



CERAMIC BALUN

RF Transformer

TCW2-392+

50Ω 3300 to 3900 MHz 1:2 Ratio

FEATURES

- Wideband, 3300 to 3900 MHz
- Miniature Size 0603 (1.6x0.8 mm)
- LTCC Construction
- Low Cost



Generic photo used for illustration purposes only

CASE STYLE: JC0603C

+RoHS Compliant

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

APPLICATIONS

- LTE
- 5G
- A/D Conversion

ELECTRICAL SPECIFICATIONS AT +25°C

| Parameter | Frequency (MHz) | Min. | Typ. | Max. | Unit |
|---|-----------------|------|------|------|--------|
| Impedance Ratio (Secondary/Primary) | | 2 | | | |
| Frequency Range | | 3300 | | 3900 | MHz |
| Avg. Insertion Loss ¹ (Sds 21) | 3300-3900 | | 0.8 | 1.3 | dB |
| Amplitude Unbalance | 3300-3900 | | 0.5 | 1.5 | dB |
| Phase Unbalance ² | 3300-3900 | | 5 | 14 | Degree |
| VSWR | 3300-3900 | | 1.35 | | (:1) |

1. Reference demo board TB-TCW2-392+.

2. Relative to 180°.

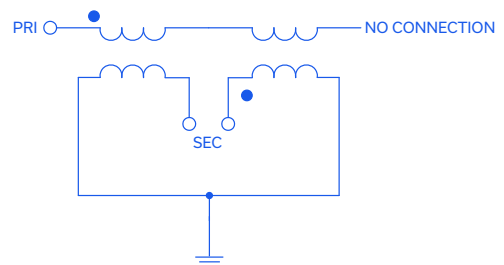
ABSOLUTE MAXIMUM RATINGS

| Parameter | Ratings |
|-----------------------------|-----------------|
| Operating Temperature | -40°C to +105°C |
| Storage Temperature | -55°C to +105°C |
| RF Power Input ³ | 2 W at +25°C |

3. Passband rating.

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

CONFIGURATION R



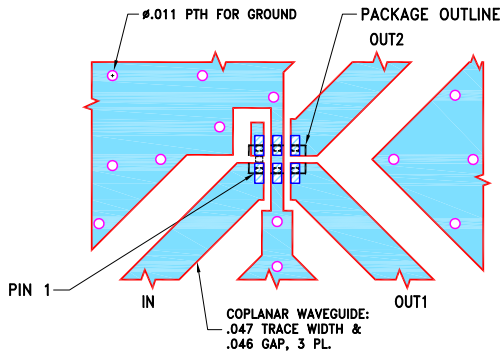


PAD CONNECTIONS

| | |
|--|---|
| PRIMARY DOT (Unbalanced Port) | 1 |
| RF GROUND (GND) | 2 |
| SECONDARY DOT (Balanced) | 4 |
| SECONDARY (Balanced) | 3 |
| NO CONNECTION | 6 |
| RF GROUND (GND) | 5 |
| PADS 2,3,4 are DC-Connected Internally | |

PRODUCT MARKING: N/A

DEMO BOARD MCL P/N: TB-TCW2-392+
SUGGESTED PCB LAYOUT (PL-574)

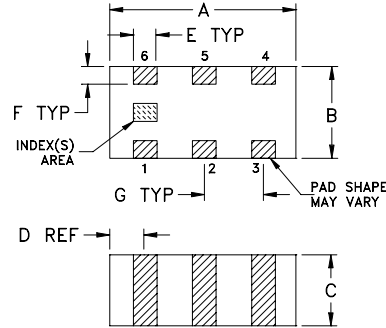


NOTES:

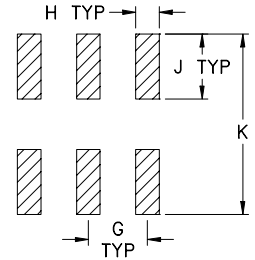
1. TRACE WIDTH & GAP PARAMETERS ARE SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS .020±.0015. COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH & GAP MAY NEED TO BE MODIFIED.
2. BOTTOM SIDE OF THE PCB IS CONTINUOUS GROUND PLANE.

