



Mini-Circuits

SURFACE MOUNT

## Bi-Directional Coupler

SYDC-20-22HP+

50Ω 20 dB Coupling 3 to 200 MHz 30 Watt

## FEATURES

- High power, 30W max.
- Wideband multi-octave
- Excellent VSWR, 1.10:1 typ.

## APPLICATIONS

- VHF/UHF reverse
- Signal monitoring
- Communications
- Military mobile



Generic photo used for illustration purposes only

CASE STYLE: AH202-1

## +RoHS Compliant

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

ELECTRICAL SPECIFICATIONS<sup>1</sup> AT +25°C

| Parameter                                          | Condition (MHz) | Min. | Typ. | Max. | Units |
|----------------------------------------------------|-----------------|------|------|------|-------|
| Frequency Range                                    |                 | 3    |      | 200  | MHz   |
| Mainline Loss<br>(above theoretical loss, 0.04 dB) | 3               | —    | 0.1  | 0.2  | dB    |
|                                                    | 30              | —    | 0.1  | 0.2  |       |
|                                                    | 100             | —    | 0.15 | 0.3  |       |
|                                                    | 200             | —    | 0.30 | 0.5  |       |
| Nominal Coupling                                   | 3-200           | —    | 20.3 | —    | dB    |
| Coupling Flatness (±)                              | 3-30            | —    | 0.2  | 0.4  | dB    |
|                                                    | 30-100          | —    | 0.3  | 0.5  |       |
|                                                    | 100-200         | —    | 0.3  | 0.5  |       |
| Directivity                                        | 3               | 16   | 27   | —    | dB    |
|                                                    | 30              | 20   | 30   | —    |       |
|                                                    | 100             | 19   | 24   | —    |       |
|                                                    | 200             | 11   | 15   | —    |       |
| Return Loss (Input)                                | 3               | 20   | 26   | —    | dB    |
|                                                    | 30              | 23   | 31   | —    |       |
|                                                    | 100             | 18   | 22   | —    |       |
|                                                    | 200             | 13   | 17   | —    |       |
| Return Loss (Output)                               | 3               | 20   | 27   | —    | dB    |
|                                                    | 30              | 23   | 31   | —    |       |
|                                                    | 100             | 15   | 22   | —    |       |
|                                                    | 200             | 12   | 16   | —    |       |
| Return Loss (Coupling)                             | 3               | 20   | 27   | —    | dB    |
|                                                    | 30              | 23   | 30   | —    |       |
|                                                    | 100             | 18   | 22   | —    |       |
|                                                    | 200             | 12   | 16   | —    |       |
| Input Power <sup>2</sup>                           | 3-30            | —    | —    | 25   | W     |
|                                                    | 30-100          | —    | —    | 30   |       |
|                                                    | 100-200         | —    | —    | 25   |       |

1. Tested on Evaluation Board TB-SYDC20-22HP+

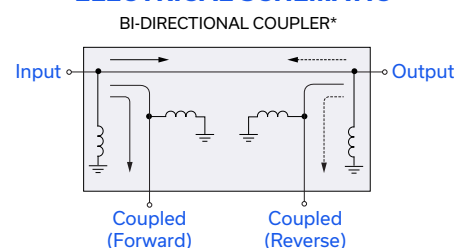
2. The user must provide adequate means of heat removal to limit the temperature of ground connections 2,3,6,7 to 85°C, in order to ensure proper performance. At 25°C ambient temperature this requires thermal resistance of the user's PC board heat sink to be 8°C/W or less when the unit is driven at maximum specified RF input power, # W. At higher ambient temperature, with the same heat sink. Input power in watts must not exceed # W x (85°C - T<sub>ambient</sub>) ÷ 60°C. \*Where # = 25 W over 3-30 MHz & 100-200 MHz, 30 W over 30 to 100 MHz.

## MAXIMUM RATINGS

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

\* Case temperature is defined as temperature on ground leads.  
Permanent damage may occur if any of these limits are exceeded.

