

# Surface Mount Directional Coupler

50Ω 10 dB Coupling 50 to 6000 MHz

## Maximum Ratings

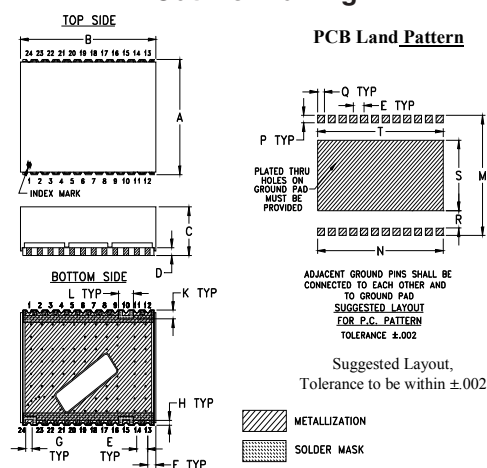
|                                                                 |                |
|-----------------------------------------------------------------|----------------|
| Operating Temperature                                           | -40°C to 85°C  |
| Storage Temperature                                             | -55°C to 100°C |
| Permanent damage may occur if any of these limits are exceeded. |                |

## Pad Connections

|         |            |
|---------|------------|
| INPUT   | 10         |
| OUTPUT  | 24         |
| COUPLED | 15         |
| GROUND  | ALL OTHERS |

## Outline Drawing

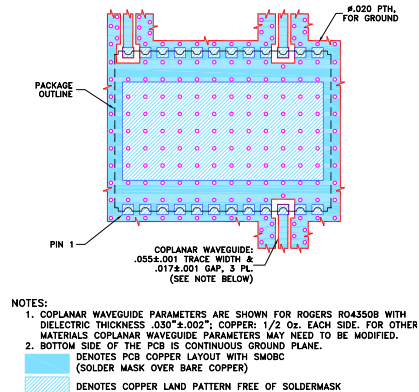
### PCB Land Pattern



## Outline Dimensions (inch)

| A     | B     | C     | D    | E    | F     | G     | H     | K     |
|-------|-------|-------|------|------|-------|-------|-------|-------|
| .93   | 1.26  | .39   | .062 | .100 | .078  | 0.06  | .040  | .070  |
| 23.62 | 32.00 | 9.91  | 1.57 | 2.54 | 1.98  | 1.52  | 1.02  | 1.78  |
| L     | M     | N     | P    | Q    | R     | S     | T     | wt    |
| .140  | .970  | 1.165 | .060 | .065 | 0.140 | 0.570 | 1.165 | grams |
| 3.56  | 24.64 | 29.59 | 1.52 | 1.65 | 3.56  | 14.48 | 29.59 | 7.3   |

## Demo Board MCL P/N: TB-605+ Suggested PCB Layout (PL-437)



- NOTES:
1. COPLANAR WAVEGUIDE PARAMETERS ARE SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS .030"±.002"; COPPER: 1/2 Oz. EACH SIDE. FOR OTHER MATERIALS COPLANAR WAVEGUIDE PARAMETERS MAY NEED TO BE MODIFIED.
  2. BOTTOM SIDE OF THE PCB IS CONTINUOUS GROUND PLANE.
  3. DENOTES PCB COPPER LAYOUT WITH SMOBC (SOLDER MASK OVER BARE COPPER)
  4. DENOTES COPPER LAND PATTERN FREE OF SOLDERMASK

## Features

- wideband, 50-6000 MHz
- flat coupling, ±0.5 dB typ.
- high directivity, 28 dB typ.

