



# Power Splitter/Combiner **SYPS-4-182-75X+**

4-Way 0° 75Ω 5 to 1800 MHz

## KEY FEATURES

- Wideband, 5 to 1800 MHz
- Low Insertion Loss, 2.5 dB typ.
- Low Amplitude Unbalance, 0.5 dB typ.



Generic photo used for illustration purposes only

## APPLICATIONS

- CATV
- VHF/UHF
- DOCSIS® 3.1/4.0

## FUNCTIONAL DIAGRAM



## PRODUCT OVERVIEW

Mini-Circuits' SYPS-4-182-75X+ is a 75Ω 4-way 0° surface mount splitter/combiner covering the 5 to 1800 MHz frequency range, supporting bandwidth requirements for DOCSIS®3.1/4.0 systems and equipment as well as other broadband applications. This model can handle up to 0.5W RF input power as a splitter and provides low insertion loss, high isolation, and low phase and amplitude unbalance. It comes on a 16-lead printed laminate base (0.50 x 0.50 x 0.14") with Top-Hat® and wrap-around terminations for excellent solderability and gold over nickel-plated termination finish.

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

| Parameter                      | Frequency (MHz) | Min. | Typ. | Max. | Unit    |
|--------------------------------|-----------------|------|------|------|---------|
| Frequency Range                |                 | 5    |      | 1800 | MHz     |
| Insertion Loss (above 6 dB)    | 5 - 40          | —    | 1.2  | 1.6  | dB      |
|                                | 40 - 1220       | —    | 2.2  | 2.6  |         |
|                                | 1220 - 1800     | —    | 3.0  | 3.9  |         |
| Isolation                      | 5 - 40          | 24   | 27   | —    | dB      |
|                                | 40 - 1220       | 15   | 20   | —    |         |
|                                | 1220 - 1800     | 12   | 16   | —    |         |
| Phase Unbalance (±)            | 5 - 870         | —    | 5    |      | Degrees |
|                                | 870 - 1800      | —    | 15   |      |         |
| Amplitude Unbalance            | 5 - 40          | —    | 0.1  | 0.3  | dB      |
|                                | 40 - 1220       | —    | 0.25 | 0.6  |         |
|                                | 1220 - 1800     | —    | 0.55 | 1.2  |         |
| Return Loss (Port S)           | 5 - 40          | 19   | 23   | —    | dB      |
|                                | 40 - 1220       | 14   | 18   | —    |         |
|                                | 1220 - 1800     | 13   | 18   | —    |         |
| Return Loss (Port 1 to Port 4) | 5 - 40          | 13   | 16   | —    | dB      |
|                                | 40 - 1220       | 15   | 20   | —    |         |
|                                | 1220 - 1800     | 14   | 20   | —    |         |

1. Bi-directional can function as a splitter or as a combiner. Refer to S-Parameters for actual performance.

## ABSOLUTE MAXIMUM RATINGS<sup>2</sup>

|                            |                   |                   |
|----------------------------|-------------------|-------------------|
| Operating Case Temperature |                   | -40° C to +85° C  |
| Storage Temperature        |                   | -55° C to +100° C |
| Input Power                | as splitter       | 0.5 W             |
|                            | combiner per port | 0.13              |

