

FME28-461 EMI Input Filters

28 VOLT INPUT – 15 AMP NOT RECOMMENDED FOR NEW DESIGN

FEATURES

- Attenuation to a minimum of 60 dB at 500 kHz
- Operating temperature -55° to +125° C
- Nominal 28 V input, 0 to 50 V operation
- Transient rating to ±100 V for 100 ms
- Up to 15 A throughput current
- Screening up to Class H (/883) of MIL-PRF-38534
- Compliant to MIL-STD-461C, CE03
- Compatible with MIL-STD-704 A-E 28 VDC power bus



FME28-461	
INPUT (V)	CURRENT (A)
0 - 50	15

DESCRIPTION

The Interpoint® FME28-461 Series™ of EMI filters offers up to 15 amps of throughput current in a low profile package. The FME28-461 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. These EMI filters are specifically designed to reduce the reflected input ripple current of Interpoint's high frequency DC-DC converters. FME filters minimize electromagnetic interference (EMI) for the MOR, MFL, MFX, MWR, MTR, MFK, MHV, MHF+, MSA and MCH. Series of converters. These filters are intended for use in 28 volt applications which must meet MIL-STD-461C CE03 levels of conducted emissions. One filter can be used with multiple converters up to the rated output current of the filter.

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-461C, a power line filter is needed. The FME28 EMI power line filters reduce the common mode and differential noise generated by the converters. FME28 filters reduce input ripple current to a minimum of 60 dB 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.

TRANSIENTS

A transient of -100 to +100 V for up to 100 ms with a 0.5 ohm source impedance will not damage the filter but will be passed on to the converter:

OPERATION OVER TEMPERATURE

The FME28-461 Series filters are rated for operation from -55° C to +125° 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

FME28-461 filters are sealed in metal hermetic side-leaded packages. See cases U, V, W, Y, and Z.

