



## LTCC SURFACE MOUNT

# Low Pass Filter

## LFCV-3202+

Mini-Circuits

50Ω DC to 32 GHz

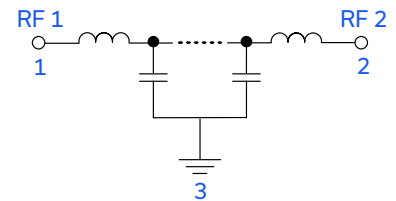
### THE BIG DEAL

- Low Insertion Loss, Typ. 2.0 dB
- Stopband Rejection, Typ. 36 dB
- Passband Return Loss, Typ. 13 dB
- Rugged Ceramic Construction
- 1210 Surface Mount Footprint



Generic photo used for illustration purposes only

### FUNCTIONAL DIAGRAM



### APPLICATIONS

- Communications
- Radar, EW, and ECM Defense Systems
- Test & Measurement Equipment

### PRODUCT OVERVIEW

Mini-Circuits' LFCV-3202+ is a miniature, low-temperature co-fired ceramic (LTCC), low pass filter with a DC to 32 GHz passband that supports a variety of applications. This model provides 2.0 dB typical insertion loss over a wide bandwidth due to its rugged monolithic construction. Housed in a small 1210 ceramic form factor, the filter is ideal for dense signal chain PCB layouts, where it complements MMIC size and performance. The LTCC fabrication process assures minimal RF performance variation from unit to unit and lot to lot while delivering a product that is well-suited for environmental extremes of high humidity and temperature.

### KEY FEATURES

| Feature                        | Advantages   |
|--------------------------------|--|
| Ultra-Wide Stopband            | Provides excellent stopband rejection to 67 GHz and beyond; suitable for wideband applications.  |
| LTCC Construction              | The use of LTCC technology allows for repeatable performance in a rugged ceramic package, well suited for tough environments such as high humidity and temperature extremes. See Mini-Circuits Environmental Rating ENV06T10 for more information.                   |
| Excellent Performance for Size | Offers best-in-class performance relative to larger-size alternative technologies. This mmWave multi-layer surface mount LTCC filter in a 1210 package allows for space to be saved in dense circuit board layouts, while also minimizing the effects of parasitics. |





### ELECTRICAL SPECIFICATIONS<sup>1,2,3</sup> AT +25°C

| Parameter | F#                         | Frequency (GHz) | Min.      | Typ. | Max. | Units |    |
|-----------|----------------------------|-----------------|-----------|------|------|-------|----|
| Passband  | Insertion Loss             | DC - F1         | DC - 32   | —    | 2.0  | 3.5   |    |
|           | Freq. Cut-Off <sup>4</sup> | Fc              | 34.4      | —    | 3    | —     | dB |
|           | Return Loss                | DC - F1         | DC - 32   | —    | 13   | —     |    |
| Stopband  | Rejection                  | F2 - F3         | 41.5 - 57 | 25   | 36   | —     | dB |
|           |                            | F3 - F4         | 57 - 67   | 25   | 32   | —     |    |

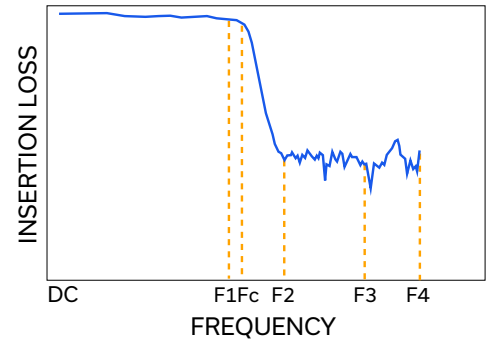
1. Tested on Evaluation Board P/N TB-LFCV-3202C+ with the connector and feedline effects de-embedded using the 2XThru IEEE P370 method.
2. Bi-directional, RF1 and RF2 ports can be interchanged.
3. In applications where DC voltage and/or current is present at either the input or output ports, external DC blocking capacitors are required.
4. Typical variation ±3%.

### ABSOLUTE MAXIMUM RATINGS<sup>5</sup>

| Parameter                | Ratings         |
|--------------------------|-----------------|
| Operating Temperature    | -55°C to +125°C |
| Storage Temperature      | -55°C to +125°C |
| Input Power <sup>6</sup> | 1 W             |

5. Permanent damage may occur if any of these limits are exceeded.
6. Power rating applies only to signals within the passband. Power rating above +25°C operating temperature decreases linearly to 0.5 W at +125°C.

