

# Reflectionless High Pass Filter

## XHF2-Series

50Ω DC to 30 GHz



CASE STYLE: MC1630-1

### The Big Deal

- Patented design eliminates in band spurs
- Pass band cut-off up to 18.3 GHz
- Stop band up to 30 GHz
- Excellent repeatability through IPD\* process

### Product Overview

Mini-Circuits' XHF2-Series reflectionless filters employ a novel filter topology which absorbs and terminates stop band signals internally rather than reflecting them back to the source. This new capability enables unique applications for filter circuits beyond those suited to traditional approaches. Traditional filters are reflective in the stop band, sending signals back to the source at 100% of the power level which interact with neighboring components and often result in intermodulation and other interferences. Reflectionless filters eliminate stop band reflections, allowing them to be paired with sensitive devices and used in applications that otherwise require circuits such as isolation amplifiers or attenuators.

### Key Features

### Advantages

|   |  |
|---|--|
| Easy integration with sensitive reflective components, e.g. mixers, multipliers | Reflectionless filters absorb unwanted signals, preventing reflections back to the source. This reduces generation of additional unwanted signals without the need for extra components like attenuators, improving system dynamic range and saving board space. |
| Enables stable integration of wideband amplifiers                               | Because reflectionless filters maintain good impedance in the stop band; they can be integrated with high gain, wideband amplifiers without the risk of creating instabilities in these out of band regions.   |
| Cascadable  | Reflectionless filters can be cascaded in multiple sections to provide sharper and higher attenuation, while also preventing any standing waves that could affect pass band signals.   |
| Excellent power handling in a tiny surface mount device                         | High power handling extends the usability of these filters to the transmit path for inter-stage filtering.   |
| Small size, 2x2mm QFN   | Allows replacement of filter/attenuator pairs with a single reflectionless filter, saving board space.   |
| Excellent repeatability of RF performance                                       | Through semiconductor IPD process, X-series filters are inherently repeatable for large volume production.   |
| Excellent stability over temperature  | With $\pm 0.3$ dB variation over temperature ideal for use in wide temperature range applications without the need for additional temperature compensation.  |
| Operating temperature up to 105°C   | Suitable for operation close to high power components.   |

\*IPD – Integrated Passive Device, is a GaAs semiconductor process



# Reflectionless High Pass Filter

## XHF2-912+

50Ω 9.1 to 30 GHz

### Features

- Match to 50Ω in the stop band, eliminates undesired reflections
- Cascadable
- Excellent Power handling
- Temperature stable, up to 105°C
- Small size, 2 x 2 mm
- Protected by US Patent No. 8,392,495

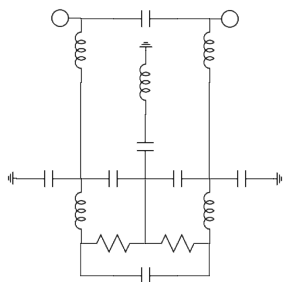
### Applications

- Wi-Fi
- WiMax
- Microwave Radio
- Military & Space

### General Description

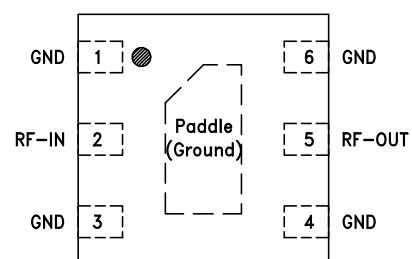
Mini-Circuits' XHF2-912+ reflectionless filter employs a novel filter topology which absorbs and terminates stop band signals internally rather than reflecting them back to the source. This new capability enables unique applications for filter circuits beyond those suited to traditional approaches. Traditional filters are reflective in the stop band, sending signals back to the source at 100% of the power level. These reflections interact with neighboring components and often result in inter-modulation and other interferences. Reflectionless filters eliminate stop band reflections, allowing them to be paired with sensitive devices and used in applications that otherwise require circuits such as isolation amplifiers or attenuators.