FME28-461 EMI Input Filters

28 VOLT INPUT - 15 AMP

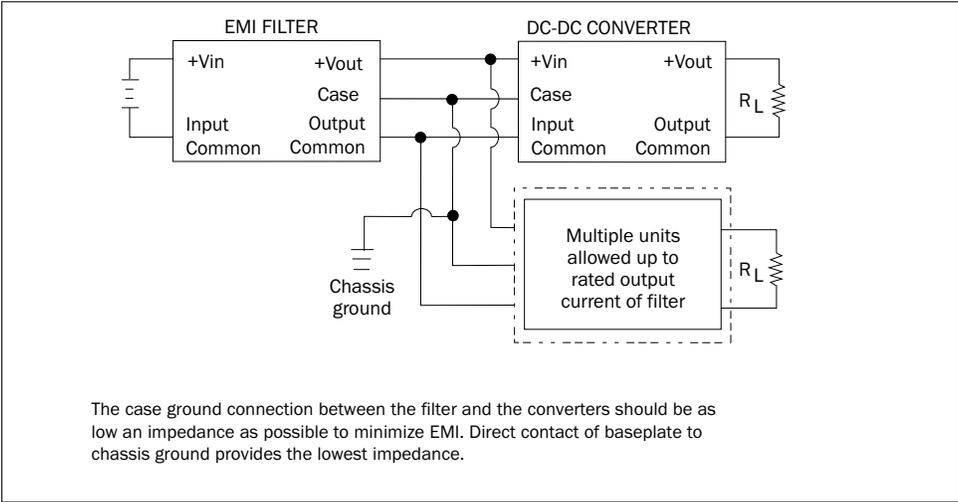


FIGURE 1: CONNECTION DIAGRAM

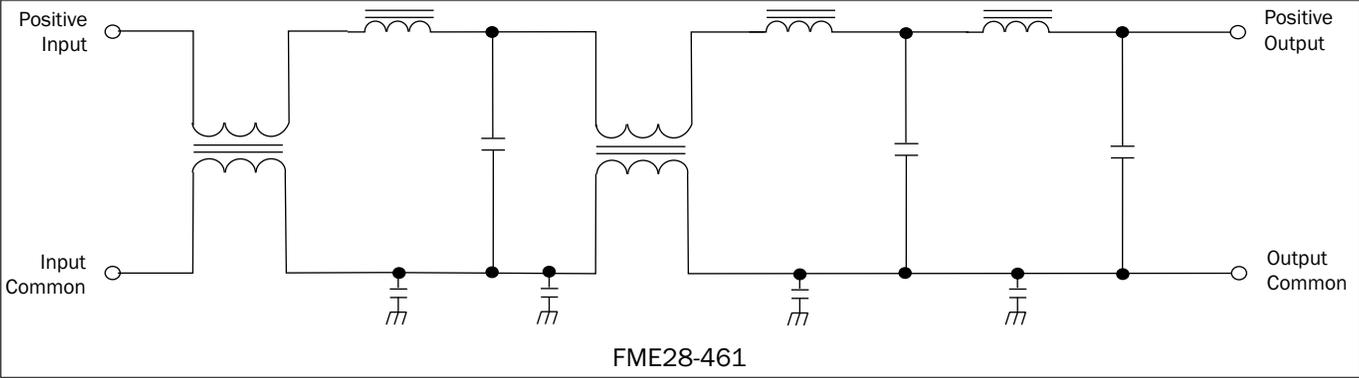


FIGURE 2: SCHEMATIC

FME28-461 EMI Input Filters

28 VOLT INPUT - 15 AMP

PIN OUT

Pin ¹	Designation
1, 2, 3	Positive Input
4, 5, 6	Input Common
7, 8, 9	Output Common
10, 11, 12	Positive Output
—	Case Ground ²

- 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

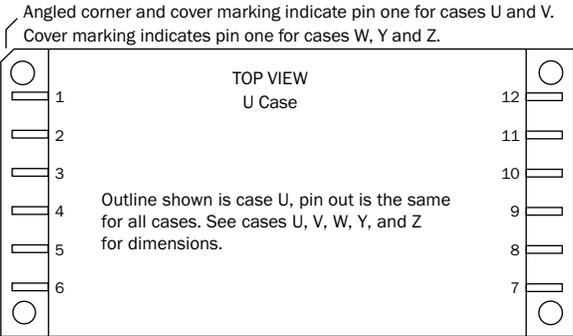


FIGURE 3: PIN OUT

FME28-461 EMI Input Filters

28 VOLT INPUT – 15 AMP

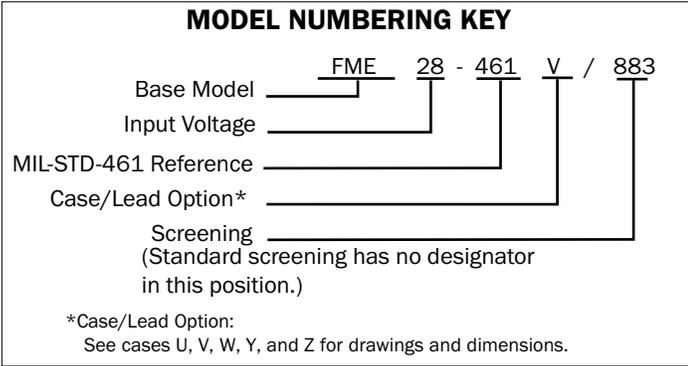


FIGURE 3: MODEL NUMBERING KEY

DLA NUMBERS	
DLA DRAWING (5915)	FME28 SIMILAR PART
95004-01HTC	FME28-461W/883
95004-01HUC	FME28-461V/883
95004-01HXC	FME28-461/883
95004-01HYC	FME28-461Y/883
95004-01HZC	FME28-461Z/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	Case Drawing	Description
T	W	Figure 10 on page 9	tabbed, leads bent up
U	V	Figure 9 on page 8	flanged, leads bent down
X	(standard case, no option required)	Figure 8 on page 7	flanged, short leads
Y	Y	Figure 11 on page 10	tabbed, short leads
Z	Z	Figure 12 on page 11	tabbed, leads bent down