### TYPICAL FREQUENCY RESPONSE AT +25°C





LTCC SURFACE MOUNT

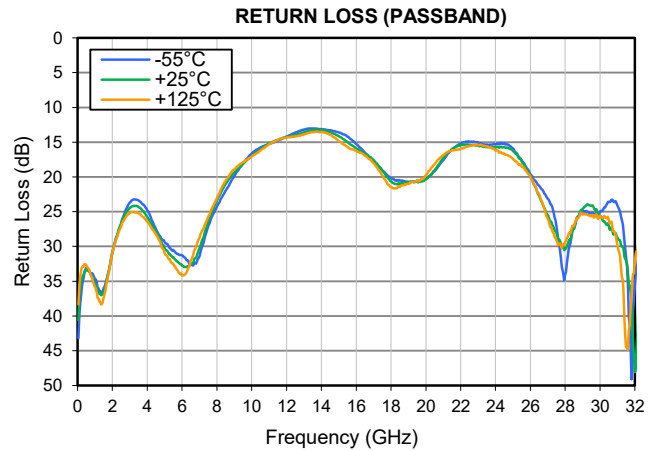
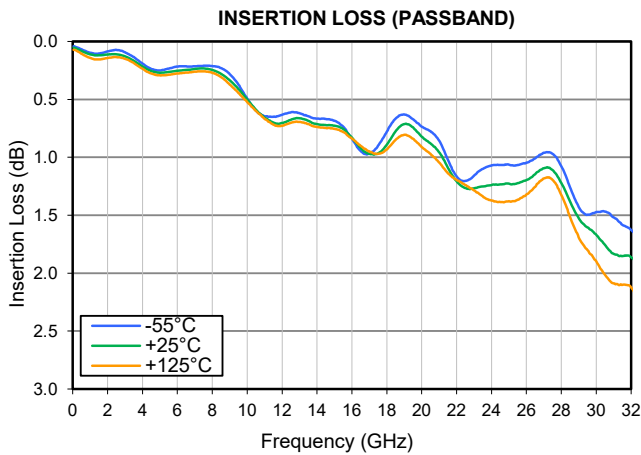
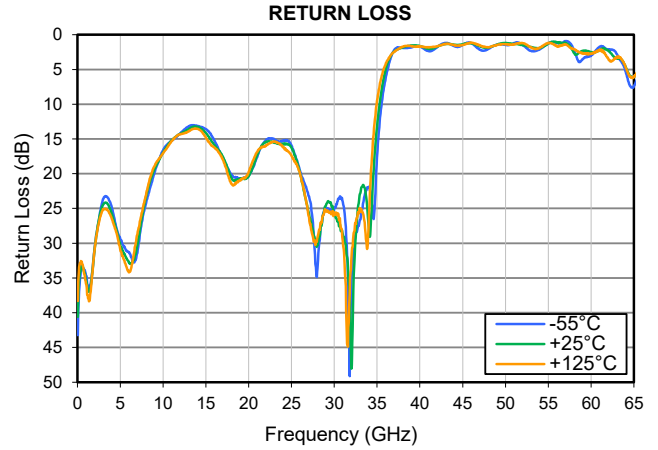
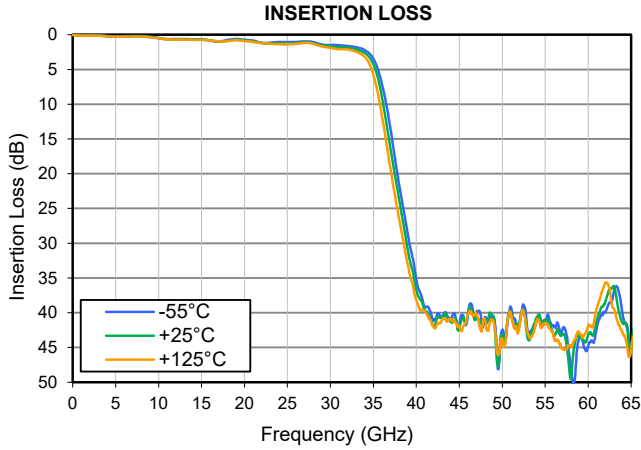
# Low Pass Filter

## LFCV-3202+

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### TYPICAL PERFORMANCE GRAPHS





### FUNCTIONAL DIAGRAM

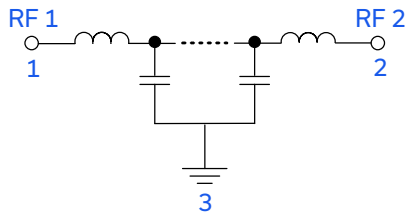
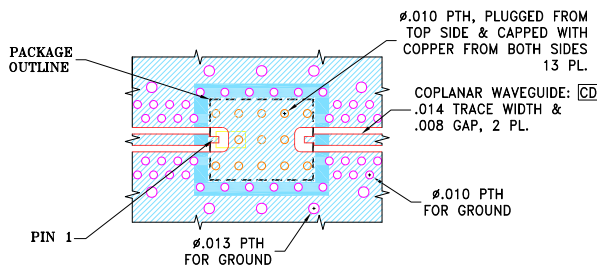


Figure 1. LFCV-3202+ Functional Diagram

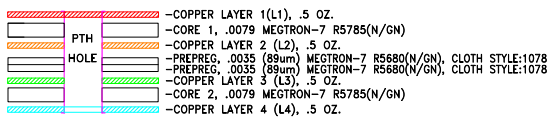
### PAD DESCRIPTION

| Function         | Pad Number | Description                                     |
|------------------|------------|---|
| RF1 <sup>2</sup> | 1          | Connects to RF Input Port                       |
| RF2 <sup>2</sup> | 2          | Connects to RF Output Port                      |
| GROUND           | 3          | Connects to Ground on PCB, (See drawing PL-743) |

### SUGGESTED PCB LAYOUT (PL-743)



#### STACK-UP DIAGRAM



- TOTAL FINISHED THICKNESS 0.026 ± 10%.
- PTH PRESENT FROM COPPER LAYER 1 TO COPPER LAYER 4.
- INDICATED ON TOP VIEW PTH'S ARE PLUGGED WITH EPOXY AND CAPPED WITH COPPER FROM TOP SIDE.
- L2, L3 AND L4 ARE CONTINUOUS GROUND PLANES.

