



Mini-Circuits®

CERAMIC BALUN

## RF Transformer

NCS2-392+

50Ω 3000 to 3900 MHz 1:2 Ratio

## FEATURES

- Wideband, 3000 to 3900 MHz
- Low phase unbalance, 5 deg. and amplitude unbalance, 0.6 dB typ.
- Miniature size, 0.079"x0.049"x0.033"
- LTCC construction
- Low cost
- Aqueous washable



Generic photo used for illustration purposes only

CASE STYLE: GE0805C-1

## APPLICATIONS

- WIMAX
- Fixed Satellite Service
- Radar

**+RoHS Compliant**

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

## ELECTRICAL SPECIFICATIONS AT 25°C

| Parameter                           | Frequency (MHz) | Min. | Typ. | Max. | Units  |
|-------------------------------------|-----------------|------|------|------|--------|
| Impedance Ratio (Secondary/Primary) |                 | 2    |      |      |        |
| Frequency Range                     |                 | 3000 |      | 3900 | MHz    |
| Insertion Loss <sup>1</sup>         | 3000 - 3900     | —    | 1.0  | —    | dB     |
| Amplitude Unbalance                 | 3000 - 3900     | —    | 0.5  | —    | dB     |
| Phase Unbalance <sup>2</sup>        | 3000 - 3900     | —    | 5    | —    | Degree |

1. Insertion Loss is referenced to mid-band loss, 0.6 dB. Reference Demo Board TB-419+

2. Relative to 180°

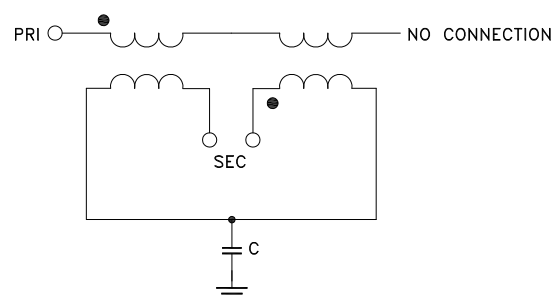
## MAXIMUM RATINGS

| Parameter             | Ratings        |
|-----------------------|----------------|
| Operating Temperature | -40°C to 85°C  |
| Storage Temperature   | -55°C to 100°C |
| RF Power <sup>3</sup> | 3W at 25°C     |

3. Derate linearly to 2W at 85°C

Permanent damage may occur if any of these limits are exceeded.

## CONFIGURATION R



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REV. E  
ECO-010141  
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211015

PAGE 1 OF 3



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CERAMIC BALUN

# RF Transformer

NCS2-392+

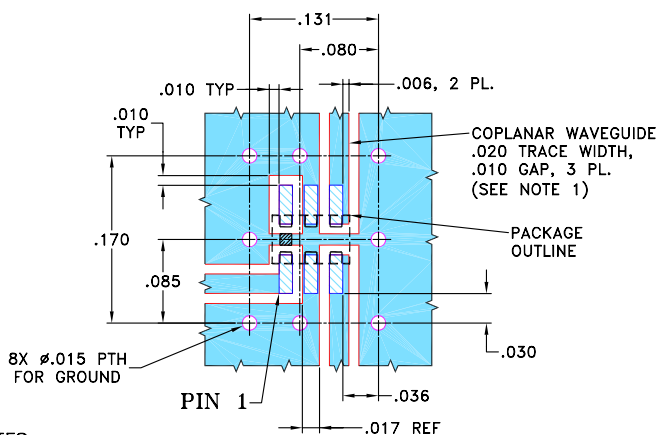
## PAD CONNECTIONS

|                               |   |
|-------------------------------|---|
| PRIMARY DOT (Unbalanced Port) | 1 |
| PRIMARY (GND)                 | 2 |
| SECONDARY DOT (Balanced)      | 4 |
| SECONDARY (Balanced)          | 3 |
| NO CONNECTION                 | 6 |
| NOT USED (GND Externally)     | 5 |

Pads 2,3,4 are DC-connected internally.

