



CERAMIC BALUN

RF Transformer

TCW1-272+

50Ω 1700 to 2700 MHz 1:1 Ratio

THE BIG DEAL

- Wideband, 1700 to 2700 MHz
- Miniature Size 0603 (1.6x0.8 mm)
- LTCC Construction
- Low Cost

APPLICATIONS

- Wi-Fi
- ISM
- LTE
- A/D Conversion
- Aviation/Aeronautical
- Radio Astronomy
- Radio Navigation



Generic photo used for illustration purposes only

CASE STYLE: JC0603C

+RoHS Compliant

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

PRODUCT OVERVIEW

Mini-Circuits' TCW1-272+ is a tiny ceramic RF balun transformer with an impedance ratio of 1:1, covering a variety of wireless communications applications from 1700 to 2700 MHz. This model provides low insertion loss, low phase unbalance (relative to 180°), low amplitude unbalance, and RF input power handling up to 1 W. Fabricated using LTCC technology, the unit comes housed in a tiny, rugged ceramic package (0.06x0.03x0.02") suitable for harsh operating environments.

KEY FEATURES

| Feature | Advantages |
|--|--|
| Low Insertion Loss, 1.25 dB | Enables excellent signal power transmission from input to output. |
| Low Unbalance, 0.6 dB, 4° (Relative to 180°) | Low unbalance can improve a system's electromagnetic compatibility by rejecting unwanted common-mode noise. |
| 1 W Power Handling | Supports a wide range of power requirements. |
| Tiny Size, 0603 | 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. |

REV. A
ECO-010340
TCW1-272+
MCL NY
250709





CERAMIC BALUN

RF Transformer

TCW1-272+

50Ω 1700 to 2700 MHz 1:1 Ratio

ELECTRICAL SPECIFICATIONS¹ AT +25°C

| Parameter | Frequency (MHz) | Min. | Typ. | Max. | Units |
|--|-----------------|------|------|------|--------|
| Impedance Ratio | | | 1 | | |
| Frequency Range | | 1700 | | 2700 | MHz |
| Avg. Insertion Loss (Ref. to Nominal Loss) | 1700-2700 | | | 1.8 | dB |
| Amplitude Unbalance | 1700-2700 | | 0.6 | 1.5 | dB |
| Phase Unbalance ² | 1700-2700 | | 4 | 7 | Degree |
| Input VSWR | 1700-2700 | | 1.6 | | (:1) |

1. Tested on TB-TCW1-272+ and with pad 2 grounded.

2. Relative to 180°.

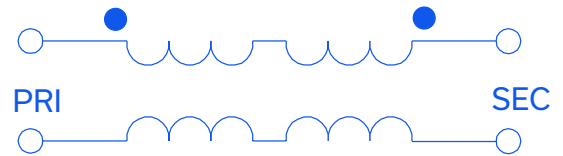
ABSOLUTE MAXIMUM RATINGS

| Parameter | Ratings |
|-----------------------------|-----------------|
| Operating Temperature | -40°C to +85°C |
| Storage Temperature | -55°C to +100°C |
| RF Power Input ³ | 1 W at +25°C |

3. Passband rating.

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

CONFIGURATION G



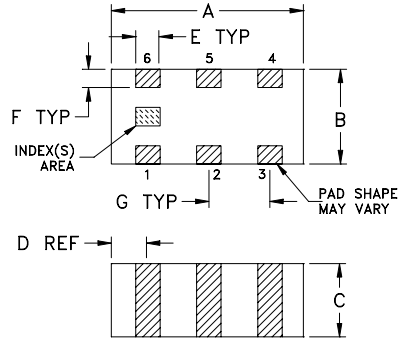


PAD CONNECTIONS

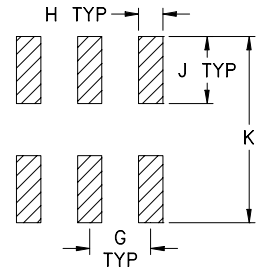
| | |
|----------------------|-----|
| PRIMARY DOT | 1 |
| PRIMARY ⁴ | 2 |
| SECONDARY DOT | 4 |
| SECONDARY | 5 |
| NO CONNECTION | 3,6 |

