FME28-461 EMI Input Filters

28 VOLT INPUT – 15 AMP

FEATURES

Attenuation to 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
- Compliant to MIL-STD-461C, CE03
- Compatible with MIL-STD-704 A-E 28 VDC power bus

DESCRIPTION

The FME Series™ 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, MTR, MHV, MHF+, MHF, MTO and MHE 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 reduces the common mode and differential noise generated by the converters. FME28 filters reduce input ripple current by as much as 60 dB at 500 kHz and 1 MHz when used in conjunction with Interpoint's 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.

Crane Aerospace & Electronics
Electronics Group (Interpoint Brand)
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425.882.3100 • power@crane-eg.com
www.interpoint.com

FME28-461 EMI Input Filters

28 VOLT INPUT – 15 AMP

OPERATING CONDITIONS AND CHARACTERISTICS

Input Voltage Range
- 0 to 50 VDC continuous
- Transient -100 to +100 volts for 100 ms

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

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

Case Operating Temperature (T_C)
- -55°C to +125°C full power
- -55°C to +135°C absolute

Derating Input/Output Current
- Linearly from 15 A at 95°C to 10 A at 125°C to zero at 135° C
- 15 A max at 95°C to 10 A max at 125°C

Isolation
- 100 megohm minimum at 500 VDC
- Any pin to case

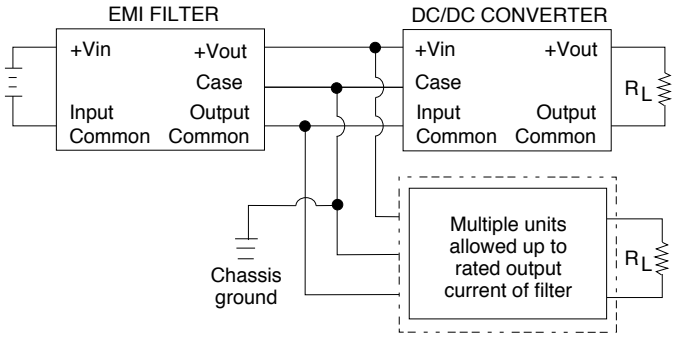
MECHANICAL AND ENVIRONMENTAL

Size (maximum)
- Case U
  3.005 x 1.505 x 0.400 inches (76.33 x 38.23 x 10.16 mm)
  The image on page one shows Case U (flanged, short leads).
- Also available:
  - Flanged: leads bent down (case V)
  - Tabbed: leads bent up (case W)
  - Tabbed: short leads (case Y)
  - Tabbed: leads bent down (case Z).
- See cases U, V, W, Y, and Z for dimensions and options.

Weight (maximum)
- 77 grams typical cases U, V, W, Y, and Z

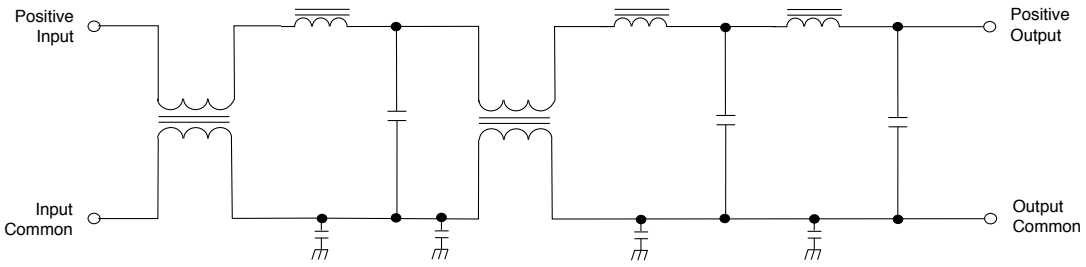
Screening

The FME28 EMI Input filter offers Standard, /ES or 883, Class H, QML screening. See page 13 “883 (Class H, QML), Standard and /ES (non-QML)” screening table for more information.



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



FME28-461

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.