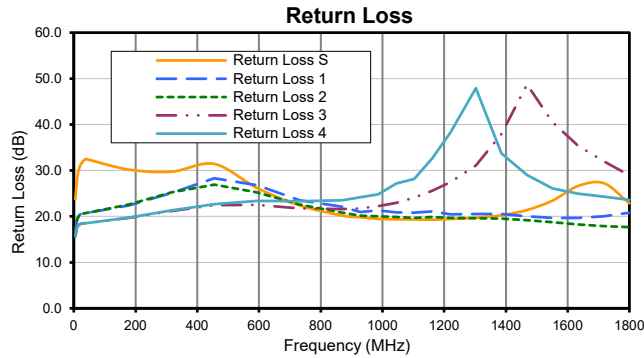
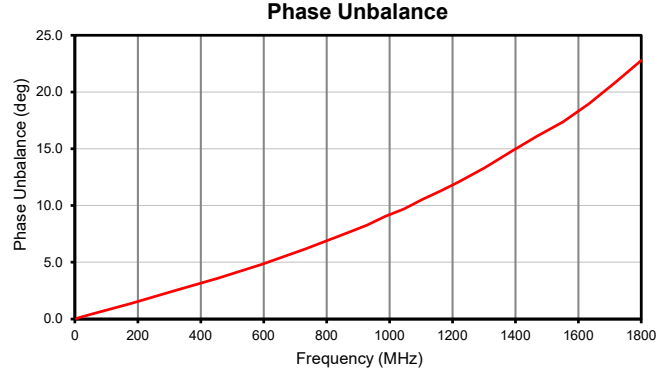
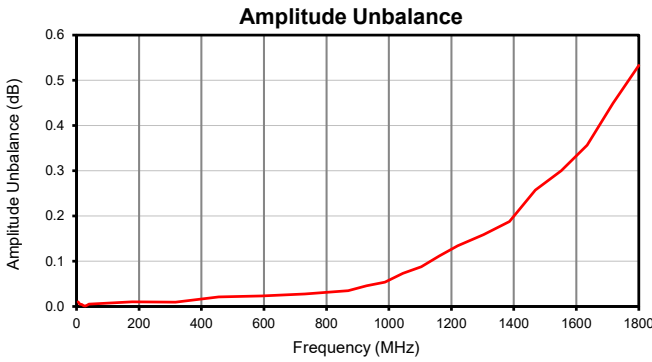
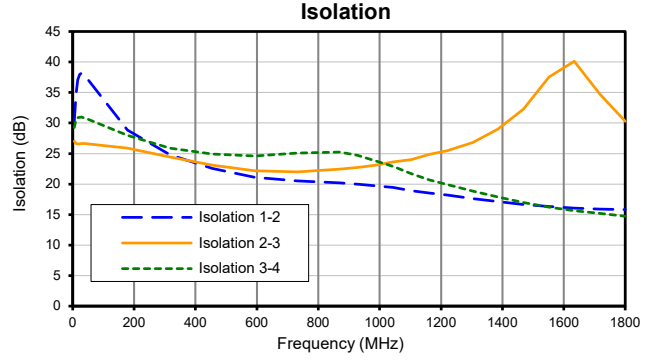
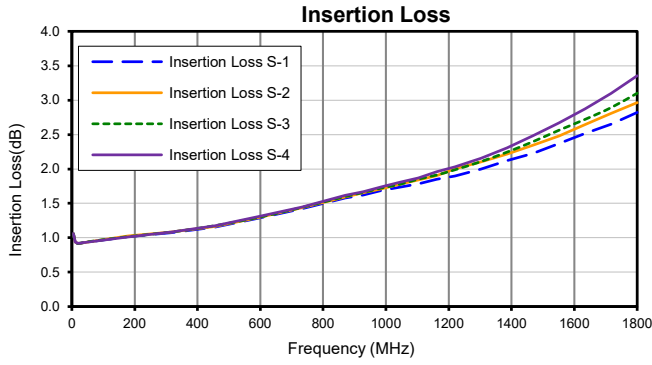
2. Permanent damage may occur if any of these limits are exceeded.



# Power Splitter/Combiner **SYPS-4-182-75X+**

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## TYPICAL PERFORMANCE GRAPHS





# Power Splitter/Combiner **SYPS-4-182-75X+**

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## FUNCTIONAL DIAGRAM

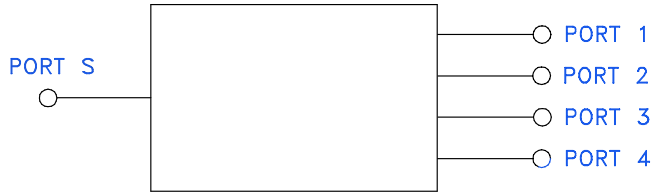
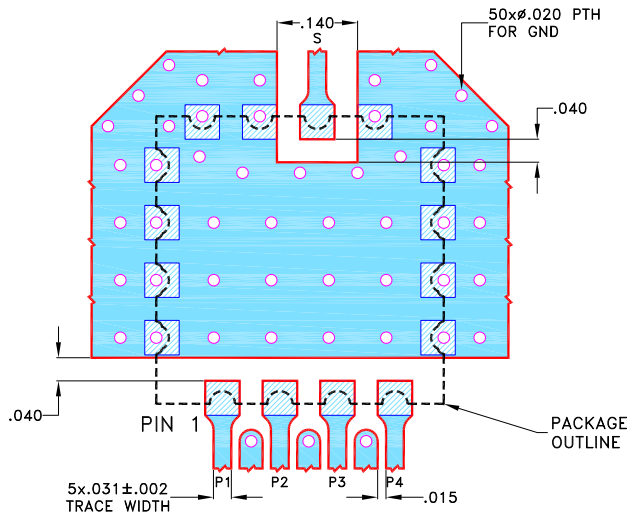


