**DESCRIPTION**

Interpoint specifically designed the FMH-461™ EMI filter to reduce the input line reflected ripple current of the following high frequency DC/DC converters: MHD, MHF, MHF+, MHV, MSA, and MTR series converters. It will also reduce EMI for several of Interpoint’s lower frequency converters: MHE/MLP, MHL, MTO, and MTW series. The FMH-461 filter is ideal for use in applications which must meet MIL-STD-461C levels of conducted and radiated emissions. Throughput current is 1.5 amps. At 16 VDC input (low line), the filter provides 24 watts of throughput power.

**FILTER OPERATION**

FMH-461 filters are rated for full power operation from –55°C to +125°C baseplate temperature. Operation is offered up to the absolute maximum of +135°C with derating as defined in “Recommended Operating Conditions” on the following page. The maximum DC insertion loss at full load and nominal input voltage (28 VDC) represents a power loss of less than 2%.

**LAYOUT REQUIREMENTS**

The case of the filter must be connected to the case of the converter through a low impedance connection to minimize EMI.

1. MSA models may require an inductor in series with the MSA’s positive input. 2 µH is the suggested value.

**FEATURES**

- –55°C to +125°C operation
- 50 dB minimum attenuation at 500 kHz
- Compliant to MIL-STD-461C, CE03
- Compatible with MIL-STD-704E DC power bus

**FILTER OPERATION**

| MODEL | FMH-461 | 1.5 amp |

**EMI INPUT FILTER**

28 VOLT INPUT

**FMH EMI FILTER**

1.5 AMP

<table>
<thead>
<tr>
<th>SIZE (max.): Non-flanged, case E3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.460 x 1.130 x 0.330 (37.08 x 28.70 x 8.38 mm)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Size (max.): Flanged, case G3</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.005 x 1.130 x 0.330 inches (50.93 x 28.70 x 8.38 mm)</td>
</tr>
</tbody>
</table>

See Section B8, cases E3 and G3, for dimensions.

**WEIGHT:** 22 grams typical, 28 grams maximum

**SCREENING:** Standard, ES, or 883 (Class H). See Section C2 for screening options, see Section A5 for ordering information.
**FMH EMI FILTER**

**1.5 AMP**

**EMI INPUT FILTERS**

**ABSOLUTE MAXIMUM RATINGS**
- Input Voltage: 0 to 40 VDC continuous
- Lead Soldering Temperature (10 sec per lead): 300°C
- Storage Temperature Range (Case): -65°C to +150°C

**RECOMMENDED OPERATING CONDITIONS**
- Input Voltage Range: 16 to 40 VDC continuous
- Case Operating Temperature (Tc): -55°C to +125°C full power
- Derating DC Input/Output current: Derate linearly from 100% at 125°C to 0% at 135°C case

**TYPICAL CHARACTERISTICS**
- Capacitance: 0.024 µF max, any pin to case
- Isolation: 100 megohm minimum at 500 V
- Any pin to case, except case pin

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

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>CONDITIONS</th>
<th>FMH-461</th>
</tr>
</thead>
<tbody>
<tr>
<td>INPUT VOLTAGE</td>
<td>CONTINUOUS</td>
<td>0</td>
</tr>
<tr>
<td>INPUT CURRENT</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>NOISE REJECTION</td>
<td>200 kHz</td>
<td>35</td>
</tr>
<tr>
<td></td>
<td>500 kHz</td>
<td>50</td>
</tr>
<tr>
<td>DC RESISTANCE (RDC)</td>
<td>TC = 25°C</td>
<td>—</td>
</tr>
<tr>
<td>OUTPUT VOLTAGE</td>
<td>STEADY STATE</td>
<td>VOUT = VIN - IIN (RDC)</td>
</tr>
<tr>
<td>OUTPUT CURRENT</td>
<td>RIPPLE</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>STEADY STATE</td>
<td>—</td>
</tr>
<tr>
<td>INTERNAL POWER</td>
<td>DISSIPATION</td>
<td>MAXIMUM CURRENT</td>
</tr>
</tbody>
</table>

**Notes**
1. Typical applications result in Vout within 2% of Vin.

**FIGURE 1: SCHEMATIC**

![Schematic Diagram](image-url)

**CRANE**
EMI INPUT FILTERS

FMH EMI FILTER

1.5 AMP

**Figure 2: Connection Diagram**

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 3: Pin Out**

<table>
<thead>
<tr>
<th>Pin</th>
<th>Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Positive Input</td>
</tr>
<tr>
<td>2</td>
<td>Positive Output</td>
</tr>
<tr>
<td>3</td>
<td>Case Ground</td>
</tr>
<tr>
<td>4</td>
<td>Output Common</td>
</tr>
<tr>
<td>5</td>
<td>Input Common</td>
</tr>
</tbody>
</table>

Dot on top of cover indicates pin one.

