

# Directional Couplers

75Ω, 16dB coupling, 5 to 1500 MHz

## Maximum Ratings

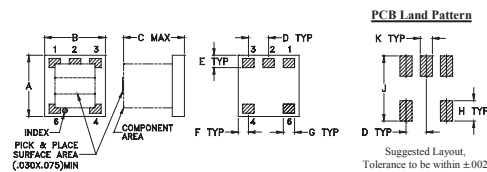
|                                                                 |                |
|-----------------------------------------------------------------|----------------|
| Operating Temperature                                           | -40°C to 85°C  |
| Storage Temperature                                             | -55°C to 100°C |
| Permanent damage may occur if any of these limits are exceeded. |                |

## Pin Connections

|                      |   |
|----------------------|---|
| INPUT                | 3 |
| OUTPUT               | 4 |
| COUPLED              | 1 |
| GROUND               | 2 |
| ISOLATE (DO NOT USE) | 6 |

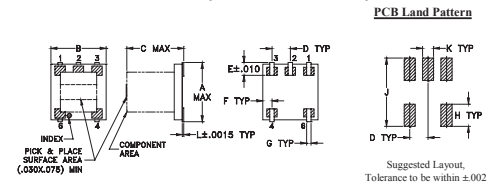
## Outline Drawing / Dimensions (inch mm)

### AT790-1 (DBTC-16-5-75)



| Dimension | Value (inch) | Value (mm) | Weight (grams) |
|-----------|--------------|------------|----------------|
| A         | .150         | 3.81       | 3.81           |
| B         | .150         | 3.81       | 3.81           |
| C         | .150         | 3.81       | 3.81           |
| D         | .050         | 1.27       | 0.76           |
| E         | .030         | 0.76       | 0.64           |
| F         | .025         | 0.64       | 0.71           |
| G         | .028         | 0.71       | 1.27           |
| H         | .050         | 1.27       | 4.06           |
| J         | .160         | 4.06       | 0.76           |
| K         | .030         | 0.76       | 0.10           |

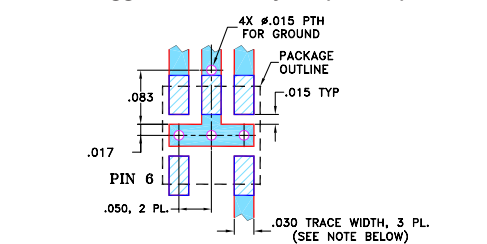
### AT1030 (DBTC-16-5-75L)



| Dimension | Value (inch) | Value (mm) | Weight (grams) |
|-----------|--------------|------------|----------------|
| A         | .166         | 4.22       | 3.81           |
| B         | .150         | 3.81       | 3.94           |
| C         | .155         | 3.94       | 1.27           |
| D         | .050         | 1.27       | 0.94           |
| E         | .037         | 0.94       | 0.64           |
| F         | .025         | 0.64       | 0.30           |
| G         | .012         | 0.30       | 1.52           |
| H         | .060         | 1.52       | 4.67           |
| J         | .184         | 4.67       | 0.76           |
| K         | .030         | 0.76       | 0.10           |
| L         | .004         | 0.10       | 0.10           |

## Demo Board MCL P/N: TB-279

### Suggested PCB Layout (PL-151)



- 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.
3. DENOTES PCB COPPER LAYOUT WITH SMOBC (SOLDER MASK OVER BARE COPPER)
4. DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK

## Notes

- A. Performance and quality attributes and conditions not expressly stated in this specification document are intended to be excluded and do not form a part of this specification document.
- B. Electrical specifications and performance data contained in this specification document are based on Mini-Circuit's applicable established test performance criteria and measurement instructions.
- C. The parts covered by this specification document are subject to Mini-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

- very flat coupling
- very broadband, multi octave
- temperature stable, LTCC base
- all welded construction
- leads attached for better solderability
- micro miniature coupler
- aqueous washable
- protected by US Patents 6,140,887 & 6,784,521

