

# Surface Mount Directional Coupler

50Ω 5 to 500 MHz

LRDC-10-1J+

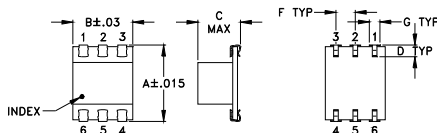
## Maximum Ratings

|                                                                 |                |
|-----------------------------------------------------------------|----------------|
| 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. |                |

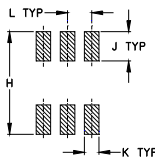
## Pin Connections

|                      |     |
|----------------------|-----|
| INPUT                | 6   |
| OUTPUT               | 1   |
| COUPLED              | 4   |
| GROUND               | 2,5 |
| ISOLATE (DO NOT USE) | 3   |

## Outline Drawing



### PCB Land Pattern

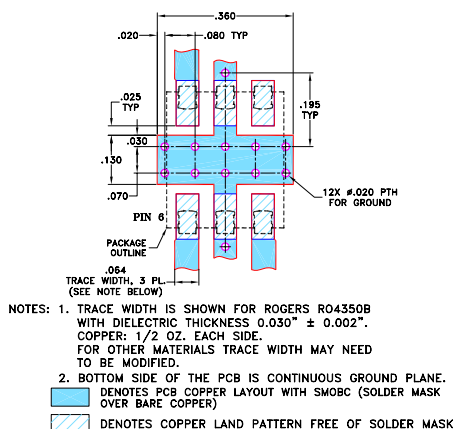


Suggested Layout,  
Tolerance to be within ±.002

## Outline Dimensions (inch)

| A     | B    | C    | D    | E    | F     | G    |
|-------|------|------|------|------|-------|------|
| .400  | .31  | .200 | .10  | .10  | .100  | .050 |
| 10.16 | 7.87 | 5.08 | 2.54 | 0.25 | 2.54  | 1.27 |
| H     | J    | K    | L    | M    | wt    |      |
| .420  | .120 | .060 | .100 | .020 | grams |      |
| 10.67 | 3.05 | 1.52 | 2.54 | 0.51 | 0.55  |      |

## Demo Board MCL P/N: TB-31 Suggested PCB Layout (PL-087)



- NOTES:
1. TRACE WIDTH IS SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS 0.030" ± 0.002". COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH 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

### 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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## Features

- low mainline loss, 0.9 dB typ.
- high directivity, 30 dB typ.
- aqueous washable
- J-leads for strain relief and excellent solderability

## Applications

- VHF/UHF
- reflective power measurements
- communications
- signal sampling



Generic photo used for illustration purposes only

CASE STYLE: QQQ569

### +RoHS Compliant

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

## Directional Coupler Electrical Specifications

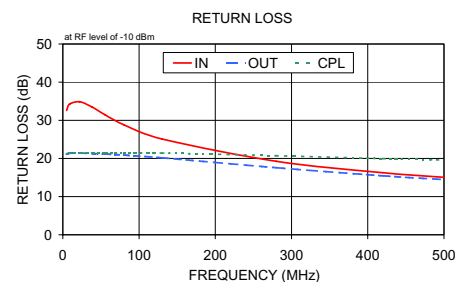
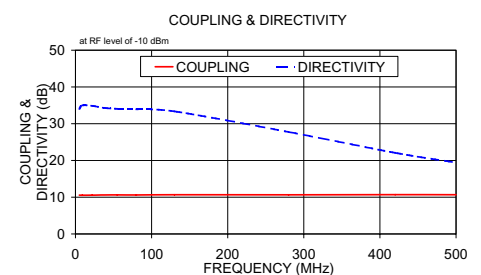
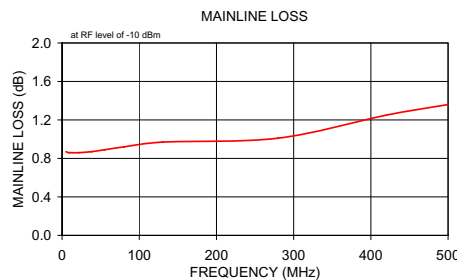
| FREQ.<br>(MHz) | COUPLING<br>(dB)               |      | MAINLINE LOSS <sup>1</sup><br>(dB) |      |      |      |      |      | DIRECTIVITY<br>(dB) |      |      |      |      |      | VSWR<br>(:1) | POWER<br>INPUT, W |      |    |
|----------------|--------------------------------|------|------------------------------------|------|------|------|------|------|---------------------|------|------|------|------|------|--------------|-------------------|------|----|
|                |                                |      | L                                  |      | M    |      | U    |      | L                   |      | M    |      | U    |      |              |                   |      |    |
|                | f <sub>L</sub> -f <sub>U</sub> | Nom. | Flatness                           | Typ. | Max. | Typ. | Max. | Typ. | Max.                | Typ. | Min. | Typ. | Min. | Typ. | Min.         | Typ.              | Max. | MU |
| 5-500          | 10.7±0.5                       | ±0.5 | 0.9                                | 1.4  | 0.9  | 1.4  | 1.2  | 1.9  | 31                  | 25   | 30   | 20   | 25   | 16   | 1.2          | 1.0               | 1.0  |    |

