

Ceramic

# Directional Coupler

DCW-9-432+

50Ω 2300 to 4300 MHz 9dB Coupling

## The Big Deal

- High Power handling
- Industry leading combination of size/ bandwidth



CASE STYLE: JC0603C

## Product Overview

Mini-Circuits new directional coupler DCW-9-432+ offers an industry leading combination of operating bandwidth and size. The low insertion loss makes this component a versatile building block for use in a variety of systems and sub-system designs.

## Key Features

| Feature             | Advantages   |
|---------------------|--|
| Small Size          | Offered in the JC0603C package size, the DCW-9-432+ offers an industry leading combination of size, bandwidth and frequency. The small footprint allows for reduced parasitics in systems with improved performance and simplified layout. |
| High Power handling | Capable of operating up to 2W, the LTCC construction of the DCW-9-432+ makes this directional coupler a robust, rugged product that can be used effectively in either the transmit or receive paths.                                       |

### 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)



# Ceramic Directional Coupler

50Ω 2300 to 4300 MHz 9dB Coupling

## DCW-9-432+



Generic photo used for illustration purposes only

CASE STYLE: JC0603C

**+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, 4000 |

### Maximum Ratings

Operating Temperature -55°C to 125°C

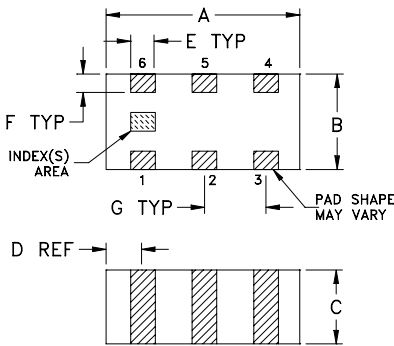
Storage Temperature\* -55°C to 125°C

\*Refer to product storage temperature after installation.  
Suggestion for T&R unused product storage condition: +5--+35°C, Humidity 45-75%RH, 12 Month max.  
Permanent damage may occur if any of these limits are exceeded.

### Pad Connections

|             |   |
|-------------|---|
| Input       | 1 |
| GND         | 2 |
| Coupled     | 3 |
| Termination | 4 |
| GND         | 5 |
| Output      | 6 |

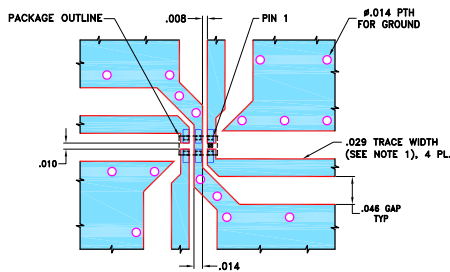
### Outline Drawing



### Outline Dimensions (inch/mm)

| A    | B    | C    | D    | E    | F    | G    | wt    |
|------|------|------|------|------|------|------|-------|
| .063 | .031 | .024 | .012 | .008 | .006 | .020 | grams |
| 1.60 | 0.79 | 0.61 | 0.30 | 0.20 | 0.15 | 0.51 | 0.005 |

### Evaluation Board MCL P/N: TB-DCW-9-432+ Suggested PCB Layout (PL-572)



- NOTES:
- TRACE WIDTH & GAP ARE SHOWN FOR FR4, GRADE IT-180TC (ITEQ CORP.) WITH DIELECTRIC THICKNESS .016±.0015. COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH & GAP MAY NEED TO BE MODIFIED.
  - BOTTOM SIDE OF THE PCB IS CONTINUOUS GROUND PLANE.
  - REFER TO MODEL DATASHEET FOR PIN OUTS.
- DENOTES PCB COPPER LAYOUT WITH SMOBC (SOLDER MASK OVER BARE COPPER).  
 DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK.

