

# Surface Mount Power Splitter/Combiner

2 Way-90° 50Ω 1700 to 2400 MHz

QBA-24W+  
QBA-24W



Generic photo used for illustration purposes only

CASE STYLE: SM33

+RoHS Compliant

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

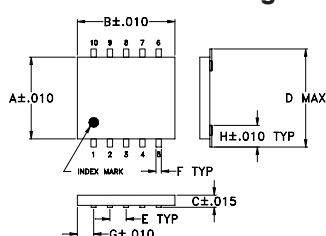
## Maximum Ratings

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

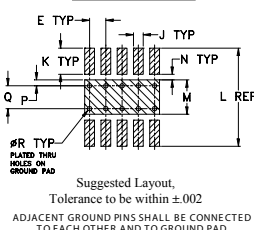
## Pin Connections

|                      |             |
|----------------------|-------------|
| SUM PORT             | 1           |
| PORT 1 (+90°)        | 10          |
| PORT 2 (0°)          | 6           |
| GROUND               | 2,3,4,7,8,9 |
| 50 OHM TERM EXTERNAL | 5           |

## Outline Drawing



## PCB Land Pattern



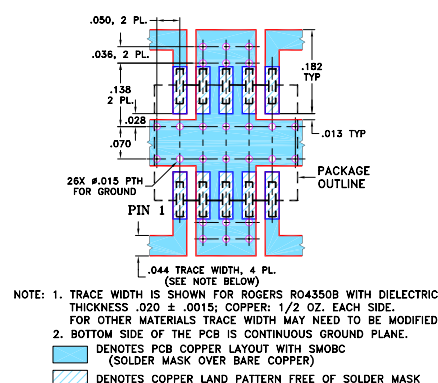
Suggested Layout,  
Tolerance to be within ±.002

ADJACENT GROUND PINS SHALL BE CONNECTED TO EACH OTHER AND TO GROUND PAD

## Outline Dimensions (inch)

| A    | B    | C    | D    | E    | F    | G    | H    |       |
|------|------|------|------|------|------|------|------|-------|
| .250 | .300 | .050 | .310 | .050 | .015 | .050 | .066 |       |
| 6.35 | 7.62 | 1.27 | 7.87 | 1.27 | 0.38 | 1.27 | 1.68 |       |
| J    | K    | L    | M    | N    | P    | Q    | R    | wt    |
| .030 | .095 | .330 | .100 | .020 | .015 | .070 | .014 | grams |
| 0.76 | 2.41 | 8.38 | 2.54 | 0.51 | 0.38 | 1.78 | 0.36 | 0.2   |

## Demo Board MCL P/N: TB-115+ Suggested PCB Layout (PL-004)



NOTE: 1. TRACE WIDTH IS SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS .020 ± .0015, 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.  
B. DENOTES PCB COPPER LAYOUT WITH SMOBC (SOLDER MASK OVER BARE COPPER)  
C. 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

- insertion loss, 0.5 dB typ.
- high power capability, 20W
- good isolation, 21 dB typ.
- ceramic body, good for heat dissipation
- solder plated leads for excellent solderability
- aqueous washable
- protected by U.S. Patent 5,534,830

## Applications

- PCS
- instrumentation
- DCS/GSM
- DECT/PHS

## Electrical Specifications

| FREQ. RANGE (MHz) | ISOLATION (dB) | INSERTION LOSS <sup>1</sup> (dB)<br>Avg. of Coupled Outputs ABOVE 3 dB | PHASE UNBALANCE (Degrees) | AMPLITUDE UNBALANCE (dB) | INPUT POWER <sup>2</sup> (W) |
|-------------------|----------------|------------------------------------------------------------------------|---------------------------|--------------------------|------------------------------|
| $f_L$ - $f_U$     | Typ. Min.      | $\bar{X}$ $\bar{X}$ $\sigma$                                           | Max.                      | Max.                     | below 25°C                   |
| 1700-2400         | 21 15          | 0.49 0.71 0.02                                                         | 6.0                       | 1.2                      | 20                           |

1. Includes test fixture losses.

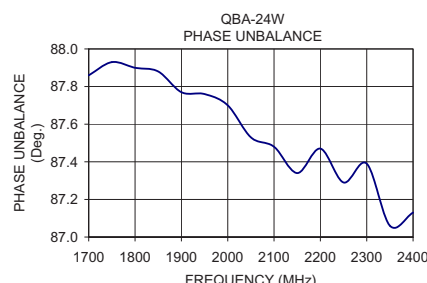
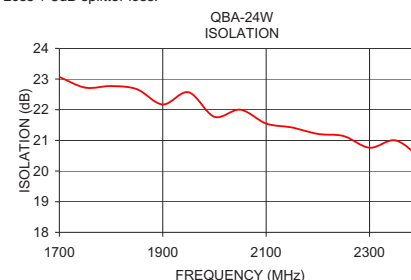
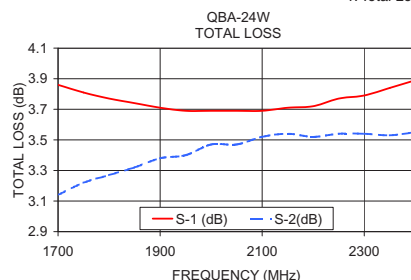
2. Derate linearly to 4W at 100°C

Thermal compound may be applied to decrease body temperature. See application note AN-10-007

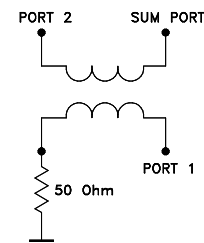
## Typical Performance Data

| Frequency (MHz) | Total Loss <sup>1</sup> (dB) | Amplitude Unbalance (dB) | Isolation (dB) | Phase Unbalance (deg.) | VSWR S | VSWR 1 | VSWR 2 |
|-----------------|------------------------------|--------------------------|----------------|------------------------|--------|--------|--------|
|                 | S-1 S-2                      |                          |                |                        |        |        |        |
| 1700.00         | 3.86 3.14                    | 0.72                     | 23.07          | 87.86                  | 1.19   | 1.24   | 1.20   |
| 1750.00         | 3.81 3.22                    | 0.59                     | 22.72          | 87.93                  | 1.19   | 1.24   | 1.21   |
| 1800.00         | 3.77 3.27                    | 0.50                     | 22.77          | 87.90                  | 1.19   | 1.24   | 1.21   |
| 1850.00         | 3.74 3.32                    | 0.43                     | 22.67          | 87.88                  | 1.19   | 1.23   | 1.21   |
| 1900.00         | 3.71 3.38                    | 0.32                     | 22.17          | 87.77                  | 1.19   | 1.23   | 1.21   |
| 1950.00         | 3.69 3.40                    | 0.29                     | 22.57          | 87.76                  | 1.19   | 1.23   | 1.22   |
| 2000.00         | 3.69 3.47                    | 0.22                     | 21.77          | 87.70                  | 1.19   | 1.22   | 1.22   |
| 2050.00         | 3.69 3.47                    | 0.23                     | 22.00          | 87.53                  | 1.20   | 1.22   | 1.22   |
| 2100.00         | 3.69 3.52                    | 0.17                     | 21.55          | 87.48                  | 1.19   | 1.22   | 1.21   |
| 2150.00         | 3.71 3.54                    | 0.18                     | 21.42          | 87.34                  | 1.19   | 1.21   | 1.21   |
| 2200.00         | 3.72 3.52                    | 0.20                     | 21.21          | 87.47                  | 1.19   | 1.21   | 1.21   |
| 2250.00         | 3.77 3.54                    | 0.22                     | 21.14          | 87.29                  | 1.19   | 1.21   | 1.20   |
| 2300.00         | 3.79 3.54                    | 0.24                     | 20.76          | 87.39                  | 1.19   | 1.20   | 1.20   |
| 2350.00         | 3.84 3.53                    | 0.31                     | 21.00          | 87.06                  | 1.18   | 1.19   | 1.20   |
| 2400.00         | 3.89 3.55                    | 0.34                     | 20.42          | 87.13                  | 1.19   | 1.20   | 1.20   |