## Applications

- military defense
- signal monitoring

Generic photo used for illustration purposes only

CASE STYLE: BL301-1

## +RoHS Compliant

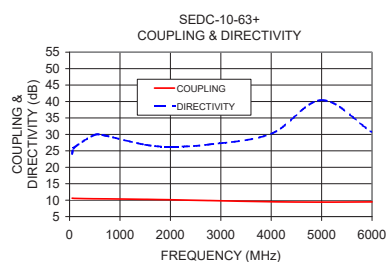
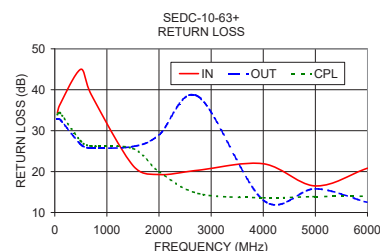
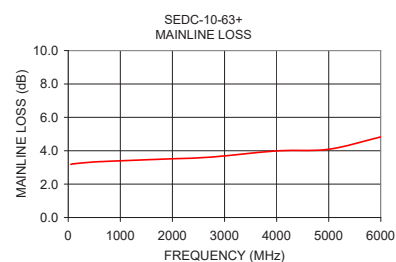
The +Suffix identifies RoHS Compliance. See our web site for RoHS Compliance methodologies and qualifications

## Electrical Specifications at 25°C

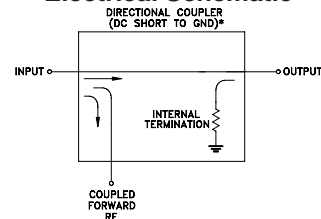
| Parameter                                      | Condition (MHz) | Min. | Typ. | Max. | Unit |
|------------------------------------------------|-----------------|------|------|------|------|
| Frequency Range                                |                 | 50   |      | 6000 | MHz  |
| Mainline Loss (above theoretical loss, 0.4 dB) | 50-6000         | —    | 4.0  | 5.5  | dB   |
| Coupling                                       | 50-6000         | 9.0  | 10.0 | 11.0 | dB   |
| Coupling Flatness(±)                           | 50-6000         | —    | 0.5  | 1.0  | dB   |
| Directivity                                    | 50              | 22.5 | 24   | —    | dB   |
|                                                | 700             | 26.0 | 29   | —    |      |
|                                                | 2750            | 23.0 | 27   | —    |      |
|                                                | 6000            | 23.0 | 24   | —    |      |
| Return Loss (Input)                            | 50-6000         | —    | 18   | —    | dB   |
| Return Loss (Output)                           | 50-6000         | —    | 14   | —    | dB   |
| Return Loss (Coupling)                         | 50-6000         | —    | 14   | —    | dB   |
| Input Power                                    | 50-6000         | —    | —    | 1.0  | W    |

## Typical Performance Data

| Frequency (MHz) | Mainline Loss (dB) In-Out | Coupling (dB) In-Cpl | Directivity (dB) | Return Loss (dB) In | Return Loss (dB) Out | Cpl   |
|-----------------|---------------------------|----------------------|------------------|---------------------|----------------------|-------|
| 50.00           | 3.18                      | 10.59                | 24.05            | 34.33               | 32.85                | 33.95 |
| 100.00          | 3.22                      | 10.53                | 26.08            | 36.42               | 32.73                | 34.33 |
| 500.00          | 3.33                      | 10.42                | 29.85            | 45.01               | 26.62                | 27.42 |
| 700.00          | 3.36                      | 10.39                | 29.64            | 38.81               | 25.78                | 26.25 |
| 1500.00         | 3.46                      | 10.25                | 26.85            | 21.47               | 26.12                | 25.64 |
| 2000.00         | 3.52                      | 10.11                | 26.30            | 19.27               | 28.93                | 19.99 |
| 2750.00         | 3.62                      | 9.89                 | 26.90            | 20.32               | 38.36                | 14.66 |
| 4000.00         | 3.99                      | 9.52                 | 30.19            | 21.92               | 13.01                | 13.61 |
| 5000.00         | 4.09                      | 9.40                 | 40.39            | 16.49               | 15.79                | 13.89 |
| 6000.00         | 4.83                      | 9.47                 | 30.65            | 20.83               | 12.48                | 13.99 |



## Electrical Schematic



\* ELECTRICAL SCHEMATIC IS FOR DIRECTIONAL COUPLER WITH INTERNAL TRANSFORMER(S) THAT ROUTES DC FROM RF PORTS TO GROUND.