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### Features

- miniature size 0603
- low cost
- aqueous washable

### Applications

- ISM Band
- Cellular
- Bluetooth
- Zigbee

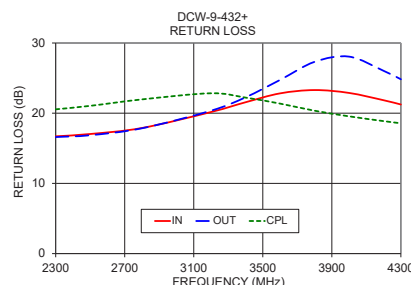
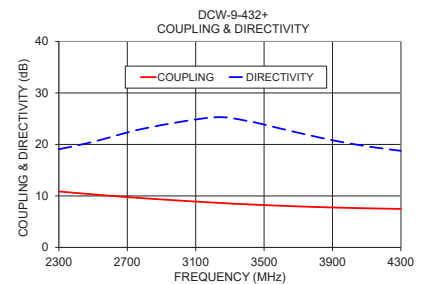
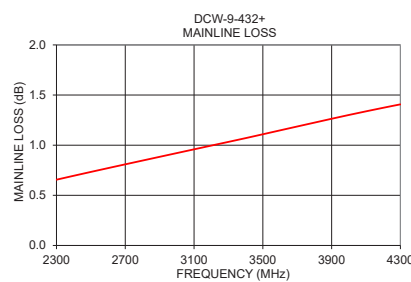
### Electrical Specifications at 25°C

| Parameter                | Frequency (MHz) | Min. | Typ. | Max. | Unit |
|--------------------------|-----------------|------|------|------|------|
| Frequency Range          |                 | 2300 |      | 4300 | MHz  |
| Mainline Loss            | 2300 - 4300     | —    | 1.3  | 1.7  | dB   |
| Coupling                 | 2300 - 4300     | —    | 9±2  | —    | dB   |
| Directivity              | 2300 - 4300     | 14   | 17   | —    | dB   |
| Return Loss (Input)      | 2300 - 4300     | 11   | —    | —    | dB   |
| Return Loss (Output)     | 2300 - 4300     | 11   | —    | —    | dB   |
| Input Power <sup>1</sup> | 2300 - 4300     | —    | —    | 2    | W    |

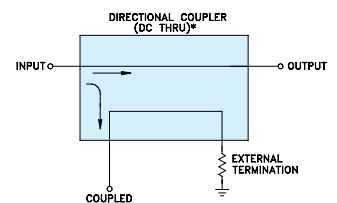
1. Derate linearly to 0.5W at 125°C.

### Typical Performance Data

| Frequency (MHz) | Mainline Loss (dB) In-Out | Coupling (dB) In-Cpl | Directivity (dB) | Return Loss (dB) |       |       |
|-----------------|---------------------------|----------------------|------------------|------------------|-------|-------|
|                 |                           |                      |                  | In               | Out   | Cpl   |
| 2300            | 0.66                      | 10.87                | 19.07            | 16.71            | 16.60 | 20.55 |
| 2500            | 0.73                      | 10.30                | 20.50            | 17.04            | 16.86 | 21.05 |
| 2800            | 0.85                      | 9.54                 | 23.10            | 17.89            | 17.86 | 21.97 |
| 3200            | 1.00                      | 8.71                 | 25.24            | 20.17            | 20.36 | 22.84 |
| 3400            | 1.07                      | 8.38                 | 24.57            | 21.56            | 22.26 | 22.22 |
| 3600            | 1.15                      | 8.09                 | 23.05            | 22.83            | 24.74 | 21.37 |
| 3800            | 1.23                      | 7.86                 | 21.52            | 23.30            | 27.32 | 20.35 |
| 4000            | 1.30                      | 7.68                 | 20.18            | 22.89            | 28.06 | 19.55 |
| 4200            | 1.37                      | 7.54                 | 19.18            | 21.85            | 26.04 | 18.87 |
| 4300            | 1.41                      | 7.48                 | 18.77            | 21.24            | 24.83 | 18.57 |



### Electrical Schematic



\* ELECTRICAL SCHEMATIC FOR DIRECTIONAL COUPLERS REQUIRING EXTERNAL TERMINATION THAT IS DESIGNED WITHOUT INTERNAL TRANSFORMERS.

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REV. OR  
ECO-005075  
DCW-9-432+  
SL/CP/AM  
201202  
Page 2 of 2

