

# High Power Bi-Directional Coupler

## SYBD-18-172HP+

50Ω 18dB Coupling DC Pass 1400 to 1750 MHz

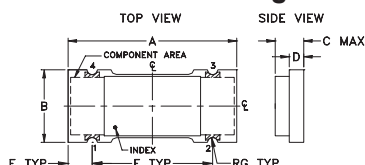
### Maximum Ratings

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

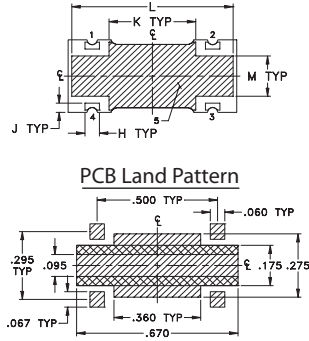
### Pin Connections

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

### Outline Drawing



### PCB Land Pattern

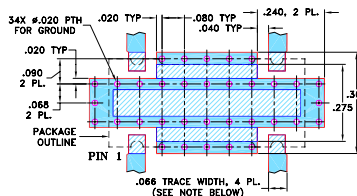


Suggested Layout,  
Tolerance to be within ±0.02

### 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" ± .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

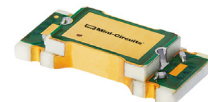
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### Features

- high power handling, 25 watts typ.
- low mainline loss 0.1 dB typ.
- excellent VSWR, 1.1:1 typ.
- excellent directivity, 28 dB typ.
- wideband frequency, 1400 to 1750 MHz

### Applications

- GPS
- instrumentation
- defense communications
- federal communications



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

### Bi-Directional Coupler Electrical Specifications

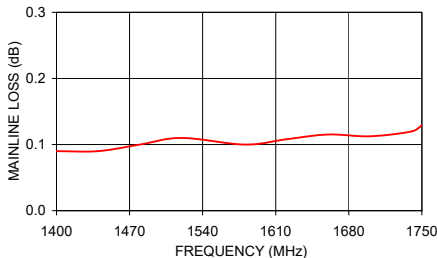
| FREQ.<br>(MHz) | COUPLING<br>(dB) |          | MAINLINE LOSS <sup>1</sup><br>(dB) |      | DIRECTIVITY<br>(dB) |      | VSWR<br>(:1) | POWER<br>INPUT<br>(W) |
|----------------|------------------|----------|------------------------------------|------|---------------------|------|--------------|-----------------------|
|                | Nom.             | Flatness | Typ.                               | Max. | Typ.                | Min. |              |                       |
| $f_L$ - $f_U$  |                  |          |                                    |      |                     |      |              |                       |
| 1400-1750      |                  |          | 0.10                               | 0.35 | 28                  | 18   | 1.10         |                       |
| 1400-1580      | 19.5±0.7         | ±0.7     | 0.10                               | 0.30 | 28                  | 18   | 1.10         | 50                    |
| 1580-1750      | 18.5±0.7         | ±0.6     | 0.12                               | 0.35 | 30                  | 18   | 1.05         | 25                    |

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

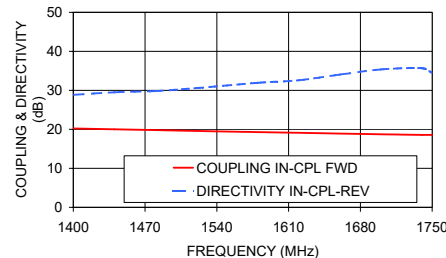
### Typical Performance Data

| 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 |
| 1400.00            | 0.09                  | 20.22            | 20.26       | 27.67               | 28.84      | 28.48               | 27.90 | 32.21   | 32.39   |
| 1440.00            | 0.09                  | 20.00            | 20.05       | 28.01               | 29.49      | 28.94               | 28.32 | 32.71   | 32.94   |
| 1480.00            | 0.10                  | 19.80            | 19.84       | 28.35               | 29.81      | 29.44               | 28.82 | 33.10   | 33.27   |
| 1520.00            | 0.11                  | 19.59            | 19.63       | 28.66               | 30.56      | 30.03               | 29.41 | 33.86   | 34.17   |
| 1580.00            | 0.10                  | 19.29            | 19.33       | 29.70               | 31.92      | 31.34               | 30.60 | 35.70   | 35.73   |
| 1620.00            | 0.11                  | 19.11            | 19.15       | 29.91               | 32.58      | 32.35               | 31.44 | 36.32   | 36.64   |
| 1660.00            | 0.12                  | 18.92            | 18.97       | 30.98               | 34.03      | 33.79               | 32.99 | 38.29   | 38.60   |
| 1700.00            | 0.11                  | 18.74            | 18.78       | 31.68               | 35.36      | 35.46               | 34.62 | 40.80   | 40.38   |
| 1740.00            | 0.12                  | 18.58            | 18.61       | 31.49               | 35.67      | 37.37               | 36.34 | 42.30   | 42.58   |
| 1750.00            | 0.13                  | 18.57            | 18.58       | 30.54               | 34.47      | 38.33               | 37.11 | 43.29   | 43.72   |

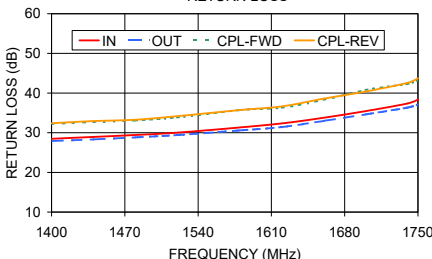
SYBD-18-172HP+  
MAINLINE LOSS



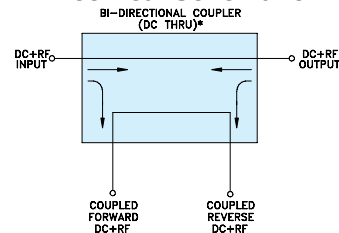
SYBD-18-172HP+  
COUPLING & DIRECTIVITY



SYBD-18-172HP+  
RETURN LOSS



### Electrical Schematic



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



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REV. B  
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SYBD-18-172HP+  
WZ/CP/AM  
200811