1. Total Loss = Insertion Loss + 3dB splitter loss.



## electrical schematic



**Mini-Circuits®**

[www.minicircuits.com](http://www.minicircuits.com) P.O. Box 350166, Brooklyn, NY 11235-0003 (718) 934-4500 sales@minicircuits.com

REV. D  
M151107  
EDB-991104/3  
QBA-24W  
BC/WZ/CP  
200818

# 2 Way-90° Power Splitter/Combiner

QBA-24W

## Typical Performance Data

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

| FREQ.<br>(MHz) | TOTAL LOSS <sup>1</sup> |      |      | AMP.<br>UNBAL.<br>(dB) | PHASE<br>UNBAL.<br>(deg.) | ISOLATION<br>(dB)<br>1-2 | VSWR |           |      |
|----------------|-------------------------|------|------|------------------------|---------------------------|--------------------------|------|-----------|------|
|                | S-1                     | S-2  | AVG. |                        |                           |                          | S    | (:1)<br>1 | 2    |
| 1000           | 5.54                    | 1.78 | 3.66 | 3.76                   | 91.48                     | 21.83                    | 1.09 | 1.32      | 1.08 |
| 1100           | 5.08                    | 1.99 | 3.53 | 3.10                   | 91.32                     | 22.50                    | 1.09 | 1.30      | 1.07 |
| 1200           | 4.71                    | 2.19 | 3.45 | 2.52                   | 91.13                     | 23.32                    | 1.10 | 1.28      | 1.08 |
| 1300           | 4.40                    | 2.39 | 3.39 | 2.00                   | 90.97                     | 24.30                    | 1.10 | 1.25      | 1.08 |
| 1400           | 4.14                    | 2.58 | 3.36 | 1.56                   | 90.84                     | 25.24                    | 1.12 | 1.22      | 1.09 |
| 1500           | 3.93                    | 2.75 | 3.34 | 1.18                   | 90.74                     | 25.97                    | 1.13 | 1.18      | 1.11 |
| 1600           | 3.75                    | 2.91 | 3.33 | 0.84                   | 90.67                     | 26.15                    | 1.15 | 1.15      | 1.13 |
| 1625           | 3.72                    | 2.95 | 3.34 | 0.77                   | 90.66                     | 26.07                    | 1.16 | 1.15      | 1.13 |
| 1650           | 3.69                    | 2.98 | 3.34 | 0.70                   | 90.67                     | 25.92                    | 1.16 | 1.14      | 1.14 |
| 1675           | 3.65                    | 3.02 | 3.34 | 0.63                   | 90.65                     | 25.71                    | 1.17 | 1.14      | 1.15 |
| 1700           | 3.63                    | 3.05 | 3.34 | 0.57                   | 90.63                     | 25.49                    | 1.17 | 1.13      | 1.15 |
| 1725           | 3.60                    | 3.09 | 3.34 | 0.51                   | 90.63                     | 25.23                    | 1.18 | 1.13      | 1.16 |
| 1750           | 3.57                    | 3.12 | 3.34 | 0.45                   | 90.59                     | 24.97                    | 1.18 | 1.13      | 1.16 |
| 1775           | 3.55                    | 3.16 | 3.36 | 0.40                   | 90.60                     | 24.65                    | 1.19 | 1.13      | 1.17 |
| 1800           | 3.53                    | 3.18 | 3.36 | 0.35                   | 90.58                     | 24.39                    | 1.19 | 1.13      | 1.17 |
| 1825           | 3.51                    | 3.21 | 3.36 | 0.30                   | 90.56                     | 24.07                    | 1.20 | 1.13      | 1.18 |
| 1850           | 3.50                    | 3.24 | 3.37 | 0.26                   | 90.57                     | 23.76                    | 1.20 | 1.13      | 1.19 |
| 1875           | 3.48                    | 3.26 | 3.37 | 0.22                   | 90.56                     | 23.41                    | 1.21 | 1.13      | 1.19 |
| 1900           | 3.47                    | 3.29 | 3.38 | 0.18                   | 90.55                     | 23.10                    | 1.21 | 1.13      | 1.20 |
| 1925           | 3.46                    | 3.31 | 3.39 | 0.15                   | 90.52                     | 22.74                    | 1.22 | 1.14      | 1.20 |
| 1950           | 3.45                    | 3.33 | 3.39 | 0.12                   | 90.51                     | 22.44                    | 1.22 | 1.14      | 1.21 |
| 1975           | 3.44                    | 3.35 | 3.40 | 0.09                   | 90.47                     | 22.11                    | 1.23 | 1.15      | 1.21 |
| 2000           | 3.43                    | 3.38 | 3.40 | 0.05                   | 90.43                     | 21.78                    | 1.24 | 1.15      | 1.22 |
