

# RF Transformer

50Ω      720 to 1600 MHz

## Maximum Ratings

|                       |               |
|-----------------------|---------------|
| Operating Temperature | -40°C to 85°C |
|-----------------------|---------------|

|                     |                |
|---------------------|----------------|
| Storage Temperature | -55°C to 100°C |
|---------------------|----------------|

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Input RF Power\*\*\* 3W

\*\*Derate linearly to 2.5W at 100°C

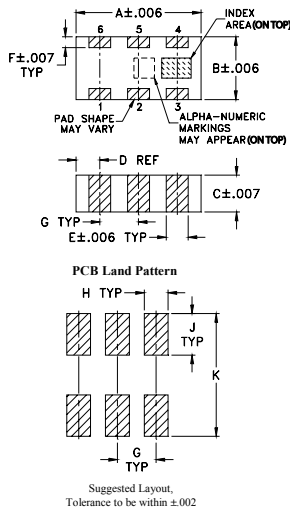
Permanent damage may occur if any of these limits are exceeded.

## Pad Connections

|                               |     |
|-------------------------------|-----|
| PRIMARY DOT (Unbalanced Port) | 5   |
| PRIMARY (GND)                 | 4,6 |
| SECONDARY DOT (Balanced)      | 3   |
| SECONDARY (Balanced)          | 1   |
| NO CONNECTION                 | 2   |

*Pads 1,3,4,6 are DC-connected internally*

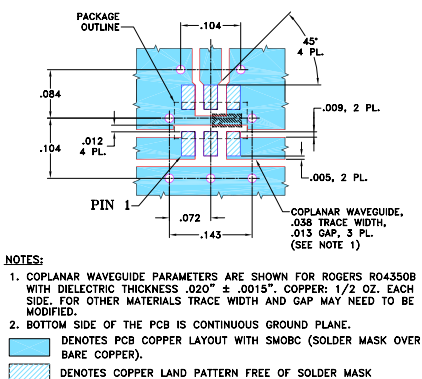
## Outline Drawing



### Outline Dimensions (inch)

|      |      |      |      |      |       |
|------|------|------|------|------|-------|
| 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  |

**Demo Board MCL P/N: TB-417+**  
**Suggested PCB Layout (PL-265)**



## 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/MCLStore/terms.jsp](http://www.minicircuits.com/MCLStore/terms.jsp)

## Features

- wideband, 720 to 1600 MHz
- low phase unbalance, 2 deg. typ. and amplitude unbalance, 0.3 dB typ.
- miniature size, 0.12"x.06"x.037"
- LTCC construction
- low cost
- aqueous washable

## Applications

- GSM
- WCDMA
- GPS
- ISM

### Electrical Specifications (T<sub>AMB</sub>=25°C)

| <b>Ω<br/>RATIO</b><br>(Secondary/Primary) | <b>FREQUENCY<br/>(MHz)</b> | <b>INSERTION*<br/>LOSS<br/>(dB)</b> | <b>PHASE<br/>UNBALANCE†<br/>(Deg.)<br/>Typ.</b> | <b>AMPLITUDE<br/>UNBALANCE<br/>(dB)<br/>Typ.</b> |
|-------------------------------------------|----------------------------|-------------------------------------|-------------------------------------------------|--------------------------------------------------|
| 4                                         | 720-1600                   | 1.0                                 | 2.0                                             | 0.4                                              |