## 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-Circuits' 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)



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REV. B  
M152930  
ED-14849/5  
SEDC-10-63+  
DJ/WP/AM  
20505  
Page 1 of 1

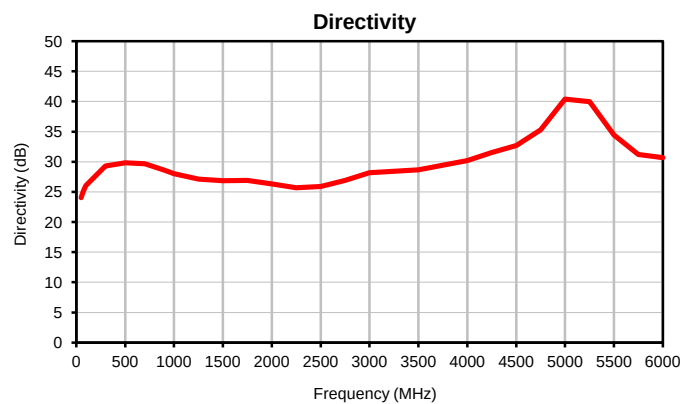
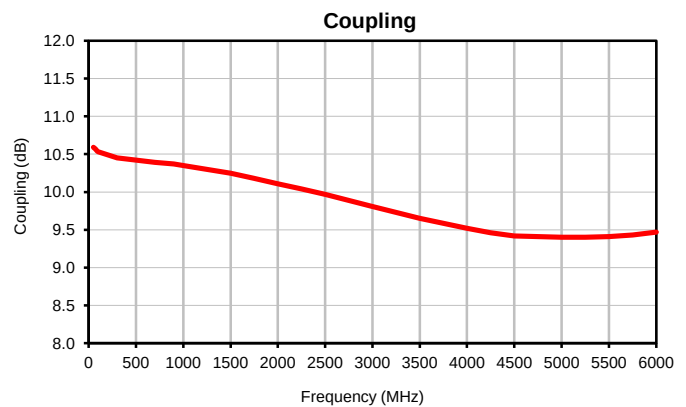
# Directional Coupler

