

# FMCE-1528 EMI Input Filters

## -0.5 TO 50 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

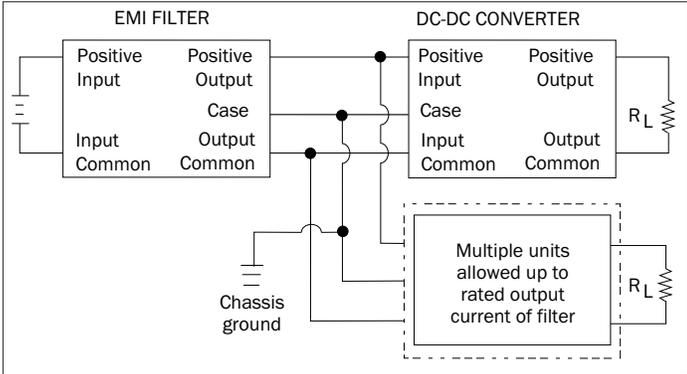
FMCE-1528 filters are sealed in metal hermetic side-leaded packages. See Figures 10-14 for cases U, V, W, Y, and Z on pages 6-10.

#### SCREENING

FMCE-1528 EMI filters are available screened to Class H of MIL-PRF-38534. See Table 7 on page 11 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

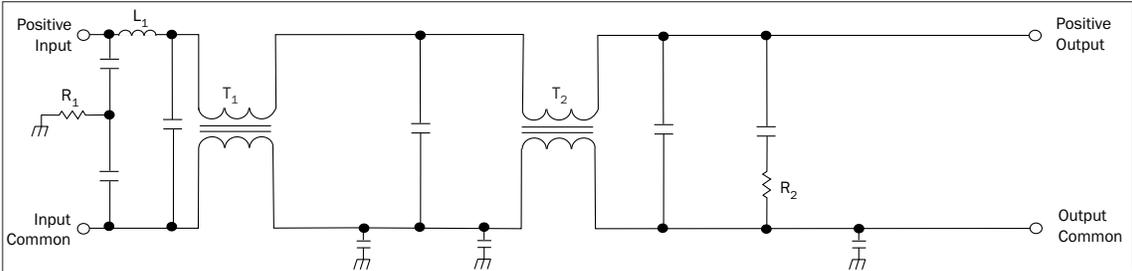
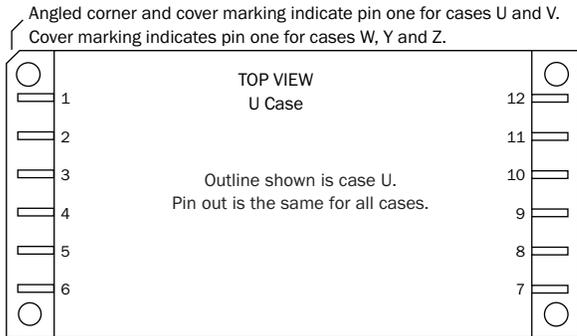


FIGURE 2: SCHEMATIC FMCE-1528

<b>PIN OUT 1, 2</b>	
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

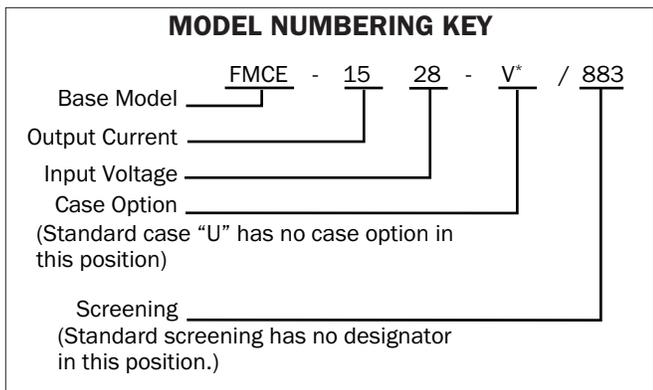


For U, V, W, Y, and Z case dimensions see Figures 10-14 on pages 6-10.

FIGURE 3: PIN OUT

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\*Case/Lead Option: No case option is needed for the standard “U” case. See cases U, V, W, Y, and Z, Figures 10-14, for drawings and dimensions.