| 2025           | 3.43                    | 3.40 | 3.42 | 0.03                   | 90.44                     | 21.45                    | 1.24 | 1.16      | 1.23 |
| 2050           | 3.43                    | 3.42 | 3.42 | 0.01                   | 90.43                     | 21.16                    | 1.25 | 1.16      | 1.23 |
| 2075           | 3.42                    | 3.43 | 3.43 | 0.01                   | 90.42                     | 20.87                    | 1.25 | 1.17      | 1.24 |
| 2100           | 3.42                    | 3.45 | 3.44 | 0.03                   | 90.41                     | 20.59                    | 1.26 | 1.18      | 1.24 |
| 2125           | 3.42                    | 3.46 | 3.44 | 0.04                   | 90.39                     | 20.30                    | 1.26 | 1.19      | 1.25 |
| 2150           | 3.43                    | 3.48 | 3.45 | 0.05                   | 90.33                     | 20.03                    | 1.27 | 1.20      | 1.25 |
| 2175           | 3.43                    | 3.49 | 3.46 | 0.06                   | 90.33                     | 19.76                    | 1.27 | 1.21      | 1.26 |
| 2200           | 3.44                    | 3.50 | 3.47 | 0.06                   | 90.27                     | 19.52                    | 1.28 | 1.21      | 1.26 |
| 2225           | 3.44                    | 3.52 | 3.48 | 0.08                   | 90.28                     | 19.25                    | 1.28 | 1.22      | 1.27 |
| 2250           | 3.45                    | 3.53 | 3.49 | 0.08                   | 90.28                     | 19.02                    | 1.29 | 1.23      | 1.27 |
| 2275           | 3.46                    | 3.54 | 3.50 | 0.08                   | 90.28                     | 18.78                    | 1.29 | 1.24      | 1.28 |
| 2300           | 3.47                    | 3.54 | 3.51 | 0.07                   | 90.24                     | 18.58                    | 1.30 | 1.26      | 1.28 |
| 2325           | 3.49                    | 3.56 | 3.52 | 0.07                   | 90.25                     | 18.32                    | 1.30 | 1.27      | 1.28 |
| 2350           | 3.51                    | 3.56 | 3.53 | 0.05                   | 90.30                     | 18.12                    | 1.31 | 1.28      | 1.29 |
| 2375           | 3.52                    | 3.55 | 3.54 | 0.03                   | 90.24                     | 17.90                    | 1.31 | 1.29      | 1.29 |
| 2400           | 3.54                    | 3.56 | 3.55 | 0.02                   | 90.20                     | 17.73                    | 1.32 | 1.30      | 1.30 |
| 2425           | 3.56                    | 3.56 | 3.56 | 0.00                   | 90.19                     | 17.55                    | 1.32 | 1.31      | 1.30 |
| 2450           | 3.58                    | 3.55 | 3.56 | 0.03                   | 90.18                     | 17.40                    | 1.32 | 1.33      | 1.30 |
| 2475           | 3.60                    | 3.55 | 3.58 | 0.05                   | 90.18                     | 17.22                    | 1.33 | 1.34      | 1.31 |
| 2500           | 3.62                    | 3.55 | 3.58 | 0.07                   | 90.18                     | 17.05                    | 1.33 | 1.35      | 1.31 |
| 2600           | 3.73                    | 3.51 | 3.62 | 0.22                   | 90.14                     | 16.45                    | 1.34 | 1.40      | 1.31 |
| 2700           | 3.88                    | 3.45 | 3.67 | 0.43                   | 90.12                     | 15.92                    | 1.35 | 1.45      | 1.32 |
| 2800           | 4.07                    | 3.37 | 3.72 | 0.70                   | 89.99                     | 15.43                    | 1.35 | 1.50      | 1.32 |
| 2900           | 4.29                    | 3.24 | 3.77 | 1.05                   | 89.86                     | 14.94                    | 1.35 | 1.56      | 1.32 |
| 3000           | 4.59                    | 3.09 | 3.84 | 1.50                   | 89.55                     | 14.43                    | 1.35 | 1.62      | 1.32 |
| 3100           | 4.94                    | 2.93 | 3.93 | 2.02                   | 89.11                     | 13.93                    | 1.35 | 1.71      | 1.31 |
| 3200           | 5.41                    | 2.74 | 4.07 | 2.67                   | 88.39                     | 13.31                    | 1.34 | 1.82      | 1.31 |
| 3300           | 5.97                    | 2.54 | 4.26 | 3.43                   | 87.20                     | 12.70                    | 1.33 | 1.98      | 1.30 |
| 3400           | 6.66                    | 2.34 | 4.50 | 4.32                   | 85.18                     | 12.07                    | 1.32 | 2.19      | 1.30 |