L = low range [ $f_L$  to  $10 f_L$ ] M = mid range [ $10 f_L$  to  $f_U/2$ ] U = upper range [ $f_U/2$  to  $f_U$ ]

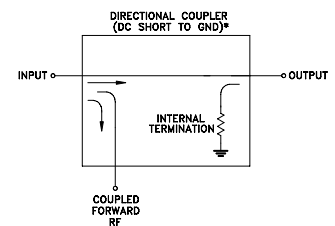
1. Mainline loss includes theoretical power loss at coupled port.

## Typical Performance Data

| Frequency<br>(MHz) | Mainline Loss<br>(dB)<br>In-Out | Coupling<br>(dB)<br>In-Cpl | Directivity<br>(dB) | Return Loss<br>(dB) |       |       |
|--------------------|---------------------------------|----------------------------|---------------------|---------------------|-------|-------|
|                    |                                 |                            |                     | In                  | Out   | Cpl   |
| 5.00               | 0.87                            | 10.56                      | 34.05               | 32.58               | 21.08 | 21.19 |
| 9.00               | 0.86                            | 10.55                      | 34.98               | 34.24               | 21.38 | 21.44 |
| 22.00              | 0.86                            | 10.57                      | 34.87               | 34.86               | 21.43 | 21.53 |
| 38.00              | 0.87                            | 10.61                      | 34.30               | 33.52               | 21.31 | 21.52 |
| 55.00              | 0.89                            | 10.62                      | 34.06               | 31.49               | 21.16 | 21.52 |
| 80.00              | 0.92                            | 10.61                      | 33.94               | 28.84               | 20.90 | 21.53 |
| 130.00             | 0.97                            | 10.68                      | 33.37               | 25.10               | 20.17 | 21.41 |
| 280.00             | 1.01                            | 10.66                      | 27.76               | 19.24               | 17.58 | 20.72 |
| 420.00             | 1.25                            | 10.69                      | 22.09               | 16.25               | 15.45 | 19.95 |
| 500.00             | 1.36                            | 10.67                      | 19.44               | 15.06               | 14.47 | 19.60 |



## Electrical Schematic



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



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REV. C  
ECO-006040  
LRDC-10-1J  
WZ/TD/CP/AM  
210208