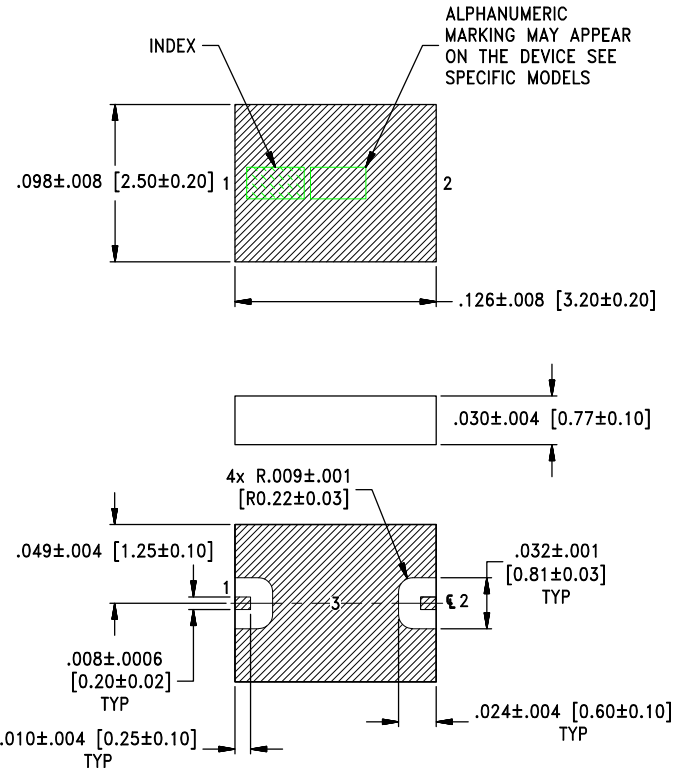
#### NOTES:

- PCB IS MULTILAYER PCB, SEE STACK-UP DIAGRAM.
- TRACE WIDTH & GAP PARAMETERS ARE SHOWN FOR MEGTRON-7 R-5785(N/GN), WITH DIELECTRIC THICKNESS .0079; COPPER: 1/2 OZ. FOR OTHER MATERIALS TRACE WIDTH AND GAP MAY NEED TO BE MODIFIED.

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

Figure 2. Suggested PCB Layout PL-743

### CASE STYLE DRAWING



METALLIZATION

Weight: .024 grams

Dimensions are in inches [mm]. Tolerances: 2 Pl.±.010; 3 Pl. ±.005

### PRODUCT MARKING\*: A1

\*Marking may contain other features or characters for internal lot control.



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ADDITIONAL INFORMATION IS AVAILABLE ON OUR DASHBOARD

[CLICK HERE](#)

|                                 |   |
|---------------------------------|---|
| Performance Data & Graphs       | Data  |
|                                 | Graphs  |
|                                 | S-Parameter (S2P Files) Data Set (.zip file) De-embedded to device pads |
| Case Style                      | JV1210C-13      Lead Finish: Gold over Nickel Plating                   |
| RoHS Status                     | Compliant   |
| Tape and Reel                   | F74   |
| Suggested Layout for PCB Design | PL-743  |
| Evaluation Board                | TB-LFCV-3202C+  |
|                                 | Gerber File   |
| Environmental Rating            | ENV06T10  |

### 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/terms/viewterm.html](http://www.minicircuits.com/terms/viewterm.html)