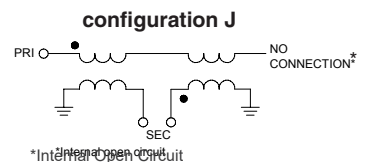
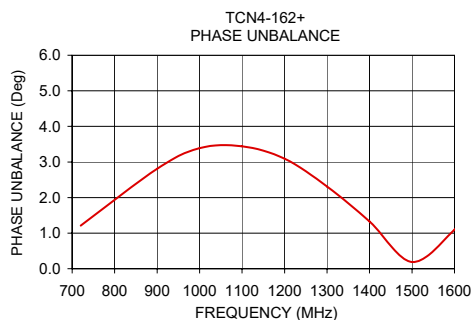
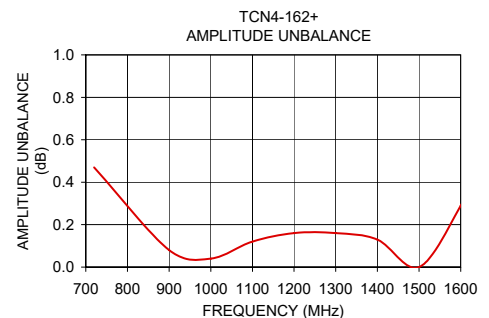
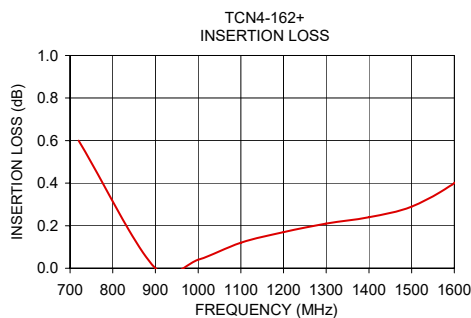
\* Insertion Loss is referenced to mid-band loss, 0.7 dB. Reference Demo Board TB-417+

† Relative to 180°

### Typical Performance Data at 25°C\*\*

| FREQUENCY<br>(MHz) | INSERTION<br>LOSS<br>(dB) | INPUT<br>R. LOSS<br>(dB) | AMPLITUDE<br>UNBALANCE<br>(dB) | PHASE<br>UNBALANCE<br>(Deg.) |
|--------------------|---------------------------|--------------------------|--------------------------------|------------------------------|
| 720.00             | 0.60                      | 10.28                    | 0.47                           | 1.21                         |
| 900.00             | 0.00                      | 25.18                    | 0.08                           | 2.81                         |
| 1000.00            | 0.04                      | 19.64                    | 0.04                           | 3.39                         |
| 1100.00            | 0.12                      | 16.88                    | 0.12                           | 3.44                         |
| 1200.00            | 0.17                      | 16.38                    | 0.16                           | 3.09                         |
| 1300.00            | 0.21                      | 17.28                    | 0.16                           | 2.31                         |
| 1400.00            | 0.24                      | 19.25                    | 0.13                           | 1.33                         |
| 1500.00            | 0.29                      | 21.00                    | 0.00                           | 0.19                         |
| 1600.00            | 0.40                      | 19.65                    | 0.29                           | 1.10                         |

\*\* Measured with Agilent E5071B network analyzer using impedance conversion and port extension.



\*Internal Open Circuit

Generic photo used for illustration purposes only

CASE STYLE: FV1206-1

**+RoHS Compliant**

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



**Available Tape and Reel  
at no extra cost**

| Reel Size | Devices/Reel                      |
|-----------|-----------------------------------|
| 7"        | 20, 50, 100, 200, 500, 1000, 3000 |


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REV. C  
M151107  
TCN4-162+  
ED-12817/34B2  
RS/CP/AM  
170410