TABLE 3: CASE OPTIONS CROSS REFERENCED

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	FME28-461	(flanged, short leads, standard "U" case, leave blank) V (flanged, leads bent down) W (tabbed, leads bent up) Y (tabbed, short leads) Z (tabbed, leads bent down)	(Standard, leave blank) ES 883 (Class H)
FILL IN FOR MODEL # ⁴	FME28-461	_____ /	_____

Notes:
 1. See Model Numbering Key above for an example of a model number.
 2. Case Options: Case U is the standard case, leave the case option blank for case U. For case V, W, Y or Z, place the appropriate letter in the case option position.
 3. Screening: See Table 7 on page 12 and Table 8 on page 13 for more information. Use "ES" for "ES" screening and "883" for Class H screening. "H" indicates Class H of MIL-PRF-38534.
 4. If ordering by model number add a "-Q" to request solder dipped leads (FME28-461V/883-Q).

TABLE 4: MODEL NUMBER OPTIONS

FME28-461 EMI Input Filters

28 VOLT INPUT – 15 AMP

TABLE 5: OPERATING CONDITIONS, 28 V_{IN}, 100% LOAD, UNLESS OTHERWISE SPECIFIED.

MODEL		FME28-461			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 15 A at 95°C to 10 A at 125°C			
		From 10 A at 125°C to 0 at 135°C			
ISOLATION, ANY PIN TO CASE	500 VDC AT 25°C	100	–	–	Megohms

TABLE 6: ELECTRICAL CHARACTERISTICS: -55 TO +125°C CASE, 28 V_{IN}, UNLESS OTHERWISE SPECIFIED.

MODEL		FME28-461			UNITS
PARAMETER	CONDITIONS	MIN	TYP	MAX	
INPUT VOLTAGE ¹	CONTINUOUS	0	28	50	V
	TRANSIENT 100 ms ^{2, 3}	-100	–	100	
NOISE REJECTION	500 kHz	60	–	–	dB
	1 MHz	60	–	–	
DC RESISTANCE (R _{DC})	T _C = 25°C	–	–	0.076	Ω
CAPACITANCE 25°C	ANY PIN TO CASE	50,000	60,000	70,000	pF
OUTPUT VOLTAGE ¹	STEADY STATE	$V_{OUT} = V_{IN} - I_{IN} (R_{DC})$			V
OUTPUT CURRENT ^{1, 4}	STEADY STATE	–	–	15	A
POWER DISSIPATION ^{1, 4} AT MAXIMUM CURRENT	15 A, T _C = 25°C	–	–	17.1	W
	10 A, T _C = 125°C	–	–	10.8	

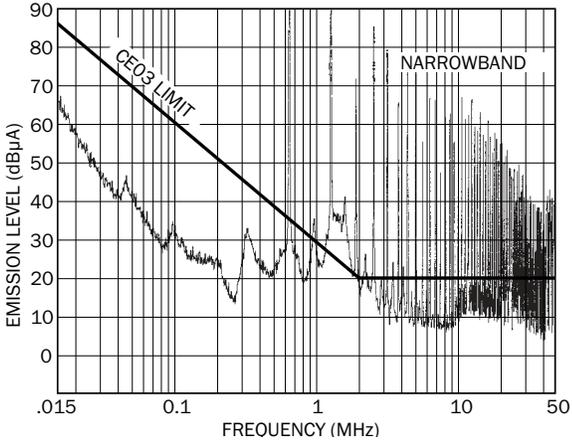
Notes Table 5 and Table 6

1. Guaranteed by characterization test and/or analysis. Not a production test.
2. 0.5 ohm source impedance.
3. Transients up to 100 volts will not damage the filter but will be passed through the filter.
4. 15 A maximum at 95°C, derate linearly to 10 A at 125°C