### *simplified schematic and pad description*



Generic photo used for illustration purposes only  
CASE STYLE: MC1630-1

**+RoHS Compliant**  
The +Suffix identifies RoHS Compliance. See our web site for RoHS Compliance methodologies and qualifications



| Function | Pad Number      | Description                    |
|----------|-----------------|--------------------------------|
| RF-IN    | 2               | RF Input Pad                   |
| RF-OUT   | 5               | RF Output Pad                  |
| GND      | 1,3,4,6, Paddle | Connected to ground externally |

Electrical Specifications<sup>1</sup> at 25°C

| Parameter | F#                | Frequency (MHz) | Min.          | Typ. | Max. | Unit |
|-----------|-------------------|-----------------|---------------|------|------|------|
| Stop Band | Rejection         | DC - F'         | DC - 1400     | —    | 6.9  | —    |
|           |                   | F' - F1         | 1400 - 7100   | 12   | 14.3 | —    |
|           | Frequency Cut-off | F2              | 8200          | —    | 3.0  | —    |
|           | VSWR              | DC - F'         | DC - 1400     | —    | 2.7  | —    |
|           | F' - F1           | 1400 - 7100     | —             | 2.1  | —    | :1   |
| Pass Band | Insertion Loss    | F3 - F4         | 9100 - 16000  | —    | 1.5  | —    |
|           |                   | F4 - F5         | 16000 - 30000 | —    | 1.4  | —    |
|           | VSWR              | F3 - F4         | 9100 - 16000  | —    | 1.7  | —    |
|           |                   | F4 - F5         | 16000 - 30000 | —    | 2.4  | —    |

<sup>1</sup> Measured on Mini-Circuits Characterization Test Board TB-883-912+

Absolute Maximum Ratings<sup>4</sup>

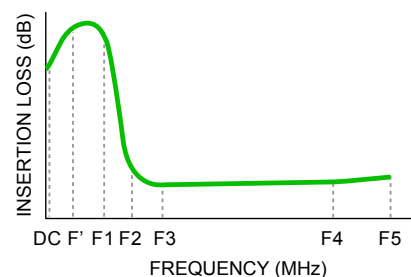
| Parameter                                     | Ratings         |
|---|-----------------|
| Operating Temperature                         | -55°C to +105°C |
| Storage Temperature                           | -65°C to +150°C |
| RF Power Input, Passband (F3-F5) <sup>2</sup> | 1.26W at 25°C   |
| RF Power Input, Stopband (DC-F3) <sup>3</sup> | 0.25W at 25°C   |

<sup>2</sup> Passband rating derates linearly to 0.63W at 105°C ambient

<sup>3</sup> Stopband rating derates linearly to 0.12W at 105°C ambient

<sup>4</sup> Permanent damage may occur if any of these limits are exceeded.

Specification Definition

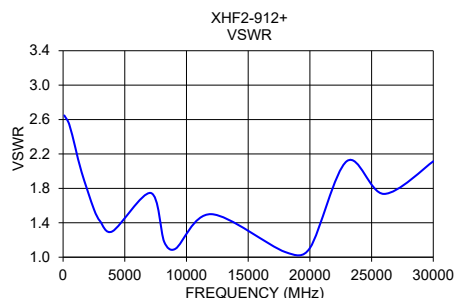
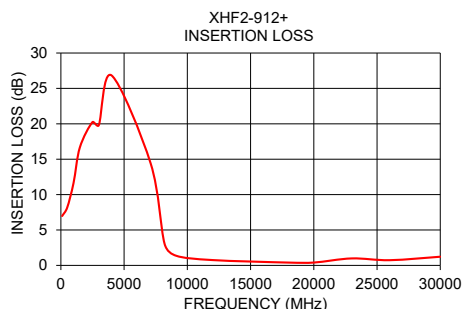


ESD rating

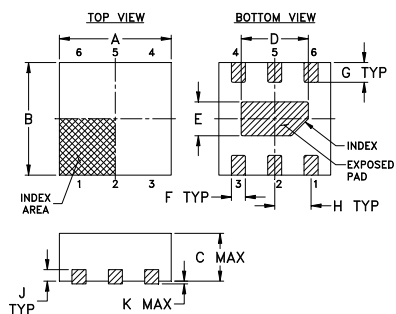
Human body model (HBM): Class 1A (250 to <500 V) in accordance with ANSI/ESD 5.1-2001