## ELECTRICAL SCHEMATIC



\*Electrical schematic is for Bi-Directional coupler with internal transformer(s) that routes DC from all ports to ground

REV. D  
ECO-015468  
ED-12278/4  
SYDC-20-22HP+  
WP/CP/AM  
240726

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PAGE 1 OF 3



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## SURFACE MOUNT

# Bi-Directional Coupler

## SYDC-20-22HP+

50Ω 20 dB Coupling 3 to 200 MHz 30 Watt

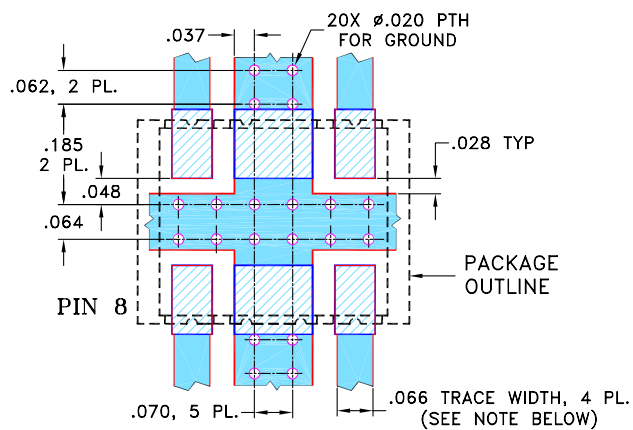
### PAD CONNECTIONS

|                   |            |
|-------------------|------------|
| INPUT             | 8          |
| OUTPUT            | 1          |
| COUPLED (FORWARD) | 5          |
| COUPLED (REVERSE) | 4          |
| GROUND            | 2, 3, 6, 7 |

**\*PRODUCT MARKING:** SYDC-20-22HP

\*Marking may contain other features or characters for internal lot control

### SUGGESTED PCB LAYOUT (PL-246)



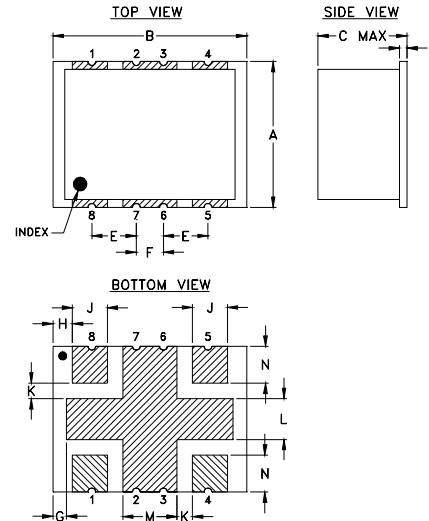
#### NOTES:

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.

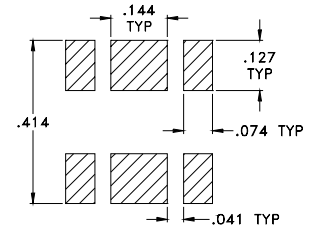


DENOTES PCB COPPER LAYOUT WITH SMOBC (SOLDER MASK OVER BARE COPPER)  
DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK

### OUTLINE DRAWING



### PCB Land Pattern



Suggested Layout,  
Tolerance to be within ±.002

### OUTLINE DIMENSIONS (Inches mm)

| A    | B     | C    | D    | E    | F    | G     |
|------|-------|------|------|------|------|-------|
| .38  | .50   | .25  | .020 | .115 | .070 | .035  |
| 9.65 | 12.70 | 6.35 | 0.51 | 2.92 | 1.78 | 0.89  |
| H    | J     | K    | L    | M    | N    | wt    |
| .050 | .090  | .040 | .105 | .140 | .095 | grams |
| 1.27 | 2.29  | 1.02 | 2.67 | 3.56 | 2.41 | 0.80  |

