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 reduces 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.
The case ground connection between the filter and the converters 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**
Angled corner and cover marking indicate pin one for cases U and V.
Cover marking indicates pin one for cases W, Y and Z.

<table>
<thead>
<tr>
<th>Pin</th>
<th>Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1, 2, 3</td>
<td>Positive Input</td>
</tr>
<tr>
<td>4, 5, 6</td>
<td>Input Common</td>
</tr>
<tr>
<td>7, 8, 9</td>
<td>Output Common</td>
</tr>
<tr>
<td>10, 11, 12</td>
<td>Positive Output</td>
</tr>
<tr>
<td>—</td>
<td>Case Ground 2</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Figure 3: Pin Out</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
</tr>
<tr>
<td>11</td>
</tr>
<tr>
<td>10</td>
</tr>
<tr>
<td>9</td>
</tr>
<tr>
<td>8</td>
</tr>
<tr>
<td>7</td>
</tr>
</tbody>
</table>

TOP VIEW
U Case
Outline shown is case U, pin out is the same for all cases. See cases U, V, W, Y, and Z for dimensions.
FME28-461 EMI Input Filters

28 VOLT INPUT – 15 AMP

MODEL NUMBERING KEY

Base Model
FME 28-461
Input Voltage
V / 883
MIL-STD-461 Reference
Case/Lead Option*
Screening
(Standard screening has no designator in this position.)

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

FIGURE 3: MODEL NUMBERING KEY

DLA NUMBERS

<table>
<thead>
<tr>
<th>DLA Drawing (5915)</th>
<th>FME28 Similar Part</th>
</tr>
</thead>
<tbody>
<tr>
<td>DLA Drawing</td>
<td>FME28-461W/883</td>
</tr>
<tr>
<td>95004-01HTC</td>
<td>FME28-461V/883</td>
</tr>
<tr>
<td>95004-01HUC</td>
<td>FME28-461/883</td>
</tr>
<tr>
<td>95004-01HXC</td>
<td>FME28-461Y/883</td>
</tr>
<tr>
<td>95004-01HYC</td>
<td>FME28-461Z/883</td>
</tr>
</tbody>
</table>

For exact specifications for a DLA product, refer to the DLA drawing. DLA drawings can be downloaded from: https://landandmaritimeapps.dla.mil/programs/smcr

CASE OPTIONS:
DLA Cases Cross Referenced to Interpoint Cases

<table>
<thead>
<tr>
<th>DLA Case Option</th>
<th>Interpoint Case Option</th>
<th>Case Drawing</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>T</td>
<td>W</td>
<td>Figure 10 on page 9</td>
<td>tabbed, leads bent up</td>
</tr>
<tr>
<td>U</td>
<td>V</td>
<td>Figure 9 on page 8</td>
<td>flanged, leads bent down</td>
</tr>
<tr>
<td>X</td>
<td>Y</td>
<td>Figure 8 on page 7</td>
<td>flanged, short leads</td>
</tr>
<tr>
<td>Y</td>
<td>Y</td>
<td>Figure 11 on page 10</td>
<td>tabbed, short leads</td>
</tr>
<tr>
<td>Z</td>
<td>Z</td>
<td>Figure 12 on page 11</td>
<td>tabbed, leads bent down</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>Base Model and Input Voltage</th>
<th>Case Option 2</th>
<th>Screening 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>OPTIONS</td>
<td>FME28-461</td>
<td>(flanged, short leads, standard “U” case, leave blank)</td>
<td>(Standard, leave blank)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>V (flanged, leads bent down)</td>
<td>ES 883 (Class H)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>W (tabbed, leads bent up)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Y (tabbed, short leads)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Z (tabbed, leads bent down)</td>
<td></td>
</tr>
</tbody>
</table>

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). Available only for Class H.

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.

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>CONDITIONS</th>
<th>MIN</th>
<th>TYP</th>
<th>MAX</th>
<th>UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>LEAD SOLDERING TEMPERATURE (^1)</td>
<td>10 seconds max.</td>
<td></td>
<td></td>
<td>300</td>
<td>°C</td>
</tr>
<tr>
<td>STORAGE TEMPERATURE (^1)</td>
<td>-65</td>
<td></td>
<td></td>
<td>+150</td>
<td>°C</td>
</tr>
<tr>
<td>CASE OPERATING TEMPERATURE (^1)</td>
<td>FULL POWER</td>
<td>-55</td>
<td></td>
<td>+125</td>
<td>°C</td>
</tr>
<tr>
<td></td>
<td>ABSOLUTE</td>
<td>-55</td>
<td></td>
<td>+135</td>
<td>°C</td>
</tr>
<tr>
<td>DERATING OUTPUT POWER/CURRENT (^1)</td>
<td>LINEARLY</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>From 15 A at 95°C to 10 A at 125°C</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>From 10 A at 125°C to 0 at 135°C</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ISOLATION, ANY PIN TO CASE</td>
<td>500 VDC AT 25°C</td>
<td></td>
<td>100</td>
<td></td>
<td>Megohms</td>
</tr>
</tbody>
</table>