## SEDC-10-63+

### Typical Performance Data

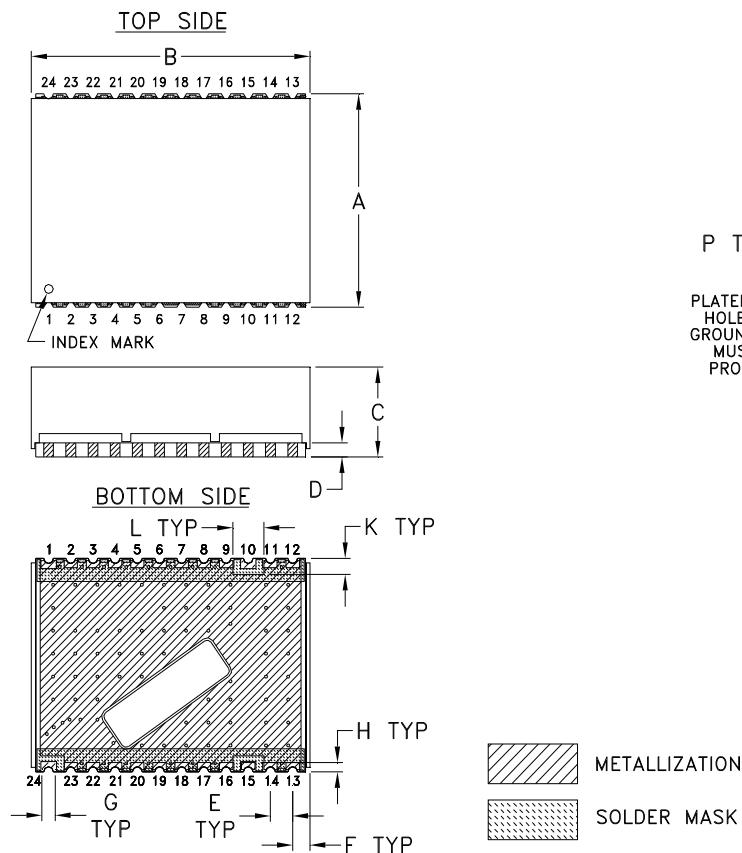
| FREQUENCY<br>(MHz) | INSERTION<br>LOSS<br>(dB) | COUPLING<br>(dB) | DIRECTIVITY<br>(dB) | RETURN LOSS<br>(dB) |       |       |
|--------------------|---------------------------|------------------|---------------------|---------------------|-------|-------|
|                    |                           |                  |                     | IN                  | OUT   | CPL   |
| 50.0               | 3.18                      | 10.59            | 24.05               | 34.33               | 32.85 | 33.95 |
| 70.0               | 3.20                      | 10.57            | 24.99               | 35.35               | 32.95 | 34.37 |
| 90.0               | 3.21                      | 10.54            | 25.75               | 36.08               | 32.81 | 34.42 |
| 100.0              | 3.22                      | 10.53            | 26.08               | 36.42               | 32.73 | 34.33 |
| 300.0              | 3.29                      | 10.45            | 29.32               | 39.15               | 28.77 | 30.38 |
| 500.0              | 3.33                      | 10.42            | 29.85               | 45.01               | 26.62 | 27.42 |
| 700.0              | 3.36                      | 10.39            | 29.64               | 38.81               | 25.78 | 26.25 |
| 900.0              | 3.38                      | 10.37            | 28.59               | 30.97               | 25.58 | 25.96 |
| 1000.0             | 3.39                      | 10.35            | 28.02               | 28.33               | 25.61 | 25.97 |
| 1250.0             | 3.42                      | 10.30            | 27.12               | 23.98               | 25.68 | 26.47 |
| 1500.0             | 3.46                      | 10.25            | 26.85               | 21.47               | 26.12 | 25.64 |
| 1750.0             | 3.49                      | 10.18            | 26.88               | 20.04               | 27.36 | 22.96 |
| 2000.0             | 3.52                      | 10.11            | 26.30               | 19.27               | 28.93 | 19.99 |
| 2250.0             | 3.56                      | 10.04            | 25.69               | 18.98               | 30.80 | 17.61 |
| 2500.0             | 3.59                      | 9.97             | 25.89               | 19.27               | 36.12 | 15.84 |
| 2750.0             | 3.62                      | 9.89             | 26.90               | 20.32               | 38.36 | 14.66 |
| 3000.0             | 3.66                      | 9.81             | 28.16               | 22.50               | 25.80 | 13.87 |
| 3500.0             | 3.81                      | 9.65             | 28.66               | 26.72               | 16.46 | 13.43 |
| 4000.0             | 3.99                      | 9.52             | 30.19               | 21.92               | 13.01 | 13.61 |
| 4250.0             | 4.07                      | 9.46             | 31.53               | 19.71               | 12.57 | 13.69 |
| 4500.0             | 4.11                      | 9.42             | 32.68               | 18.05               | 12.83 | 13.72 |
| 4750.0             | 4.11                      | 9.41             | 35.31               | 16.96               | 13.77 | 13.78 |
| 5000.0             | 4.09                      | 9.40             | 40.39               | 16.49               | 15.79 | 13.89 |
| 5250.0             | 4.10                      | 9.40             | 39.98               | 16.58               | 20.05 | 14.09 |
| 5500.0             | 4.19                      | 9.41             | 34.44               | 17.73               | 27.46 | 14.11 |
| 5750.0             | 4.44                      | 9.43             | 31.20               | 20.10               | 18.53 | 14.20 |
| 6000.0             | 4.83                      | 9.47             | 30.65               | 20.83               | 12.48 | 13.99 |