<sup>1</sup> Total Loss = Insertion Loss + 3dB Splitter Loss

REV. X2

QBA-24W

100627

Page 1 of 3



IF/RF MICROWAVE COMPONENTS • ISO 9001 ISO 14001 AS9100 CERTIFIED • RoHS compliant

P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661



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



# 2 Way-90° Power Splitter/Combiner

**QBA-24W**

## Typical Performance Data

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

| FREQ.<br>(MHz) | TOTAL LOSS <sup>1</sup> |      |      | AMP.<br>UNBAL.<br>(dB) | PHASE<br>UNBAL.<br>(deg.) | ISOLATION<br>(dB)<br>1-2 | VSWR |           |      |
|----------------|-------------------------|------|------|------------------------|---------------------------|--------------------------|------|-----------|------|
|                | S-1                     | S-2  | AVG. |                        |                           |                          | S    | (:1)<br>1 | 2    |
| 1000           | 5.39                    | 1.60 | 3.49 | 3.79                   | 89.35                     | 21.63                    | 1.09 | 1.32      | 1.08 |
| 1100           | 4.94                    | 1.80 | 3.37 | 3.13                   | 89.55                     | 22.17                    | 1.10 | 1.31      | 1.08 |
| 1200           | 4.56                    | 1.99 | 3.28 | 2.56                   | 89.84                     | 23.04                    | 1.10 | 1.29      | 1.08 |
| 1300           | 4.23                    | 2.17 | 3.20 | 2.05                   | 90.12                     | 24.24                    | 1.10 | 1.26      | 1.08 |
| 1400           | 3.95                    | 2.35 | 3.15 | 1.60                   | 90.34                     | 25.33                    | 1.11 | 1.22      | 1.09 |
| 1500           | 3.73                    | 2.52 | 3.12 | 1.22                   | 90.54                     | 26.33                    | 1.12 | 1.18      | 1.11 |
| 1600           | 3.54                    | 2.67 | 3.11 | 0.88                   | 90.68                     | 26.74                    | 1.15 | 1.16      | 1.13 |
| 1625           | 3.51                    | 2.70 | 3.11 | 0.81                   | 90.71                     | 26.70                    | 1.15 | 1.15      | 1.13 |
| 1650           | 3.48                    | 2.73 | 3.11 | 0.74                   | 90.75                     | 26.55                    | 1.16 | 1.14      | 1.14 |
| 1675           | 3.43                    | 2.77 | 3.10 | 0.66                   | 90.79                     | 26.26                    | 1.17 | 1.13      | 1.15 |
| 1700           | 3.40                    | 2.80 | 3.10 | 0.60                   | 90.83                     | 25.98                    | 1.18 | 1.13      | 1.16 |
| 1725           | 3.37                    | 2.83 | 3.10 | 0.54                   | 90.86                     | 25.67                    | 1.18 | 1.12      | 1.17 |
| 1750           | 3.35                    | 2.86 | 3.10 | 0.49                   | 90.91                     | 25.33                    | 1.19 | 1.12      | 1.17 |
| 1775           | 3.33                    | 2.90 | 3.11 | 0.43                   | 90.93                     | 24.91                    | 1.20 | 1.12      | 1.19 |
| 1800           | 3.30                    | 2.92 | 3.11 | 0.38                   | 90.99                     | 24.60                    | 1.20 | 1.11      | 1.19 |
| 1825           | 3.28                    | 2.96 | 3.12 | 0.32                   | 91.03                     | 24.25                    | 1.21 | 1.12      | 1.20 |
| 1850           | 3.26                    | 2.97 | 3.12 | 0.29                   | 91.07                     | 23.85                    | 1.22 | 1.11      | 1.22 |
| 1875           | 3.25                    | 3.00 | 3.13 | 0.24                   | 91.09                     | 23.35                    | 1.23 | 1.12      | 1.23 |
| 1900           | 3.23                    | 3.03 | 3.13 | 0.20                   | 91.09                     | 22.94                    | 1.24 | 1.12      | 1.23 |
| 1925           | 3.21                    | 3.04 | 3.13 | 0.17                   | 91.14                     | 22.59                    | 1.24 | 1.13      | 1.24 |
| 1950           | 3.20                    | 3.07 | 3.14 | 0.13                   | 91.17                     | 22.29                    | 1.24 | 1.13      | 1.25 |
| 1975           | 3.19                    | 3.09 | 3.14 | 0.10                   | 91.22                     | 21.84                    | 1.25 | 1.14      | 1.26 |
| 2000           | 3.19                    | 3.12 | 3.15 | 0.07                   | 91.30                     | 21.39                    | 1.26 | 1.15      | 1.27 |
| 2025           | 3.18                    | 3.13 | 3.16 | 0.05                   | 91.35                     | 21.03                    | 1.27 | 1.16      | 1.27 |
| 2050           | 3.17                    | 3.15 | 3.16 | 0.02                   | 91.40                     | 20.72                    | 1.27 | 1.17      | 1.28 |
| 2075           | 3.16                    | 3.17 | 3.17 | 0.01                   | 91.42                     | 20.44                    | 1.28 | 1.18      | 1.28 |
| 2100           | 3.16                    | 3.19 | 3.18 | 0.03                   | 91.41                     | 20.10                    | 1.28 | 1.19      | 1.29 |
| 2125           | 3.16                    | 3.20 | 3.18 | 0.04                   | 91.45                     | 19.78                    | 1.29 | 1.20      | 1.29 |
| 2150           | 3.16                    | 3.21 | 3.19 | 0.05                   | 91.54                     | 19.49                    | 1.30 | 1.20      | 1.30 |
| 2175           | 3.16                    | 3.23 | 3.19 | 0.07                   | 91.58                     | 19.21                    | 1.30 | 1.21      | 1.31 |
| 2200           | 3.17                    | 3.24 | 3.21 | 0.07                   | 91.62                     | 18.92                    | 1.31 | 1.23      | 1.31 |
| 2225           | 3.18                    | 3.25 | 3.21 | 0.07                   | 91.62                     | 18.66                    | 1.31 | 1.24      | 1.31 |
| 2250           | 3.17                    | 3.26 | 3.22 | 0.09                   | 91.63                     | 18.42                    | 1.32 | 1.25      | 1.31 |
| 2275           | 3.19                    | 3.27 | 3.23 | 0.08                   | 91.68                     | 18.15                    | 1.33 | 1.27      | 1.32 |
| 2300           | 3.20                    | 3.27 | 3.24 | 0.07                   | 91.70                     | 17.94                    | 1.33 | 1.28      | 1.32 |
| 2325           | 3.21                    | 3.29 | 3.25 | 0.08                   | 91.73                     | 17.73                    | 1.34 | 1.30      | 1.32 |
| 2350           | 3.23                    | 3.28 | 3.26 | 0.05                   | 91.73                     | 17.49                    | 1.35 | 1.31      | 1.32 |
| 2375           | 3.24                    | 3.29 | 3.26 | 0.05                   | 91.76                     | 17.23                    | 1.36 | 1.32      | 1.32 |
| 2400           | 3.25                    | 3.29 | 3.27 | 0.04                   | 91.82                     | 17.03                    | 1.36 | 1.34      | 1.32 |
| 2425           | 3.26                    | 3.28 | 3.27 | 0.02                   | 91.87                     | 16.88                    | 1.37 | 1.36      | 1.31 |
| 2450           | 3.27                    | 3.28 | 3.27 | 0.01                   | 91.88                     | 16.80                    | 1.37 | 1.37      | 1.31 |
| 2475           | 3.29                    | 3.28 | 3.28 | 0.01                   | 91.89                     | 16.66                    | 1.37 | 1.38      | 1.32 |
| 2500           | 3.31                    | 3.28 | 3.29 | 0.03                   | 91.84                     | 16.47                    | 1.37 | 1.39      | 1.32 |
| 2600           | 3.41                    | 3.23 | 3.32 | 0.18                   | 91.85                     | 15.96                    | 1.38 | 1.43      | 1.31 |
| 2700           | 3.53                    | 3.15 | 3.34 | 0.39                   | 91.95                     | 15.49                    | 1.39 | 1.47      | 1.31 |
| 2800           | 3.69                    | 3.05 | 3.37 | 0.64                   | 92.02                     | 15.11                    | 1.39 | 1.52      | 1.30 |
| 2900           | 3.90                    | 2.90 | 3.40 | 1.00                   | 92.16                     | 14.74                    | 1.39 | 1.58      | 1.29 |
| 3000           | 4.16                    | 2.74 | 3.45 | 1.42                   | 92.37                     | 14.36                    | 1.37 | 1.63      | 1.29 |
| 3100           | 4.48                    | 2.53 | 3.50 | 1.95                   | 92.92                     | 13.94                    | 1.36 | 1.71      | 1.29 |
| 3200           | 4.94                    | 2.34 | 3.64 | 2.59                   | 93.35                     | 13.29                    | 1.32 | 1.83      | 1.31 |
| 3300           | 5.52                    | 2.11 | 3.82 | 3.41                   | 94.92                     | 12.72                    | 1.31 | 2.01      | 1.32 |
| 3400           | 6.17                    | 1.92 | 4.05 | 4.25                   | 97.18                     | 12.06                    | 1.32 | 2.25      | 1.35 |

