

# Surface Mount Directional Coupler

## ADC-17-122-75+

75Ω    17dB    5 to 1250 MHz

### The Big Deal

- Covers DOCSIS® 3.1 Bandwidth Requirements
- Low mainline loss, 0.8 dB
- Excellent coupling flatness,  $\pm 0.4$  dB up to 1000 MHz
- Good VSWR: 1.15:1



CASE STYLE: CD542

### Product Overview

Mini-Circuits' ADC-17-122-75+ is a 75Ω surface-mount directional coupler providing 17 dB coupling from 5 to 1250 MHz, supporting bandwidth requirements for DOCSIS 3.1 systems and equipment. This model, provides excellent coupling flatness, low mainline loss, good VSWR and RF input power handling up to 1W. The unit comes housed in a miniature 6-lead plastic package (0.27 x 0.31 x 0.11"), saving space in dense PCB layouts.

### Key Features

| Feature                                             | Advantages                                                                                         |
|-----------------------------------------------------|----------------------------------------------------------------------------------------------------|
| Wideband, 5 to 1250 MHz                             | The ADC-17-122-75+ supports a variety of 75Ω applications, including DOCSIS 3.1 compliant systems. |
| Good coupling flatness, $\pm 0.4$ dB up to 1000 MHz | Provides consistent coupling performance across frequency.                                         |
| High power handling, 1W                             | Usable in systems with a wide range of high-power requirements.                                    |
| Low mainline loss, 0.8 dB                           | Provides excellent through-path signal power transmission.                                         |
| Small size, 0.27 x 0.31 x 0.11"                     | Provides high power capability while saving space in systems with tight layouts.                   |

# Surface Mount Directional Coupler

75Ω 17dB 5 to 1250 MHz

## ADC-17-122-75+

### Features

- wideband, 5-1250 MHz
- low mainline loss, 0.8 dB typ.
- good VSWR, 1.15:1 typ.
- excellent coupling flatness,  $\pm 0.4$  dB typ. up to 1000 MHz
- aqueous washable
- protected by U.S. Patents 6,133,525 & 6,140,887

### Applications

- cable tv
- cellular
- DOCSIS 3.1 system
- VHF/UHF



Generic photo used for illustration purposes only  
CASE STYLE: CD542

### +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 |
| 13"       | 500, 1000        |

### Electrical Specifications at 25°C

| Parameter                   | Condition (MHz) | Min. | Typ.         | Max. | Unit |
|-----------------------------|-----------------|------|--------------|------|------|
| Frequency Range             |                 | 5    |              | 1250 | MHz  |
| Mainline Loss <sup>1</sup>  | 5 - 1000        | —    | 0.8          | 1.2  | dB   |
|                             | 1000 - 1250     | —    | 1.0          | 1.4  |      |
| Coupling                    | 5 - 1250        | —    | 17 $\pm$ 0.5 | —    | dB   |
| Coupling Flatness ( $\pm$ ) | 5 - 1000        | —    | 0.4          | 0.9  | dB   |
|                             | 5 - 1250        | —    | 0.6          | 1.0  |      |
| Isolation                   | 5 - 50          | 30   | 48           | —    | dB   |
|                             | 50 - 870        | 22   | 30           | —    |      |
|                             | 870 - 1250      | 20   | 25           | —    |      |
| Return Loss (Input)         | 5 - 1250        | 18   | 23           | —    | dB   |
| Return Loss (Output)        | 5 - 1250        | 19   | 25           | —    | dB   |
| Return Loss (Coupling)      | 5 - 1250        | 18   | 22           | —    | dB   |
| Input Power                 | 5 - 1250        | —    | —            | 1.0  | W    |

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

### Maximum Ratings

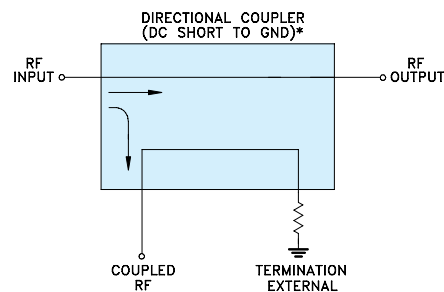
| Parameter             | Ratings        |
|-----------------------|----------------|
| Operating Temperature | -40°C to 85°C  |
| Storage Temperature   | -55°C to 100°C |

