

**THE BIG DEAL**

- Tiny Size, 0603
- Low Cost
- Rugged LTCC Construction

*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**

- 5G Sub 6 GHz
- Wireless Communication

**PRODUCT OVERVIEW**

Mini-Circuits' TCW1-362+ is a tiny ceramic RF balun transformer with an impedance ratio of 1:1, covering a variety of wireless communications applications from 2150 to 3600 MHz. This model provides low insertion loss, low phase unbalance (relative to 180°), low amplitude unbalance. It provides DC isolation from input to output allowing it to be used for DC biasing of external circuits at the output. 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                                                                                                                                                               |
|----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| DC Isolated from Input to Output | Can be used to DC bias external circuits at the output.                                                                                                                  |
| 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. |



Mini-Circuits

CERAMIC BALUN

# RF Transformer

TCW1-362+

50Ω 2150 to 3600 MHz 1:1 Ratio

## ELECTRICAL SPECIFICATIONS AT +25°C

| Parameter                          | Frequency (MHz) | Min. | Typ. | Max. | Units  |
|------------------------------------|-----------------|------|------|------|--------|
| Impedance Ratio                    |                 | 1    |      |      |        |
| Frequency Range                    |                 | 2150 |      | 3600 | MHz    |
| Average Insertion Loss (Over 3 dB) | 2150-3600       |      |      | 1.5  | dB     |
| Amplitude Unbalance                | 2150-3600       |      |      | 1.5  | dB     |
| Phase Unbalance <sup>1</sup>       | 2150-3600       |      |      | 13   | Degree |
| Return Loss Unbalanced Port        | 2150-3600       | 9.5  |      |      | dB     |

1. Relative to 180°.

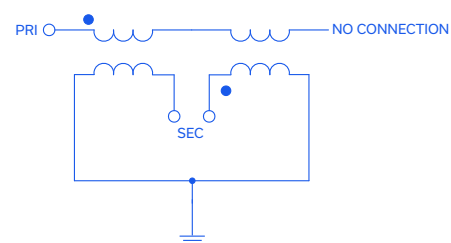
## ABSOLUTE MAXIMUM RATINGS

| Parameter                   | Ratings         |
|-----------------------------|-----------------|
| Operating Temperature       | -55°C to +125°C |
| Storage Temperature         | -55°C to +125°C |
| RF Power Input <sup>2</sup> | 0.5 W at +25°C  |

2. Passband rating.

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

## CONFIGURATION R





Mini-Circuits

CERAMIC BALUN

## RF Transformer

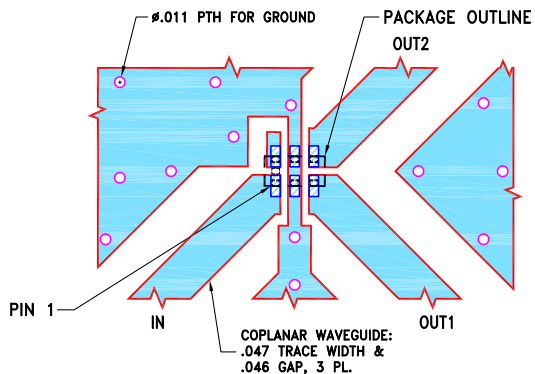
TCW1-362+

50Ω 2150 to 3600 MHz 1:1 Ratio

## PAD CONNECTIONS

|                 |     |
|-----------------|-----|
| UNBALANCED PORT | 1   |
| BALANCED PORT   | 3,4 |
| RF GROUND       | 5   |
| NO CONNECT      | 6   |
| RF GROUND       | 2   |

PRODUCT MARKING: N/A

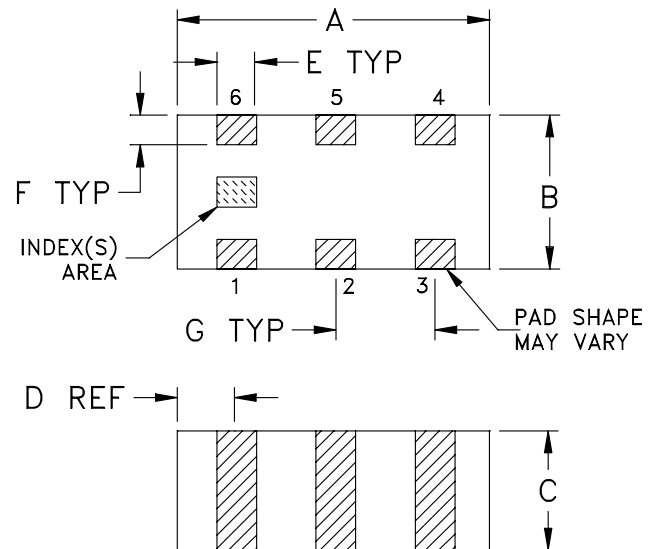
DEMO BOARD MCL P/N: TB-TCW1-362+  
SUGGESTED PCB LAYOUT (PL-574)

## NOTES:

1. TRACE WIDTH & GAP PARAMETERS ARE SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS  $.020 \pm .0015$ . 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.

