

# Power Splitter/Combiner

# JSPQ-80

2 Way-90° 50Ω 10 to 80 MHz



Generic photo used for illustration purposes only

CASE STYLE: BK276

### Maximum Ratings

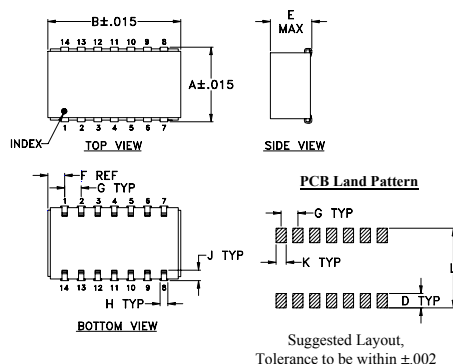
|                             |                |
|-----------------------------|----------------|
| Operating Temperature       | -40°C to 85°C  |
| Storage Temperature         | -55°C to 100°C |
| Power Input (as a splitter) | 1W max.        |
| Internal Dissipation        | 0.125W max.    |

Permanent damage may occur if any of these limits are exceeded.

## Pin Connections

|               |                            |
|---------------|----------------------------|
| SUM PORT      | 1                          |
| PORT 1 (0°)   | 7                          |
| PORT 2 (+90°) | 8                          |
| GROUND        | 2,3,4,5,6,9,10,11,12,13,14 |

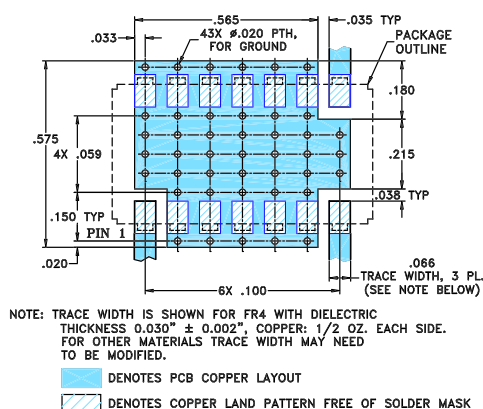
## Outline Drawing



### Outline Dimensions (inch)

|       |       |      |       |      |      |       |
|-------|-------|------|-------|------|------|-------|
| A     | B     | C    | D     | E    | F    | G     |
| .450  | .803  | --   | .100  | .250 | .102 | .100  |
| 11.43 | 20.40 | --   | 2.54  | 6.35 | 2.59 | 2.54  |
| H     | J     | K    | L     |      |      | wt    |
| .047  | .065  | .065 | .470  |      |      | grams |
| 1.19  | 1.65  | 1.65 | 11.94 |      |      | 3.0   |

**Demo Board MCL P/N: TB-217**  
**Suggested PCB Layout (PL-099)**



## Notes

**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-Circuits standard limited warranty and terms and conditions (collectively, "Standard Terms"); Purchasers of this part are entitled to the rights and benefits contained therein. For a full statement of the Standard Terms and the exclusive rights and remedies thereunder, please visit Mini-Circuits' website at [www.minicircuits.com/MC/Store/terms\\_iso](http://www.minicircuits.com/MC/Store/terms_iso)

## Features

- low insertion loss, 0.45 dB typ.
- excellent isolation, 44 dB typ.
- aqueous washable

## Applications

- HF/VHF
- radio communications
- instrumentation

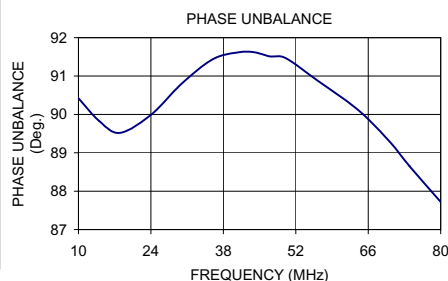
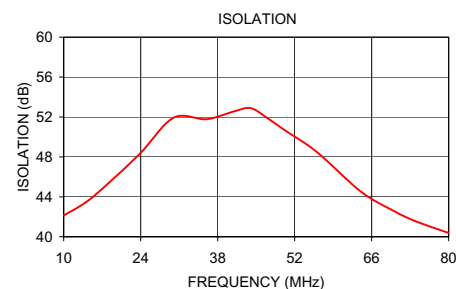
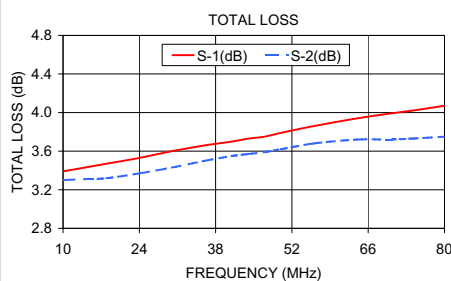
## Electrical Specifications

| FREQ.<br>RANGE<br>(MHz) | ISOLATION<br>(dB) | INSERTION LOSS (dB)<br>Avg. of Coupled Outputs<br>ABOVE 3 dB | PHASE<br>UNBALANCE<br>(Degrees) | AMPLITUDE<br>UNBALANCE<br>(dB) |
|-------------------------|-------------------|--------------------------------------------------------------|---------------------------------|--------------------------------|
| $f_L$ - $f_U$           | Typ. Min.         | Typ. Max.                                                    | Max.                            | Max.                           |
| 10-80                   | 44 30             | 0.45 1.4                                                     | 6                               | 0.6                            |