# Directional Coupler

# LRDC-10-1J+

## Typical Performance Data

| FREQUENCY<br>(MHz) | INSERTION<br>LOSS<br>(dB) | COUPLING<br>(dB) | DIRECTIVITY<br>(dB) | RETURN LOSS |       |       |
|--------------------|---------------------------|------------------|---------------------|-------------|-------|-------|
|                    |                           |                  |                     | IN          | OUT   | CPL   |
| 5.0                | 0.87                      | 10.56            | 34.05               | 32.58       | 21.08 | 21.19 |
| 6.0                | 0.86                      | 10.56            | 34.44               | 33.23       | 21.19 | 21.29 |
| 7.0                | 0.86                      | 10.55            | 34.65               | 33.67       | 21.28 | 21.35 |
| 8.0                | 0.85                      | 10.55            | 34.83               | 34.00       | 21.33 | 21.41 |
| 9.0                | 0.86                      | 10.55            | 34.98               | 34.24       | 21.38 | 21.44 |
| 10.0               | 0.85                      | 10.54            | 35.09               | 34.41       | 21.40 | 21.47 |
| 14.0               | 0.85                      | 10.55            | 35.08               | 34.86       | 21.45 | 21.51 |
| 18.0               | 0.85                      | 10.56            | 35.12               | 34.94       | 21.43 | 21.51 |
| 22.0               | 0.86                      | 10.57            | 34.87               | 34.86       | 21.43 | 21.53 |
| 26.0               | 0.86                      | 10.58            | 34.65               | 34.62       | 21.40 | 21.52 |
| 30.0               | 0.86                      | 10.59            | 34.60               | 34.30       | 21.37 | 21.52 |
| 34.0               | 0.87                      | 10.60            | 34.34               | 33.93       | 21.33 | 21.52 |
| 38.0               | 0.87                      | 10.61            | 34.30               | 33.52       | 21.31 | 21.52 |
| 42.0               | 0.87                      | 10.61            | 34.23               | 33.03       | 21.27 | 21.52 |
| 46.0               | 0.87                      | 10.62            | 34.25               | 32.56       | 21.23 | 21.51 |
| 50.0               | 0.88                      | 10.62            | 34.14               | 32.09       | 21.20 | 21.52 |
| 55.0               | 0.89                      | 10.62            | 34.06               | 31.49       | 21.16 | 21.52 |
| 60.0               | 0.90                      | 10.63            | 34.05               | 30.91       | 21.11 | 21.52 |
| 65.0               | 0.91                      | 10.63            | 34.03               | 30.35       | 21.06 | 21.54 |
| 70.0               | 0.92                      | 10.63            | 33.92               | 29.82       | 21.01 | 21.53 |
| 75.0               | 0.92                      | 10.62            | 33.94               | 29.32       | 20.96 | 21.54 |
| 80.0               | 0.92                      | 10.61            | 33.94               | 28.84       | 20.90 | 21.53 |
| 85.0               | 0.92                      | 10.62            | 33.76               | 28.39       | 20.83 | 21.52 |
| 90.0               | 0.92                      | 10.62            | 33.87               | 27.95       | 20.79 | 21.53 |
| 95.0               | 0.92                      | 10.62            | 33.66               | 27.53       | 20.72 | 21.52 |
| 100.0              | 0.92                      | 10.64            | 33.81               | 27.13       | 20.64 | 21.50 |
| 130.0              | 0.97                      | 10.68            | 33.37               | 25.10       | 20.17 | 21.41 |
| 160.0              | 0.96                      | 10.64            | 32.79               | 23.53       | 19.67 | 21.30 |
| 190.0              | 0.97                      | 10.67            | 31.74               | 22.20       | 19.16 | 21.20 |
| 220.0              | 1.09                      | 10.73            | 30.65               | 21.04       | 18.61 | 21.05 |
| 250.0              | 1.02                      | 10.65            | 29.27               | 20.08       | 18.07 | 20.87 |
| 280.0              | 1.01                      | 10.66            | 27.76               | 19.24       | 17.58 | 20.72 |
| 310.0              | 1.24                      | 10.76            | 26.53               | 18.45       | 17.07 | 20.55 |
| 340.0              | 1.09                      | 10.66            | 25.25               | 17.76       | 16.58 | 20.35 |
| 370.0              | 1.09                      | 10.64            | 23.97               | 17.16       | 16.13 | 20.19 |
| 400.0              | 1.33                      | 10.75            | 22.82               | 16.61       | 15.73 | 20.07 |
| 420.0              | 1.25                      | 10.69            | 22.09               | 16.25       | 15.45 | 19.95 |
| 440.0              | 1.17                      | 10.62            | 21.37               | 15.92       | 15.18 | 19.85 |
| 460.0              | 1.25                      | 10.67            | 20.65               | 15.61       | 14.94 | 19.75 |
| 480.0              | 1.42                      | 10.72            | 20.06               | 15.33       | 14.70 | 19.66 |
| 500.0              | 1.36                      | 10.67            | 19.44               | 15.06       | 14.47 | 19.60 |