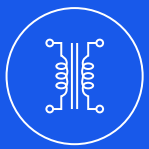
-  DENOTES PCB COPPER LAYOUT WITH SMOBC (SOLDER MASK OVER BARE COPPER).
-  DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK.

## OUTLINE DRAWING



## OUTLINE DIMENSIONS (Inches/mm)

| A    | B    | C    | D    | E    | F    | G    | wt    |
|------|------|------|------|------|------|------|-------|
| .063 | .031 | .024 | .012 | .008 | .006 | .020 | grams |
| 1.60 | 0.79 | 0.61 | 0.30 | 0.20 | 0.15 | 0.51 | 0.005 |



Mini-Circuits

CERAMIC BALUN

# RF Transformer

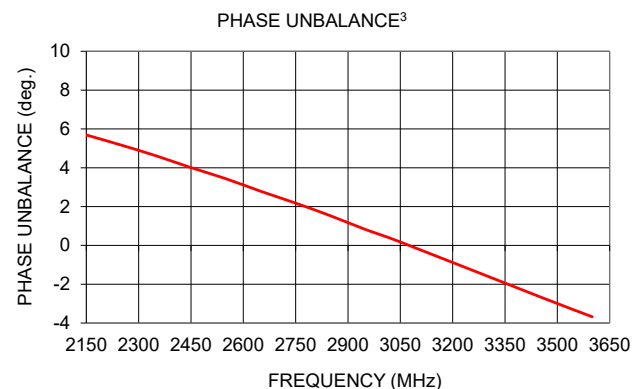
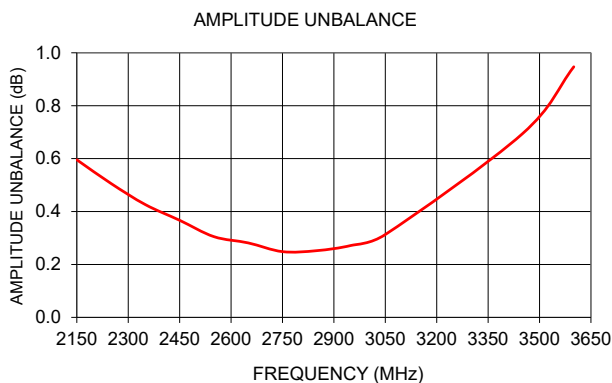
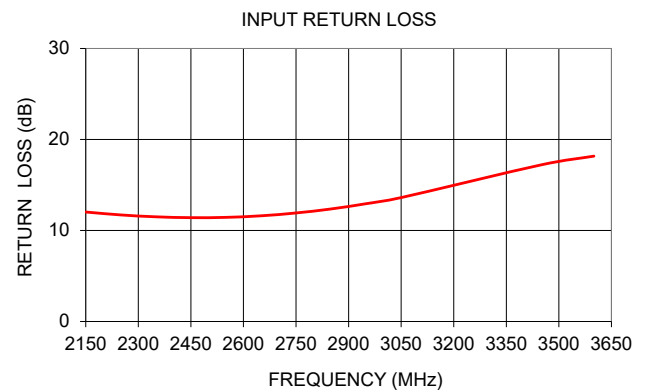
TCW1-362+

50Ω 2150 to 3600 MHz 1:1 Ratio

## TYPICAL PERFORMANCE DATA

| Frequency (MHz) | Insertion Loss (dB) | Return Loss (dB) | Amplitude Unbalance (dB) | Phase Unbalance <sup>3</sup> (deg) |
|-----------------|---------------------|------------------|--------------------------|------------------------------------|
| 2150            | 4.11                | 12.03            | 0.60                     | 5.69                               |
| 2250            | 4.13                | 11.71            | 0.51                     | 5.17                               |
| 2350            | 4.14                | 11.50            | 0.43                     | 4.62                               |
| 2450            | 4.14                | 11.41            | 0.37                     | 4.01                               |
| 2550            | 4.14                | 11.44            | 0.31                     | 3.44                               |
| 2650            | 4.13                | 11.61            | 0.28                     | 2.79                               |
| 2750            | 4.10                | 11.93            | 0.25                     | 2.18                               |
| 2850            | 4.07                | 12.37            | 0.25                     | 1.53                               |
| 2950            | 4.04                | 12.94            | 0.27                     | 0.82                               |
| 3050            | 4.01                | 13.62            | 0.31                     | 0.18                               |
| 3450            | 3.95                | 17.22            | 0.69                     | -2.65                              |
| 3600            | 3.98                | 18.17            | 0.95                     | -3.68                              |

3. Relative to 180°.



- NOTES
- 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.
  - Electrical specifications and performance data contained in this specification document are based on Mini-Circuit's applicable established test performance criteria and measurement instructions.
  - 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)