4. Bypass capacitor to gnd should be connected at pin 2 when feeding DC current.

OUTLINE DRAWING



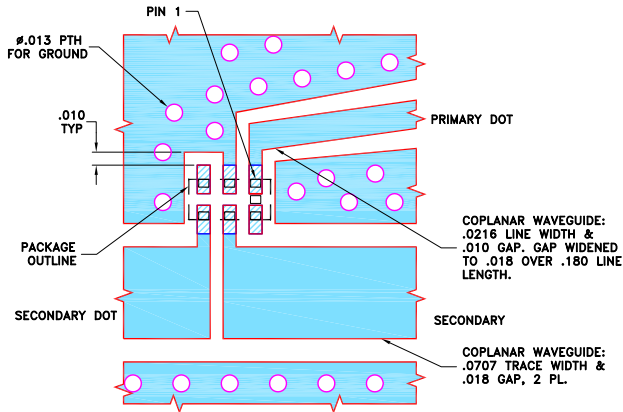
PCB Land Pattern



Suggested Layout, Tolerance to be within ±.002

PRODUCT MARKING: N/A

DEMO BOARD MCL P/N: TB-TCW1-272+ SUGGESTED PCB LAYOUT (PL-537)



NOTES:

- TRACE WIDTH PARAMETERS ARE SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS .010"±.001". COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS LINE WIDTH AND GAP MAY NEED TO BE MODIFIED.
- BOTTOM SIDE OF THE PCB IS CONTINUOUS GROUND PLANE.

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

OUTLINE DIMENSIONS (Inches / mm)

| | | | | | |
|------|------|------|------|------|-------|
| A | B | C | D | E | F |
| .063 | .031 | .024 | .012 | .008 | .006 |
| 1.60 | 0.79 | 0.61 | 0.30 | 0.20 | 0.15 |
| G | H | J | K | | wt |
| .020 | .010 | .022 | .053 | | grams |
| 0.51 | 0.25 | 0.56 | 1.35 | | 0.005 |

TAPE & REEL INFORMATION: F114



CERAMIC BALUN

RF Transformer

TCW1-272+



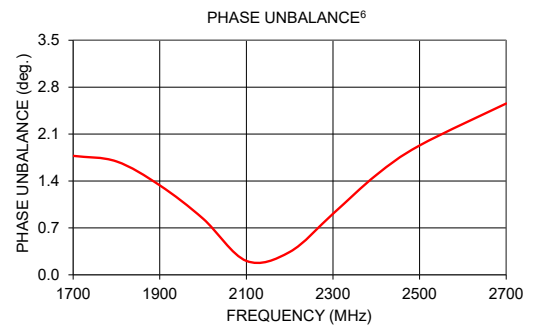
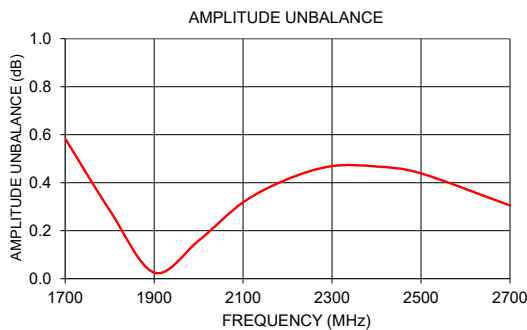
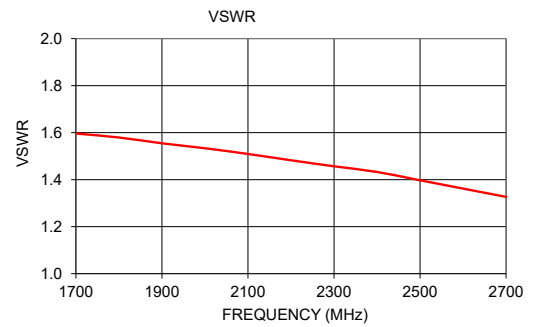
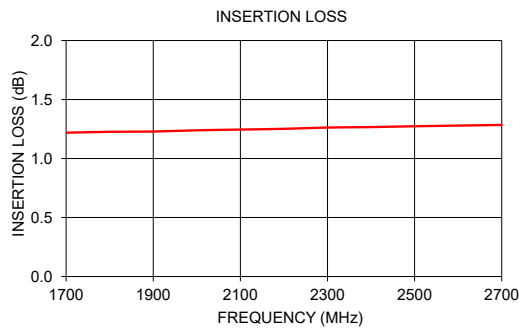
50Ω 1700 to 2700 MHz 1:1 Ratio

