

**FEATURES**

- **-55°C to +85°C operation**
- 50 dB minimum attenuation at 500 kHz
- Compliant to MIL-STD-461C, CE03
- Overvoltage protection

**EMI INPUT FILTER**  
**28 VOLT INPUT**



**MSF EMI FILTER**  
**0.8 AMP**

| MODEL   |         |
|---------|---------|
| MSF-461 | 0.8 amp |

Size (max.): 1.075 x 1.075 x 0.370 (27.31 x 27.31 x 9.40 mm)  
See Section B8, cases C3, for dimensions.  
Weight: 15 grams typical, 16 grams maximum  
Screening: Standard or ES. See Section C2 for screening options, see Section A5 for ordering information.

**DESCRIPTION**

The MSF-461 EMI filter module has been specifically designed to reduce the input line reflected ripple current of Interpoint's MSR and DCH Series of DC/DC converters. They are intended for use in applications where switch-mode DC/DC converters, operating at a frequency of higher than 50 kHz, must meet MIL-STD-461C levels of conducted power line noise.

MSF-461 EMI filters are built using thick-film hybrid technology and are sealed in metal packages for military, aerospace, and other high-reliability applications. See Section B8, case C3, for dimensions. See Section C2 for screening options.

**MIL-STD NOISE MANAGEMENT**

When used in conjunction with Interpoint's DC/DC converters (see connection diagram, Figure 2), the input ripple current will be reduced by 50 dB within the frequency band of 50 kHz to 50 MHz.

This gives the filter/converter combination a performance which exceeds the CE03 test limit of MIL-STD-461C. The CE03 performance of a model MSR2812D converter with and without the MSF-461 filter is shown in Figures 4 and 5.

**FILTER OPERATION**

The MSF-461 filters are rated to operate, with no degradation of performance, over the temperature range of -55°C to +85°C (as measured at the baseplate). Above 85°C, input voltage and current must be derated as specified in "Derating" on the following page. The maximum power dissipation of 0.62 watts (at maximum input current) represents a power loss of less than 10% at typical input voltage.

**LAYOUT REQUIREMENTS**

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

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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)**
- -55°C to +125°C

DERATING

- Input Voltage**
- Derate linearly from 100% at 85°C case to the 33 VDC at 125°C case
- DC Input and Output Current**
- Derate linearly from 100% at 85°C case to 150 mA at 125°C case.

TYPICAL CHARACTERISTICS

- Capacitance**
- 6600 pF max, any pin to case
- Isolation**
- 100 megohm minimum at 500 V
  - Any pin to case, except case pin

RECOMMENDED OPERATING CONDITIONS

- Input Voltage Range**
- 0 to 40 VDC continuous
- Case Operating Temperature (Tc)**
- -55°C to +85°C full power

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

| PARAMETER                                     | CONDITIONS           | MSF-461                              |      |      | UNITS |
|-----------------------------------------------|----------------------|--------------------------------------|------|------|-------|
|                                               |                      | MIN                                  | TYP  | MAX  |       |
| INPUT VOLTAGE                                 | CONTINUOUS           | 0                                    | 28   | 40   | VDC   |
| INPUT CLAMPING VOLTAGE                        | -55°C                | 38.9                                 | 43.2 | 47.5 | VDC   |
|                                               | 25°C                 | 42.3                                 | 47.0 | 51.7 |       |
|                                               | 85°C                 | 44.9                                 | 49.9 | 54.8 |       |
| INPUT CURRENT                                 |                      | —                                    | —    | 420  | mA DC |
| NOISE REJECTION                               |                      | 50                                   | —    | —    | dB    |
| DC RESISTANCE <sup>1</sup> (R <sub>DC</sub> ) | TC = 25°C            | 3.00                                 | 3.20 | 3.50 | Ω     |
| OUTPUT VOLTAGE <sup>2</sup>                   | STEADY STATE         | $V_{OUT} = V_{IN} - I_{IN} (R_{DC})$ |      |      | VDC   |
| OUTPUT CURRENT                                | STEADY STATE, 28 Vin | —                                    | —    | 420  | mA    |
| INTERNAL POWER DISSIPATION                    | MAXIMUM CURRENT      | —                                    | —    | 0.62 | W     |

