



Mini-Circuits®

ULTRA-SMALL CERAMIC

## Power Splitter/Combiner

QCN-5D+

2 Way-90° 50Ω 330 to 580 MHz

## FEATURES

- Low insertion loss, 0.4 dB typ.
- High isolation, 20 dB typ.
- Wrap-around terminal for excellent solderability
- Ultra small, 0.12"X0.06"X0.035"
- Patent pending



Generic photo used for illustration purposes only

CASE STYLE: FV1206-1

**+RoHS Compliant**

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

## APPLICATIONS

- Balanced amplifiers
- Modulators
- VHF
- Defense communication

## ELECTRICAL SPECIFICATIONS AT +25°C

| Parameter                            | Frequency (MHz) | Min. | Typ. | Max. | Unit   |
|--------------------------------------|-----------------|------|------|------|--------|
| Frequency Range                      |                 | 330  |      | 580  | MHz    |
| Average Insertion Loss, above 3.0 dB | 330-400         |      | 0.3  | 0.6  | dB     |
|                                      | 400-525         |      | 0.4  | 0.7  |        |
|                                      | 525-580         |      | 0.6  | 0.9  |        |
| Isolation                            | 330-400         | 17   | 20   |      | dB     |
|                                      | 400-525         | 16   | 20   |      |        |
|                                      | 525-580         | 14   | 18   |      |        |
| Phase Unbalance                      | 330-400         |      | 2.5  | 5    | Degree |
|                                      | 400-525         |      | 2.5  | 4    |        |
|                                      | 525-580         |      | 1    | 4    |        |
| Amplitude Unbalance                  | 330-400         |      | 0.6  | 1.1  | dB     |
|                                      | 400-525         |      | 0.2  | 0.5  |        |
|                                      | 525-580         |      | 0.8  | 1.6  |        |
| VSWR                                 | 330-400         |      | 1.2  |      | (:1)   |
|                                      | 400-525         |      | 1.2  |      |        |
|                                      | 525-580         |      | 1.2  |      |        |

1. For applications requiring DC voltage to be applied to the RF ports. DC resistance to ground is 100 Mohms min.

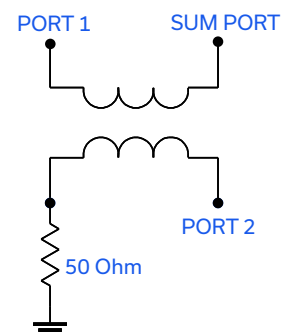
## ABSOLUTE MAXIMUM RATINGS

| Parameter                   | Ratings         |
|-----------------------------|-----------------|
| Operating Temperature       | -55°C to +100°C |
| Storage Temperature         | -55°C to +100°C |
| Power Input (as a splitter) | 15 W* max.      |

\* Derate linearly to 7 W at +100°C ambient.

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

## ELECTRICAL SCHEMATIC (NOTE 1)



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REV. P  
ECO-010256  
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MCL NY  
250718

PAGE 1 OF 3



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## Power Splitter/Combiner

QCN-5D+

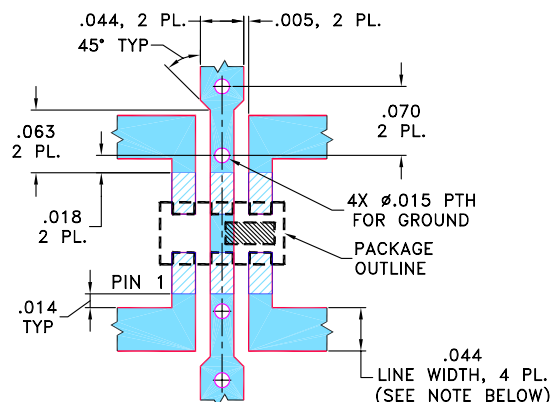
2 Way-90° 50Ω 330 to 580 MHz

## PIN CONNECTIONS

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

PRODUCT MARKING: N/A

DEMO BOARD MCL P/N: TB-QCN-5D+  
SUGGESTED PCB LAYOUT (PL-131)