## Applications

- VHF/UHF receivers/transmitters
- cellular

## Electrical Specifications

| FREQ.<br>RANGE<br>(MHz)        | COUPLING<br>(dB) |               | MAINLINE LOSS*<br>(dB) |      |      |      |      |      | DIRECTIVITY<br>(dB) |      |      |      |      |      | VSWR**<br>(:1) | POWER<br>INPUT<br>(W) |      |
|--------------------------------|------------------|---------------|------------------------|------|------|------|------|------|---------------------|------|------|------|------|------|----------------|-----------------------|------|
|                                |                  |               | L                      |      | M    |      | U    |      | L                   |      | M    |      | U    |      |                | L                     | MU   |
|                                | Nom.             | Max. Flatness | Typ.                   | Max. | Typ. | Max. | Typ. | Max. | Typ.                | Min. | Typ. | Min. | Typ. | Min. |                | Typ.                  | Max. |
| f <sub>c</sub> -f <sub>u</sub> |                  |               |                        |      |      |      |      |      |                     |      |      |      |      |      |                |                       |      |
| 5-1000                         | 16.3±0.5         | ±0.7          | 1.2                    | 2.0  | 1.0  | 1.5  | 1.1  | 1.6  | 22                  | 16   | 21   | 13   | 20   | —    | 1.3            | 0.5                   | 1.0  |
| 1000-1500                      | 16.8±0.7         | ±0.7          |                        |      | 1.3  | 1.9  |      |      |                     |      | 19   | —    |      |      | 1.3            |                       | 1.0  |

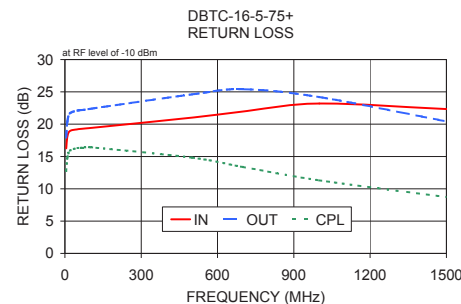
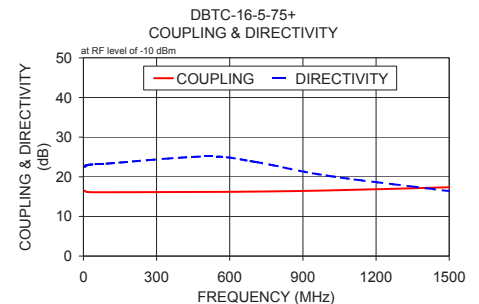
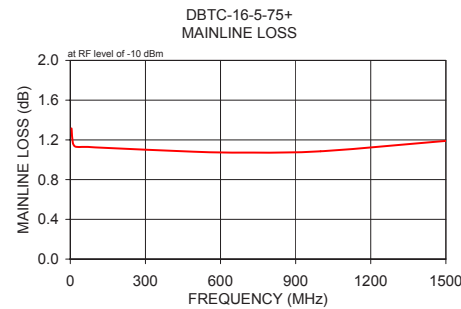
L = 5-50 MHz, M=50-500 MHz, U=500-1000 MHz apply to upper row of specs. 2nd row is for 1000-1500 MHz.

\* Includes theoretical coupled power loss of 0.10 dB at 16 dB coupling

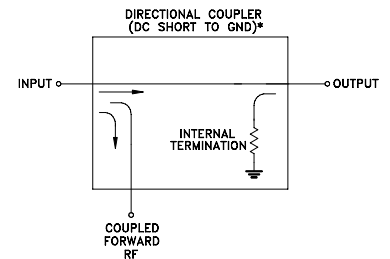
\*\* For coupled port VSWR above 500 MHz, 1.6:1 typ.

## Typical Performance Data

| Frequency (MHz) | Mainline Loss (dB) In-Out | Coupling (dB) In-Cpl | Directivity (dB) | Return Loss (dB) |       |       |
|-----------------|---------------------------|----------------------|------------------|------------------|-------|-------|
|                 |                           |                      |                  | In               | Out   | Cpl   |
| 5.0             | 1.32                      | 16.54                | 22.53            | 16.26            | 17.94 | 12.74 |
| 10.0            | 1.18                      | 16.25                | 22.81            | 18.13            | 20.48 | 14.84 |
| 20.0            | 1.13                      | 16.14                | 23.00            | 18.94            | 21.68 | 15.90 |
| 50.0            | 1.13                      | 16.11                | 23.19            | 19.20            | 22.11 | 16.31 |
| 70.0            | 1.13                      | 16.10                | 23.23            | 19.30            | 22.19 | 16.37 |
| 100.0           | 1.12                      | 16.10                | 23.35            | 19.41            | 22.38 | 16.43 |
| 500.0           | 1.08                      | 16.18                | 25.13            | 21.01            | 24.62 | 14.81 |
| 700.0           | 1.07                      | 16.27                | 23.81            | 21.95            | 25.41 | 13.38 |
| 1000.0          | 1.09                      | 16.56                | 20.29            | 23.20            | 24.19 | 11.31 |
| 1500.0          | 1.19                      | 17.35                | 16.40            | 22.34            | 20.43 | 8.71  |