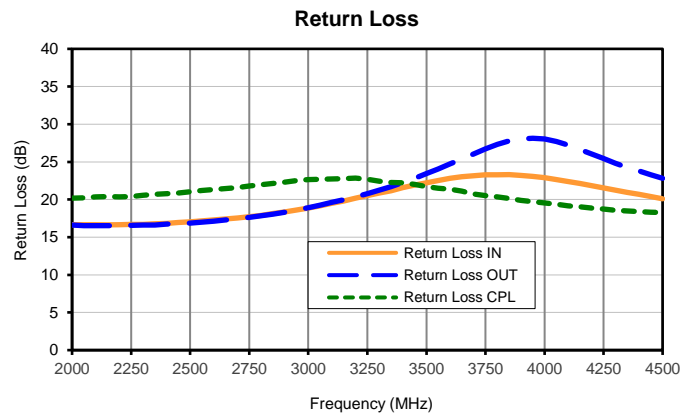
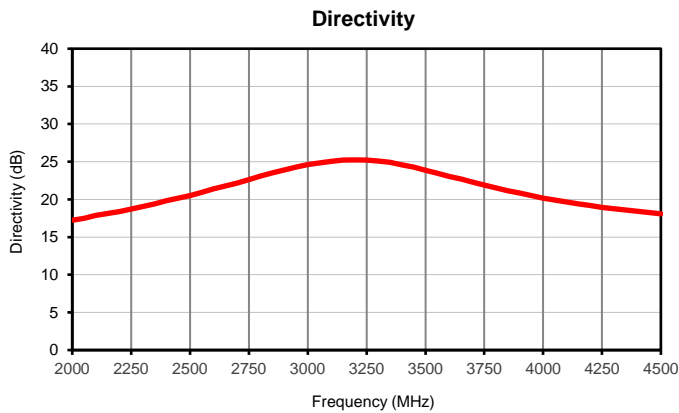
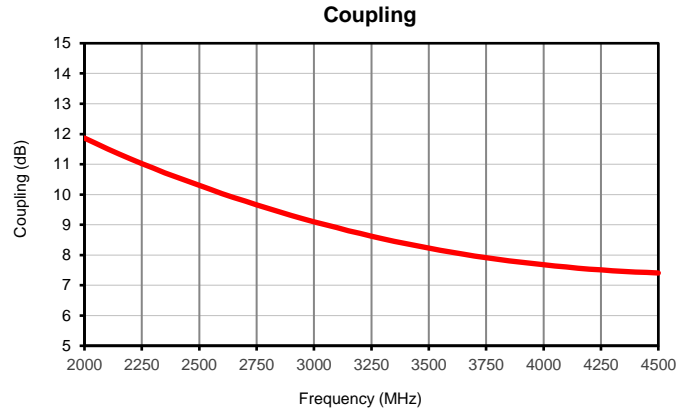
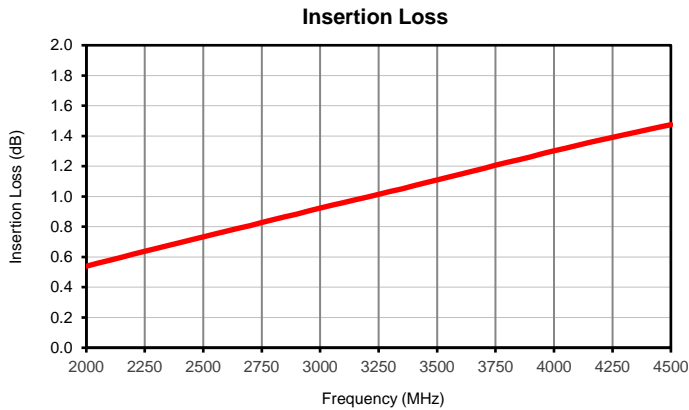
## Typical Performance Data