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

### Pin Connections

| Function             | Pin Number |
|----------------------|------------|
| INPUT                | 1          |
| OUTPUT               | 6          |
| COUPLED              | 3          |
| GROUND               | 2          |
| 75Ω TERM EXTERNAL    | 4          |
| ISOLATE (DO NOT USE) | 5          |

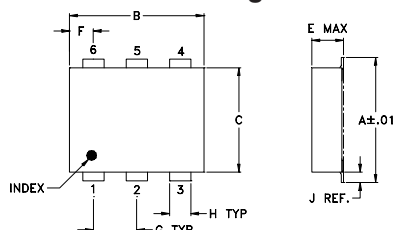
### Electrical Schematic



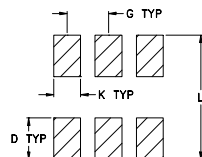
\* ELECTRICAL SCHEMATIC IS FOR DIRECTIONAL COUPLER WITH INTERNAL TRANSFORMER(S) AND EXTERNAL TERMINATION.



## Outline Drawing



## PCB Land Pattern



Suggested Layout,  
Tolerance to be within ±.002

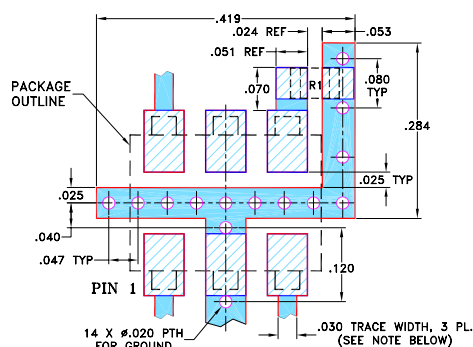
## Outline Dimensions (inch mm)

| A    | B    | C    | D    | E    | F    | G    |
|------|------|------|------|------|------|------|
| .272 | .310 | .220 | .100 | .112 | .055 | .100 |
| 6.91 | 7.87 | 5.59 | 2.54 | 2.84 | 1.40 | 2.54 |

| H    | J    | K    | L    | wt    |
|------|------|------|------|-------|
| .030 | .026 | .065 | .300 | grams |
| 0.76 | 0.66 | 1.65 | 7.62 | 0.20  |

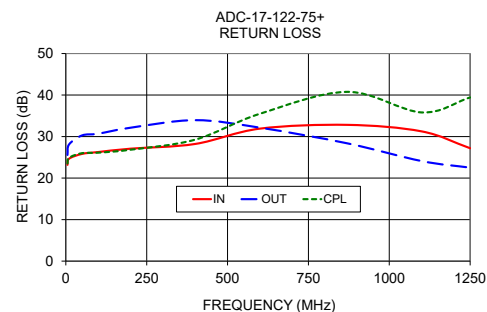
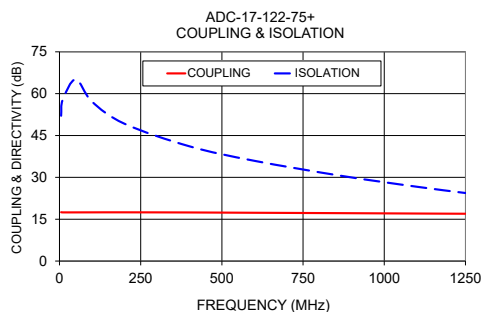
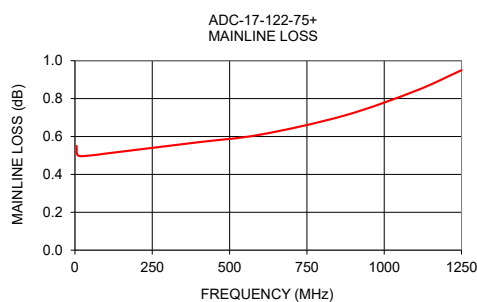
## Demo Board MCL P/N: TB-08 Suggested PCB Layout (PL-042)



RESISTOR R1: 75 Ohm, 0805 SIZE.  
NOTES: 1. TRACE WIDTH IS SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS .030" ± .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

