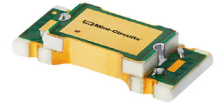


# High Power Bi-Directional Coupler

50Ω 13dB Coupling DC Pass 2700 to 6000 MHz

SYBD-13-63HP+



Generic photo used for illustration purposes only

CASE STYLE: JB1233

**+RoHS Compliant**

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

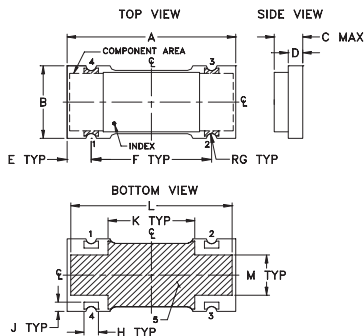
## Maximum Ratings

|                                                                 |                |
|-----------------------------------------------------------------|----------------|
| Operating Temperature                                           | -55°C to 100°C |
| Storage Temperature                                             | -55°C to 100°C |
| DC Current                                                      | 2A             |
| Permanent damage may occur if any of these limits are exceeded. |                |

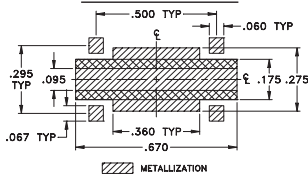
## Pin Connections

|                   |   |
|-------------------|---|
| INPUT             | 1 |
| OUTPUT            | 2 |
| COUPLED (forward) | 4 |
| COUPLED (reverse) | 3 |
| GROUND            | 5 |

## Outline Drawing



## PCB Land Pattern

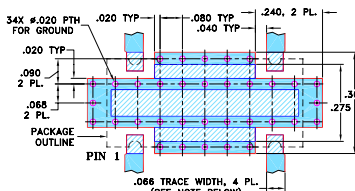


Suggested Layout,  
Tolerance to be within  $\pm 0.02$

## Outline Dimensions (inch/mm)

| A     | B    | C    | D     | E    | F     | G     |
|-------|------|------|-------|------|-------|-------|
| .70   | .32  | .13  | .060  | .100 | .500  | .022  |
| 17.78 | 8.13 | 3.30 | 1.52  | 2.54 | 12.70 | 0.56  |
| H     | J    | K    | L     | M    |       | wt    |
| .060  | .040 | .360 | .670  | .175 |       | grams |
| 1.52  | 1.02 | 9.14 | 17.02 | 4.45 |       | 0.68  |

## Demo Board MCL P/N: TB-398 Suggested PCB Layout (PL-260)



- NOTES: 1. TRACE WIDTH IS SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS .030"  $\pm$  .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.  
3. DENOTES PCB COPPER LAYOUT WITH SMOBC (SOLDER MASK OVER BARE COPPER)  
4. 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.  
C. The parts covered by this specification document are subject to Mini-Circuit's 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-Circuit's website at [www.minicircuits.com/MCLStore/terms.jsp](http://www.minicircuits.com/MCLStore/terms.jsp)

## Features

- high power handling, 25 watts typ.
- low mainline loss, 0.45 dB typ.
- excellent VSWR, 1.2:1 typ.
- excellent directivity, 20 dB typ.
- wideband frequency, 2700 to 6000 MHz

## Applications

- instrumentation
- ISM
- defense communications
- federal communications
- fixed satellite

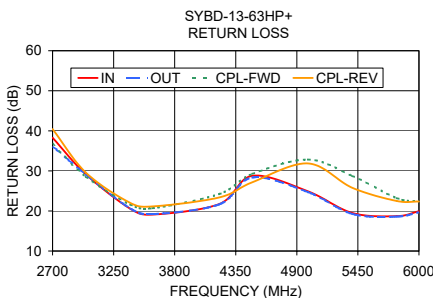
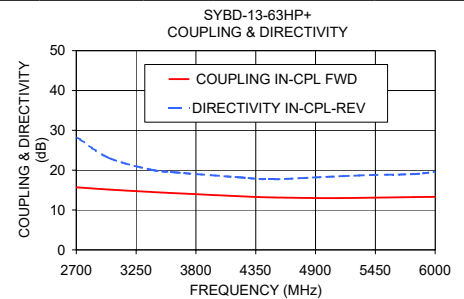
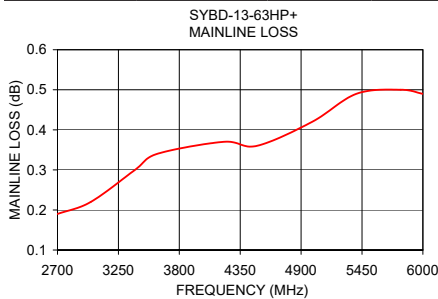
## Bi-Directional Coupler Electrical Specifications