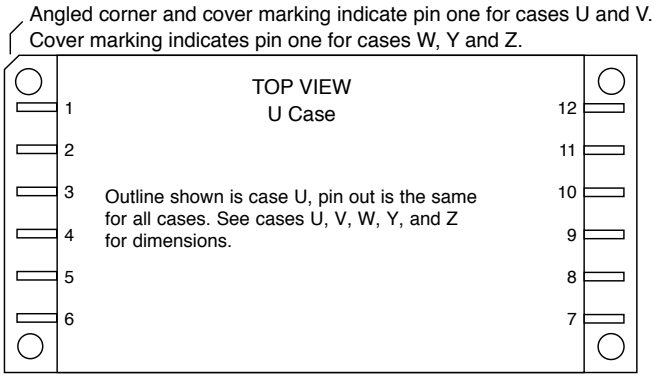
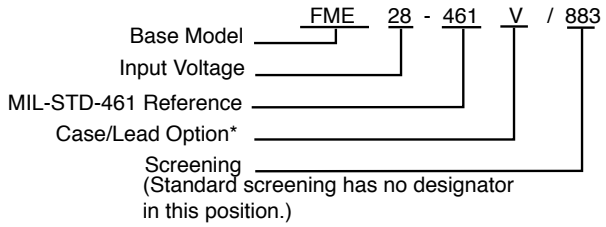


FIGURE 3: PIN OUT

FME28-461 EMI Input Filters

28 VOLT INPUT – 15 AMP

MODEL NUMBERING KEY



*Case/Lead Option:
See cases U, V, W, Y, and Z for drawings and dimensions.

DSCC NUMBERS

DSCC 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 DSCC product, refer to the DSCC drawing. DSCC drawings can be downloaded from: http://www.dscc.dla.mil/programs/smcr

Case Options: DSCC Cross Referenced to Interpoint

DSCC Case Option	Interpoint Case Option
T	W
U	V
X	(standard case, no option required)
Y	Y
Z	Z

MODEL SELECTION

ON THE LINES BELOW, ENTER ONE SELECTION FROM UNDER EACH CATEGORY TO DETERMINE THE MODEL NUMBER.

CATEGORY	FME28 BASE MODEL AND INPUT VOLTAGE	-461 MIL-STD-461 REFERENCE	_____ CASE/LEAD OPTION [1]	/	_____ SCREENING [2]
SELECTION	"FME28" is the only available selection	"-461" is the only available selection	U (leave blank) V W Y Z		Standard (leave blank) ES 883 (Class H, QML)

Notes:
1. Case U is the standard, side-leaded, flanged case. Leave the option blank for case U. Refer to the case drawings on pages 7 - 11 for other case options.
2. Leave blank for standard screening. Use "ES" for "ES" screening and "883" for Class H screening. See the table on page 13 for more information.

FME28-461 EMI Input Filters

28 VOLT INPUT – 15 AMP

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

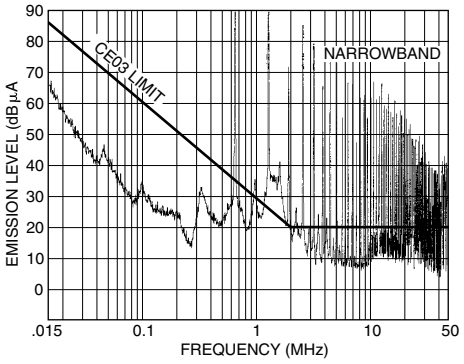
MODEL		FME28-461			
PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
INPUT VOLTAGE	CONTINUOUS	0	28	50	VDC
	TRANSIENT 100 ms [1, 2]	-100	—	100	V
NOISE REJECTION	500 KHz	60	—	—	dB
	1 MHz	60	—	—	
DC RESISTANCE (R_{DC}) AT MAXIMUM CURRENT [1]	T_C = 25°C	—	—	0.07	Ω
	T_C = 125°C	—	—	0.07	
CAPACITANCE [1]	ANY PIN TO CASE		60,000		pF
OUTPUT VOLTAGE	STEADY STATE	$V_{OUT} = V_{IN} - I_{IN} (R_{DC})$			VDC
OUTPUT CURRENT	STEADY STATE	—	—	15 [3]	A
POWER DISSIPATION AT MAXIMUM CURRENT [1]	T_C = 25°C	—	—	13.5	W
	T_C = 125°C	—	—	19.7	