### TAPE & REEL INFORMATION: F61





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**SURFACE MOUNT**

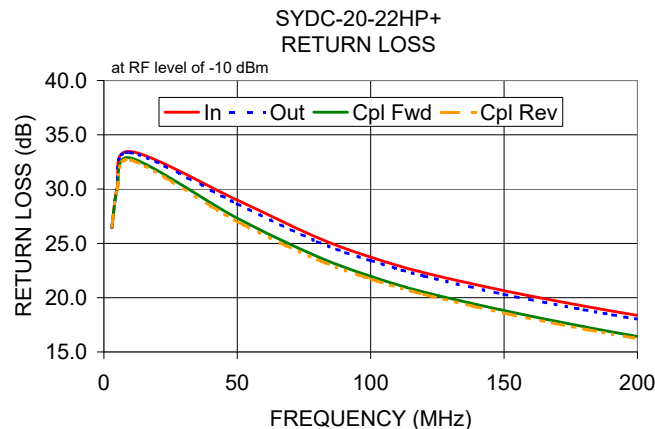
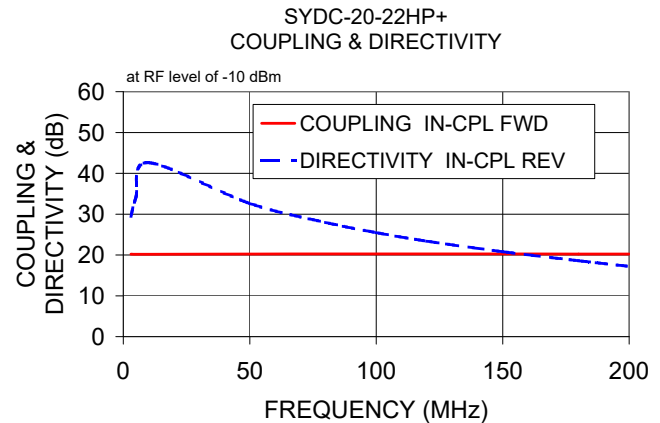
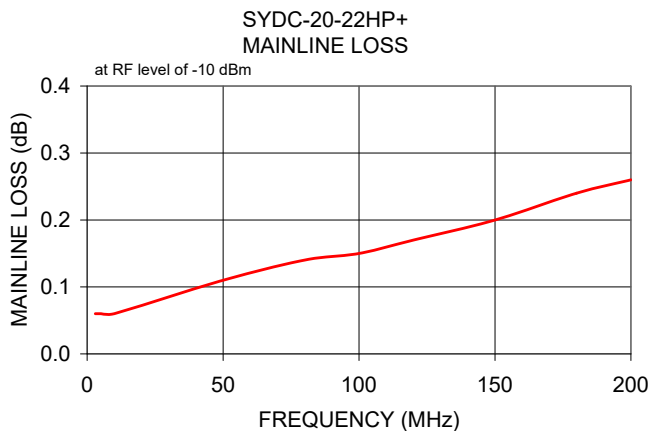
# Bi-Directional Coupler

**SYDC-20-22HP+**

50Ω 20 dB Coupling 3 to 200 MHz 30 Watt

## TYPICAL PERFORMANCE DATA

| Frequency<br>(MHz) | Mainline Loss<br>(dB) | Coupling<br>(dB) |             | Directivity<br>(dB) |            | Return Loss<br>(dB) |       |         |         |
|--------------------|-----------------------|------------------|-------------|---------------------|------------|---------------------|-------|---------|---------|
|                    | In-Out                | In-Cpl Fwd       | Out-Cpl Rev | Out-Cpl Fwd         | In-Cpl Rev | In                  | Out   | Cpl Fwd | Cpl Rev |
| 3.00               | 0.06                  | 20.21            | 20.15       | 29.46               | 29.32      | 26.44               | 26.52 | 26.48   | 26.54   |
| 5.00               | 0.06                  | 20.18            | 20.16       | 34.16               | 33.65      | 30.10               | 30.12 | 29.98   | 30.02   |
| 10.00              | 0.06                  | 20.18            | 20.16       | 42.60               | 38.34      | 33.46               | 33.36 | 32.87   | 32.68   |
| 50.00              | 0.11                  | 20.22            | 20.18       | 32.63               | 34.35      | 28.99               | 28.64 | 27.32   | 27.00   |
| 80.00              | 0.14                  | 20.25            | 20.26       | 27.99               | 28.98      | 25.53               | 25.15 | 23.79   | 23.50   |
| 100.00             | 0.15                  | 20.25            | 20.31       | 25.49               | 26.11      | 23.73               | 23.42 | 21.97   | 21.72   |
| 120.00             | 0.17                  | 20.26            | 20.36       | 23.39               | 23.61      | 22.30               | 21.99 | 20.51   | 20.29   |
| 150.00             | 0.20                  | 20.25            | 20.44       | 20.80               | 20.50      | 20.64               | 20.31 | 18.81   | 18.57   |
| 180.00             | 0.24                  | 20.24            | 20.53       | 18.58               | 17.78      | 19.22               | 18.88 | 17.32   | 17.10   |
| 200.00             | 0.26                  | 20.24            | 20.60       | 17.21               | 16.08      | 18.37               | 18.03 | 16.42   | 16.23   |



