



# Directional Coupler

## TCD-20-4-75X+

75Ω 40 to 1200 MHz

### FEATURES

- Wideband, 40 to 1200 MHz
- Excellent flatness, ±0.5 dB typ. each band
- Better performance than MA-COM EMDC-20-2-75
- Footprint compatible to EMDC-10-1-75
- Aqueous washable



Generic photo used for illustration purposes only

CASE STYLE: DB1627

### APPLICATIONS

- CATV

**+RoHS Compliant**

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

### ELECTRICAL SPECIFICATIONS AT 25°C

| Parameter                  | Frequency (MHz) | Min. | Typ.     | Max. | Unit |
|----------------------------|-----------------|------|----------|------|------|
| Frequency Range            | —               | 40   | —        | 1200 | MHz  |
| Mainline Loss <sup>1</sup> | 40-500          | —    | 0.5      | 0.9  | dB   |
|                            | 500-870         | —    | 0.6      | 1.0  |      |
|                            | 870-1200        | —    | 0.6      | 1.1  |      |
| Coupling                   | 40-500          | —    | 21±0.5   | —    | dB   |
|                            | 500-870         | —    | 20±0.5   | —    |      |
|                            | 870-1200        | —    | 19.5±0.5 | —    |      |
| Coupling Flatness (±)      | 40-1200         | —    | ±0.8     | —    | dB   |
| Directivity                | 40-500          | 15   | 20       | —    | dB   |
|                            | 500-870         | 16   | 23       | —    |      |
|                            | 870-1200        | 14   | 20       | —    |      |
| VSWR                       | 40-1200         | —    | 1.15     | —    | :1   |
| Input Power                | 40-1200         | —    | —        | 1.0  | W    |

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

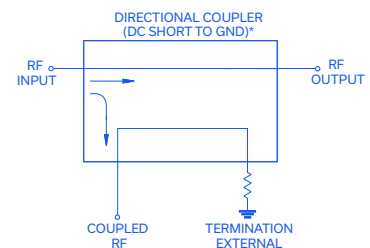
### MAXIMUM RATINGS

| Parameter             | Ratings        |
|-----------------------|----------------|
| Operating Temperature | -40°C to 85°C* |
| Storage Temperature   | -55°C to 100°C |

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

\* Case temperature is defined as temperature on ground leads.

### ELECTRICAL SCHEMATIC



\*Electrical schematic is for Directional coupler with internal transformer(s) and external termination



# Directional Coupler

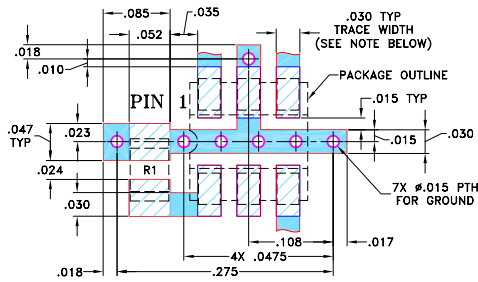
## TCD-20-4-75X+

### PIN CONNECTIONS

|                   |   |
|-------------------|---|
| INPUT             | 3 |
| OUTPUT            | 4 |
| COUPLED           | 1 |
| GROUND            | 2 |
| 75Ω TERM EXTERNAL | 6 |
| NOT USED          | 5 |

**PRODUCT MARKING:** DJ

### DEMO BOARD MCL P/N: TB-72 SUGGESTED PCB LAYOUT (PL-010)



RESISTOR R1: 75 ± 1% Ohm, 0805 SIZE

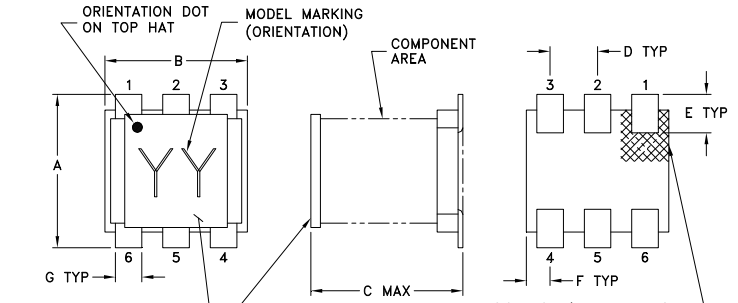
**NOTES:** 1. TRACE WIDTH IS SHOWN FOR ROGERS R04350B WITH DIELECTRIC THICKNESS 0.030" ± 0.002"; COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH MAY NEED TO BE MODIFIED.