FIGURE 4: MODEL NUMBERING KEY

<b>DLA NUMBERS</b>	
<b>DLA DRAWING (5915)</b>	<b>FMCE-1528 SIMILAR PART</b>
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

The DLA Drawing numbers shown are for screening level Class H, all cases (T, U, X, Y and Z), non-solder dipped pins (C). For other options please refer to the DLA Drawing for the DLA number and the vendor similar number. All DLA Drawing numbers are listed on the DLA Drawing at the end of the document. For exact specifications for an SMD product, refer to the DLA Drawing. DLA Drawings can be downloaded from <https://landandmaritimeapps.dla.mil/programs/smcr>

TABLE 2: DLA NUMBER CROSS REFERENCE

<b>Case Options: DLA Cases Cross Referenced to Interpoint Cases</b>	
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

<b>MODEL NUMBER OPTIONS <sup>1</sup></b>					
<b>TO DETERMINE THE MODEL NUMBER ENTER ONE OPTION FROM EACH CATEGORY IN THE FORM BELOW.</b>					
CATEGORY	Base Model and Input Voltage	Case Option <sup>2</sup>	Screening <sup>3</sup>		
<b>OPTIONS</b>	FMCE-1528	(“U” standard, leave blank) V W Y Z	(standard, leave blank) ES 883		
<b>FILL IN FOR MODEL # <sup>4</sup></b>	FMCE-1528	-	_____	/	_____

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

TABLE 4: MODEL NUMBER OPTIONS

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TABLE 5: OPERATING CONDITIONS

MODEL	PARAMETER	CONDITIONS	FMCE-1528			UNITS
			MIN	TYP	MAX	
	LEAD SOLDERING TEMPERATURE <sup>1</sup>	10 seconds max.	–	–	300	°C
	STORAGE TEMPERATURE <sup>1</sup>		-65	–	+150	°C
	CASE OPERATING TEMPERATURE <sup>1</sup>	FULL POWER	-55	–	+125	°C
		ABSOLUTE	-55	–	+135	
	DERATING OUTPUT POWER/CURRENT <sup>1</sup>	LINEARLY	From 100% at 125 °C to 80% at 135 °C			
	ESD RATING <sup>1, 2</sup>	MIL-STD-883, METHOD 3015	≥8000			V
	MIL-PRF-38534, 3.9.5.8.2	CLASS 3B				
	ISOLATION <sup>3</sup>	500 VDC AT 25 °C	100	–	–	Megohms

## Notes

1. Guaranteed by characterization test and/or analysis. Not a production test.
2. Passes 8000 volts.
3. Tested with all pins, except case pin, tied together. When testing isolation, discharge the pins before and after testing.

TABLE 6: ELECTRICAL CHARACTERISTICS: -55 °C TO +125 °C T<sub>C</sub>, UNLESS OTHERWISE SPECIFIED.

MODEL	PARAMETER	CONDITIONS	FMCE-1528			UNITS
			MIN	TYP	MAX	
	INPUT VOLTAGE <sup>1</sup>	CONTINUOUS	-0.5	28	50	V
		TRANSIENT, 1 SEC <sup>2</sup>	-0.5	–	80	V
	NOISE REJECTION	500 kHz	60	70	–	dB
		1 MHz	60	70	–	
	DC RESISTANCE (R <sub>DC</sub> )	T <sub>C</sub> = 25 °C	–	–	0.06	Ω
		T <sub>C</sub> = 125 °C <sup>1</sup>	–	–	0.07	
	CAPACITANCE <sup>3</sup>	T <sub>C</sub> = 25 °C	50,000	60,000	70,000	pF
	OUTPUT VOLTAGE <sup>4</sup>	STEADY STATE	$V_{OUT} = V_{IN} - I_{IN} (R_{DC})$			V
	OUTPUT CURRENT <sup>1</sup>	STEADY STATE V <sub>IN</sub> = -0.5 - 50 VOLTS	–	–	15	A
	POWER DISSIPATION <sup>1</sup>	T <sub>C</sub> = 25 °C	–	–	13.5	W
		T <sub>C</sub> = 125 °C	–	–	15.75	