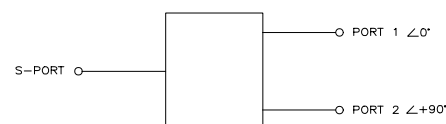
### Typical Performance Data

| Frequency<br>(MHz) | Total Loss¹<br>(dB) |      | Amplitude<br>Unbalance<br>(dB) | Isolation<br>(dB) | Phase<br>Unbalance<br>(deg.) | VSWR<br>S | VSWR<br>1 | VSWR<br>2 |
|--------------------|---------------------|------|--------------------------------|-------------------|------------------------------|-----------|-----------|-----------|
|                    | S-1                 | S-2  |                                |                   |                              |           |           |           |
| 10.00              | 3.39                | 3.30 | 0.09                           | 42.13             | 90.42                        | 1.10      | 1.17      | 1.20      |
| 14.00              | 3.43                | 3.31 | 0.12                           | 43.44             | 89.83                        | 1.08      | 1.10      | 1.12      |
| 18.00              | 3.47                | 3.32 | 0.14                           | 45.30             | 89.52                        | 1.07      | 1.06      | 1.03      |
| 24.00              | 3.53                | 3.37 | 0.16                           | 48.41             | 89.99                        | 1.09      | 1.09      | 1.09      |
| 30.00              | 3.60                | 3.43 | 0.17                           | 51.93             | 90.81                        | 1.12      | 1.15      | 1.21      |
| 36.00              | 3.66                | 3.50 | 0.16                           | 51.78             | 91.44                        | 1.15      | 1.22      | 1.31      |
| 41.00              | 3.70                | 3.55 | 0.15                           | 52.57             | 91.62                        | 1.19      | 1.27      | 1.38      |
| 44.00              | 3.73                | 3.57 | 0.16                           | 52.89             | 91.62                        | 1.21      | 1.29      | 1.41      |
| 47.00              | 3.75                | 3.59 | 0.16                           | 51.91             | 91.51                        | 1.22      | 1.32      | 1.45      |
| 50.00              | 3.79                | 3.62 | 0.17                           | 50.75             | 91.47                        | 1.24      | 1.35      | 1.47      |
| 56.00              | 3.86                | 3.68 | 0.18                           | 48.51             | 90.90                        | 1.26      | 1.40      | 1.51      |
| 64.00              | 3.94                | 3.72 | 0.22                           | 44.54             | 90.12                        | 1.29      | 1.48      | 1.52      |
| 70.00              | 3.99                | 3.72 | 0.27                           | 42.59             | 89.31                        | 1.32      | 1.53      | 1.52      |
| 74.00              | 4.02                | 3.73 | 0.29                           | 41.55             | 88.65                        | 1.34      | 1.57      | 1.51      |
| 80.00              | 4.07                | 3.75 | 0.32                           | 40.38             | 87.72                        | 1.36      | 1.62      | 1.49      |