Notes

1. DC resistance measured using four wire technique.
2. Typical applications result in Vout within 5% of Vin.

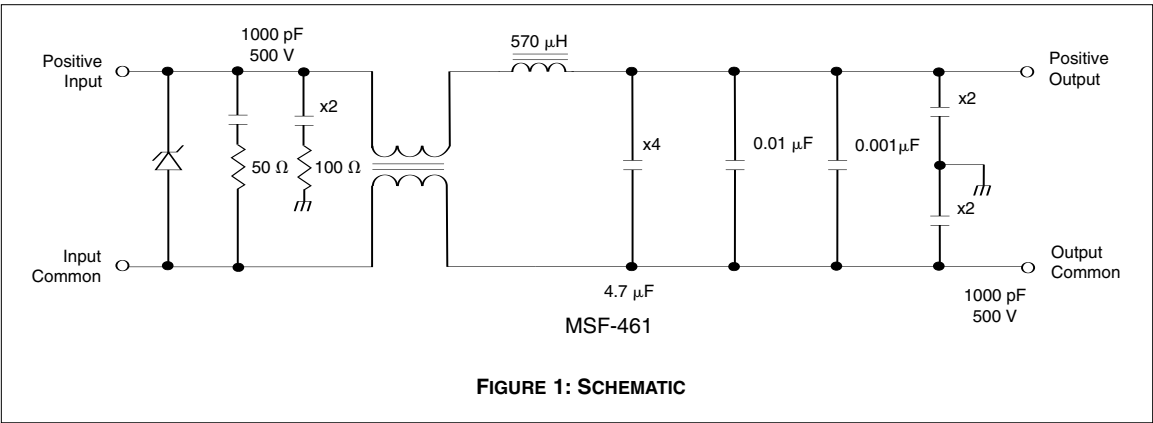


FIGURE 1: SCHEMATIC

# EMI INPUT FILTERS

**MSF EMI FILTER**  
**0.8 AMP**

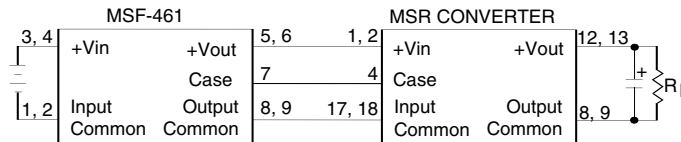


**FIGURE 2: CONNECTION DIAGRAM**

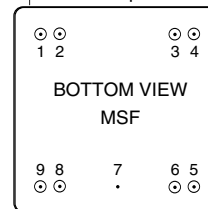
## PIN OUT

| Pin               | Designation     |
|-------------------|-----------------|
| 1, 2 <sup>1</sup> | Input Common    |
| 3, 4 <sup>1</sup> | Positive Input  |
| 5, 6 <sup>1</sup> | Positive Output |
| 7                 | Case Ground     |
| 8, 9 <sup>1</sup> | Output Common   |

**Note**

1. Make external connections to both pins.

Dot on top of cover indicates pin one.



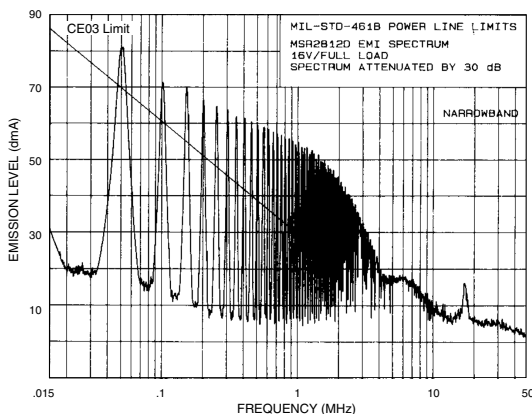
See Section B8, case C3, for dimensions.

**FIGURE 3: PIN OUT**

## MODEL NUMBERING KEY

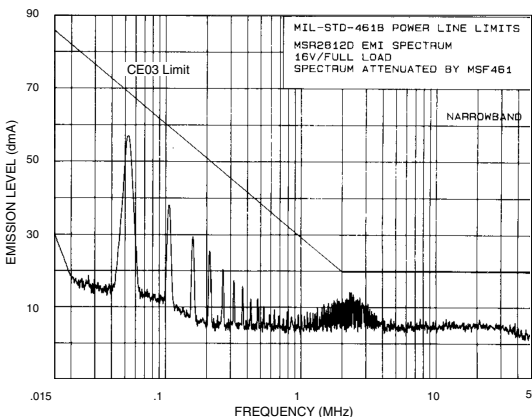
Base Model MSF - 461 / ES  
MIL-STD-461 reference                       
Screening                       
(Standard screening has no designator in this position.)

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



Narrowband spectrum of an MSR2812D converter without an EMI filter.