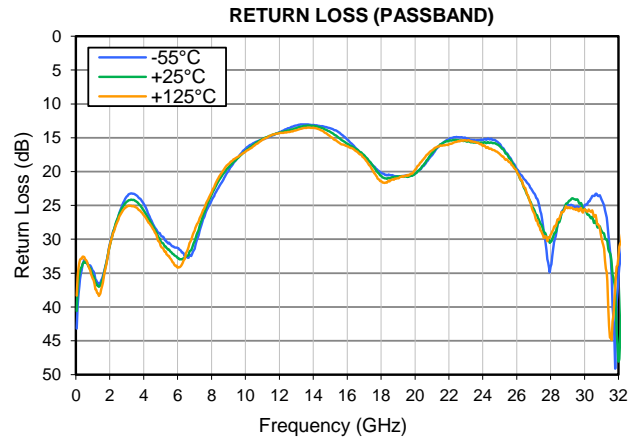
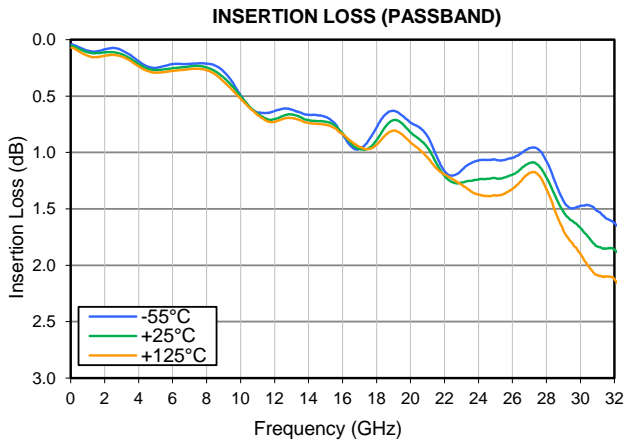
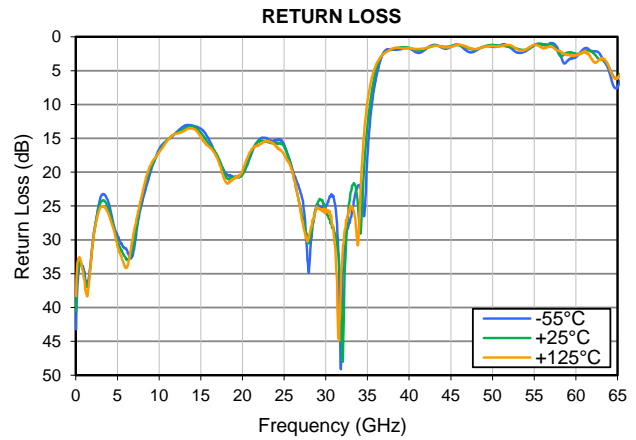
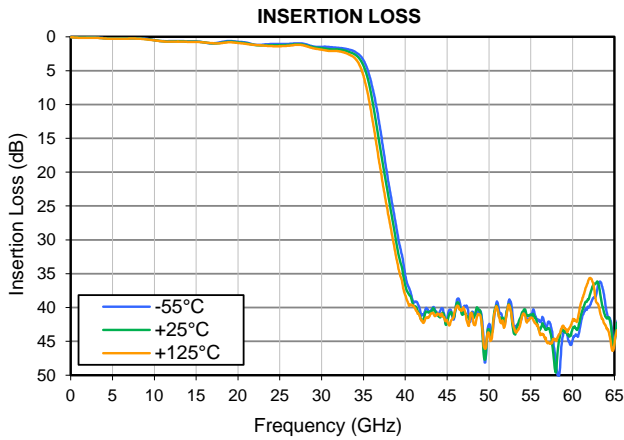
# LTCC Lowpass Filter

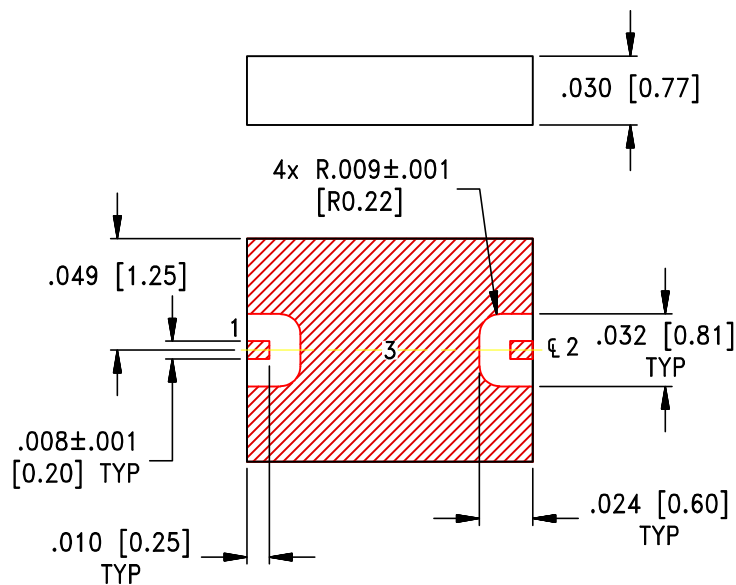
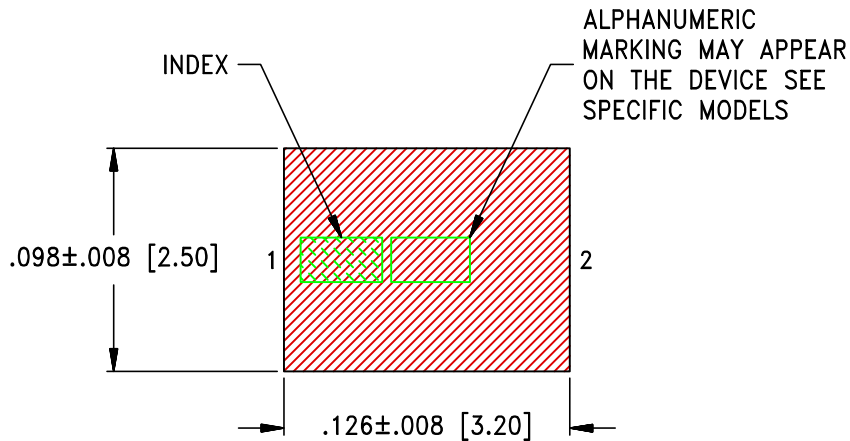
Typical Performance Data