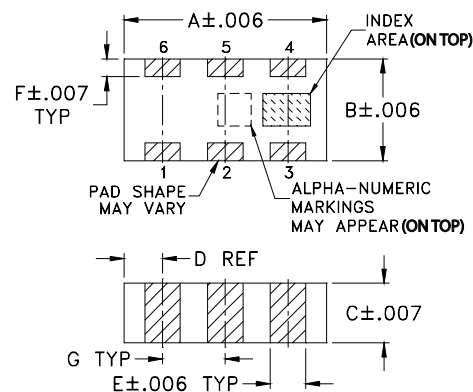
NOTES: 1. TRACE WIDTH IS SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS  $0.020" \pm 0.0015"$ ; COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH MAY NEED TO BE MODIFIED.

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

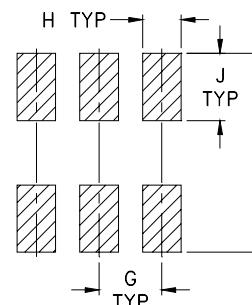
 DENOTES PCB COPPER LAYOUT WITH SMOBC (SOLDER MASK OVER BARE COPPER)

 DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK

## OUTLINE DRAWING



## PCB Land Pattern



Suggested Layout,  
Tolerance to be within  $\pm 0.002$

## OUTLINE DIMENSIONS (Inches/mm)

| A    | B    | C    | D    | E    | F     |
|------|------|------|------|------|-------|
| .126 | .063 | .035 | .024 | .022 | .011  |
| 3.20 | 1.60 | 0.89 | 0.61 | 0.56 | 0.28  |
| G    | H    | J    | K    |      | wt    |
| .039 | .024 | .042 | .123 |      | grams |
| 0.99 | 0.61 | 1.07 | 3.12 |      | .020  |

## TAPE &amp; REEL INFORMATION: F75





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ULTRA-SMALL CERAMIC

## Power Splitter/Combiner

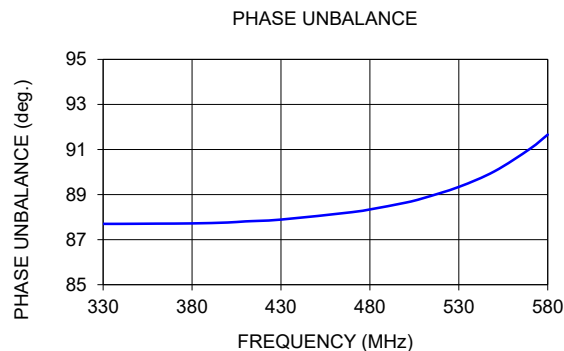
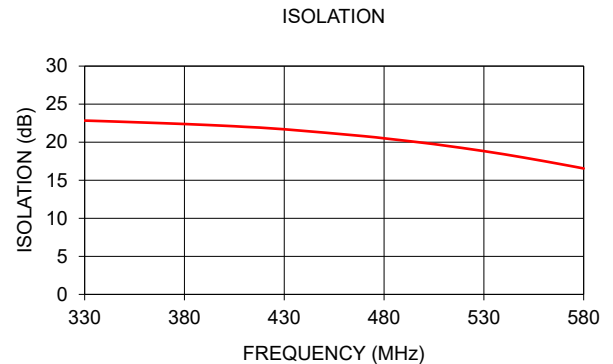
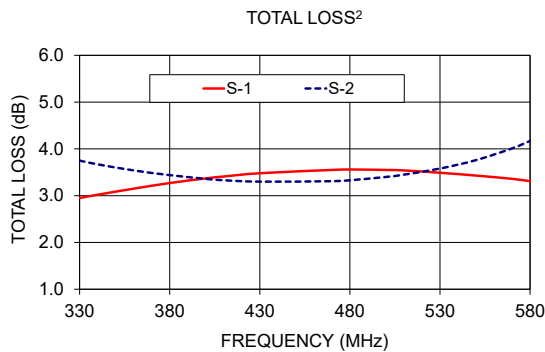
QCN-5D+

