*Ceramic*

# High Pass Filter

# HFCW-5000+

50Ω 5500 to 20000 MHz



*Generic photo used for illustration purposes only*
CASE STYLE: JC0603C

## The Big Deal

- Very good rejection, 45 dB typical
- Small size 0603 (0.063" X 0.032" X 0.024")
- Good Power handling, 1.75W
- Ceramic construction

## Product Overview

HFCW-5000+ is a high pass filter with passband from 5500 MHz to 20000 MHz supporting a variety of applications. This model provides good insertion loss over a wide band due to strategically constructed layout. Housed in a tiny 0603 ceramic form factor with wraparound terminations, the filter is ideal for dense PCB layouts with minimal performance variation due to parasitics.

## Key Features

| Feature | Advantages |
|---|---|
| Small size, 0603 (0.063" X 0.032" X 0.024") | Accommodates tight space requirements for dense PCB layouts. |
| Wrap around termination | Provides excellent solderability and easy visual inspection capability. |
| LTCC construction | Provides a rugged package that is well suited for tough environments including high humidity and high temperature extremes. |
| Ultra-wide pass band | This filter has a very wide passband from 5.5 GHz to 20 GHz. |

**Notes**
**A.** Performance and quality attributes and conditions not expressly stated in this specification document are intended to be excluded and do not form a part of this specification document.
**B.** Electrical specifications and performance data contained in this specification document are based on Mini-Circuit's applicable established test performance criteria and measurement instructions.
**C.** The parts covered by this specification document are subject to Mini-Circuits standard limited warranty and terms and conditions (collectively, "Standard Terms"); Purchasers of this part are entitled to the rights and benefits contained therein. For a full statement of the Standard Terms and the exclusive rights and remedies thereunder, please visit Mini-Circuits' website at www.minicircuits.com/MCLStore/terms.jsp

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# High Pass Filter

50Ω 5500 to 20000 MHz

# HFCW-5000+



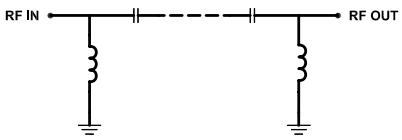
*Generic photo used for illustration purposes only*
CASE STYLE: JC0603C

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

## Features
- Very good rejection, 45 dB typ.
- Small size 0603 (0.063" X 0.032" X 0.024")
- Temperature stable
- LTCC construction

## Applications
- Test and measurements
- Military applications
- Telecommunications and broadband wireless systems

## Functional Schematic




## Electrical Specifications[1,2] at 25°C

| Parameter | | F# | Frequency (MHz) | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| Stop Band | Rejection Loss | DC-F1 | DC - 3000 | 39 | 45 | - | dB |
| | | F1-F2 | 3000 - 4000 | 20 | 40 | - | dB |
| | Freq. Cut-Off | F3 | 5000 | - | 3.0 | - | dB |
| Pass Band | Insertion Loss | F4-F5 | 5500 - 7000 | - | 2.2 | - | dB |
| | | F5-F6 | 7000 - 13500 | - | 0.9 | 1.4 | dB |
| | | F6-F7 | 13500 - 20000 | - | 2.0 | - | dB |
| | Return Loss | F4-F7 | 5500 - 20000 | - | 9 | - | dB |

1 This component is not intended to act as a DC block. Please consult with Mini-Circuits for further details
2 Measured on Mini-Circuits Characterization Test Board TB-HFCW-5000+

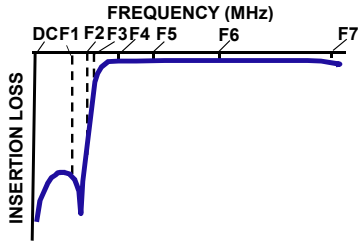
| Maximum Ratings | |
|---|---|
| Operating Temperature | -55°C to 125°C |
| Storage Temperature | -55°C to 125°C |
| RF Power Input* | 1.75W @ 25°C |

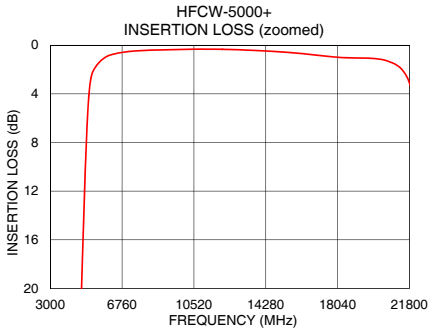
* Passband rating, derate linearly to 0.5W at 125°C ambient
Permanent damage may occur if any of these limits are exceeded.

