



CERAMIC

# Bandpass Filter & Balun **BBFCG2-372+**

50Ω 3300 to 4000 MHz

## THE BIG DEAL

- Tiny size, (0805)
- Compact design includes Balun & Filter in one package
- Low cost
- Temperature stable
- Hermetically sealed



Generic photo used for illustration purposes only

CASE STYLE: GE0805C-15

### +RoHS Compliant

The +Suffix identifies RoHS Compliance. See our website for methodologies and qualifications

## APPLICATIONS

- Telecommunications
- 5G sub 6GHz

## PRODUCT OVERVIEW

Mini-Circuits' BBFCG2-372+ is a tiny ceramic RF balun filter with an impedance ratio of 1:2, covering a variety of wireless communications applications from 3300 to 4000 MHz. This model provides low insertion loss, low phase unbalance (relative to 180°), low amplitude unbalance. Fabricated using LTCC technology, the unit comes housed in a tiny, rugged ceramic package (0.079" x 0.049" x 0.037") suitable for harsh operating environments.

## KEY FEATURES

| Feature           | Advantages   |
|-------------------|--|
| Compact Design    | Integrates filter and balun in one tiny package  |
| Tiny size, 0805   | Accommodates tight space requirements for dense PCB layouts.   |
| LTCC construction | LTCC process enables tiny size and low cost, suitable for high-volume production. Rugged ceramic package provides excellent reliability in harsh operating environments. |



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# Bandpass Filter & Balun **BBFCG2-372+**

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### ELECTRICAL SPECIFICATIONS AT 25°C

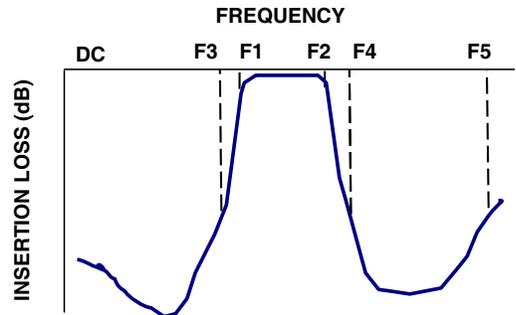
| Parameter             | F#              | Frequency (MHz) | Min. | Typ. | Max. | Units  |
|-----------------------|-----------------|-----------------|------|------|------|--------|
| Impedance Ratio       | —               | —               | 2    |      |      |        |
| Insertion Loss*       | F1-F2           | 3300 - 4000     | —    | 2.5  | 3    | dB     |
| Return Loss           | Unbalanced Port | F1-F2           | 8.5  | 13   | —    | dB     |
|                       | Balanced Port*  | F1-F2           | 8.5  | 13   | —    |        |
| Stopband Rejection    | DC-F3           | DC - 2598       | 20   | 23   | —    | dB     |
|                       |                 | 4847 - 5548     | 30   | —    | —    |        |
|                       | F4-F5           | 7796 - 8498     | 15   | 31   | —    |        |
| Amplitude Unbalance ± | F1-F2           | 3300 - 4000     | -1.5 | —    | 1.5  | dB     |
| Phase Unbalance       | F1-F2           | 3300 - 4000     | -13  | —    | 13   | Degree |
| CMRR                  | F1-F2           | 3300 - 4000     | —    | 24   | —    | dB     |

\* Single ended - Differential (2-port) measurement.

### MAXIMUM RATINGS

| Parameter             | Ratings        |
|-----------------------|----------------|
| Operating Temperature | -55°C to 125°C |
| Storage Temperature   | -55°C to 125°C |
| RF Power Input        | 0.5W at 25°C   |

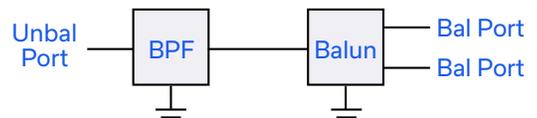
### TYPICAL FREQUENCY RESPONSE



### DC INTERFACE TABLE

|                                |          |
|--------------------------------|----------|
| Unbalance Port - GND           | DC short |
| Unbalance Port - Balance Ports | DC open  |
| Balance port - GND             | DC open  |
| Balance port-Balance Port      | DC short |

### FUNCTIONAL SCHEMATIC





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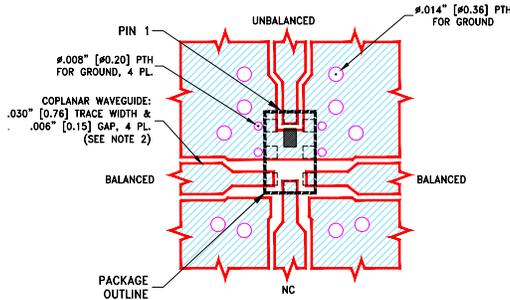
# Bandpass Filter & Balun **BBFCG2-372+**