2 Way-90° 50Ω 330 to 580 MHz

## TYPICAL PERFORMANCE DATA

| Frequency<br>(MHz) | Total Loss <sup>2</sup><br>(dB) |      | Amplitude<br>Unbalance<br>(dB) | Isolation<br>(dB) | Phase<br>Unbalance<br>(deg.) | VSWR<br>(:1) |      |      |
|--------------------|---------------------------------|------|--------------------------------|-------------------|------------------------------|--------------|------|------|
|                    | S-1                             | S-2  |                                |                   |                              | S            | 1    | 2    |
| 330                | 2.95                            | 3.75 | 0.81                           | 22.84             | 87.70                        | 1.15         | 1.20 | 1.13 |
| 340                | 3.02                            | 3.67 | 0.66                           | 22.76             | 87.70                        | 1.15         | 1.20 | 1.14 |
| 360                | 3.15                            | 3.54 | 0.39                           | 22.58             | 87.71                        | 1.15         | 1.20 | 1.14 |
| 380                | 3.27                            | 3.44 | 0.17                           | 22.39             | 87.72                        | 1.15         | 1.21 | 1.15 |
| 400                | 3.37                            | 3.36 | 0.01                           | 22.16             | 87.76                        | 1.15         | 1.22 | 1.16 |
| 410                | 3.41                            | 3.33 | 0.08                           | 22.02             | 87.81                        | 1.15         | 1.22 | 1.17 |
| 430                | 3.48                            | 3.30 | 0.18                           | 21.70             | 87.89                        | 1.16         | 1.23 | 1.19 |
| 470                | 3.55                            | 3.31 | 0.24                           | 20.79             | 88.22                        | 1.17         | 1.26 | 1.23 |
| 480                | 3.56                            | 3.33 | 0.22                           | 20.51             | 88.34                        | 1.18         | 1.27 | 1.24 |
| 500                | 3.55                            | 3.40 | 0.15                           | 19.91             | 88.64                        | 1.20         | 1.30 | 1.28 |
| 510                | 3.54                            | 3.45 | 0.08                           | 19.57             | 88.84                        | 1.21         | 1.31 | 1.30 |
| 530                | 3.49                            | 3.58 | 0.09                           | 18.83             | 89.34                        | 1.23         | 1.34 | 1.34 |
| 550                | 3.43                            | 3.76 | 0.33                           | 17.98             | 90.03                        | 1.26         | 1.39 | 1.39 |
| 570                | 3.36                            | 4.01 | 0.66                           | 17.04             | 91.03                        | 1.31         | 1.44 | 1.46 |
| 580                | 3.31                            | 4.17 | 0.85                           | 16.55             | 91.66                        | 1.33         | 1.48 | 1.50 |

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



## NOTES

- A. Performance and quality attributes and conditions not expressly stated in this specification document are intended to be excluded and do not form a part of this specification document.
- B. Electrical specifications and performance data contained in this specification document are based on Mini-Circuit's applicable established test performance criteria and measurement instructions.
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# 2 Way-90° Power Splitter/Combiner