## Typical Performance Data

| Frequency (MHz) | Mainline Loss (dB) In-Out | Coupling (dB) In-Cpl | Isolation (dB) | In    | Return Loss (dB) Out | Cpl   |
|-----------------|---------------------------|----------------------|----------------|-------|----------------------|-------|
| 5               | 0.55                      | 17.51                | 52.07          | 23.18 | 25.57                | 23.52 |
| 10              | 0.50                      | 17.45                | 57.83          | 24.67 | 28.11                | 24.90 |
| 50              | 0.50                      | 17.45                | 65.11          | 25.82 | 30.27                | 26.00 |
| 100             | 0.51                      | 17.46                | 57.14          | 26.27 | 30.69                | 26.12 |
| 200             | 0.53                      | 17.47                | 49.22          | 27.08 | 32.13                | 26.83 |
| 400             | 0.57                      | 17.42                | 41.13          | 28.22 | 33.95                | 29.26 |
| 600             | 0.61                      | 17.31                | 35.93          | 31.91 | 32.14                | 35.49 |
| 870             | 0.71                      | 17.17                | 30.50          | 32.82 | 28.37                | 40.77 |
| 1100            | 0.84                      | 17.04                | 26.64          | 31.25 | 24.10                | 35.81 |
| 1250            | 0.95                      | 16.96                | 24.39          | 27.19 | 22.51                | 39.42 |



## Additional Notes

- 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.
- Electrical specifications and performance data contained in this specification document are based on Mini-Circuit's applicable established test performance criteria and measurement instructions.
- 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)

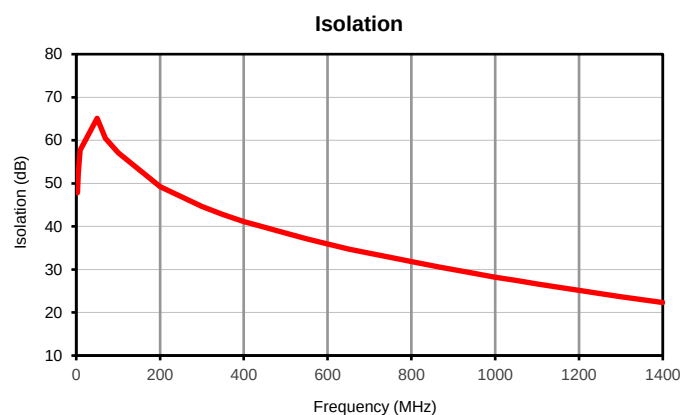
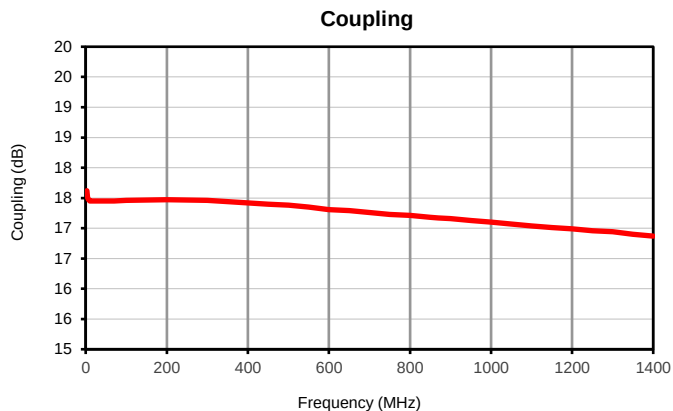
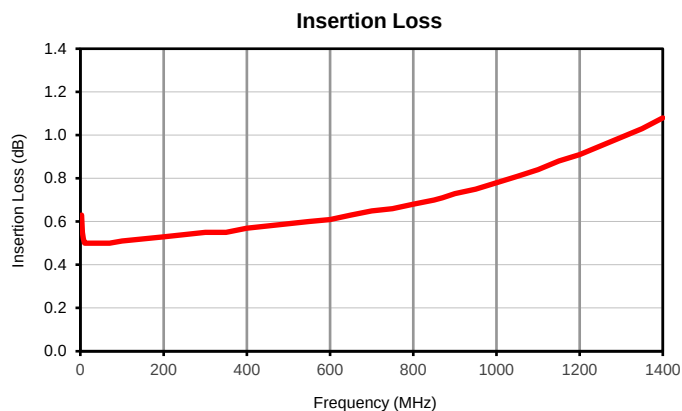
# Directional Coupler