Note
1. Guaranteed by design, not tested.
2. 0.5 ohm source impedance
3. 15 A maximum at 95°C, derate linearly to 10A at 125°C

FME28-461 EMI Input Filters

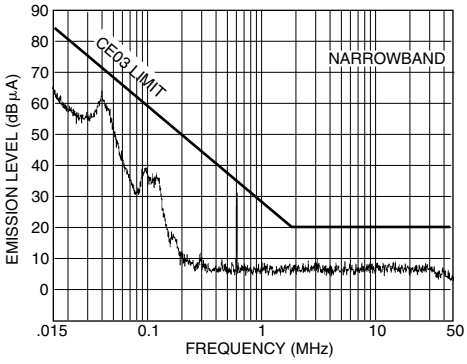
28 VOLT INPUT – 15 AMP

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



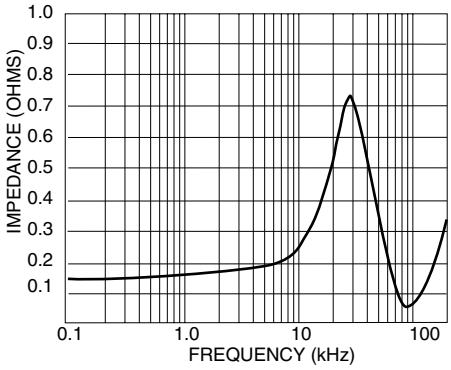
Three paralleled and synchronized MFL2815D converters without filtering.

FIGURE 4



CE03: Three paralleled and synchronized MFL2815D converters with an FME28-461.