TYPICAL PERFORMANCE DATA⁵

| Frequency (MHz) | Insertion Loss (dB) | Input Return Loss (dB) | Amplitude Unbalance (dB) | Phase Unbalance ⁶ (deg) |
|-----------------|---------------------|------------------------|--------------------------|------------------------------------|
| 1700 | 1.22 | 1.60 | 0.58 | 1.78 |
| 1800 | 1.23 | 1.58 | 0.29 | 1.69 |
| 1900 | 1.23 | 1.55 | 0.03 | 1.34 |
| 2000 | 1.24 | 1.53 | 0.16 | 0.84 |
| 2100 | 1.25 | 1.51 | 0.32 | 0.21 |
| 2200 | 1.25 | 1.48 | 0.41 | 0.34 |
| 2300 | 1.26 | 1.46 | 0.47 | 0.91 |
| 2400 | 1.27 | 1.43 | 0.47 | 1.49 |
| 2500 | 1.27 | 1.40 | 0.44 | 1.93 |
| 2700 | 1.28 | 1.33 | 0.30 | 2.56 |

5. Measured with Agilent N5242A network analyzer using impedance conversion and port extension.

6. Relative to 180°.



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



RF Transformer

TCW1-272+

Typical Performance Data

| FREQUENCY (MHz) | INSERTION LOSS (dB) | INPUT RETURN LOSS (dB) | AMPLITUDE UNBALANCE (dB) | PHASE UNBALANCE ⁽¹⁾ (Deg) |
|--------------------|------------------------|---------------------------|--------------------------------|--|
| 1200 | 1.29 | 13.22 | 3.11 | 3.90 |
| 1250 | 1.27 | 13.02 | 2.77 | 2.76 |
| 1300 | 1.26 | 12.86 | 2.45 | 1.72 |
| 1350 | 1.24 | 12.75 | 2.16 | 0.86 |
| 1400 | 1.23 | 12.66 | 1.88 | 0.18 |
| 1450 | 1.23 | 12.61 | 1.62 | 0.42 |
| 1500 | 1.22 | 12.61 | 1.38 | 0.92 |
| 1550 | 1.22 | 12.62 | 1.16 | 1.27 |
| 1600 | 1.22 | 12.62 | 0.95 | 1.53 |
| 1650 | 1.22 | 12.69 | 0.76 | 1.71 |
| 1700 | 1.22 | 12.78 | 0.58 | 1.78 |
| 1750 | 1.22 | 12.86 | 0.42 | 1.76 |
| 1800 | 1.23 | 12.97 | 0.29 | 1.69 |
| 1850 | 1.23 | 13.12 | 0.15 | 1.54 |