# Bi-Directional Coupler

# SYBD-18-172HP+

## Typical Performance Data

TEST CONDITIONS: INPUT POWER =0 dBm @Temperature = +25°C

| FREQ.<br>(MHz) | INSERTION LOSS |                 | COUPLING       |                 | DIRECTIVITY    |                 | RETURN LOSS |             |             |             |
|----------------|----------------|-----------------|----------------|-----------------|----------------|-----------------|-------------|-------------|-------------|-------------|
|                | (dB)<br>IN-OUT | (dB)<br>FWD-REV | (dB)<br>IN-FWD | (dB)<br>OUT-REV | (dB)<br>IN-REV | (dB)<br>OUT-FWD | (dB)<br>IN  | (dB)<br>OUT | (dB)<br>FWD | (dB)<br>REV |
| 1000           | 0.04           | 0.02            | 22.85          | 22.86           | 29.68          | 27.38           | 31.54       | 31.33       | 30.23       | 30.93       |
| 1200           | 0.08           | 0.04            | 21.39          | 21.38           | 29.82          | 26.78           | 30.24       | 30.31       | 29.25       | 29.88       |
| 1250           | 0.09           | 0.05            | 21.10          | 21.11           | 31.43          | 27.37           | 30.26       | 30.60       | 29.31       | 29.91       |
| 1300           | 0.10           | 0.06            | 20.79          | 20.79           | 31.84          | 27.25           | 30.44       | 30.65       | 29.34       | 29.86       |
| 1350           | 0.10           | 0.07            | 20.49          | 20.51           | 31.25          | 27.02           | 30.72       | 30.79       | 29.51       | 30.01       |
| 1375           | 0.11           | 0.07            | 20.33          | 20.35           | 32.39          | 27.93           | 30.82       | 30.86       | 29.58       | 30.04       |
| 1400           | 0.11           | 0.08            | 20.16          | 20.17           | 31.09          | 27.46           | 30.56       | 30.60       | 29.76       | 30.27       |
| 1450           | 0.12           | 0.07            | 19.99          | 19.99           | 30.80          | 25.92           | 31.29       | 30.96       | 30.57       | 31.08       |
| 1475           | 0.11           | 0.06            | 19.86          | 19.87           | 31.96          | 26.47           | 31.72       | 31.61       | 30.72       | 30.99       |
| 1500           | 0.10           | 0.07            | 19.68          | 19.68           | 34.48          | 28.03           | 31.54       | 31.77       | 30.86       | 30.89       |
| 1550           | 0.11           | 0.08            | 19.38          | 19.39           | 33.68          | 28.45           | 31.78       | 31.93       | 31.41       | 31.41       |
| 1575           | 0.12           | 0.09            | 19.29          | 19.28           | 31.68          | 26.79           | 31.97       | 31.82       | 31.81       | 32.19       |
| 1580           | 0.12           | 0.09            | 19.31          | 19.31           | 32.41          | 26.17           | 32.01       | 31.84       | 32.08       | 32.39       |
| 1600           | 0.12           | 0.08            | 19.23          | 19.25           | 31.77          | 26.12           | 32.95       | 33.08       | 32.76       | 32.69       |
| 1625           | 0.12           | 0.07            | 19.06          | 19.08           | 36.40          | 28.80           | 32.75       | 33.08       | 33.43       | 32.65       |
| 1650           | 0.12           | 0.08            | 18.92          | 18.94           | 37.60          | 29.26           | 33.02       | 33.63       | 33.80       | 32.80       |
| 1675           | 0.12           | 0.08            | 18.80          | 18.82           | 36.98          | 29.41           | 33.47       | 34.17       | 33.97       | 33.07       |
| 1700           | 0.13           | 0.08            | 18.68          | 18.68           | 39.38          | 30.08           | 33.50       | 34.36       | 35.03       | 33.67       |
| 1725           | 0.13           | 0.10            | 18.57          | 18.58           | 34.34          | 28.45           | 34.41       | 35.11       | 34.68       | 33.84       |
| 1750           | 0.13           | 0.10            | 18.49          | 18.51           | 40.20          | 29.49           | 33.90       | 35.74       | 36.52       | 35.15       |
| 1775           | 0.15           | 0.11            | 18.34          | 18.35           | 35.91          | 29.90           | 34.49       | 35.93       | 36.30       | 35.07       |
| 1800           | 0.14           | 0.11            | 18.27          | 18.29           | 42.49          | 30.26           | 34.42       | 36.65       | 38.46       | 36.25       |
| 1850           | 0.16           | 0.11            | 18.04          | 18.05           | 40.32          | 31.96           | 35.01       | 37.11       | 39.47       | 36.18       |
| 1900           | 0.18           | 0.15            | 17.81          | 17.82           | 33.57          | 31.18           | 35.45       | 36.46       | 39.01       | 38.49       |
| 1950           | 0.17           | 0.14            | 17.78          | 17.78           | 42.78          | 29.50           | 34.23       | 36.95       | 40.16       | 37.42       |
| 2000           | 0.19           | 0.15            | 17.59          | 17.60           | 38.88          | 30.36           | 34.56       | 36.44       | 38.13       | 37.44       |
| 2100           | 0.21           | 0.15            | 17.21          | 17.23           | 43.43          | 34.07           | 33.76       | 35.23       | 36.31       | 36.13       |
| 2200           | 0.21           | 0.18            | 17.06          | 17.08           | 41.25          | 29.67           | 32.18       | 33.87       | 33.56       | 35.23       |
| 2300           | 0.26           | 0.19            | 16.72          | 16.72           | 41.16          | 32.72           | 32.25       | 31.69       | 33.68       | 35.76       |
| 2400           | 0.26           | 0.19            | 16.53          | 16.50           | 38.18          | 33.78           | 32.15       | 31.72       | 34.09       | 34.94       |
| 2500           | 0.28           | 0.20            | 16.28          | 16.30           | 37.71          | 35.05           | 32.59       | 31.79       | 35.67       | 36.67       |
| 2600           | 0.30           | 0.22            | 15.93          | 15.91           | 30.84          | 40.80           | 33.83       | 31.58       | 41.86       | 41.44       |
| 2700           | 0.33           | 0.29            | 15.89          | 16.05           | 30.71          | 27.69           | 34.45       | 29.62       | 40.25       | 40.62       |
| 2800           | 0.32           | 0.28            | 15.62          | 15.67           | 32.08          | 39.18           | 33.27       | 30.39       | 41.24       | 41.26       |
| 2900           | 0.33           | 0.27            | 15.34          | 15.39           | 27.89          | 30.33           | 31.59       | 28.98       | 33.56       | 34.88       |
| 3000           | 0.34           | 0.31            | 15.20          | 15.22           | 26.42          | 28.13           | 29.53       | 28.38       | 29.38       | 30.71       |
| 3100           | 0.38           | 0.30            | 14.96          | 15.04           | 25.31          | 26.88           | 27.96       | 27.07       | 27.02       | 27.80       |
| 3200           | 0.39           | 0.32            | 14.83          | 14.85           | 24.71          | 26.32           | 25.82       | 25.61       | 24.95       | 25.38       |
| 3300           | 0.42           | 0.35            | 14.66          | 14.67           | 22.93          | 23.88           | 24.69       | 24.41       | 23.77       | 23.99       |
| 3400           | 0.43           | 0.36            | 14.54          | 14.57           | 22.51          | 23.61           | 23.85       | 23.95       | 22.82       | 23.13       |
| 3500           | 0.45           | 0.40            | 14.41          | 14.37           | 21.88          | 22.80           | 22.92       | 23.17       | 22.39       | 22.85       |
| 3600           | 0.47           | 0.40            | 14.28          | 14.33           | 21.15          | 21.88           | 22.81       | 23.17       | 22.64       | 22.58       |
| 3700           | 0.47           | 0.41            | 14.10          | 14.12           | 22.09          | 21.36           | 22.88       | 23.27       | 22.82       | 22.76       |
| 3800           | 0.48           | 0.41            | 14.01          | 14.05           | 20.76          | 20.44           | 22.70       | 23.49       | 23.56       | 23.39       |
| 3900           | 0.50           | 0.44            | 13.89          | 13.85           | 21.23          | 20.39           | 23.30       | 23.71       | 24.71       | 24.70       |
| 4000           | 0.51           | 0.44            | 13.81          | 13.76           | 21.01          | 19.41           | 24.07       | 24.69       | 26.50       | 26.27       |
| 4500           | 0.60           | 0.52            | 13.39          | 13.39           | 21.56          | 18.43           | 28.37       | 28.62       | 31.79       | 31.26       |
| 4750           | 0.62           | 0.56            | 13.30          | 13.33           | 23.51          | 18.11           | 25.49       | 26.45       | 25.79       | 25.70       |
| 5000           | 0.68           | 0.60            | 13.36          | 13.29           | 24.29          | 18.65           | 23.78       | 24.56       | 23.70       | 23.77       |
| 5500           | 0.73           | 0.64            | 13.44          | 13.46           | 25.27          | 17.34           | 22.15       | 23.50       | 23.38       | 23.86       |
| 6000           | 0.78           | 0.71            | 13.54          | 13.67           | 25.92          | 16.53           | 22.18       | 22.91       | 21.77       | 20.70       |
| 6500           | 0.91           | 0.88            | 13.79          | 13.95           | 19.57          | 14.52           | 19.99       | 22.01       | 17.30       | 16.68       |
| 7000           | 1.15           | 1.13            | 14.54          | 14.66           | 15.25          | 14.38           | 15.07       | 16.56       | 13.50       | 13.24       |