| FREQUENCY<br>(MHz) | INSERTION<br>LOSS<br>(dB) | COUPLING<br>(dB) | DIRECTIVITY<br>(dB) | RETURN LOSS<br>(dB) |       |       |
|--------------------|---------------------------|------------------|---------------------|---------------------|-------|-------|
|                    |                           |                  |                     | IN                  | OUT   | CPL   |
| 2000               | 0.54                      | 11.87            | 17.23               | 16.67               | 16.62 | 20.18 |
| 2050               | 0.56                      | 11.69            | 17.51               | 16.65               | 16.54 | 20.23 |
| 2100               | 0.58                      | 11.51            | 17.86               | 16.65               | 16.53 | 20.35 |
| 2150               | 0.60                      | 11.34            | 18.12               | 16.63               | 16.53 | 20.39 |
| 2200               | 0.62                      | 11.18            | 18.40               | 16.65               | 16.54 | 20.37 |
| 2250               | 0.64                      | 11.03            | 18.73               | 16.68               | 16.58 | 20.40 |
| 2300               | 0.66                      | 10.87            | 19.07               | 16.71               | 16.60 | 20.55 |
| 2350               | 0.68                      | 10.72            | 19.39               | 16.78               | 16.62 | 20.71 |
| 2400               | 0.69                      | 10.58            | 19.81               | 16.83               | 16.72 | 20.77 |
| 2450               | 0.71                      | 10.43            | 20.17               | 16.93               | 16.79 | 20.87 |
| 2500               | 0.73                      | 10.30            | 20.50               | 17.04               | 16.86 | 21.05 |
| 2550               | 0.75                      | 10.16            | 20.92               | 17.14               | 16.99 | 21.20 |
| 2600               | 0.77                      | 10.03            | 21.38               | 17.28               | 17.13 | 21.34 |
| 2650               | 0.79                      | 9.90             | 21.76               | 17.40               | 17.28 | 21.44 |
| 2700               | 0.81                      | 9.78             | 22.18               | 17.54               | 17.43 | 21.60 |
| 2750               | 0.83                      | 9.66             | 22.63               | 17.71               | 17.62 | 21.79 |
| 2800               | 0.85                      | 9.54             | 23.10               | 17.89               | 17.86 | 21.97 |
| 2850               | 0.87                      | 9.42             | 23.52               | 18.13               | 18.07 | 22.15 |
| 2900               | 0.88                      | 9.31             | 23.89               | 18.35               | 18.32 | 22.29 |
| 2950               | 0.90                      | 9.20             | 24.28               | 18.61               | 18.59 | 22.50 |
| 3000               | 0.92                      | 9.10             | 24.60               | 18.86               | 18.91 | 22.62 |
| 3050               | 0.94                      | 9.00             | 24.85               | 19.18               | 19.26 | 22.69 |
| 3100               | 0.96                      | 8.90             | 25.07               | 19.49               | 19.61 | 22.72 |
| 3150               | 0.98                      | 8.81             | 25.21               | 19.80               | 19.95 | 22.76 |
| 3200               | 1.00                      | 8.71             | 25.24               | 20.17               | 20.36 | 22.84 |
| 3250               | 1.01                      | 8.62             | 25.22               | 20.53               | 20.78 | 22.70 |
| 3300               | 1.03                      | 8.54             | 25.10               | 20.86               | 21.25 | 22.44 |
| 3350               | 1.05                      | 8.46             | 24.92               | 21.17               | 21.73 | 22.27 |
| 3400               | 1.07                      | 8.38             | 24.57               | 21.56               | 22.26 | 22.22 |
| 3450               | 1.09                      | 8.30             | 24.27               | 21.92               | 22.81 | 22.01 |
| 3500               | 1.11                      | 8.23             | 23.84               | 22.24               | 23.44 | 21.70 |
| 3550               | 1.13                      | 8.16             | 23.48               | 22.52               | 24.06 | 21.50 |
| 3600               | 1.15                      | 8.09             | 23.05               | 22.83               | 24.74 | 21.37 |
| 3650               | 1.17                      | 8.03             | 22.71               | 23.02               | 25.37 | 21.09 |
| 3700               | 1.19                      | 7.97             | 22.29               | 23.17               | 26.06 | 20.74 |
| 3750               | 1.21                      | 7.91             | 21.91               | 23.26               | 26.71 | 20.51 |
| 3800               | 1.23                      | 7.86             | 21.52               | 23.30               | 27.32 | 20.35 |
| 3850               | 1.24                      | 7.81             | 21.15               | 23.30               | 27.76 | 20.15 |
| 3900               | 1.26                      | 7.76             | 20.83               | 23.19               | 28.05 | 19.89 |
| 3950               | 1.28                      | 7.72             | 20.52               | 23.06               | 28.13 | 19.70 |
| 4000               | 1.30                      | 7.68             | 20.18               | 22.89               | 28.06 | 19.55 |
| 4050               | 1.32                      | 7.64             | 19.93               | 22.66               | 27.69 | 19.37 |
| 4100               | 1.34                      | 7.60             | 19.66               | 22.40               | 27.22 | 19.17 |
| 4150               | 1.36                      | 7.57             | 19.40               | 22.13               | 26.65 | 19.01 |
| 4200               | 1.37                      | 7.54             | 19.18               | 21.85               | 26.04 | 18.87 |
| 4250               | 1.39                      | 7.51             | 18.94               | 21.54               | 25.43 | 18.73 |
| 4300               | 1.41                      | 7.48             | 18.77               | 21.24               | 24.83 | 18.57 |
| 4350               | 1.43                      | 7.46             | 18.58               | 20.95               | 24.26 | 18.48 |
| 4400               | 1.44                      | 7.44             | 18.40               | 20.67               | 23.78 | 18.41 |
| 4450               | 1.46                      | 7.42             | 18.23               | 20.37               | 23.27 | 18.32 |
| 4500               | 1.47                      | 7.41             | 18.08               | 20.11               | 22.81 | 18.27 |