QCN-5D+

## Typical Performance Data

| FREQUENCY<br>(MHz) | TOTAL LOSS <sup>1</sup><br>(dB) |      | AMPLITUDE<br>UNBALANCE<br>(dB) | ISOLATION<br>(dB) | PHASE<br>UNBALANCE<br>(deg.) | FREQUENCY<br>(MHz) | VSWR<br>(:1) |      |      |
|--------------------|---------------------------------|------|--------------------------------|-------------------|------------------------------|--------------------|--------------|------|------|
|                    | S-1                             | S-2  |                                |                   |                              |                    | S            | 1    | 2    |
| 330.0              | 2.95                            | 3.75 | 0.81                           | 22.84             | 87.70                        | 330.0              | 1.15         | 1.20 | 1.13 |
| 340.0              | 3.02                            | 3.67 | 0.66                           | 22.76             | 87.70                        | 340.0              | 1.15         | 1.20 | 1.14 |
| 360.0              | 3.15                            | 3.54 | 0.39                           | 22.58             | 87.71                        | 360.0              | 1.15         | 1.20 | 1.14 |
| 380.0              | 3.27                            | 3.44 | 0.17                           | 22.39             | 87.72                        | 380.0              | 1.15         | 1.21 | 1.15 |
| 400.0              | 3.37                            | 3.36 | 0.01                           | 22.16             | 87.76                        | 400.0              | 1.15         | 1.22 | 1.16 |
| 410.0              | 3.41                            | 3.33 | 0.08                           | 22.02             | 87.81                        | 410.0              | 1.15         | 1.22 | 1.17 |
| 430.0              | 3.48                            | 3.30 | 0.18                           | 21.70             | 87.89                        | 430.0              | 1.16         | 1.23 | 1.19 |
| 470.0              | 3.55                            | 3.31 | 0.24                           | 20.79             | 88.22                        | 470.0              | 1.17         | 1.26 | 1.23 |
| 480.0              | 3.56                            | 3.33 | 0.22                           | 20.51             | 88.34                        | 480.0              | 1.18         | 1.27 | 1.24 |
| 500.0              | 3.55                            | 3.40 | 0.15                           | 19.91             | 88.64                        | 500.0              | 1.20         | 1.30 | 1.28 |
| 510.0              | 3.54                            | 3.45 | 0.08                           | 19.57             | 88.84                        | 510.0              | 1.21         | 1.31 | 1.30 |
| 530.0              | 3.49                            | 3.58 | 0.09                           | 18.83             | 89.34                        | 530.0              | 1.23         | 1.34 | 1.34 |
| 550.0              | 3.43                            | 3.76 | 0.33                           | 17.98             | 90.03                        | 550.0              | 1.26         | 1.39 | 1.39 |
| 570.0              | 3.36                            | 4.01 | 0.66                           | 17.04             | 91.03                        | 570.0              | 1.31         | 1.44 | 1.46 |
| 580.0              | 3.31                            | 4.17 | 0.85                           | 16.55             | 91.66                        | 580.0              | 1.33         | 1.48 | 1.50 |