REV. X1  
LRDC-10-1J+  
060718  
Page 1 of 1



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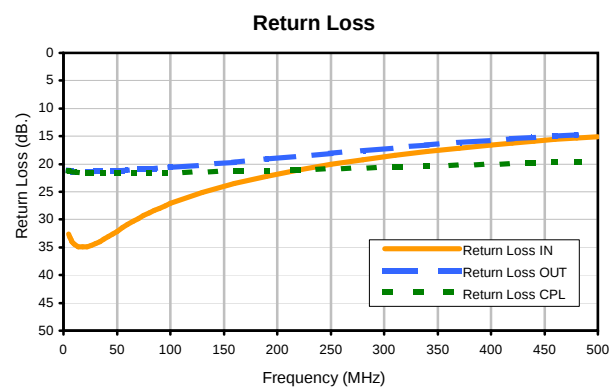
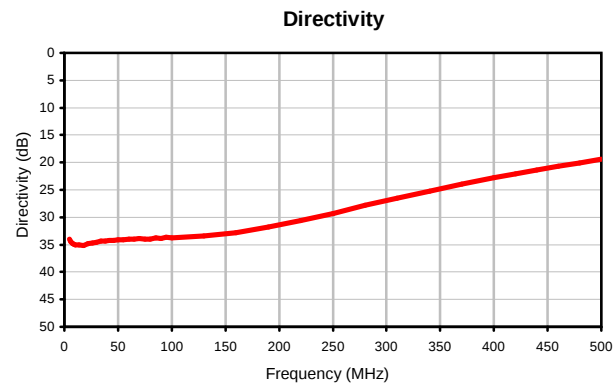
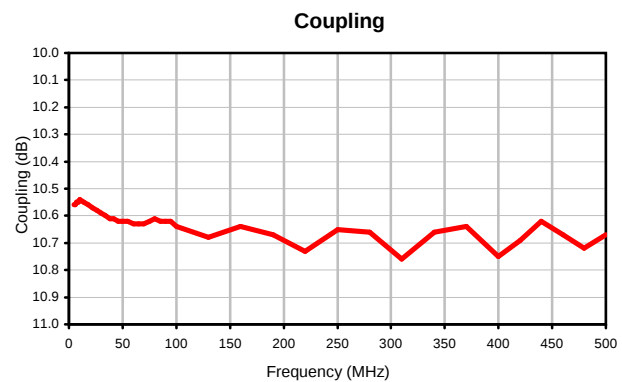
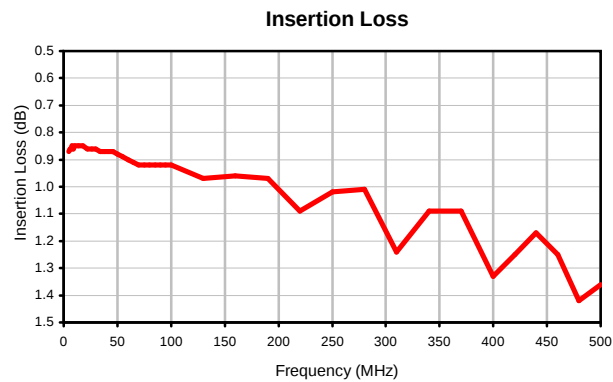
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# Directional Coupler

LRDC-10-1J+

## Typical Performance Curves



REV. X1  
LRDC-10-1J+  
060718  
Page 1 of 1



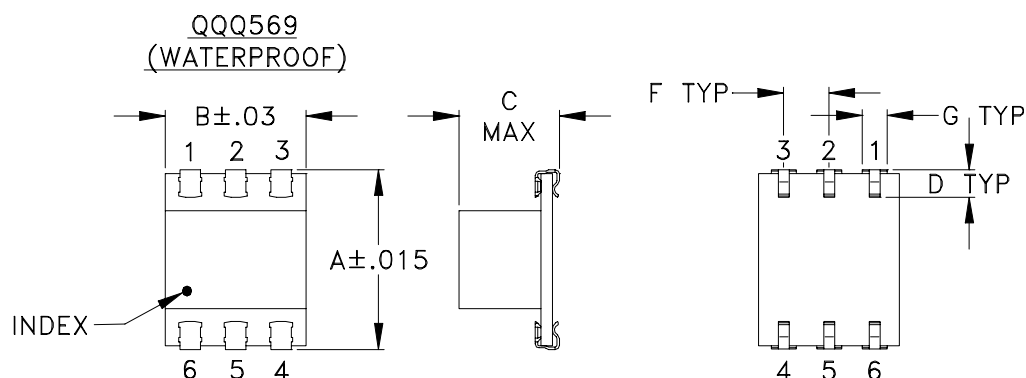
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# Case Style