FME28-461 EMI Input Filters

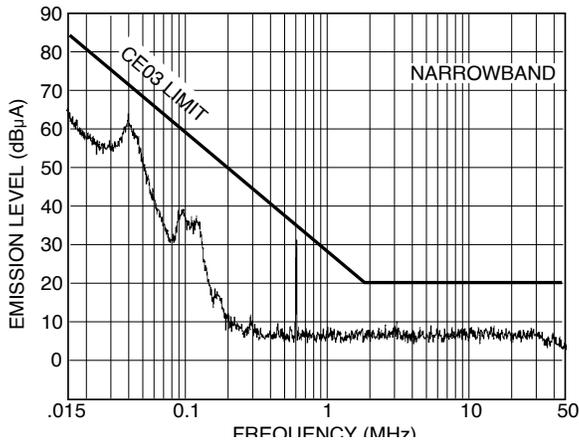
28 VOLT INPUT - 15 AMP

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



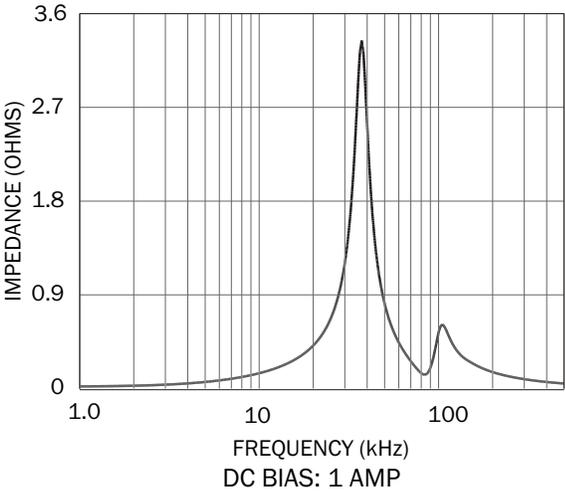
THREE PARALLELED AND SYNCHRONIZED MFL2815D CONVERTERS WITHOUT FILTERING.

FIGURE 4



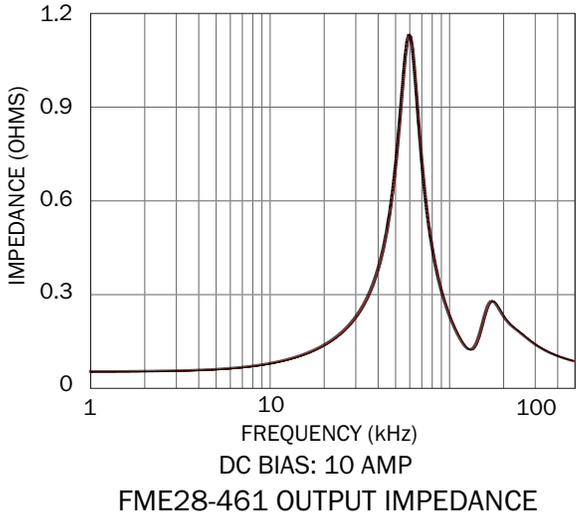
CE03: THREE PARALLELED AND SYNCHRONIZED MFL2815D CONVERTERS WITH AN FME28-461.