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

OUTLINE DRAWING



PCB Land Pattern



Suggested Layout,
Tolerance to be within ±.002

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



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RF Transformer

TCW2-392+



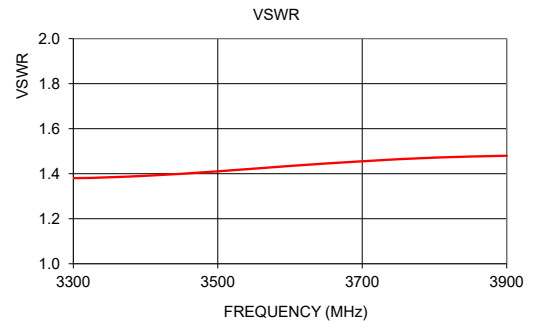
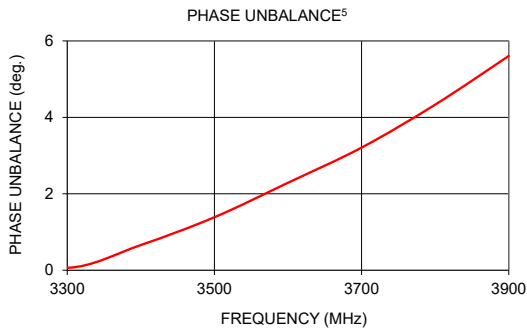
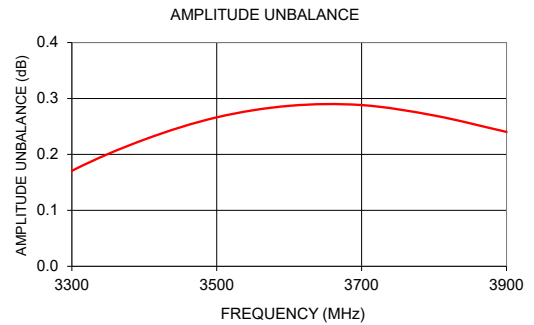
50Ω 3300 to 3900 MHz 1:2 Ratio

TYPICAL PERFORMANCE DATA⁴

| Frequency (MHz) | Insertion Loss (dB) | VSWR (:1) | Amplitude Unbalance (dB) | Phase Unbalance ⁵ (deg) |
|-----------------|---------------------|-----------|--------------------------|------------------------------------|
| 3300 | 0.86 | 1.38 | 0.17 | 0.06 |
| 3200 | 0.88 | 1.39 | 0.09 | 0.57 |
| 3300 | 0.86 | 1.38 | 0.17 | 0.06 |
| 3400 | 0.87 | 1.39 | 0.23 | 0.66 |
| 3500 | 0.87 | 1.41 | 0.27 | 1.39 |
| 3600 | 0.89 | 1.43 | 0.29 | 2.29 |
| 3700 | 0.91 | 1.46 | 0.29 | 3.21 |
| 3800 | 0.93 | 1.47 | 0.27 | 4.33 |
| 3900 | 0.94 | 1.48 | 0.24 | 5.61 |