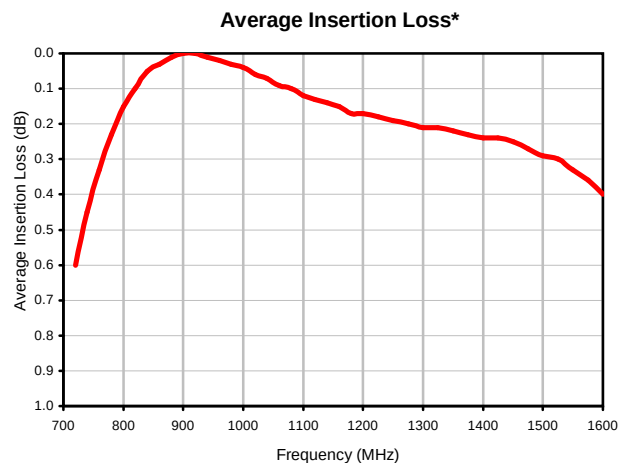
*Typical Performance Data*

| FREQUENCY<br>(MHz) | AVERAGE<br>INSERTION<br>LOSS* | INPUT<br>RETURN<br>LOSS | AMPLITUDE<br>UNBALANCE | PHASE<br>UNBALANCE** |
|--------------------|-------------------------------|-------------------------|------------------------|----------------------|
| (dB)               | (dB)                          | (dB)                    | (dB)                   | (deg)                |
| 720                | 0.60                          | 10.28                   | 0.47                   | 1.21                 |
| 740                | 0.45                          | 11.53                   | 0.41                   | 1.35                 |
| 760                | 0.33                          | 12.89                   | 0.36                   | 1.50                 |
| 780                | 0.23                          | 14.44                   | 0.32                   | 1.67                 |
| 800                | 0.15                          | 16.17                   | 0.27                   | 1.91                 |
| 820                | 0.10                          | 18.11                   | 0.23                   | 2.12                 |
| 840                | 0.05                          | 20.22                   | 0.19                   | 2.36                 |
| 860                | 0.03                          | 22.44                   | 0.14                   | 2.51                 |
| 880                | 0.01                          | 24.37                   | 0.11                   | 2.62                 |
| 900                | 0.00                          | 25.18                   | 0.08                   | 2.81                 |
| 920                | 0.00                          | 24.56                   | 0.05                   | 2.98                 |
| 940                | 0.01                          | 23.30                   | 0.02                   | 3.20                 |
| 960                | 0.02                          | 21.96                   | 0.01                   | 3.30                 |
| 980                | 0.03                          | 20.68                   | 0.02                   | 3.31                 |
| 1000               | 0.04                          | 19.64                   | 0.04                   | 3.39                 |
| 1020               | 0.06                          | 18.83                   | 0.06                   | 3.47                 |
| 1040               | 0.07                          | 18.18                   | 0.07                   | 3.61                 |
| 1060               | 0.09                          | 17.66                   | 0.09                   | 3.67                 |
| 1080               | 0.10                          | 17.23                   | 0.10                   | 3.51                 |
| 1100               | 0.12                          | 16.88                   | 0.12                   | 3.44                 |
| 1120               | 0.13                          | 16.63                   | 0.13                   | 3.39                 |
| 1140               | 0.14                          | 16.47                   | 0.13                   | 3.51                 |
| 1160               | 0.15                          | 16.40                   | 0.14                   | 3.43                 |
| 1180               | 0.17                          | 16.37                   | 0.15                   | 3.26                 |
| 1200               | 0.17                          | 16.38                   | 0.16                   | 3.09                 |
| 1225               | 0.18                          | 16.46                   | 0.16                   | 2.87                 |
| 1250               | 0.19                          | 16.65                   | 0.15                   | 2.79                 |
| 1275               | 0.20                          | 16.94                   | 0.16                   | 2.60                 |
| 1300               | 0.21                          | 17.28                   | 0.16                   | 2.31                 |
| 1325               | 0.21                          | 17.64                   | 0.16                   | 1.93                 |
| 1350               | 0.22                          | 18.08                   | 0.15                   | 1.70                 |
| 1375               | 0.23                          | 18.64                   | 0.15                   | 1.52                 |
| 1400               | 0.24                          | 19.25                   | 0.13                   | 1.33                 |
| 1425               | 0.24                          | 19.77                   | 0.10                   | 1.02                 |
| 1450               | 0.25                          | 20.27                   | 0.08                   | 0.62                 |
| 1475               | 0.27                          | 20.70                   | 0.04                   | 0.41                 |
| 1500               | 0.29                          | 21.00                   | 0.00                   | 0.19                 |
| 1525               | 0.30                          | 20.96                   | 0.05                   | 0.19                 |
| 1550               | 0.33                          | 20.74                   | 0.11                   | 0.59                 |
| 1575               | 0.36                          | 20.31                   | 0.19                   | 0.85                 |
| 1600               | 0.40                          | 19.65                   | 0.29                   | 1.10                 |

