in the Case Option position of the model number.



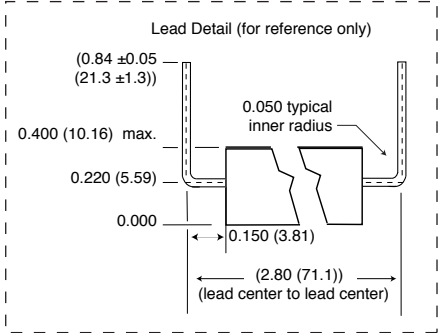
Weight: 86 grams maximum

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	OFHC copper/gold, compression glass seal
	Gold plating of 50 - 150 microinches
	Included in pin diameter
	Seal Hole: 0.120 ±0.002 (3.05 ±0.05)



Please refer to the numerical dimensions for accuracy.

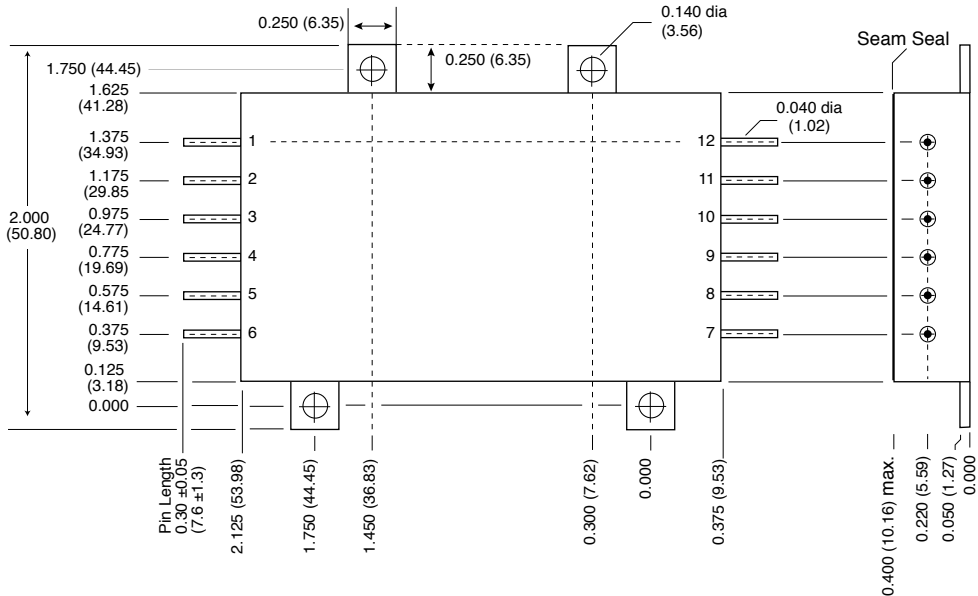
FIGURE 12: CASE W

FMCE-1528 EMI Input Filters

28 VOLT INPUT – 15 AMP

TOP VIEW CASE Y Tabbed case, straight-leaded

Case "Y" requires a "Y" in the Case Option position of the model number.



Weight: 86 grams maximum

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 OFHC copper/gold, compression glass seal
 Gold plating of 50 - 150 microinches
 Included in pin diameter
 Seal Hole: 0.120 \pm 0.002 (3.05 \pm 0.05)

Please refer to the numerical dimensions for accuracy.

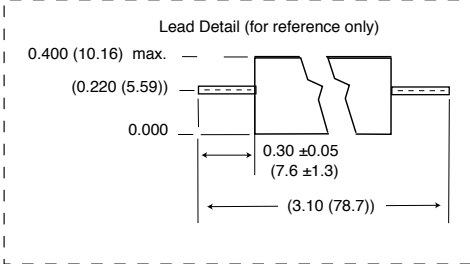


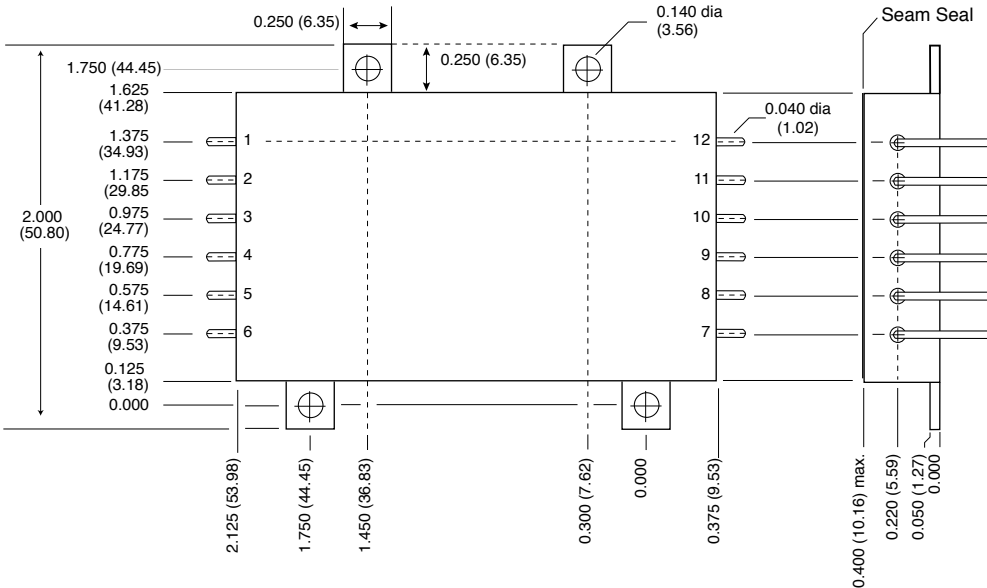
FIGURE 13: CASE Y

FMCE-1528 EMI Input Filters

28 VOLT INPUT – 15 AMP

TOP VIEW CASE Z Tabbed case, down-led

Case "Z" requires a "Z" in the Case Option position of the model number.

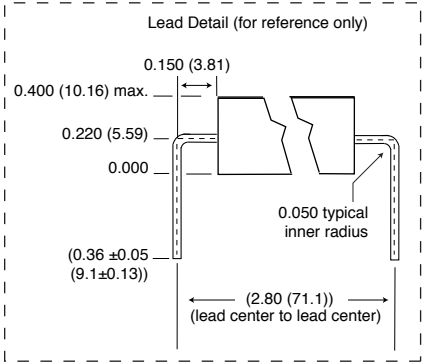


Weight: 86 grams maximum

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 OFHC copper/gold, compression glass seal
 Gold plating of 50 - 150 microinches
 Included in pin diameter
 Seal Hole: 0.120 \pm 0.002 (3.05 \pm 0.05)



Please refer to the numerical dimensions for accuracy.

FIGURE 14: CASE Z

FMCE-1528 EMI Input Filters

28 VOLT INPUT – 15 AMP

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 SX ³	/883 CH ⁴	/883 QML ⁵
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			■	■ ⁶	■ ⁶
Burn-in Method 1015, +125°C case, typical ⁷					

TABLE 7: ELEMENT EVALUATION

FMCE-1528 EMI Input Filters

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ENVIRONMENTAL SCREENING HIGH RELIABILITY STANDARD, /ES AND /883 (CLASS H)

TEST PERFORMED	NON-QML ¹		CLASS H QML ²
	STANDARD	/ES	/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			■ ³
Burn-in Method 1015, +125°C case, typical ⁴			
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. Not required by DLA but performed to assure product quality.
4. Burn-in temperature designed to bring the case temperature to +125°C minimum. Burn-in is a powered test.

TABLE 8: ENVIRONMENTAL SCREENING