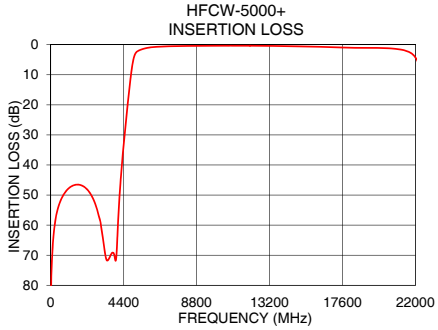
## Typical Performance Data at 25°C

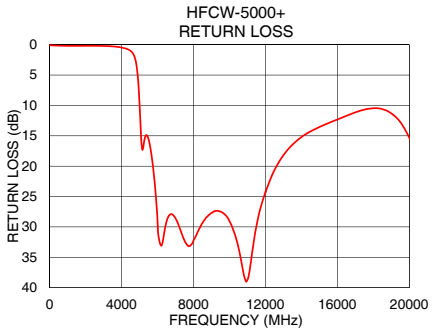
| Frequency (MHz) | Insertion Loss (dB) | Return Loss (dB) |
|---|---|---|
| 10 | 82.88 | 0.08 |
| 100 | 68.86 | 0.10 |
| 500 | 53.21 | 0.15 |
| 1000 | 48.20 | 0.18 |
| 2000 | 47.21 | 0.18 |
| 3000 | 58.91 | 0.20 |
| 3500 | 71.26 | 0.28 |
| 4000 | 66.10 | 0.45 |
| 4450 | 30.12 | 0.90 |
| 4630 | 20.28 | 1.42 |
| 4840 | 9.93 | 3.56 |
| 5000 | 4.53 | 9.72 |
| 5500 | 1.52 | 15.55 |
| 6000 | 0.89 | 28.99 |
| 7000 | 0.54 | 28.57 |
| 10000 | 0.35 | 29.07 |
| 13500 | 0.42 | 16.47 |
| 15000 | 0.54 | 13.55 |
| 18000 | 0.98 | 10.46 |
| 20000 | 1.10 | 15.36 |

## Typical Frequency Response



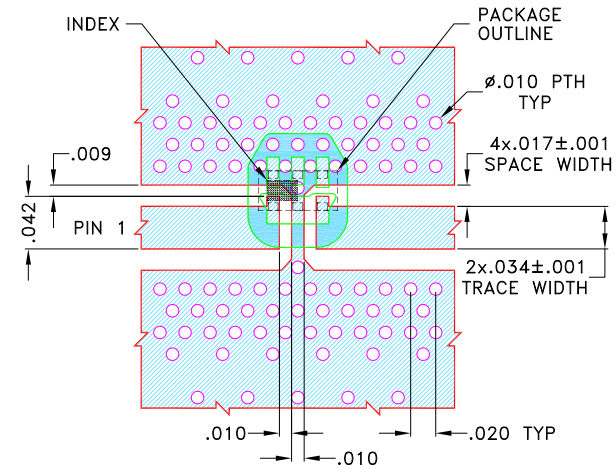

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## Pad Connections

| | |
|---|---|
| INPUT | 1 |
| OUTPUT | 3 |
| GROUND | 2,4,5,6 |

**Product Marking: 3**

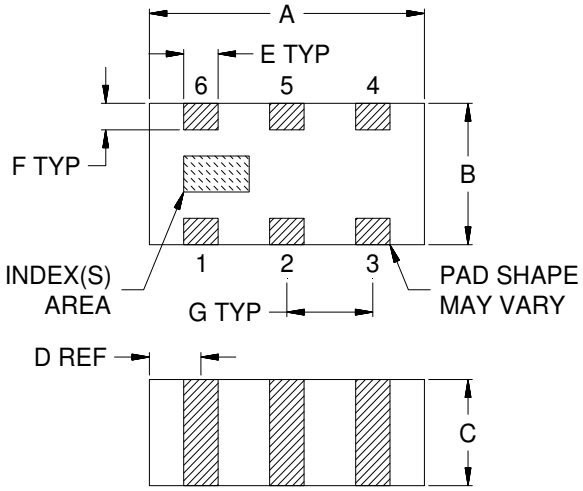
***Demo Board MCL P/N: TB-HFCW-5000+***
***Suggested PCB Layout (PL-703)***




NOTES:
1. COPLANAR WAVEGUIDE PARAMETERS ARE SHOWN FOR ROGERS (RO4350B) WITH DIELECTRIC THICKNESS .0200±.0015. COPPER: 1/2 Oz. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH AND GAP MAY NEED TO BE MODIFIED.
2. BOTTOM SIDE OF THE PCB IS CONTINUOUS GROUND PLANE.

DENOTES PCB COPPER PATTERN WITH SMOBC (SOLDER MASK OVER BARE COPPER)
DENOTES PCB COPPER PATTERN FREE OF SOLDERMASK

## Outline Drawing




## Outline Dimensions ( inch / mm )

| A | B | C | D | E | F | G | Wt. |
|---|---|---|---|---|---|---|---|
| **.063** | **.032** | **.024** | **.012** | **.008** | **.006** | **.020** | grams |
| 1.60 | 0.80 | 0.60 | 0.30 | 0.20 | 0.15 | 0.50 | .005 |

*Note: Please refer to case style drawing for details.*

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# Ceramic High Pass Filter HFCW-5000+