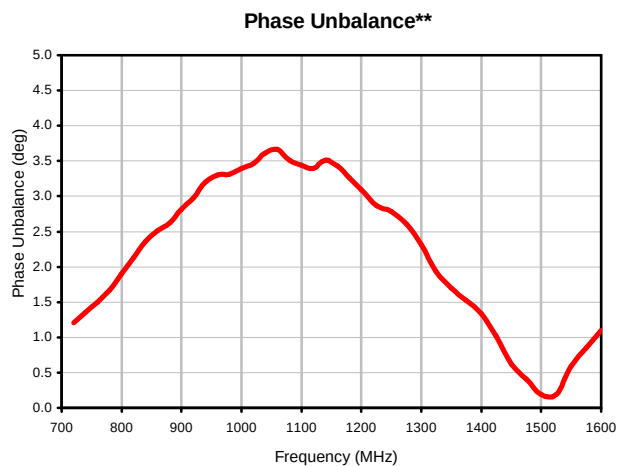
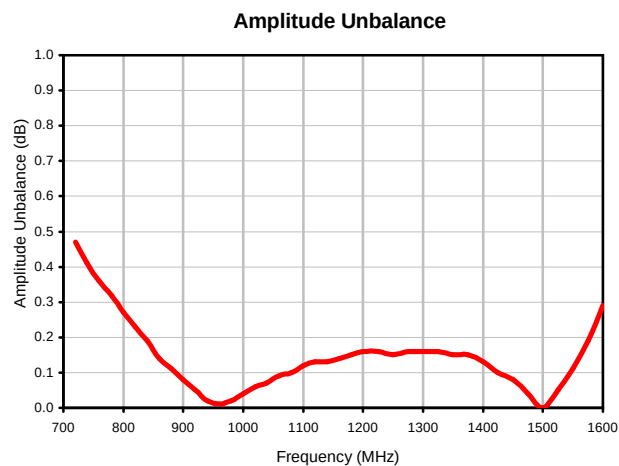
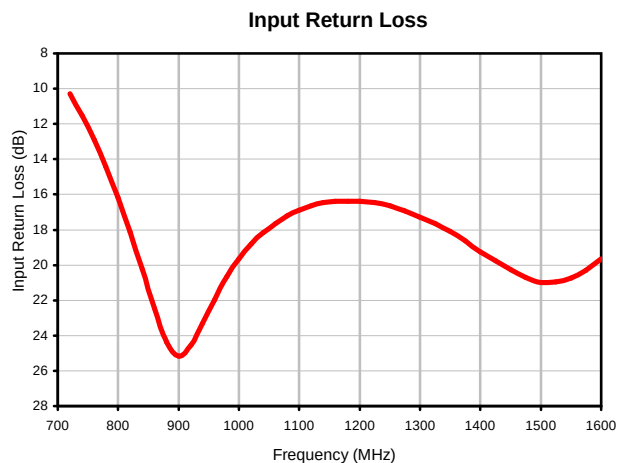
\* Insertion Loss is referenced to mid-band loss , 0.7 dB.