| 1900 | 1.23 | 13.27 | 0.03 | 1.34 |
| 1950 | 1.24 | 13.40 | 0.08 | 1.13 |
| 2000 | 1.24 | 13.53 | 0.16 | 0.84 |
| 2050 | 1.24 | 13.68 | 0.24 | 0.50 |
| 2100 | 1.25 | 13.85 | 0.32 | 0.21 |
| 2150 | 1.25 | 14.05 | 0.37 | 0.03 |
| 2200 | 1.25 | 14.23 | 0.41 | 0.34 |
| 2250 | 1.26 | 14.40 | 0.45 | 0.65 |
| 2300 | 1.26 | 14.61 | 0.47 | 0.91 |
| 2350 | 1.27 | 14.81 | 0.47 | 1.18 |
| 2400 | 1.27 | 15.00 | 0.47 | 1.49 |
| 2450 | 1.27 | 15.27 | 0.46 | 1.75 |
| 2500 | 1.27 | 15.61 | 0.44 | 1.93 |
| 2550 | 1.27 | 15.94 | 0.41 | 2.14 |
| 2600 | 1.28 | 16.25 | 0.39 | 2.31 |
| 2650 | 1.28 | 16.65 | 0.35 | 2.44 |
| 2700 | 1.28 | 17.05 | 0.30 | 2.56 |
| 2750 | 1.29 | 17.45 | 0.26 | 2.66 |
| 2800 | 1.29 | 17.97 | 0.23 | 2.70 |
| 2850 | 1.30 | 18.58 | 0.19 | 2.65 |
| 2900 | 1.30 | 19.15 | 0.15 | 2.50 |
| 2950 | 1.31 | 19.71 | 0.11 | 2.31 |
| 3000 | 1.32 | 20.34 | 0.05 | 2.21 |
| 3050 | 1.33 | 20.77 | 0.02 | 2.10 |
| 3100 | 1.34 | 20.91 | 0.01 | 1.77 |
| 3150 | 1.36 | 20.94 | 0.01 | 1.37 |
| 3200 | 1.38 | 20.62 | 0.05 | 1.03 |
| 3250 | 1.41 | 19.87 | 0.06 | 0.63 |
| 3300 | 1.44 | 19.03 | 0.07 | 0.22 |
| 3350 | 1.48 | 18.16 | 0.10 | 0.00 |
| 3400 | 1.52 | 17.21 | 0.10 | 0.09 |
| 3450 | 1.57 | 16.29 | 0.07 | 0.35 |
| 3500 | 1.63 | 15.47 | 0.05 | 0.71 |
| 3550 | 1.69 | 14.67 | 0.04 | 0.82 |
| 3600 | 1.75 | 13.92 | 0.01 | 0.80 |
| 3650 | 1.82 | 13.27 | 0.03 | 0.84 |
| 3700 | 1.89 | 12.67 | 0.07 | 0.79 |
| 3750 | 1.98 | 12.13 | 0.10 | 0.53 |
| 3800 | 2.06 | 11.65 | 0.15 | 0.28 |
| 3850 | 2.15 | 11.25 | 0.17 | 0.01 |
| 3900 | 2.25 | 10.88 | 0.18 | 0.67 |
| 3950 | 2.34 | 10.55 | 0.18 | 1.76 |
| 4000 | 2.45 | 10.26 | 0.17 | 3.07 |