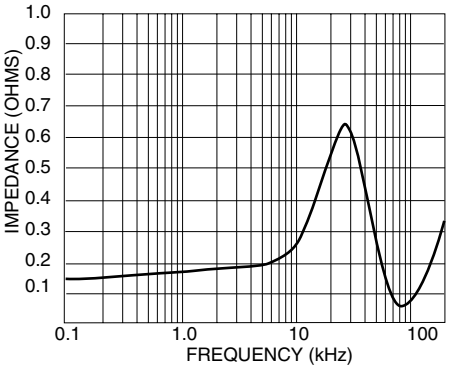
FIGURE 5



DC BIAS: 1 AMP

FME28-461 OUTPUT IMPEDANCE

FIGURE 6



DC BIAS: 10 AMP

FME28-461 OUTPUT IMPEDANCE

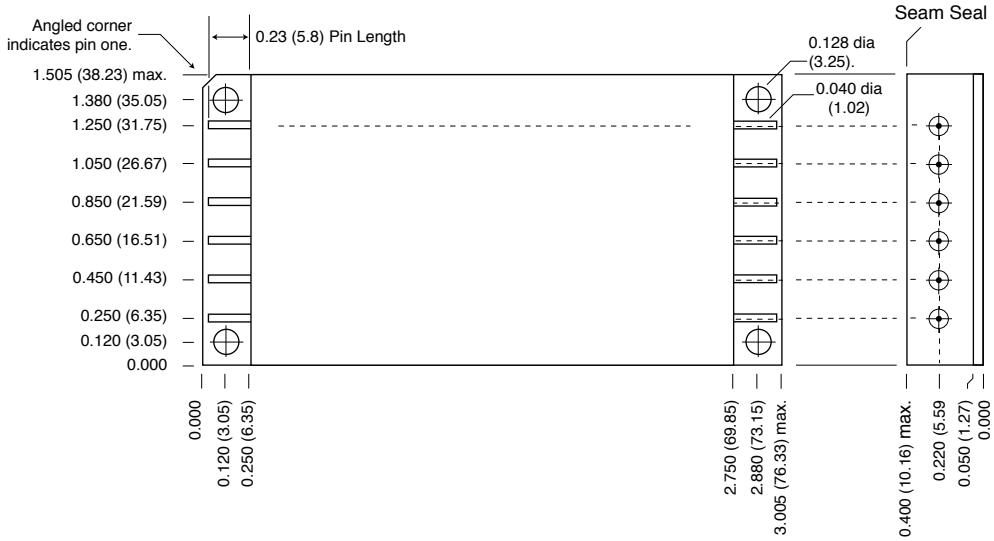
FIGURE 7

FME28-461 EMI Input Filters – Cases

28 VOLT INPUT – 15 AMP

TOP VIEW CASE U*
Flanged case, short-leaded

*Does not require designator 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, compression glass seal Seal Hole: 0.100 ±0.002 (2.54 ±0.05)

Case U, Rev E, 20100401
Please refer to the numerical dimensions for accuracy. All information is believed to be accurate, but no responsibility is assumed for errors or omissions. Interpoint reserves the right to make changes in products or specifications without notice.

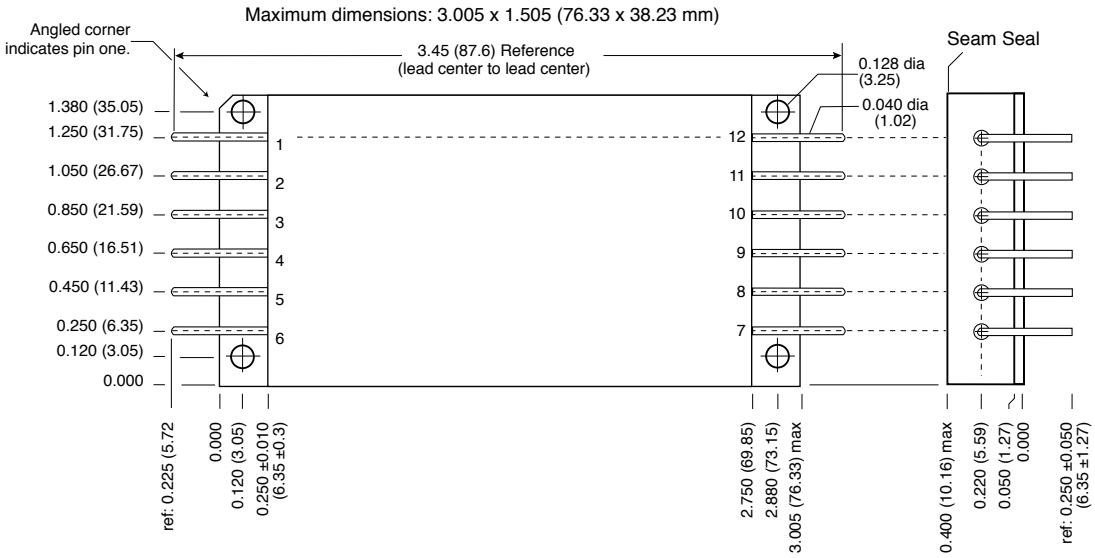
FIGURE 8: CASE U - FME28-461

FME28-461 EMI Input Filters – Cases

28 VOLT INPUT – 15 AMP

TOP VIEW CASE V*
Flanged case, down leaded

*Designator "V" 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, compresssion glas seal
	Seal Hole: 0.120 ±0.002 (3.05 ±0.05)

Case V, Rev E, 20100106
Please refer to the numerical dimensions for accuracy. All information is believed to be accurate, but no responsibility is assumed for errors or omissions. Interpoint reserves the right to make changes in products or specifications without notice.