# LFCV-3202+

| FREQUENCY<br>(GHz) | INSERTION LOSS<br>(dB) |        |         | RETURN LOSS<br>(dB) |        |         |
|--------------------|------------------------|--------|---------|---------------------|--------|---------|
|                    | @-55°C                 | @+25°C | @+125°C | @-55°C              | @+25°C | @+125°C |
| 0.1                | 0.04                   | 0.06   | 0.07    | 39.86               | 37.67  | 35.59   |
| 1.0                | 0.10                   | 0.11   | 0.14    | 34.68               | 35.35  | 35.84   |
| 2.0                | 0.09                   | 0.11   | 0.14    | 30.80               | 30.95  | 30.97   |
| 3.0                | 0.09                   | 0.13   | 0.15    | 23.65               | 24.45  | 25.13   |
| 4.0                | 0.19                   | 0.22   | 0.24    | 24.76               | 25.74  | 26.45   |
| 5.0                | 0.25                   | 0.27   | 0.29    | 29.39               | 30.28  | 30.99   |
| 6.0                | 0.22                   | 0.25   | 0.28    | 31.28               | 32.77  | 34.20   |
| 7.0                | 0.21                   | 0.24   | 0.26    | 31.38               | 30.30  | 28.73   |
| 8.0                | 0.21                   | 0.25   | 0.27    | 24.26               | 23.44  | 23.04   |
| 9.0                | 0.28                   | 0.34   | 0.37    | 19.86               | 19.37  | 18.89   |
| 10.0               | 0.49                   | 0.50   | 0.52    | 16.65               | 16.98  | 17.07   |
| 11.0               | 0.65                   | 0.66   | 0.67    | 15.23               | 15.17  | 15.30   |
| 12.0               | 0.63                   | 0.70   | 0.73    | 14.21               | 14.27  | 14.32   |
| 13.0               | 0.62                   | 0.66   | 0.69    | 13.20               | 13.58  | 13.91   |
| 14.0               | 0.67                   | 0.71   | 0.74    | 13.12               | 13.25  | 13.53   |
| 15.0               | 0.68                   | 0.73   | 0.75    | 13.57               | 14.14  | 14.79   |
| 16.0               | 0.84                   | 0.83   | 0.84    | 15.27               | 15.89  | 16.27   |
| 17.0               | 0.97                   | 0.97   | 0.95    | 17.74               | 17.57  | 18.00   |
| 18.0               | 0.78                   | 0.89   | 0.93    | 20.13               | 20.62  | 21.44   |
| 19.0               | 0.63                   | 0.71   | 0.81    | 20.72               | 20.72  | 20.99   |
| 20.0               | 0.73                   | 0.82   | 0.91    | 20.22               | 20.28  | 19.72   |
| 21.0               | 0.86                   | 0.96   | 1.04    | 17.58               | 17.29  | 16.86   |
| 22.0               | 1.16                   | 1.21   | 1.19    | 15.22               | 15.46  | 15.94   |
| 23.0               | 1.16                   | 1.27   | 1.29    | 15.07               | 15.50  | 15.42   |
| 24.0               | 1.07                   | 1.24   | 1.37    | 15.34               | 15.79  | 16.20   |
| 25.0               | 1.06                   | 1.23   | 1.38    | 15.93               | 16.25  | 17.42   |
| 26.0               | 1.05                   | 1.20   | 1.32    | 19.61               | 19.95  | 20.01   |
| 27.0               | 0.96                   | 1.09   | 1.18    | 23.15               | 25.50  | 26.03   |
| 28.0               | 1.08                   | 1.22   | 1.32    | 34.09               | 30.25  | 29.34   |
| 29.0               | 1.43                   | 1.53   | 1.69    | 24.90               | 24.64  | 25.40   |
| 30.0               | 1.47                   | 1.67   | 1.90    | 24.98               | 25.55  | 25.54   |
| 31.0               | 1.52                   | 1.83   | 2.09    | 24.11               | 28.73  | 29.80   |
| 32.0               | 1.63                   | 1.86   | 2.13    | 35.75               | 48.05  | 32.57   |
| 33.0               | 1.80                   | 2.11   | 2.46    | 26.65               | 22.89  | 25.20   |
| 34.0               | 2.22                   | 2.63   | 3.19    | 21.88               | 27.24  | 27.84   |
| 35.0               | 3.47                   | 4.27   | 5.76    | 17.69               | 13.18  | 9.53    |
| 36.0               | 7.12                   | 9.01   | 11.68   | 6.28                | 5.04   | 4.23    |
| 37.0               | 13.60                  | 16.43  | 19.35   | 2.19                | 2.42   | 2.46    |
| 38.0               | 21.58                  | 23.71  | 26.48   | 1.90                | 1.85   | 1.75    |
| 39.0               | 28.67                  | 30.91  | 33.08   | 1.82                | 1.55   | 1.67    |
| 40.0               | 35.26                  | 36.75  | 38.14   | 1.70                | 1.63   | 1.68    |
| 41.0               | 39.17                  | 39.75  | 39.78   | 2.36                | 2.03   | 1.79    |
| 41.5               | 39.45                  | 40.57  | 40.95   | 2.23                | 1.97   | 1.75    |
| 42.0               | 41.16                  | 41.84  | 41.87   | 1.82                | 1.74   | 1.67    |
| 43.0               | 40.59                  | 40.58  | 40.94   | 1.19                | 1.36   | 1.34    |
| 44.0               | 41.02                  | 41.27  | 40.94   | 1.67                | 1.46   | 1.52    |
| 45.0               | 41.82                  | 42.26  | 42.02   | 1.47                | 1.37   | 1.50    |
| 46.0               | 40.30                  | 40.26  | 40.22   | 1.21                | 1.25   | 1.16    |
| 47.0               | 39.98                  | 40.69  | 40.15   | 2.14                | 1.64   | 1.51    |
| 48.0               | 40.60                  | 40.95  | 41.08   | 2.06                | 1.84   | 1.83    |
| 49.0               | 40.53                  | 40.73  | 41.27   | 1.44                | 1.45   | 1.49    |
| 50.0               | 42.48                  | 43.21  | 43.78   | 1.47                | 1.20   | 1.38    |
| 51.0               | 39.16                  | 40.02  | 40.14   | 1.21                | 1.33   | 1.38    |
| 52.0               | 41.71                  | 41.43  | 41.85   | 1.48                | 1.50   | 1.22    |
| 53.0               | 42.80                  | 43.86  | 43.05   | 2.33                | 1.77   | 1.85    |
| 54.0               | 41.00                  | 40.65  | 41.09   | 2.11                | 1.92   | 1.89    |
| 55.0               | 41.18                  | 41.06  | 41.49   | 1.25                | 1.27   | 1.20    |
| 56.0               | 41.85                  | 43.40  | 43.50   | 1.20                | 1.12   | 1.64    |
| 57.0               | 42.44                  | 43.08  | 45.28   | 0.92                | 1.19   | 1.42    |
| 58.0               | 48.10                  | 49.62  | 44.90   | 2.19                | 2.63   | 2.08    |
| 59.0               | 43.39                  | 43.55  | 42.96   | 3.51                | 2.31   | 2.62    |
| 60.0               | 44.81                  | 43.12  | 42.06   | 2.97                | 2.52   | 2.72    |
| 61.0               | 42.12                  | 41.15  | 39.25   | 1.71                | 2.18   | 2.15    |
| 62.0               | 39.90                  | 38.45  | 35.70   | 2.10                | 2.25   | 3.44    |
| 63.0               | 36.90                  | 36.21  | 39.38   | 2.78                | 3.44   | 3.32    |
| 64.0               | 40.19                  | 41.46  | 42.82   | 5.14                | 4.51   | 4.56    |
| 65.0               | 45.15                  | 45.31  | 45.28   | 7.41                | 6.11   | 6.14    |