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

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

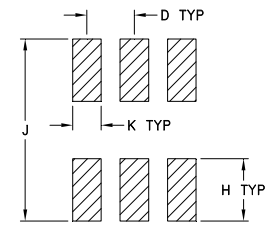
DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK

### OUTLINE DRAWING



TOP-HAT / PICK & PLACE SURFACE AREA (10X.10) MIN  
TOP-HAT TOTAL THICKNESS: .013 inches MAX.

### PCB Land Pattern



SUGGESTED LAYOUT TOLERANCE TO BE WITHIN ±.002

### OUTLINE DIMENSIONS (Inches mm)

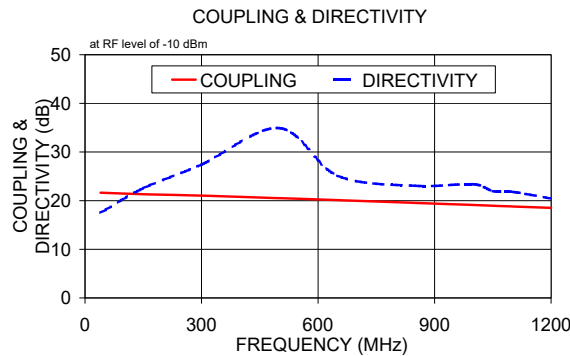
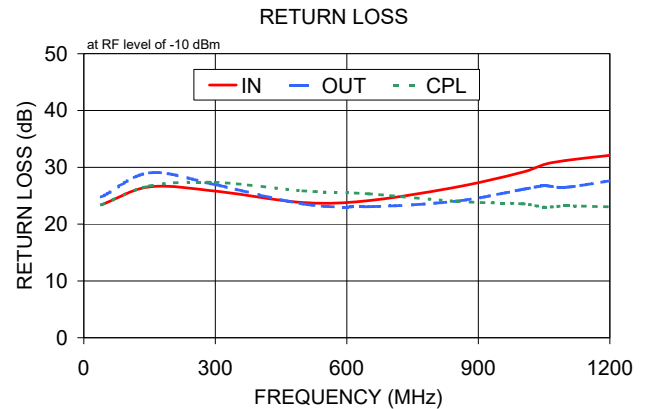
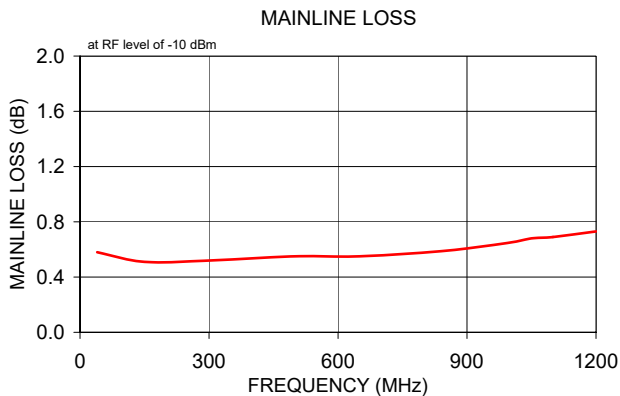
|      |      |      |      |      |       |
|------|------|------|------|------|-------|
| A    | B    | C    | D    | E    | F     |
| .160 | .150 | .160 | .050 | .040 | .025  |
| 4.06 | 3.81 | 4.06 | 1.27 | 1.02 | 0.64  |
| G    | H    | J    | K    |      | wt    |
| .028 | .065 | .190 | .030 |      | grams |
| 0.71 | 1.65 | 4.83 | 0.76 |      | 0.15  |