Figure 1. SYPS-4-182-75+ Functional Diagram

## PIN CONNECTIONS

| Function | Pad Number | Description          |
|----------|------------|----------------------|
| Sum Port | 10         | Connects to Sum Port |
| Port 1   | 1          | Connects to 1 Port   |
| Port 2   | 2          | Connects to 2 Port   |
| Port 3   | 3          | Connects to 3 Port   |
| Port 4   | 4          | Connects to 4 Port   |
| GND      | All Others | Connects to GND      |

## SUGGESTED PCB LAYOUT (PL-827)



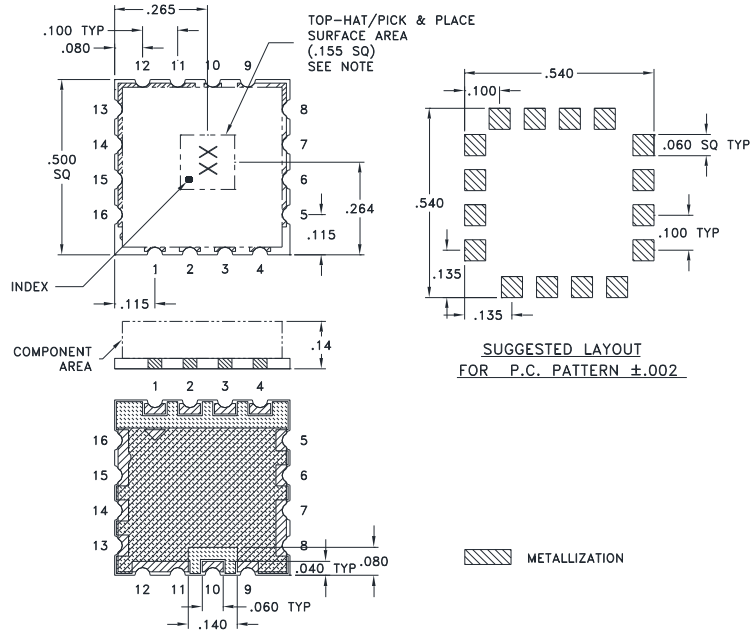
### NOTES:

- TRACE WIDTH IS SHOWN FOR ROGERS (R04350B) WITH DIELECTRIC THICKNESS .030±.002 COPPER: 1/2 Oz ON EACH SIDE. FOR OTHER MATERIALS THESE PARAMETERS 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.

Figure 2. Suggested PCB Layout PL-827

## OUTLINE DRAWING



Weight: .5 grams  
Dimensions are in inches. Tolerances: 2 Pl.±.03; 3 Pl. ±.015

Note: Top-Hat thickness: .013 inches MAX.

## PRODUCT MARKING\*: BP

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



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SURFACE MOUNT <sup>top hat</sup> 

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ADDITIONAL DETAILED INFORMATION IS AVAILABLE ON OUR DASHBOARD. [CLICK HERE](#)

|                                 |   |
|---------------------------------|---|
| Performance Data & Graphs       | Data<br>Graphs<br>S-Parameter (S5P Files) Data Set (.zip file) De-embedded to device pads |
| Case Style                      | CK1704-4 Lead Finish: Gold over Nickel plate  |
| RoHS Status                     | Compliant   |
| Tape and Reel                   | TR-F37  |
| Suggested Layout for PCB Design | PL-827  |
| Evaluation Board                | TB-SYPS418275X+<br>Gerber File  |
| Environmental Rating            | ENV02T1   |