## Typical Performance Data





Weight: .024 grams

Dimensions are in inches [mm]. Tolerances: 3 Pl. ±.005 Inches

Notes:

1. Open style, Ceramic base.
2. Termination finish: **as shown below or indicated on Data Sheet.**  
For RoHS Case Styles: Gold plate over Nickel plate. All models, (+) suffix.
3. Primary dimensions are in Inches[millimeters]. Inch equivalents are calculated and subject to roundoff errors.

 **Mini-Circuits**<sup>®</sup>  
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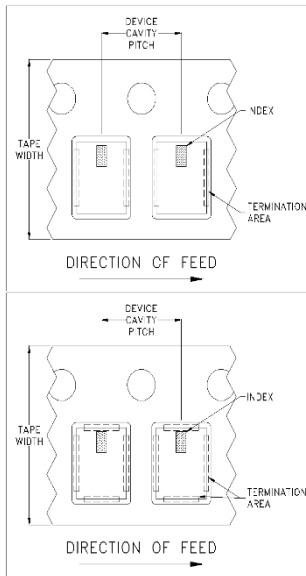
The Design Engineers Search Engine Provides ACTUAL Data Instantly From MINI-CIRCUITS At: [www.minicircuits.com](http://www.minicircuits.com)

RF/IF MICROWAVE COMPONENTS

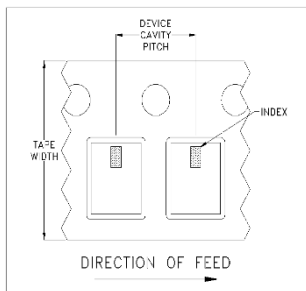


# Tape & Reel Packaging TR-F74

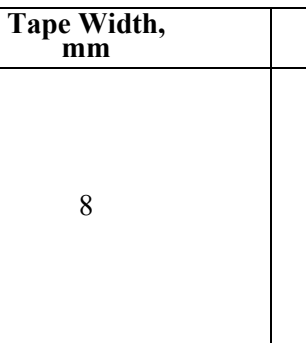
## DEVICE ORIENTATION IN T&R



**ILLUSTRATION 1**



**ILLUSTRATION 2**



**ILLUSTRATION 3**

| Applicable Case Styles |
|------------------------|
| GE0805C-1              |
| GE0805C-1AP            |
| JV1210C-1              |
| GU2939                 |