| FREQ.<br>(MHz) | COUPLING<br>(dB) |           | MAINLINE LOSS <sup>1</sup><br>(dB) |      | DIRECTIVITY<br>(dB) |      | VSWR<br>(:1) | POWER<br>INPUT<br>(W) |
|----------------|------------------|-----------|------------------------------------|------|---------------------|------|--------------|-----------------------|
|                | Nom.             | Flatness  | Typ.                               | Max. | Typ.                | Min. |              |                       |
| $f_L$ - $f_U$  |                  |           |                                    |      |                     |      |              |                       |
| 2700-6000      |                  |           | 0.45                               | 0.80 | 20                  | 10   | 1.20         |                       |
| 2700-3000      | 15.3 $\pm$ 0.8   | $\pm$ 0.5 | 0.25                               | 0.45 | 23                  | 16   | 1.15         | 25                    |
| 3000-3600      | 14.3 $\pm$ 0.8   | $\pm$ 0.7 | 0.30                               | 0.50 | 21                  | 15   | 1.20         | 25                    |
| 3600-4500      | 13.3 $\pm$ 0.7   | $\pm$ 0.7 | 0.40                               | 0.75 | 18                  | 13   | 1.25         | 20                    |
| 4500-6000      | 12.6 $\pm$ 0.7   | $\pm$ 0.5 | 0.45                               | 0.80 | 17                  | 10   | 1.25         | 20                    |

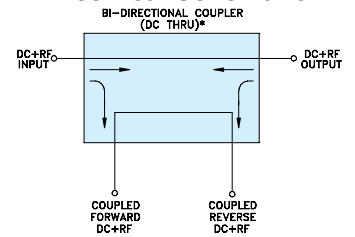
1. Mainline loss includes theoretical power loss at coupled port.

## Typical Performance Data

| Frequency<br>(MHz) | Mainline Loss<br>(dB) | Coupling<br>(dB) |             | Directivity<br>(dB) |            | Return Loss<br>(dB) |       |         |         |
|--------------------|-----------------------|------------------|-------------|---------------------|------------|---------------------|-------|---------|---------|
|                    | In-Out                | In-Cpl Fwd       | Out-Cpl Rev | Out-Cpl Fwd         | In-Cpl Rev | In                  | Out   | Cpl Fwd | Cpl Rev |
| 2700.00            | 0.19                  | 15.71            | 15.72       | 31.11               | 28.33      | 38.29               | 36.15 | 36.76   | 40.44   |
| 3000.00            | 0.22                  | 15.13            | 15.14       | 24.62               | 23.07      | 29.14               | 29.11 | 28.54   | 29.55   |
| 3400.00            | 0.30                  | 14.51            | 14.50       | 20.72               | 20.06      | 20.56               | 20.64 | 21.58   | 22.01   |
| 3600.00            | 0.34                  | 14.24            | 14.23       | 20.12               | 19.47      | 19.10               | 19.21 | 20.70   | 21.14   |
| 4200.00            | 0.37                  | 13.46            | 13.46       | 18.11               | 18.21      | 21.72               | 21.63 | 24.22   | 23.37   |
| 4500.00            | 0.36                  | 13.17            | 13.21       | 17.65               | 17.71      | 28.79               | 28.35 | 29.24   | 27.18   |
| 5000.00            | 0.42                  | 12.99            | 13.03       | 17.90               | 18.31      | 24.90               | 24.71 | 32.83   | 31.87   |
| 5400.00            | 0.49                  | 13.09            | 13.06       | 17.67               | 18.76      | 19.49               | 19.26 | 28.75   | 25.78   |
| 5800.00            | 0.50                  | 13.25            | 13.18       | 17.83               | 19.03      | 18.71               | 18.59 | 23.22   | 22.49   |
| 6000.00            | 0.49                  | 13.31            | 13.26       | 18.69               | 19.59      | 19.93               | 19.69 | 22.38   | 22.35   |