## ADC-17-122-75+

### Typical Performance Data

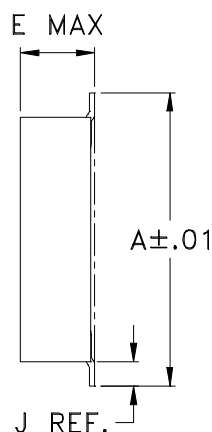
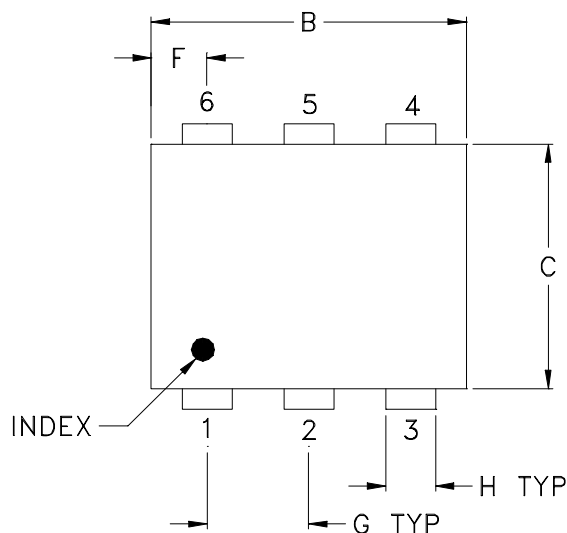
| FREQUENCY<br>(MHz) | INSERTION<br>LOSS<br>(dB) | COUPLING<br>(dB) | ISOLATION<br>(dB) | RETURN LOSS<br>(dB) |       |       |
|--------------------|---------------------------|------------------|-------------------|---------------------|-------|-------|
|                    |                           |                  |                   | IN                  | OUT   | CPL   |
| 3                  | 0.63                      | 17.62            | 47.84             | 21.37               | 23.08 | 21.79 |
| 5                  | 0.55                      | 17.51            | 52.07             | 23.18               | 25.57 | 23.52 |
| 7                  | 0.52                      | 17.47            | 55.13             | 24.04               | 26.94 | 24.28 |
| 9                  | 0.51                      | 17.46            | 57.62             | 24.54               | 27.75 | 24.73 |
| 10                 | 0.50                      | 17.45            | 57.83             | 24.67               | 28.11 | 24.90 |
| 50                 | 0.50                      | 17.45            | 65.11             | 25.82               | 30.27 | 26.00 |
| 70                 | 0.50                      | 17.45            | 60.44             | 26.01               | 30.49 | 26.10 |
| 100                | 0.51                      | 17.46            | 57.14             | 26.27               | 30.69 | 26.12 |
| 200                | 0.53                      | 17.47            | 49.22             | 27.08               | 32.13 | 26.83 |
| 300                | 0.55                      | 17.46            | 44.62             | 27.68               | 32.98 | 27.87 |
| 350                | 0.55                      | 17.44            | 42.78             | 28.11               | 32.80 | 28.46 |
| 400                | 0.57                      | 17.42            | 41.13             | 28.22               | 33.95 | 29.26 |
| 450                | 0.58                      | 17.40            | 39.79             | 29.03               | 32.88 | 30.51 |
| 500                | 0.59                      | 17.38            | 38.42             | 29.50               | 33.22 | 31.53 |
| 550                | 0.60                      | 17.35            | 37.09             | 30.28               | 33.06 | 33.19 |
| 600                | 0.61                      | 17.31            | 35.93             | 31.91               | 32.14 | 35.49 |
| 650                | 0.63                      | 17.29            | 34.77             | 32.92               | 32.93 | 37.50 |
| 700                | 0.65                      | 17.26            | 33.76             | 35.03               | 31.45 | 41.84 |
| 750                | 0.66                      | 17.23            | 32.80             | 34.67               | 30.33 | 43.27 |
| 800                | 0.68                      | 17.21            | 31.81             | 34.74               | 30.32 | 43.82 |
| 850                | 0.70                      | 17.18            | 30.85             | 32.99               | 28.36 | 43.32 |
| 870                | 0.71                      | 17.17            | 30.50             | 32.82               | 28.37 | 40.77 |
| 900                | 0.73                      | 17.16            | 29.99             | 32.79               | 28.80 | 38.45 |
| 950                | 0.75                      | 17.13            | 29.10             | 32.19               | 26.78 | 39.31 |
| 1000               | 0.78                      | 17.10            | 28.22             | 32.16               | 26.41 | 36.68 |
| 1050               | 0.81                      | 17.07            | 27.42             | 32.09               | 25.36 | 37.44 |
| 1100               | 0.84                      | 17.04            | 26.64             | 31.25               | 24.10 | 35.81 |
| 1150               | 0.88                      | 17.01            | 25.86             | 30.55               | 23.95 | 36.54 |
| 1200               | 0.91                      | 16.99            | 25.12             | 28.82               | 22.50 | 39.31 |
| 1250               | 0.95                      | 16.96            | 24.39             | 27.19               | 22.51 | 39.42 |
| 1300               | 0.99                      | 16.94            | 23.69             | 25.46               | 21.45 | 44.77 |
| 1350               | 1.03                      | 16.90            | 22.98             | 23.84               | 21.20 | 42.15 |
| 1400               | 1.08                      | 16.87            | 22.32             | 22.53               | 20.80 | 41.68 |