PRODUCT MARKING: N/A

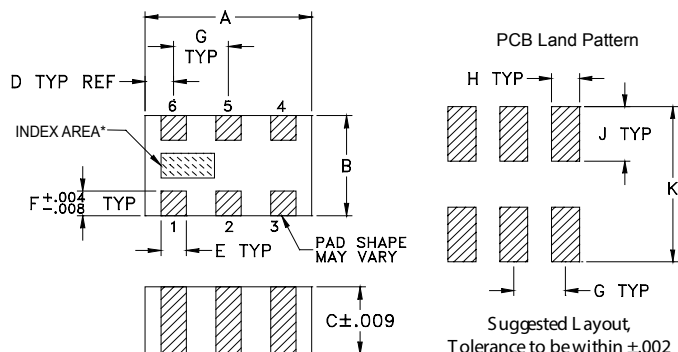
## DEMO BOARD MCL P/N: TB-419+ SUGGESTED PCB LAYOUT (PL-264)



### NOTES:

1. COPLANAR WAVEGUIDE PARAMETERS ARE SHOWN FOR ROGERS R04350B WITH DIELECTRIC THICKNESS  $.010'' \pm .001''$ . 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 LAYOUT WITH SMOBC (SOLDER MASK OVER BARE COPPER).  
 DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK

## OUTLINE DRAWING



\*Shape of index marking may vary

## OUTLINE DIMENSIONS (Inches mm)

| A    | B    | C    | D    | E    | F     |
|------|------|------|------|------|-------|
| .079 | .049 | .033 | .014 | .012 | .012  |
| 2.01 | 1.24 | 0.84 | 0.36 | 0.30 | 0.30  |
| G    | H    | J    | K    |      | wt    |
| .026 | .014 | .039 | .110 |      | grams |
| 0.66 | 0.36 | 1.00 | 2.80 |      | .008  |

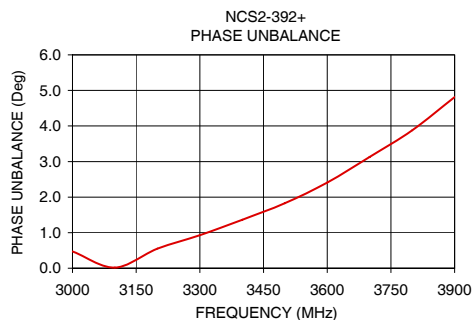
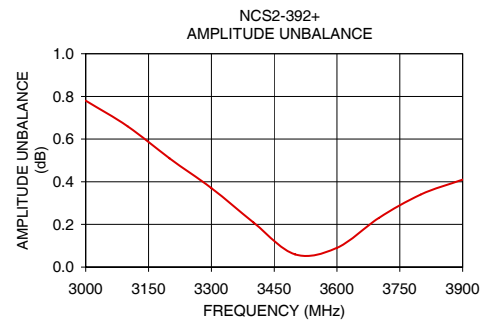
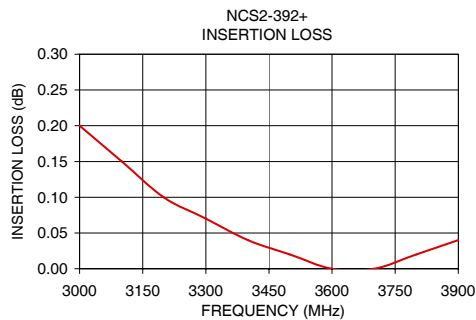
## TAPE & REEL INFORMATION: F74

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TYPICAL PERFORMANCE DATA<sup>3</sup>

| Frequency (MHz) | Insertion Loss (dB) | Input Return Loss (dB) | Amplitude Unbalance (dB) | Phase Unbalance (deg) |
|-----------------|---------------------|------------------------|--------------------------|-----------------------|
| 3000            | 0.20                | 13.67                  | 0.78                     | 0.47                  |
| 3100            | 0.15                | 14.72                  | 0.66                     | 0.02                  |
| 3200            | 0.10                | 15.73                  | 0.51                     | 0.55                  |
| 3300            | 0.07                | 16.86                  | 0.37                     | 0.93                  |
| 3400            | 0.04                | 18.05                  | 0.21                     | 1.36                  |
| 3500            | 0.02                | 19.30                  | 0.06                     | 1.83                  |
| 3600            | 0.00                | 20.47                  | 0.09                     | 2.41                  |
| 3700            | 0.00                | 21.56                  | 0.23                     | 3.13                  |
| 3800            | 0.02                | 22.44                  | 0.34                     | 3.88                  |
| 3900            | 0.04                | 22.99                  | 0.41                     | 4.81                  |