*Typical Performance Data*

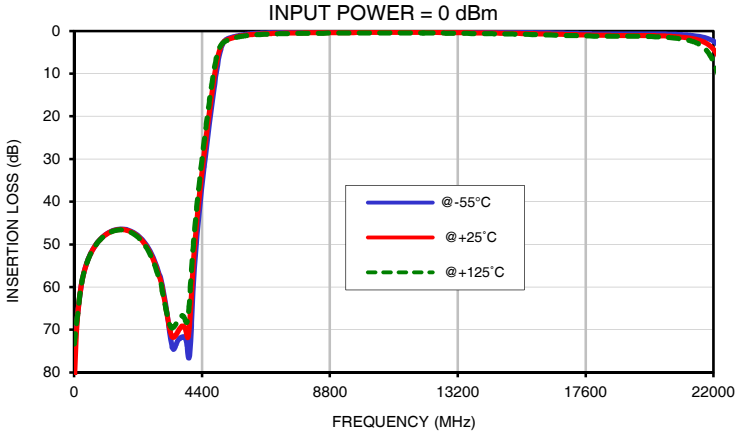
| FREQ. (MHz) | INSERTION LOSS (dB) | | | INPUT RETURN LOSS (dB) | | | OUTPUT RETURN LOSS (dB) | | |
|---|---|---|---|---|---|---|---|---|---|
| | @-55°C | @+25°C | @+125°C | @-55°C | @+25°C | @+125°C | @-55°C | @+25°C | @+125°C |
| 10 | 76.20 | 82.88 | 73.33 | 0.06 | 0.08 | 0.10 | 0.05 | 0.08 | 0.09 |
| 100 | 67.95 | 68.86 | 67.56 | 0.07 | 0.10 | 0.12 | 0.06 | 0.09 | 0.11 |
| 300 | 57.64 | 57.63 | 57.65 | 0.10 | 0.13 | 0.16 | 0.09 | 0.12 | 0.15 |
| 500 | 53.18 | 53.21 | 53.23 | 0.12 | 0.15 | 0.19 | 0.11 | 0.15 | 0.18 |
| 700 | 50.54 | 50.58 | 50.62 | 0.13 | 0.17 | 0.22 | 0.11 | 0.16 | 0.20 |
| 900 | 48.80 | 48.84 | 48.88 | 0.13 | 0.18 | 0.23 | 0.12 | 0.17 | 0.22 |
| 1100 | 47.62 | 47.67 | 47.72 | 0.13 | 0.18 | 0.24 | 0.12 | 0.18 | 0.22 |
| 1300 | 46.87 | 46.94 | 47.00 | 0.13 | 0.19 | 0.24 | 0.11 | 0.18 | 0.22 |
| 1500 | 46.49 | 46.57 | 46.65 | 0.12 | 0.19 | 0.24 | 0.11 | 0.18 | 0.22 |
| 1700 | 46.43 | 46.55 | 46.66 | 0.11 | 0.18 | 0.24 | 0.10 | 0.18 | 0.23 |
| 1900 | 46.74 | 46.91 | 47.04 | 0.10 | 0.18 | 0.24 | 0.10 | 0.18 | 0.23 |
| 2100 | 47.44 | 47.61 | 47.79 | 0.10 | 0.18 | 0.24 | 0.09 | 0.18 | 0.23 |
| 2300 | 48.59 | 48.81 | 49.05 | 0.09 | 0.18 | 0.24 | 0.09 | 0.18 | 0.24 |
| 2500 | 50.28 | 50.61 | 50.92 | 0.08 | 0.18 | 0.25 | 0.09 | 0.19 | 0.25 |
| 2700 | 52.75 | 53.20 | 53.61 | 0.08 | 0.19 | 0.26 | 0.09 | 0.19 | 0.27 |
| 2900 | 56.42 | 56.99 | 57.51 | 0.08 | 0.20 | 0.27 | 0.09 | 0.20 | 0.28 |
| 3000 | 58.31 | 58.91 | 59.47 | 0.09 | 0.20 | 0.28 | 0.10 | 0.21 | 0.29 |
| 3200 | 66.23 | 66.55 | 66.51 | 0.10 | 0.22 | 0.31 | 0.11 | 0.23 | 0.32 |
| 3400 | 74.48 | 71.76 | 69.51 | 0.12 | 0.26 | 0.35 | 0.13 | 0.27 | 0.37 |
| 3600 | 72.28 | 70.11 | 67.54 | 0.15 | 0.30 | 0.41 | 0.16 | 0.31 | 0.43 |
| 3800 | 71.76 | 69.41 | 67.34 | 0.20 | 0.36 | 0.49 | 0.21 | 0.38 | 0.52 |
| 4000 | 73.93 | 66.10 | 60.03 | 0.27 | 0.45 | 0.60 | 0.28 | 0.47 | 0.64 |
| 4450 | 33.18 | 30.12 | 27.28 | 0.60 | 0.90 | 1.21 | 0.60 | 0.95 | 1.32 |
| 4630 | 23.11 | 20.28 | 17.67 | 0.95 | 1.42 | 1.98 | 0.95 | 1.51 | 2.20 |
| 4840 | 12.26 | 9.93 | 8.10 | 2.26 | 3.56 | 5.35 | 2.26 | 3.83 | 6.09 |
| 5000 | 5.60 | 4.53 | 4.00 | 6.42 | 9.72 | 12.86 | 6.46 | 10.94 | 16.58 |
| 5090 | 3.39 | 3.08 | 3.01 | 12.17 | 15.34 | 16.44 | 12.32 | 18.58 | 20.96 |
| 5500 | 1.34 | 1.52 | 1.64 | 14.36 | 15.55 | 17.44 | 13.95 | 15.02 | 16.56 |
| 5900 | 0.79 | 0.98 | 1.11 | 21.00 | 24.67 | 29.08 | 19.68 | 22.35 | 24.96 |