Dotted line outlines flanged package option.

See Section B8, cases E3 and G3 for dimensions.

**DSCC Number**

DSCC Drawing (5915)

FMH-461 Filter

Similar Part

95003-01HXC  FMH-461/883
95003-01HZC  FMH-461F/883

For exact specifications for a DSCC product, refer to the DSCC drawing. See Section A3, "SMD/DSCC Lists", for more information.

**Model Numbering Key**

Base Model

FMH-461

F / 883

MIL-STD-461 Reference

Case Option

(Non-flanged case has no designator in this position)

Screening

(Standard screening has no designator in this position.)
Typical Performance Curves: 25°C Tc, nominal Vin, unless otherwise specified.

**Figure 4**

MHF+2805S Converter Without Filter

**Figure 5**

MHF+2805S Converter With FMH-461 Filter

**Figure 6**

Typical Output Impedance (Z) With Input Shorted FMH-461
### CASE G

**CASE MATERIALS**
- **Header**: Cold Rolled Steel/Nickel/Gold
- **Cover**: MHF+ Series and FMH Filter
- **SMHF**: Cold Rolled Steel/Nickel
- **Pins**: #52 alloy (all cases)
- **Seal**: Compression glass seal

**CASE DIMENSIONS IN INCHES (MM)**
- Tolerance: ±0.005 (0.13) for three decimal places
- ±0.01 (0.2) 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.

**BOTTOM VIEW CASE G1**
- **Flanged cases**: Designator "F" required in Case Option position of model number
- **MHF+ Series Single and Dual, LIM5050 Module**: Screening – Standard, ES, or 883
- **SMHF Series, SLIM5050 Module**: Screening – Space Standard, H, or K

**FIGURE 24: CASE G MAXIMUM DIMENSIONS**

**FIGURE 25: CASE G1**

Note: Although every effort has been made to render the case drawings at actual size, variations in the printing process may cause some distortion. Please refer to the numerical dimensions for accuracy.
BOTTOM VIEW CASE G2
Flanged case: Designator required in Case Option position of model number.
MHF+ Series Triple: Screening – Standard, ES, or 883

FIGURE 26: CASE G2

BOTTOM VIEW CASE G3
Flanged case: Designator required in Case Option position of model number.
FMH EMI Filter: Screening – Standard, ES, or 883

FIGURE 27: CASE G3
CASE E

SQUARED CORNER AND DOT ON TOP OF CASE INDICATE PIN ONE.

CASE E
BOTTOM VIEW
See Figures 16 – 18 for pin configurations.

1.460 max (37.08)

1.130 max (28.70)

Materials
- Header: Cold Rolled Steel/Nickel/Gold
- Cover: Kovar/Nickel
  (SMHF Series
  Cold Rolled Steel/Nickel/Gold)
- Pins: #52 alloy/Gold
  compression glass seal

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.

FIGURE 15: CASE E MAXIMUM DIMENSIONS

BOTTOM VIEW CASE E1
MHF+ Series Single and Dual: Screening – Standard, ES, or 883
MHF Series and LIM5050 Module: Screening – Standard or ES
SMHF Series Single and Dual and SLIM5050 Module:
  Screening – Space Standard, H, or K
HR120 Series: No screening options

SQUARED CORNER AND DOT ON TOP OF CASE INDICATE PIN ONE.

FIGURE 16: CASE E1

Note: Although every effort has been made to render the case drawings at actual size, variations in the printing process may cause some distortion. Please refer to the numerical dimensions for accuracy.
FIGURE 17: CASE E2

BOTTOM VIEW CASE E2
MHF+ Series Triple: Screening – Standard, ES, or 883

Seam Seal
Projection Weld
Squared corner and dot on top of case indicate pin one.