- NOTES**
- A. Performance and quality attributes and conditions not expressly stated in this specification document are intended to be excluded and do not form a part of this specification document.
  - B. Electrical specifications and performance data contained in this specification document are based on Mini-Circuit's applicable established test performance criteria and measurement instructions.
  - C. The parts covered by this specification document are subject to Mini-Circuits standard limited warranty and terms and conditions (collectively, "Standard Terms"); Purchasers of this part are entitled to the rights and benefits contained therein. For a full statement of the standard. Terms and the exclusive rights and remedies thereunder, please visit Mini-Circuits' website at [www.minicircuits.com/terms/viewterm.html](http://www.minicircuits.com/terms/viewterm.html)



# 4 Way-0° Power Splitter/Combiner

# SYPS-4-182-75X+

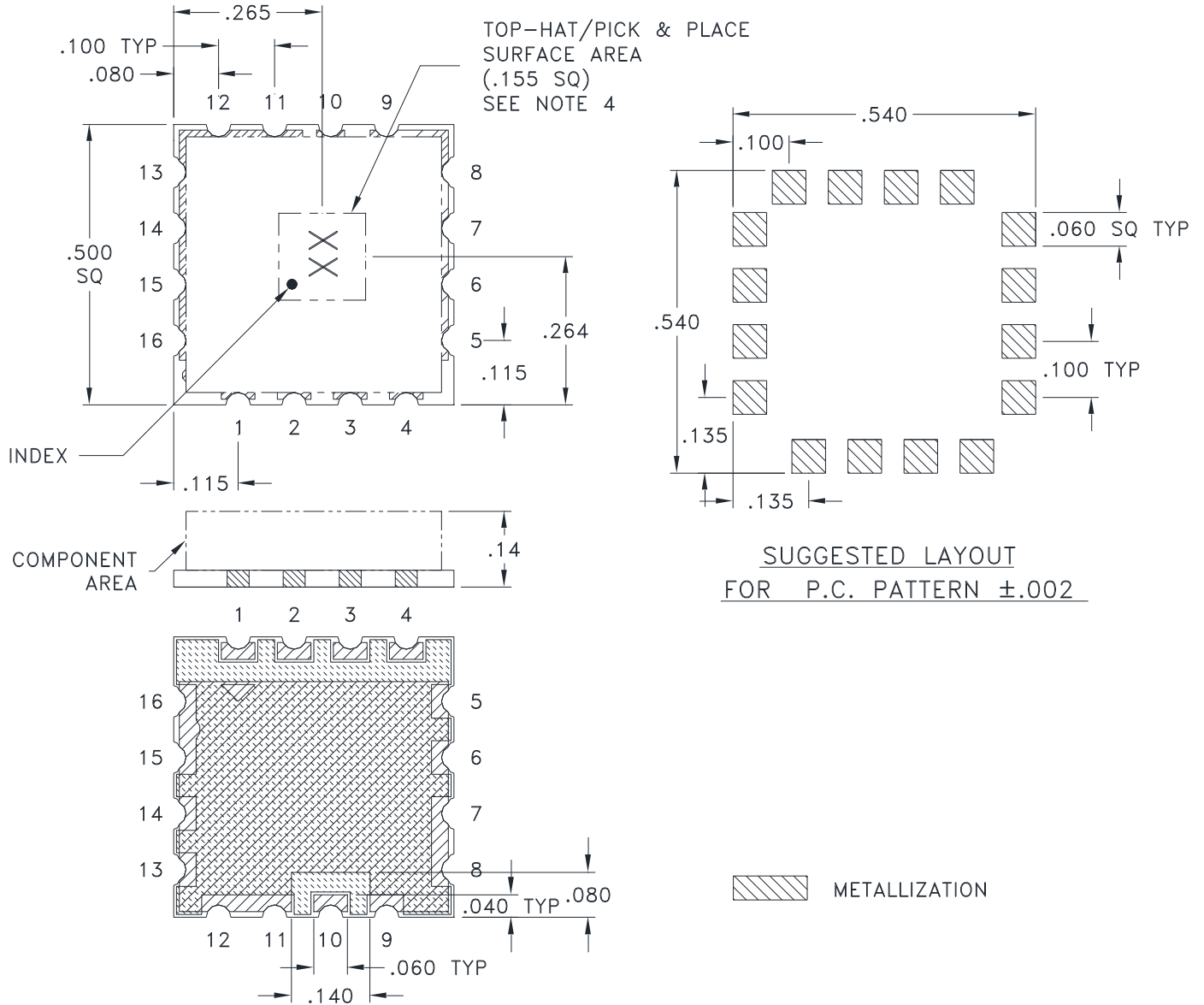
## Typical Performance Data

| FREQ.<br>(MHz) | INSERTION LOSS <sup>1</sup><br>(dB) |      |      |      | AMP.<br>UNBAL.<br>(dB) | ISOLATION<br>(dB) |       |       | PHASE<br>UNBAL.<br>(deg.) | FREQ.<br>(MHz) | Return Loss<br>(dB) |       |       |       |       |
|----------------|-------------------------------------|------|------|------|------------------------|-------------------|-------|-------|---------------------------|----------------|---------------------|-------|-------|-------|-------|
|                | S-1                                 | S-2  | S-3  | S-4  |                        | 1-2               | 2-3   | 3-4   |                           |                | S                   | 1     | 2     | 3     | 4     |
| 5              | 1.06                                | 1.06 | 1.05 | 1.05 | 0.01                   | 30.21             | 26.99 | 29.29 | 0.04                      | 5              | 23.77               | 16.61 | 16.60 | 15.62 | 15.64 |
| 11             | 0.94                                | 0.94 | 0.94 | 0.94 | 0.01                   | 34.77             | 26.66 | 30.59 | 0.10                      | 11             | 28.27               | 19.34 | 19.34 | 17.64 | 17.67 |
| 17             | 0.92                                | 0.92 | 0.92 | 0.92 | 0.00                   | 37.05             | 26.59 | 30.89 | 0.15                      | 17             | 30.25               | 20.18 | 20.17 | 18.19 | 18.20 |
| 23             | 0.92                                | 0.92 | 0.92 | 0.92 | 0.00                   | 37.98             | 26.57 | 30.92 | 0.19                      | 23             | 31.33               | 20.51 | 20.47 | 18.39 | 18.40 |
| 28             | 0.92                                | 0.92 | 0.92 | 0.92 | 0.00                   | 38.14             | 26.61 | 30.98 | 0.25                      | 28             | 31.83               | 20.63 | 20.59 | 18.47 | 18.47 |