3. Measured with Agilent E5071B network analyzer using impedance conversion and port extension.



## 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.
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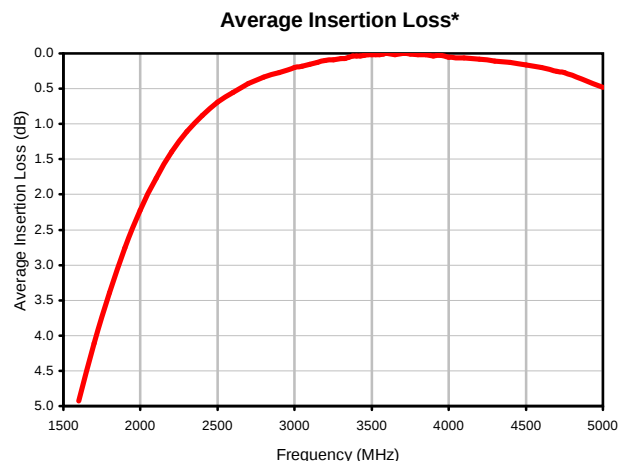
*Typical Performance Data*

| FREQUENCY<br>(MHz) | AVERAGE<br>INSERTION<br>LOSS* | INPUT<br>RETURN<br>LOSS | AMPLITUDE<br>UNBALANCE | PHASE<br>UNBALANCE** |
|--------------------|-------------------------------|-------------------------|------------------------|----------------------|
| (dB)               | (dB)                          | (dB)                    | (dB)                   | (deg)                |
| 1600               | 4.93                          | 2.39                    | 3.54                   | 1.97                 |
| 1700               | 4.11                          | 2.88                    | 3.35                   | 2.34                 |
| 1800               | 3.39                          | 3.45                    | 3.15                   | 2.69                 |
| 1900               | 2.76                          | 4.10                    | 2.94                   | 3.15                 |
| 2000               | 2.22                          | 4.82                    | 2.73                   | 3.55                 |
| 2100               | 1.77                          | 5.61                    | 2.49                   | 3.84                 |
| 2200               | 1.40                          | 6.43                    | 2.25                   | 3.97                 |
| 2300               | 1.11                          | 7.28                    | 2.01                   | 4.02                 |
| 2400               | 0.88                          | 8.15                    | 1.78                   | 3.80                 |
| 2500               | 0.69                          | 9.04                    | 1.58                   | 3.51                 |
| 2600               | 0.55                          | 9.93                    | 1.37                   | 3.00                 |
| 2700               | 0.43                          | 10.84                   | 1.21                   | 2.40                 |
| 2800               | 0.34                          | 11.75                   | 1.05                   | 1.79                 |
| 2900               | 0.27                          | 12.72                   | 0.92                   | 1.12                 |
| 3000               | 0.20                          | 13.67                   | 0.78                   | 0.47                 |
| 3050               | 0.18                          | 14.16                   | 0.68                   | 0.40                 |
| 3100               | 0.15                          | 14.72                   | 0.66                   | 0.02                 |
| 3150               | 0.13                          | 15.26                   | 0.58                   | 0.07                 |
| 3200               | 0.10                          | 15.73                   | 0.51                   | 0.55                 |
| 3250               | 0.09                          | 16.43                   | 0.44                   | 0.51                 |
| 3300               | 0.07                          | 16.86                   | 0.37                   | 0.93                 |
| 3325               | 0.07                          | 17.26                   | 0.34                   | 0.93                 |
| 3350               | 0.05                          | 17.66                   | 0.31                   | 0.95                 |
| 3375               | 0.04                          | 17.83                   | 0.26                   | 1.20                 |
| 3400               | 0.04                          | 18.05                   | 0.21                   | 1.36                 |
| 3425               | 0.04                          | 18.46                   | 0.19                   | 1.42                 |
| 3450               | 0.03                          | 18.88                   | 0.16                   | 1.47                 |
| 3475               | 0.02                          | 19.08                   | 0.10                   | 1.65                 |
| 3500               | 0.02                          | 19.30                   | 0.06                   | 1.83                 |
| 3525               | 0.02                          | 19.64                   | 0.03                   | 1.97                 |
| 3550               | 0.02                          | 20.03                   | 0.01                   | 2.04                 |
| 3575               | 0.01                          | 20.24                   | 0.02                   | 2.28                 |
| 3600               | 0.00                          | 20.47                   | 0.09                   | 2.41                 |
| 3650               | 0.02                          | 21.10                   | 0.13                   | 2.78                 |
| 3700               | 0.00                          | 21.56                   | 0.23                   | 3.13                 |
| 3750               | 0.01                          | 21.99                   | 0.27                   | 3.60                 |
| 3800               | 0.02                          | 22.44                   | 0.34                   | 3.88                 |
| 3850               | 0.02                          | 22.67                   | 0.35                   | 4.53                 |
| 3900               | 0.04                          | 22.99                   | 0.41                   | 4.81                 |
| 3950               | 0.03                          | 23.07                   | 0.43                   | 5.45                 |
| 4000               | 0.05                          | 23.42                   | 0.46                   | 5.79                 |
| 4100               | 0.06                          | 23.51                   | 0.47                   | 6.73                 |
| 4200               | 0.08                          | 23.03                   | 0.45                   | 7.54                 |
| 4300               | 0.11                          | 22.15                   | 0.37                   | 8.24                 |
| 4400               | 0.13                          | 20.86                   | 0.27                   | 8.86                 |
| 4500               | 0.16                          | 19.40                   | 0.14                   | 9.52                 |
| 4600               | 0.20                          | 17.91                   | 0.00                   | 10.06                |
| 4700               | 0.25                          | 16.56                   | 0.16                   | 10.79                |
| 4750               | 0.27                          | 15.99                   | 0.27                   | 11.26                |
| 5000               | 0.48                          | 13.24                   | 0.92                   | 15.72                |