## Typical Performance Curves

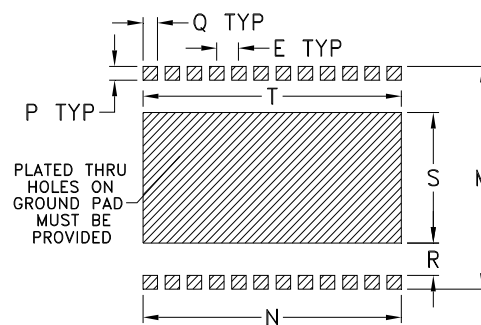


## Outline Dimensions

BL301-1



## PCB Land Pattern



ADJACENT GROUND PINS SHALL BE CONNECTED TO EACH OTHER AND TO GROUND PAD  
SUGGESTED LAYOUT FOR P.C. PATTERN  
TOLERANCE  $\pm .002$

| CASE #  | A              | B               | C             | D              | E              | F              | G              | H              | J        | K              | L              |
|---------|----------------|-----------------|---------------|----------------|----------------|----------------|----------------|----------------|----------|----------------|----------------|
| BL301-1 | .93<br>(23.62) | 1.26<br>(32.00) | .39<br>(9.91) | .062<br>(1.57) | .100<br>(2.54) | .078<br>(1.98) | .060<br>(1.52) | .040<br>(1.02) | --<br>-- | .070<br>(1.78) | .140<br>(3.56) |

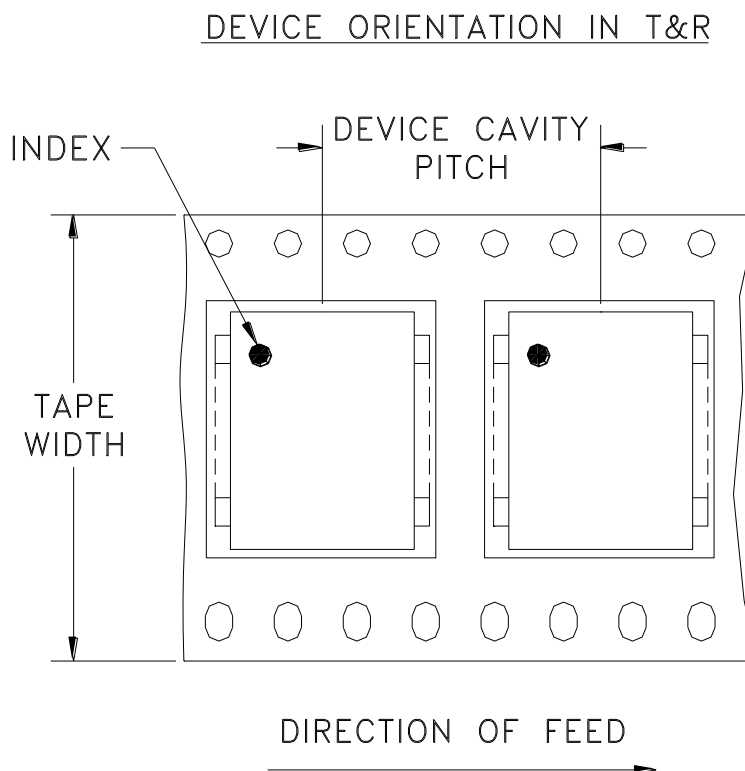
| CASE#   | M               | N                | P              | Q              | R              | S               | T                | U        | WT. GRAM |
|---------|-----------------|------------------|----------------|----------------|----------------|-----------------|------------------|----------|----------|
| BL301-1 | .970<br>(24.64) | 1.165<br>(29.59) | .060<br>(1.52) | .065<br>(1.65) | .140<br>(3.56) | .570<br>(14.48) | 1.165<br>(29.59) | --<br>-- | 7.3      |

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

### Notes:

- Case material: Plastic.
- Base material: Printed wiring laminate.
- Termination finish:
  - For RoHS Case Styles: Tin plate over Nickel plate. All models, (+) suffix.
  - For RoHS-5 Case Styles: Tin-Lead plate. All models, no (+) suffix.