⁽¹⁾ Relative to 180°



P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 • Fax (718) 332-4661 For detailed performance specs & shopping online see Mini-Circuits web site

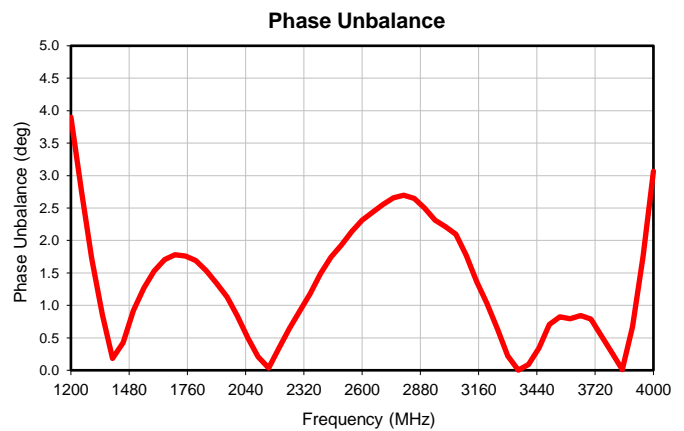
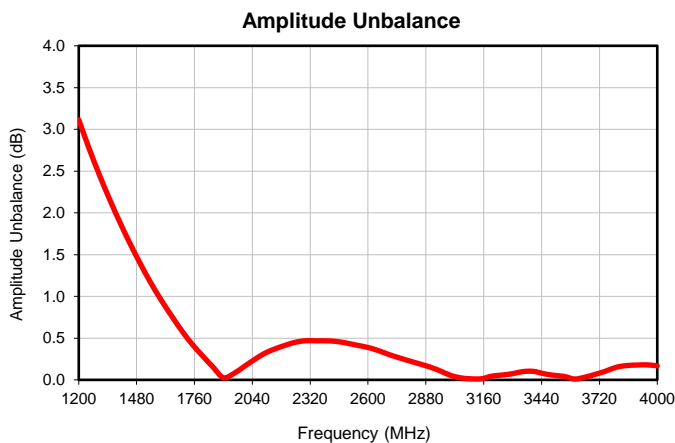
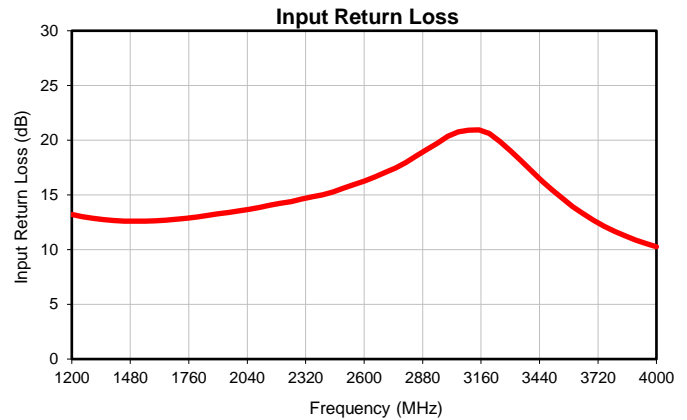