## Electrical Schematic



\* ELECTRICAL SCHEMATIC IS FOR BI-DIRECTIONAL COUPLER WITHOUT INTERNAL TRANSFORMERS AND RESISTORS.



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REV. B  
M151107  
ED-12713/1A  
SYBD-13-63HP+  
WZ/QL/AM  
200811

# Bi-Directional Coupler

# SYBD-13-63HP+

## Typical Performance Data

| FREQ.<br>(MHz) | INSERTION<br>LOSS<br>(dB)<br>IN-OUT | COUPLING<br>(dB) |         | DIRECTIVITY<br>(dB) |         | RETURN LOSS<br>(dB) |       |       |       |
|----------------|-------------------------------------|------------------|---------|---------------------|---------|---------------------|-------|-------|-------|
|                |                                     | IN-FWD           | OUT-REV | IN-REV              | OUT-FWD | IN                  | OUT   | FWD   | REV   |
| 2700           | 0.19                                | 15.71            | 15.72   | 28.33               | 31.11   | 38.29               | 36.15 | 36.76 | 40.44 |
| 2750           | 0.19                                | 15.61            | 15.62   | 27.33               | 29.90   | 40.62               | 38.24 | 36.10 | 39.77 |
| 2800           | 0.19                                | 15.50            | 15.52   | 26.09               | 28.49   | 40.64               | 37.67 | 35.80 | 38.20 |
| 2850           | 0.19                                | 15.40            | 15.41   | 25.55               | 27.72   | 37.23               | 35.86 | 33.49 | 35.30 |
| 2900           | 0.20                                | 15.31            | 15.32   | 24.51               | 26.34   | 33.89               | 33.46 | 31.93 | 33.54 |
| 2950           | 0.20                                | 15.21            | 15.23   | 23.98               | 25.56   | 31.18               | 31.04 | 30.20 | 31.25 |
| 3000           | 0.22                                | 15.13            | 15.14   | 23.07               | 24.62   | 29.14               | 29.11 | 28.54 | 29.55 |
| 3100           | 0.22                                | 14.96            | 14.96   | 21.95               | 23.25   | 25.78               | 26.02 | 26.04 | 26.60 |
| 3200           | 0.25                                | 14.80            | 14.80   | 21.13               | 22.08   | 23.52               | 23.65 | 24.08 | 24.47 |
| 3300           | 0.27                                | 14.65            | 14.65   | 20.48               | 21.30   | 21.78               | 21.90 | 22.57 | 22.95 |
| 3400           | 0.30                                | 14.51            | 14.50   | 20.06               | 20.72   | 20.56               | 20.64 | 21.58 | 22.01 |
| 3500           | 0.32                                | 14.39            | 14.34   | 19.94               | 20.60   | 19.62               | 19.78 | 21.00 | 21.49 |
| 3600           | 0.34                                | 14.24            | 14.23   | 19.47               | 20.12   | 19.10               | 19.21 | 20.70 | 21.14 |
| 3650           | 0.35                                | 14.18            | 14.17   | 19.29               | 19.91   | 18.92               | 19.04 | 20.58 | 20.97 |
| 3725           | 0.36                                | 14.08            | 14.06   | 19.18               | 19.89   | 18.79               | 19.01 | 20.67 | 20.97 |
| 3800           | 0.37                                | 13.99            | 13.96   | 19.20               | 19.59   | 18.84               | 19.01 | 20.81 | 21.15 |
| 3900           | 0.37                                | 13.84            | 13.82   | 18.97               | 19.16   | 19.14               | 19.23 | 21.25 | 21.40 |
| 3975           | 0.37                                | 13.74            | 13.72   | 18.73               | 18.99   | 19.51               | 19.56 | 21.86 | 21.77 |
| 4000           | 0.37                                | 13.71            | 13.69   | 18.77               | 18.83   | 19.74               | 19.74 | 22.01 | 21.99 |
| 4100           | 0.37                                | 13.58            | 13.57   | 18.46               | 18.38   | 20.62               | 20.51 | 23.08 | 22.63 |
| 4200           | 0.37                                | 13.46            | 13.46   | 18.21               | 18.11   | 21.72               | 21.63 | 24.22 | 23.37 |
| 4300           | 0.37                                | 13.35            | 13.37   | 17.92               | 17.82   | 23.19               | 23.12 | 25.65 | 24.31 |
| 4400           | 0.36                                | 13.26            | 13.28   | 17.81               | 17.71   | 25.50               | 25.36 | 27.33 | 25.71 |
| 4500           | 0.36                                | 13.17            | 13.21   | 17.71               | 17.65   | 28.79               | 28.35 | 29.24 | 27.18 |
| 4600           | 0.36                                | 13.10            | 13.14   | 17.66               | 17.69   | 34.43               | 33.07 | 31.31 | 28.80 |
| 4700           | 0.38                                | 13.05            | 13.10   | 17.86               | 17.79   | 38.42               | 37.60 | 32.61 | 29.99 |
| 4800           | 0.39                                | 13.01            | 13.07   | 18.02               | 17.77   | 32.29               | 32.29 | 32.66 | 30.82 |
| 4900           | 0.41                                | 13.00            | 13.05   | 18.05               | 17.76   | 27.71               | 27.62 | 33.38 | 32.06 |
| 5000           | 0.42                                | 12.99            | 13.03   | 18.31               | 17.90   | 24.90               | 24.71 | 32.83 | 31.87 |
| 5100           | 0.44                                | 13.00            | 13.02   | 18.51               | 17.92   | 22.90               | 22.89 | 32.65 | 30.89 |
| 5200           | 0.46                                | 13.01            | 13.03   | 18.67               | 18.02   | 21.30               | 21.25 | 31.55 | 28.57 |
| 5300           | 0.47                                | 13.06            | 13.05   | 18.63               | 17.78   | 20.10               | 20.05 | 30.54 | 26.88 |
| 5400           | 0.49                                | 13.09            | 13.06   | 18.76               | 17.67   | 19.49               | 19.26 | 28.75 | 25.78 |
| 5500           | 0.50                                | 13.13            | 13.09   | 18.52               | 17.53   | 18.99               | 18.82 | 26.66 | 24.79 |
| 5600           | 0.50                                | 13.17            | 13.12   | 18.47               | 17.54   | 18.55               | 18.41 | 25.31 | 23.86 |
| 5700           | 0.49                                | 13.21            | 13.14   | 18.67               | 17.58   | 18.42               | 18.42 | 24.14 | 23.16 |
| 5800           | 0.50                                | 13.25            | 13.18   | 19.03               | 17.83   | 18.71               | 18.59 | 23.22 | 22.49 |
| 5900           | 0.50                                | 13.29            | 13.23   | 19.43               | 18.20   | 19.24               | 19.05 | 22.72 | 22.25 |
| 6000           | 0.49                                | 13.31            | 13.26   | 19.59               | 18.69   | 19.93               | 19.69 | 22.38 | 22.35 |