<sup>1</sup> Total Loss = Insertion Loss + 3dB Splitter Loss

REV. X2

QBA-24W

100627

Page 2 of 3



IF/RF MICROWAVE COMPONENTS • ISO 9001 ISO 14001 AS9100 CERTIFIED RoHS compliant

P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661



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



# 2 Way-90° Power Splitter/Combiner

QBA-24W

## Typical Performance Data

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

| FREQ.<br>(MHz) | TOTAL LOSS <sup>1</sup> |      |      | AMP.<br>UNBAL.<br>(dB) | PHASE<br>UNBAL.<br>(deg.) | ISOLATION<br>(dB)<br>1-2 | VSWR |           |      |
|----------------|-------------------------|------|------|------------------------|---------------------------|--------------------------|------|-----------|------|
|                | S-1                     | S-2  | AVG. |                        |                           |                          | S    | (:1)<br>1 | 2    |
| 1000           | 5.59                    | 1.88 | 3.73 | 3.71                   | 92.25                     | 22.35                    | 1.07 | 1.30      | 1.07 |
| 1100           | 5.14                    | 2.11 | 3.62 | 3.04                   | 92.16                     | 22.96                    | 1.09 | 1.28      | 1.08 |
| 1200           | 4.78                    | 2.32 | 3.55 | 2.46                   | 92.07                     | 23.52                    | 1.11 | 1.26      | 1.09 |
| 1300           | 4.48                    | 2.53 | 3.50 | 1.94                   | 92.04                     | 24.07                    | 1.12 | 1.24      | 1.11 |
| 1400           | 4.23                    | 2.73 | 3.48 | 1.50                   | 92.06                     | 24.52                    | 1.14 | 1.21      | 1.13 |
| 1500           | 4.04                    | 2.92 | 3.48 | 1.13                   | 92.08                     | 24.72                    | 1.16 | 1.20      | 1.14 |
| 1600           | 3.87                    | 3.08 | 3.48 | 0.80                   | 92.12                     | 24.57                    | 1.18 | 1.18      | 1.15 |
| 1625           | 3.85                    | 3.11 | 3.48 | 0.74                   | 92.14                     | 24.46                    | 1.18 | 1.18      | 1.15 |
| 1650           | 3.82                    | 3.15 | 3.49 | 0.66                   | 92.15                     | 24.34                    | 1.18 | 1.17      | 1.15 |
| 1675           | 3.78                    | 3.19 | 3.49 | 0.59                   | 92.17                     | 24.20                    | 1.18 | 1.17      | 1.15 |
| 1700           | 3.76                    | 3.22 | 3.49 | 0.54                   | 92.18                     | 24.07                    | 1.19 | 1.17      | 1.15 |
| 1725           | 3.73                    | 3.26 | 3.50 | 0.47                   | 92.20                     | 23.92                    | 1.19 | 1.17      | 1.15 |
| 1750           | 3.71                    | 3.28 | 3.50 | 0.43                   | 92.21                     | 23.78                    | 1.20 | 1.17      | 1.16 |
| 1775           | 3.69                    | 3.32 | 3.50 | 0.37                   | 92.21                     | 23.62                    | 1.20 | 1.16      | 1.16 |
| 1800           | 3.67                    | 3.34 | 3.51 | 0.33                   | 92.23                     | 23.46                    | 1.20 | 1.16      | 1.16 |
| 1825           | 3.65                    | 3.38 | 3.52 | 0.28                   | 92.23                     | 23.23                    | 1.20 | 1.16      | 1.16 |
| 1850           | 3.63                    | 3.40 | 3.52 | 0.23                   | 92.25                     | 23.07                    | 1.21 | 1.17      | 1.16 |
| 1875           | 3.62                    | 3.43 | 3.52 | 0.19                   | 92.29                     | 22.84                    | 1.21 | 1.17      | 1.16 |
| 1900           | 3.61                    | 3.45 | 3.53 | 0.16                   | 92.32                     | 22.70                    | 1.21 | 1.17      | 1.16 |
| 1925           | 3.60                    | 3.47 | 3.54 | 0.13                   | 92.35                     | 22.49                    | 1.21 | 1.17      | 1.16 |
| 1950           | 3.59                    | 3.50 | 3.54 | 0.09                   | 92.35                     | 22.33                    | 1.21 | 1.17      | 1.17 |
| 1975           | 3.59                    | 3.52 | 3.56 | 0.07                   | 92.41                     | 22.06                    | 1.21 | 1.17      | 1.17 |
| 2000           | 3.57                    | 3.54 | 3.55 | 0.03                   | 92.35                     | 21.92                    | 1.22 | 1.18      | 1.17 |
| 2025           | 3.57                    | 3.55 | 3.56 | 0.02                   | 92.39                     | 21.71                    | 1.22 | 1.18      | 1.17 |
| 2050           | 3.56                    | 3.57 | 3.56 | 0.01                   | 92.37                     | 21.56                    | 1.22 | 1.18      | 1.17 |
| 2075           | 3.56                    | 3.58 | 3.57 | 0.02                   | 92.39                     | 21.35                    | 1.22 | 1.19      | 1.17 |
| 2100           | 3.56                    | 3.60 | 3.58 | 0.04                   | 92.43                     | 21.16                    | 1.22 | 1.19      | 1.18 |
| 2125           | 3.57                    | 3.61 | 3.59 | 0.04                   | 92.42                     | 20.96                    | 1.23 | 1.20      | 1.18 |
| 2150           | 3.57                    | 3.62 | 3.59 | 0.05                   | 92.42                     | 20.80                    | 1.23 | 1.20      | 1.18 |
| 2175           | 3.57                    | 3.63 | 3.60 | 0.06                   | 92.45                     | 20.63                    | 1.23 | 1.20      | 1.18 |
| 2200           | 3.59                    | 3.64 | 3.62 | 0.05                   | 92.47                     | 20.35                    | 1.23 | 1.21      | 1.18 |
| 2225           | 3.59                    | 3.65 | 3.62 | 0.06                   | 92.51                     | 20.16                    | 1.24 | 1.21      | 1.19 |
| 2250           | 3.61                    | 3.65 | 3.63 | 0.04                   | 92.47                     | 20.00                    | 1.24 | 1.22      | 1.19 |
| 2275           | 3.62                    | 3.65 | 3.63 | 0.03                   | 92.46                     | 19.83                    | 1.24 | 1.22      | 1.20 |
| 2300           | 3.64                    | 3.66 | 3.65 | 0.02                   | 92.45                     | 19.64                    | 1.24 | 1.23      | 1.20 |
| 2325           | 3.65                    | 3.67 | 3.66 | 0.02                   | 92.44                     | 19.46                    | 1.25 | 1.24      | 1.21 |
| 2350           | 3.67                    | 3.67 | 3.67 | 0.00                   | 92.49                     | 19.26                    | 1.25 | 1.24      | 1.21 |
| 2375           | 3.70                    | 3.66 | 3.68 | 0.04                   | 92.46                     | 19.11                    | 1.25 | 1.25      | 1.21 |
| 2400           | 3.70                    | 3.65 | 3.68 | 0.05                   | 92.39                     | 18.98                    | 1.25 | 1.26      | 1.22 |
| 2425           | 3.72                    | 3.65 | 3.69 | 0.07                   | 92.36                     | 18.86                    | 1.25 | 1.27      | 1.23 |
| 2450           | 3.75                    | 3.65 | 3.70 | 0.10                   | 92.38                     | 18.68                    | 1.25 | 1.27      | 1.23 |
| 2475           | 3.77                    | 3.65 | 3.71 | 0.12                   | 92.38                     | 18.52                    | 1.25 | 1.28      | 1.24 |
| 2500           | 3.81                    | 3.64 | 3.73 | 0.16                   | 92.39                     | 18.30                    | 1.25 | 1.29      | 1.25 |
| 2600           | 3.95                    | 3.61 | 3.78 | 0.35                   | 92.38                     | 17.54                    | 1.26 | 1.33      | 1.27 |
| 2700           | 4.12                    | 3.54 | 3.83 | 0.58                   | 92.13                     | 16.91                    | 1.27 | 1.40      | 1.30 |
| 2800           | 4.34                    | 3.48 | 3.91 | 0.86                   | 91.93                     | 16.20                    | 1.28 | 1.46      | 1.33 |
| 2900           | 4.61                    | 3.36 | 3.98 | 1.25                   | 91.58                     | 15.47                    | 1.30 | 1.53      | 1.35 |
| 3000           | 4.95                    | 3.24 | 4.10 | 1.71                   | 91.07                     | 14.73                    | 1.32 | 1.62      | 1.36 |
| 3100           | 5.36                    | 3.13 | 4.24 | 2.23                   | 90.37                     | 13.99                    | 1.33 | 1.72      | 1.38 |
| 3200           | 5.84                    | 3.00 | 4.42 | 2.84                   | 89.62                     | 13.17                    | 1.34 | 1.84      | 1.37 |
| 3300           | 6.40                    | 2.82 | 4.61 | 3.58                   | 88.01                     | 12.52                    | 1.36 | 2.00      | 1.36 |
| 3400           | 7.07                    | 2.68 | 4.87 | 4.39                   | 85.99                     | 11.82                    | 1.37 | 2.20      | 1.33 |