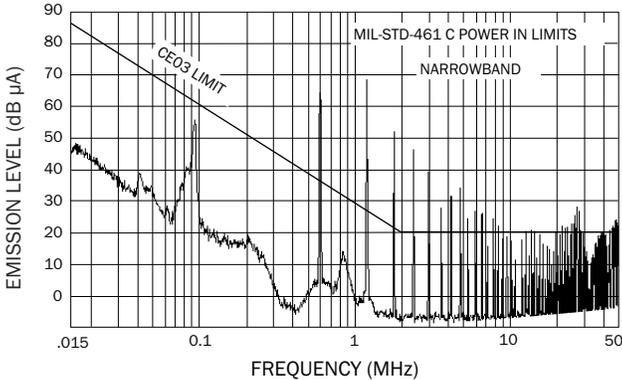
## Notes

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. Tested with all pins tied together except case pin.
4. Typical applications result in V<sub>out</sub> within 4% of V<sub>in</sub>.

# FMCE-1528 EMI Input Filters

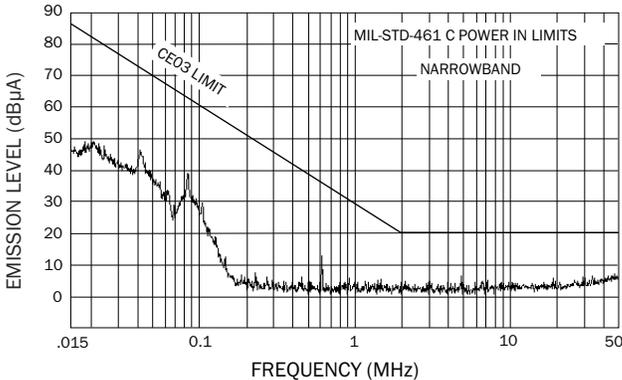
**-0.5 TO 50 VOLT INPUT – 15 AMP**

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



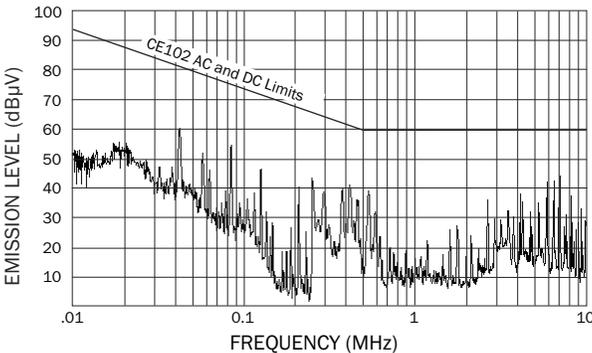
Three paralleled and synchronized MFL2815D converters without filtering.

FIGURE 5



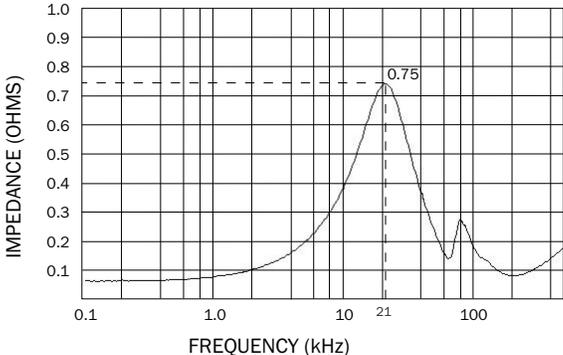
CE03: Three paralleled and synchronized MFL2815D converters with an FMCE-1528.

FIGURE 6



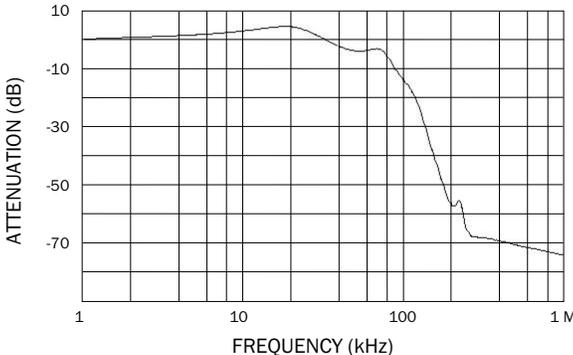
CE102: Three paralleled and synchronized MFL2815D converters with an FMCE-1528.