REV. X1

SYBD-18-172HP+

090203

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# Bi-Directional Coupler

# SYBD-18-172HP+

## Typical Performance Data

TEST CONDITIONS: INPUT POWER = 0 dBm @Temperature = -55°C

| FREQ.<br>(MHz) | INSERTION LOSS |                 | COUPLING       |                 | DIRECTIVITY    |                 | RETURN LOSS |             |             |             |
|----------------|----------------|-----------------|----------------|-----------------|----------------|-----------------|-------------|-------------|-------------|-------------|
|                | (dB)<br>IN-OUT | (dB)<br>FWD-REV | (dB)<br>IN-FWD | (dB)<br>OUT-REV | (dB)<br>IN-REV | (dB)<br>OUT-FWD | (dB)<br>IN  | (dB)<br>OUT | (dB)<br>FWD | (dB)<br>REV |
| 1000           | 0.02           | 0.11            | 22.79          | 22.79           | 28.61          | 26.60           | 31.44       | 31.14       | 29.95       | 30.70       |
| 1200           | 0.01           | 0.11            | 21.32          | 21.30           | 28.89          | 26.15           | 29.18       | 29.22       | 28.02       | 28.81       |
| 1250           | 0.01           | 0.11            | 21.03          | 21.02           | 29.88          | 26.40           | 29.30       | 29.49       | 27.54       | 28.28       |
| 1300           | 0.01           | 0.10            | 20.72          | 20.71           | 30.27          | 26.61           | 29.56       | 29.60       | 27.47       | 28.04       |
| 1350           | 0.02           | 0.09            | 20.41          | 20.41           | 29.69          | 25.83           | 29.74       | 29.54       | 27.78       | 28.15       |
| 1375           | 0.02           | 0.09            | 20.25          | 20.25           | 31.49          | 26.89           | 29.87       | 29.56       | 28.03       | 28.35       |
| 1400           | 0.02           | 0.08            | 20.06          | 20.06           | 30.27          | 26.40           | 29.36       | 29.08       | 28.35       | 28.74       |
| 1450           | 0.03           | 0.10            | 19.97          | 19.95           | 29.28          | 24.68           | 30.10       | 29.38       | 29.37       | 29.93       |
| 1475           | 0.02           | 0.10            | 19.74          | 19.74           | 31.32          | 26.06           | 29.88       | 29.42       | 29.15       | 29.59       |
| 1500           | 0.02           | 0.11            | 19.59          | 19.58           | 32.45          | 26.99           | 29.89       | 29.63       | 29.26       | 29.44       |
| 1550           | 0.02           | 0.10            | 19.29          | 19.28           | 32.21          | 27.91           | 30.00       | 29.80       | 29.99       | 30.11       |
| 1575           | 0.03           | 0.09            | 19.18          | 19.16           | 30.80          | 26.89           | 30.30       | 29.82       | 30.78       | 31.02       |
| 1580           | 0.03           | 0.08            | 19.18          | 19.17           | 30.39          | 25.99           | 30.37       | 29.90       | 30.85       | 31.35       |
| 1600           | 0.03           | 0.09            | 19.07          | 19.09           | 30.32          | 25.26           | 31.03       | 30.86       | 30.97       | 31.42       |
| 1625           | 0.02           | 0.11            | 18.97          | 18.97           | 33.97          | 27.48           | 31.37       | 31.24       | 32.03       | 31.55       |
| 1650           | 0.03           | 0.11            | 18.82          | 18.83           | 34.97          | 27.94           | 31.97       | 32.05       | 31.67       | 31.20       |
| 1675           | 0.02           | 0.10            | 18.70          | 18.71           | 34.30          | 28.42           | 32.73       | 32.78       | 31.94       | 31.48       |
| 1700           | 0.03           | 0.10            | 18.57          | 18.56           | 37.00          | 29.24           | 32.97       | 33.43       | 33.35       | 32.52       |
| 1725           | 0.04           | 0.09            | 18.46          | 18.46           | 32.89          | 28.15           | 34.36       | 34.71       | 33.24       | 32.72       |
| 1750           | 0.04           | 0.09            | 18.38          | 18.39           | 36.89          | 28.89           | 34.13       | 35.38       | 35.84       | 34.49       |
| 1775           | 0.04           | 0.09            | 18.24          | 18.23           | 36.01          | 29.13           | 35.00       | 36.39       | 35.48       | 34.51       |
| 1800           | 0.04           | 0.09            | 18.15          | 18.15           | 41.17          | 30.20           | 34.98       | 37.43       | 37.78       | 35.67       |
| 1850           | 0.05           | 0.09            | 17.94          | 17.93           | 38.73          | 30.56           | 35.74       | 38.64       | 38.72       | 36.23       |
| 1900           | 0.08           | 0.06            | 17.63          | 17.62           | 33.99          | 32.64           | 35.91       | 37.74       | 37.67       | 36.02       |