<sup>1</sup> Total Loss = Insertion Loss + 3dB Splitter Loss

REV. X2

QBA-24W

100627

Page 3 of 3



IF/RF MICROWAVE COMPONENTS • ISO 9001 ISO 14001 AS9100 CERTIFIED RoHS compliant

P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661



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

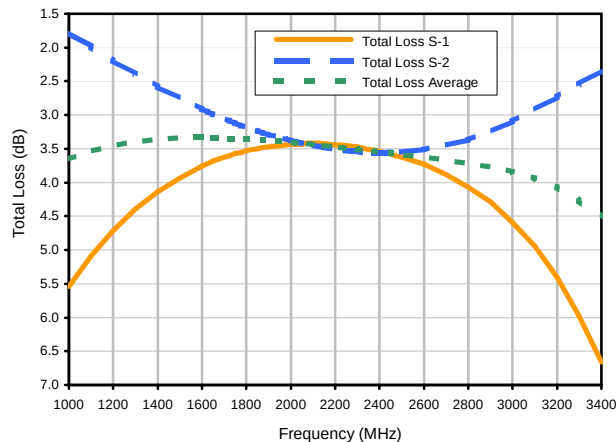


# 2 Way-90° Power Splitter/Combiner

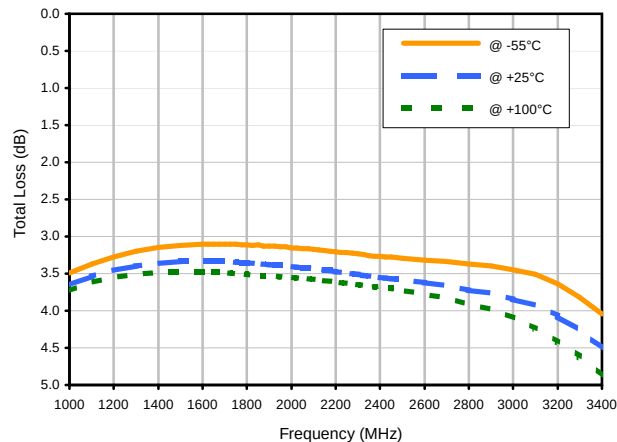
QBA-24W

## Typical Performance Curves

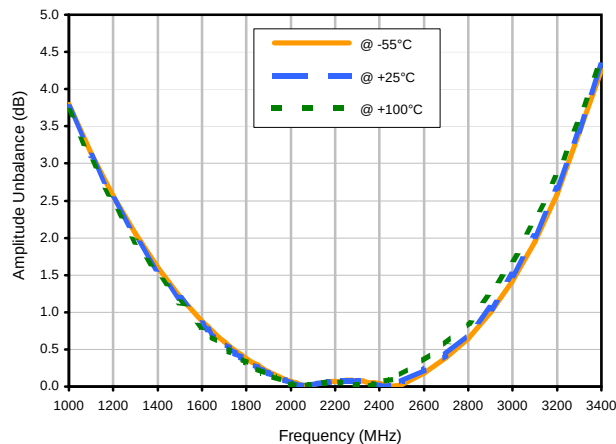
Total Loss



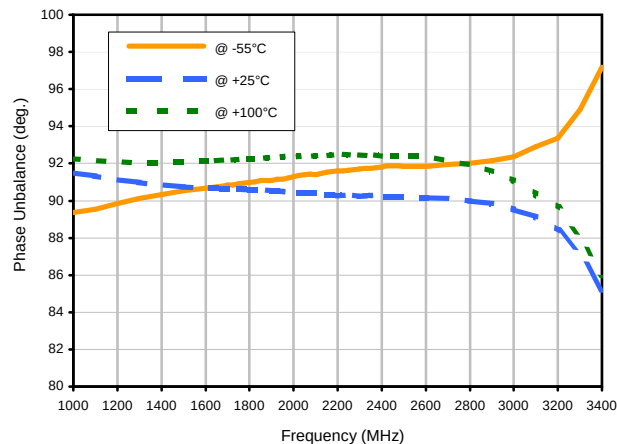
Average Total Loss vs. TEMPERATURE



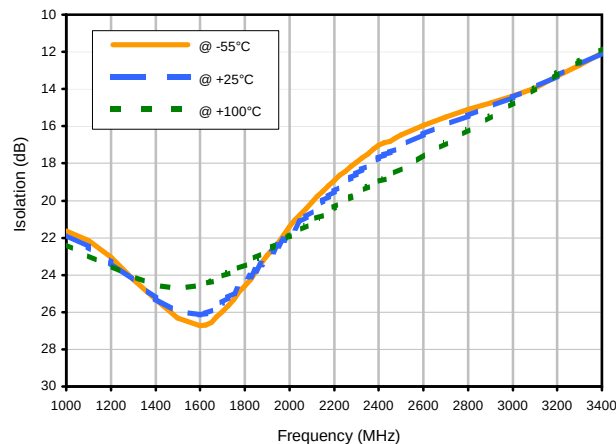
Amplitude Unbalance vs. TEMPERATURE



Phase Unbalance vs. TEMPERATURE



Isolation 1-2 vs. TEMPERATURE

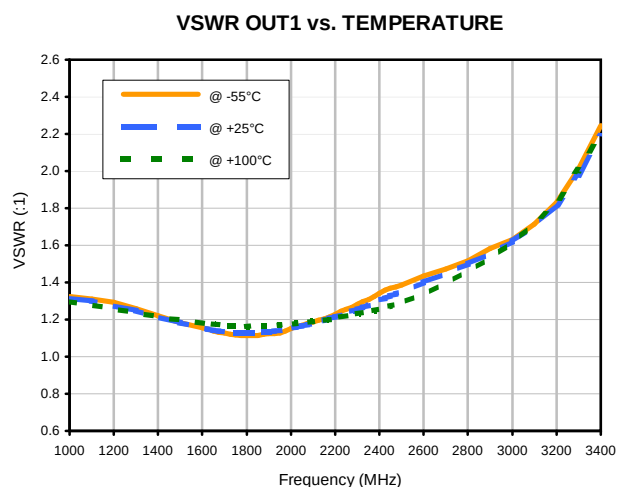
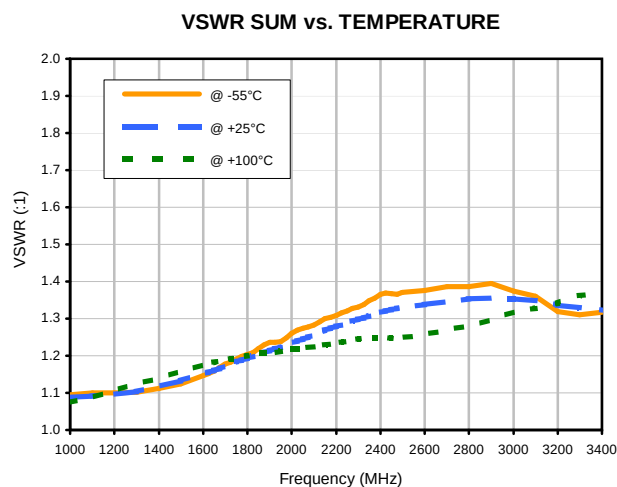
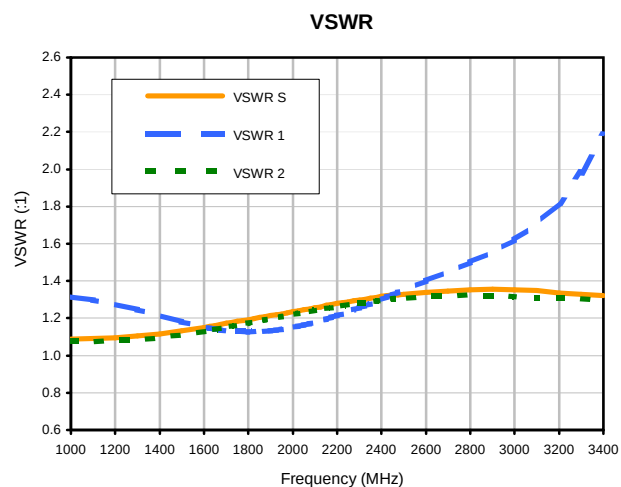