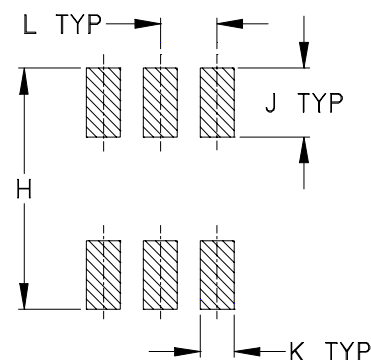
# QQQ

QQQ569 (waterproof)

## Outline Dimensions



## PCB Land Pattern



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

| CASE#  | A              | B             | C              | D              | E | F              | G              | H               | J              | K              | L              | M | WT,<br>GRAM |
|--------|----------------|---------------|----------------|----------------|---|----------------|----------------|-----------------|----------------|----------------|----------------|---|-------------|
| QQQ569 | .390<br>(9.90) | .31<br>(7.87) | .225<br>(5.72) | .060<br>(1.52) | - | .100<br>(2.54) | .045<br>(1.14) | .420<br>(10.67) | .120<br>(3.05) | .060<br>(1.52) | .100<br>(2.54) | - | .50         |

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

### Notes:

- Case material: Ceramic.
- Termination finish:
  - For RoHS Case Styles: Tin plate over Nickel plate.
  - For RoHS-5 Case Styles: Tin-Lead plate.



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# Tape & Reel Packaging TR-F5



| Tape Width,<br>mm | Device Cavity<br>Pitch, mm | Reel Size,<br>inches | Devices per Reel |
|-------------------|----------------------------|----------------------|------------------|
| 32                | 16                         | 13                   | 500              |

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)



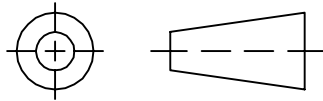
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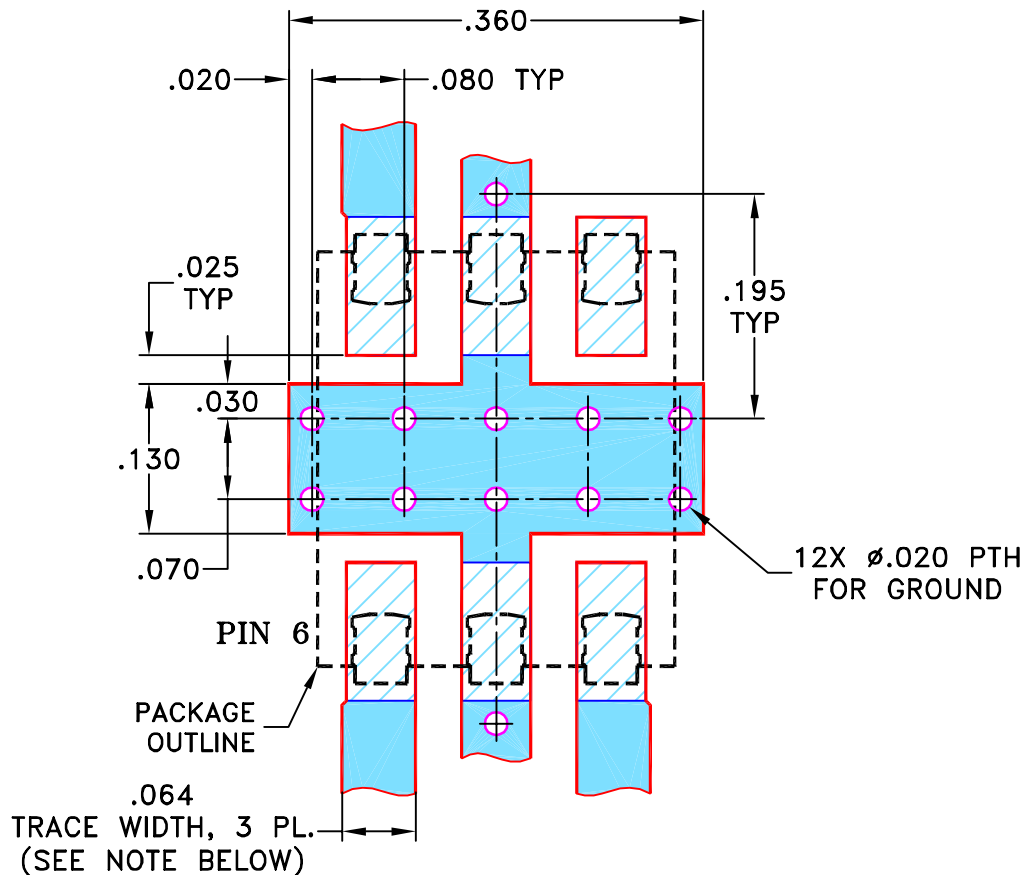
## THIRD ANGLE PROJECTION