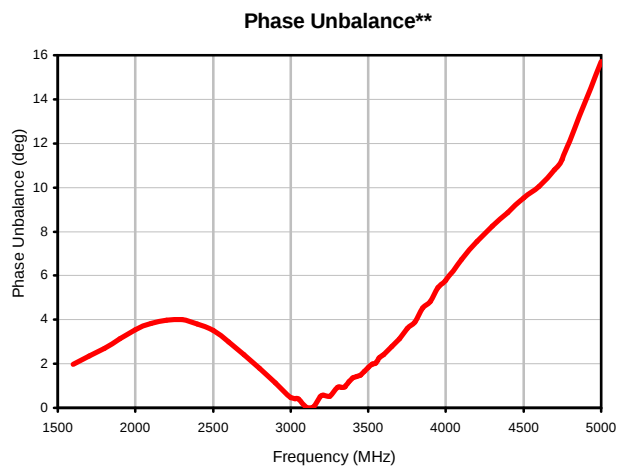
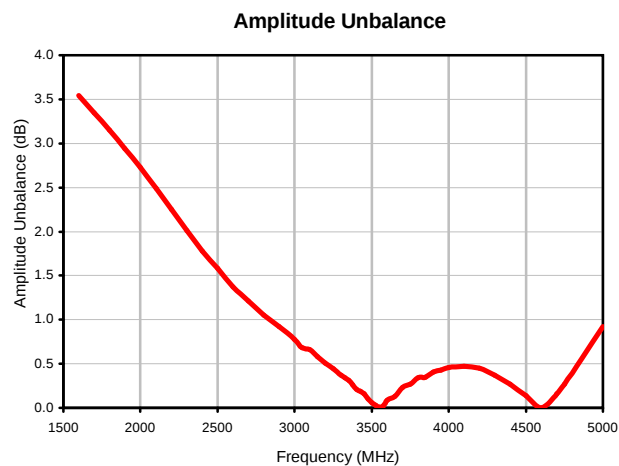
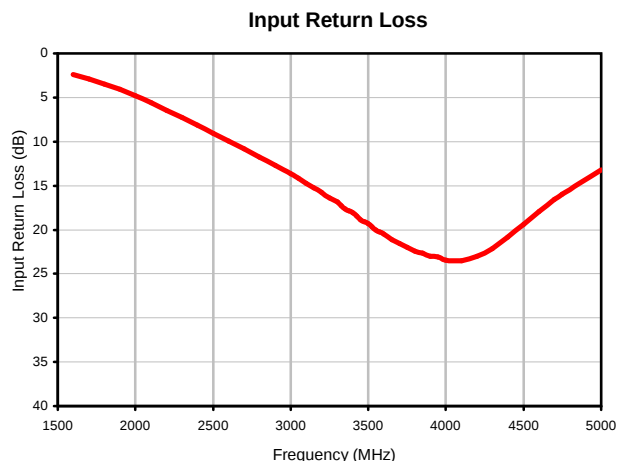
\* Insertion Loss is referenced to mid-band loss , 0.7 dB.