# Directional Coupler

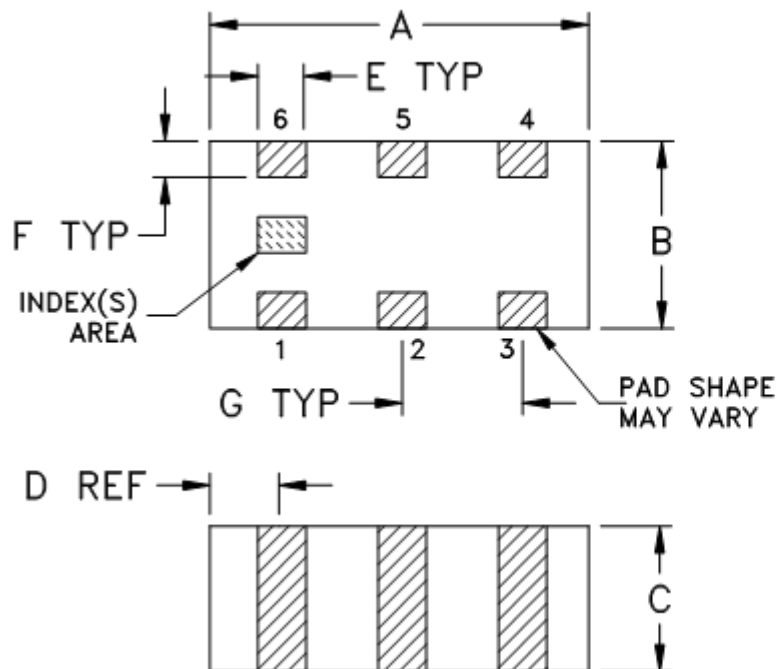
## Typical Performance Curves

DCW-9-432+

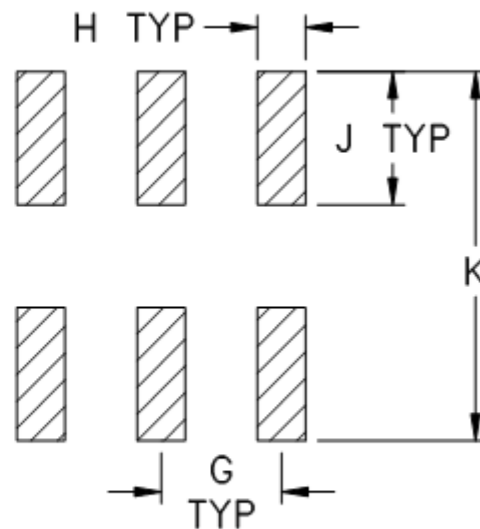


## Outline Dimensions

JC0603C



## PCB Land Pattern



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

| CASE #  | A              | B              | C              | D              | E              | F              | G              | H              | J              | K               | WT. GRAM |
|---------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|-----------------|----------|
| JC0603C | .063<br>(1.60) | .031<br>(0.80) | .024<br>(0.60) | .012<br>(0.30) | .008<br>(0.20) | .006<br>(0.15) | .020<br>(0.50) | .010<br>(0.25) | .022<br>(0.55) | 0.053<br>(1.35) | .005     |

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

### Notes:

1. Open style, ceramic base.
2. Termination finish:  
For RoHS Case Styles: Tin plate over Nickel plate. All models, (+) suffix.