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



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IF/RF MICROWAVE COMPONENTS



REV. X2

QCN-5D+

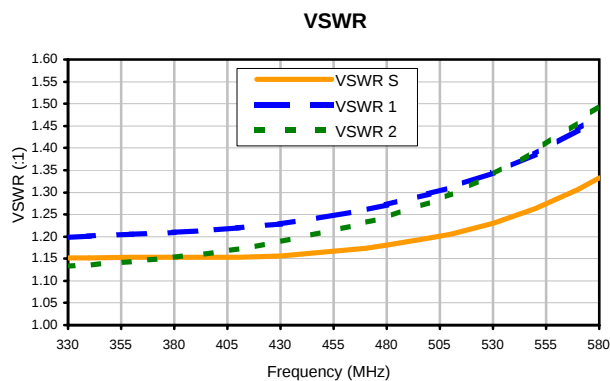
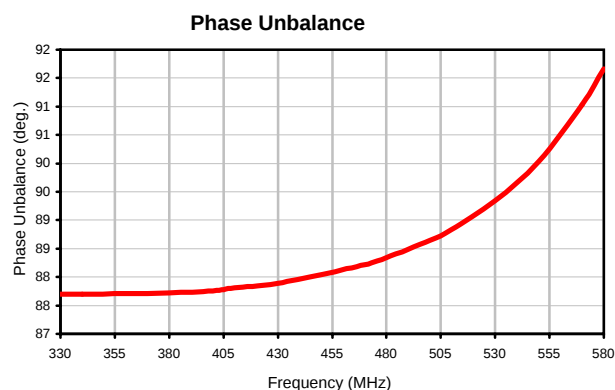
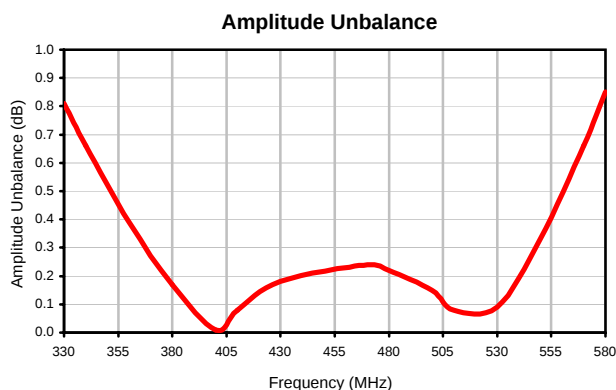
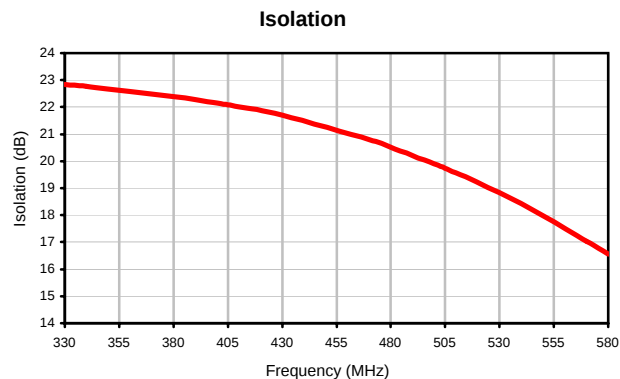
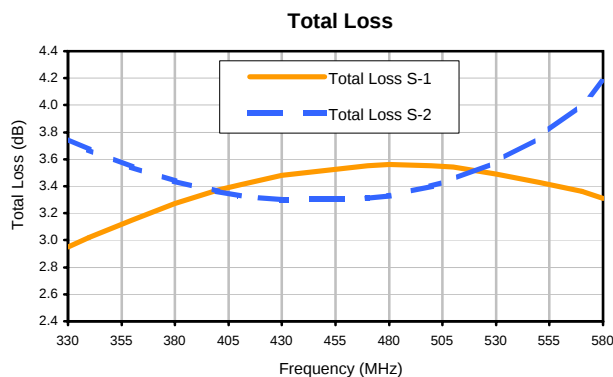
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# 2 Way-90° Power Splitter/Combiner

QCN-5D+

## Typical Performance Curves



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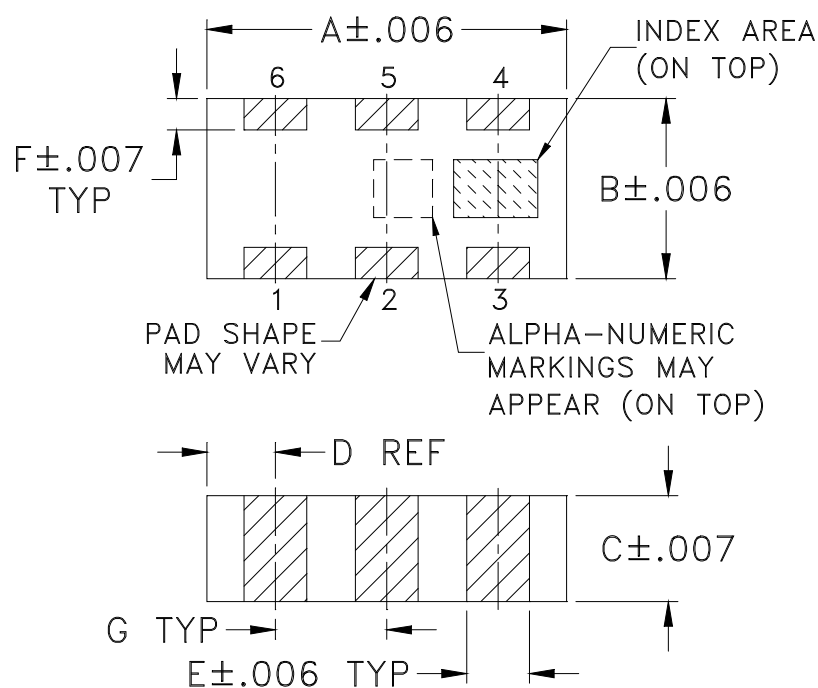
REV. X2