FIGURE 5



FME28-461 OUTPUT IMPEDANCE

FIGURE 6



FME28-461 OUTPUT IMPEDANCE

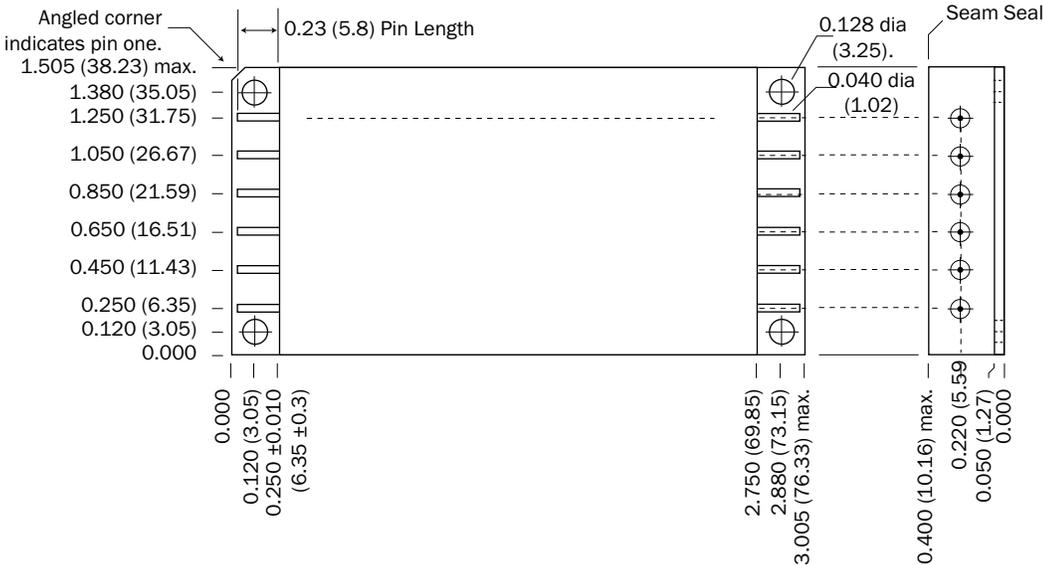
FIGURE 7

FME28-461 EMI Input Filters

28 VOLT INPUT - 15 AMP

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, compression glass 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.

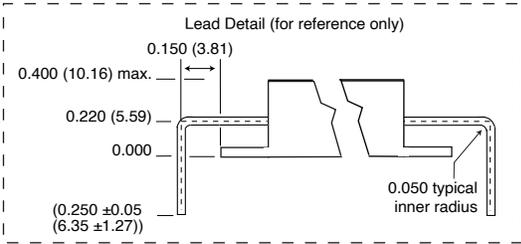
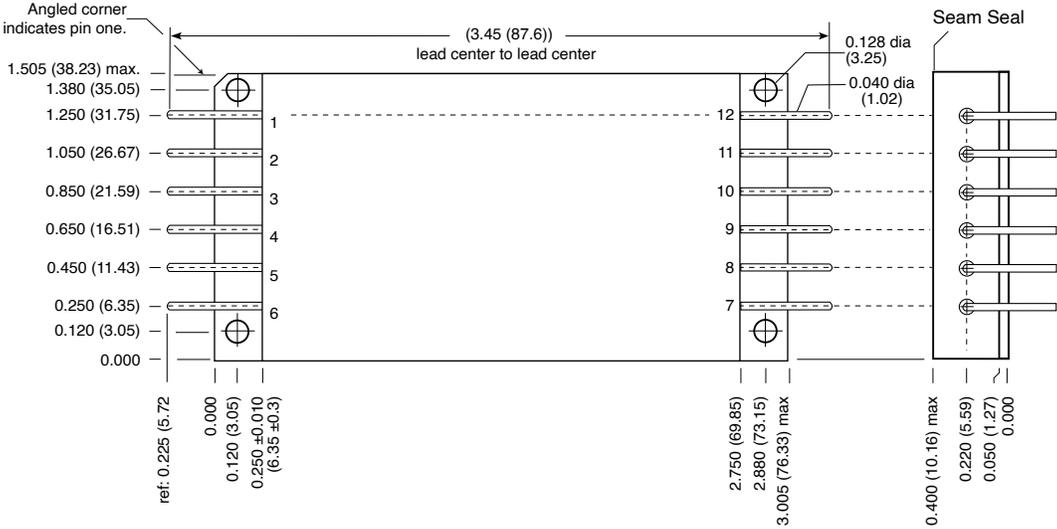
FIGURE 8: CASE U - FME28-461