## Typical Performance Curves

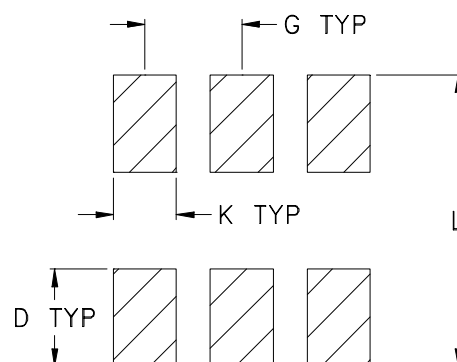


CD541  
CD542  
CD636  
CD637

## 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              | WT, GRAM |
|-------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------|
| CD541 |                |                |                |                | .082<br>(2.08) |                |                |                |                |                |                | .15      |
| CD542 | .272<br>(6.91) | .310<br>(7.87) | .220<br>(5.58) | .100<br>(2.54) | .112<br>(2.84) | .055<br>(1.40) | .100<br>(2.54) | .030<br>(0.76) | .026<br>(0.66) | .065<br>(1.65) | .300<br>(7.62) | .20      |
| CD636 |                |                |                |                | .162<br>(4.11) |                |                |                |                |                |                | .25      |
| CD637 |                |                |                |                | .206<br>(5.23) |                |                |                |                |                |                | .40      |

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

### 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.



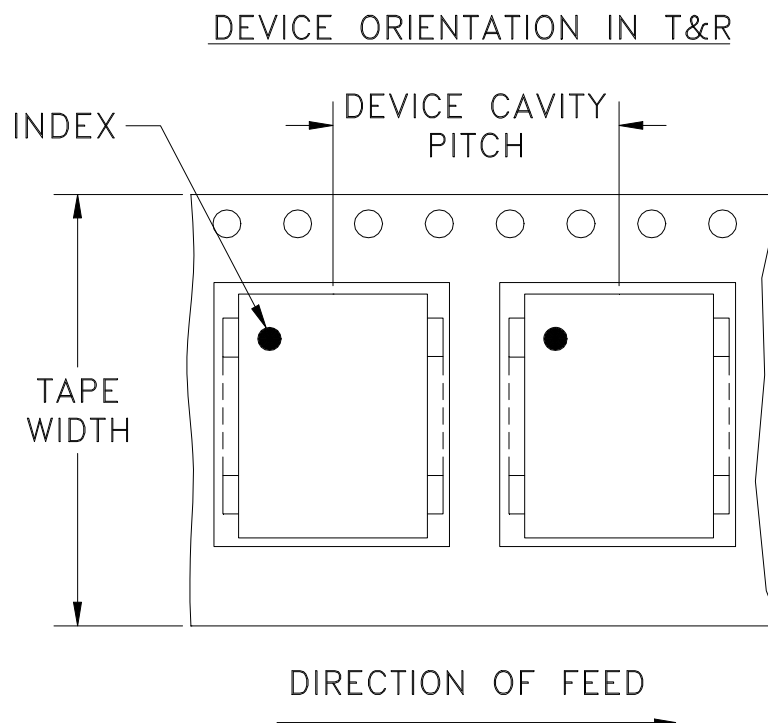
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# Tape & Reel Packaging TR-F34



| Tape Width,<br>mm | Device Cavity<br>Pitch, mm | Reel Size,<br>inches | Devices per Reel<br>see note                |      |
|-------------------|----------------------------|----------------------|---------------------------------------------|------|
| 16                | 12                         | 7                    | Small<br>quantity<br>standard<br>(see note) | 20   |
|                   |                            |                      |                                             | 50   |
|                   |                            |                      |                                             | 100  |
|                   |                            |                      |                                             | 200  |
|                   |                            | 13                   | Standard                                    | 500  |
|                   |                            |                      |                                             | 1000 |

Note: Availability of small reel quantity varies by model.  
Refer to pricing and availability on individual model dashboard.