## PAD CONNECTIONS

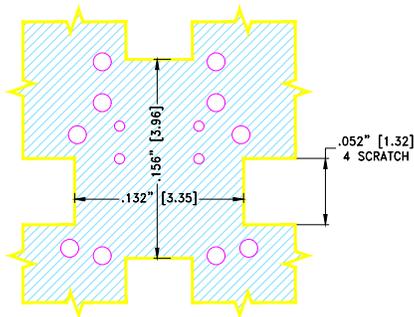
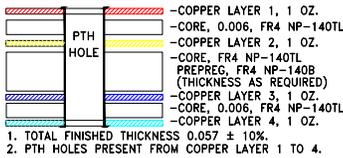
|                    |         |
|--------------------|---------|
| UNBALANCED PORT    | 1       |
| BALANCED PORT      | 4,6     |
| GROUND             | 2,3,7,8 |
| NOT CONNECT OR GND | 5       |

PRODUCT MARKING: N/A

DEMO BOARD MCL P/N: TB-BBFCG2-372+  
SUGGESTED PCB LAYOUT (PL-724)



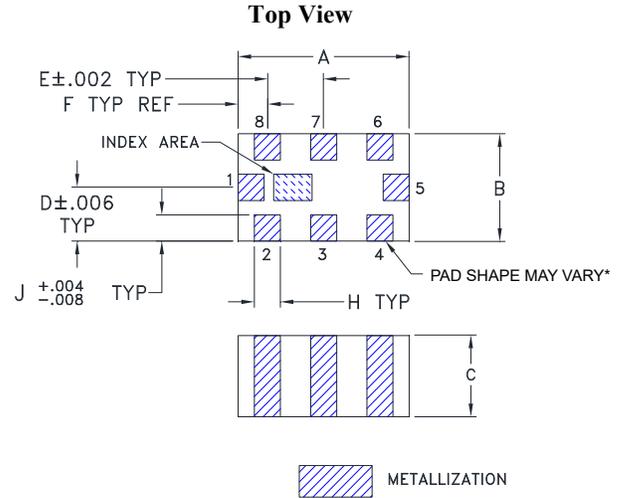
### STACK-UP DIAGRAM



TOP VIEW TO LAYER 2

- NOTES:
- PCB IS MULTILAYER PCB, SEE STACK-UP DIAGRAM.
  - TRACE WIDTH & GAP PARAMETERS ARE SHOWN FOR FR4 NP-140TL WITH DIELECTRIC THICKNESS .006" ± .0005"; COPPER: 1 OZ. FOR OTHER MATERIALS TRACE WIDTH AND GAP MAY NEED TO BE MODIFIED.
  - COPPER LAYERS 3,4 OF THE PCB IS CONTINUOUS GROUND PLANES.
- DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK.

## OUTLINE DRAWING



\*During the manufacturing process, the pad shape may not be rectangular and may take on a more semi-circle shape. However, the pad dimensions reflect this, with the pad shape being within the specified lengths. The metallization compensates accordingly and so performance will not be affected. In addition, solderability will not be influenced by the pad shape.

## OUTLINE DIMENSIONS (Inches mm)

| A    | B    | C    | D    | E    | F    | G    | H    | J    | wt    |
|------|------|------|------|------|------|------|------|------|-------|
| .079 | .049 | .037 | .025 | .026 | .014 | .110 | .012 | .010 | grams |
| 2.00 | 1.25 | 0.95 | 0.63 | 0.65 | 0.35 | 2.80 | 0.30 | 0.25 | .008  |



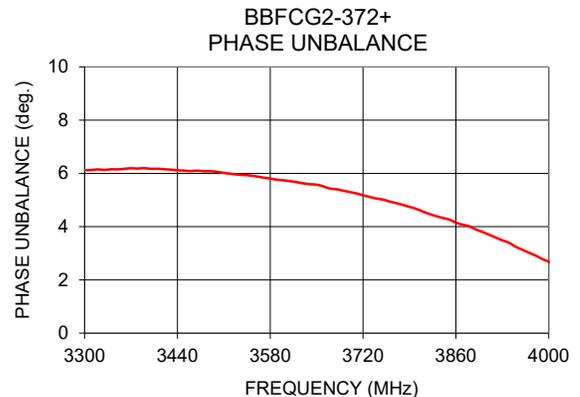
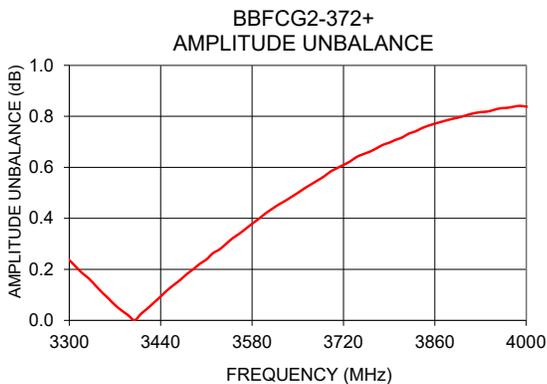
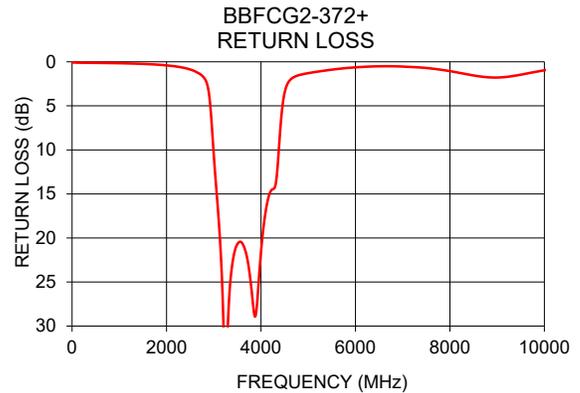
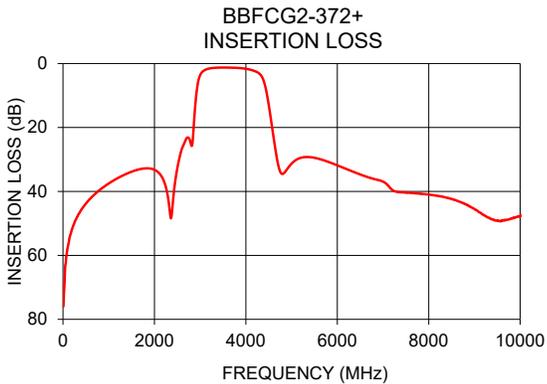
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# Bandpass Filter & Balun **BBFCG2-372+**