REV. X1

SYBD-13-63HP+

070411

Page 1 of 1



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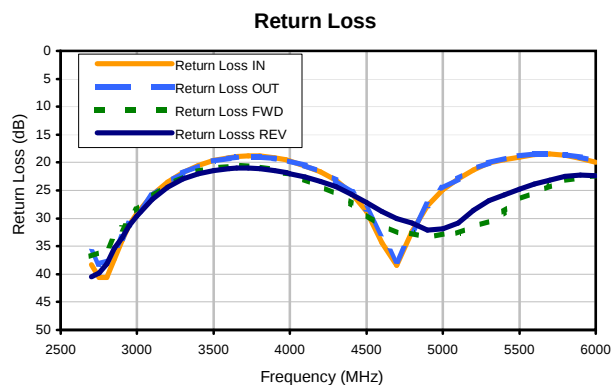
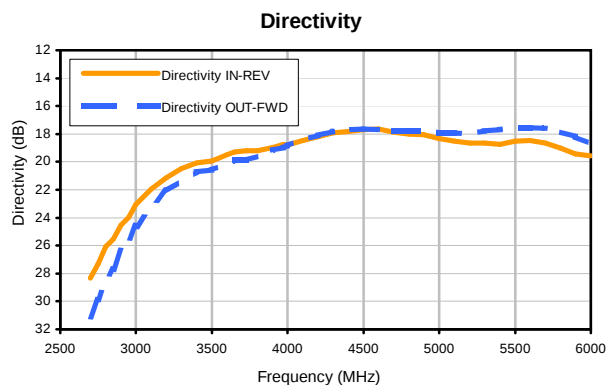
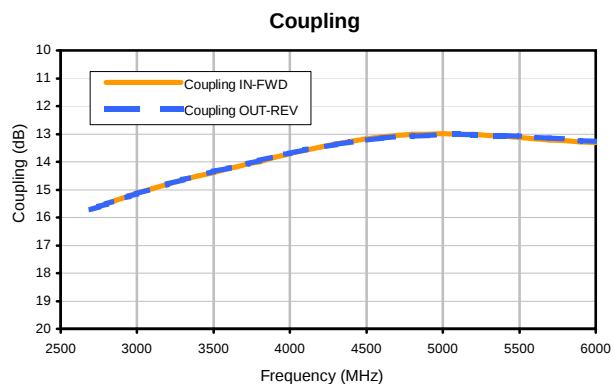
The Design Engineers Search Engine finds the model you need, Instantly • For detailed performance specs &amp; shopping online see