| 1950           | 0.06           | 0.07            | 17.69          | 17.66           | 36.52          | 28.36           | 34.02       | 39.13       | 42.61       | 37.67       |
| 2000           | 0.08           | 0.06            | 17.44          | 17.44           | 40.65          | 31.16           | 34.09       | 39.14       | 38.79       | 38.47       |
| 2100           | 0.09           | 0.07            | 17.08          | 17.07           | 40.60          | 34.58           | 32.15       | 36.77       | 34.59       | 35.14       |
| 2200           | 0.10           | 0.06            | 16.90          | 16.90           | 34.91          | 30.18           | 30.19       | 33.82       | 31.74       | 32.64       |
| 2300           | 0.13           | 0.05            | 16.60          | 16.58           | 40.57          | 33.26           | 29.65       | 31.31       | 32.35       | 32.43       |
| 2400           | 0.14           | 0.04            | 16.37          | 16.36           | 34.74          | 33.65           | 29.20       | 31.13       | 34.26       | 34.66       |
| 2500           | 0.16           | 0.05            | 16.13          | 16.11           | 36.02          | 39.71           | 30.21       | 31.56       | 35.82       | 36.39       |
| 2600           | 0.18           | 0.02            | 15.78          | 15.67           | 28.12          | 33.72           | 33.06       | 33.12       | 36.18       | 36.50       |
| 2700           | 0.21           | 0.02            | 15.67          | 15.81           | 26.49          | 28.61           | 33.34       | 29.65       | 37.84       | 37.10       |
| 2800           | 0.18           | 0.00            | 15.43          | 15.46           | 30.85          | 37.22           | 31.26       | 29.45       | 42.41       | 39.48       |
| 2900           | 0.19           | 0.01            | 15.18          | 15.20           | 26.67          | 29.34           | 30.93       | 28.18       | 32.04       | 33.11       |
| 3000           | 0.20           | 0.02            | 15.01          | 15.02           | 26.68          | 26.47           | 28.93       | 27.57       | 29.56       | 31.15       |
| 3100           | 0.22           | 0.01            | 14.78          | 14.81           | 25.69          | 25.72           | 28.21       | 26.84       | 26.86       | 28.55       |
| 3200           | 0.23           | 0.02            | 14.62          | 14.62           | 24.30          | 26.21           | 27.04       | 25.94       | 24.63       | 25.78       |
| 3300           | 0.27           | 0.05            | 14.47          | 14.45           | 22.25          | 24.09           | 25.59       | 24.51       | 22.76       | 23.54       |
| 3400           | 0.26           | 0.05            | 14.35          | 14.36           | 22.30          | 22.72           | 23.67       | 23.04       | 22.32       | 22.79       |
| 3500           | 0.29           | 0.07            | 14.23          | 14.18           | 21.17          | 21.85           | 22.22       | 21.92       | 21.64       | 22.38       |
| 3600           | 0.31           | 0.07            | 14.05          | 14.06           | 20.76          | 22.06           | 22.08       | 21.70       | 23.00       | 23.13       |
| 3700           | 0.30           | 0.06            | 13.87          | 13.86           | 22.91          | 21.60           | 22.11       | 21.86       | 24.55       | 24.25       |
| 3800           | 0.31           | 0.06            | 13.77          | 13.79           | 21.61          | 20.86           | 21.97       | 22.11       | 24.39       | 24.05       |
| 3900           | 0.32           | 0.08            | 13.65          | 13.59           | 21.98          | 21.25           | 22.79       | 22.80       | 25.03       | 24.65       |
| 4000           | 0.34           | 0.09            | 13.57          | 13.50           | 21.71          | 20.03           | 23.27       | 23.49       | 25.06       | 24.70       |
| 4500           | 0.39           | 0.13            | 13.15          | 13.11           | 21.55          | 18.39           | 27.08       | 29.81       | 34.05       | 34.74       |
| 4750           | 0.41           | 0.15            | 12.95          | 13.00           | 24.27          | 18.38           | 25.24       | 27.19       | 27.40       | 27.17       |
| 5000           | 0.47           | 0.17            | 12.99          | 12.92           | 25.61          | 18.26           | 22.89       | 23.58       | 23.91       | 23.66       |
| 5500           | 0.49           | 0.19            | 13.12          | 13.08           | 27.45          | 16.71           | 21.93       | 22.86       | 21.37       | 21.08       |
| 6000           | 0.52           | 0.21            | 13.18          | 13.30           | 26.77          | 16.93           | 22.92       | 23.92       | 22.22       | 21.62       |
| 6500           | 0.65           | 0.32            | 13.42          | 13.44           | 19.41          | 15.90           | 19.61       | 20.36       | 17.86       | 17.68       |
| 7000           | 0.84           | 0.64            | 14.11          | 14.29           | 18.23          | 13.93           | 15.00       | 15.99       | 12.56       | 11.99       |