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### TYPICAL PERFORMANCE DATA

| Frequency (MHz) | Insertion Loss (dB) | Return Loss (dB) | Amplitude Unbalance (dB) | Phase Unbalance (Deg.) |
|-----------------|---------------------|------------------|--------------------------|------------------------|
| 10              | 75.96               | 0.04             | 3.49                     | 88.81                  |
| 1000            | 37.52               | 0.16             | 5.96                     | 27.75                  |
| 2598            | 26.75               | 1.06             | 1.94                     | 5.62                   |
| 2700            | 23.39               | 1.36             | 1.56                     | 6.71                   |
| 3300            | 1.36                | 29.80            | 0.24                     | 6.12                   |
| 4000            | 1.65                | 21.60            | 0.84                     | 2.69                   |
| 4847            | 34.09               | 1.45             | 6.54                     | 36.35                  |
| 5548            | 29.64               | 0.86             | 0.97                     | 27.44                  |
| 6000            | 31.85               | 0.63             | 1.77                     | 32.04                  |
| 7000            | 36.94               | 0.54             | 7.95                     | 155.62                 |
| 7796            | 40.72               | 0.89             | 8.42                     | 35.44                  |
| 8497            | 42.31               | 1.54             | 6.52                     | 171.12                 |



- 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](http://www.minicircuits.com/MCLStore/terms.jsp)

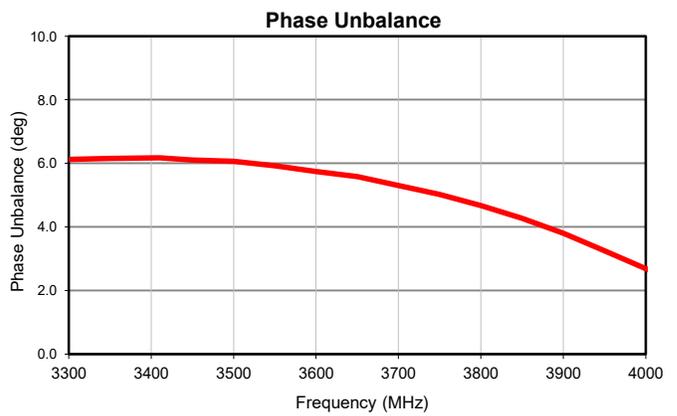
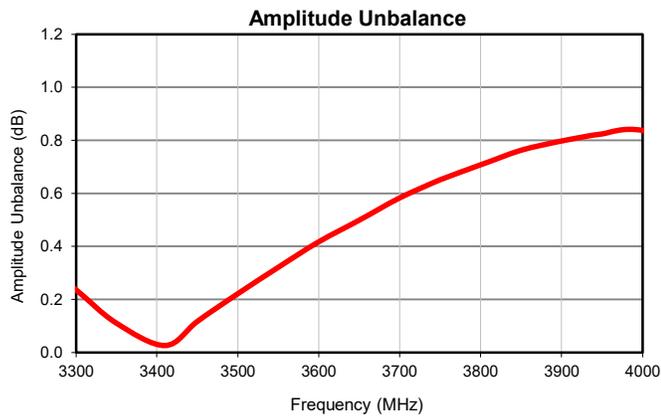
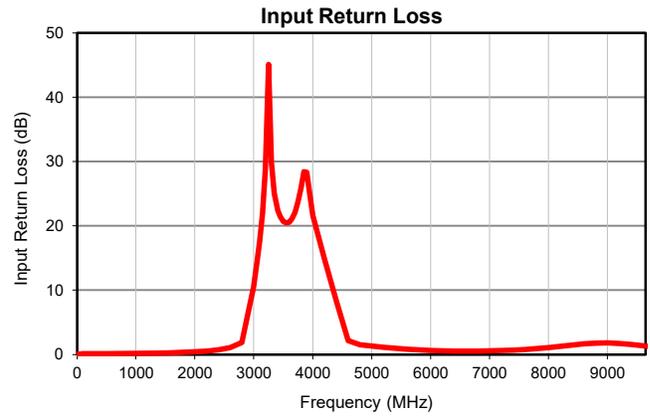