### TAPE & REEL INFORMATION: F47



**TYPICAL PERFORMANCE DATA**

| Frequency (MHz) | Mainline Loss (dB) | Coupling (dB) | Directivity (dB) | Return Loss (dB) |       |       |
|-----------------|--------------------|---------------|------------------|------------------|-------|-------|
|                 | In-Out             |               |                  | In               | Out   | Cpl   |
| 40.00           | 0.58               | 21.64         | 17.52            | 23.40            | 24.77 | 23.38 |
| 150.00          | 0.51               | 21.32         | 22.55            | 26.56            | 29.03 | 26.72 |
| 300.00          | 0.52               | 21.04         | 27.40            | 25.81            | 26.94 | 27.36 |
| 500.00          | 0.55               | 20.52         | 34.93            | 23.79            | 23.55 | 25.86 |
| 650.00          | 0.55               | 20.11         | 25.14            | 24.15            | 23.07 | 25.34 |
| 850.00          | 0.59               | 19.53         | 23.06            | 26.52            | 24.05 | 24.00 |
| 1000.00         | 0.65               | 19.12         | 23.38            | 29.12            | 26.11 | 23.57 |
| 1050.00         | 0.68               | 18.96         | 21.95            | 30.51            | 26.75 | 22.99 |
| 1100.00         | 0.69               | 18.81         | 21.82            | 31.20            | 26.49 | 23.19 |
| 1200.00         | 0.73               | 18.51         | 20.42            | 32.12            | 27.62 | 23.06 |



- 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/terms/viewterm.html](http://www.minicircuits.com/terms/viewterm.html)

# Directional Coupler

# TCD-20-4-75X+

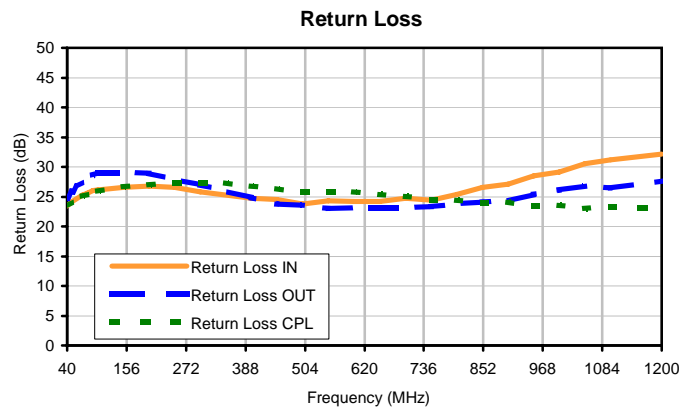
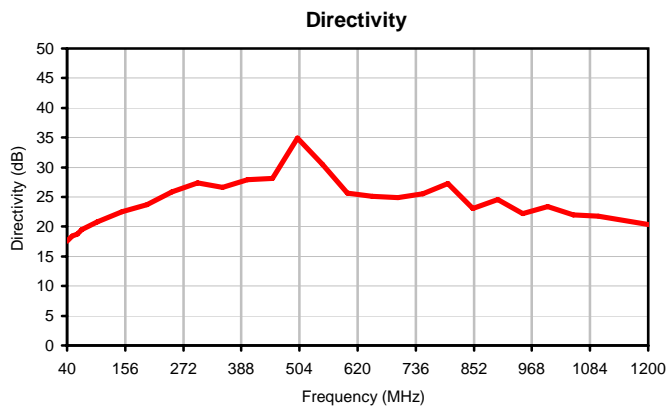
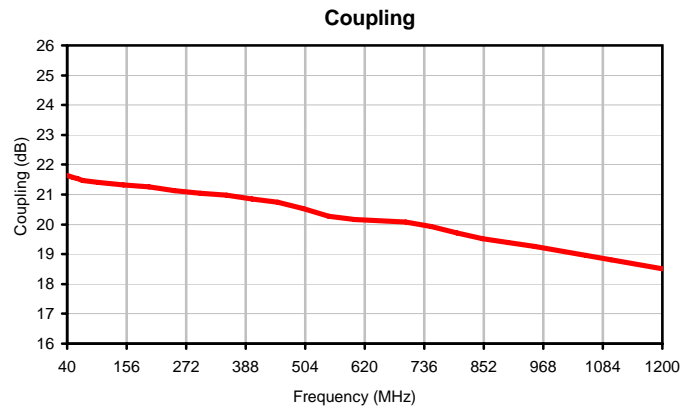
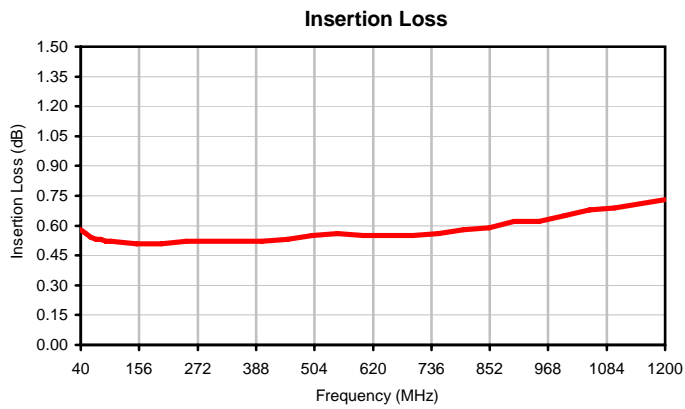
## Typical Performance Data