| Applicable Case Styles |
|------------------------|
| JV1210C                |
| JV1210C-2              |
| JV1210C-3              |
| JV1210C-4              |
| JV1210C-5              |
| JV1210C-6              |
| JV1210C-11             |

| Applicable Case Styles |
|------------------------|
| JC0603C-8              |
| JC0603C-9              |
| JV1210C-7              |
| JV1210C-8              |
| JV1210C-9              |
| JV1210C-10             |
| JV1210C-13             |
| GE0805C-13             |
| GE0805C-19             |
| GE0805C-20             |

| Tape Width, mm | Device Cavity Pitch, mm | Real Size, inches | Devices per Reel                    |      |
|----------------|-------------------------|-------------------|-------------------------------------|------|
| 8              | 4                       | 7                 | Small quantity standards (see note) | 20   |
|                |                         |                   |                                     | 50   |
|                |                         |                   |                                     | 100  |
|                |                         |                   |                                     | 200  |
|                |                         |                   |                                     | 500  |
|                |                         |                   |                                     | 1000 |
|                |                         |                   | Standard                            | 2000 |
|                |                         |                   |                                     | 4000 |

Note: Small reel availability varies by model. Refer to pricing and availability on individual model dashboard.

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](http://www.minicircuits.com/pages/pdfs/tape.pdf)



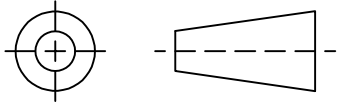
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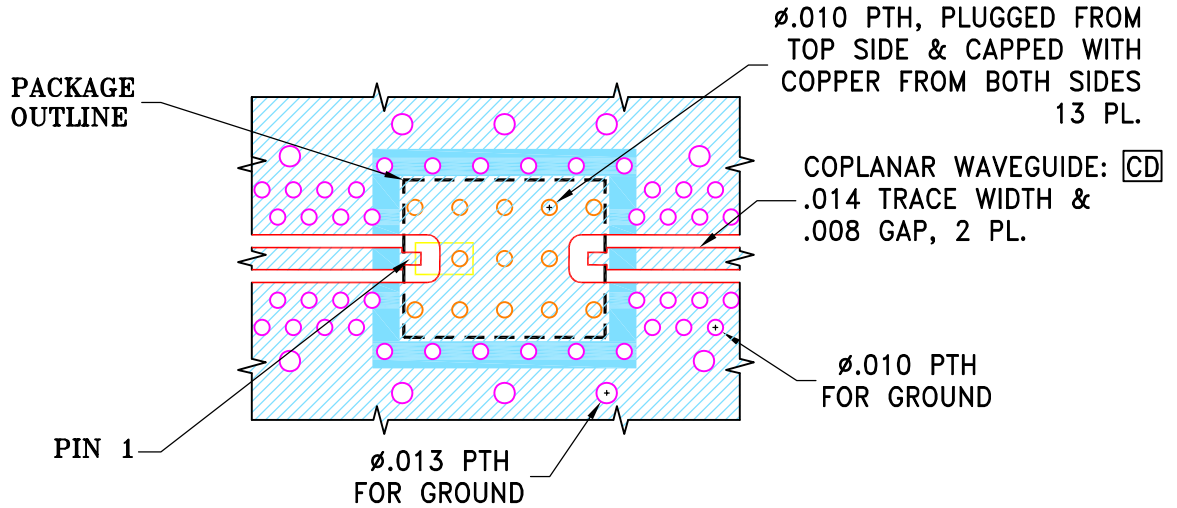
THIRD ANGLE PROJECTION



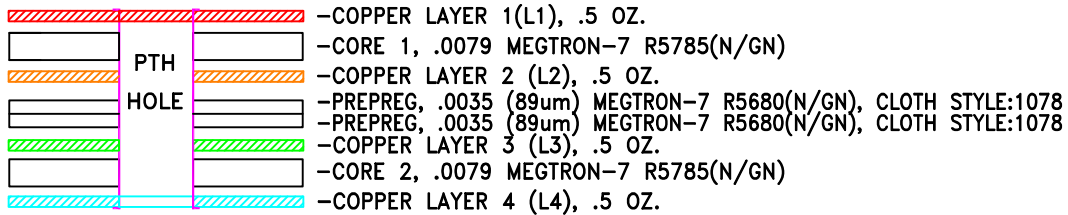
REVISIONS

| REV | ECN No.    | DESCRIPTION | DATE     | DR | AUTH |
|-----|------------|-------------|----------|----|------|
| OR  | ECO-015970 | NEW RELEASE | 12/06/22 | GF | IL   |
|     |            |             |          |    |      |
|     |            |             |          |    |      |

SUGGESTED MOUNTING CONFIGURATION FOR  
JV1210C-13 CASE STYLE



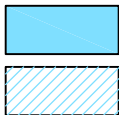
STACK-UP DIAGRAM



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- L2, L3 AND L4 ARE CONTINUOUS GROUND PLANES.