**Ceramic Bandpass Filter & Balun BBFCG2-372+**

*Typical Performance Data*

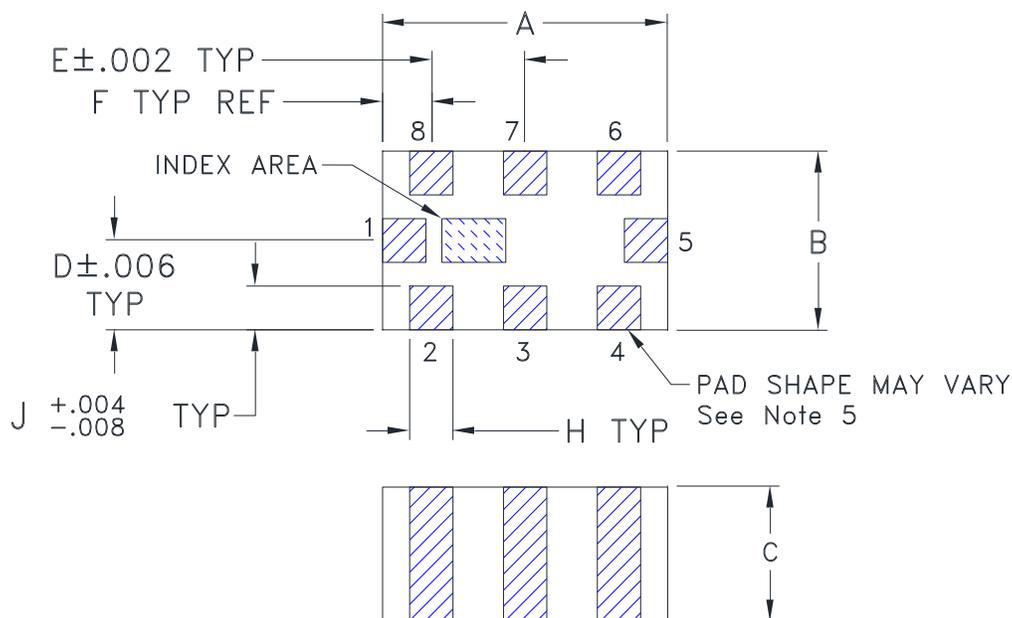
| FREQUENCY (MHz) | INSERTION LOSS (dB) | RETURN LOSS (dB) | AMPLITUDE UNBALANCE (dB) | PHASE UNBALANCE (deg.) |
|-----------------|---------------------|------------------|--------------------------|------------------------|
| 10              | 75.96               | 0.04             | 3.49                     | 88.81                  |
| 100             | 57.75               | 0.10             | 1.04                     | 12.75                  |
| 500             | 43.82               | 0.12             | 4.02                     | 29.42                  |
| 1000            | 37.52               | 0.16             | 5.96                     | 27.75                  |
| 1500            | 33.84               | 0.24             | 5.99                     | 23.30                  |
| 2000            | 33.24               | 0.41             | 5.34                     | 20.91                  |
| 2200            | 36.51               | 0.53             | 5.36                     | 22.05                  |
| 2400            | 43.95               | 0.72             | 5.51                     | 5.88                   |
| 2598            | 26.75               | 1.06             | 1.94                     | 5.62                   |
| 2800            | 25.22               | 1.85             | 2.85                     | 15.36                  |
| 3000            | 3.63                | 10.52            | 1.06                     | 3.91                   |
| 3050            | 2.59                | 14.12            | 0.91                     | 4.71                   |
| 3100            | 2.07                | 17.60            | 0.75                     | 5.28                   |
| 3150            | 1.76                | 21.91            | 0.62                     | 5.66                   |
| 3200            | 1.56                | 28.84            | 0.49                     | 5.89                   |
| 3250            | 1.44                | 45.11            | 0.36                     | 6.04                   |
| 3300            | 1.36                | 29.80            | 0.24                     | 6.12                   |
| 3350            | 1.31                | 24.99            | 0.11                     | 6.15                   |
| 3410            | 1.28                | 22.38            | 0.03                     | 6.17                   |
| 3450            | 1.27                | 21.38            | 0.12                     | 6.10                   |
| 3500            | 1.26                | 20.69            | 0.22                     | 6.06                   |
| 3550            | 1.26                | 20.43            | 0.32                     | 5.92                   |
| 3600            | 1.27                | 20.57            | 0.42                     | 5.74                   |
| 3650            | 1.28                | 21.14            | 0.50                     | 5.58                   |
| 3700            | 1.30                | 22.10            | 0.58                     | 5.30                   |
| 3750            | 1.33                | 23.68            | 0.65                     | 5.02                   |
| 3800            | 1.36                | 25.89            | 0.71                     | 4.67                   |
| 3850            | 1.40                | 28.40            | 0.76                     | 4.27                   |
| 3900            | 1.46                | 28.33            | 0.80                     | 3.80                   |
| 3950            | 1.54                | 25.03            | 0.82                     | 3.25                   |
| 4000            | 1.65                | 21.60            | 0.84                     | 2.69                   |
| 4200            | 2.40                | 14.75            | 0.69                     | 0.48                   |
| 4400            | 5.86                | 8.27             | 0.19                     | 5.17                   |
| 4600            | 22.47               | 2.17             | 4.62                     | 12.20                  |
| 4800            | 34.53               | 1.52             | 9.35                     | 41.65                  |
| 5000            | 31.31               | 1.29             | 2.17                     | 10.19                  |
| 5200            | 29.50               | 1.12             | 0.37                     | 9.41                   |
| 5400            | 29.28               | 0.96             | 0.48                     | 21.20                  |
| 5600            | 29.83               | 0.83             | 1.12                     | 29.01                  |
| 5800            | 30.76               | 0.71             | 1.68                     | 33.22                  |
| 6000            | 31.85               | 0.63             | 1.77                     | 32.04                  |
| 6200            | 33.00               | 0.56             | 1.08                     | 25.69                  |
| 6400            | 34.14               | 0.52             | 1.34                     | 15.60                  |
| 6600            | 35.18               | 0.50             | 6.82                     | 5.43                   |
| 6800            | 36.12               | 0.51             | 27.98                    | 48.58                  |
| 7000            | 36.94               | 0.54             | 7.95                     | 155.62                 |
| 7200            | 39.49               | 0.59             | 1.32                     | 143.67                 |
| 7400            | 40.27               | 0.66             | 2.83                     | 112.82                 |
| 7600            | 40.47               | 0.76             | 0.45                     | 60.85                  |
| 7796            | 40.72               | 0.89             | 8.42                     | 35.44                  |
| 8000            | 41.00               | 1.06             | 32.10                    | 143.16                 |
| 8200            | 41.45               | 1.25             | 12.24                    | 168.81                 |
| 8400            | 42.00               | 1.45             | 7.81                     | 169.84                 |
| 8600            | 42.77               | 1.63             | 5.46                     | 171.94                 |
| 8800            | 44.00               | 1.75             | 3.94                     | 174.16                 |
| 9000            | 45.54               | 1.78             | 2.86                     | 176.54                 |
| 9200            | 47.35               | 1.71             | 2.12                     | 179.33                 |
| 9400            | 48.83               | 1.56             | 1.65                     | 177.94                 |
| 9600            | 49.22               | 1.36             | 1.38                     | 175.40                 |
| 9800            | 48.51               | 1.15             | 1.28                     | 173.63                 |
| 10000           | 47.51               | 0.96             | 1.29                     | 172.21                 |