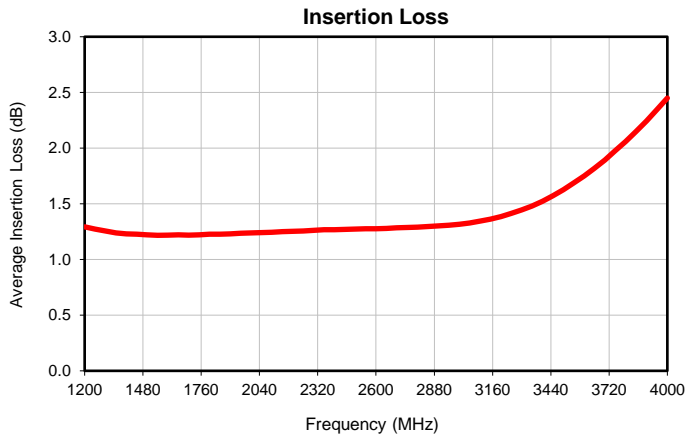


The Design Engineers Search Engine Provides ACTUAL Data Instantly From MINI-CIRCUITS At: www.minicircuits.com

IF/RF MICROWAVE COMPONENTS

REV. OR
TCW1-272+
3/21/2018
Page 1 of 1

Typical Performance Data

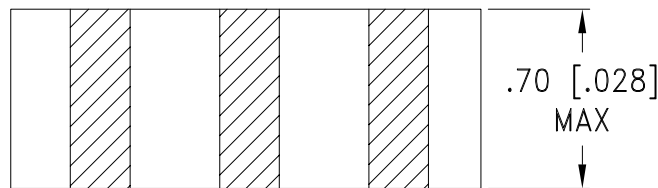
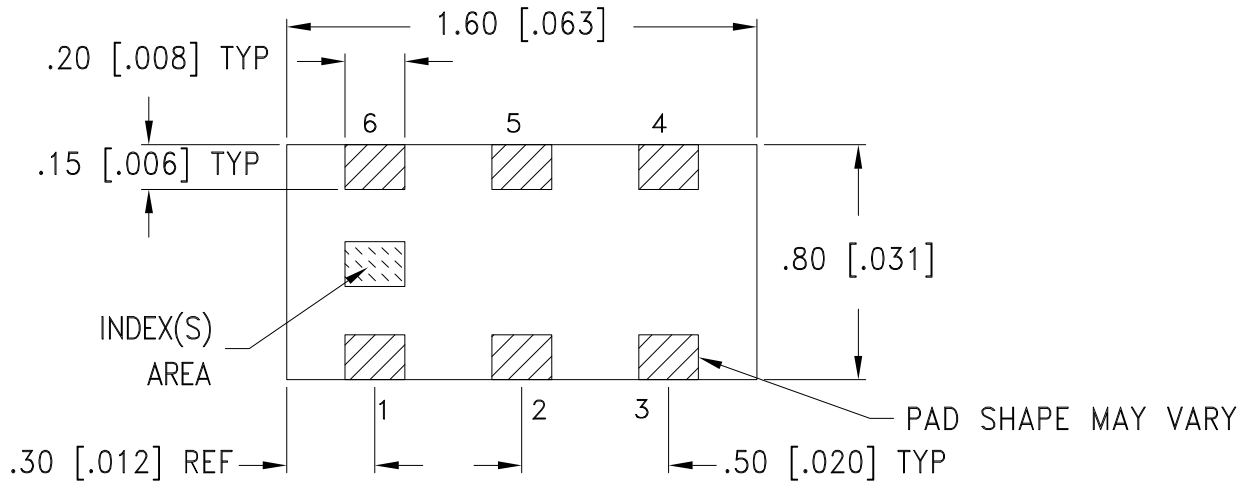