## Electrical Schematic



\* ELECTRICAL SCHEMATIC IS FOR DIRECTIONAL COUPLER WITH INTERNAL TRANSFORMER(S) THAT ROUTES DC FROM RF PORTS TO GROUND.

# Directional Coupler

**DBTC-16-5-75L+**

## Typical Performance Data

| FREQUENCY<br>(MHz) | INSERTION<br>LOSS<br>(dB) | COUPLING<br>(dB) | DIRECTIVITY<br>(dB) | RETURN LOSS<br>(dB) |       |       |
|--------------------|---------------------------|------------------|---------------------|---------------------|-------|-------|
|                    |                           |                  |                     | IN                  | OUT   | CPL   |
| 5.0                | 1.32                      | 16.54            | 22.53               | 16.26               | 17.94 | 12.74 |
| 10.0               | 1.18                      | 16.25            | 22.81               | 18.13               | 20.48 | 14.84 |
| 20.0               | 1.13                      | 16.14            | 23.00               | 18.94               | 21.68 | 15.90 |
| 30.0               | 1.13                      | 16.12            | 23.04               | 19.10               | 21.90 | 16.15 |
| 40.0               | 1.13                      | 16.11            | 23.12               | 19.16               | 22.03 | 16.25 |
| 50.0               | 1.13                      | 16.11            | 23.19               | 19.20               | 22.11 | 16.31 |
| 60.0               | 1.13                      | 16.10            | 23.20               | 19.25               | 22.15 | 16.35 |
| 70.0               | 1.13                      | 16.10            | 23.23               | 19.30               | 22.19 | 16.37 |
| 80.0               | 1.13                      | 16.11            | 23.25               | 19.35               | 22.24 | 16.40 |
| 85.0               | 1.13                      | 16.10            | 23.29               | 19.37               | 22.28 | 16.41 |
| 90.0               | 1.13                      | 16.10            | 23.31               | 19.39               | 22.31 | 16.42 |
| 95.0               | 1.13                      | 16.10            | 23.33               | 19.40               | 22.34 | 16.42 |
| 100.0              | 1.12                      | 16.10            | 23.35               | 19.41               | 22.38 | 16.43 |
| 150.0              | 1.12                      | 16.11            | 23.84               | 19.55               | 22.85 | 16.41 |
| 200.0              | 1.12                      | 16.13            | 23.69               | 19.66               | 22.75 | 16.24 |
| 250.0              | 1.11                      | 16.14            | 24.02               | 19.90               | 23.04 | 16.08 |
| 300.0              | 1.11                      | 16.15            | 24.32               | 20.13               | 23.31 | 15.90 |
| 350.0              | 1.10                      | 16.16            | 24.64               | 20.30               | 23.63 | 15.65 |
| 400.0              | 1.09                      | 16.16            | 24.94               | 20.55               | 23.98 | 15.40 |
| 450.0              | 1.09                      | 16.17            | 25.14               | 20.71               | 24.28 | 15.13 |
| 500.0              | 1.08                      | 16.18            | 25.13               | 21.01               | 24.62 | 14.81 |
| 550.0              | 1.08                      | 16.19            | 25.00               | 21.24               | 24.80 | 14.43 |
| 600.0              | 1.07                      | 16.21            | 24.81               | 21.43               | 25.12 | 14.09 |
| 650.0              | 1.07                      | 16.24            | 24.40               | 21.78               | 25.19 | 13.74 |
| 700.0              | 1.07                      | 16.27            | 23.81               | 21.95               | 25.41 | 13.38 |
| 750.0              | 1.07                      | 16.30            | 23.24               | 22.26               | 25.37 | 12.98 |
| 800.0              | 1.07                      | 16.35            | 22.66               | 22.43               | 25.28 | 12.66 |
| 850.0              | 1.08                      | 16.39            | 22.01               | 22.73               | 25.15 | 12.31 |
| 900.0              | 1.08                      | 16.44            | 21.41               | 22.86               | 24.85 | 11.95 |
| 950.0              | 1.08                      | 16.50            | 20.85               | 23.08               | 24.63 | 11.63 |
| 1000.0             | 1.09                      | 16.56            | 20.29               | 23.20               | 24.19 | 11.31 |
| 1050.0             | 1.09                      | 16.62            | 19.80               | 23.24               | 23.86 | 11.00 |
| 1100.0             | 1.10                      | 16.69            | 19.30               | 23.29               | 23.39 | 10.68 |
| 1150.0             | 1.11                      | 16.77            | 18.86               | 23.23               | 22.96 | 10.40 |
| 1200.0             | 1.12                      | 16.85            | 18.44               | 23.19               | 22.54 | 10.11 |
| 1250.0             | 1.13                      | 16.92            | 18.06               | 23.08               | 22.11 | 9.85  |
| 1300.0             | 1.14                      | 17.01            | 17.68               | 23.02               | 21.79 | 9.58  |
| 1350.0             | 1.15                      | 17.09            | 17.34               | 22.85               | 21.35 | 9.37  |
| 1400.0             | 1.16                      | 17.17            | 17.03               | 22.67               | 21.05 | 9.11  |
| 1450.0             | 1.18                      | 17.26            | 16.69               | 22.55               | 20.66 | 8.89  |
| 1500.0             | 1.19                      | 17.35            | 16.40               | 22.34               | 20.43 | 8.71  |