0.000 (0.00)
0.030 dia. (0.76)
0.330 max (8.38)
0.330 max (8.38)
0.330 max (8.38)

0.000
0.205 (5.21)
0.505 (12.83)
0.705 (17.91)
0.905 (22.99)
1.105 (28.07)

FIGURE 18: CASE E3

BOTTOM VIEW CASE E3
FMH EMI Filter: Screening – Standard, ES, or 883

Seam Seal
Projection Weld
Squared corner and dot on case top indicate pin one.

0.000 (0.00)
0.030 dia. (0.76)
0.330 max (8.38)
0.330 max (8.38)
0.330 max (8.38)

0.000
0.205 (5.21)
0.560 (14.22)
0.960 (24.38)
0.560 (14.22)
0.960 (24.38)

0.330 max (8.38)
0.330 max (8.38)
0.330 max (8.38)
0.330 max (8.38)
0.330 max (8.38)

0.000
0.205 (5.21)
0.560 (14.22)
0.960 (24.38)
0.560 (14.22)
0.960 (24.38)

0.330 max (8.38)
0.330 max (8.38)
0.330 max (8.38)
0.330 max (8.38)
0.330 max (8.38)

0.000
0.205 (5.21)
0.560 (14.22)
0.960 (24.38)
0.560 (14.22)
0.960 (24.38)
QA SCREENING
125°C PRODUCTS

125°C PRODUCTS

<table>
<thead>
<tr>
<th>TEST (125°C Products)</th>
<th>STANDARD</th>
<th>/ES</th>
<th>/883 (Class H)*</th>
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<tbody>
<tr>
<td>PRE-CAP INSPECTION</td>
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<td></td>
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<tr>
<td>Method 2017, 2032</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
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<td>TEMPERATURE CYCLE (10 times)</td>
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<tr>
<td>Method 1010, Cond. C, -65°C to 150°C</td>
<td>no</td>
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<td>yes</td>
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<td>Method 1010, Cond. B, -55°C to 125°C</td>
<td>no</td>
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<td>no</td>
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<td>CONSTANT ACCELERATION</td>
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<tr>
<td>Method 2001, 3000 g</td>
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<td>no</td>
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<td>Method 2001, 500 g</td>
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<td>no</td>
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<tr>
<td>BURN-IN</td>
<td></td>
<td></td>
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<tr>
<td>Method 1015, 160 hours at 125°C</td>
<td>no</td>
<td>no</td>
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<tr>
<td>96 hours at 125°C case (typical)</td>
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<td>yes</td>
<td>no</td>
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<td>FINAL ELECTRICAL TEST MIL-PRF-38534, Group A</td>
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<tr>
<td>Subgroups 1 through 6: -55°C, +25°C, +125°C</td>
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<td>no</td>
<td>yes</td>
</tr>
<tr>
<td>Subgroups 1 and 4: +25°C case</td>
<td>yes</td>
<td>yes</td>
<td>no</td>
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<tr>
<td>HERMETICITY TESTING</td>
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<tr>
<td>Fine Leak, Method 1014, Cond. A</td>
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<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Gross Leak, Method 1014, Cond. C</td>
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<td>yes</td>
<td>yes</td>
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<tr>
<td>Gross Leak, Dip (1 x 10⁻³)</td>
<td>yes</td>
<td>no</td>
<td>no</td>
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<tr>
<td>FINAL VISUAL INSPECTION</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Method 2009</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
</tbody>
</table>

Test methods are referenced to MIL-STD-883 as determined by MIL-PRF-38534.

*883 products are built with element evaluated components and are 100% tested and guaranteed over the full military temperature range of −55°C to +125°C.

Applies to the following products:

- MOR Series
- MFLHP Series
- MFL Series
- MHP Series
- MTR Series
- MQO Series
- MHD Series
- MGH Series
- MCH Series
- FMGA EMI Filter
- FMH Series
- FM-704A EMI Filter
- HUM Modules**
- FMD**/FME EMI Filter
- LCM Modules**
- FMC EMI Filter
- LIM Modules
- MSA Series
- FMH EMI Filter

**MFLHP Series, MQO Series, MHF Series, FMD EMI Filters, Hum Modules, and LCM Modules do not offer '883' screening.