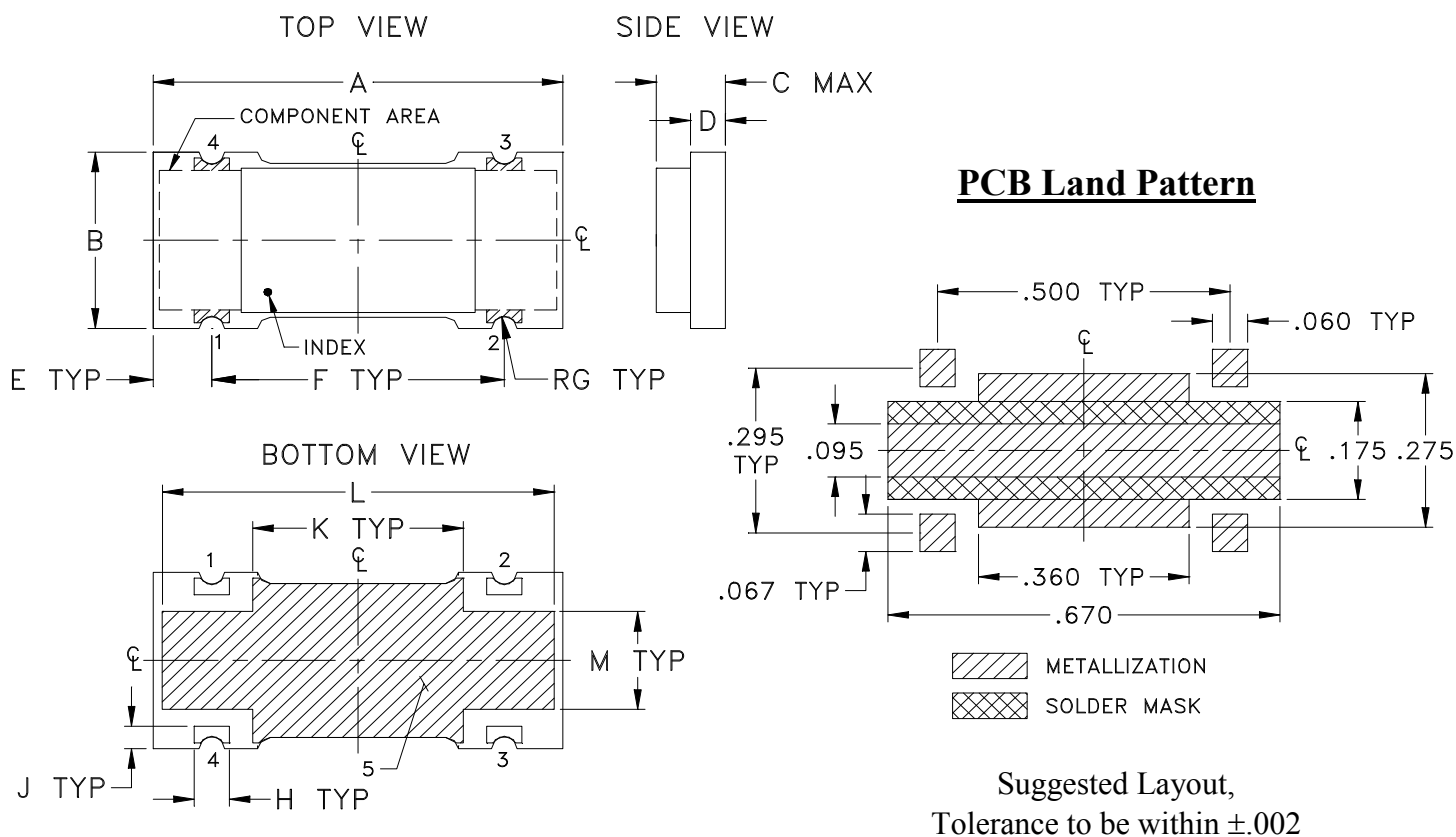
# Bi-Directional Coupler

## Typical Performance Curves

SYBD-13-63HP+



## Outline Dimensions



| CASE #. | A              | B             | C             | D              | E              | F               | G              | H              | J              | K              | L               | M              | WT, GRAM |
|---------|----------------|---------------|---------------|----------------|----------------|-----------------|----------------|----------------|----------------|----------------|-----------------|----------------|----------|