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IF/RF MICROWAVE COMPONENTS

REV. OR

DBTC-16-5-75L+

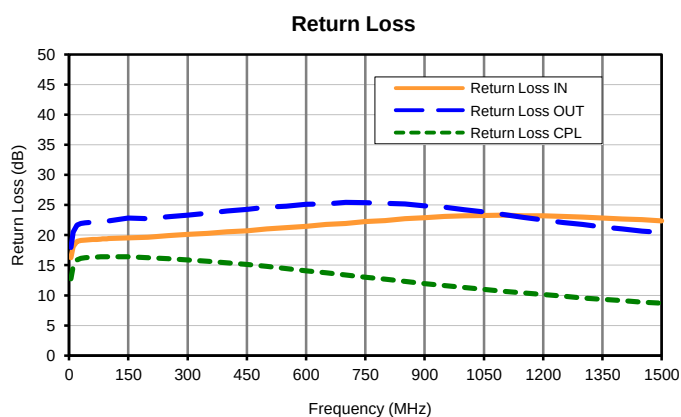
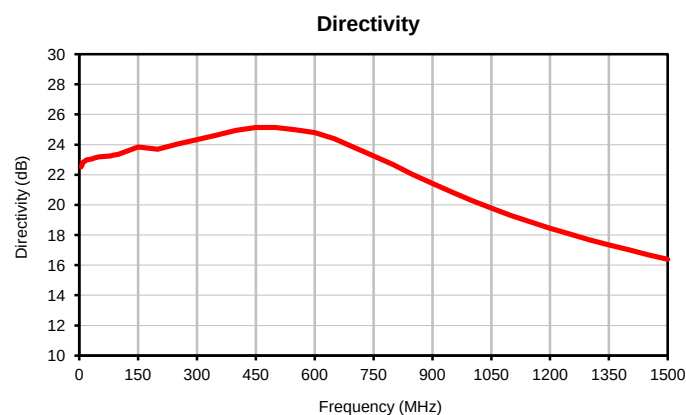
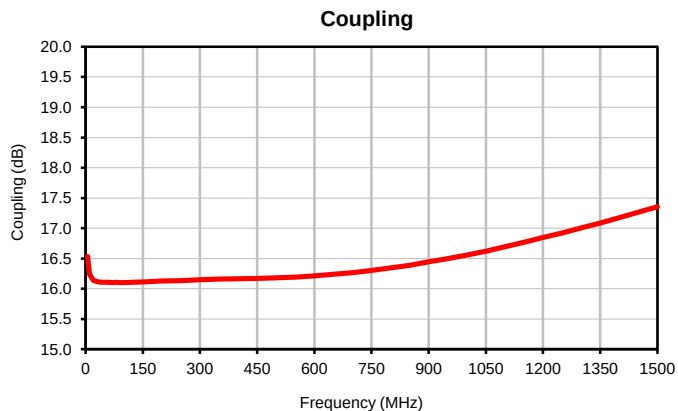
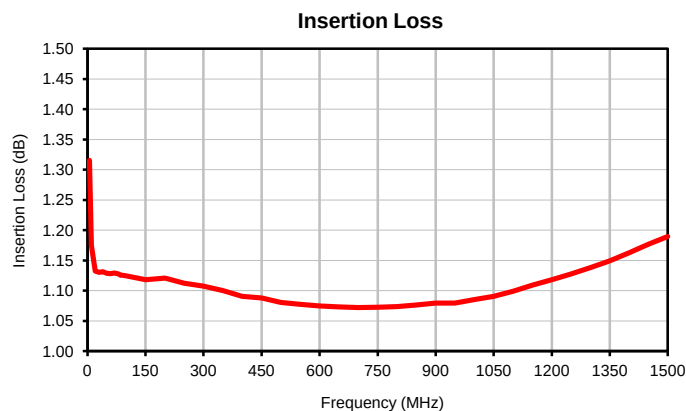
9/25/2013