| 6300 | 0.54 | 0.74 | 0.87 | 30.53 | 32.27 | 32.65 | 27.94 | 29.27 | 30.56 |
| 6700 | 0.42 | 0.61 | 0.73 | 27.22 | 27.96 | 30.65 | 28.11 | 28.66 | 32.00 |
| 7000 | 0.36 | 0.54 | 0.66 | 27.07 | 28.57 | 32.68 | 28.34 | 29.93 | 35.63 |
| 7400 | 0.30 | 0.48 | 0.59 | 28.87 | 31.55 | 34.89 | 30.75 | 34.27 | 38.90 |
| 7800 | 0.26 | 0.44 | 0.55 | 31.48 | 33.14 | 32.59 | 33.62 | 35.57 | 32.96 |
| 8200 | 0.23 | 0.41 | 0.52 | 32.50 | 31.07 | 29.80 | 33.31 | 31.39 | 29.26 |
| 8600 | 0.21 | 0.40 | 0.51 | 31.22 | 28.90 | 28.20 | 31.01 | 28.59 | 27.48 |
| 9000 | 0.19 | 0.38 | 0.49 | 30.43 | 27.73 | 27.26 | 29.55 | 27.33 | 26.69 |
| 9400 | 0.17 | 0.36 | 0.48 | 30.27 | 27.40 | 27.07 | 29.47 | 27.11 | 26.84 |
| 9800 | 0.15 | 0.35 | 0.46 | 30.79 | 28.12 | 27.61 | 30.02 | 28.08 | 27.68 |
| 10200 | 0.13 | 0.34 | 0.45 | 32.81 | 30.42 | 29.28 | 32.03 | 30.84 | 29.88 |
| 10600 | 0.13 | 0.32 | 0.44 | 38.27 | 34.76 | 32.81 | 38.07 | 37.09 | 34.89 |
| 11000 | 0.12 | 0.32 | 0.44 | 45.90 | 38.71 | 38.10 | 43.28 | 49.43 | 50.06 |
| 11400 | 0.12 | 0.33 | 0.45 | 33.43 | 31.46 | 32.18 | 32.81 | 31.75 | 32.74 |
| 11800 | 0.12 | 0.33 | 0.45 | 27.86 | 26.11 | 26.06 | 27.38 | 26.11 | 26.12 |
| 12200 | 0.12 | 0.35 | 0.47 | 24.15 | 22.71 | 22.26 | 23.73 | 22.58 | 22.21 |
| 12600 | 0.12 | 0.36 | 0.49 | 21.23 | 20.09 | 19.48 | 21.11 | 20.12 | 19.57 |
| 13000 | 0.14 | 0.38 | 0.52 | 19.03 | 18.20 | 17.59 | 19.11 | 18.35 | 17.76 |
| 13500 | 0.17 | 0.42 | 0.57 | 16.98 | 16.47 | 15.96 | 17.14 | 16.67 | 16.16 |
| 14000 | 0.20 | 0.45 | 0.61 | 15.43 | 15.20 | 14.80 | 15.71 | 15.49 | 15.10 |
| 14500 | 0.24 | 0.49 | 0.66 | 14.34 | 14.29 | 14.00 | 14.60 | 14.55 | 14.26 |
| 15000 | 0.28 | 0.54 | 0.71 | 13.49 | 13.55 | 13.31 | 13.68 | 13.78 | 13.52 |
| 15500 | 0.33 | 0.60 | 0.78 | 12.78 | 12.91 | 12.60 | 12.91 | 13.08 | 12.74 |
| 16000 | 0.38 | 0.66 | 0.86 | 12.24 | 12.32 | 11.91 | 12.27 | 12.39 | 11.94 |
| 16500 | 0.44 | 0.74 | 0.96 | 11.58 | 11.71 | 11.20 | 11.56 | 11.73 | 11.18 |
| 17000 | 0.52 | 0.83 | 1.06 | 10.97 | 11.14 | 10.66 | 10.97 | 11.14 | 10.63 |
| 17500 | 0.60 | 0.91 | 1.14 | 10.43 | 10.68 | 10.33 | 10.42 | 10.68 | 10.31 |
| 18000 | 0.67 | 0.98 | 1.20 | 10.15 | 10.46 | 10.38 | 10.17 | 10.49 | 10.41 |
| 18500 | 0.71 | 1.03 | 1.22 | 10.20 | 10.61 | 10.87 | 10.30 | 10.71 | 11.02 |
| 19000 | 0.72 | 1.05 | 1.23 | 10.72 | 11.32 | 11.98 | 10.88 | 11.55 | 12.35 |
| 20000 | 0.70 | 1.10 | 1.34 | 14.51 | 15.36 | 16.73 | 15.24 | 16.67 | 19.01 |