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)



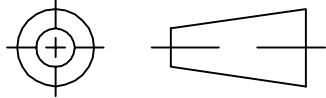
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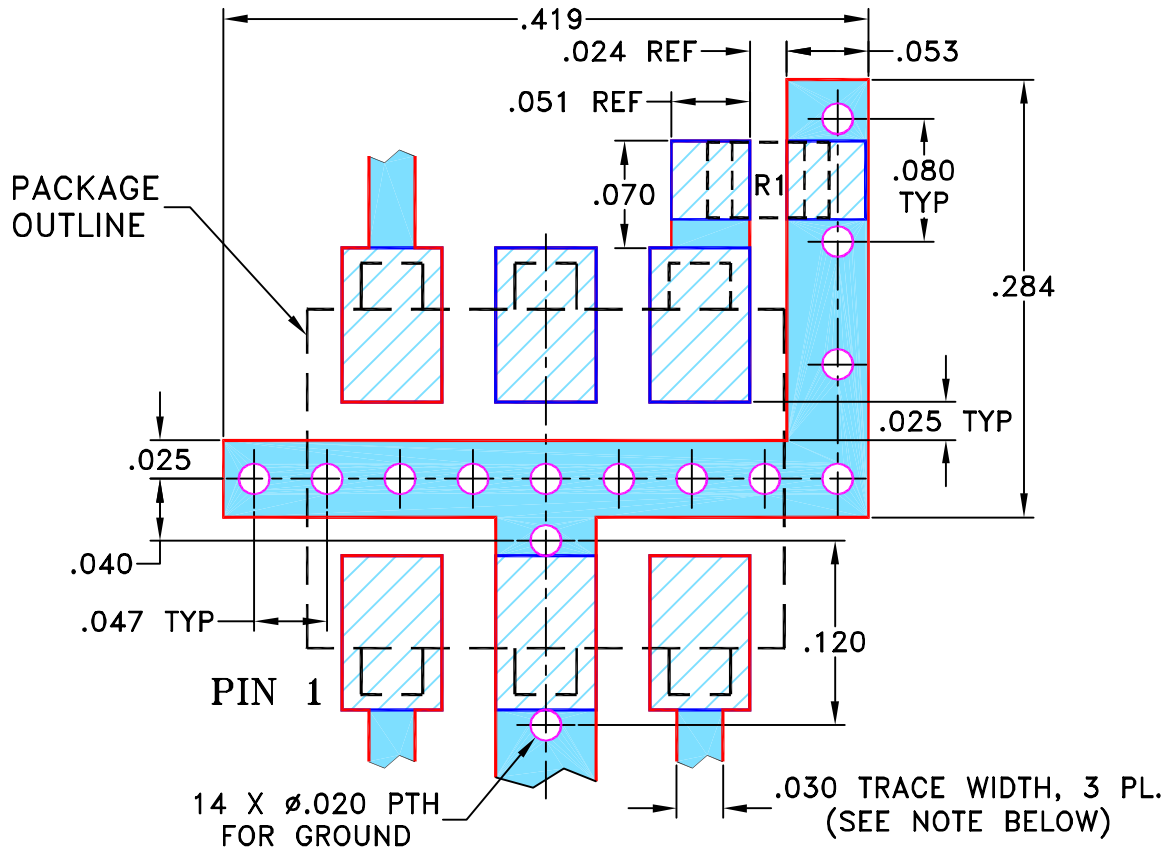
## THIRD ANGLE PROJECTION



## REVISIONS

| REV | ECN No. | DESCRIPTION                    | DATE     | DR  | AUTH |
|-----|---------|--------------------------------|----------|-----|------|
| OR  | M81068  | NEW RELEASE                    | 07/22/02 | GF  | LC   |
| A   | M102713 | ADDED NOTE 2 & "...WITH SMOBC" | 01/17/06 | MMG | IL   |
|     |         |                                |          |     |      |
|     |         |                                |          |     |      |

**SUGGESTED MOUNTING CONFIGURATION FOR  
CD542 CASE STYLE, "kd" PIN CONNECTION**



RESISTOR R1: 75 Ohm, 0805 SIZE.