FIGURE 7



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

FIGURE 8



FMCE-1528 Attenuation

FIGURE 9

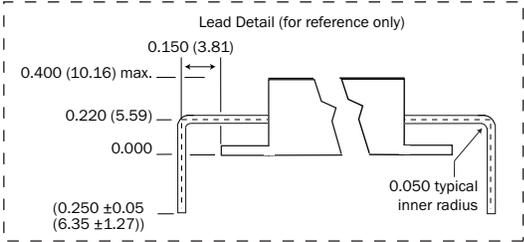
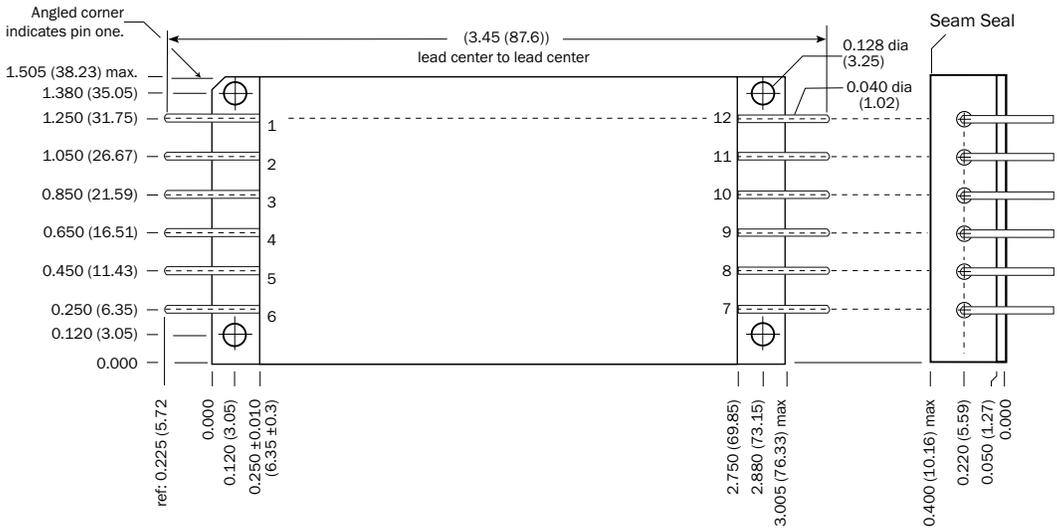


# FMCE-1528 EMI Input Filters

## -0.5 TO 50 VOLT INPUT – 15 AMP

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

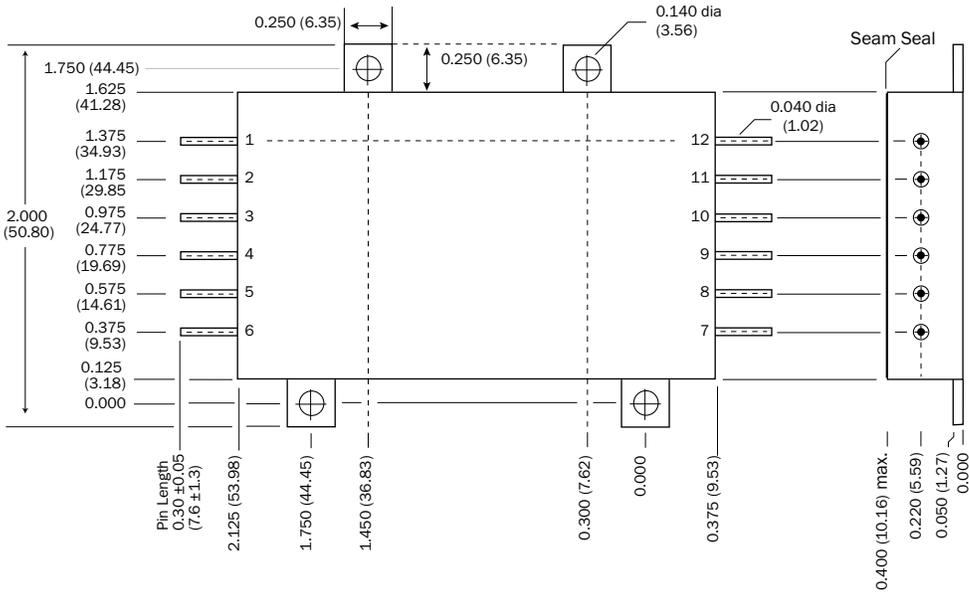


# FMCE-1528 EMI Input Filters

## -0.5 TO 50 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 ± 0.002 (3.05 ± 0.05)

Please refer to the numerical dimensions for accuracy.