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

5. 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

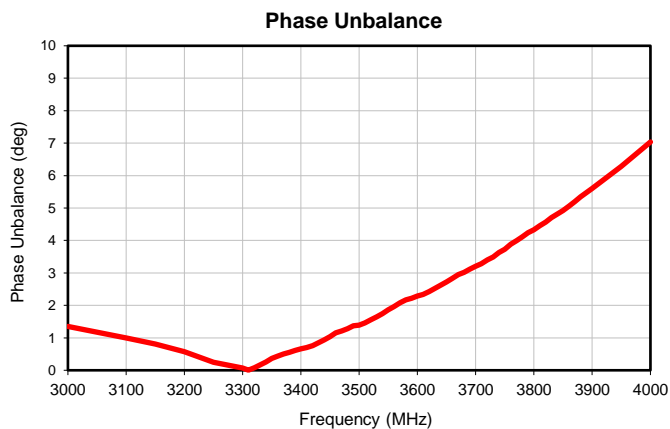
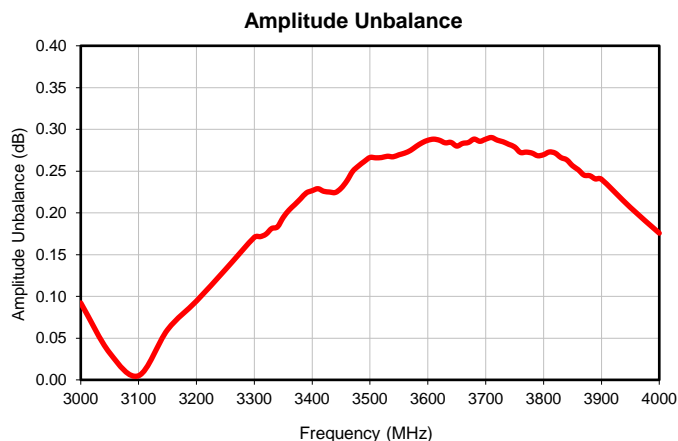
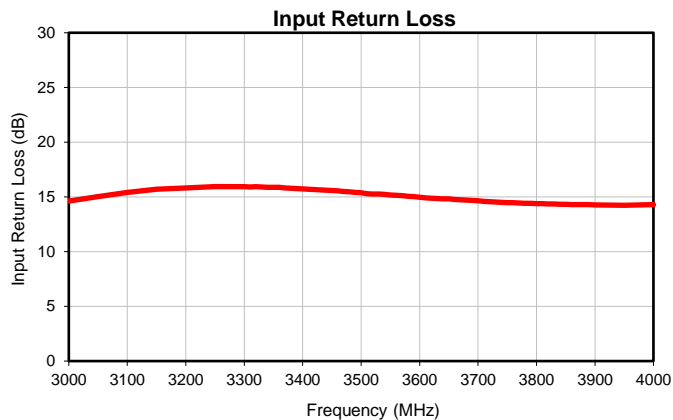
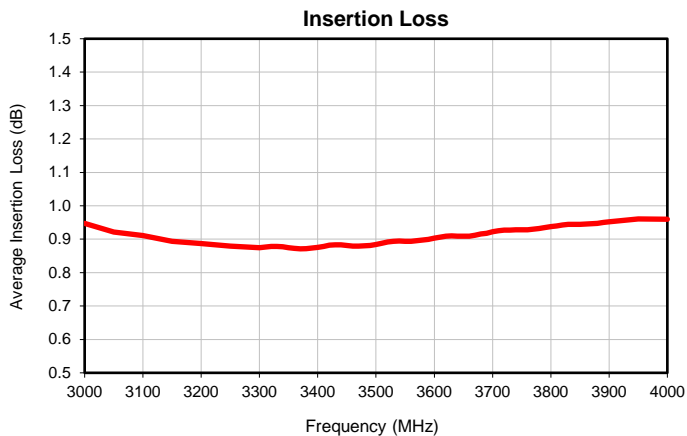