| JB1233  | .70<br>(17.78) | .32<br>(8.13) | .13<br>(3.30) | .060<br>(1.52) | .100<br>(2.54) | .500<br>(12.70) | .022<br>(0.56) | .060<br>(1.52) | .040<br>(1.02) | .360<br>(9.14) | .670<br>(17.02) | .175<br>(4.45) | 0.68     |

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

### Notes:

- Open style, Base material: Printed wiring laminate.
- Termination finish: 3-5  $\mu$  inch (.08-.13 microns) Gold over 120-240  $\mu$  inch (3.05-6.10 microns) Nickel plate.  
All models, (+) suffix.



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

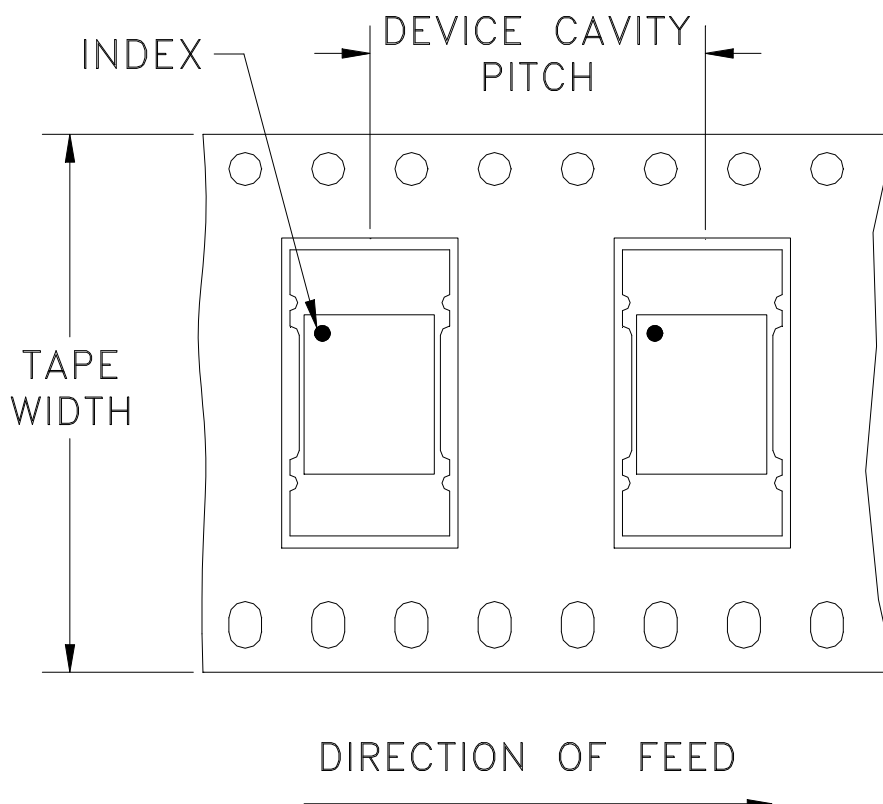
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# Tape & Reel Packaging TR-F84