## Typical Performance Data

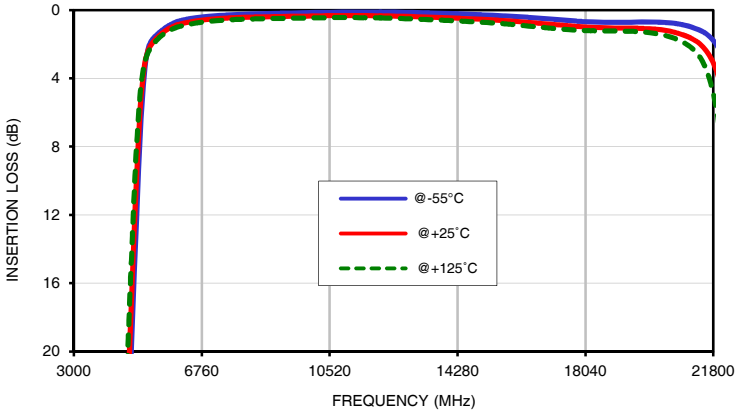
| FREQ. (MHz) | GROUP DELAY (nsec) | | |
|---|---|---|---|
| | @-55°C | @+25°C | @+125°C |
| 5500 | 0.39 | 0.37 | 0.35 |
| 5800 | 0.29 | 0.28 | 0.27 |
| 6100 | 0.23 | 0.22 | 0.21 |
| 6400 | 0.19 | 0.18 | 0.18 |
| 6700 | 0.16 | 0.16 | 0.15 |
| 7000 | 0.14 | 0.14 | 0.13 |
| 7300 | 0.12 | 0.12 | 0.12 |
| 7600 | 0.11 | 0.11 | 0.11 |
| 7900 | 0.10 | 0.10 | 0.10 |
| 8200 | 0.09 | 0.09 | 0.09 |
| 8500 | 0.08 | 0.08 | 0.08 |
| 8800 | 0.08 | 0.08 | 0.08 |
| 9100 | 0.08 | 0.07 | 0.07 |
| 9400 | 0.07 | 0.07 | 0.07 |
| 9700 | 0.07 | 0.07 | 0.07 |
| 10000 | 0.06 | 0.06 | 0.07 |
| 10300 | 0.06 | 0.06 | 0.06 |
| 10600 | 0.06 | 0.06 | 0.06 |
| 10900 | 0.06 | 0.06 | 0.06 |
| 11200 | 0.06 | 0.06 | 0.06 |
| 11500 | 0.06 | 0.06 | 0.06 |
| 11800 | 0.05 | 0.06 | 0.06 |
| 12100 | 0.05 | 0.05 | 0.06 |
| 12500 | 0.05 | 0.05 | 0.05 |
| 12800 | 0.05 | 0.05 | 0.05 |
| 13100 | 0.05 | 0.05 | 0.05 |
| 13500 | 0.05 | 0.05 | 0.05 |
| 14000 | 0.05 | 0.05 | 0.05 |
| 14500 | 0.05 | 0.05 | 0.05 |
| 15000 | 0.05 | 0.05 | 0.05 |
| 15500 | 0.05 | 0.05 | 0.05 |
| 16000 | 0.05 | 0.05 | 0.06 |
| 16500 | 0.05 | 0.05 | 0.06 |
| 17000 | 0.05 | 0.06 | 0.06 |
| 17500 | 0.06 | 0.06 | 0.06 |
| 18000 | 0.06 | 0.06 | 0.06 |
| 18500 | 0.06 | 0.06 | 0.07 |
| 19000 | 0.06 | 0.07 | 0.07 |
| 19500 | 0.07 | 0.08 | 0.08 |
| 20000 | 0.08 | 0.08 | 0.09 |

## *Typical Performance Curves*

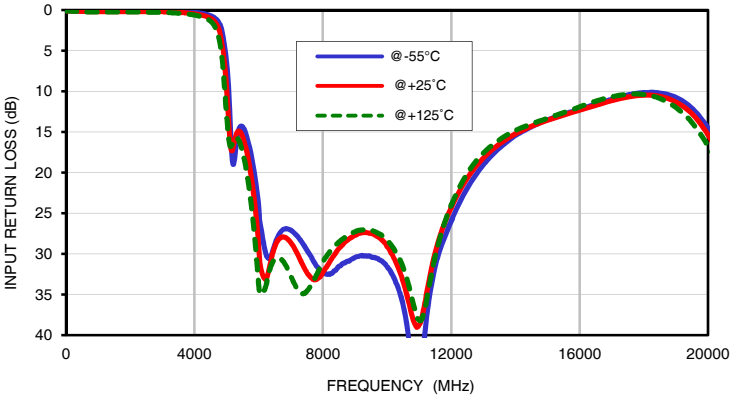
**INSERTION LOSS vs. TEMPERATURE**
INPUT POWER = 0 dBm