| FREQUENCY<br>(MHz) | INSERTION<br>LOSS<br>(dB) | COUPLING<br>(dB) | DIRECTIVITY<br>(dB) | RETURN LOSS<br>(dB) |       |       |
|--------------------|---------------------------|------------------|---------------------|---------------------|-------|-------|
|                    |                           |                  |                     | IN                  | OUT   | CPL   |
| 40.0               | 0.58                      | 21.64            | 17.52               | 23.40               | 24.77 | 23.38 |
| 50.0               | 0.56                      | 21.59            | 18.38               | 24.17               | 25.76 | 24.05 |
| 60.0               | 0.54                      | 21.54            | 18.79               | 24.77               | 26.63 | 24.58 |
| 70.0               | 0.53                      | 21.48            | 19.52               | 25.24               | 27.40 | 25.01 |
| 80.0               | 0.53                      | 21.46            | 19.93               | 25.64               | 28.07 | 25.34 |
| 90.0               | 0.52                      | 21.43            | 20.42               | 25.97               | 28.65 | 25.65 |
| 100.0              | 0.52                      | 21.40            | 20.79               | 26.18               | 29.06 | 25.90 |
| 150.0              | 0.51                      | 21.32            | 22.55               | 26.56               | 29.03 | 26.72 |
| 200.0              | 0.51                      | 21.26            | 23.71               | 26.81               | 28.91 | 27.00 |
| 250.0              | 0.52                      | 21.12            | 25.82               | 26.55               | 28.00 | 27.29 |
| 300.0              | 0.52                      | 21.04            | 27.40               | 25.81               | 26.94 | 27.36 |
| 350.0              | 0.52                      | 20.97            | 26.66               | 25.32               | 25.96 | 27.34 |
| 400.0              | 0.52                      | 20.86            | 27.87               | 24.72               | 24.81 | 26.78 |
| 450.0              | 0.53                      | 20.75            | 28.12               | 24.48               | 23.76 | 26.35 |
| 500.0              | 0.55                      | 20.52            | 34.93               | 23.79               | 23.55 | 25.86 |
| 550.0              | 0.56                      | 20.28            | 30.53               | 24.26               | 22.98 | 25.86 |
| 600.0              | 0.55                      | 20.16            | 25.62               | 24.21               | 23.10 | 25.83 |
| 650.0              | 0.55                      | 20.11            | 25.14               | 24.15               | 23.07 | 25.34 |
| 700.0              | 0.55                      | 20.07            | 24.89               | 24.78               | 23.12 | 25.06 |
| 750.0              | 0.56                      | 19.92            | 25.50               | 24.45               | 23.35 | 24.52 |
| 800.0              | 0.58                      | 19.72            | 27.27               | 25.41               | 23.80 | 24.41 |
| 850.0              | 0.59                      | 19.53            | 23.06               | 26.52               | 24.05 | 24.00 |
| 900.0              | 0.62                      | 19.38            | 24.56               | 27.11               | 24.33 | 24.10 |
| 950.0              | 0.62                      | 19.26            | 22.23               | 28.45               | 25.42 | 23.44 |
| 1000.0             | 0.65                      | 19.12            | 23.38               | 29.12               | 26.11 | 23.57 |
| 1050.0             | 0.68                      | 18.96            | 21.95               | 30.51               | 26.75 | 22.99 |
| 1100.0             | 0.69                      | 18.81            | 21.82               | 31.20               | 26.49 | 23.19 |
| 1200.0             | 0.73                      | 18.51            | 20.42               | 32.12               | 27.62 | 23.06 |