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



# Bi-Directional Coupler

# SYDC-20-22HP+

## Typical Performance Data

| FREQ.<br>(MHz) | INSERTION<br>LOSS<br>(dB)<br>IN-OUT | COUPLING<br>(dB) |         | DIRECTIVITY<br>(dB) |         | RETURN LOSS<br>(dB) |       |       |       |
|----------------|-------------------------------------|------------------|---------|---------------------|---------|---------------------|-------|-------|-------|
|                |                                     | IN-FWD           | OUT-REV | IN-REV              | OUT-FWD | IN                  | OUT   | FWD   | REV   |
| 3.0            | 0.06                                | 20.21            | 20.15   | 29.32               | 29.46   | 26.44               | 26.52 | 26.48 | 26.54 |
| 5.0            | 0.06                                | 20.18            | 20.16   | 33.65               | 34.16   | 30.10               | 30.12 | 29.98 | 30.02 |
| 7.0            | 0.06                                | 20.19            | 20.16   | 36.00               | 37.71   | 32.03               | 32.08 | 31.78 | 31.63 |
| 9.0            | 0.06                                | 20.18            | 20.15   | 37.77               | 40.30   | 33.05               | 33.03 | 32.67 | 32.48 |
| 10.0           | 0.06                                | 20.18            | 20.16   | 38.34               | 42.60   | 33.46               | 33.36 | 32.87 | 32.68 |
| 20.0           | 0.07                                | 20.18            | 20.15   | 39.72               | 43.52   | 33.63               | 33.38 | 32.41 | 32.09 |
| 30.0           | 0.09                                | 20.18            | 20.14   | 38.31               | 37.86   | 32.13               | 31.90 | 30.64 | 30.37 |
| 40.0           | 0.10                                | 20.20            | 20.16   | 36.39               | 34.78   | 30.47               | 30.15 | 28.85 | 28.55 |
| 50.0           | 0.11                                | 20.22            | 20.18   | 34.35               | 32.63   | 28.99               | 28.64 | 27.32 | 27.00 |
| 60.0           | 0.12                                | 20.23            | 20.21   | 32.39               | 30.91   | 27.71               | 27.37 | 26.01 | 25.69 |
| 70.0           | 0.13                                | 20.24            | 20.23   | 30.64               | 29.34   | 26.57               | 26.21 | 24.84 | 24.53 |
| 80.0           | 0.14                                | 20.25            | 20.26   | 28.98               | 27.99   | 25.53               | 25.15 | 23.79 | 23.50 |
| 90.0           | 0.14                                | 20.25            | 20.28   | 27.51               | 26.69   | 24.59               | 24.24 | 22.83 | 22.57 |
| 100.0          | 0.15                                | 20.25            | 20.31   | 26.11               | 25.49   | 23.73               | 23.42 | 21.97 | 21.72 |
| 110.0          | 0.16                                | 20.26            | 20.33   | 24.81               | 24.41   | 22.98               | 22.65 | 21.19 | 20.97 |
| 120.0          | 0.17                                | 20.26            | 20.36   | 23.61               | 23.39   | 22.30               | 21.99 | 20.51 | 20.29 |
| 130.0          | 0.18                                | 20.26            | 20.39   | 22.51               | 22.47   | 21.69               | 21.39 | 19.90 | 19.68 |
| 140.0          | 0.19                                | 20.26            | 20.42   | 21.49               | 21.60   | 21.15               | 20.83 | 19.34 | 19.11 |
| 150.0          | 0.20                                | 20.25            | 20.44   | 20.50               | 20.80   | 20.64               | 20.31 | 18.81 | 18.57 |
| 160.0          | 0.21                                | 20.25            | 20.47   | 19.58               | 20.02   | 20.15               | 19.82 | 18.30 | 18.06 |
| 170.0          | 0.23                                | 20.25            | 20.50   | 18.67               | 19.30   | 19.68               | 19.35 | 17.81 | 17.57 |
| 180.0          | 0.24                                | 20.24            | 20.53   | 17.78               | 18.58   | 19.22               | 18.88 | 17.32 | 17.10 |
| 190.0          | 0.25                                | 20.24            | 20.57   | 16.90               | 17.89   | 18.77               | 18.44 | 16.85 | 16.65 |
| 200.0          | 0.26                                | 20.24            | 20.60   | 16.08               | 17.21   | 18.37               | 18.03 | 16.42 | 16.23 |