## REVISIONS

| REV | ECN No. | DESCRIPTION                          | DATE     | DR | AUTH |
|-----|---------|--------------------------------------|----------|----|------|
| OR  | M82272  | NEW RELEASE                          | 08/06/02 | AV | DJ   |
| A   | M102713 | UPDATED NOTES, ADDED "...WITH SMOBC" | 01/16/06 | GT | IL   |
|     |         |                                      |          |    |      |
|     |         |                                      |          |    |      |

### SUGGESTED MOUNTING CONFIGURATION FOR QQQ569 CASE STYLE, "cz" PIN CONNECTION

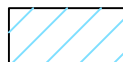


NOTES: 1. TRACE WIDTH IS SHOWN FOR ROGERS R04350B WITH DIELECTRIC THICKNESS  $0.030'' \pm 0.002''$ . COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH MAY NEED TO BE MODIFIED.

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

DRAWN

AV

07/23/02

TOLERANCES ON:

CHECKED

LC

08/06/02

2 PL DECIMALS  $\pm$

APPROVED

DJ

08/06/02

3 PL DECIMALS  $\pm$  .005

ANGLES  $\pm$

FRACTIONS  $\pm$

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PL, cz, QQQ569, LRDC-J, TB-31

SIZE  
A

CODE IDENT  
15542

DRAWING NO:  
98-PL-087

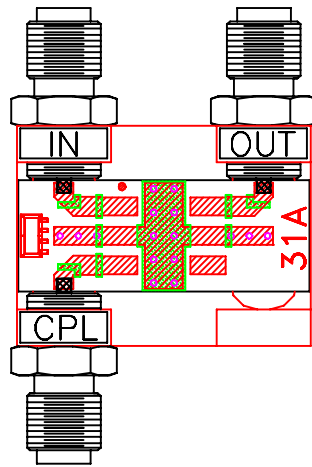
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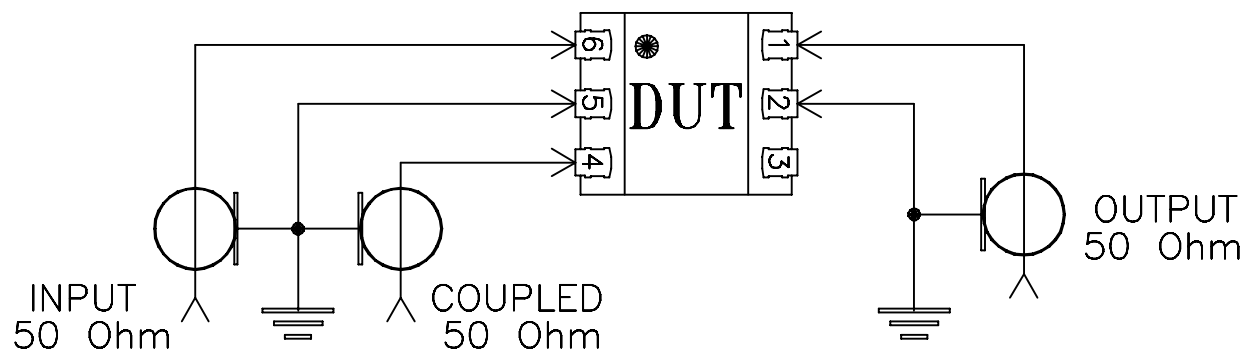
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SHEET: 1 OF 1

# Evaluation Board and Circuit



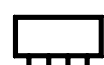
TB-31



Schematic Diagram

## Notes:

1. SMA Female connectors.
2. PCB Material: Rogers R04350 or equivalent,  
Dielectric Constant=3.5, Thickness=.030 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, 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                                                                 |
| 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                                                                              |