# Tape & Reel Packaging TR-F25



| Tape Width,<br>mm | Device Cavity<br>Pitch, mm | Reel Size,<br>inches | Devices per Reel                             |     |
|-------------------|----------------------------|----------------------|----------------------------------------------|-----|
| 44                | 32                         | 13                   | Small<br>quantity<br>standards<br>(see note) | 20  |
|                   |                            |                      |                                              | 50  |
|                   |                            |                      |                                              | 100 |
|                   |                            |                      | Standard                                     | 125 |

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)



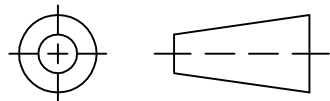
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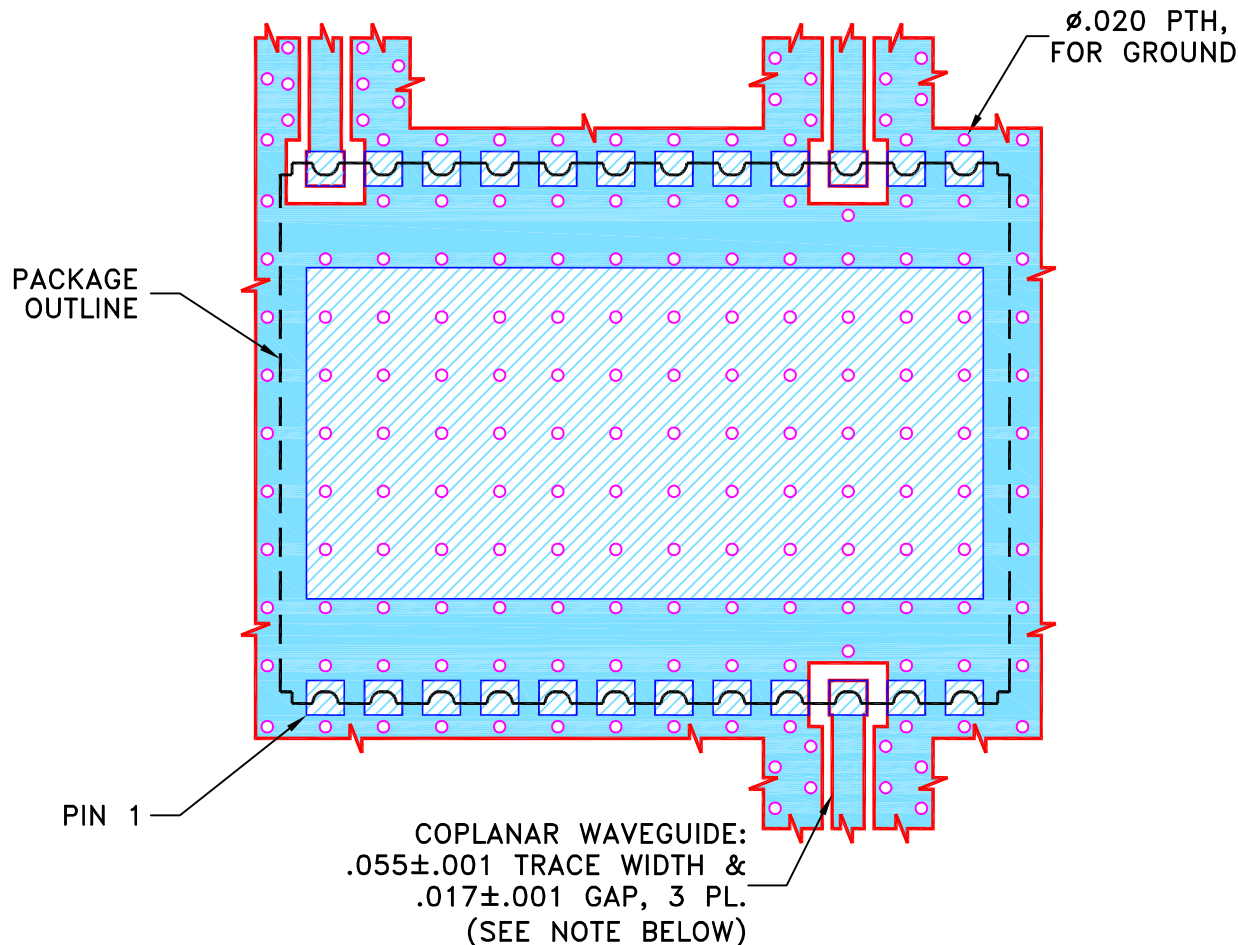
## THIRD ANGLE PROJECTION