Typical Performance Data

| FREQUENCY (MHz) | INSERTION LOSS (dB) | INPUT RETURN LOSS (dB) | AMPLITUDE UNBALANCE (dB) | PHASE UNBALANCE ⁽¹⁾ (Deg) |
|--------------------|------------------------|---------------------------|--------------------------------|--|
| 3000 | 0.95 | 14.61 | 0.09 | 1.35 |
| 3050 | 0.92 | 15.04 | 0.03 | 1.17 |
| 3100 | 0.91 | 15.40 | 0.01 | 0.99 |
| 3150 | 0.89 | 15.69 | 0.06 | 0.81 |
| 3200 | 0.89 | 15.82 | 0.09 | 0.57 |
| 3250 | 0.88 | 15.94 | 0.13 | 0.24 |
| 3300 | 0.87 | 15.93 | 0.17 | 0.06 |
| 3310 | 0.88 | 15.91 | 0.17 | 0.00 |
| 3320 | 0.88 | 15.92 | 0.17 | 0.08 |
| 3330 | 0.88 | 15.90 | 0.18 | 0.17 |
| 3340 | 0.88 | 15.89 | 0.18 | 0.25 |
| 3350 | 0.88 | 15.89 | 0.19 | 0.37 |
| 3360 | 0.87 | 15.87 | 0.20 | 0.43 |
| 3370 | 0.87 | 15.82 | 0.21 | 0.50 |
| 3380 | 0.87 | 15.79 | 0.22 | 0.56 |
| 3390 | 0.87 | 15.76 | 0.22 | 0.61 |
| 3400 | 0.88 | 15.73 | 0.23 | 0.66 |
| 3410 | 0.88 | 15.70 | 0.23 | 0.70 |
| 3420 | 0.88 | 15.66 | 0.23 | 0.76 |
| 3430 | 0.88 | 15.64 | 0.22 | 0.84 |
| 3440 | 0.88 | 15.61 | 0.22 | 0.94 |
| 3450 | 0.88 | 15.60 | 0.23 | 1.04 |
| 3460 | 0.88 | 15.55 | 0.24 | 1.15 |
| 3470 | 0.88 | 15.51 | 0.25 | 1.22 |
| 3480 | 0.88 | 15.46 | 0.26 | 1.28 |
| 3490 | 0.88 | 15.42 | 0.26 | 1.37 |
| 3500 | 0.88 | 15.38 | 0.27 | 1.39 |
| 3510 | 0.89 | 15.30 | 0.27 | 1.46 |
| 3520 | 0.89 | 15.28 | 0.27 | 1.55 |
| 3530 | 0.89 | 15.26 | 0.27 | 1.65 |
| 3540 | 0.89 | 15.22 | 0.27 | 1.75 |
| 3550 | 0.89 | 15.18 | 0.27 | 1.87 |
| 3560 | 0.89 | 15.14 | 0.27 | 1.96 |
| 3570 | 0.90 | 15.10 | 0.27 | 2.08 |
| 3580 | 0.90 | 15.06 | 0.28 | 2.17 |
| 3590 | 0.90 | 15.03 | 0.28 | 2.22 |
| 3600 | 0.90 | 14.97 | 0.29 | 2.29 |
| 3610 | 0.91 | 14.92 | 0.29 | 2.34 |
| 3620 | 0.91 | 14.88 | 0.29 | 2.43 |
| 3630 | 0.91 | 14.86 | 0.28 | 2.52 |
| 3640 | 0.91 | 14.82 | 0.28 | 2.63 |
| 3650 | 0.91 | 14.81 | 0.28 | 2.72 |
| 3660 | 0.91 | 14.78 | 0.28 | 2.83 |
| 3670 | 0.91 | 14.74 | 0.28 | 2.95 |
| 3680 | 0.92 | 14.72 | 0.29 | 3.02 |
| 3690 | 0.92 | 14.67 | 0.29 | 3.12 |
| 3700 | 0.92 | 14.64 | 0.29 | 3.21 |
| 3710 | 0.93 | 14.60 | 0.29 | 3.28 |
| 3720 | 0.93 | 14.56 | 0.29 | 3.40 |
| 3730 | 0.93 | 14.54 | 0.29 | 3.49 |
| 3740 | 0.93 | 14.50 | 0.28 | 3.63 |
| 3750 | 0.93 | 14.49 | 0.28 | 3.73 |
| 3760 | 0.93 | 14.47 | 0.27 | 3.88 |
| 3770 | 0.93 | 14.44 | 0.27 | 4.00 |
| 3780 | 0.93 | 14.42 | 0.27 | 4.12 |
| 3790 | 0.94 | 14.41 | 0.27 | 4.24 |
| 3800 | 0.94 | 14.39 | 0.27 | 4.33 |
| 3810 | 0.94 | 14.38 | 0.27 | 4.45 |
| 3820 | 0.94 | 14.35 | 0.27 | 4.57 |
| 3830 | 0.94 | 14.35 | 0.27 | 4.71 |
| 3840 | 0.94 | 14.32 | 0.26 | 4.81 |
| 3850 | 0.94 | 14.32 | 0.26 | 4.92 |
| 3860 | 0.95 | 14.31 | 0.25 | 5.06 |
| 3870 | 0.95 | 14.30 | 0.25 | 5.19 |
| 3880 | 0.95 | 14.30 | 0.24 | 5.35 |
| 3890 | 0.95 | 14.29 | 0.24 | 5.48 |
| 3900 | 0.95 | 14.27 | 0.24 | 5.61 |
| 3950 | 0.96 | 14.23 | 0.21 | 6.29 |
| 4000 | 0.96 | 14.29 | 0.18 | 7.04 |