\*\*Phase Unbalance is relative to 180°

## Typical Performance Curves

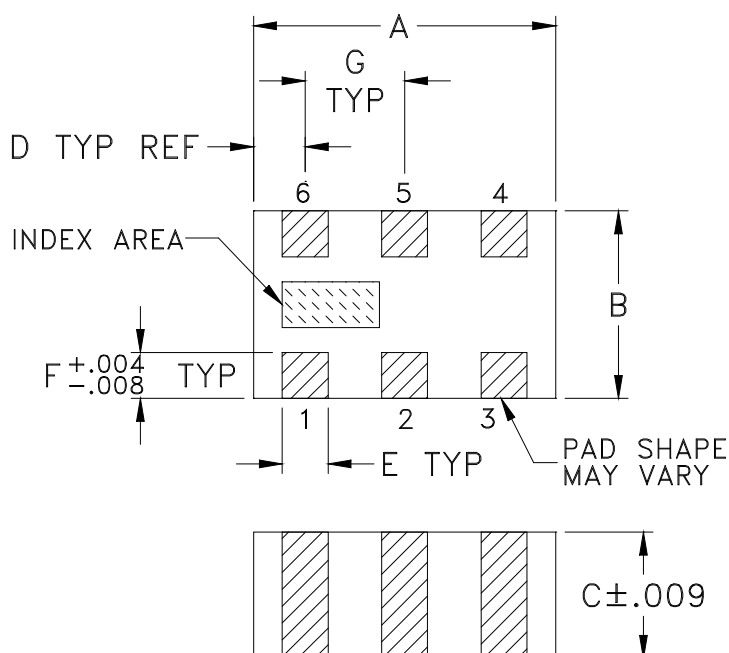


\* Insertion Loss is referenced to mid-band loss , 0.7 dB.

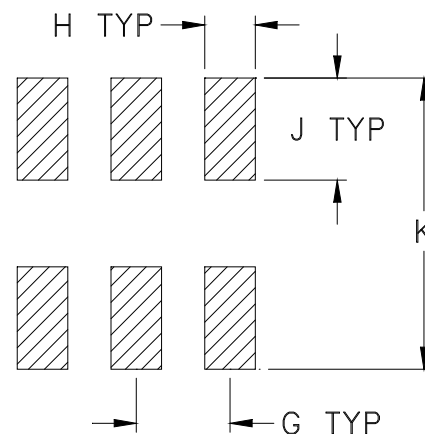


\*\*Phase Unbalance is relative to 180°

### Outline Dimensions



### PCB Land Pattern



Suggested Layout,  
Tolerance to be within  $\pm .002$

| CASE #    | A              | B              | C              | D              | E              | F              | G              | H              | J              | K              | WT. GRAM |
|-----------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------|
| GE0805C-1 | .079<br>(2.00) | .049<br>(1.25) | .033<br>(0.84) | .014<br>(0.35) | .012<br>(0.30) | .012<br>(0.30) | .026<br>(0.65) | .014<br>(0.35) | .039<br>(1.00) | .110<br>(2.80) | .008     |

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

### Notes:

- Open style, ceramic base.
- Termination finish: For RoHS Case Styles: Tin plate over Nickel plate. All models, (+) suffix.  
For RoHS-5 Case Style: Tin-lead plate. All models, no (+) suffix.



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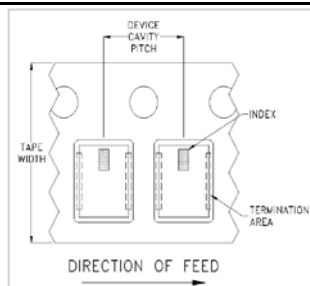


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RF/IF MICROWAVE COMPONENTS

# Tape & Reel Packaging TR-F74

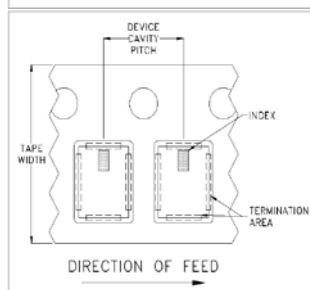
## DEVICE ORIENTATION IN T&R



**ILLUSTRATION 1**

### Applicable Case Styles

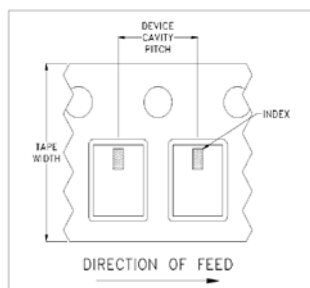
GE0805C-1  
GE0805C-1AP  
JV1210C-1  
GU2939