NOTES:

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

| UNLESS OTHERWISE SPECIFIED   | INITIALS |    | DATE     |
|--|----------|----|----------|
| DIMENSIONS ARE IN INCHES<br>TOLERANCES ON:<br>2 PL DECIMALS ±<br>3 PL DECIMALS ± .005<br>ANGLES ±<br>FRACTIONS ± | DRAWN    | GF | 12/06/22 |
|  | CHECKED  | IL | 12/06/22 |
|  | APPROVED | IL | 12/06/22 |



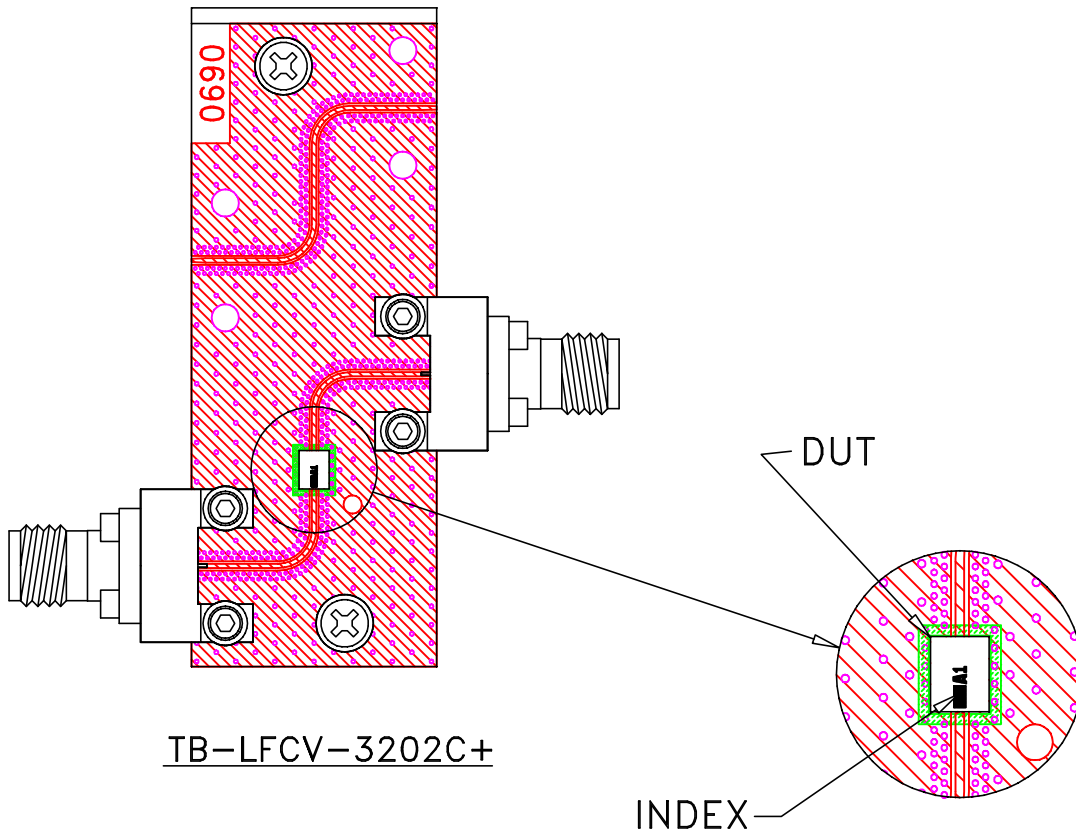
**Mini-Circuits®** 13 Neptune Avenue  
Brooklyn NY 11235

PL, JV1210C-13, TB-HFCV-2002+

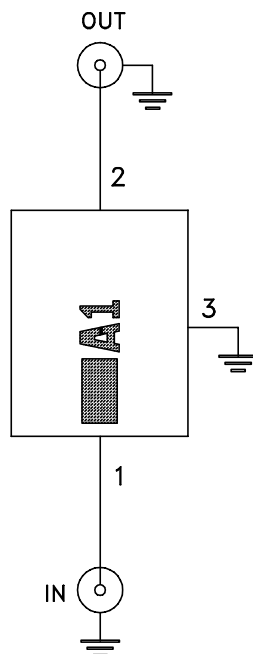
|                  |                     |                          |            |
|------------------|---------------------|--------------------------|------------|
| SIZE<br>A        | CODE IDENT<br>15542 | DRAWING NO:<br>98-PL-743 | REV:<br>OR |
| FILE:<br>98PL743 | SCALE:<br>8:1       | SHEET:<br>1 OF 1         |            |

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# Evaluation Board and Circuit




TB-LFCV-3202C+



Schematic Diagram

1. 50 Ohm 1.85 End Launch Female connectors.
2. PCB Material: Megtron 7(N) or equivalent,  
Dielectric Constant=3.4, Thickness=.0079 inch.

 Mini-Circuits®

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, Test B,B1, 95% Coverage   |
| Thermal Shock         | -55° to +125°C, 15 min dwell,250 cycles                                | MIL-STD-202, Method 107  |
| Bend Test             | 1mm, deflection for 5 seconds<br>Span of bending: 2.75"                | --   |
| High Temp Storage     | 125°C to 1000 Hrs  | ---  |