## Typical Performance Data



### Outline Dimensions

#### Top View



| CASE#      | A              | B              | C              | D              | E              | F              | G              | H              | J              | WT, GRAM |
|------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------|
| GE0805C-15 | .079<br>(2.00) | .049<br>(1.25) | .037<br>(0.95) | .025<br>(0.63) | .026<br>(0.65) | .014<br>(0.35) | .110<br>(2.80) | .012<br>(0.30) | .010<br>(0.25) | .008     |

Dimensions are in inches (mm). Tolerances: 2 Pl.  $\pm .01(.25)$ ; 3 Pl.  $\pm .005(.100)$

#### Notes:

- Open style, ceramic base
- Termination finish: For RoHS Case Styles: Tin plate over Nickel plate. All model, (+) suffix.  
For RoHS-5 Case Styles: Tin-lead plate over Nickel plate. All model, no (+) suffix.
- Pad tolerance to be non-cumulative. Minimum spacing between each pad is .004(0.1).
- Pin numbers do not appear on unit. For reference only.
- During the manufacturing process, the pad shape may not be rectangular and may take on a more semi-circle shape. However, the pad dimensions reflect this, with the pad shape being within the specified lengths. The metallization compensates accordingly and so performance will not be affected. In addition, solderability will not be influenced by the pad shape



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# Tape & Reel Packaging TR-F114

## DEVICE ORIENTATION IN T&R

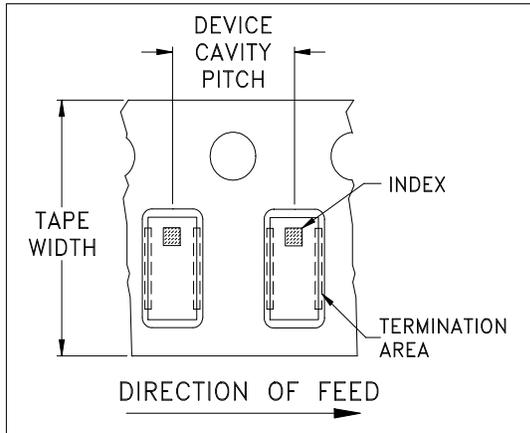


ILLUSTRATION 1

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

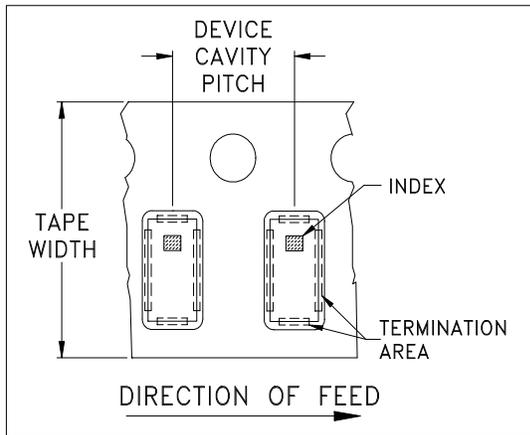


ILLUSTRATION 2

| 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              | JV1210C-1 |
| 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](http://www.minicircuits.com/pages/pdfs/tape.pdf)