FME28-461 EMI Input Filters

28 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

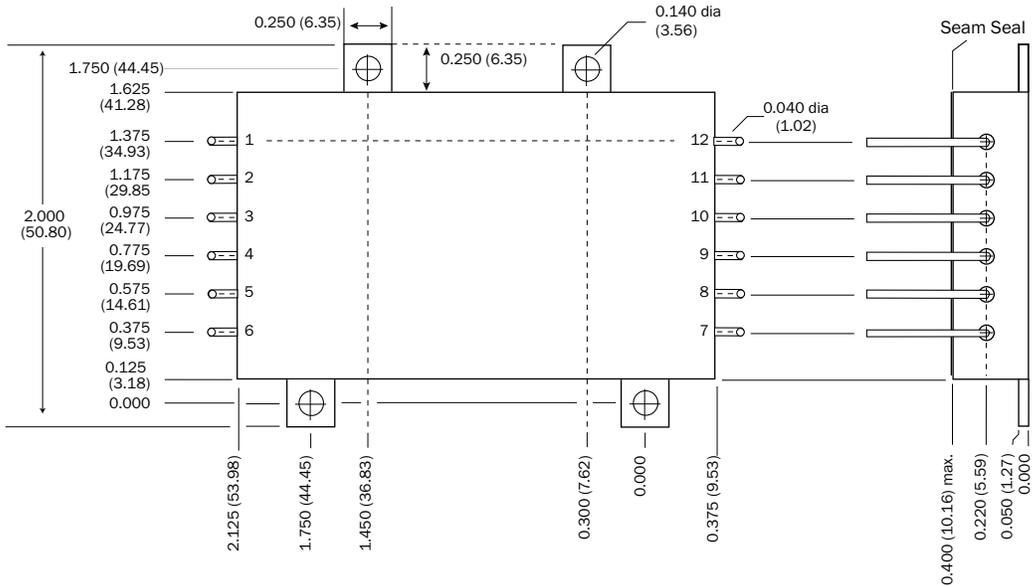
FIGURE 9: CASE V - FME28-461V

FME28-461 EMI Input Filters

28 VOLT INPUT - 15 AMP

TOP VIEW CASE W
Tabbed case, up-leaded

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

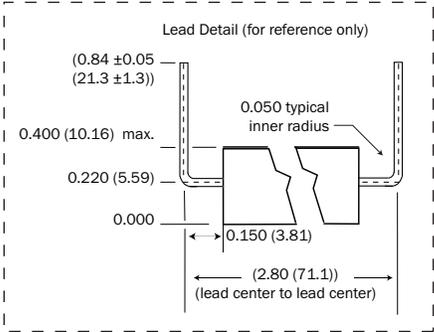


Weight: 86 grams maximum

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 \pm 0.05)



Please refer to the numerical dimensions for accuracy.

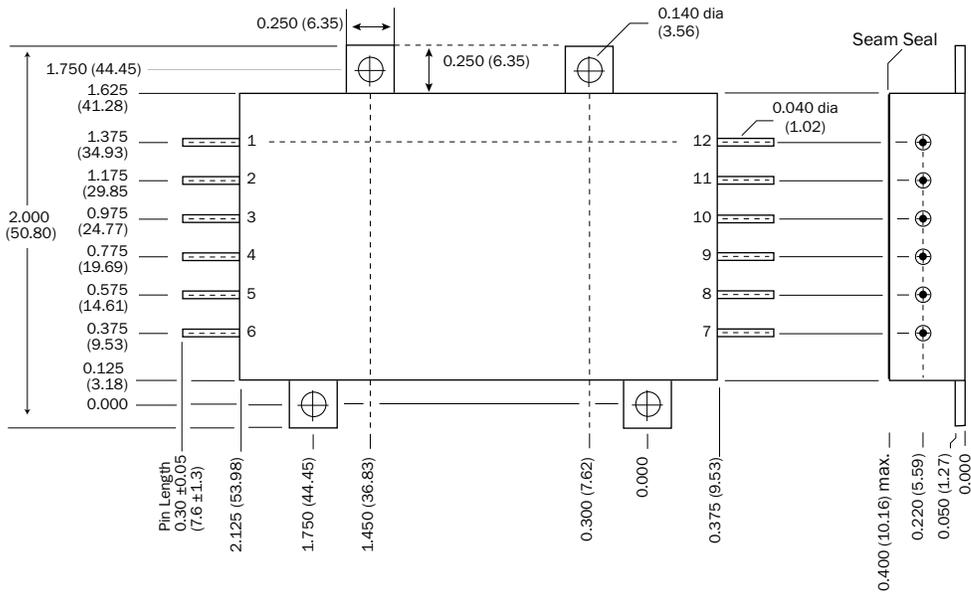
FIGURE 10: CASE W - FME28-461W

FME28-461 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.