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# Bi-Directional Coupler

# SYBD-18-172HP+

## Typical Performance Data

TEST CONDITIONS: INPUT POWER = 0 dBm @ Temperature = +100°C

| FREQ.<br>(MHz) | INSERTION LOSS<br>(dB) |         | COUPLING<br>(dB) |         | DIRECTIVITY<br>(dB) |         | RETURN LOSS<br>(dB) |       |       |       |
|----------------|------------------------|---------|------------------|---------|---------------------|---------|---------------------|-------|-------|-------|
|                | IN-OUT                 | FWD-REV | IN-FWD           | OUT-REV | IN-REV              | OUT-FWD | IN                  | OUT   | FWD   | REV   |
| 1000           | 0.07                   | 0.09    | 22.89            | 22.91   | 31.75               | 27.27   | 31.78               | 31.52 | 30.34 | 31.08 |
| 1200           | 0.11                   | 0.12    | 21.44            | 21.44   | 32.36               | 27.53   | 30.86               | 30.70 | 30.23 | 30.65 |
| 1250           | 0.12                   | 0.13    | 21.16            | 21.17   | 33.94               | 27.35   | 30.92               | 31.03 | 30.46 | 30.79 |
| 1300           | 0.12                   | 0.14    | 20.84            | 20.85   | 34.25               | 27.45   | 31.12               | 31.09 | 30.48 | 30.57 |
| 1350           | 0.13                   | 0.16    | 20.52            | 20.56   | 32.26               | 26.74   | 31.38               | 31.13 | 30.40 | 30.42 |
| 1375           | 0.14                   | 0.16    | 20.38            | 20.41   | 34.42               | 27.96   | 31.59               | 31.37 | 30.43 | 30.33 |
| 1400           | 0.14                   | 0.17    | 20.21            | 20.23   | 32.41               | 27.44   | 31.30               | 31.00 | 30.75 | 30.61 |
| 1450           | 0.15                   | 0.17    | 20.09            | 20.11   | 30.02               | 24.71   | 32.65               | 31.63 | 31.82 | 31.61 |
| 1475           | 0.13                   | 0.16    | 19.90            | 19.92   | 35.35               | 27.02   | 32.49               | 32.24 | 32.05 | 31.30 |
| 1500           | 0.13                   | 0.16    | 19.73            | 19.75   | 37.56               | 28.11   | 32.51               | 32.48 | 32.25 | 31.20 |
| 1550           | 0.14                   | 0.18    | 19.44            | 19.46   | 36.70               | 29.03   | 32.88               | 32.85 | 32.62 | 31.52 |
| 1575           | 0.15                   | 0.19    | 19.34            | 19.36   | 34.11               | 27.59   | 33.03               | 32.40 | 33.17 | 32.33 |
| 1580           | 0.16                   | 0.20    | 19.33            | 19.35   | 34.86               | 27.05   | 33.10               | 32.47 | 33.27 | 32.31 |
| 1600           | 0.15                   | 0.19    | 19.18            | 19.23   | 34.27               | 27.40   | 33.89               | 33.71 | 32.85 | 32.06 |
| 1625           | 0.15                   | 0.18    | 19.14            | 19.17   | 38.21               | 28.37   | 33.85               | 34.00 | 34.59 | 32.26 |
| 1650           | 0.15                   | 0.18    | 18.99            | 19.01   | 40.12               | 29.30   | 34.03               | 34.42 | 34.91 | 32.22 |
| 1675           | 0.15                   | 0.19    | 18.86            | 18.89   | 39.61               | 29.61   | 34.37               | 35.26 | 34.48 | 32.11 |
| 1700           | 0.16                   | 0.20    | 18.74            | 18.76   | 41.90               | 30.29   | 34.03               | 34.93 | 35.72 | 32.66 |
| 1725           | 0.16                   | 0.20    | 18.63            | 18.66   | 36.61               | 29.66   | 35.03               | 36.03 | 34.70 | 32.44 |
| 1750           | 0.17                   | 0.21    | 18.57            | 18.60   | 40.52               | 29.33   | 34.29               | 36.19 | 36.73 | 33.53 |
| 1775           | 0.18                   | 0.22    | 18.44            | 18.49   | 36.04               | 29.47   | 35.02               | 36.54 | 35.75 | 34.16 |
| 1800           | 0.18                   | 0.23    | 18.34            | 18.37   | 44.51               | 30.75   | 34.68               | 37.46 | 36.26 | 33.94 |
| 1850           | 0.19                   | 0.24    | 18.14            | 18.16   | 37.48               | 31.07   | 35.35               | 38.16 | 36.01 | 34.14 |
| 1900           | 0.22                   | 0.26    | 17.82            | 17.87   | 31.48               | 34.26   | 36.05               | 36.80 | 36.58 | 35.61 |
| 1950           | 0.21                   | 0.27    | 17.90            | 17.91   | 37.09               | 28.62   | 34.70               | 38.17 | 37.01 | 35.55 |
| 2000           | 0.22                   | 0.28    | 17.62            | 17.66   | 36.89               | 32.79   | 35.16               | 38.08 | 36.82 | 35.87 |
| 2100           | 0.25                   | 0.28    | 17.28            | 17.32   | 42.55               | 36.27   | 33.74               | 36.84 | 36.41 | 35.98 |
| 2200           | 0.26                   | 0.31    | 17.12            | 17.14   | 45.01               | 31.62   | 32.79               | 35.70 | 36.47 | 36.85 |
| 2300           | 0.30                   | 0.33    | 16.82            | 16.89   | 44.81               | 35.01   | 33.53               | 33.79 | 37.80 | 37.10 |
| 2400           | 0.31                   | 0.34    | 16.58            | 16.59   | 42.39               | 35.12   | 33.13               | 33.55 | 39.87 | 37.91 |
| 2500           | 0.33                   | 0.35    | 16.36            | 16.39   | 42.88               | 37.81   | 32.77               | 33.07 | 41.16 | 37.22 |
| 2600           | 0.35                   | 0.38    | 16.05            | 16.03   | 35.18               | 38.07   | 33.63               | 32.29 | 46.69 | 36.28 |
| 2700           | 0.40                   | 0.44    | 15.96            | 16.10   | 30.21               | 28.30   | 34.98               | 29.49 | 46.18 | 34.16 |
| 2800           | 0.37                   | 0.43    | 15.76            | 15.85   | 35.82               | 33.63   | 33.67               | 30.90 | 37.63 | 35.77 |
| 2900           | 0.38                   | 0.45    | 15.47            | 15.53   | 29.51               | 30.46   | 32.05               | 29.55 | 31.64 | 32.22 |
| 3000           | 0.40                   | 0.48    | 15.28            | 15.38   | 27.53               | 27.09   | 29.90               | 28.77 | 28.24 | 28.93 |
| 3100           | 0.42                   | 0.49    | 15.11            | 15.18   | 26.70               | 25.77   | 27.83               | 27.01 | 26.48 | 26.61 |
| 3200           | 0.45                   | 0.52    | 14.95            | 14.99   | 25.45               | 25.66   | 24.99               | 24.91 | 25.10 | 24.77 |
| 3300           | 0.49                   | 0.55    | 14.76            | 14.80   | 23.85               | 23.12   | 23.61               | 23.57 | 24.67 | 24.13 |
| 3400           | 0.49                   | 0.55    | 14.70            | 14.71   | 23.02               | 23.06   | 23.20               | 23.50 | 24.05 | 23.29 |
| 3500           | 0.52                   | 0.60    | 14.55            | 14.56   | 22.52               | 21.72   | 22.67               | 22.91 | 24.00 | 23.12 |
| 3600           | 0.54                   | 0.61    | 14.44            | 14.44   | 21.89               | 21.14   | 22.79               | 23.25 | 23.93 | 22.56 |
| 3700           | 0.54                   | 0.63    | 14.26            | 14.27   | 22.26               | 20.60   | 23.15               | 23.50 | 24.07 | 22.65 |
| 3800           | 0.56                   | 0.64    | 14.14            | 14.22   | 20.97               | 19.98   | 22.94               | 23.79 | 25.05 | 23.50 |
| 3900           | 0.57                   | 0.66    | 14.02            | 14.02   | 21.10               | 19.86   | 23.77               | 24.28 | 27.04 | 25.58 |
| 4000           | 0.58                   | 0.68    | 13.92            | 13.93   | 21.55               | 19.60   | 24.87               | 25.78 | 30.33 | 28.65 |
| 4500           | 0.69                   | 0.78    | 13.58            | 13.57   | 21.59               | 18.99   | 27.30               | 26.89 | 33.77 | 28.83 |
| 4750           | 0.72                   | 0.83    | 13.49            | 13.51   | 23.65               | 19.06   | 24.12               | 24.01 | 27.39 | 24.97 |
| 5000           | 0.79                   | 0.88    | 13.51            | 13.44   | 25.35               | 19.31   | 23.74               | 23.73 | 26.73 | 26.67 |
| 5500           | 0.84                   | 0.97    | 13.63            | 13.75   | 24.45               | 16.43   | 22.71               | 25.01 | 22.73 | 22.91 |
| 6000           | 0.88                   | 1.10    | 13.72            | 13.87   | 25.20               | 14.79   | 21.67               | 21.97 | 18.68 | 17.47 |
| 6500           | 1.03                   | 1.27    | 13.95            | 14.23   | 20.29               | 14.90   | 20.12               | 22.05 | 17.57 | 15.83 |
| 7000           | 1.35                   | 1.50    | 14.87            | 14.74   | 15.47               | 14.78   | 15.39               | 17.60 | 15.54 | 16.15 |