## DEVICE ORIENTATION IN T&R



| Tape Width, mm | Device Cavity Pitch, mm | Reel Size, inches | Devices per Reel |
|----------------|-------------------------|-------------------|------------------|
| 32             | 12                      | 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)



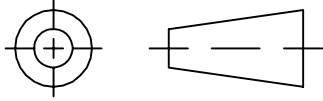
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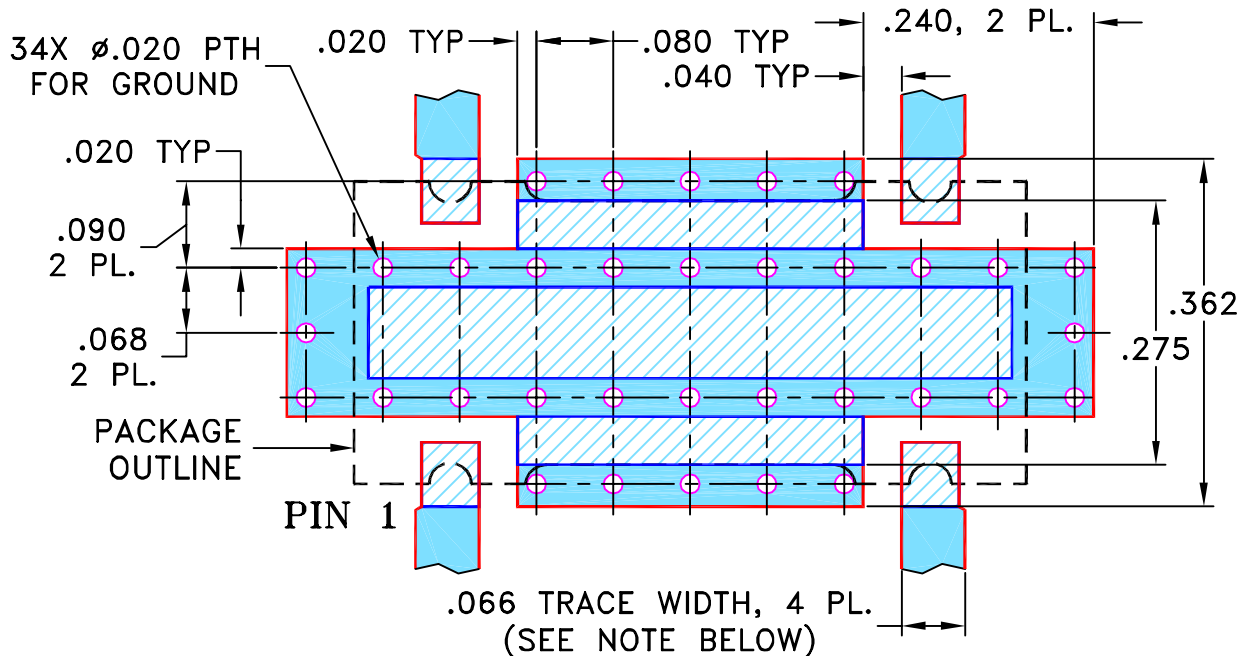
## THIRD ANGLE PROJECTION