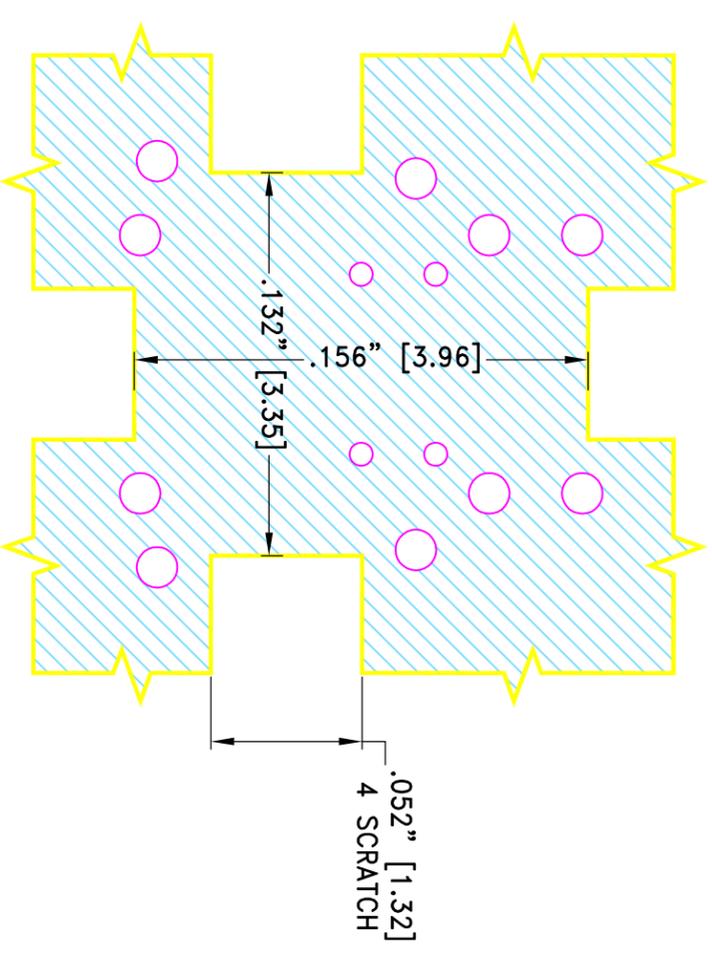
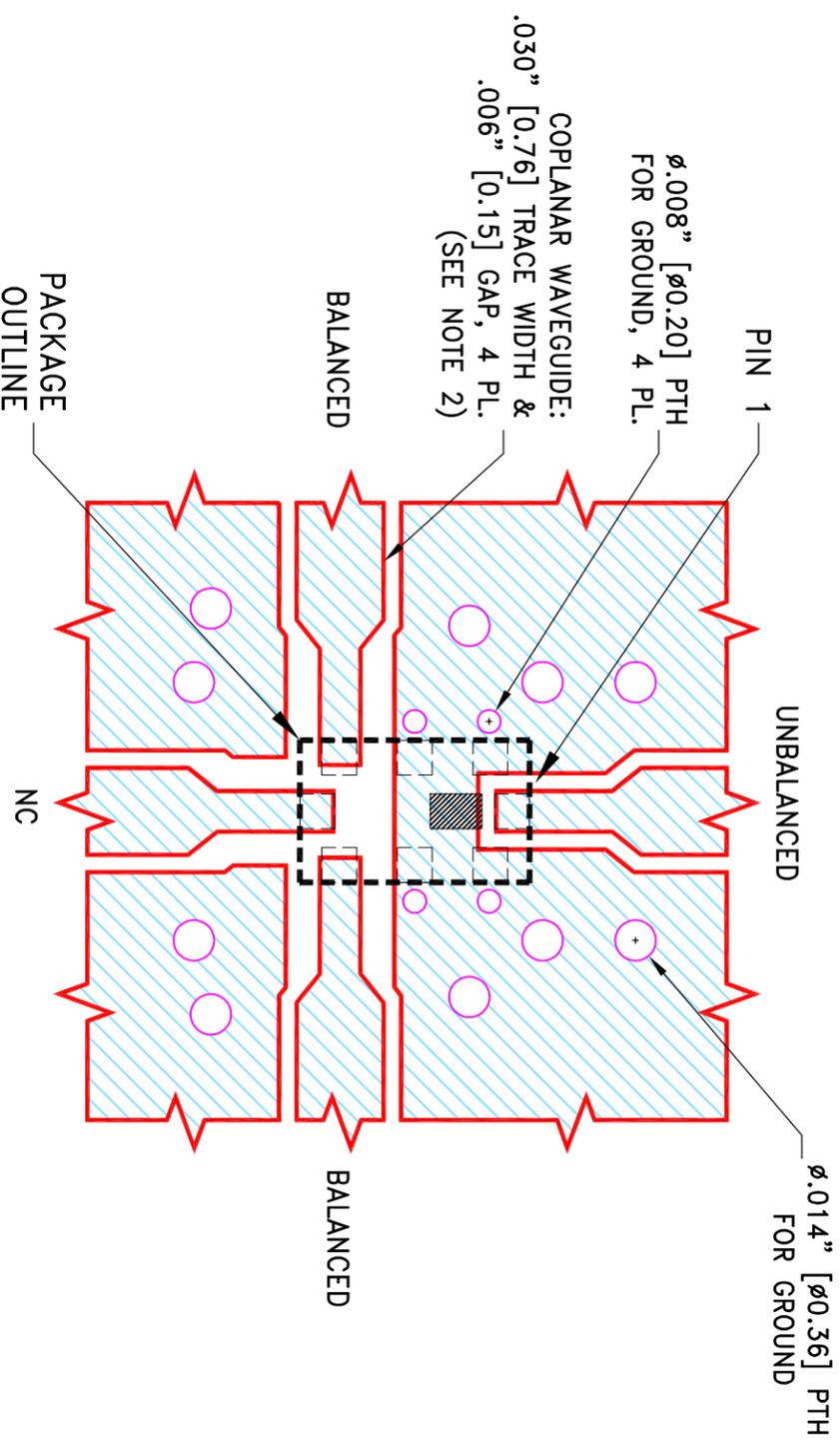
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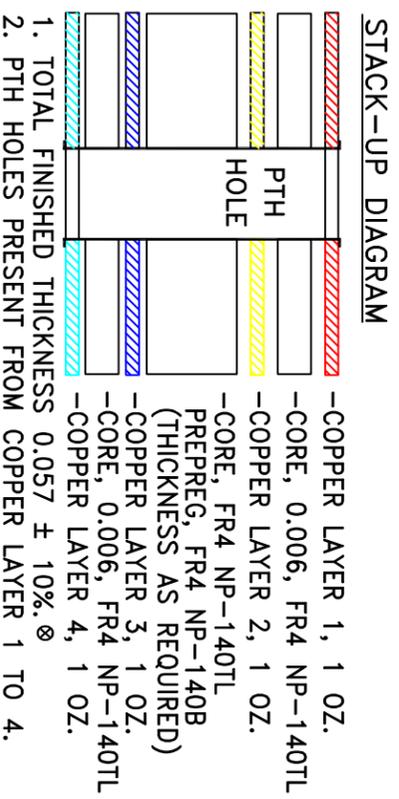
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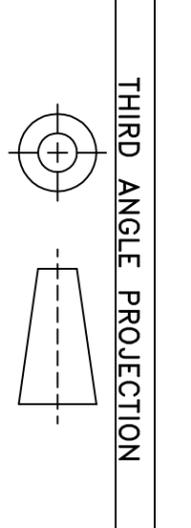
**SUGGESTED MOUNTING CONFIGURATION  
FOR GE0805C-15 CASE STYLE**