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IF/RF MICROWAVE COMPONENTS

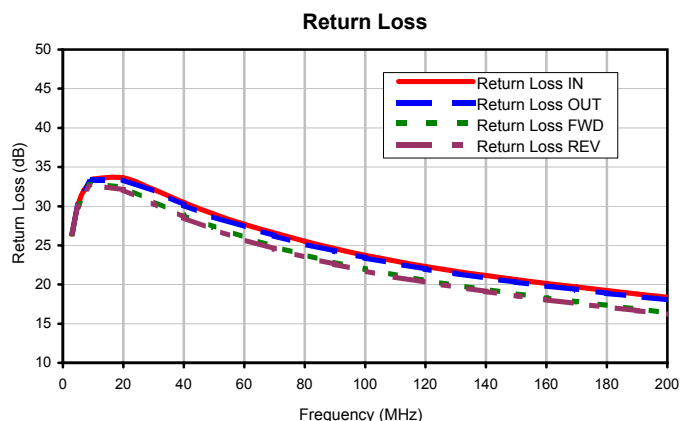
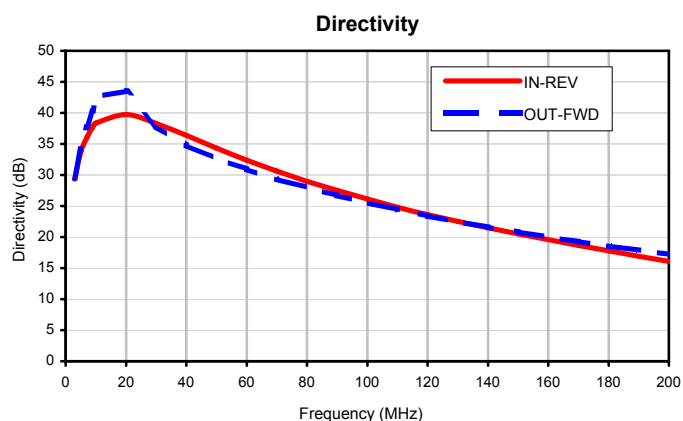
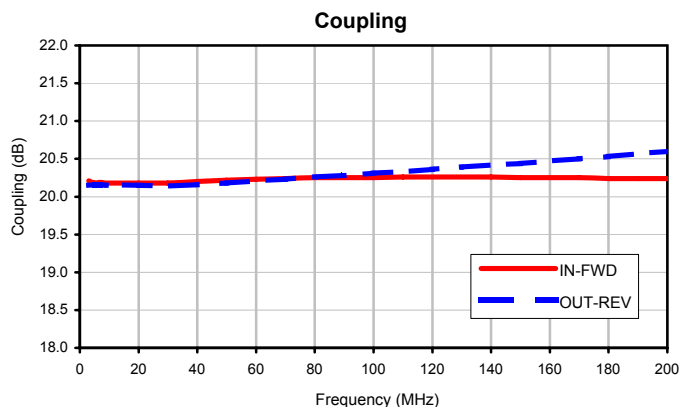
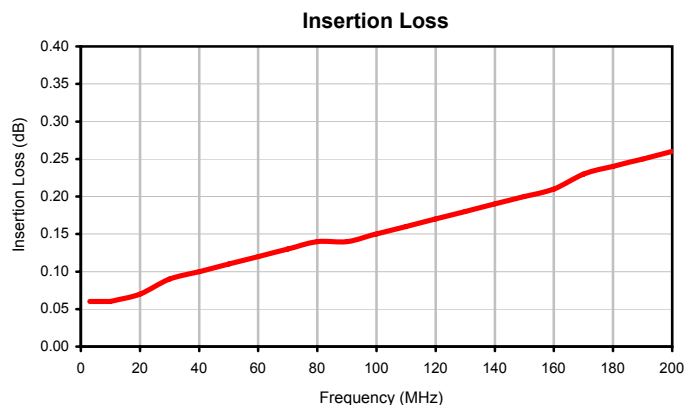