QCN-5D+

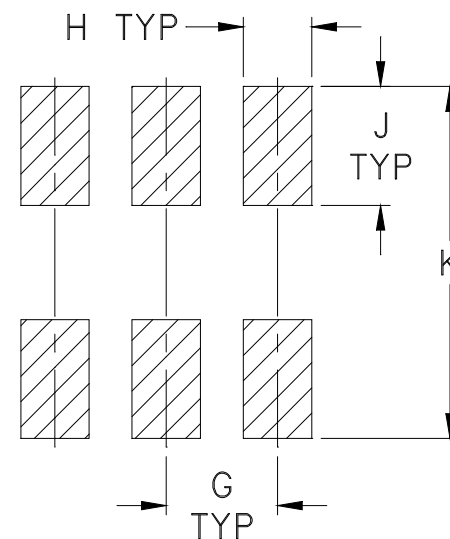
8/4/2010

Page 1 of 1

### Outline Dimensions



### PCB Land Pattern



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

| CASE #   | A              | B              | C              | D              | E              | F              | G              | H              | J              | K              | L  | M  | N  | P  | WT. GRAM |
|----------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----|----|----|----|----------|
| FV1206-1 | .126<br>(3.20) | .063<br>(1.60) | .035<br>(0.89) | .024<br>(0.61) | .022<br>(0.56) | .011<br>(0.28) | .039<br>(0.99) | .024<br>(0.61) | .042<br>(1.07) | .123<br>(3.12) | -- | -- | -- | -- | .020     |

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

#### Notes:

- Open style, ceramic base.
- Termination finish: **as shown below or indicated on Data Sheet.**  
 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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RF/IF MICROWAVE COMPONENTS

## DEVICE ORIENTATION IN T&R

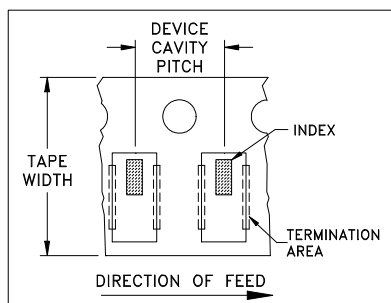


ILLUSTRATION 1

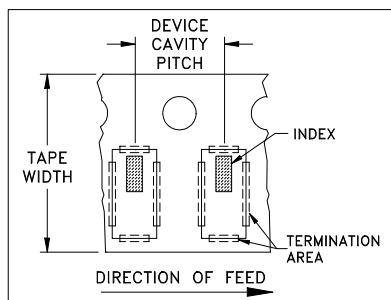


ILLUSTRATION 2

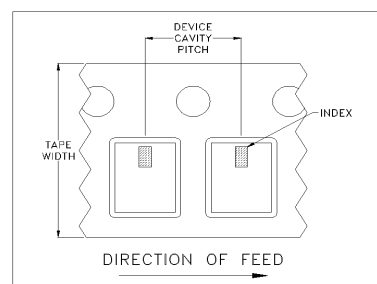


ILLUSTRATION 3

### Applicable Case Styles

FV1206-1  
FV1206-3

### Applicable Case Styles

FV1206-4  
FV1206-5  
FV1206-6  
FV1206-7  
FV1206-9

### Applicable Case Styles

FV1206-11  
FV1206-12  
GE0805C-18  
NL1008C-6  
NL1008C-7  
NL1008C-9  
NL1008C-10  
NL1008C-12

| Tape Width, mm | Device Cavity Pitch, mm | Reel Size, inches | Devices per Reel                    |      |
|----------------|-------------------------|-------------------|-------------------------------------|------|
| 8              | 4                       | 7                 | Small quantity standards (see note) | 20   |
|                |                         |                   |                                     | 50   |
|                |                         |                   |                                     | 100  |
|                |                         |                   |                                     | 200  |
|                |                         |                   |                                     | 500  |
|                |                         |                   |                                     | 1000 |
|                |                         |                   | Standard                            | 3000 |

Note: Please consult individual model data sheet to determine device per reel availability.