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# Directional Coupler

DBTC-16-5-75L+

## Typical Performance Curves



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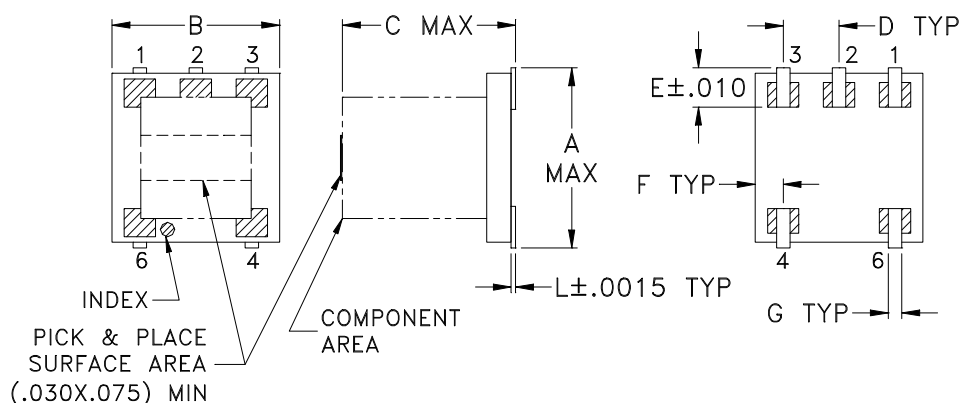
IF/RF MICROWAVE COMPONENTS



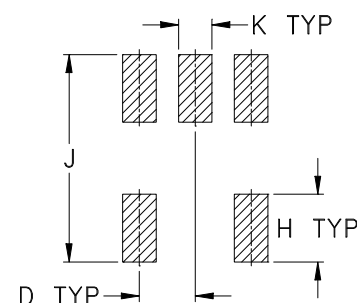
REV. OR  
DBTC-16-5-75L+  
9/25/2013  
Page 1 of 1

## Outline Dimensions

AT1030



## PCB Land Pattern



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

| CASE # | A              | B              | C              | D              | E              | F              | G              | H              | J              | K              | L              | WT. GRAMS |
|--------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|-----------|
| AT1030 | .166<br>(4.22) | .150<br>(3.81) | .155<br>(3.94) | .050<br>(1.27) | .037<br>(0.94) | .025<br>(0.64) | .012<br>(0.30) | .060<br>(1.52) | .184<br>(4.67) | .030<br>(0.76) | .004<br>(0.10) | .10       |

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

### Notes:

- Open style, ceramic base.
- Termination finish:  
For RoHS Case Styles: Tin plate.  
For RoHS-5 Case Styles: Tin-Lead plate.