REV. OR  
SYDC-20-22HP+  
10/16/2012  
Page 1 of 1

# Bi-Directional Coupler

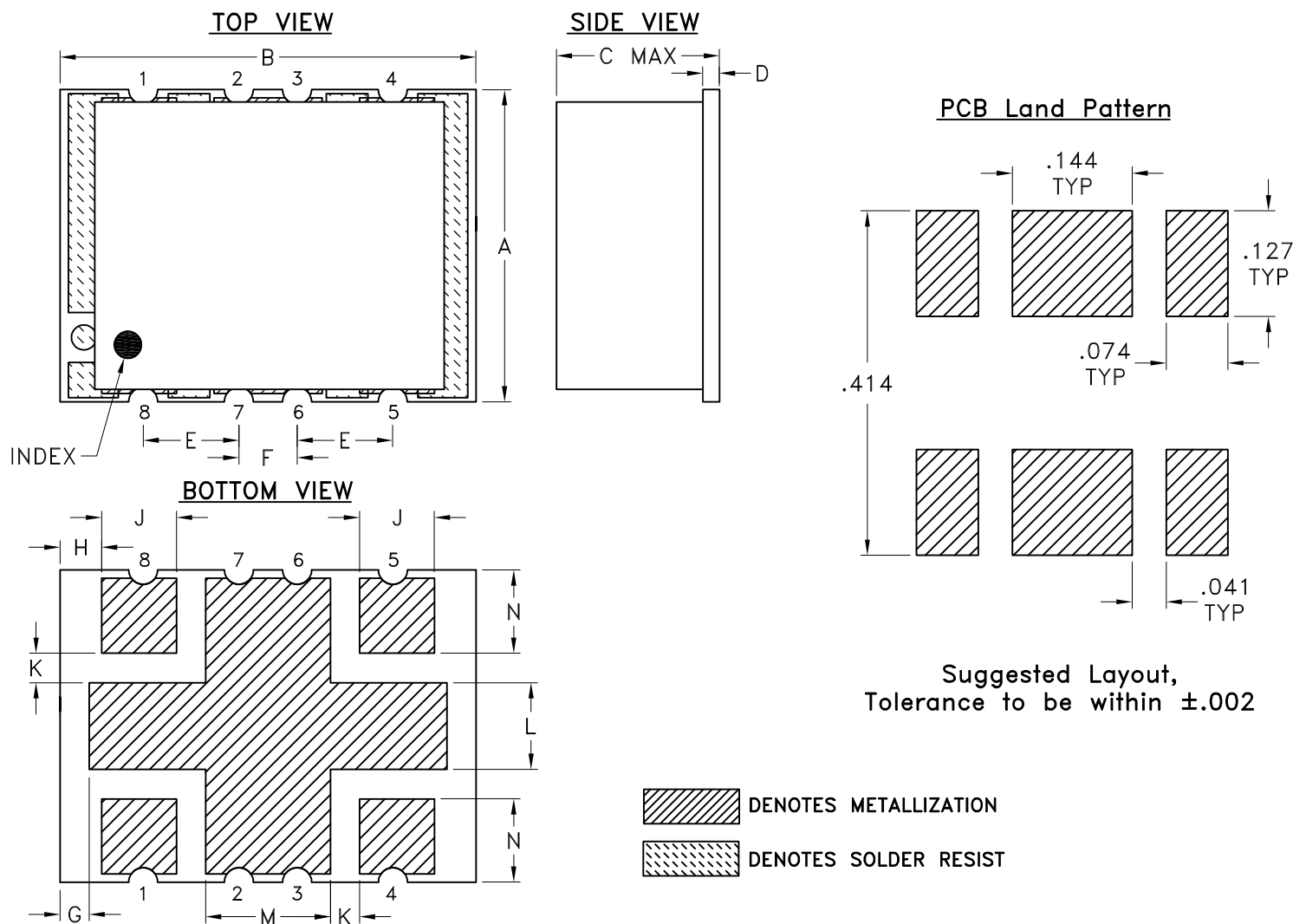
## Typical Performance Curves

**SYDC-20-22HP+**



## Outline Dimensions

AH202-1



| CASE#   | A             | B              | C             | D              | E              | F              | G              | H              | J              | K              | L              | M              | N              | WT, GRAM |
|---------|---------------|----------------|---------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------|
| AH202-1 | .38<br>(9.65) | .50<br>(12.70) | .25<br>(6.35) | .020<br>(0.51) | .115<br>(2.92) | .070<br>(1.78) | .035<br>(0.89) | .050<br>(1.27) | .090<br>(2.29) | .040<br>(1.02) | .105<br>(2.67) | .140<br>(3.56) | .095<br>(2.41) | .80      |

Dimensions are in inches (mm). Tolerances: 2 Pl.  $\pm 0.01$ ; 3 Pl.  $\pm 0.005$

### Notes:

- Case material: Nickel Silver alloy.
- Base material: Printed wiring laminate.
- Termination finish:

For RoHS 3-5  $\mu$  inch (.08-.13 microns) Gold over 120-240  $\mu$  inch (3.05-6.10 microns) Nickel plate.

All models, (+) suffix.

For RoHS-5 Case Styles: Tin-Lead plate. All models, no (+) suffix.