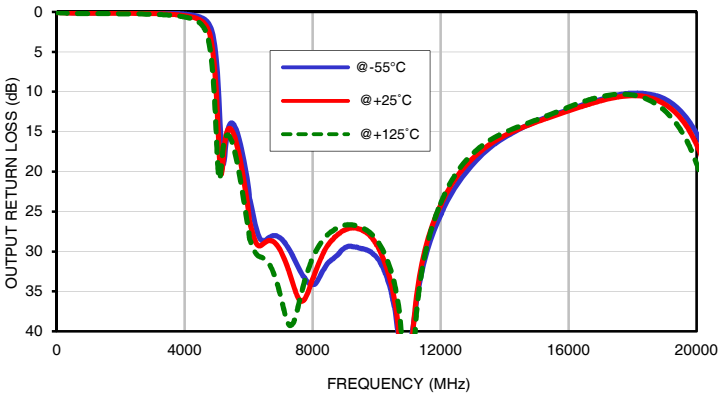

**INSERTION LOSS vs. TEMPERATURE (Zoomed)**
INPUT POWER = 0 dBm



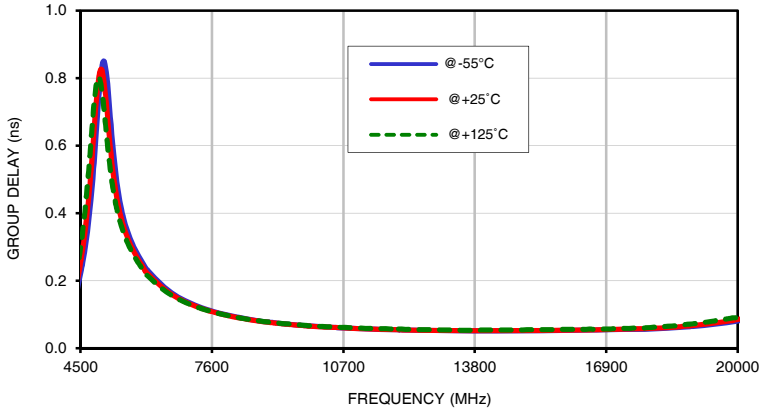

**INPUT RETURN LOSS vs. TEMPERATURE**
INPUT POWER = 0 dBm




**OUTPUT RETURN LOSS vs. TEMPERATURE**
INPUT POWER = 0 dBm

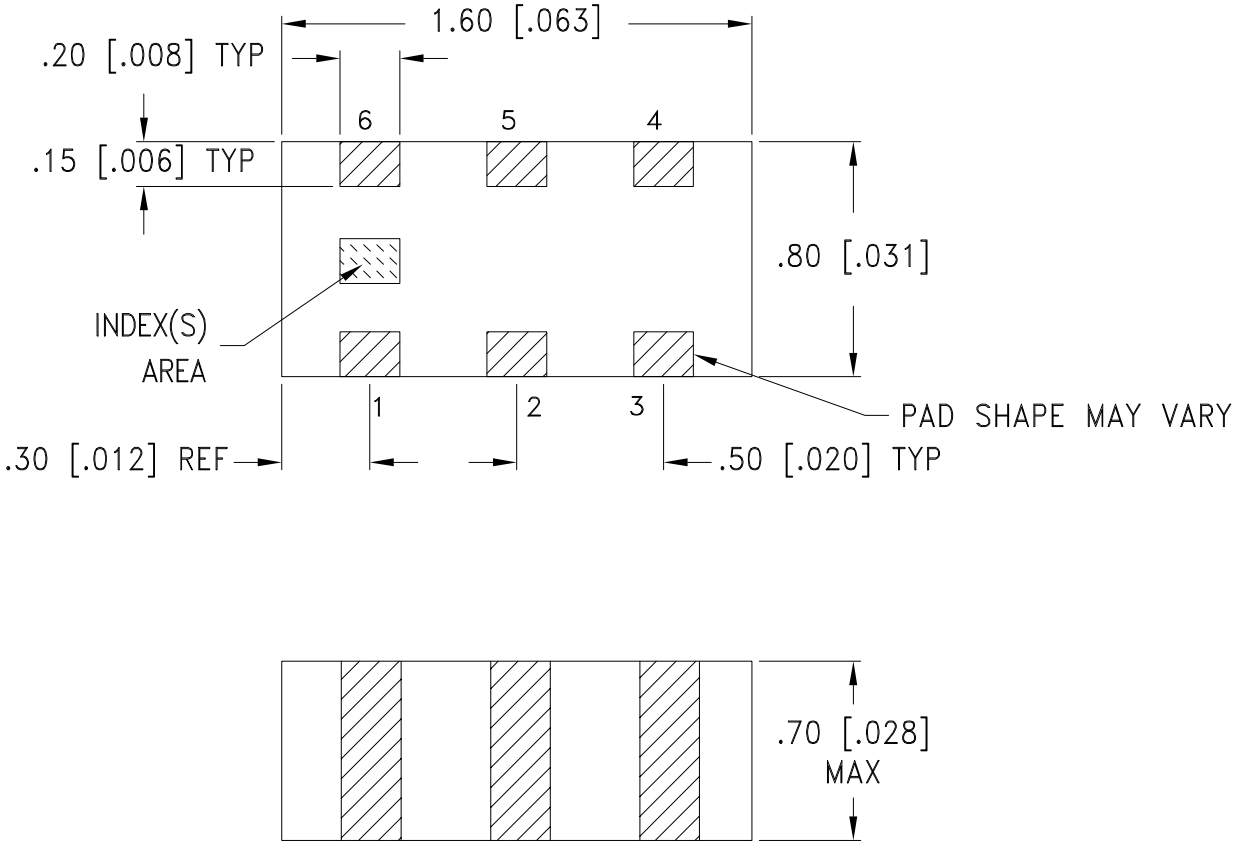



**GROUP DELAY vs. TEMPERATURE**
**INPUT POWER = 0 dBm**



# Case Style JC

## Outline Dimensions JC0603C




METALLIZATION

Weight: .005 grams

Dimensions are in mm [inch]. Tolerances: ±0.13 mm

**Notes:**

1. Open style, ceramic base.
2. Termination finish:
   For RoHS Case Styles: Tin plate over Nickel plate. All models, (+) suffix.