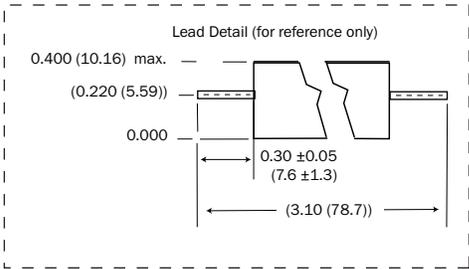


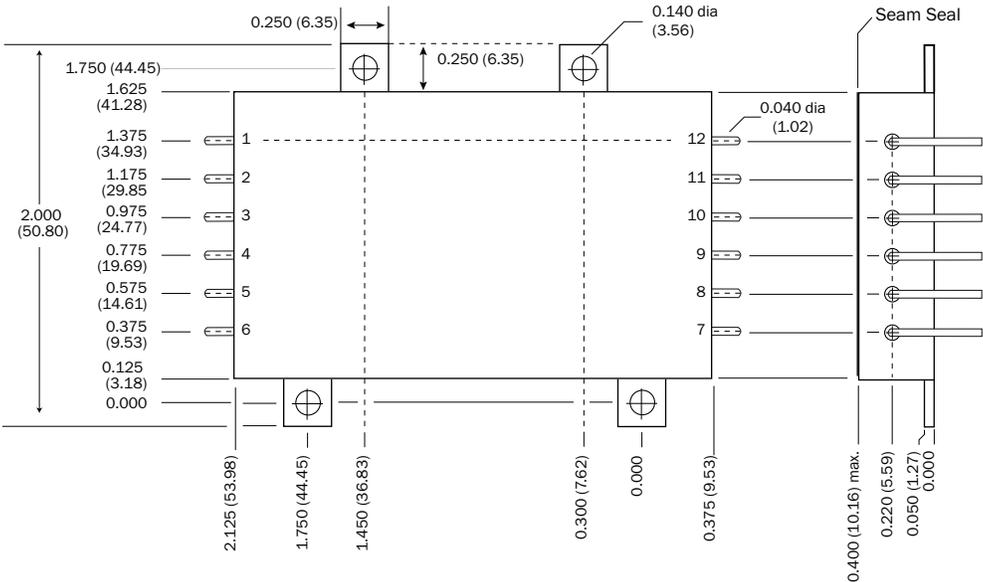
FIGURE 13: CASE Y

# FMCE-1528 EMI Input Filters

## -0.5 TO 50 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  $\pm 0.005$  (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 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.

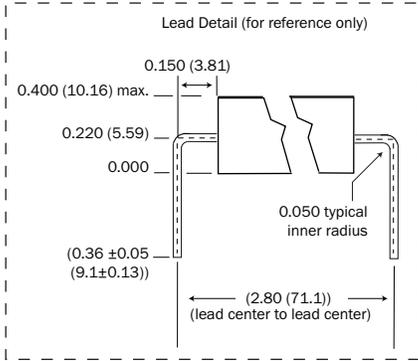


FIGURE 14: CASE Z

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ELEMENT EVALUATION TABLES FOR QML PRODUCTS ARE IN “APP-009 QUALITY AND CERTIFICATION”, APPENDIX A, IN COMPLIANCE WITH MIL-PRF-38534 REVISION L.  
( LINK [HTTPS://WWW.CRANEAE.COM/QUALITY-ASSURANCE-MODULAR-POWER](https://www.craneae.com/quality-assurance-modular-power) )

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

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

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 with no SMD number are marked “CH” per MIL-PRF-38534, 3.9.5.8.3, Table III.
4. Class H QML products have an SMD number
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 HIGH RELIABILITY STANDARD, /ES AND /883 (CLASS H)