**TOP VIEW TO LAYER 2**



- NOTES:**
1. PCB IS MULTILAYER PCB, SEE STACK-UP DIAGRAM.
  2. TRACE WIDTH & GAP PARAMETERS ARE SHOWN FOR FR4 NP-140TL WITH DIELECTRIC THICKNESS .006"±.0005"; COPPER: 1 OZ. FOR OTHER MATERIALS TRACE WIDTH AND GAP MAY NEED TO BE MODIFIED.
  3. COPPER LAYERS 3,4 OF THE PCB IS CONTINUOUS GROUND PLANES.
-  DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK.



| OR         | ECN | NO. | DESCRIPTION | DATE     | DR  | AUTH |
|------------|-----|-----|-------------|----------|-----|------|
| ECO-010908 |     |     | NEW RELEASE | 12/02/21 | ITG | IL   |
| REV        | ECN | No. | DESCRIPTION | DATE     | DR  | AUTH |

| UNLESS OTHERWISE SPECIFIED | INITIALS | DATE     |
|----------------------------|----------|----------|
| DIMENSIONS ARE IN INCHES   | ITG      | 12/02/21 |
| TOLERANCES ON:             | GF       | 12/02/21 |
| 2 PL DECIMALS ± .005       | IL       | 12/02/21 |
| 3 PL DECIMALS ± .005       |          |          |
| ANGLES ± 1°                |          |          |
| FRACTIONS ±                |          |          |