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)

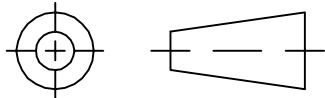


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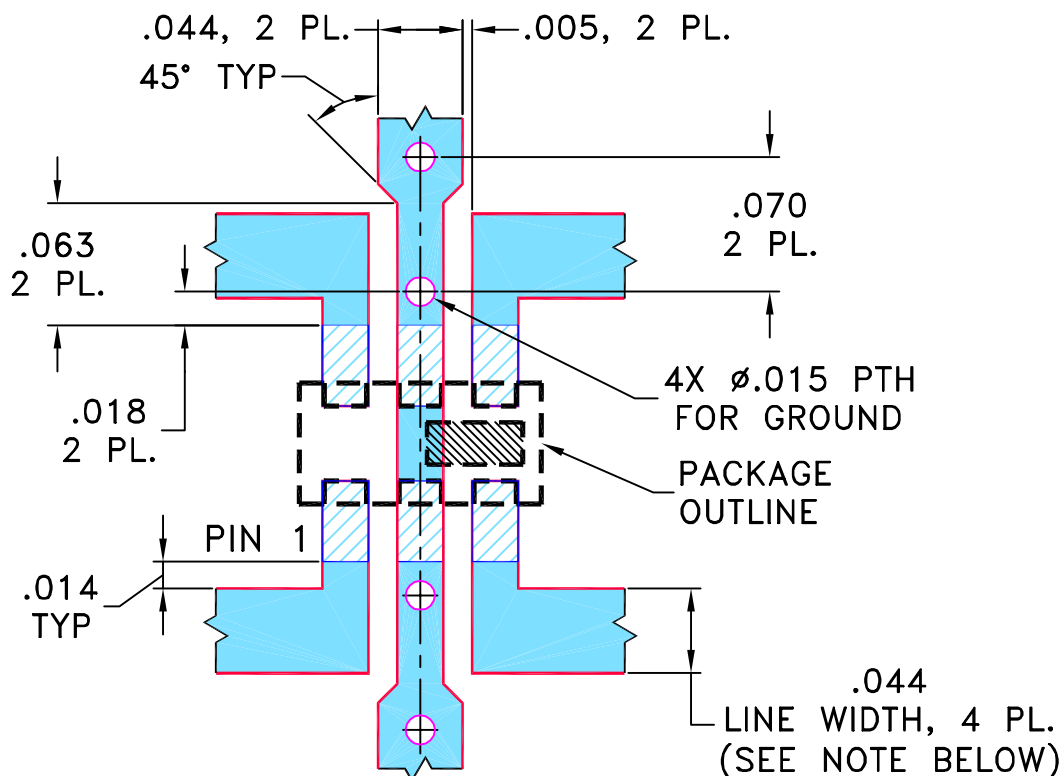
## THIRD ANGLE PROJECTION



## REVISIONS

| REV | ECN No. | DESCRIPTION               | DATE     | DR  | AUTH |
|-----|---------|---------------------------|----------|-----|------|
| OR  | M87001  | NEW RELEASE               | 05/20/03 | MMG | ABD  |
| A   | M87231  | CORRECTED DWG.            | 05/28/03 | MMG | ABD  |
| B   | M91636  | ADDED "pn" PIN CONNECTION | 04/07/04 | AV  | ABD  |
| C   | M102713 | ADDED "...WITH SMOBC"     | 01/16/06 | GF  | IL   |

SUGGESTED MOUNTING CONFIGURATION  
FOR FV1206-1 CASE STYLE, "pb/pn" PIN CONNECTIONS

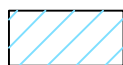


NOTES: 1. TRACE WIDTH IS SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS 0.020"  $\pm$  0.0015"; COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH MAY NEED TO BE MODIFIED.