Case Style

JC

Outline Dimensions

JC0603C



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.

 **Mini-Circuits**[®]
ISO 9001 ISO 14001 CERTIFIED

ALL NEW
minicircuits.com

P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661 For detailed performance specs & shopping online see Mini-Circuits web site



The Design Engineers Search Engine Provides ACTUAL Data Instantly From MINI-CIRCUITS At: www.minicircuits.com

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



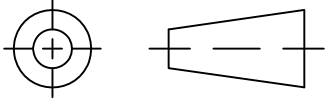
INTERNET <http://www.minicircuits.com>

P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661

Distribution Centers NORTH AMERICA 800-654-7949 • 417-335-5935 • Fax 417-335-5945 • EUROPE 44-1252-832600 • Fax 44-1252-837010

Mini-Circuits ISO 9001 & ISO 14001 Certified

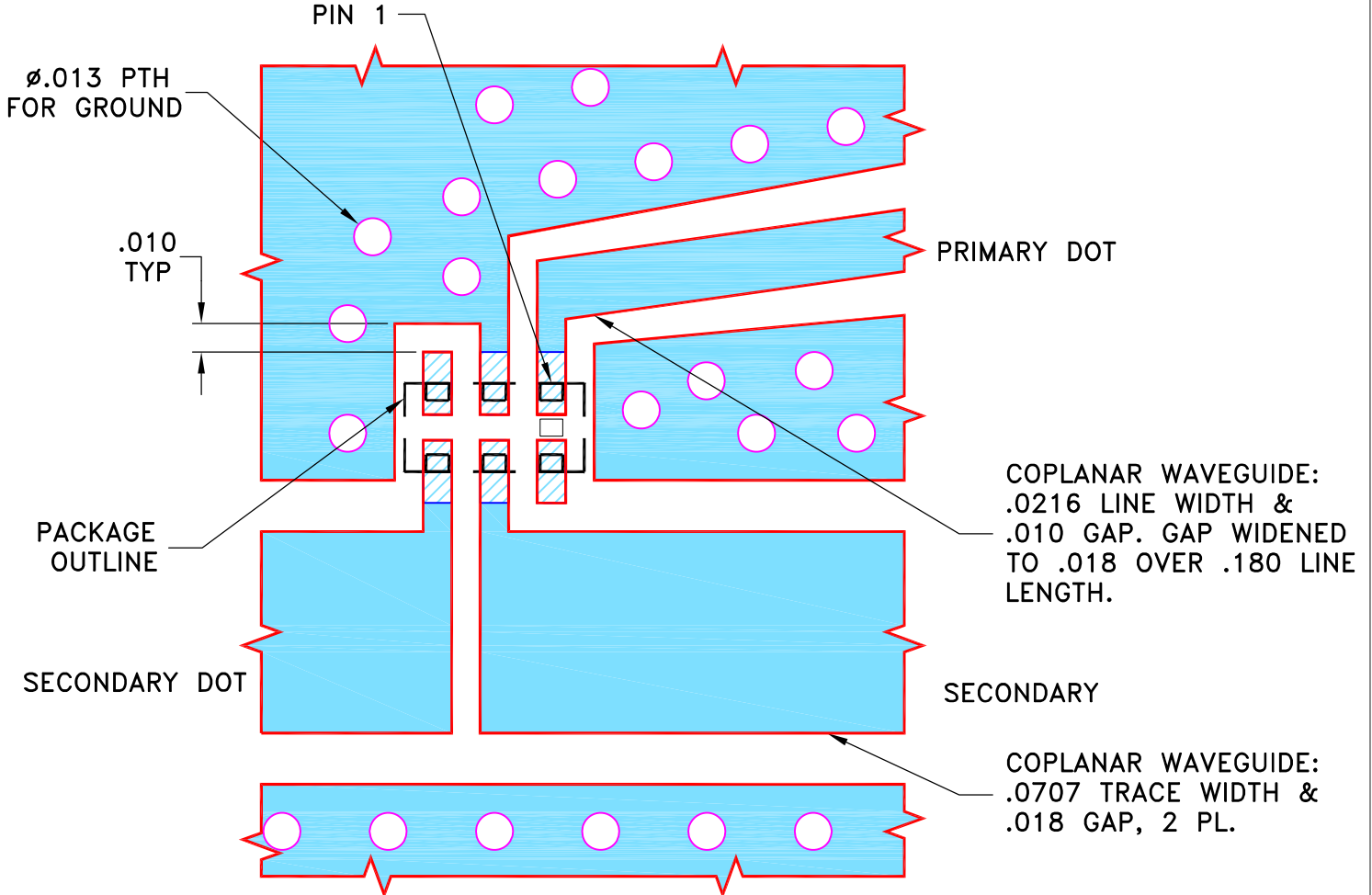
THIRD ANGLE PROJECTION



REVISIONS

| REV | ECN No. | DESCRIPTION | DATE | DR | AUTH |
|-----|---------|-------------|----------|-----|------|
| OR | M165159 | NEW RELEASE | 12/19/17 | ITG | BK |
| | | | | | |
| | | | | | |

**SUGGESTED MOUNTING CONFIGURATION
FOR JC0603C CASE STYLE, "06TG06" PIN CODE**

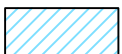


NOTES:

- TRACE WIDTH PARAMETERS ARE SHOWN FOR ROGERS R04350B WITH DIELECTRIC THICKNESS .010"±.001". COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS LINE WIDTH AND GAP MAY NEED TO BE MODIFIED.
- 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 | DRAWN ITG | 12/14/17 |
| TOLERANCES ON: | CHECKED GF | 12/19/17 |
| 2 PL DECIMALS ± | APPROVED BK | 12/19/17 |
| 3 PL DECIMALS ± .005 | | |
| ANGLES ± | | |
| FRACTIONS ± | | |