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RF/IF MICROWAVE COMPONENTS

# Tape & Reel Packaging TR-F114

## DEVICE ORIENTATION IN T&R

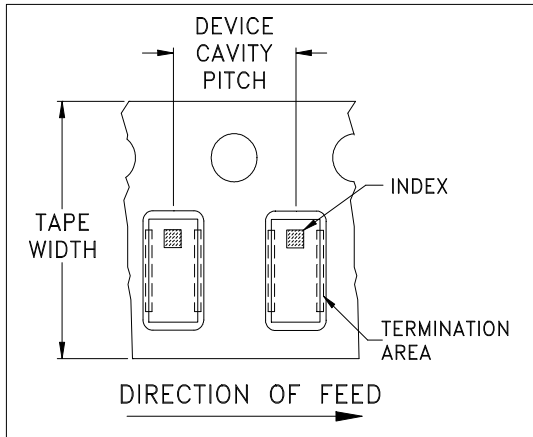


ILLUSTRATION 1

| Applicable Case Styles |           |
|------------------------|-----------|
| GE0805C                | JC0603C   |
| GE0805C-1              | JC0603C-4 |
| GE0805C-1AP            | JC0603C-6 |
| GE0805C-7              |           |
| GE0805C-9              |           |
| GE0805C-10             |           |
| GE0805C-11             |           |
| GE0805C-12             |           |

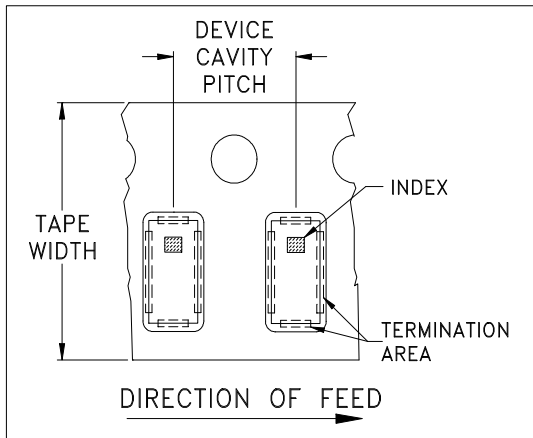


ILLUSTRATION 2

| Applicable Case Styles |           |
|------------------------|-----------|
| GE0805C-2              | JC0603C-1 |
| GE0805C-3              | JC0603C-2 |
| GE0805C-4              | JC0603C-3 |
| GE0805C-5              | JC0603C-5 |
| GE0805C-6              | JC0603C-7 |
| GE0805C-8              | JV1210C-1 |
| GE0805C-15             |           |

| 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                            | 4000 |

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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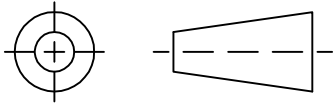
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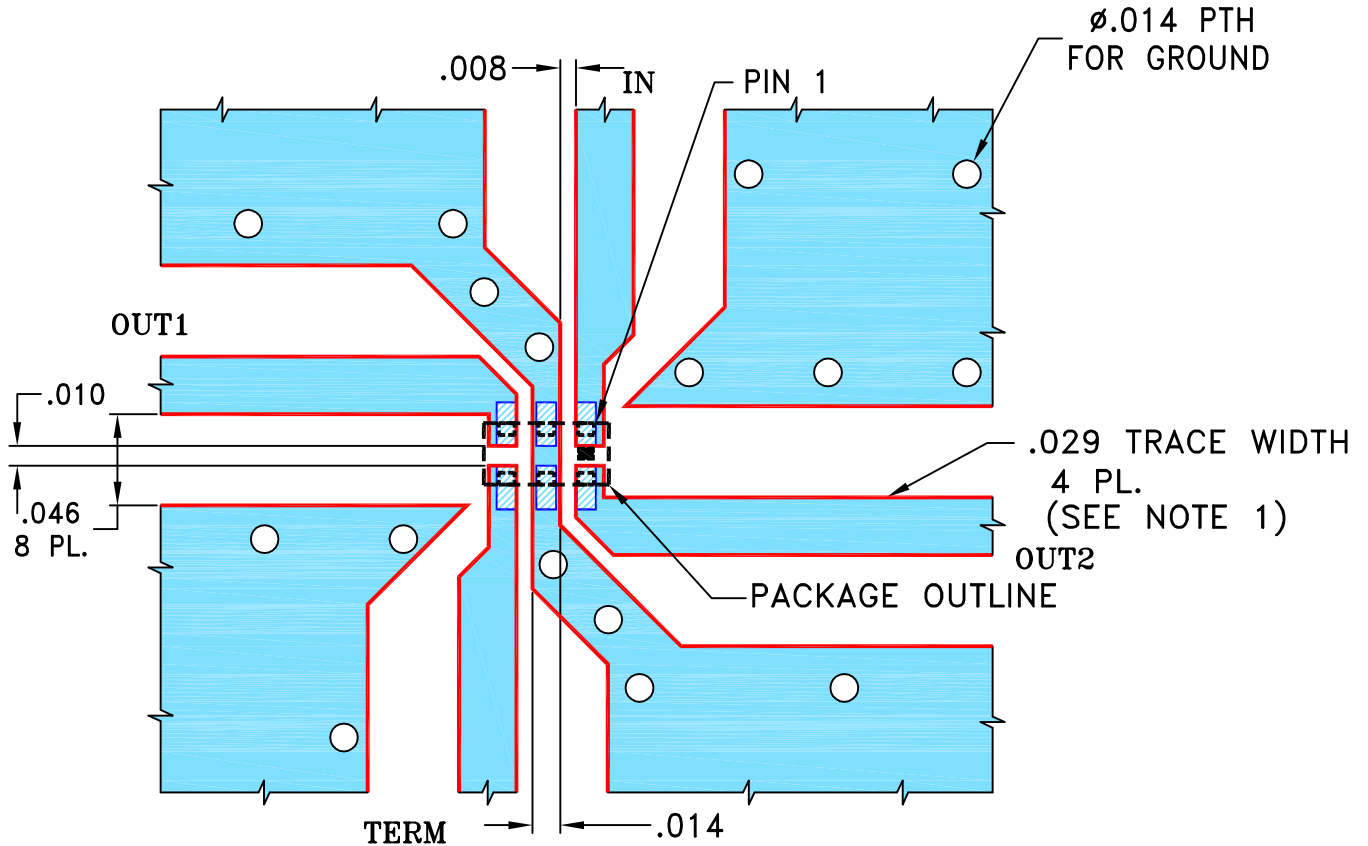
THIRD ANGLE PROJECTION