REV. X2  
QBA-24W  
100627  
Page 1 of 2

# 2 Way-90° Power Splitter/Combiner

QBA-24W

## Typical Performance Curves



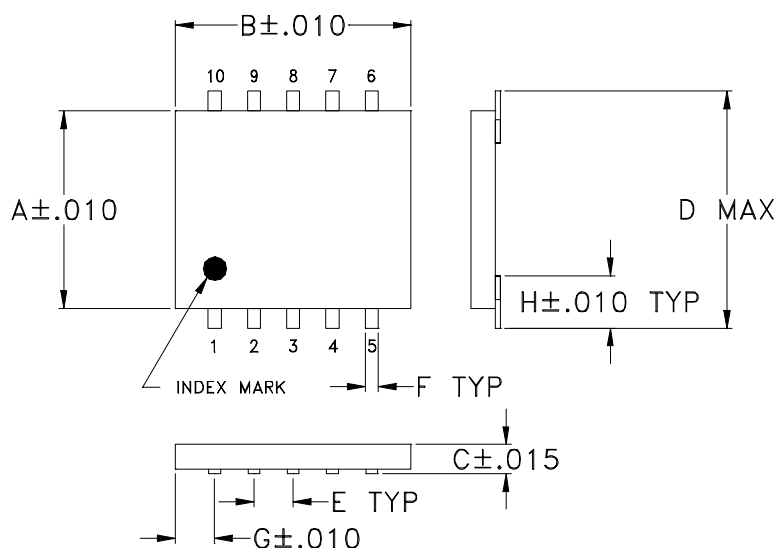
REV. X2  
QBA-24W  
100627  
Page 2 of 2

# Case Style

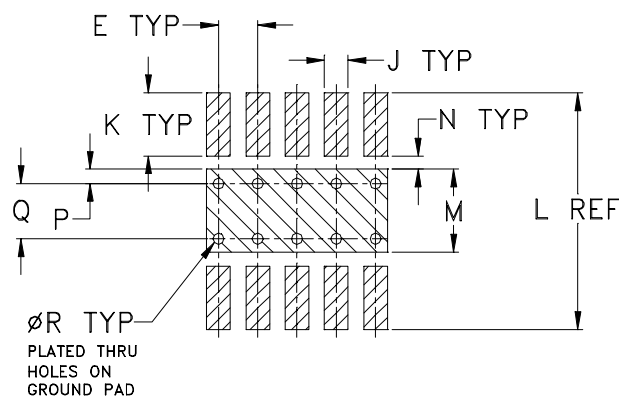
# SM33

SM33

## Outline Dimensions



## PCB Land Pattern



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

ADJACENT GROUND PINS SHALL BE CONNECTED  
TO EACH OTHER AND TO GROUND PAD

| CASE # | A              | B              | C              | D              | E              | F              | G              | H              | J              | K              | L              | M              | N              | P              |
|--------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| SM33   | .250<br>(6.35) | .300<br>(7.62) | .050<br>(1.27) | .310<br>(7.87) | .050<br>(1.27) | .015<br>(0.38) | .050<br>(1.27) | .066<br>(1.68) | .030<br>(0.76) | .095<br>(2.41) | .330<br>(8.38) | .100<br>(2.54) | .020<br>(0.51) | .015<br>(0.38) |

| CASE # | Q              | R              | WT. GRAM |
|--------|----------------|----------------|----------|
| SM33   | .070<br>(1.78) | .014<br>(0.36) | 0.2      |

Dimensions are in inches (mm). Tolerances:  $\pm .005$

### Notes:

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

**Mini-Circuits®**

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

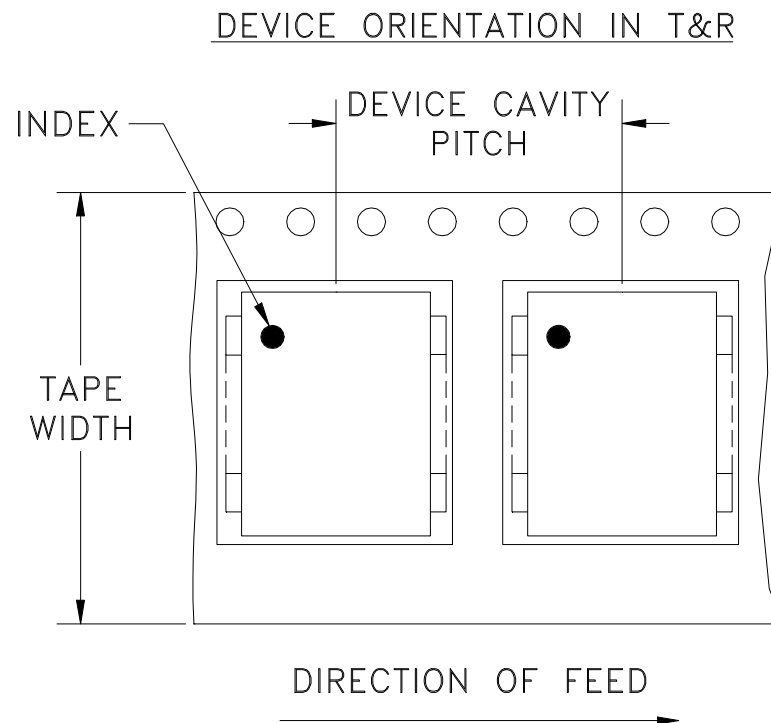
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661

Distribution Centers NORTH AMERICA 800-654-7949 • 417-335-5935 • Fax 417-335-5945 • EUROPE 44-1252-832600 • Fax 44-1252-837010

Mini-Circuits ISO 9001 & ISO 14001 Certified



# Tape & Reel Packaging TR-F34



| Tape Width,<br>mm | Device Cavity<br>Pitch, mm | Reel Size,<br>inches | Devices per Reel<br>see note                |      |
|-------------------|----------------------------|----------------------|---------------------------------------------|------|
| 16                | 12                         | 7                    | Small<br>quantity<br>standard<br>(see note) | 20   |
|                   |                            |                      |                                             | 50   |
|                   |                            |                      |                                             | 100  |
|                   |                            |                      |                                             | 200  |
|                   |                            | 13                   | Standard                                    | 500  |
|                   |                            |                      |                                             | 1000 |

Note: Availability of small reel quantity varies by model.  
Refer to pricing and availability on individual model dashboard.

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)



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

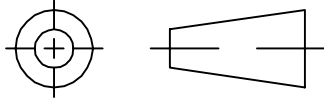
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661

Distribution Centers NORTH AMERICA 800-654-7949 • 417-335-5935 • Fax 417-335-5945 • EUROPE 44-1252-832600 • Fax 44-1252-837010