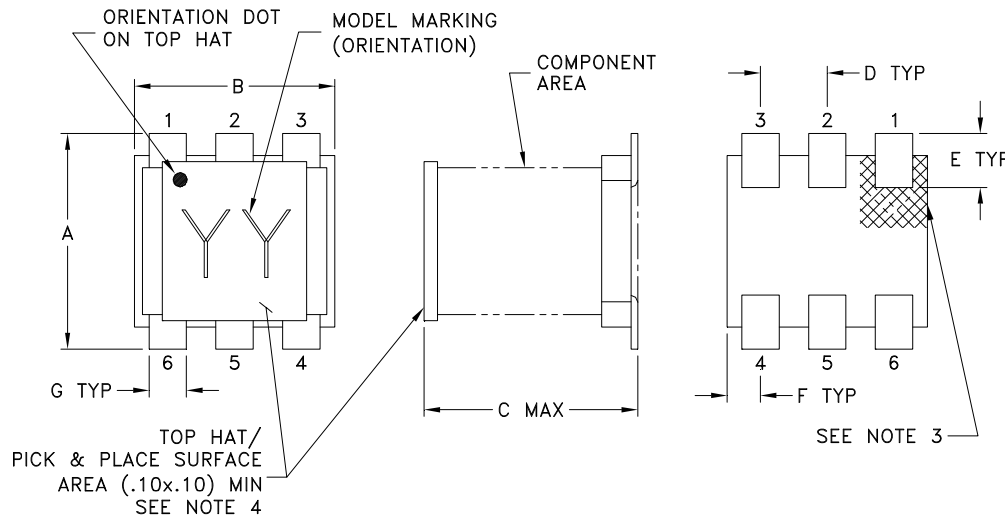
# Directional Coupler

# TCD-20-4-75X+

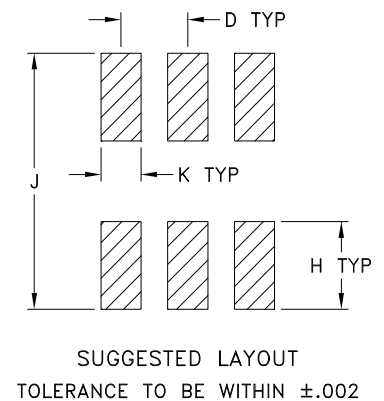
## Typical Performance Curves



### Outline Dimensions



### PCB Land Pattern



| CASE # | A              | B              | C              | D              | E              | F              | G              | H              | J              | K              | WT. GRAM |
|--------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------|
| DB1627 | .160<br>(4.06) | .150<br>(3.81) | .160<br>(4.06) | .050<br>(1.27) | .040<br>(1.02) | .025<br>(0.64) | .028<br>(0.71) | .065<br>(1.65) | .190<br>(4.83) | .030<br>(0.76) | .15      |

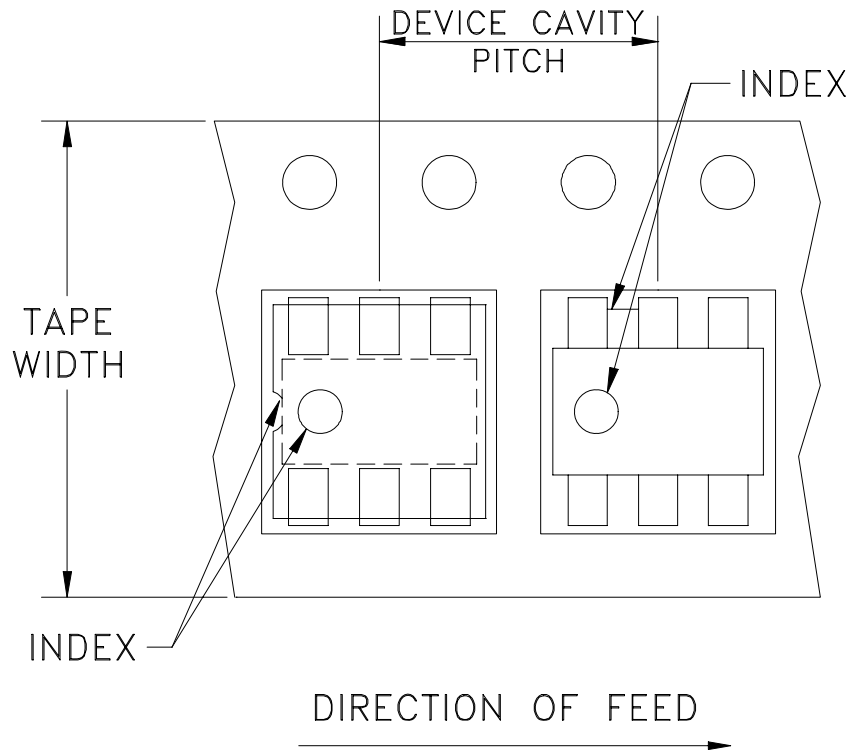
Dimensions are in inches (mm). Tolerances: 2 Pl.  $\pm .01$ ; 3Pl.  $\pm .005$