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



**electrical schematic**



# 2 Way-90° Power Splitter/Combiner

**JSPQ-80**

## Typical Performance Data

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

| FREQ.<br>(MHz) | TOTAL LOSS <sup>1</sup><br>(dB) |      |      | AMP.<br>UNBAL.<br>(dB) | PHASE<br>UNBAL.<br>(deg.) | ISOLATION<br>(dB)<br>1-2 | VSWR<br>(:1) |      |      |
|----------------|---------------------------------|------|------|------------------------|---------------------------|--------------------------|--------------|------|------|
|                | S-1                             | S-2  | AVG. |                        |                           |                          | S            | 1    | 2    |
| 10             | 3.32                            | 3.29 | 3.30 | 0.03                   | 92.10                     | 38.90                    | 1.09         | 1.11 | 1.20 |
| 15             | 3.36                            | 3.28 | 3.32 | 0.08                   | 91.90                     | 39.92                    | 1.08         | 1.07 | 1.10 |
| 20             | 3.40                            | 3.29 | 3.34 | 0.11                   | 91.41                     | 40.50                    | 1.08         | 1.07 | 1.04 |
| 25             | 3.44                            | 3.33 | 3.39 | 0.11                   | 90.41                     | 40.80                    | 1.11         | 1.10 | 1.11 |
| 30             | 3.49                            | 3.38 | 3.43 | 0.11                   | 89.44                     | 40.96                    | 1.15         | 1.14 | 1.20 |
| 35             | 3.54                            | 3.43 | 3.49 | 0.10                   | 88.61                     | 40.99                    | 1.19         | 1.19 | 1.27 |
| 40             | 3.58                            | 3.50 | 3.54 | 0.08                   | 88.09                     | 40.92                    | 1.22         | 1.25 | 1.34 |
| 45             | 3.63                            | 3.53 | 3.58 | 0.10                   | 87.93                     | 40.73                    | 1.26         | 1.30 | 1.40 |
| 50             | 3.68                            | 3.59 | 3.63 | 0.09                   | 88.04                     | 40.52                    | 1.29         | 1.35 | 1.44 |
| 55             | 3.72                            | 3.62 | 3.67 | 0.10                   | 88.36                     | 40.16                    | 1.32         | 1.40 | 1.48 |
| 60             | 3.77                            | 3.65 | 3.71 | 0.12                   | 88.86                     | 39.80                    | 1.34         | 1.46 | 1.50 |
| 65             | 3.82                            | 3.68 | 3.75 | 0.14                   | 89.49                     | 39.46                    | 1.36         | 1.51 | 1.51 |
| 70             | 3.86                            | 3.70 | 3.78 | 0.16                   | 90.23                     | 38.94                    | 1.39         | 1.56 | 1.51 |
| 75             | 3.91                            | 3.71 | 3.81 | 0.20                   | 91.05                     | 38.64                    | 1.41         | 1.60 | 1.51 |
| 80             | 3.95                            | 3.73 | 3.84 | 0.22                   | 91.96                     | 38.27                    | 1.43         | 1.65 | 1.50 |
| 90             | 4.03                            | 3.74 | 3.88 | 0.29                   | 93.82                     | 37.80                    | 1.46         | 1.74 | 1.46 |
| 100            | 4.11                            | 3.76 | 3.94 | 0.35                   | 95.72                     | 37.62                    | 1.50         | 1.82 | 1.43 |
| 110            | 4.19                            | 3.77 | 3.98 | 0.42                   | 97.56                     | 37.37                    | 1.54         | 1.90 | 1.39 |
| 120            | 4.26                            | 3.79 | 4.02 | 0.47                   | 99.28                     | 37.07                    | 1.58         | 1.96 | 1.37 |

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

REV. X2

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# 2 Way-90° Power Splitter/Combiner

**JSPQ-80**

## Typical Performance Data

TEST CONDITIONS: INPUT POWER = 0dBm @Temperature = -40°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    |
| 10             | 3.29                    | 3.27 | 3.28 | 0.02                   | 92.09                     | 34.58                    | 1.09 | 1.09      | 1.20 |
| 15             | 3.31                    | 3.24 | 3.28 | 0.07                   | 91.99                     | 37.75                    | 1.08 | 1.08      | 1.10 |
| 20             | 3.34                    | 3.25 | 3.29 | 0.09                   | 91.50                     | 40.45                    | 1.08 | 1.08      | 1.04 |
| 25             | 3.37                    | 3.28 | 3.33 | 0.09                   | 90.54                     | 42.80                    | 1.10 | 1.10      | 1.11 |
| 30             | 3.40                    | 3.31 | 3.36 | 0.09                   | 89.55                     | 45.09                    | 1.14 | 1.14      | 1.20 |
| 35             | 3.45                    | 3.36 | 3.41 | 0.09                   | 88.72                     | 47.34                    | 1.17 | 1.19      | 1.28 |
| 40             | 3.50                    | 3.43 | 3.47 | 0.07                   | 88.20                     | 50.64                    | 1.21 | 1.24      | 1.36 |
| 45             | 3.54                    | 3.46 | 3.50 | 0.07                   | 88.05                     | 54.73                    | 1.25 | 1.29      | 1.42 |
| 50             | 3.59                    | 3.52 | 3.55 | 0.07                   | 88.14                     | 61.02                    | 1.29 | 1.35      | 1.48 |
| 55             | 3.64                    | 3.55 | 3.60 | 0.09                   | 88.45                     | 57.35                    | 1.32 | 1.41      | 1.51 |
| 60             | 3.69                    | 3.58 | 3.64 | 0.11                   | 88.95                     | 51.62                    | 1.35 | 1.47      | 1.54 |
| 65             | 3.75                    | 3.61 | 3.68 | 0.14                   | 89.56                     | 47.82                    | 1.38 | 1.53      | 1.55 |
| 70             | 3.79                    | 3.63 | 3.71 | 0.16                   | 90.33                     | 44.96                    | 1.41 | 1.59      | 1.54 |
| 75             | 3.84                    | 3.63 | 3.73 | 0.21                   | 91.21                     | 43.20                    | 1.43 | 1.65      | 1.53 |
| 80             | 3.88                    | 3.64 | 3.76 | 0.24                   | 92.15                     | 41.76                    | 1.46 | 1.70      | 1.51 |
| 90             | 3.96                    | 3.65 | 3.80 | 0.31                   | 94.14                     | 39.87                    | 1.50 | 1.80      | 1.46 |
| 100            | 4.02                    | 3.65 | 3.84 | 0.37                   | 96.19                     | 38.96                    | 1.53 | 1.88      | 1.42 |
| 110            | 4.09                    | 3.67 | 3.88 | 0.42                   | 98.13                     | 38.41                    | 1.57 | 1.94      | 1.39 |
| 120            | 4.14                    | 3.68 | 3.91 | 0.46                   | 99.86                     | 38.25                    | 1.60 | 2.00      | 1.37 |