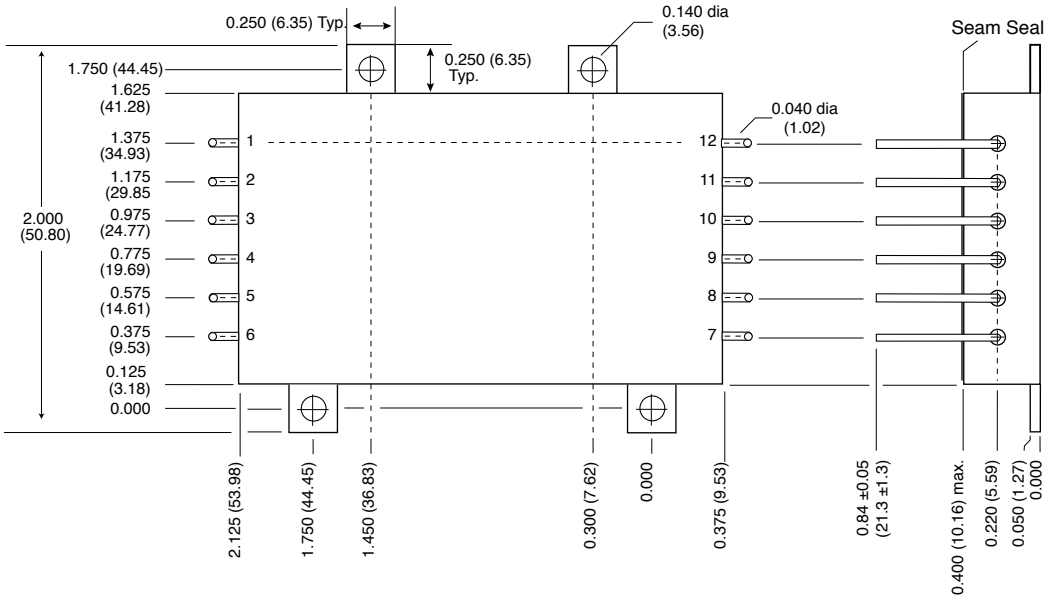
FIGURE 9: CASE V - FME28-461V

FME28-461 EMI Input Filters – Cases

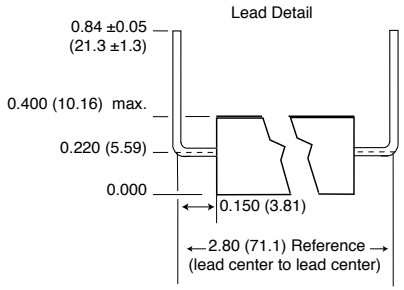
28 VOLT INPUT – 15 AMP

TOP VIEW CASE W*
Tabbed case, up-leaded

*Designator "W" 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, compresssion glass seal
	Seal Hole: 0.120 ±0.002 (3.05 ±0.05)

Case W, Rev E, 20100401
Please refer to the numerical dimensions for accuracy. All information is believed to be accurate, but no responsibility is assumed for errors or omissions. Interpoint reserves the right to make changes in products or specifications without notice.