## REVISIONS

| REV | ECN No. | DESCRIPTION | DATE     | DR  | AUTH |
|-----|---------|-------------|----------|-----|------|
| OR  | M148377 | NEW RELEASE | 12/30/14 | ITG | DJ   |
|     |         |             |          |     |      |
|     |         |             |          |     |      |

**SUGGESTED MOUNTING CONFIGURATION FOR  
BL301-1 CASE STYLE "24BT01" PIN CODE**



## NOTES:

1. COPLANAR WAVEGUIDE PARAMETERS ARE SHOWN FOR ROGERS R04350B WITH DIELECTRIC THICKNESS  $.030 \pm .002$ "; COPPER: 1/2 Oz. EACH SIDE. FOR OTHER MATERIALS COPLANAR WAVEGUIDE PARAMETERS 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 SOLDERMASK

UNLESS OTHERWISE SPECIFIED

INITIALS

DATE

DIMENSIONS ARE IN INCHES

DRAWN

ITG

12/17/14

TOLERANCES ON:

CHECKED

GF

12/30/14

2 PL DECIMALS  $\pm$ 

APPROVED

DJ

12/30/14

3 PL DECIMALS  $\pm$  .005"ANGLES  $\pm$ FRACTIONS  $\pm$ 
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ASHEETA1.DWG REV:A DATE:01/12/95



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PL, 24BT01, BL301-1, TB-605+

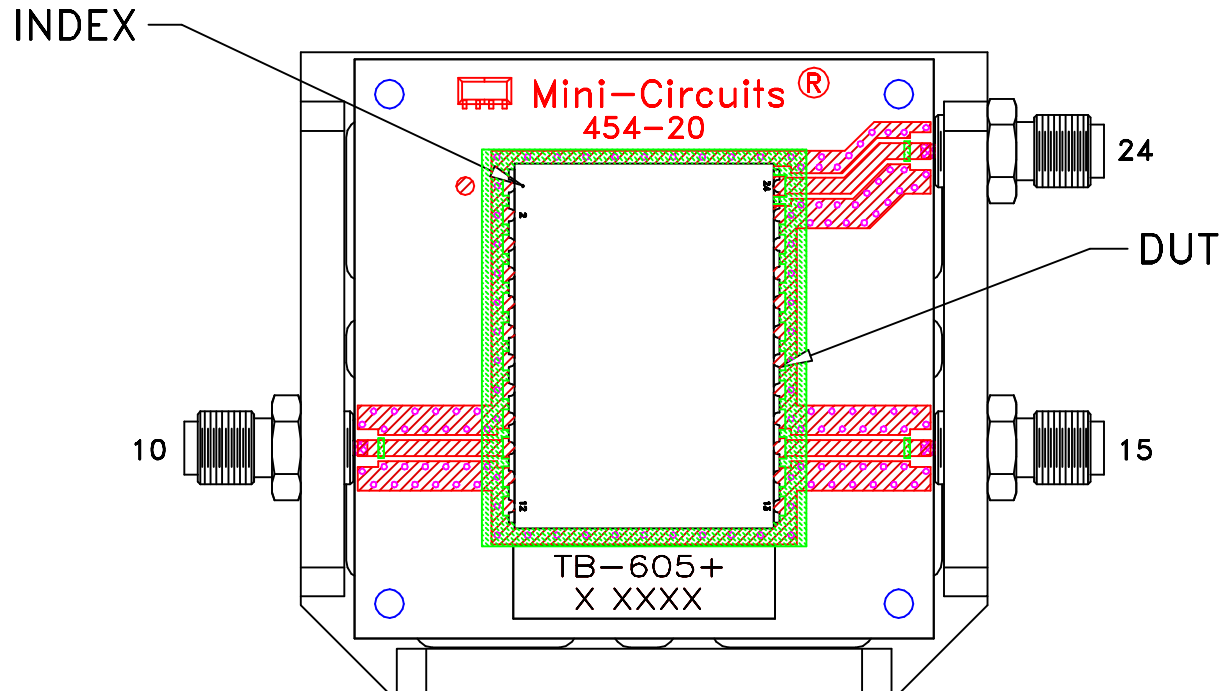
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98-PL-437REV:  
OR