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

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# 2 Way-90° Power Splitter/Combiner

**JSPQ-80**

## Typical Performance Data

TEST CONDITIONS: INPUT POWER = 0dBm @Temperature = +85°C

| FREQ.<br>(MHz) | TOTAL LOSS <sup>1</sup><br>(dB) |      |      | AMP.<br>UNBAL.<br>(dB) | PHASE<br>UNBAL.<br>(deg.) | ISOLATION<br>(dB)<br>1-2 | VSWR<br>(:1) |      |      |
|----------------|---------------------------------|------|------|------------------------|---------------------------|--------------------------|--------------|------|------|
|                | S-1                             | S-2  | AVG. |                        |                           |                          | S            | 1    | 2    |
| 10             | 3.38                            | 3.35 | 3.37 | 0.03                   | 91.82                     | 35.15                    | 1.09         | 1.09 | 1.22 |
| 15             | 3.42                            | 3.34 | 3.38 | 0.08                   | 91.68                     | 34.95                    | 1.07         | 1.04 | 1.11 |
| 20             | 3.47                            | 3.36 | 3.41 | 0.11                   | 91.26                     | 34.78                    | 1.09         | 1.05 | 1.06 |
| 25             | 3.51                            | 3.41 | 3.46 | 0.10                   | 90.31                     | 34.60                    | 1.13         | 1.09 | 1.13 |
| 30             | 3.56                            | 3.46 | 3.51 | 0.10                   | 89.32                     | 34.37                    | 1.17         | 1.14 | 1.22 |
| 35             | 3.62                            | 3.53 | 3.58 | 0.08                   | 88.47                     | 34.13                    | 1.21         | 1.20 | 1.30 |
| 40             | 3.66                            | 3.59 | 3.63 | 0.07                   | 87.93                     | 33.94                    | 1.25         | 1.25 | 1.35 |
| 45             | 3.71                            | 3.63 | 3.67 | 0.08                   | 87.78                     | 33.73                    | 1.28         | 1.31 | 1.40 |
| 50             | 3.76                            | 3.68 | 3.72 | 0.08                   | 87.86                     | 33.57                    | 1.30         | 1.36 | 1.43 |
| 55             | 3.81                            | 3.71 | 3.76 | 0.10                   | 88.20                     | 33.42                    | 1.32         | 1.41 | 1.45 |
| 60             | 3.85                            | 3.73 | 3.79 | 0.12                   | 88.74                     | 33.38                    | 1.34         | 1.45 | 1.47 |
| 65             | 3.89                            | 3.76 | 3.82 | 0.13                   | 89.38                     | 33.40                    | 1.36         | 1.49 | 1.48 |
| 70             | 3.93                            | 3.78 | 3.86 | 0.15                   | 90.15                     | 33.37                    | 1.37         | 1.53 | 1.49 |
| 75             | 3.98                            | 3.80 | 3.89 | 0.18                   | 90.98                     | 33.50                    | 1.39         | 1.58 | 1.49 |
| 80             | 4.02                            | 3.81 | 3.91 | 0.21                   | 91.83                     | 33.63                    | 1.40         | 1.62 | 1.49 |
| 90             | 4.11                            | 3.84 | 3.97 | 0.27                   | 93.62                     | 34.11                    | 1.43         | 1.70 | 1.48 |
| 100            | 4.19                            | 3.85 | 4.02 | 0.34                   | 95.43                     | 34.78                    | 1.47         | 1.79 | 1.45 |
| 110            | 4.29                            | 3.87 | 4.08 | 0.42                   | 97.23                     | 35.27                    | 1.51         | 1.88 | 1.42 |
| 120            | 4.38                            | 3.90 | 4.14 | 0.48                   | 98.93                     | 35.36                    | 1.56         | 1.97 | 1.39 |

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

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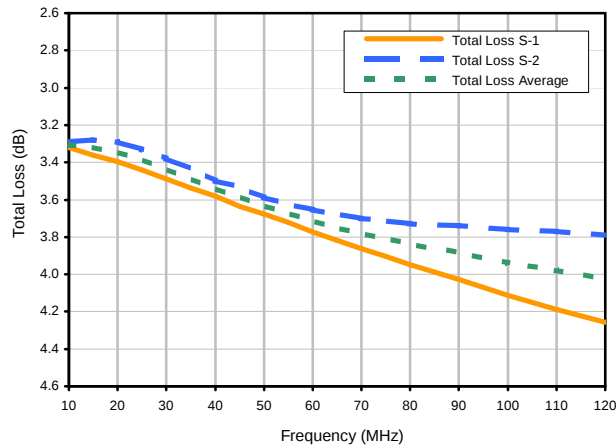