Mini-Circuits ISO 9001 & ISO 14001 Certified



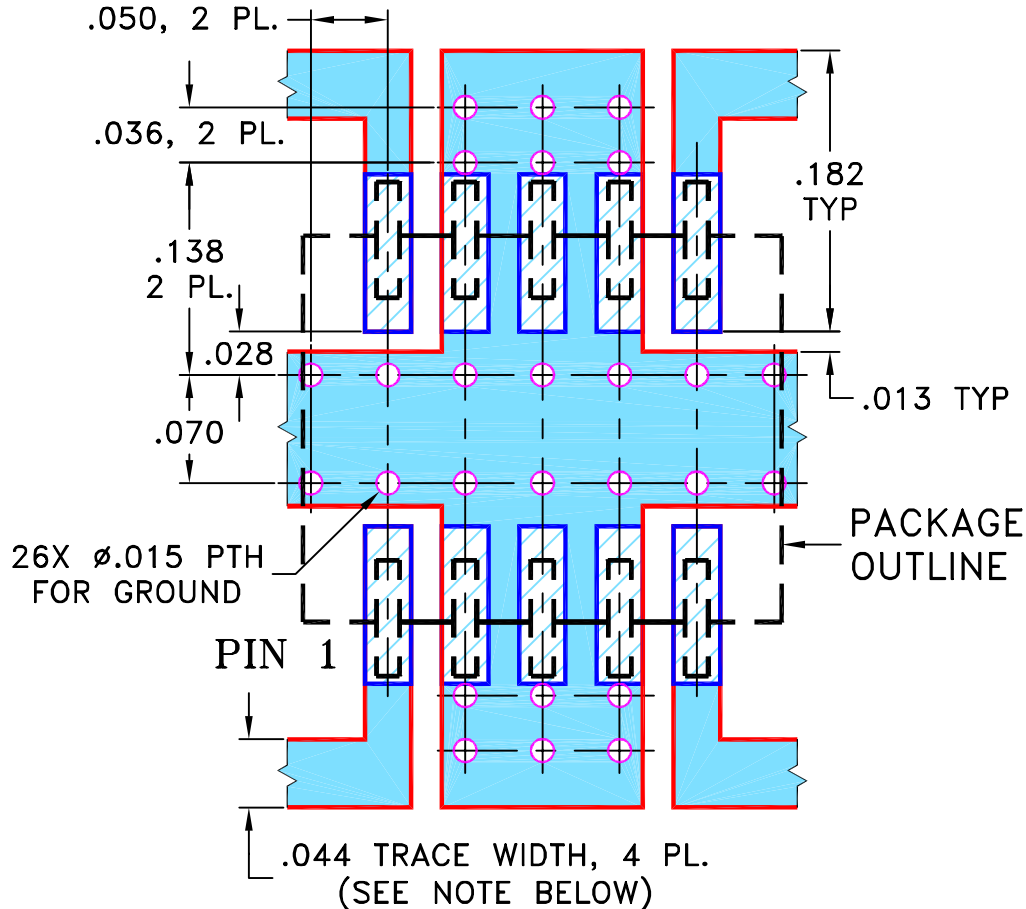
## THIRD ANGLE PROJECTION



## REVISIONS

| REV | ECN No. | DESCRIPTION               | DATE     | DR  | AUTH |
|-----|---------|---------------------------|----------|-----|------|
| A   | M82377  | UPDATED DRAWING           | 07/31/02 | AV  | DB   |
| B   | M101085 | UPDATED DRAWING, ADDED    | 10/06/05 | MMG | HY   |
|     |         | DZ944 CASE STYLE & NOTE 2 |          |     |      |
| C   | M102713 | UPDATED NOTES             | 01/10/06 | MMG | ABD  |

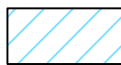
### SUGGESTED MOUNTING CONFIGURATION FOR SM1L/SM33/DZ944 CASE STYLES, "lf/nl" PIN CONNECTIONS



- NOTE: 1. TRACE WIDTH IS SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS  $.020 \pm .0015$ ; 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  $\pm .005$ ANGLES  $\pm$ FRACTIONS  $\pm$ 

DRAWN

MMG

04/12/00

CHECKED

WP

04/27/00

APPROVED

DB

04/27/00

Mini-Circuits®

THIS DOCUMENT AND ITS CONTENTS ARE THE PROPERTY OF MINI-CIRCUITS. EXCEPT FOR USE EXPRESSLY GRANTED, IN WRITING, TO ITS VENDORS, VENDEE AND THE UNITED STATES GOVERNMENT, MINI-CIRCUITS RESERVES ALL PROPRIETARY DESIGN, USE, MANUFACTURING AND REPRODUCTION RIGHTS THERETO. THESE CONTENTS SHALL NOT BE USED, DUPLICATED OR DISCLOSED TO ANY OUTSIDE PARTY, IN WHOLE OR IN PART, WITHOUT WRITTEN PERMISSION OF MINI-CIRCUITS.

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



Mini-Circuits®

13 Neptune Avenue  
Brooklyn NY 11235

PL, lf/nl, SM1L/SM33/DZ944, BDCA/QBA, TB-115

SIZE

A

CODE IDENT

15542

DRAWING NO:

98-PL-004

REV:

C

FILE: 98PL004

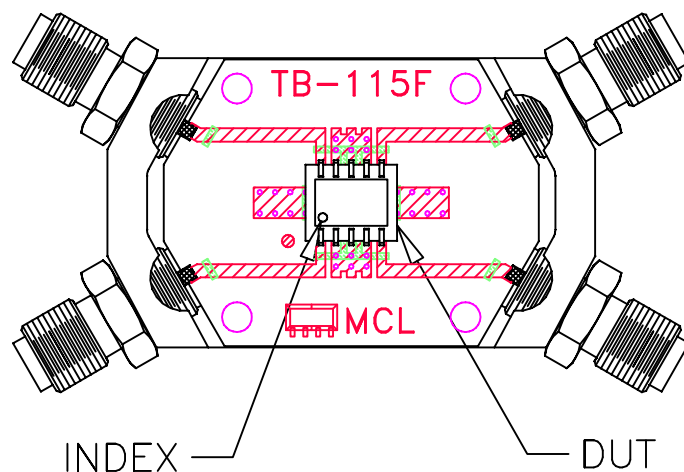
SCALE:

8:1

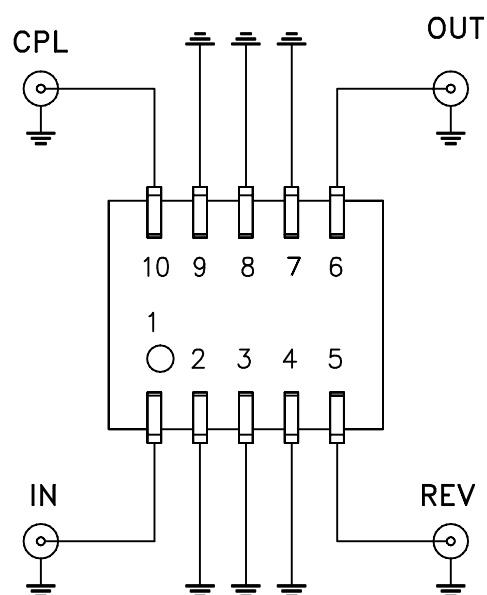
SHEET:

1 OF 1

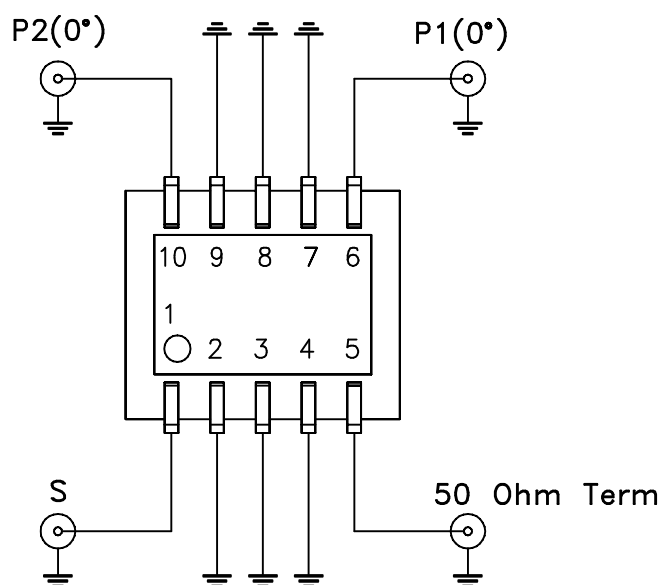
# Evaluation Board and Circuit



TB-115+



BDCA MODELS



QBA MODELS

## SCHEMATIC DIAGRAM

### Notes:

1. SMA Female connectors.
2. PCB Material: Rogers R04350 or equivalent,  
Dielectric Constant=3.5, Thickness=.020 inch.

 **Mini-Circuits®**



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                                                                              |