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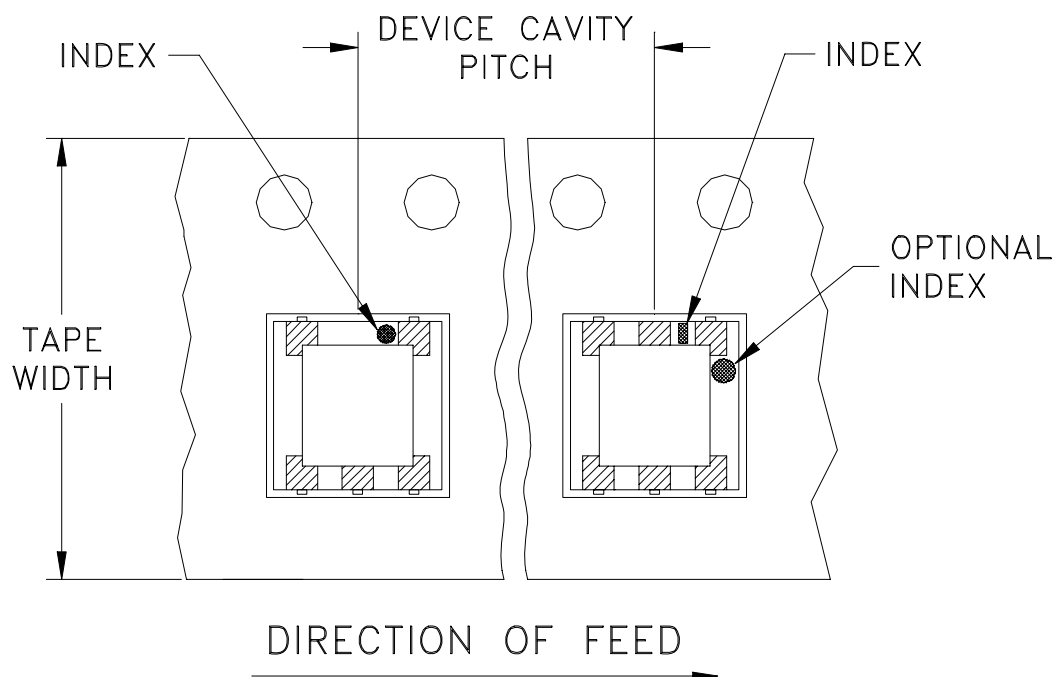


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RF/IF MICROWAVE COMPONENTS

# Tape & Reel Packaging TR-F76

## DEVICE ORIENTATION IN T&R



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

**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.

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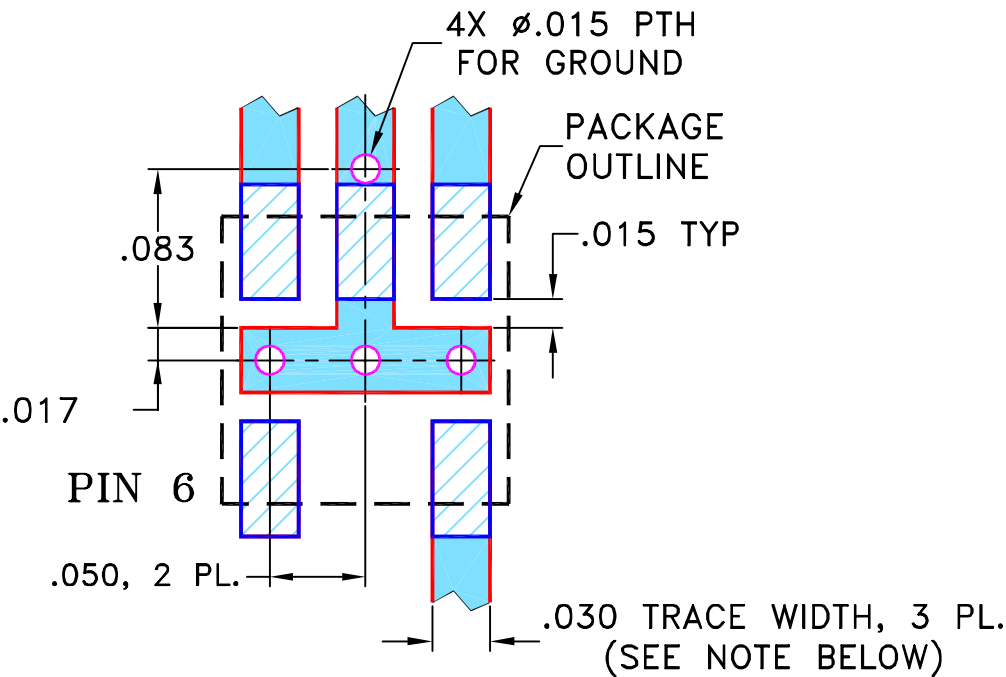
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THIRD ANGLE PROJECTION