# 2 Way-90° Power Splitter/Combiner

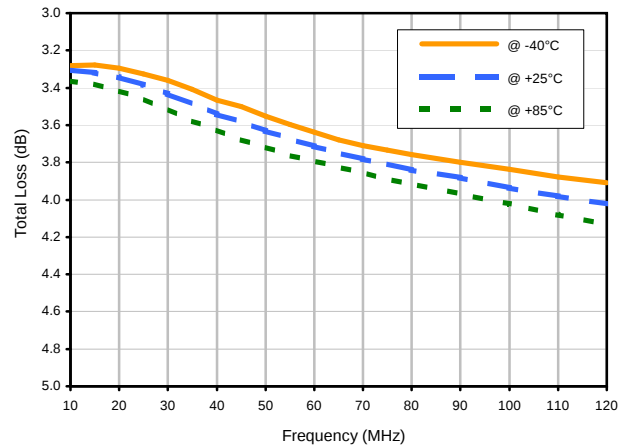
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## Typical Performance Curves

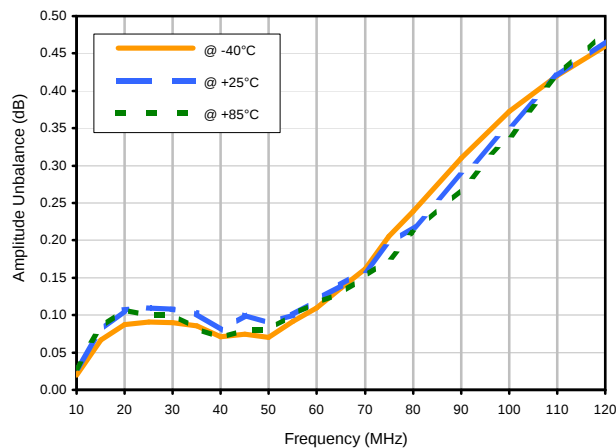
Total Loss



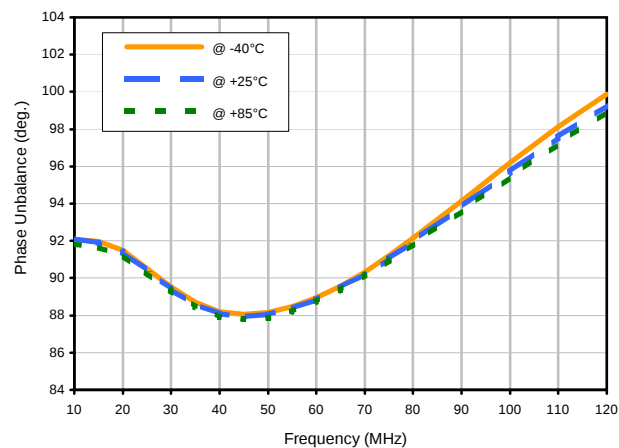
Average Total Loss vs. TEMPERATURE



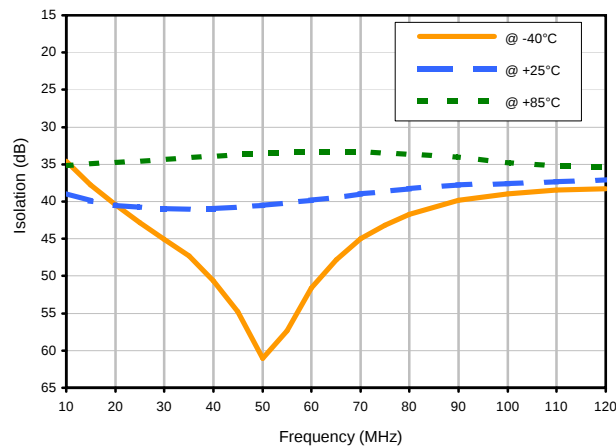
Amplitude Unbalance vs. TEMPERATURE



Phase Unbalance vs. TEMPERATURE



Isolation 1-2 vs. TEMPERATURE



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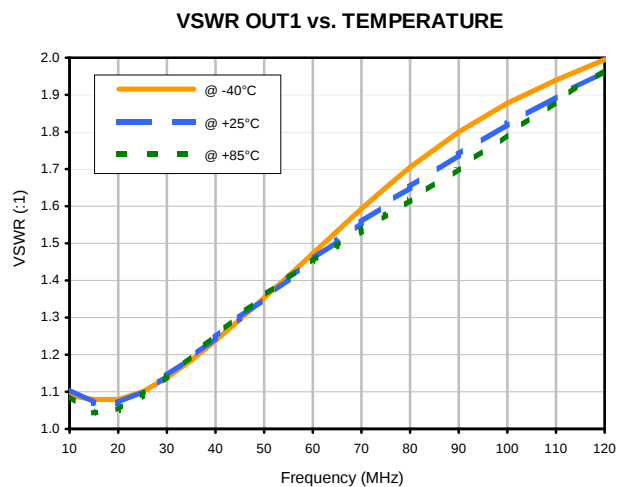
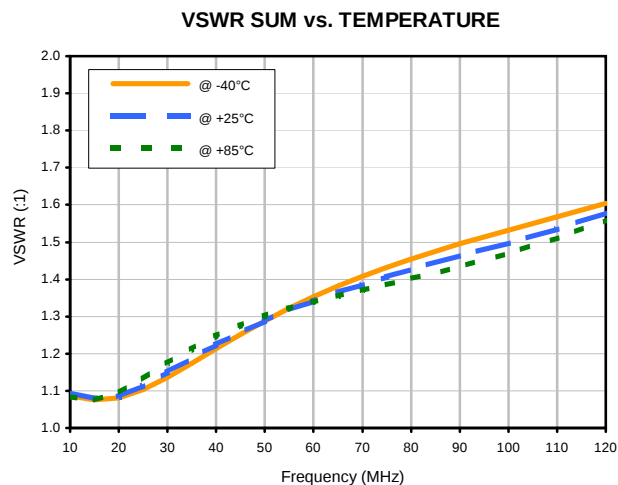
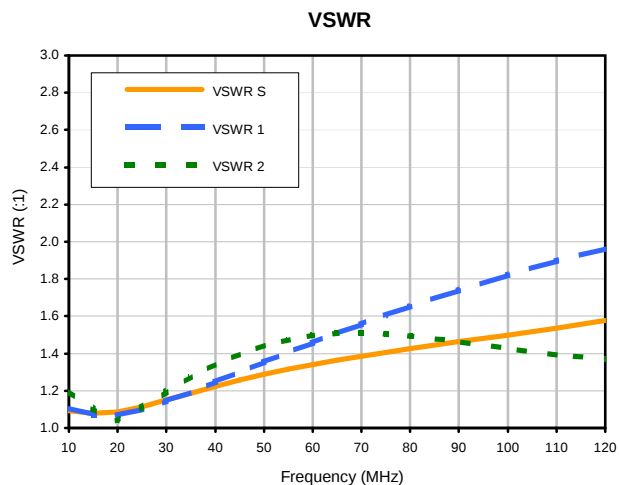


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## Typical Performance Curves



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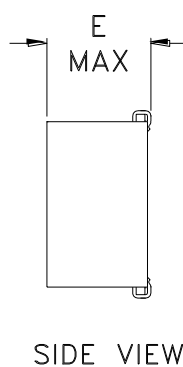
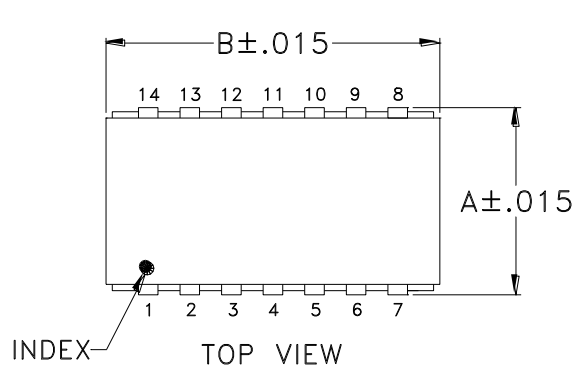


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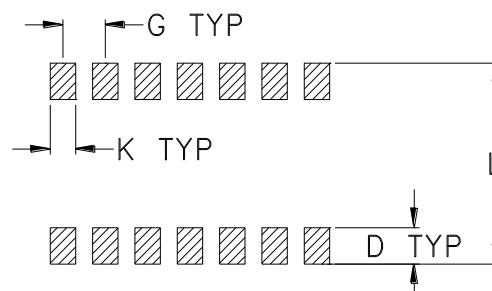
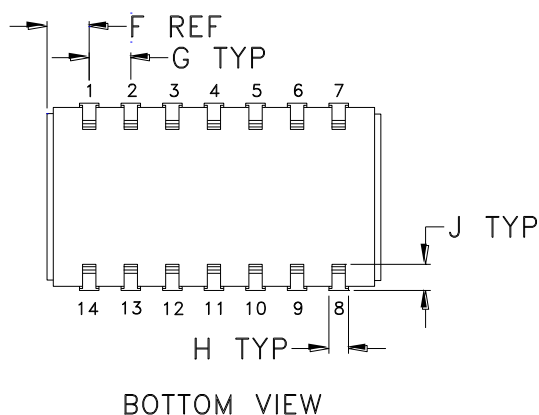
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### Outline Dimensions



### PCB Land Pattern



| CASE # | A               | B               | C        | D              | E              | F              | G              | H              | J              | K              | L               | WT. GRAM    |
|--------|-----------------|-----------------|----------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|-----------------|-------------|
| BK276  | .450<br>(11.43) | .803<br>(20.40) | --<br>-- | .100<br>(2.54) | .250<br>(6.35) | .102<br>(2.59) | .100<br>(2.54) | .047<br>(1.19) | .065<br>(1.65) | .065<br>(1.65) | .470<br>(11.94) | 2.0<br>MAX. |

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

### Notes:

- Case material: Copper Nickel alloy.
- Base material: Printed wiring laminate.
- Termination finish:

For RoHS Case Styles: Tin plate over Nickel plate. All models, (+) suffix.

For RoHS-5 Case Styles: Tin-Lead plate. All models, no (+) suffix.