- NOTES: 1. TRACE WIDTH IS SHOWN FOR ROGERS R04350B WITH DIELECTRIC THICKNESS .030"  $\pm$  .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

GF

06/21/02

TOLERANCES ON:

CHECKED

IL

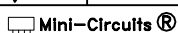
07/22/02

2 PL DECIMALS  $\pm$ 

APPROVED

LC

07/22/02

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

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



**Mini-Circuits®** 13 Neptune Avenue  
Brooklyn NY 11235

**PL, kd, 75, CD542, ADC, TB-08**

SIZE  
A

CODE IDENT  
15542

DRAWING NO:  
98-PL-042

REV:  
A

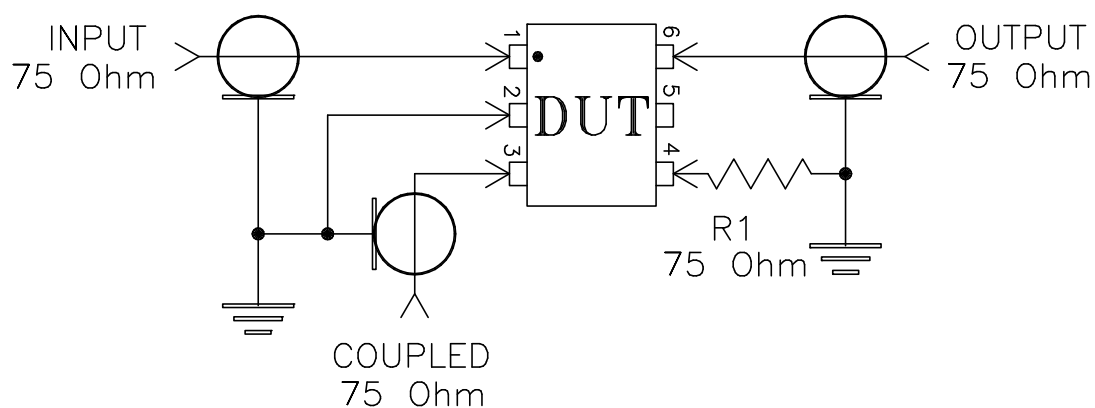
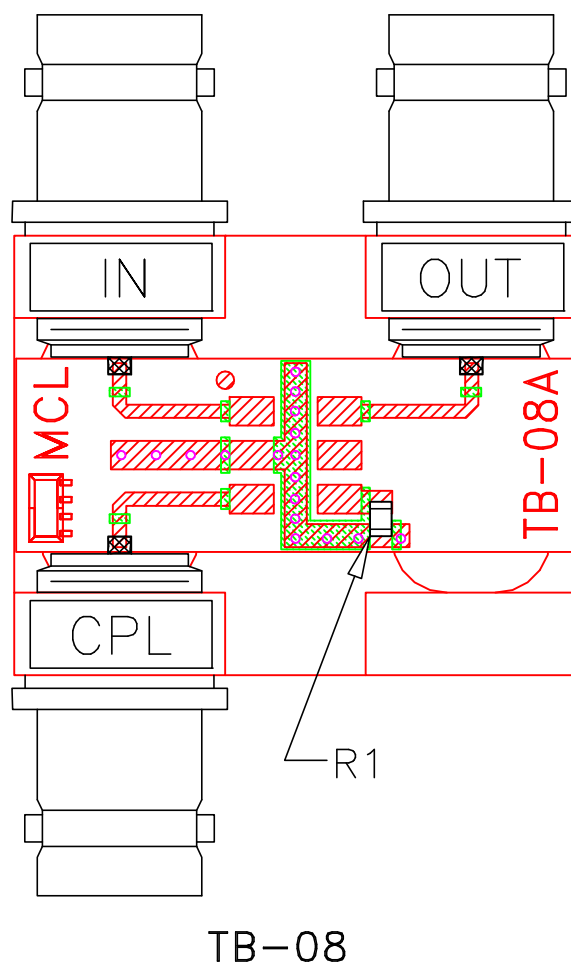
FILE: 98PL042

SCALE: 8:1

SHEET: 1 OF 1



# Evaluation Board and Circuit



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                                                                              |