| 34             | 0.93                                | 0.93 | 0.93 | 0.93 | 0.00                   | 38.02             | 26.65 | 30.90 | 0.28                      | 34             | 32.30               | 20.72 | 20.69 | 18.51 | 18.50 |
| 40             | 0.93                                | 0.93 | 0.94 | 0.93 | 0.00                   | 37.77             | 26.66 | 30.84 | 0.33                      | 40             | 32.47               | 20.76 | 20.72 | 18.55 | 18.51 |
| 178            | 1.01                                | 1.02 | 1.02 | 1.01 | 0.01                   | 28.83             | 25.86 | 27.99 | 1.36                      | 178            | 30.19               | 22.41 | 22.61 | 19.67 | 19.73 |
| 317            | 1.08                                | 1.09 | 1.08 | 1.08 | 0.01                   | 24.81             | 24.41 | 25.89 | 2.51                      | 317            | 29.74               | 25.08 | 25.21 | 21.13 | 21.33 |
| 455            | 1.15                                | 1.17 | 1.18 | 1.18 | 0.02                   | 22.55             | 23.08 | 24.94 | 3.60                      | 455            | 31.43               | 28.30 | 26.92 | 22.47 | 22.67 |
| 593            | 1.28                                | 1.29 | 1.30 | 1.31 | 0.02                   | 21.13             | 22.16 | 24.58 | 4.82                      | 593            | 26.19               | 26.77 | 25.24 | 22.56 | 23.40 |
| 732            | 1.42                                | 1.44 | 1.44 | 1.45 | 0.03                   | 20.51             | 21.99 | 25.06 | 6.15                      | 732            | 22.40               | 23.49 | 22.61 | 21.77 | 23.30 |
| 870            | 1.58                                | 1.59 | 1.60 | 1.61 | 0.03                   | 20.19             | 22.44 | 25.26 | 7.65                      | 870            | 20.17               | 22.12 | 20.79 | 21.61 | 23.53 |
| 928            | 1.62                                | 1.66 | 1.66 | 1.67 | 0.05                   | 19.97             | 22.70 | 24.71 | 8.28                      | 928            | 19.81               | 20.95 | 20.19 | 21.71 | 24.19 |
| 987            | 1.69                                | 1.71 | 1.72 | 1.74 | 0.05                   | 19.71             | 23.11 | 23.78 | 9.06                      | 987            | 19.46               | 21.29 | 20.01 | 22.22 | 24.84 |
| 1045           | 1.73                                | 1.78 | 1.78 | 1.81 | 0.07                   | 19.46             | 23.64 | 22.87 | 9.68                      | 1045           | 19.37               | 20.89 | 19.87 | 22.94 | 27.16 |
| 1103           | 1.78                                | 1.84 | 1.85 | 1.87 | 0.09                   | 18.92             | 24.03 | 21.70 | 10.52                     | 1103           | 19.34               | 20.81 | 19.70 | 24.09 | 28.13 |