### Notes:

- Case material: Plastic.
- 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.
- Orientation dot on top hat & orientation feature on substrate correspondence to pin #1.
- Top-Hat total thickness: .013 inches MAX.

# Tape & Reel Packaging TR-F47

## DEVICE ORIENTATION IN T&R



| Tape Width, mm | Device Cavity Pitch, mm | Reel Size, inches | Devices per Reel see note |
|----------------|-------------------------|-------------------|---------------------------|
| 12             | 8                       | 13                | 1000, 2000                |
|                |                         | 7                 | 20, 50, 100, 200, 500     |

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)



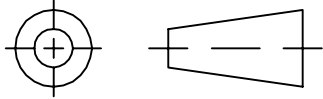
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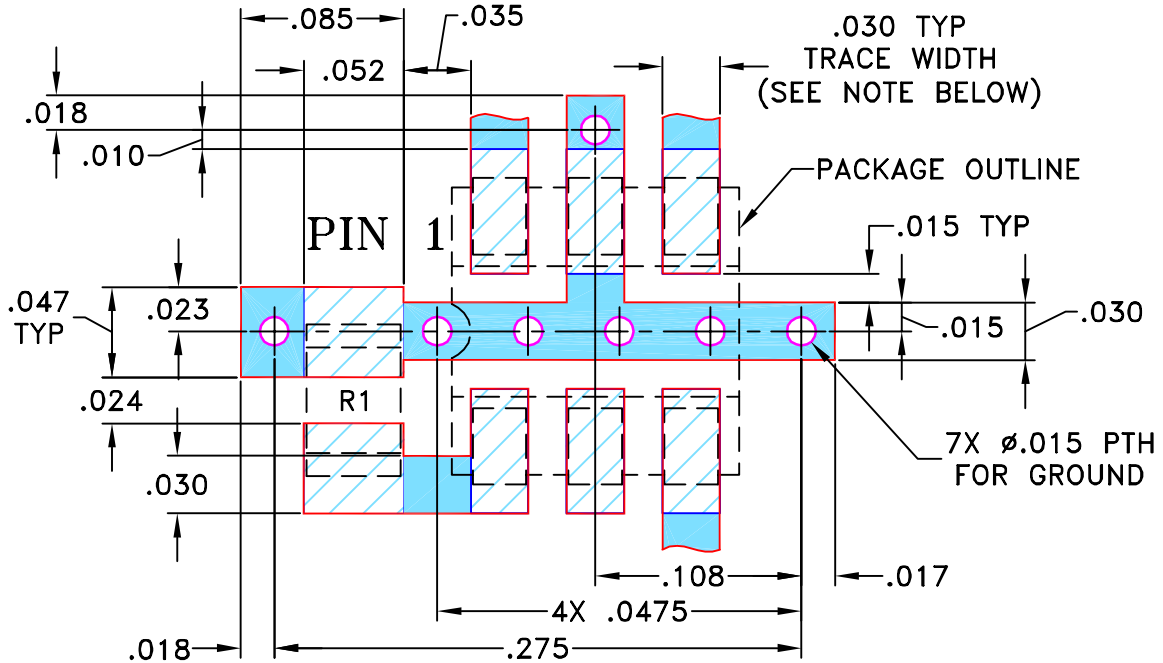
THIRD ANGLE PROJECTION