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# Tape & Reel Packaging TR-F5



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

Mini-Circuits carrier tape materials provide protection from ESD (Electro-Static Discharge) during handling and transportation. Tapes are static dissipative and comply with industry standards EIA-481/EIA-541.

Go to: [www.minicircuits.com/pages/pdfs/tape.pdf](http://www.minicircuits.com/pages/pdfs/tape.pdf)



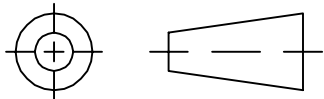
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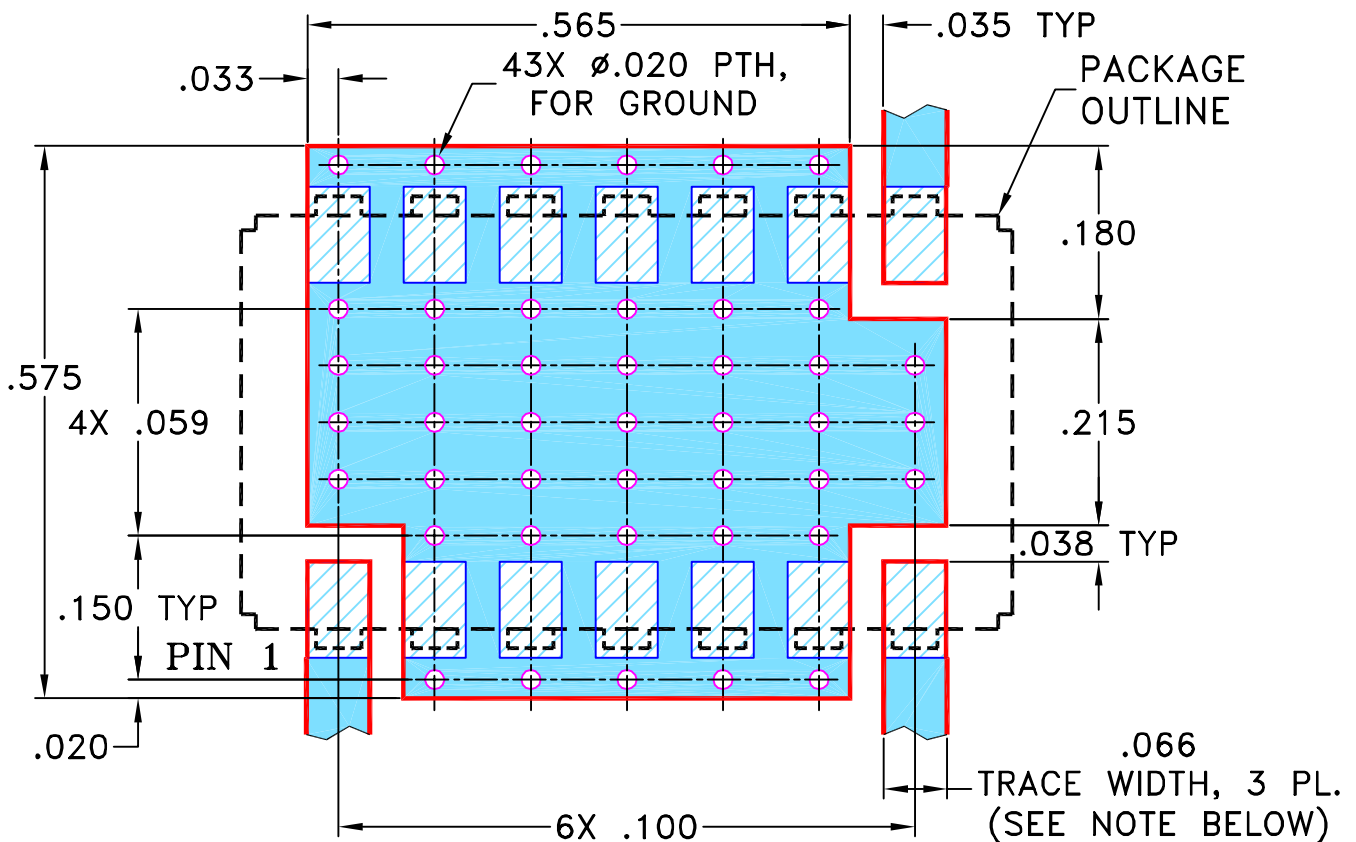
## THIRD ANGLE PROJECTION



## REVISIONS

| REV | ECN No. | DESCRIPTION                           | DATE     | DR  | AUTH |
|-----|---------|---------------------------------------|----------|-----|------|
| OR  | M82550  | NEW RELEASE                           | 11/07/02 | MMG | HY   |
| A   | M102713 | MODIFIED NOTES, ADDED "...WITH SMOBC" | 01/16/06 | GT  | IL   |
|     |         |                                       |          |     |      |
|     |         |                                       |          |     |      |

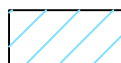
### SUGGESTED MOUNTING CONFIGURATION FOR BK276 CASE STYLE, "mq" PIN CONNECTION



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

2. BOTTOM SIDE OF THE PCB IS CONTINUOUS GROUND PLANE.

 DENOTES PCB COPPER LAYOUT WITH SMOBC (SOLDER MASK OVER BARE COPPER)

 DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK

UNLESS OTHERWISE SPECIFIED

INITIALS

DATE

DIMENSIONS ARE IN INCHES

TOLERANCES ON:

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

DRAWN

MMG

10/29/02

CHECKED

AV

11/07/02

APPROVED

HY

11/07/02



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PL, mq, BK276, JSPQ, TB-217

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

SIZE

A

CODE IDENT

15542

DRAWING NO:

98-PL-099

REV:

A

FILE: 98PL099

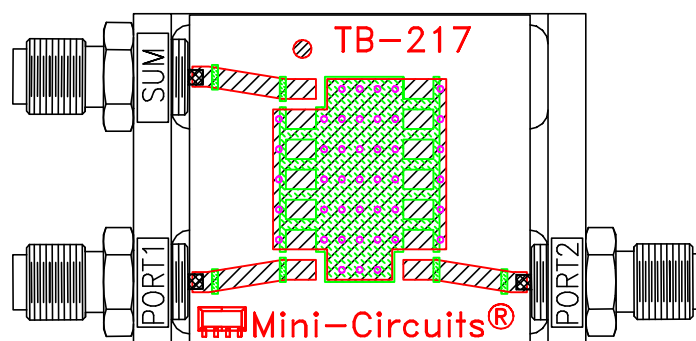
SCALE:

5:1

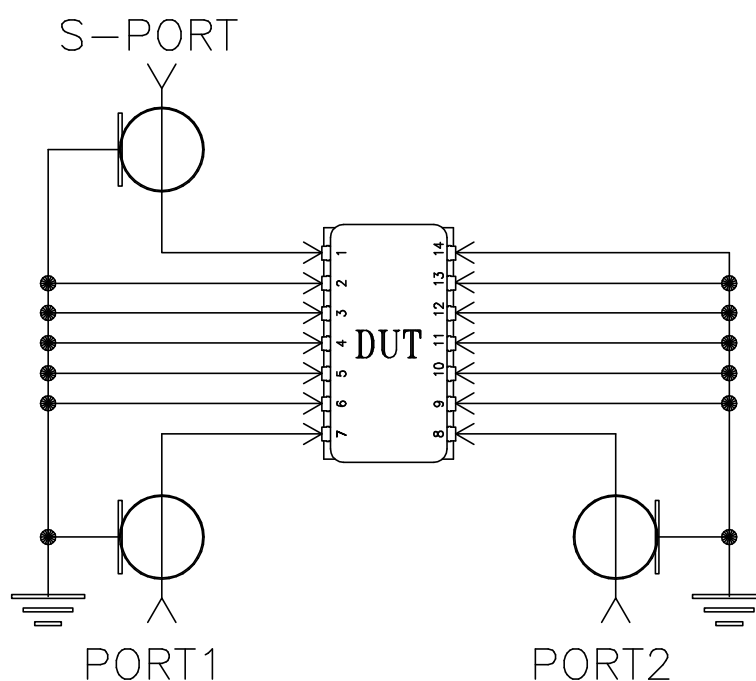
SHEET:

1 OF 1

# Evaluation Board and Circuit



TB-217



Schematic Diagram

## Notes:

1. SMA Female connectors.
2. PCB Material: Rogers R04350 or equivalent,  
Dielectric Constant=3.5, Thickness=.030 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          | -40° to 85°C<br>Ambient Environment                                                                                                                             | Individual Model Data Sheet                                                                          |
| Storage Temperature            | -55° to 100° C<br>Ambient Environment                                                                                                                           | Individual Model Data Sheet                                                                          |
| Humidity                       | 90 to 95% RH, 240 hours, 50°C                                                                                                                                   | MIL-STD-202, Method 103, Condition A, Except 50°C and end-point electrical test done within 12 hours |
| Thermal Shock                  | -55° to 100°C, 100 cycles                                                                                                                                       | MIL-STD-202, Method 107, Condition A-3, except +100°C                                                |
| Solder Reflow Heat             | Sn-Pb Eutetic Process: 225°C peak<br>Pb-Free Process 245° - 250°C peak                                                                                          | J-STD-020, Table 4-1, 4-2 and 5-2, Figure 5-1                                                        |
| Solderability                  | 10X Magnification                                                                                                                                               | J-STD-002, 95% Coverage                                                                              |
| Vibration (High Frequency)     | 20g peak, 10-2000 Hz, 12 times in each of three perpendicular directions (total 36)                                                                             | MIL-STD-202, Method 204, Condition D                                                                 |
| Mechanical Shock               | 50g, 11 ms, 1/2-sine, 18 shocks: 3 each direction, each of 3 axes                                                                                               | MIL-STD-202, Method 213, Condition A                                                                 |
| Marking Resistance to Solvents | Isopropyl alcohol + mineral spirits at 25°C; terpene defluxer at 25°C;<br>distilled water + proylene glycol monomethyl ether + monoethanolamine at 63°C to 70°C | MIL-STD-202, Method 215                                                                              |