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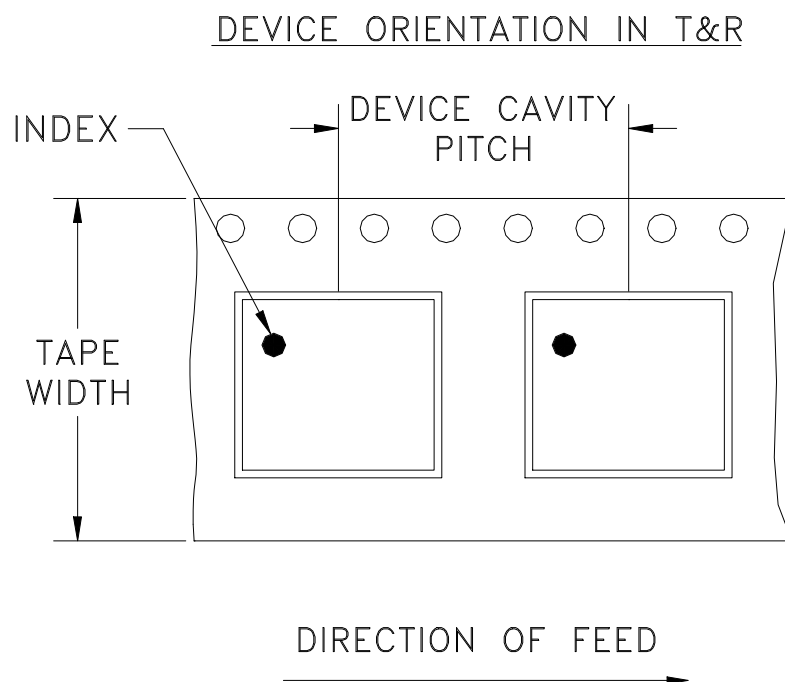
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RF/IF MICROWAVE COMPONENTS

# Tape & Reel Packaging TR-F61



| Tape Width,<br>mm | Device Cavity<br>Pitch, mm | Reel Size,<br>inches | Devices per Reel |
|-------------------|----------------------------|----------------------|------------------|
| 24                | 12                         | 13                   | 200              |

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)

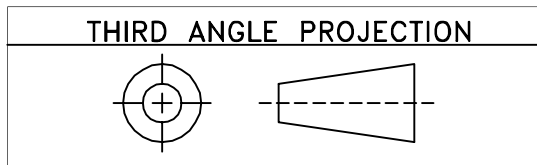


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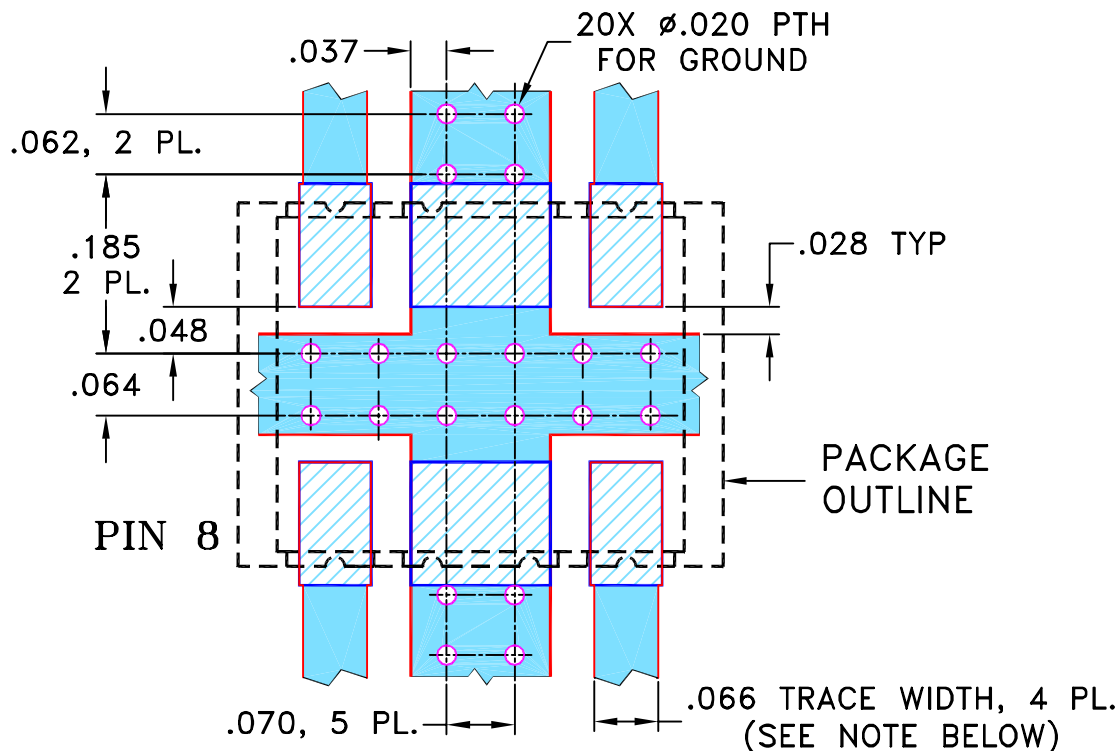
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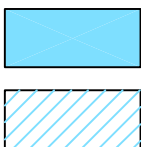
| REVISIONS |         |             |          |    |      |
|-----------|---------|-------------|----------|----|------|
| REV OR    | ECN No. | DESCRIPTION | DATE     | DR | AUTH |
|           | M107473 | NEW RELEASE | 09/25/06 | AV | DY   |
|           |         |             |          |    |      |
|           |         |             |          |    |      |
|           |         |             |          |    |      |