\*\*Phase Unbalance is relative to 180°

## Typical Performance Curves

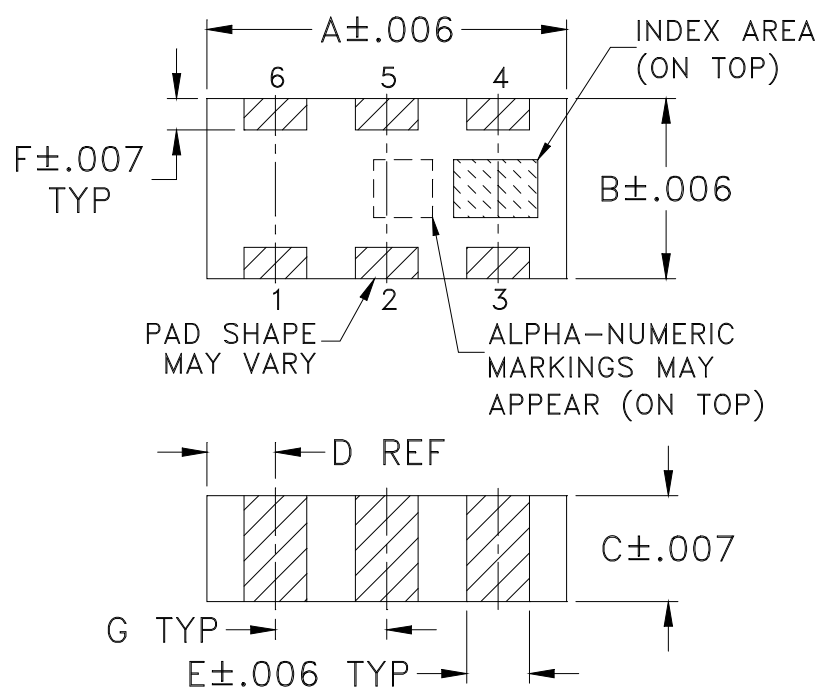


\* Insertion Loss is referenced to mid-band loss , 0.7 dB.

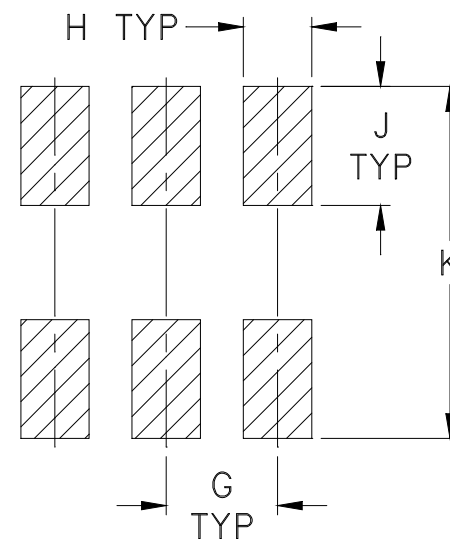


\*\*Phase Unbalance is relative to 180°

### 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.



P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661 For detailed performance specs & shopping online see Mini-Circuits web site



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RF/IF MICROWAVE COMPONENTS

# Tape & Reel Packaging

# TR-F75

## DEVICE ORIENTATION IN T&R

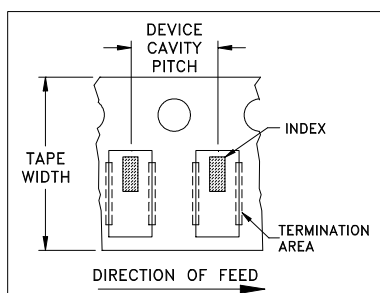


ILLUSTRATION 1

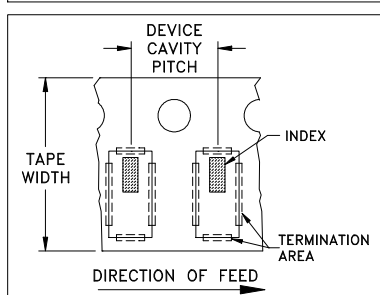


ILLUSTRATION 2

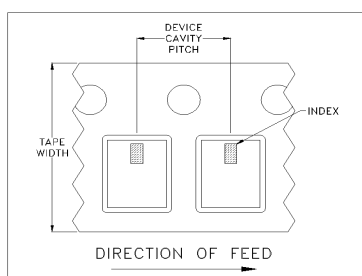


ILLUSTRATION 3

| Applicable Case Styles |
|------------------------|
| FV1206-1               |
| FV1206-3               |

| Applicable Case Styles |
|------------------------|
| FV1206-4               |
| FV1206-5               |
| FV1206-6               |
| FV1206-7               |
| FV1206-9               |
| JC0603C-1              |

| Applicable Case Styles |
|------------------------|
| NL1008C-6              |
| FV1206-12              |
| NL1008C-9              |
| NL1008C-10             |

| 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.

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|     |         |             |          |    |      |
|-----|---------|-------------|----------|----|------|
| REV | ECN No. | DESCRIPTION | DATE     | DR | AUTH |
| OR  | M109527 | NEW RELEASE | 01/31/07 | PW | DJ   |
|     |         |             |          |    |      |
|     |         |             |          |    |      |

[illegible]

1. COPLANAR WAVEGUIDE PARAMETERS ARE SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS .020"  $\pm$  .0015". COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH AND GAP MAY NEED TO BE MODIFIED.
2. BOTTOM SIDE OF THE PCB IS CONTINUOUS GROUND PLANE.