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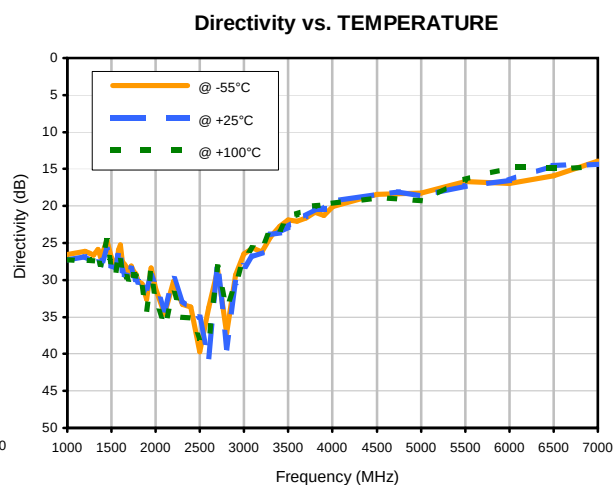
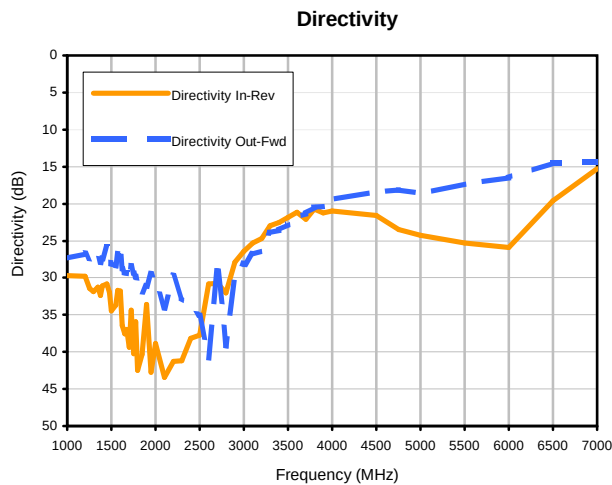
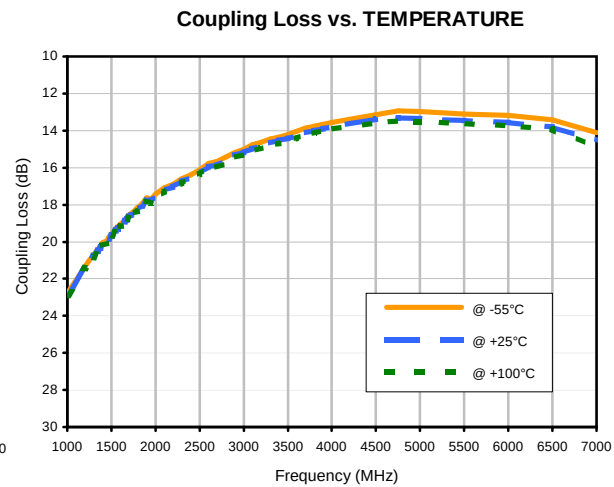
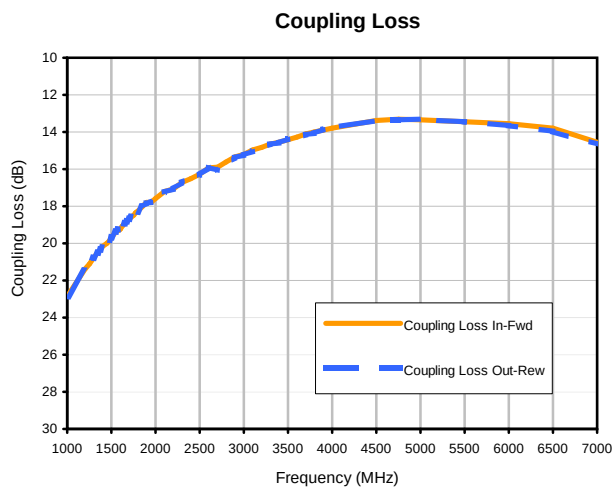
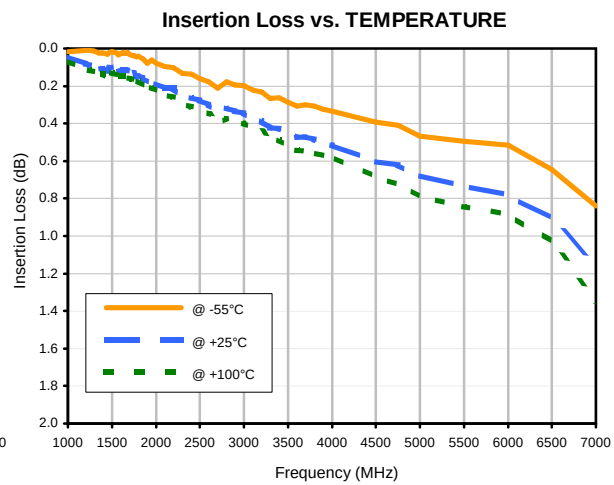
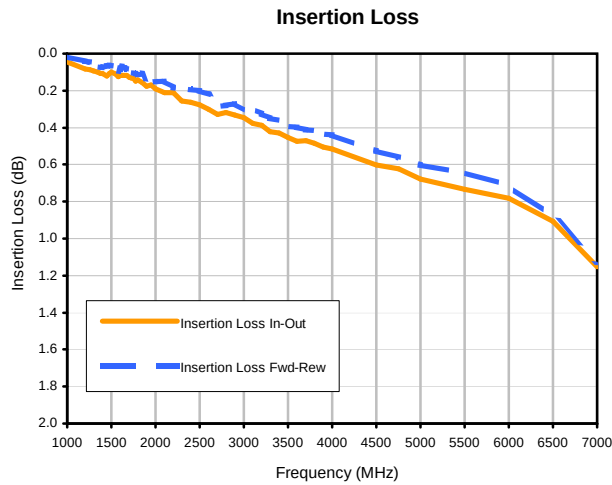
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# Bi-Directional Coupler

## Typical Performance Curves

**SYBD-18-172HP+**



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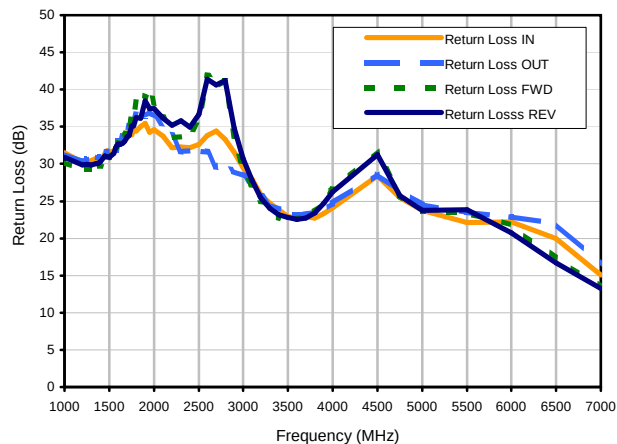


# Bi-Directional Coupler

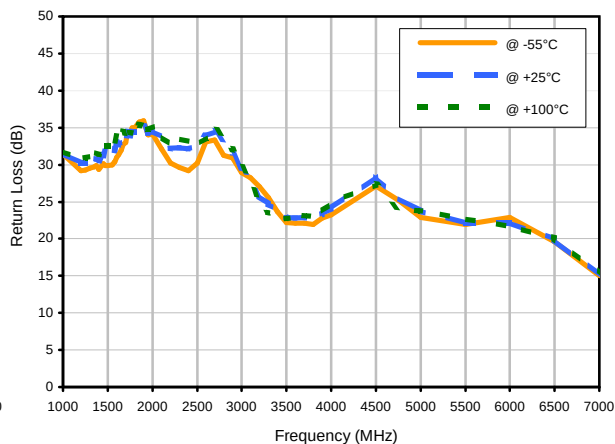
## Typical Performance Curves

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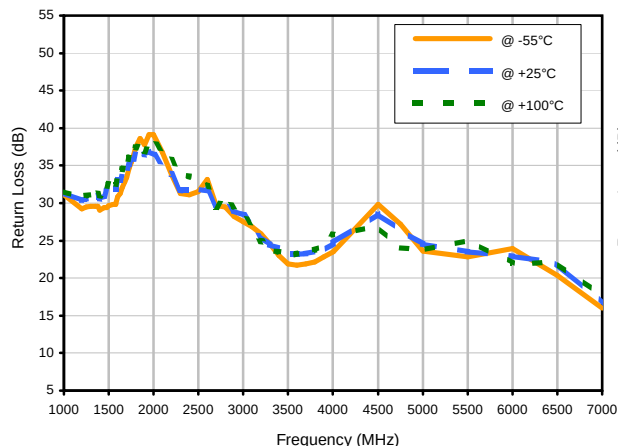
**Return Loss**