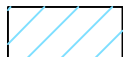
## REVISIONS

| REV OR | ECN No. | DESCRIPTION | DATE     | DR  | AUTH |
|--------|---------|-------------|----------|-----|------|
|        | M109017 | NEW RELEASE | 12/29/06 | MMG | WP   |
|        |         |             |          |     |      |
|        |         |             |          |     |      |

SUGGESTED MOUNTING CONFIGURATION FOR  
JB1233 CASE STYLE, "rw" PIN CONNECTION



- NOTES: 1. TRACE WIDTH IS SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS  $.030'' \pm .002''$ ; 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 MMG   | 12/21/06 |
| TOLERANCES ON:             | CHECKED AV  | 12/29/06 |
| 2 PL DECIMALS $\pm$        | APPROVED WP | 12/29/06 |
| 3 PL DECIMALS $\pm .005$   |             |          |
| ANGLES $\pm$               |             |          |
| FRACTIONS $\pm$            |             |          |

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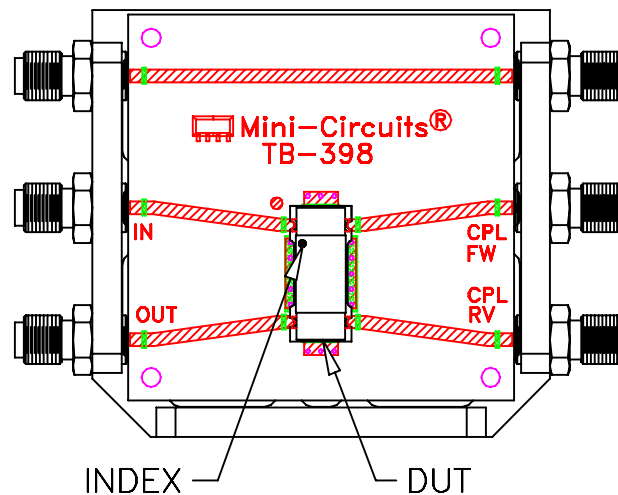
ASHEETA1.DWG REV:A DATE:01/12/95

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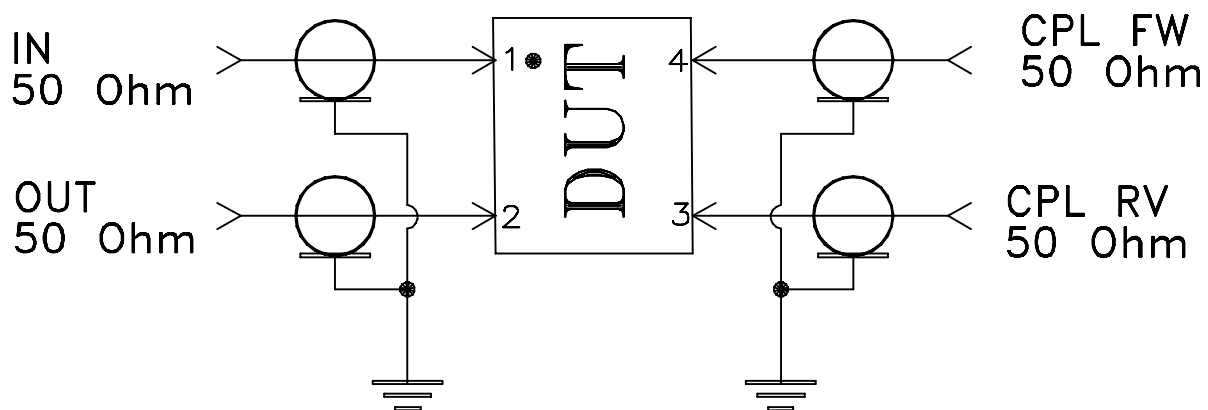
PL, rw, JB1233, SYBD, TB-398

| SIZE  | CODE IDENT | DRAWING NO: | REV:   |
|-------|------------|-------------|--------|
| A     | 15542      | 98-PL-260   | OR     |
| FILE: | 98PL260    | SCALE:      | SHEET: |
|       |            | 5:1         | 1 OF 1 |

# Evaluation Board and Circuit



TB-398



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          | -55° to 100°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                                                                              |