**SUGGESTED MOUNTING CONFIGURATION  
FOR AH202-1 CASE STYLE, "rr" PIN CONNECTION**



**NOTES:**

- TRACE WIDTH IS SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS .030"  $\pm$  .002"; COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH MAY NEED TO BE MODIFIED.
- 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 $\pm$<br>3 PL DECIMALS $\pm$ .005<br>ANGLES $\pm$<br>FRACTIONS $\pm$ | DRAWN    | AV | 09/19/06 |
|                                                                                                                                  | CHECKED  | IL | 09/25/06 |
|                                                                                                                                  | APPROVED | DY | 09/25/06 |
|                                                                                                                                  |          |    |          |



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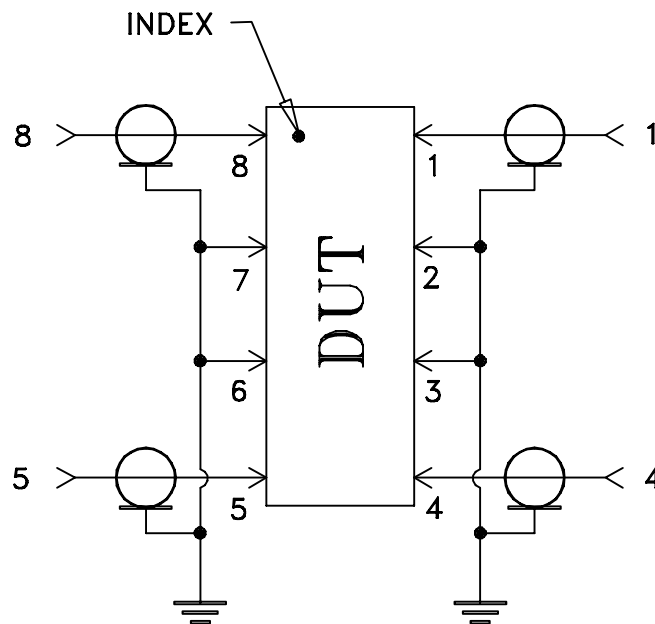
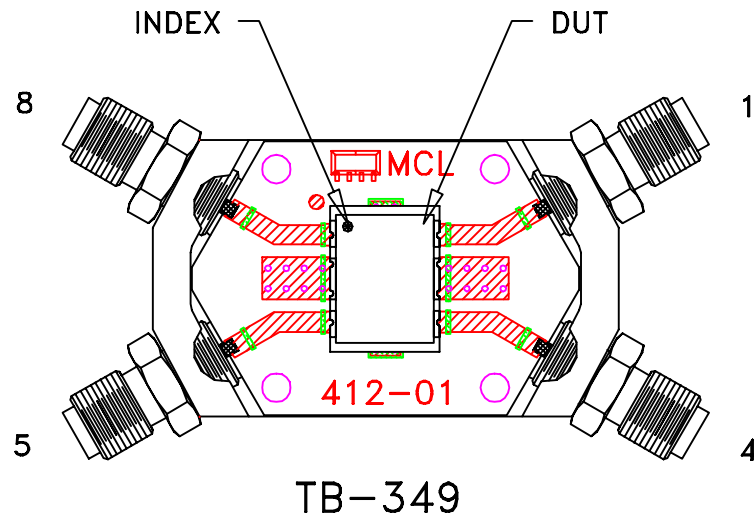
**PL, rr, AH202-1, SYDC, TB-349**

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

|                  |                     |                          |            |
|------------------|---------------------|--------------------------|------------|
| SIZE<br>A        | CODE IDENT<br>15542 | DRAWING NO:<br>98-PL-246 | REV:<br>OR |
| FILE:<br>98PL246 | SCALE:<br>5:1       | SHEET:<br>1 OF 1         |            |

# Evaluation Board and Circuit

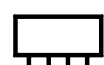
For Pin Connections refer to Data Sheet of the DUT



Schematic Diagram

## Notes:

1. SMA 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                                                                              |