FIGURE 4

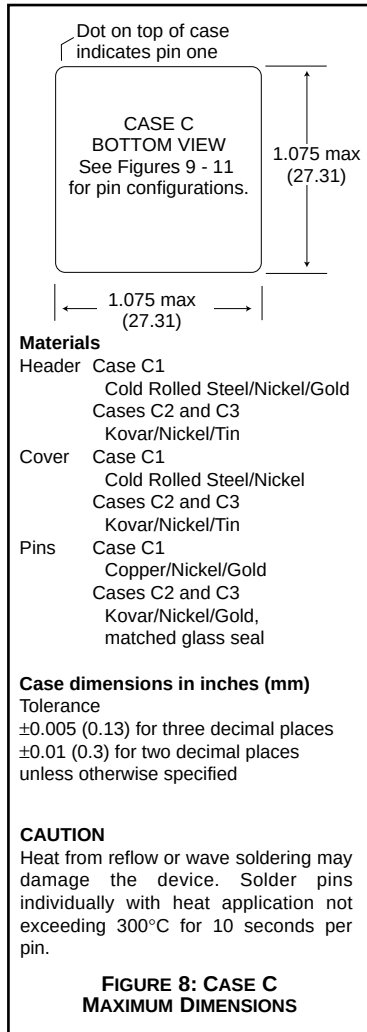
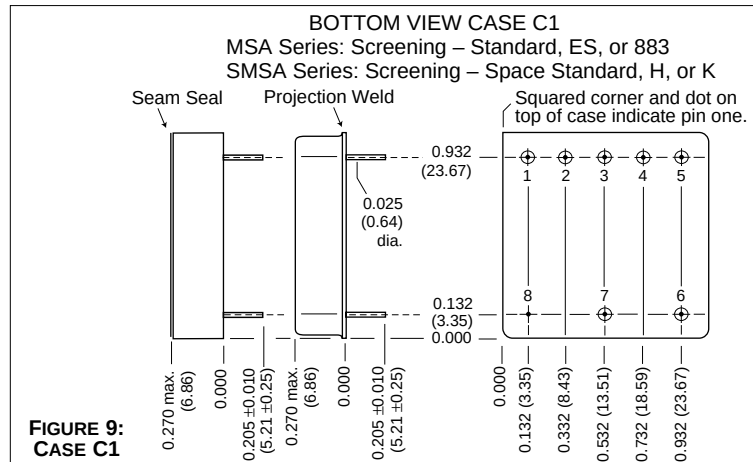
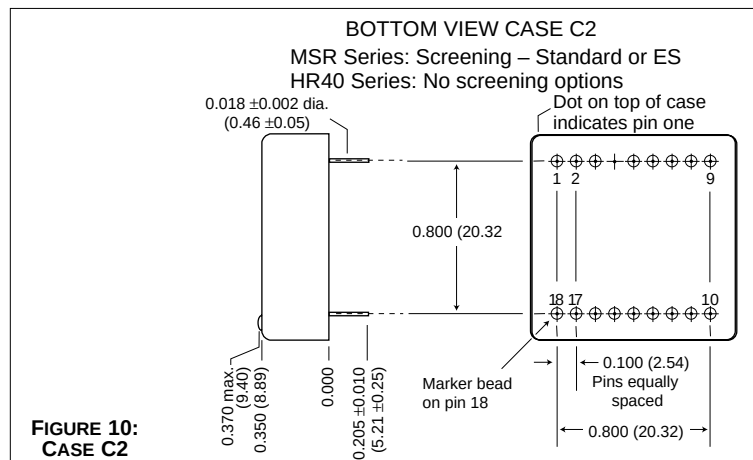
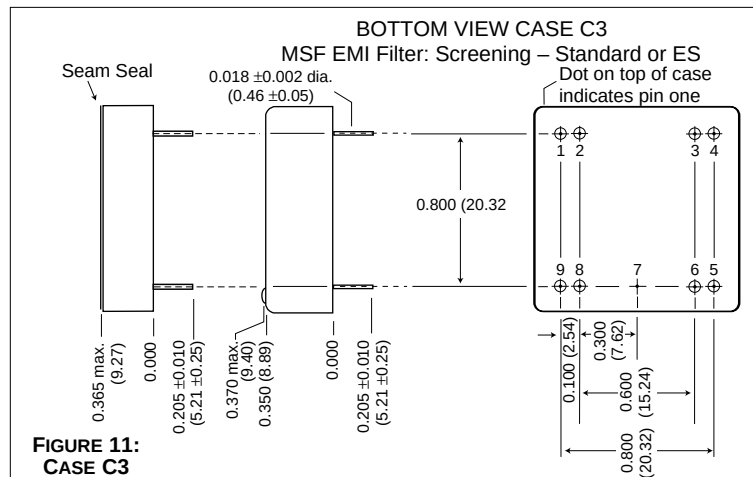


Narrowband spectrum of an MSR2812D converter with an MSF-461 filter on the input line.

FIGURE 5

## CASE C

## CASES



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.

## QA SCREENING 85°C PRODUCTS

### 85°C PRODUCTS

| TEST (85°C Products excluding HR products)                                    | STANDARD | /ES |
|-------------------------------------------------------------------------------|----------|-----|
| PRE-CAP INSPECTION<br>Method 2017                                             | yes      | yes |
| TEMPERATURE CYCLE (10 times)<br>Method 1010, Cond. B, -55°C to 125°C          | no       | yes |
| CONSTANT ACCELERATION<br>Method 2001, 500 g                                   | no       | yes |
| BURN-IN<br>96 hours at 70°C ambient (typical)                                 | no       | yes |
| FINAL ELECTRICAL TEST MIL-PRF-38534, Group A<br>Subgroups 1 and 4: +25°C case | yes      | yes |
| HERMETICITY TESTING<br>Fine Leak, Method 1014, Cond. A                        | no       | yes |
| Gross Leak, Method 1014, Cond. C                                              | no       | yes |
| Gross Leak, Dip (1 x 10 <sup>-3</sup> )                                       | yes      | no  |
| FINAL VISUAL INSPECTION<br>Method 2009                                        | yes      | yes |

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

Applies to the following products:

MFW Series  
 MTW Series  
 MHE/MLP Series  
 MHL Series  
 MRH Series  
 MTO Series  
 MSR Series  
 DCH Series  
 FM/FMA/FMB EMI Filters  
 MSF EMI Filter