⁽¹⁾ Relative to 180°

Typical Performance Data



Tape & Reel Packaging TR-F114

DEVICE ORIENTATION IN T&R

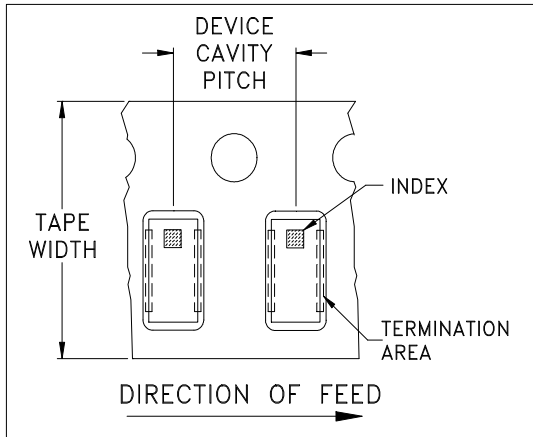


ILLUSTRATION 1

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

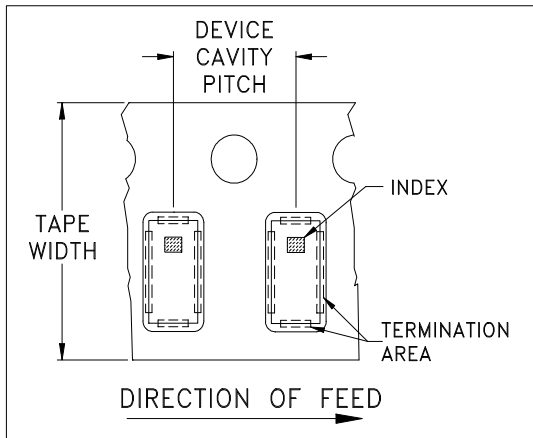


ILLUSTRATION 2

| 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



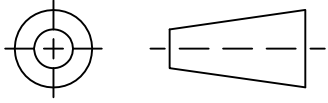
INTERNET <http://www.minicircuits.com>

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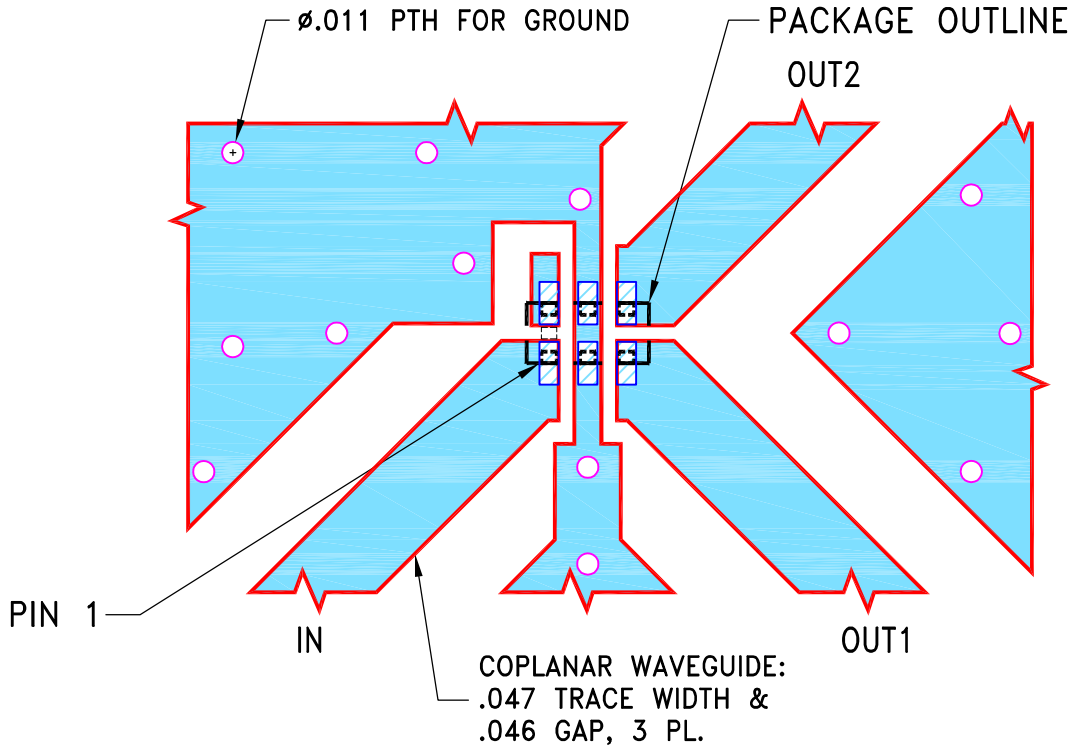
THIRD ANGLE PROJECTION