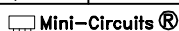
 DENOTES PCB COPPER LAYOUT WITH SMOBC (SOLDER MASK OVER BARE COPPER).

 DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK

**DIMENSIONS ARE IN INCHES**  
**TOLERANCES ON:**  
**2 PL DECIMALS ±**  
**3 PL DECIMALS ± .005**  
**ANGLES ± 1°**  
**FRACTIONS ±**

01/31/07

01/31/07



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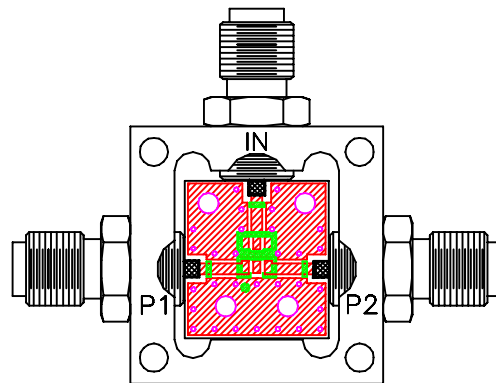


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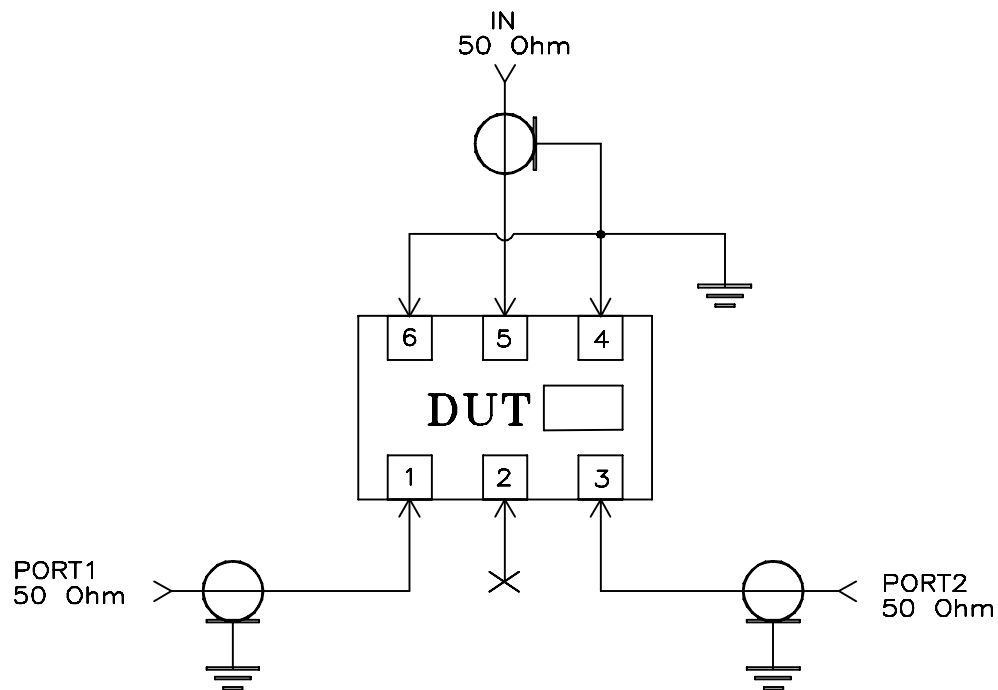
PL, sa, FV1206-1, TCN, TB-417+

|           |                     |                          |      |               |
|-----------|---------------------|--------------------------|------|---------------|
| SIZE<br>A | CODE IDENT<br>15542 | DRAWING NO:<br>98-PL-265 |      | REV:<br>OR    |
| FILE:     | 98PL265             | SCALE:                   | 10:1 | SHEET: 1 OF 1 |

# Evaluation Board and Circuit



TB-417+



Schematic Diagram

## Notes:

1. SMA Female connectors.
2. PCB Material: Rogers R04350 or equivalent,  
Dielectric Constant=3.5, Thickness=.010 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      | -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, 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                                                                 |