REVISIONS

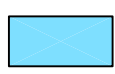
| REV | ECN No. | DESCRIPTION     | DATE     | DR | AUTH |
|-----|---------|-----------------|----------|----|------|
| OR  | M73159  | NEW RELEASE     | 08/00    | IL | DB   |
| A   | M82377  | UPDATED DRAWING | 07/30/02 | AV | LC   |
| B   | M102713 | UPDATED NOTES   | 01/12/08 | GF | IL   |

SUGGESTED MOUNTING CONFIGURATION FOR  
DB714 CASE STYLE, "mm" PIN CONNECTION



RESISTOR R1: 75 ± 1% Ohm, 0805 SIZE

- NOTES: 1. TRACE WIDTH IS SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS 0.030" ± 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

DRAWN

IL

08/03/00

TOLERANCES ON:

2 PL DECIMALS ±

CHECKED

WP

08/08/00

3 PL DECIMALS ± .005

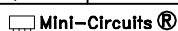
APPROVED

DB

08/09/00

ANGLES ±

FRACTIONS ±



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Mini-Circuits®

13 Neptune Avenue  
Brooklyn NY 11235

PL, mm, 75, DB714, TCD, TB-72

SIZE

CODE IDENT

DRAWING NO:

REV:

A

15542

98-PL-010

B

FILE: 98PL010

SCALE:

10:1

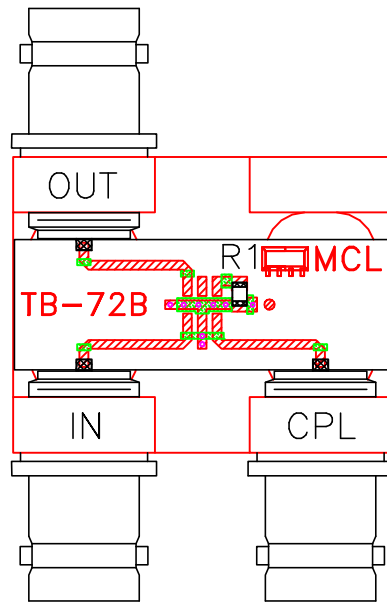
SHEET:

1 OF 1

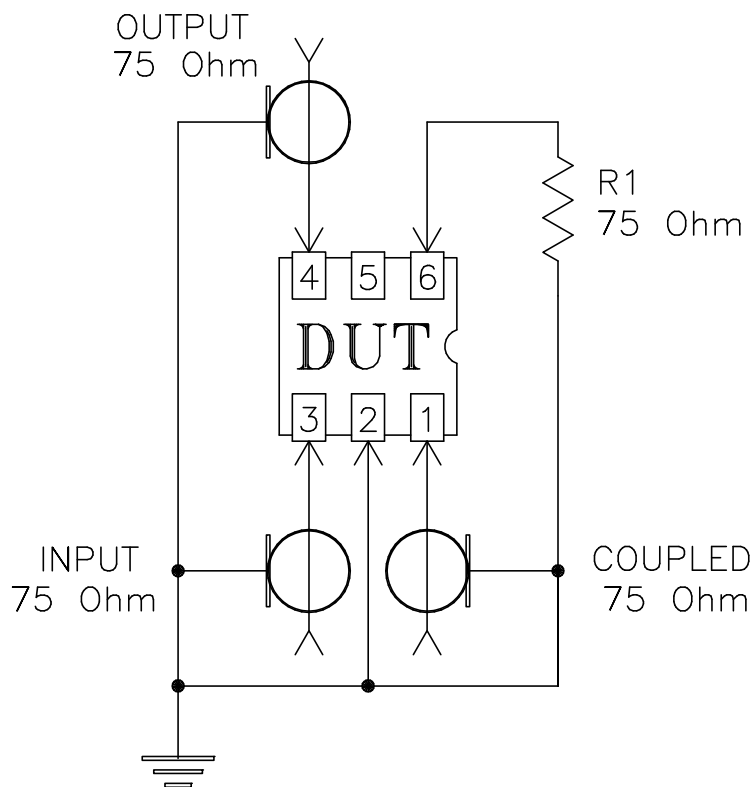
ASHEETA1.DWG REV:A DATE:01/12/95



# Evaluation Board and Circuit




TB-72



Schematic Diagram

## Notes:

1. 75 Ohm BNC 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  |