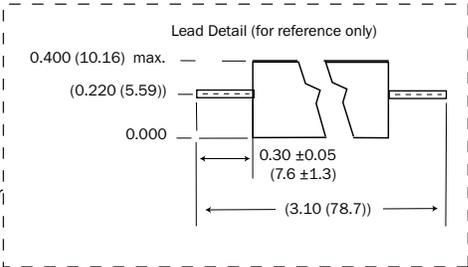


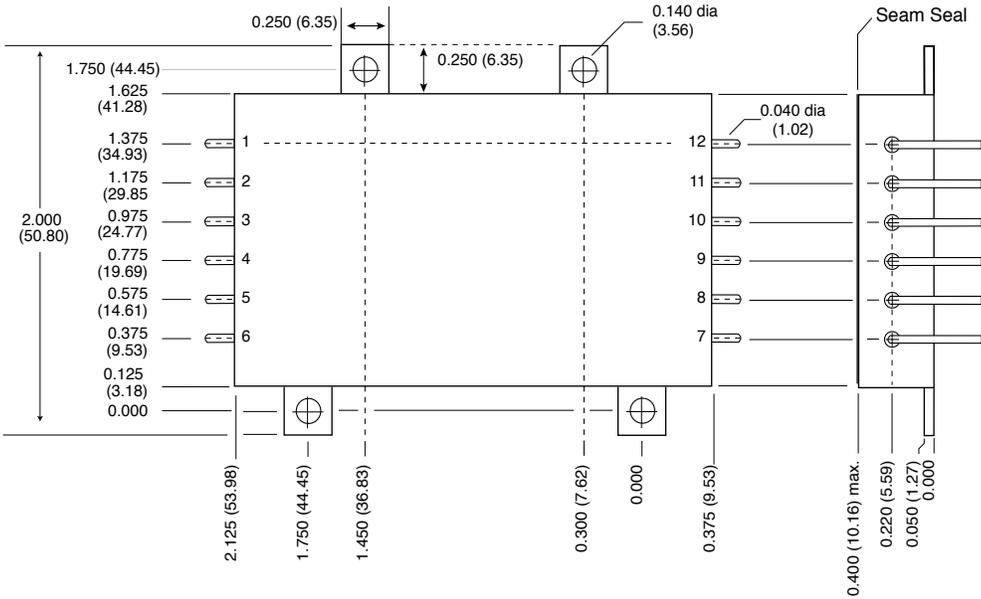
FIGURE 11: CASE Y - FME28-461Y

FME28-461 EMI Input Filters

28 VOLT INPUT - 15 AMP

TOP VIEW CASE Z Tabbed case, down-leaded

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

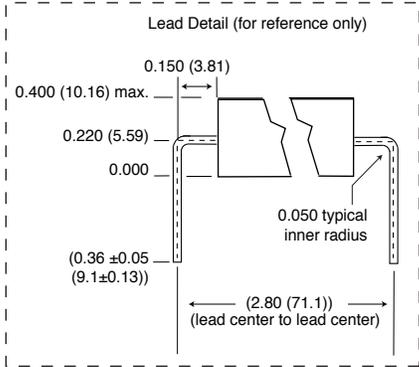


Weight: 86 grams maximum

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 ± 0.002 (3.05 ± 0.05)



Please refer to the numerical dimensions for accuracy.

FIGURE 12: CASE Z - FME28-461Z

FME28-461 EMI Input Filters

28 VOLT INPUT – 15 AMP

ELEMENT EVALUATION ¹ HIGH RELIABILITY /883 (CLASS H)

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

FME28-461 EMI Input Filters

28 VOLT INPUT – 15 AMP

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

TEST PERFORMED	NON-QML ¹		CLASS H QML ²
	STANDARD	/ES	/883
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, Method 1014			
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