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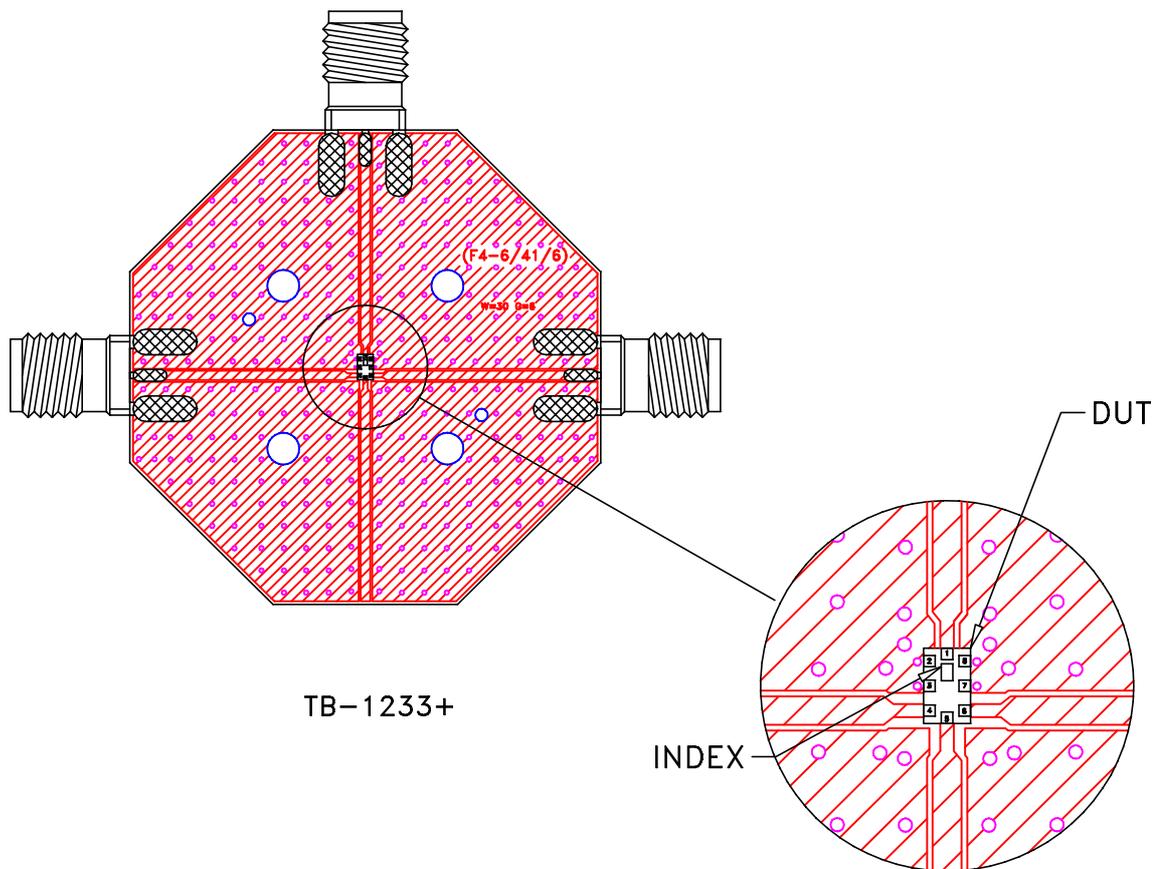
**PL, GE0805C-15, TB-1233+**

|       |            |             |        |
|-------|------------|-------------|--------|
| SIZE  | CODE IDENT | DRAWING NO: | REV:   |
| B     | 15542      | 98-PL-724   | OR     |
| FILE: | 98PL724    | SCALE:      | 15:1   |
|       |            | SHEET:      | 1 OF 1 |

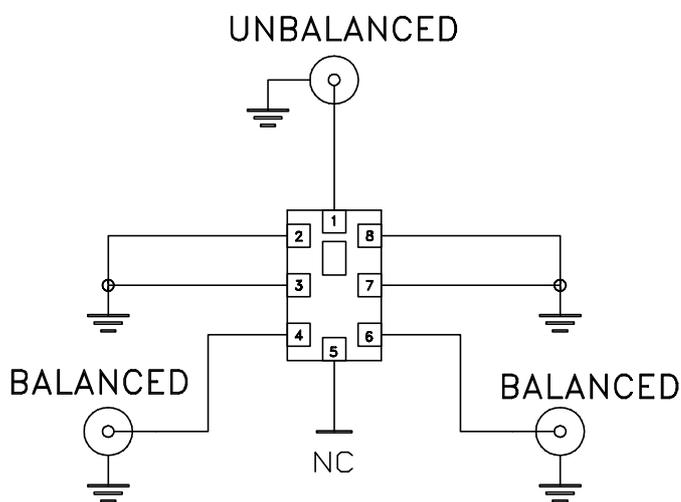
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BSHEETA1.DWG REV:A DATE:01/12/94

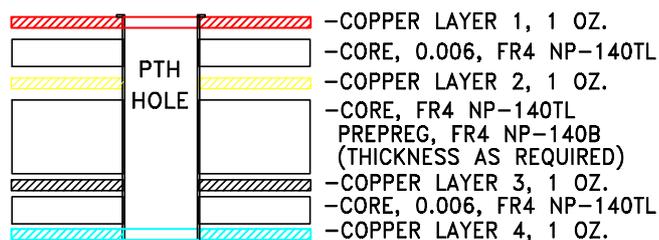
# Evaluation Board and Circuit



TB-1233+



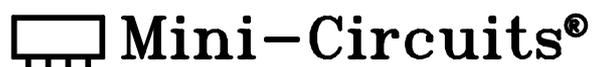
Schematic Diagram



Stack-up Diagram

**Notes:**

1. 50 Ohm SMA Female connectors.
2. PCB Material: FR4 or equivalent, Dielectric Constant=4.5, Total finished Thickness = .057 inch.





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: 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   |