REVISIONS

| REV | ECN No. | DESCRIPTION | DATE     | DR | AUTH |
|-----|---------|-------------|----------|----|------|
| OR  | M168200 | NEW RELEASE | 05/31/18 | NP | SL   |
|     |         |             |          |    |      |
|     |         |             |          |    |      |

SUGGESTED MOUNTING CONFIGURATION  
FOR JC0603C CASE STYLE, "06DC12" PIN CODE



**NOTES:**

1. TRACE WIDTH IS SHOWN FOR FR4, GRADE IT-180TC (ITEQ CORP.) WITH DIELECTRIC THICKNESS  $.016 \pm .0015$ . COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH & 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.

| UNLESS OTHERWISE SPECIFIED | INITIALS | DATE     |
|----------------------------|----------|----------|
| DRAWN                      | NP       | 05/30/18 |
| CHECKED                    | GF       | 05/30/18 |
| APPROVED                   | SL       | 05/31/18 |

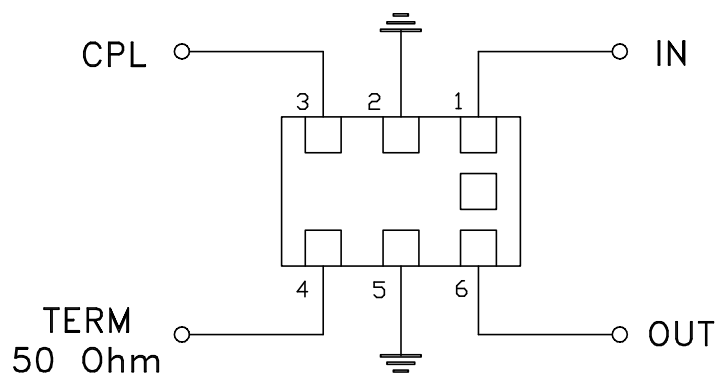
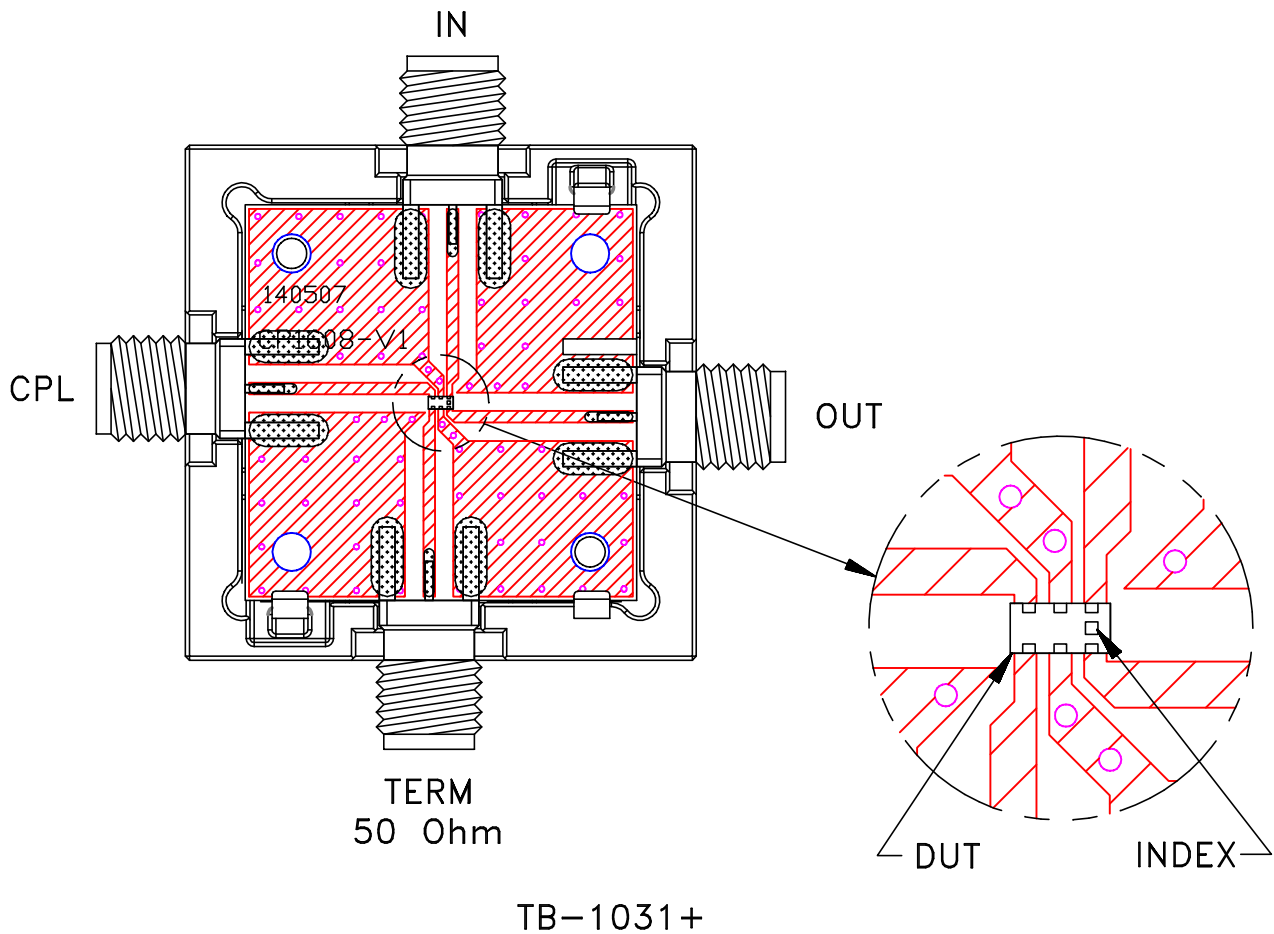
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PL, 06DC12, JC0603C, TB-1031+

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|                  |                     |                          |            |
|------------------|---------------------|--------------------------|------------|
| SIZE<br>A        | CODE IDENT<br>15542 | DRAWING NO:<br>98-PL-572 | REV:<br>OR |
| FILE:<br>98PL572 | SCALE:<br>10:1      | SHEET:<br>1 OF 1         |            |


# Evaluation Board and Circuit



Schematic Diagram

## Notes:

1. 50 Ohm SMA Female connectors.
2. PCB Material: FR4 or equivalent,  
Dielectric Constant=4.5, Thickness=.016 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      | -55° to 125° C<br>Ambient Environment   | Individual Model Data Sheet  |
| Storage Temperature        | -55° to 125° 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 Eutectic Process: 225°C peak<br>Pb-Free Process: 250°C peak                   | J-STD-020C, 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   |