**ILLUSTRATION 2**

### Applicable Case Styles

JV1210C  
JV1210C-2  
JV1210C-3  
JV1210C-4  
JV1210C-5  
JV1210C-6  
JV1210C-11



**ILLUSTRATION 3**

### Applicable Case Styles

JC0603C-8  
JV1210C-7  
JV1210C-8  
JV1210C-9  
JV1210C-10  
JV1210C-13  
GE0805C-13

| Tape Width,<br>mm | Device Cavity Pitch,<br>mm | Real Size,<br>inches | Devices per Reel                             |      |
|-------------------|----------------------------|----------------------|----------------------------------------------|------|
| 8                 | 4                          | 7                    | Small<br>quantity<br>standards<br>(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)

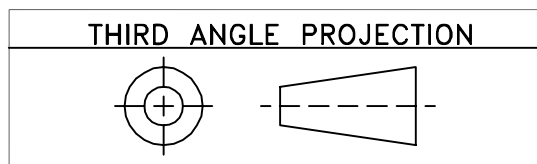


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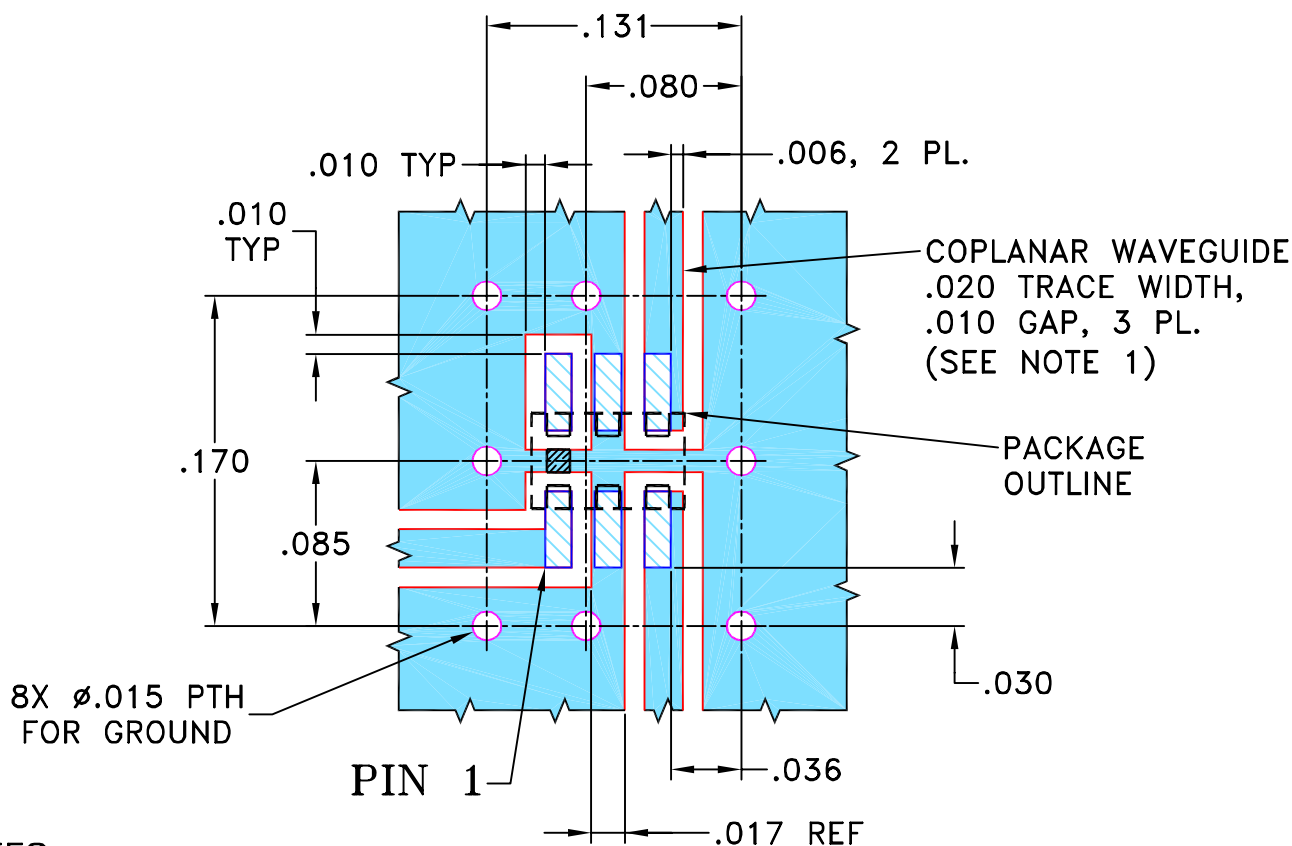
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| REVISIONS |         |             |          |    |      |
|-----------|---------|-------------|----------|----|------|
| REV OR    | ECN No. | DESCRIPTION | DATE     | DR | AUTH |
|           | M109549 | NEW RELEASE | 01/31/07 | PW | DJ   |
|           |         |             |          |    |      |
|           |         |             |          |    |      |