Mini-Circuits®

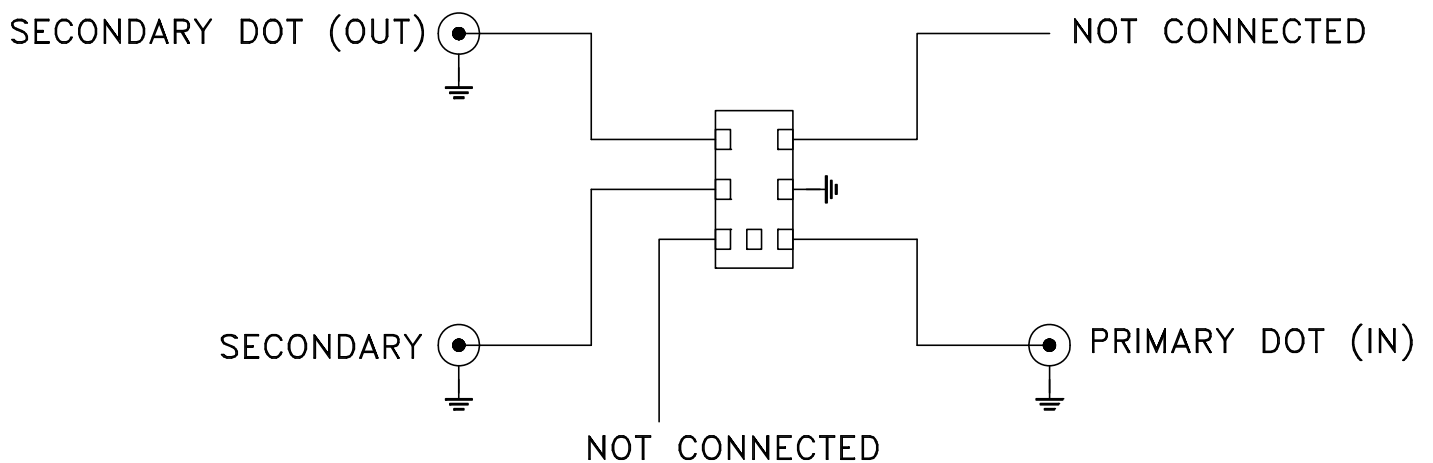
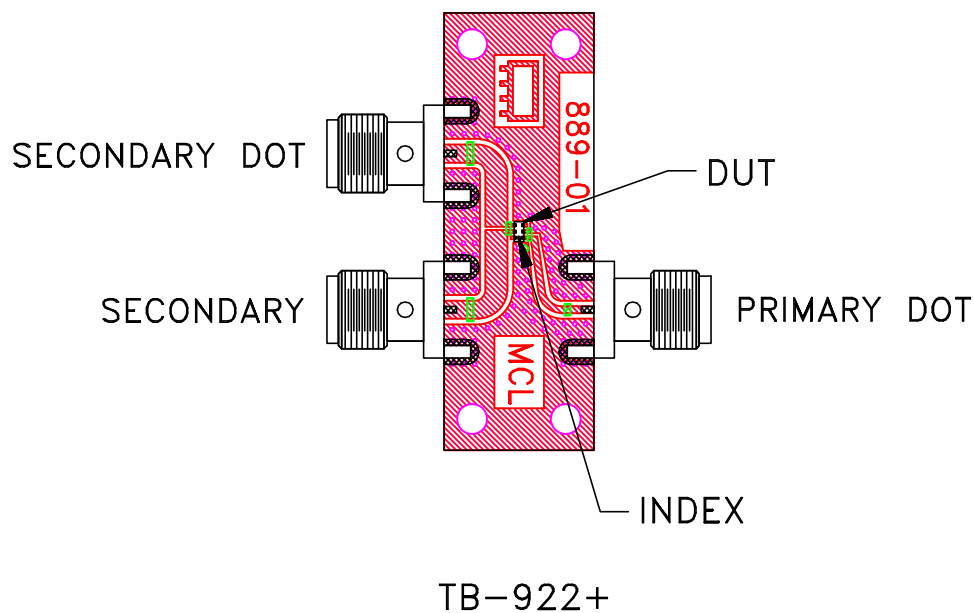
13 Neptune Avenue
Brooklyn NY 11235

PL, 06TG06, JC0603C, TB-922+

| | | | |
|-------------------------|----------------------------|---------------------------------|-------------------|
| SIZE A | CODE IDENT 15542 | DRAWING NO: 98-PL-537 | REV: OR |
| FILE: 98PL537 | SCALE: 16:1 | SHEET: 1 OF 1 | |

THIS DOCUMENT AND ITS CONTENTS ARE THE PROPERTY OF MINI-CIRCUITS. EXCEPT FOR USE EXPRESSLY GRANTED, IN WRITING, TO ITS VENDORS, VENDEE AND THE UNITED STATES GOVERNMENT, MINI-CIRCUITS RESERVES ALL PROPRIETARY DESIGN, USE, MANUFACTURING AND REPRODUCTION RIGHTS THERETO. THESE CONTENTS SHALL NOT BE USED, DUPLICATED OR DISCLOSED TO ANY OUTSIDE PARTY, IN WHOLE OR IN PART, WITHOUT WRITTEN PERMISSION OF MINI-CIRCUITS.


Evaluation Board and Circuit



Schematic Diagram

Notes:

1. 50 Ohm SMA Female connectors.
2. PCB Material: R04350 or equivalent, Dielectric Constant=3.5, Thickness=.020 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 100°C Ambient Environment | Individual Model Data Sheet |
| Storage Temperature | -55° to 100° C 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 Eutetic Process: 225°C peak 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 |