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RF/IF MICROWAVE COMPONENTS

# Tape & Reel Packaging TR-F114

DEVICE ORIENTATION IN T&R

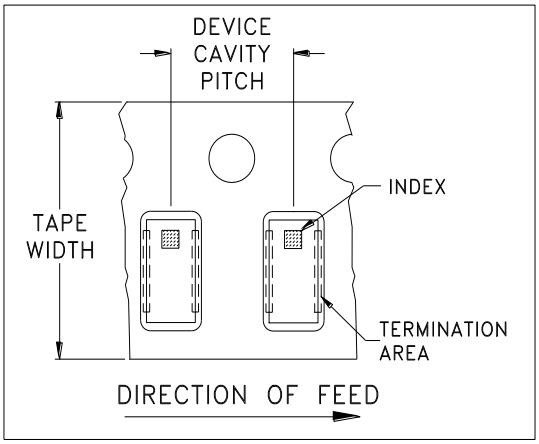



ILLUSTRATION 1

| Applicable Case Styles | |
|---|---|
| GE0805C | JC0603C |
| GE0805C-1 | JC0603C-4 |
| GE0805C-1AP | JC0603C-6 |
| GE0805C-7 | |
| GE0805C-9 | |
| GE0805C-10 | |
| GE0805C-11 | |
| GE0805C-12 | |

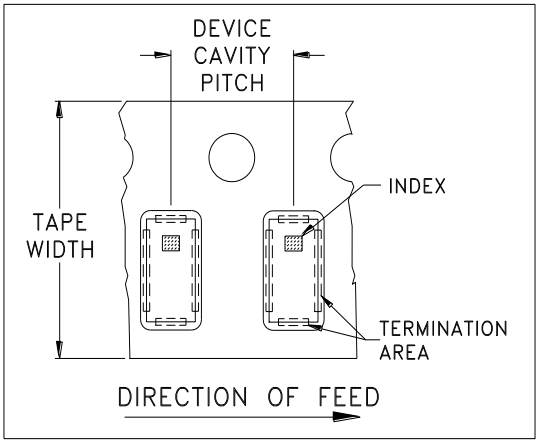



ILLUSTRATION 2

| Applicable Case Styles | |
|---|---|
| GE0805C-2 | JC0603C-1 |
| GE0805C-3 | JC0603C-2 |
| GE0805C-4 | JC0603C-3 |
| GE0805C-5 | JC0603C-5 |
| GE0805C-6 | JC0603C-7 |
| GE0805C-8 | |
| GE0805C-15 | |

| Tape Width, mm | Device Cavity Pitch, mm | Reel Size, inches | Devices per Reel | |
|---|---|---|---|---|
| 8 | 4 | 7 | Small quantity standards (see note) | 20 |
| | | | | 50 |
| | | | | 100 |
| | | | | 200 |
| | | | | 500 |
| | | | | 1000 |
| | | | Standard | 4000 |

Note: Please Consult individual model data sheet to determine device per reel availability.

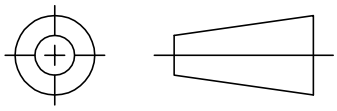
Mini-Circuits carrier tape materials provide protection from ESD (Electro-Static Discharge) during handling and transportation. Tapes are static dissipative and comply with industry standards EIA-481/EIA-541.

Go to: www.minicircuits.com/pages/pdfs/tape.pdf

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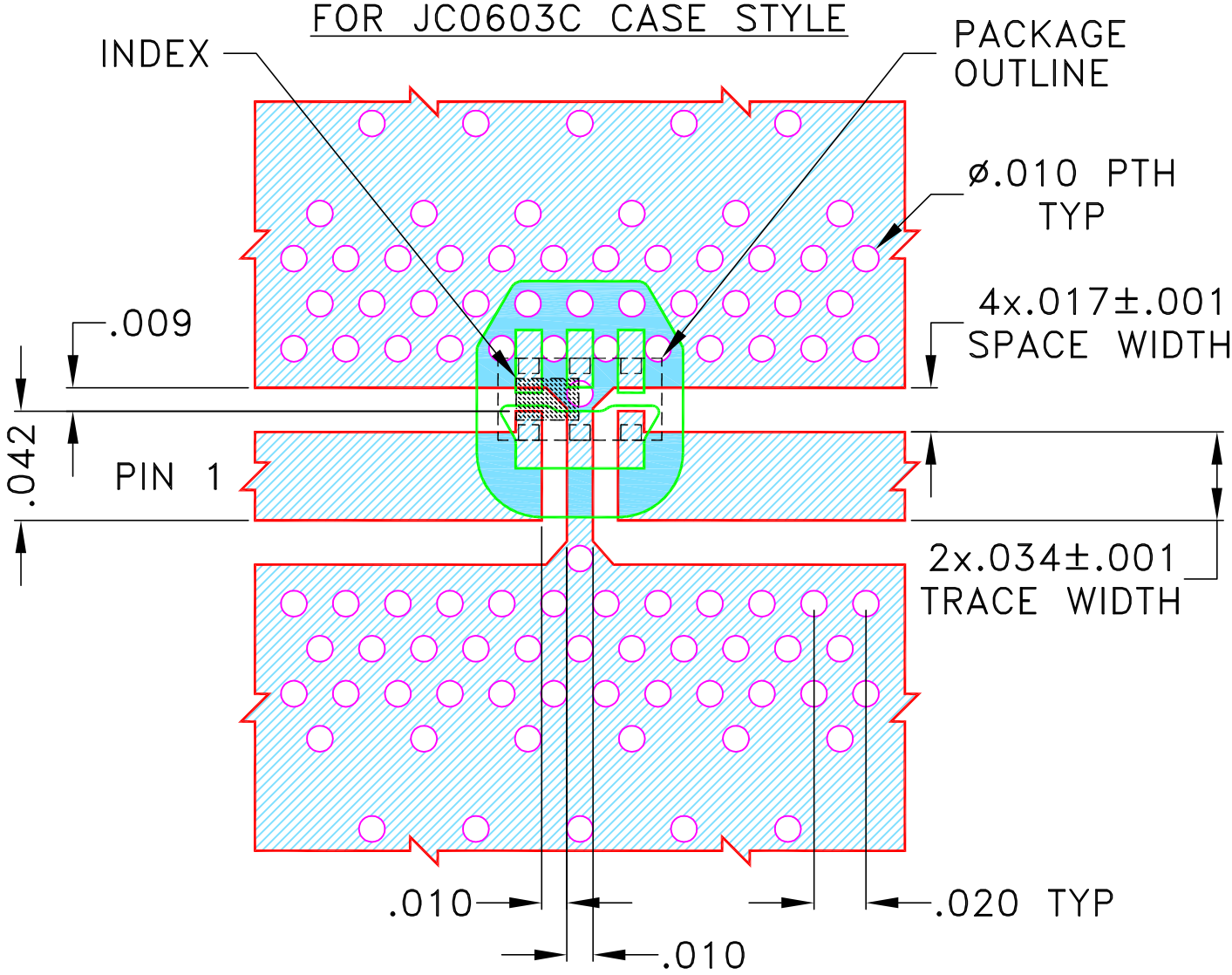