SUGGESTED MOUNTING CONFIGURATION  
FOR GE0805C-1 CASE STYLE, "ry" PIN CONNECTION.

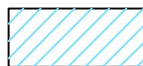


**NOTES:**

1. COPLANAR WAVEGUIDE PARAMETERS ARE SHOWN FOR ROGERS R04350B WITH DIELECTRIC THICKNESS .010"  $\pm$  .001". 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 LAYOUT WITH SMOBC (SOLDER MASK OVER BARE COPPER).



DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK

| UNLESS OTHERWISE SPECIFIED                                                                                                       | INITIALS |    | DATE     |
|----------------------------------------------------------------------------------------------------------------------------------|----------|----|----------|
| DIMENSIONS ARE IN INCHES<br>TOLERANCES ON:<br>2 PL DECIMALS $\pm$<br>3 PL DECIMALS $\pm$ .005<br>ANGLES $\pm$<br>FRACTIONS $\pm$ | DRAWN    | PW | 01/30/07 |
|                                                                                                                                  | CHECKED  | IL | 01/31/07 |
|                                                                                                                                  | APPROVED | DJ | 01/31/07 |
|                                                                                                                                  |          |    |          |



**Mini-Circuits®**

13 Neptune Avenue  
Brooklyn NY 11235

PL, ry, GE0805C-1, NCS, TB-419+