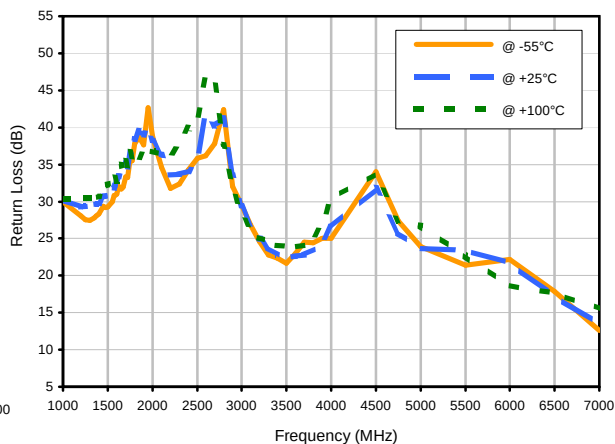
**Return Loss In vs. TEMPERATURE**



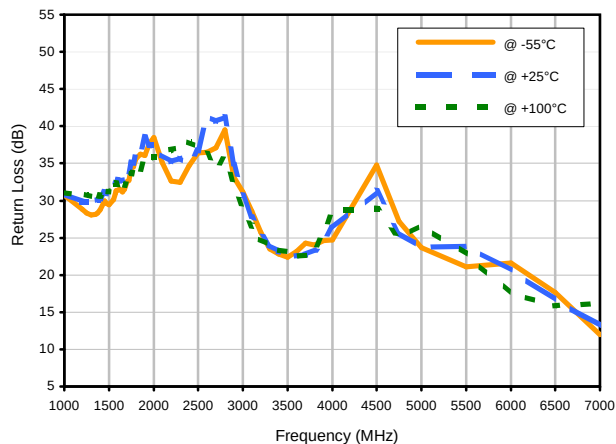
**Return Loss Out vs. TEMPERATURE**



**Return Loss Fwd vs. TEMPERATURE**



**Return Loss Rev vs. TEMPERATURE**



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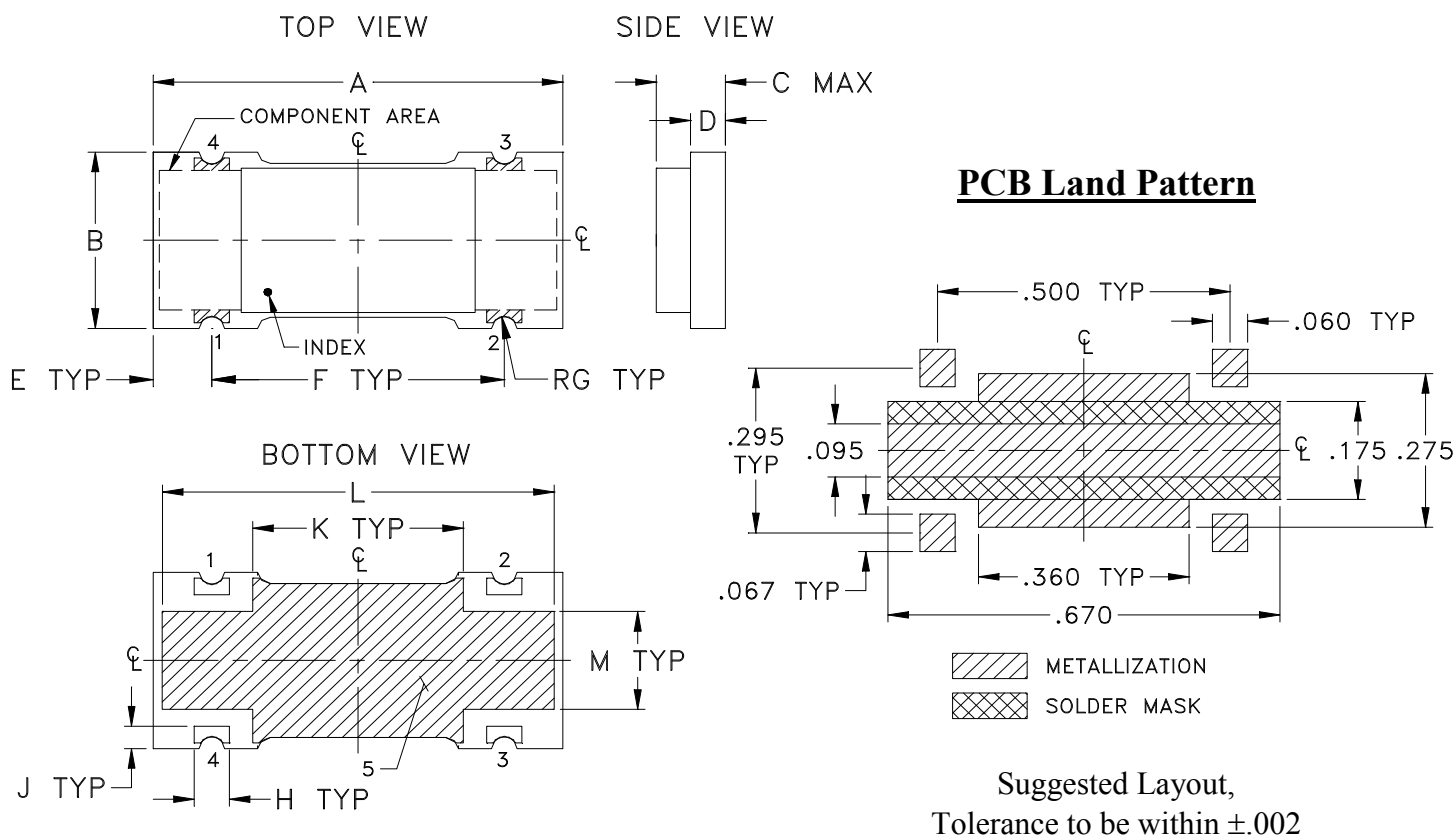


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## Outline Dimensions



| 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>

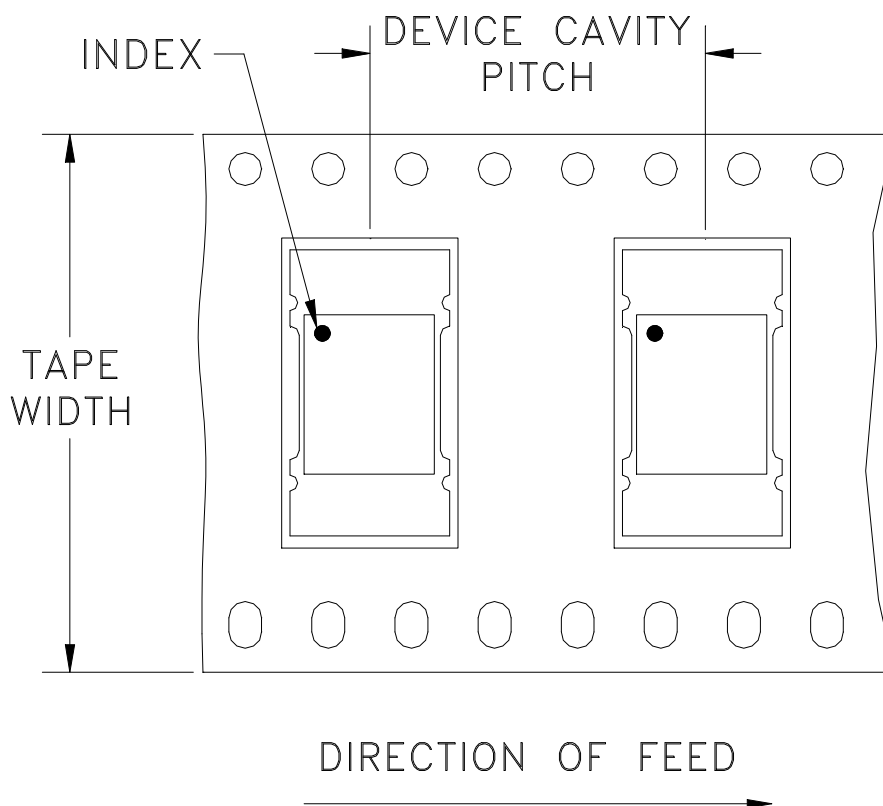
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# Tape & Reel Packaging TR-F84