REVISIONS

| REV | ECN No. | DESCRIPTION | DATE | DR | AUTH |
|-----|---------|-------------|----------|-----|------|
| OR | M166452 | NEW RELEASE | 02/22/18 | ITG | BK |
| | | | | | |
| | | | | | |

SUGGESTED MOUNTING CONFIGURATION
FOR JC0603C CASE STYLE, "06TR01" PIN CODE

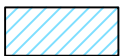


NOTES:

1. TRACE WIDTH & GAP PARAMETERS ARE SHOWN FOR ROGERS R04350B WITH DIELECTRIC THICKNESS .020±.0015. COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH & 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 TOLERANCES ON: 2 PL DECIMALS ± 3 PL DECIMALS ± .005 ANGLES ± FRACTIONS ± | DRAWN | ITG 02/20/18 |
| | CHECKED | GF 02/21/18 |
| | APPROVED | BK 02/22/18 |



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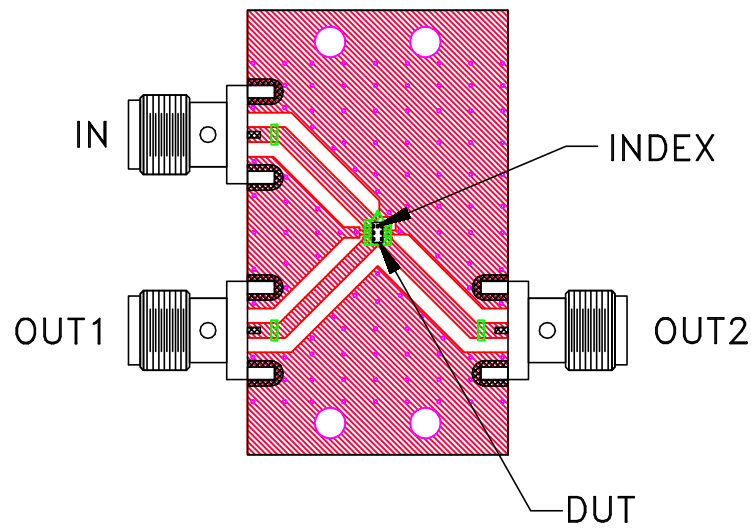
PL, 06TR01, JC0603C, TB-912+

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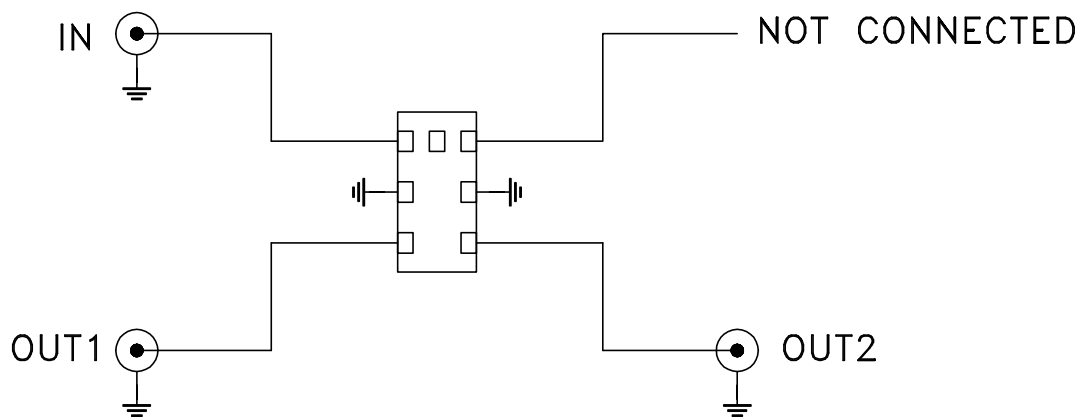
ASHEETA1.DWG REV:A DATE:01/12/95

| SIZE | CODE IDENT | DRAWING NO: | REV: |
|-------|------------|-------------|---------------|
| A | 15542 | 98-PL-574 | OR |
| FILE: | 98PL574 | SCALE: 10:1 | SHEET: 1 OF 1 |

Evaluation Board and Circuit




TB-912+



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 |