Typical Performance Data at 25°C

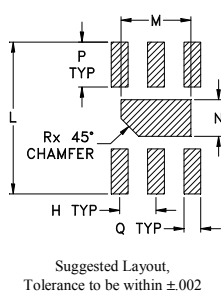
| Frequency (MHz) | Insertion Loss (dB) | VSWR (:1) |
|-----------------|---------------------|-----------|
| 100             | 6.98                | 2.65      |
| 500             | 8.17                | 2.54      |
| 1000            | 11.63               | 2.27      |
| 1500            | 16.67               | 1.99      |
| 2500            | 20.25               | 1.56      |
| 3000            | 19.81               | 1.42      |
| 4000            | 26.85               | 1.30      |
| 7100            | 14.40               | 1.75      |
| 8200            | 3.04                | 1.18      |
| 9100            | 1.37                | 1.10      |
| 12000           | 0.75                | 1.50      |
| 18000           | 0.40                | 1.06      |
| 20000           | 0.40                | 1.11      |
| 23000           | 0.98                | 2.12      |
| 26000           | 0.73                | 1.74      |
| 30000           | 1.22                | 2.11      |



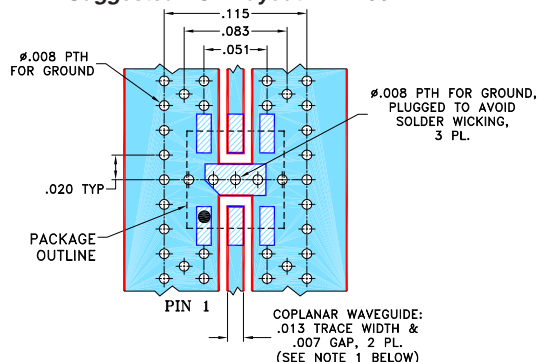
Outline Drawing



PCB Land Pattern



Demo Board MCL P/N:  
 TB-883-912+ (without connectors)  
 TB-883-912C+ (with connectors)  
 B20-118-F1+ Connector sold separately  
 Suggested PCB Layout: PL-499+



NOTES:

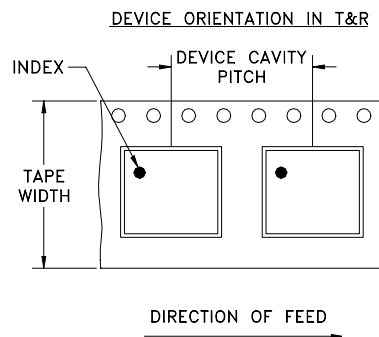
1. COPLANAR WAVEGUIDE IS SHOWN FOR ROGERS R04350B WITH DIELECTRIC THICKNESS .0066" ± .0007"; COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH MAY NEED TO BE MODIFIED.
2. BOTTOM SIDE OF THE PCB IS CONTINUOUS GROUND PLANE.

- DENOTES PCB COPPER LAYOUT WITH SMOBC (SOLDER MASK OVER BARE COPPER)
- DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK

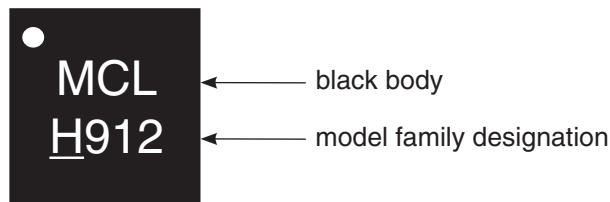
Outline Dimensions ( inch / mm )

|       |       |       |       |       |       |       |       |       |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| A     | B     | C     | D     | E     | F     | G     | H     | J     |
| 0.079 | 0.079 | 0.039 | 0.047 | 0.024 | 0.010 | 0.014 | 0.026 | 0.008 |
| 2.00  | 2.00  | 1.00  | 1.20  | 0.60  | 0.25  | 0.35  | 0.65  | 0.20  |
| K     | L     | M     | N     | P     | Q     | R     |       | wt    |
| 0.002 | 0.106 | 0.049 | 0.026 | 0.031 | 0.012 | 0.012 |       | grams |
| 0.05  | 2.70  | 1.25  | 0.65  | 0.80  | 0.30  | 0.30  |       | 0.006 |

Tape & Reel Packaging



Product Marking



| Tape Width, mm | Device Cavity Pitch, mm | Reel Size, inches | Devices per Reel see note |            |
|----------------|-------------------------|-------------------|---------------------------|------------|
| 8              | 4                       | 7                 | Small quantity standard   | 20         |
|                |                         |                   |                           | 50         |
|                |                         | 7                 |                           | 100        |
|                |                         |                   |                           | 200        |
|                |                         |                   |                           | 500        |
|                |                         | 7                 | Standard                  | 1000, 2000 |

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