FILE: 98PL437

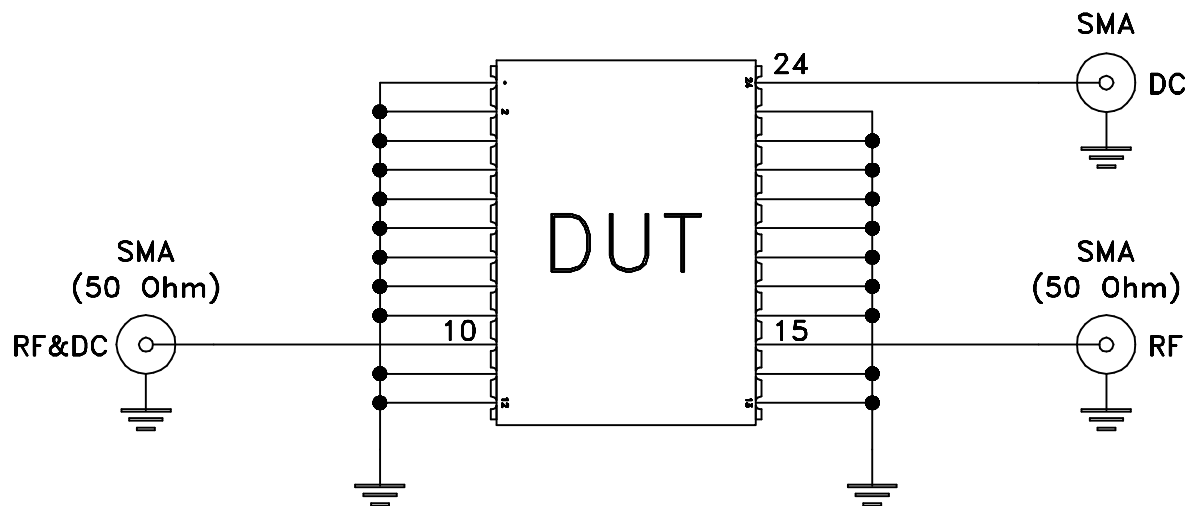
SCALE: 3:1

SHEET: 1 OF 1

# Evaluation Board and Circuit



TB-605+



Schematic Diagram

## Notes:

1. 50 Ohm SMA Female connectors.
2. PCB Material: ROGERS R04350B or equivalent.  
Dielectric Constant=2.5, Thickness=0.22 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                                                                          |
| HAST                           | 130°C, 85% RH, 96 hours                                                                                                                                         | JESD22-A110                                                                                          |
| 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 Eutectic Process: 225°C peak<br>Pb-Free Process, 245°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, 20-2000 Hz, 4 times in each of three axes (total 12)                                                                                                  | MIL-STD-883, Method 2007.3, Condition A                                                              |
| Mechanical Shock               | 50g, 11 ms, 1/2-sine, 18 shocks: 3 each direction, each of 3 axes                                                                                               | MIL-STD-202, Method 213, Condition A                                                                 |
| Marking Resistance to Solvents | Isopropyl alcohol + mineral spirits at 25°C; terpene defluxer at 25°C;<br>distilled water + proylene glycol monomethyl ether + monoethanolamine at 63°C to 70°C | MIL-STD-202, Method 215                                                                              |