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  $\pm$  .005ANGLES  $\pm$ FRACTIONS  $\pm$ 

DRAWN

MMG

05/14/03

CHECKED

AV

05/19/03

APPROVED

ABD

05/20/03



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13 Neptune Avenue  
Brooklyn NY 11235

PL, pb/pn, FV1206-1, QCN/BDCN, TB-255

SIZE

CODE IDENT

DRAWING NO:

REV:

A

15542

98-PL-131

C

FILE:

98PL131

SCALE:

10:1

SHEET:

1 OF 1

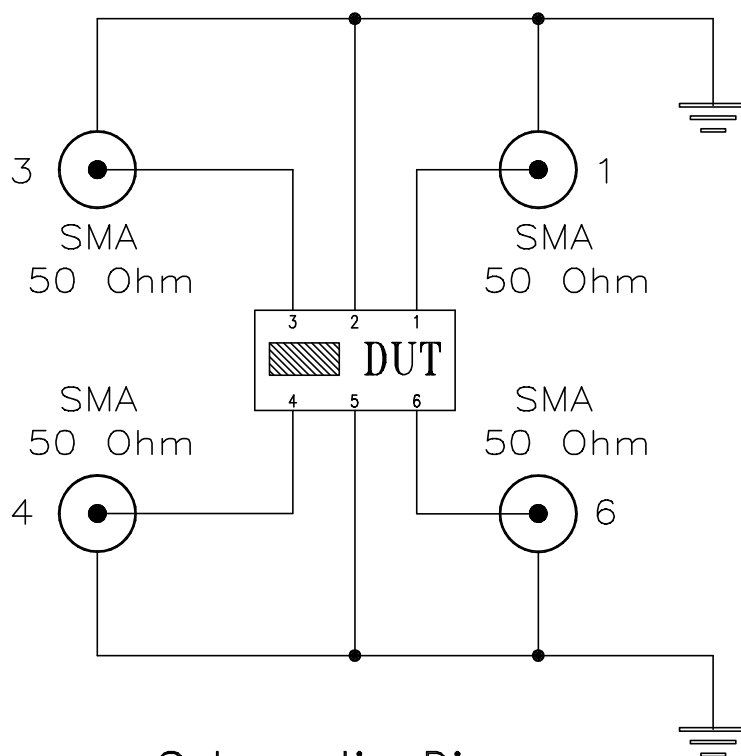
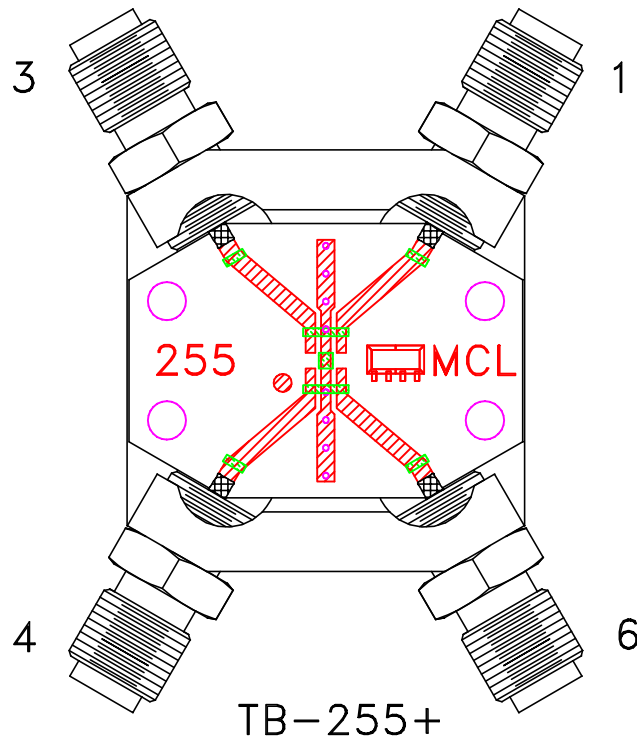
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ASHEETA1.DWG REV:A DATE:01/12/95

# Evaluation Board and Circuit

For Pin Connections refer to Data Sheet of the DUT



Schematic Diagram

## Notes:

1. SMA Female connectors.
2. PCB Material: Rogers R04350 or equivalent, Dielectric Constant=3.5, Thickness=.020 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 |
| 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, Para 4.2.5, Test S, 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                                                                 |