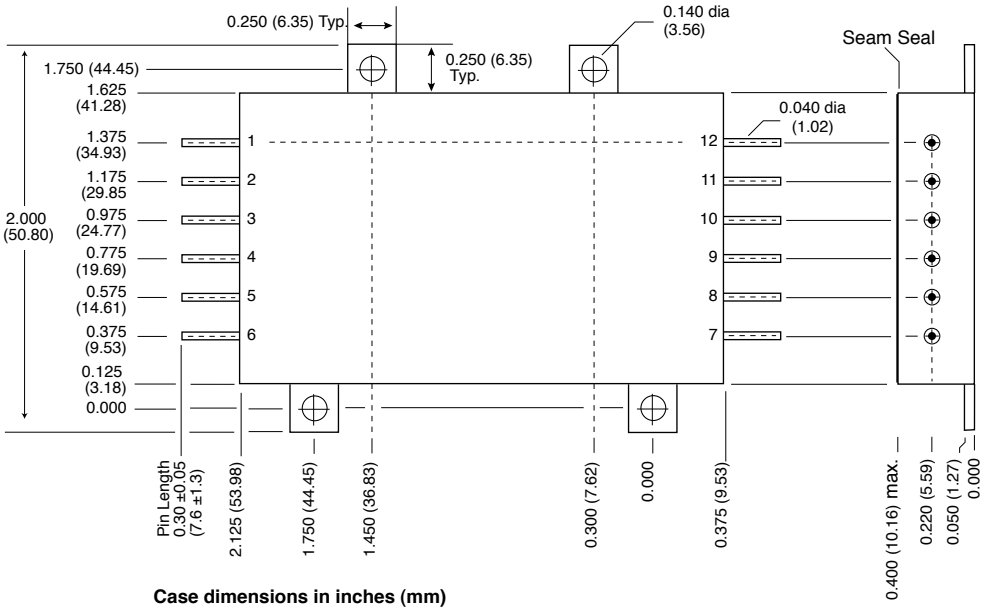
FIGURE 10: CASE W - FME28-461W

FME28-461 EMI Input Filters – Cases

28 VOLT INPUT – 15 AMP

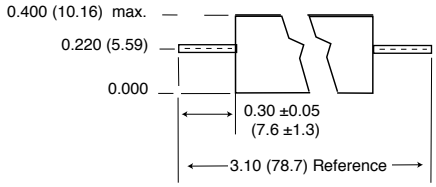
TOP VIEW CASE Y*
Tabbed case, straight-leaded

*Designator “Y” 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

Lead Detail



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, compresssion glass seal
	Seal Hole: 0.120 ±0.002 (3.05 ±0.05)

Case Y, Rev E, 20100401
Please refer to the numerical dimensions for accuracy. All information is believed to be accurate, but no responsibility is assumed for errors or omissions. Interpoint reserves the right to make changes in products or specifications without notice.