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THIRD ANGLE PROJECTION



| REVISIONS | | | | | |
|---|---|---|---|---|---|
| REV | ECN No. | DESCRIPTION | DATE | DR | AUTH |
| OR | ECO-006344 | NEW RELEASE | FEB 21 | DDR | VC |
| | | | | | |
| | | | | | |
| | | | | | |

# SUGGESTED MOUNTING CONFIGURATION FOR JC0603C CASE STYLE




## NOTES:

1. COPLANAR WAVEGUIDE PARAMETERS ARE SHOWN FOR ROGERS (RO4350B) WITH DIELECTRIC THICKNESS .0200±.0015. COPPER: 1/2 Oz. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH AND GAP MAY NEED TO BE MODIFIED.
2. BOTTOM SIDE OF THE PCB IS CONTINUOUS GROUND PLANE.

DENOTES PCB COPPER PATTERN WITH SMOBC (SOLDER MASK OVER BARE COPPER)

DENOTES PCB COPPER PATTERN FREE OF SOLDERMASK

| UNLESS OTHERWISE SPECIFIED | | INITIALS | DATE |
|---|---|---|---|
| DIMENSIONS ARE IN INCHES | DRAWN | DDR | 17 FEB 21 |
| TOLERANCES ON: | CHECKED | RV | 17 FEB 21 |
| 2 PL DECIMALS ± | APPROVED | RKS | 17 FEB 21 |
| 3 PL DECIMALS ± .005 | | | |
| ANGLES ± | | | |
| FRACTIONS ± | | | |

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ASHEETA1.DWG REV:A DATE:01/12/95

Mini-Circuits®
13 Neptune Avenue
Brooklyn NY 11235

PL DWG, JC0603C C.S, 50 OHM, HFCW

| SIZE | CODE IDENT | DRAWING NO: | REV: |
|---|---|---|---|
| A | 15542 | 98-PL-703 | OR |
| FILE: 98PL703 | | SCALE: 15:1 | SHEET: 1 OF 1 |

Mini-Circuits

# Environmental Specifications ENV126

All Mini-Circuits products are manufactured under exacting quality assurance and control standards, and are capable of meeting published specifications after being subjected to any or all of the following physical and environmental test.

| Specification | Test/Inspection Condition | Reference/Spec |
|---|---|---|
| Operating Temperature | -55° to 125° C<br>Ambient Environment | Individual Model Data Sheet |
| Storage Temperature | -55° to 125° C<br>Ambient Environment | Individual Model Data Sheet |
| Humidity | 90 to 95% RH, 240 hours, 50°C | MIL-STD-202, Method 103, Condition A, Except 50°C and end-point electrical test done within 12 hours |
| Solder Reflow Heat | Sn-Pb Eutectic Process 225°C peak<br>Pb-Free Process 245° - 250°C peak | J-STD-020C, Table 4-1, 4-2 and 5-2, Figure 5-1 |
| Solderability | 10X Magnification | J-STD-002, Para 4.2.5, Test S, 95% Coverage |
| Vibration (High Frequency) | 20g peak, 10-2000 Hz, 12 times in each of three perpendicular directions (total 36) | MIL-STD-202, Method 204, Condition D |
| Mechanical Shock | 50g, 11 ms, 1/2-sine, 18 shocks: 3 each direction, each of 3 axes | MIL-STD-202, Method 213, Condition A |


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