## 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.

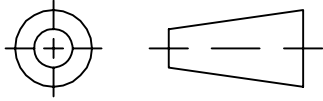
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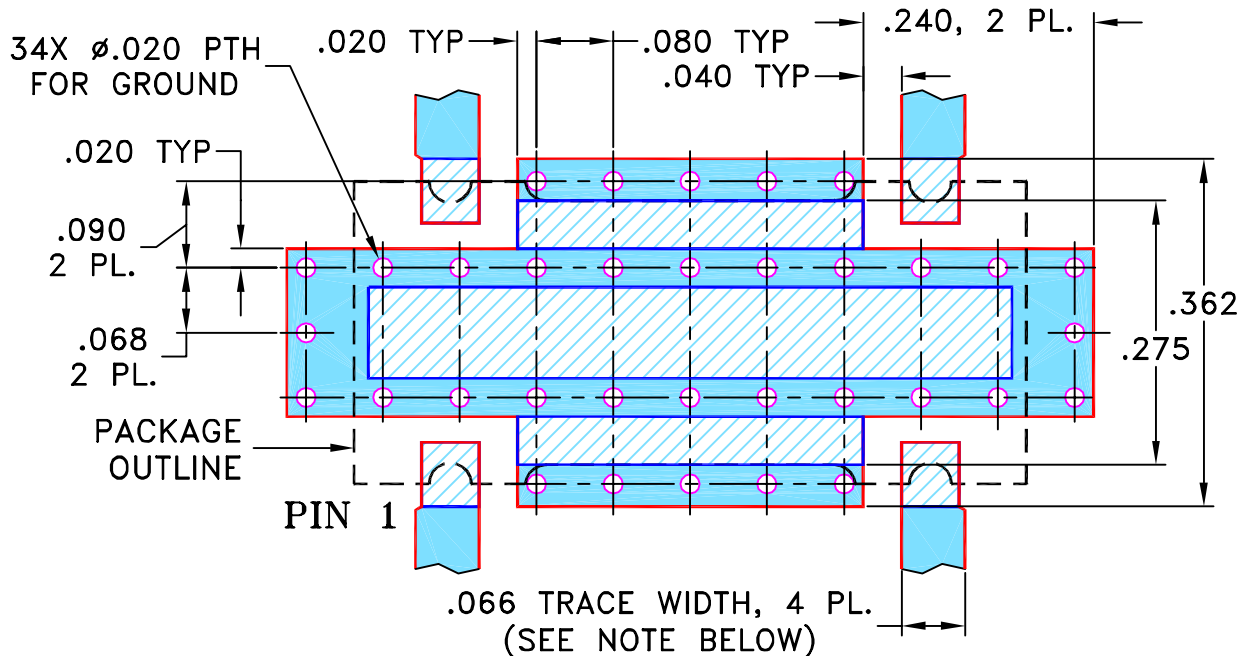
## THIRD ANGLE PROJECTION



## REVISIONS

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

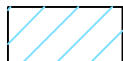
SUGGESTED MOUNTING CONFIGURATION FOR  
JB1233 CASE STYLE, "rw" PIN CONNECTION



- 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

TOLERANCES ON:

2 PL DECIMALS  $\pm$ 3 PL DECIMALS  $\pm$  .005ANGLES  $\pm$ FRACTIONS  $\pm$ 

DRAWN

MMG

12/21/06

CHECKED

AV

12/29/06

APPROVED

WP

12/29/06



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PL, rw, JB1233, SYBD, TB-398

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A

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98-PL-260

REV:  
OR

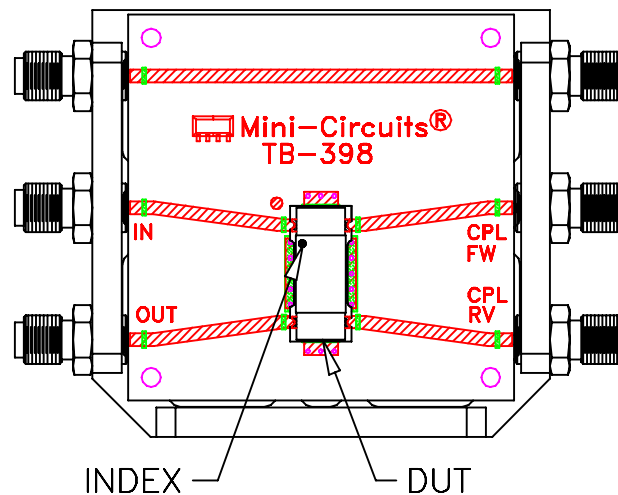
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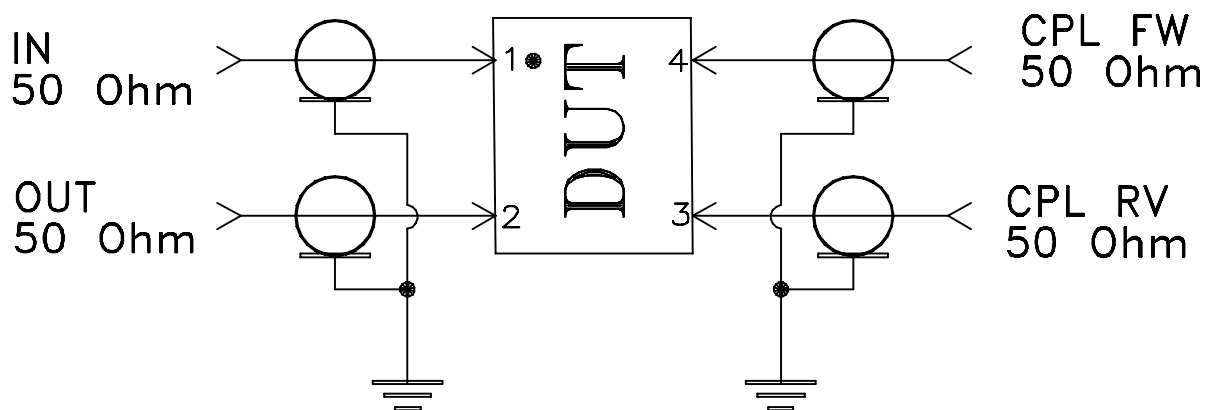
SHEET: 1 OF 1

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

# 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                                                                              |