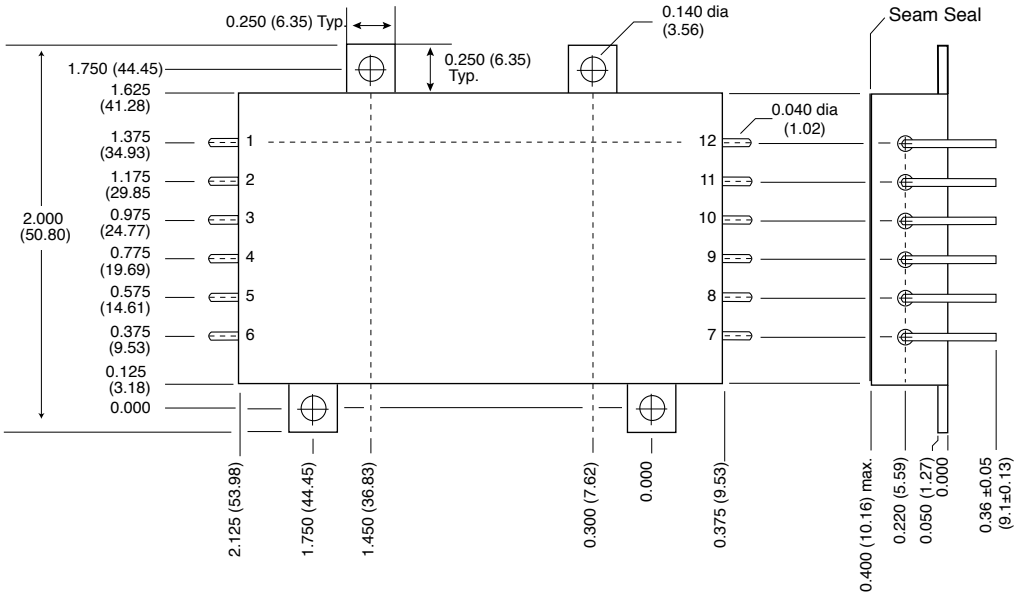
FIGURE 11: CASE Y - FME28-461Y

FME28-461 EMI Input Filters – Cases

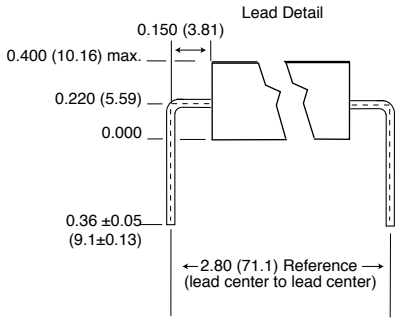
28 VOLT INPUT – 15 AMP

TOP VIEW CASE Z*
Tabbed case, down-leaded

*Designator "Z" 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, compresssion glass seal Seal Hole: 0.120 ±0.002 (3.05 ±0.05)

Case Z, Rev E, 20100401
Please refer to the numerical dimensions for accuracy. All information is believed to be accurate, but no responsibility is assumed for errors or omissions. Interpoint reserves the right to make changes in products or specifications without notice.

FIGURE 12: CASE Z - FME28-461Z

FME28-461 EMI Input Filters

28 VOLT INPUT – 15 AMP

STANDARD AND /ES (NON-QML) AND /883 (CLASS H, QML) PRODUCT ELEMENT EVALUATION

COMPONENT-LEVEL TEST PERFORMED	STANDARD AND /ES NON-QML [1]		/883 CLASS H QML	
	M/S [2]	P [3]	M/S [2]	P [3]
Element Electrical (probe)	yes	no	yes	yes
Element Visual	no	no	yes	yes
Internal Visual	no	N/A	yes	N/A
Final Electrical	no	no	yes	yes
Wire Bond Evaluation [4]	no	no	yes	yes
SLAM™/C-SAM: Input capacitors only (Add'l test, not req. by H)	no	no	no	yes

Notes:
1. Standard and /ES, non-QML products, do no meet all of the requirements of MIL-PRF-38534.
2. M/S = Active components (Microcircuit and Semiconductor Die)
3. P = Passive components
4. Not applicable to EMI filters that have no wire bonds.

Definitions:
Element Evaluation: Component testing/screening per MIL-STD-883 as determined by MIL-PRF-38534
SLAM™: Scanning Laser Acoustic Microscopy
C-SAM: C - Mode Scanning Acoustic Microscopy

FME28-461 EMI Input Filters

28 VOLT INPUT – 15 AMP

STANDARD AND /ES (NON-QML) AND /883 (CLASS H, QML) PRODUCT ENVIRONMENTAL SCREENING

TEST PERFORMED	125°C STANDARD NON-QML[1]	125°C /ES NON-QML[1]	/883 CLASS H QML
Pre-cap Inspection			
Method 2017, 2032	yes	yes	yes
Temperature Cycle (10 times)			
Method 1010, Cond. C, -65°C to 150°C, ambient	no	no	yes
Method 1010, Cond. B, -55°C to 125°C, ambient	no	yes	no
Constant Acceleration			
Method 2001, 3000 g	no	no	yes
Method 2001, 500 g	no	yes	no
Burn-in [2]			
Method 1015, 125°C case, typical			
96 hours	no	yes	no
160 hours	no	no	yes
Final Electrical Test MIL-PRF-38534, Group A			
Subgroups 1 through 6: -55°C, +25°C, +125°C case	no	no	yes
Subgroups 1 and 4: +25°C case	yes	yes	no
Hermeticity Test			
Fine Leak, Method 1014, Cond. A	no	yes	yes
Gross Leak, Method 1014, Cond. C	no	yes	yes
Gross Leak, Dip (1 x 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.

Notes:
1. Standard and /ES, non-QML products, do not meet all of the requirements of MIL-PRF-38534.
2. Burn-in temperature designed to bring the case temperature to +125°C