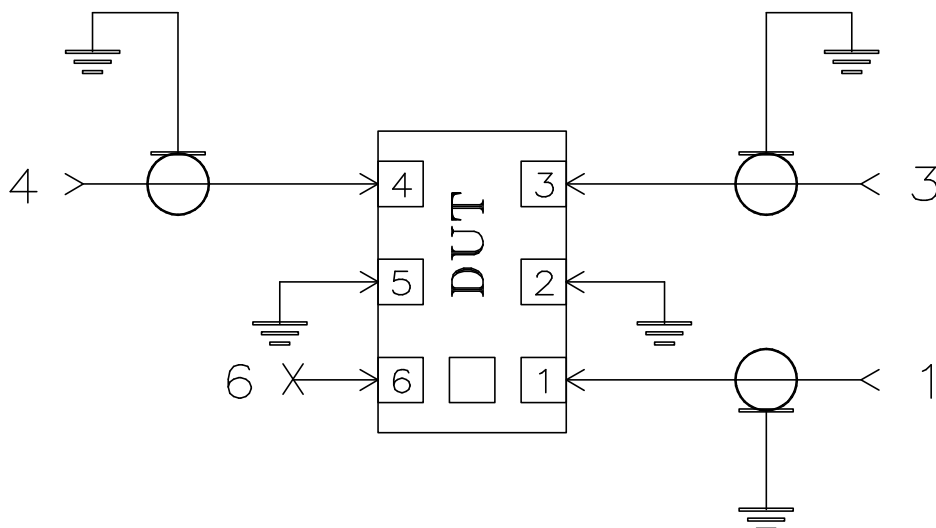
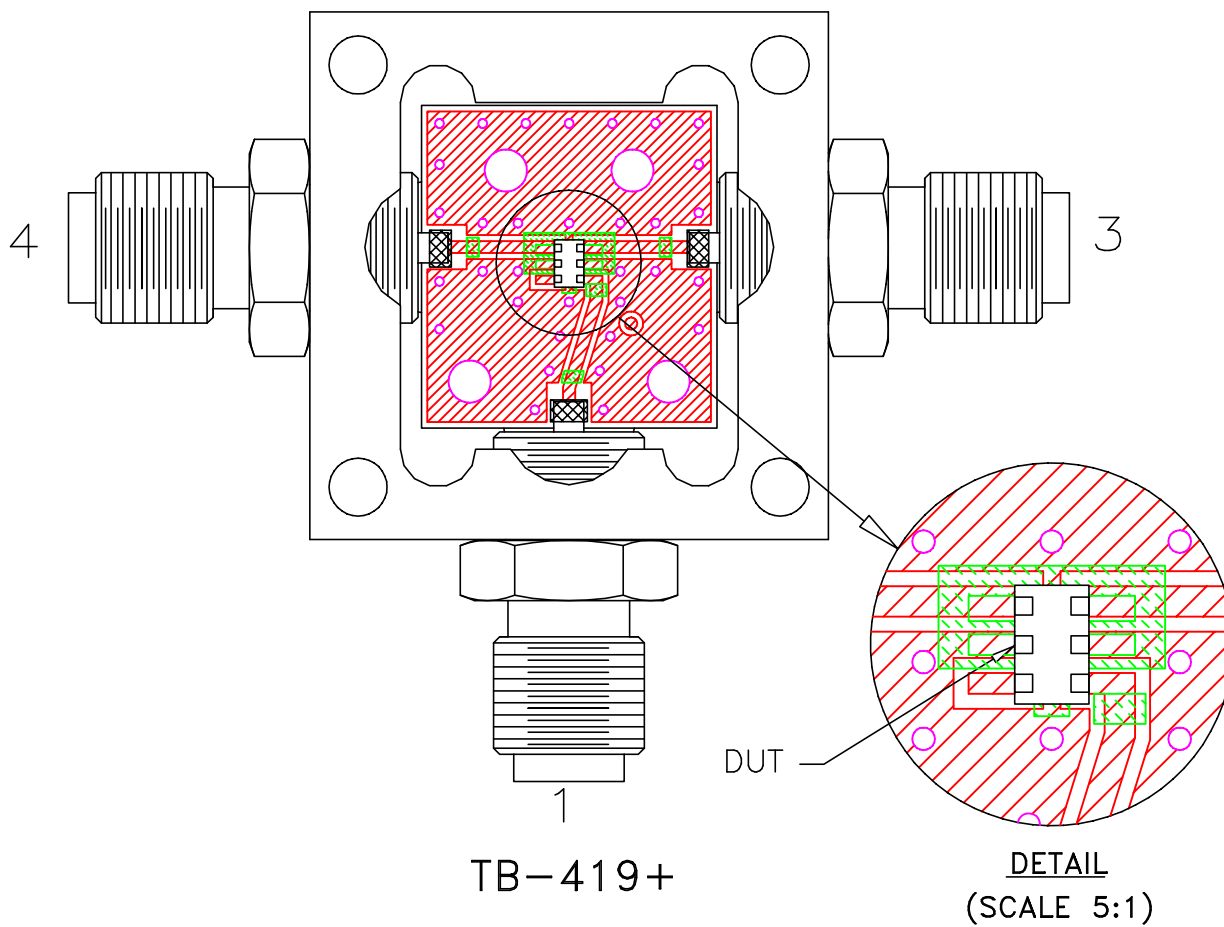
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| SIZE  | CODE IDENT | DRAWING NO: | REV:          |
|-------|------------|-------------|---------------|
| A     | 15542      | 98-PL-264   | OR            |
| FILE: | 98PL264    | SCALE: 10:1 | SHEET: 1 OF 1 |

# Evaluation Board and Circuit

For Pin Connections refer to Data Sheet of the DUT



Schematic Diagram

## Notes:

1. SMA Female connectors.
2. PCB Material: Rogers R04350 or equivalent,  
Dielectric Constant=3.5, Thickness=.010 inch.

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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      | -40° to 85° C<br>Ambient Environment                                                | Individual Model Data Sheet                                                                          |
| Storage Temperature        | -55° to 100° 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 |
| Thermal Shock              | -55° to 100°C, 100 cycles                                                           | MIL-STD-202, Method 107, Condition A-3, except +100°C                                                |
| Solder Reflow Heat         | Sn-Pb Eutetic Process: 225°C peak<br>Pb-Free Process 245° - 250°C peak              | J-STD-020, 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                                                                 |