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

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

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>CONDITIONS</th>
<th>MIN</th>
<th>TYP</th>
<th>MAX</th>
<th>UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>INPUT VOLTAGE (^1)</td>
<td>CONTINUOUS</td>
<td>0</td>
<td>28</td>
<td>50</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td>TRANSIENT 100 ms (^2, 3)</td>
<td>-100</td>
<td></td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>NOISE REJECTION</td>
<td>500 kHz</td>
<td>60</td>
<td></td>
<td></td>
<td>dB</td>
</tr>
<tr>
<td></td>
<td>1 MHz</td>
<td>60</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DC RESISTANCE ((R_{DC})) (^1)</td>
<td>(T_C = 25°C)</td>
<td></td>
<td></td>
<td></td>
<td>Ω</td>
</tr>
<tr>
<td>CAPACITANCE (25°C)</td>
<td>ANY PIN TO CASE</td>
<td>50,000</td>
<td>60,000</td>
<td>70,000</td>
<td>pF</td>
</tr>
<tr>
<td>OUTPUT VOLTAGE (^1)</td>
<td>STEADY STATE</td>
<td>(V_{OUT} = V_{IN} \cdot I_{IN} \cdot (R_{DC}))</td>
<td></td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>OUTPUT CURRENT (^1, 4)</td>
<td>STEADY STATE</td>
<td></td>
<td></td>
<td></td>
<td>A</td>
</tr>
<tr>
<td>POWER DISSIPATION (^1, 4) AT MAXIMUM CURRENT</td>
<td>15 A, (T_C = 25°C)</td>
<td></td>
<td></td>
<td></td>
<td>17.1</td>
</tr>
<tr>
<td></td>
<td>10 A, (T_C = 125°C)</td>
<td></td>
<td></td>
<td></td>
<td>10.8</td>
</tr>
</tbody>
</table>

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

Typical performance plots: 25°C case, unless otherwise specified.
**FME28-461 EMI Input Filters**

**28 VOLT INPUT – 15 AMP**

**TOP VIEW CASE U**
Flanged case, short leads

Case “U” does not require a designator in the Case Option position of the model number.

- Angled corner indicates pin one.
- Pin Length: 0.23 (5.8) max.
- Seam Seal: 0.128 dia (3.25).
- 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 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.

Angled corner indicates pin one.

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)

Seam Seal

Lead Detail (for reference only)

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 ±0.05)

Please refer to the numerical dimensions for accuracy.

Case W, Rev L, 2017.07.26

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 ±0.002 (3.05 ±0.05)

Please refer to the numerical dimensions for accuracy.

FIGURE 11: CASE Y - FME28-461Y
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
## ELEMENT EVALUATION / HIGH RELIABILITY /883 (CLASS H)

<table>
<thead>
<tr>
<th>COMPONENT-LEVEL TEST PERFORMED</th>
<th>QML</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M/S 2</td>
</tr>
<tr>
<td>Element Electrical</td>
<td>■</td>
</tr>
<tr>
<td>Visual</td>
<td>■</td>
</tr>
<tr>
<td>Internal Visual</td>
<td>■</td>
</tr>
<tr>
<td>Final Electrical</td>
<td>■</td>
</tr>
<tr>
<td>Wire Bond Evaluation</td>
<td>■</td>
</tr>
</tbody>
</table>

**Notes**

1. Element evaluation does not apply to standard and /ES product.
2. M/S = Active components (microcircuit and semiconductor die).

### TABLE 7: ELEMENT EVALUATION
### TABLE 9: ENVIRONMENTAL SCREENING HIGH RELIABILITY STANDARD, /ES AND /883 (CLASS H)

<table>
<thead>
<tr>
<th>Test Performed</th>
<th>Non-QML 1</th>
<th>Class H QML 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-cap Inspection, Method 2017, 2032</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature Cycle (10 times)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Method 1010, Cond. C, -65°C to +150°C, ambient</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Method 1010, Cond. B, -55°C to +125°C, ambient</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant Acceleration</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Method 2001, 3000 g</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Method 2001, 500 g</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PIND, Test Method 2020, Cond. A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Burn-in Method 1015, +125°C case, typical 5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>96 hours</td>
<td></td>
<td></td>
</tr>
<tr>
<td>160 hours</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Final Electrical Test, MIL-PRF-38534, Group A,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subgroups 1 through 6, -55°C, +25°C, +125°C case</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subgroups 1 and 4, +25°C case</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hermeticity Test</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gross Leak, Cond. C₁, fluorocarbon</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fine Leak, Cond. A₂, helium</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gross Leak, Dip</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Final visual inspection, Method 2009</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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-STD-38534 Rev J, 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.

Next steps for a successful burn-in.

- **Preparation**: Ensure all necessary resources are available and equipment is set up correctly.
- **Qualification**: Conduct preliminary qualifications to ensure the products meet the specified standards.
- **Execution**: Conduct the burn-in process according to the established parameters.
- **Monitoring**: Regularly monitor the products to ensure they meet the quality standards.
- **Conclusion**: Upon completion, review the results and make necessary adjustments for future burn-ins.