| REVISIONS |         |                       |          |     |      |
|-----------|---------|-----------------------|----------|-----|------|
| REV/      | ECN No. | DESCRIPTION           | DATE     | DR  | AUTH |
| OR        | M90455  | NEW RELEASE           | 01/16/04 | AV  | WP   |
| A         | M102713 | ADDED "...WITH SMOBC" | 01/17/06 | MMG | IL   |
|           |         |                       |          |     |      |
|           |         |                       |          |     |      |

SUGGESTED MOUNTING CONFIGURATION FOR

AT1029 CASE STYLE, "na" PIN CONNECTION

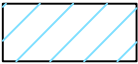


- NOTES: 1. TRACE WIDTH IS SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS 0.030" ± 0.002"; COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH MAY NEED TO BE MODIFIED.

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<br>TOLERANCES ON:<br>2 PL DECIMALS ±<br>3 PL DECIMALS ± .005<br>ANGLES ±<br>FRACTIONS ± | DRAWN    | AV | 01/07/04 |
|                                                                                                                  | CHECKED  | IL | 01/16/04 |
|                                                                                                                  | APPROVED | WP | 01/16/04 |
|                                                                                                                  |          |    |          |



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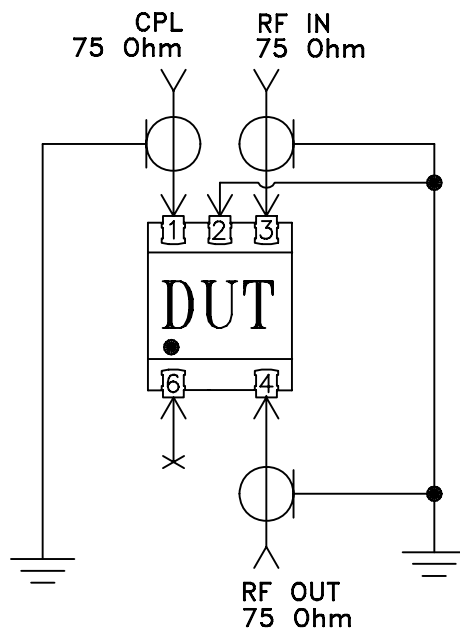
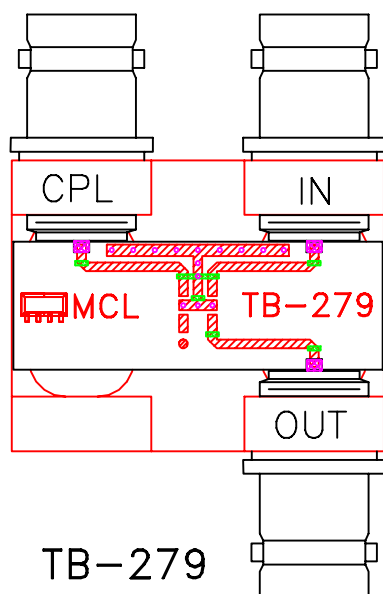
PL, na, 75, AT1029, DBTC, TB-279

|                  |                     |                          |           |
|------------------|---------------------|--------------------------|-----------|
| SIZE<br>A        | CODE IDENT<br>15542 | DRAWING NO:<br>98-PL-151 | REV:<br>A |
| FILE:<br>98PL151 | SCALE:<br>10:1      | SHEET:<br>1 OF 1         |           |

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# Evaluation Board and Circuit



Schematic Diagram

## Notes:

1. BNC Female connectors.
2. PCB Material: Rogers R04350 or equivalent,  
Dielectric Constant=3.5, Thickness=.030 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, 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                                                                              |