| 1162           | 1.85                                | 1.90 | 1.91 | 1.96 | 0.11                   | 18.54             | 24.88 | 20.68 | 11.29                     | 1162           | 19.29               | 21.10 | 19.91 | 25.61 | 32.67 |
| 1220           | 1.90                                | 2.00 | 1.99 | 2.03 | 0.13                   | 18.19             | 25.46 | 19.92 | 12.08                     | 1220           | 19.44               | 20.42 | 19.68 | 27.46 | 38.21 |
| 1303           | 2.00                                | 2.10 | 2.11 | 2.15 | 0.16                   | 17.61             | 26.80 | 18.84 | 13.32                     | 1303           | 19.71               | 20.54 | 19.58 | 31.08 | 47.91 |
| 1386           | 2.12                                | 2.21 | 2.25 | 2.31 | 0.19                   | 17.11             | 28.97 | 17.86 | 14.73                     | 1386           | 20.24               | 20.49 | 19.50 | 37.96 | 33.70 |
| 1469           | 2.23                                | 2.34 | 2.40 | 2.49 | 0.26                   | 16.67             | 32.26 | 16.97 | 16.11                     | 1469           | 21.40               | 20.05 | 19.16 | 48.72 | 29.03 |
| 1551           | 2.37                                | 2.48 | 2.56 | 2.67 | 0.30                   | 16.33             | 37.54 | 16.22 | 17.38                     | 1551           | 23.45               | 19.65 | 18.74 | 40.50 | 26.06 |
| 1634           | 2.52                                | 2.65 | 2.72 | 2.88 | 0.36                   | 16.07             | 40.12 | 15.65 | 19.00                     | 1634           | 26.63               | 19.68 | 18.24 | 35.37 | 24.96 |
| 1717           | 2.65                                | 2.81 | 2.89 | 3.10 | 0.45                   | 15.88             | 34.77 | 15.18 | 20.82                     | 1717           | 27.23               | 20.01 | 17.88 | 31.99 | 24.33 |
| 1800           | 2.82                                | 2.96 | 3.10 | 3.35 | 0.53                   | 15.82             | 30.31 | 14.73 | 22.78                     | 1800           | 22.85               | 20.82 | 17.65 | 28.97 | 23.56 |

<sup>1</sup>Insertion loss is loss above theoretical loss (6dB)

## Outline Dimensions

CK1704-4



Weight: .5 grams

Dimensions are in inches. Tolerances: 2Pl. ± .03; 3Pl. ± .015

### Notes:

1. Open style, Base material: Printed wiring laminate.
2. Termination finish: 3-5  $\mu$  inch (.08-.13 microns) Gold over 120-240  $\mu$  inch (3.05-6.10 microns) Nickel plate  
All models, (+) suffix.
3. Orientation dot on top hat & orientation feature on substrate correspondence to pin #1
4. Top-Hat total thickness: .013 inches MAX.

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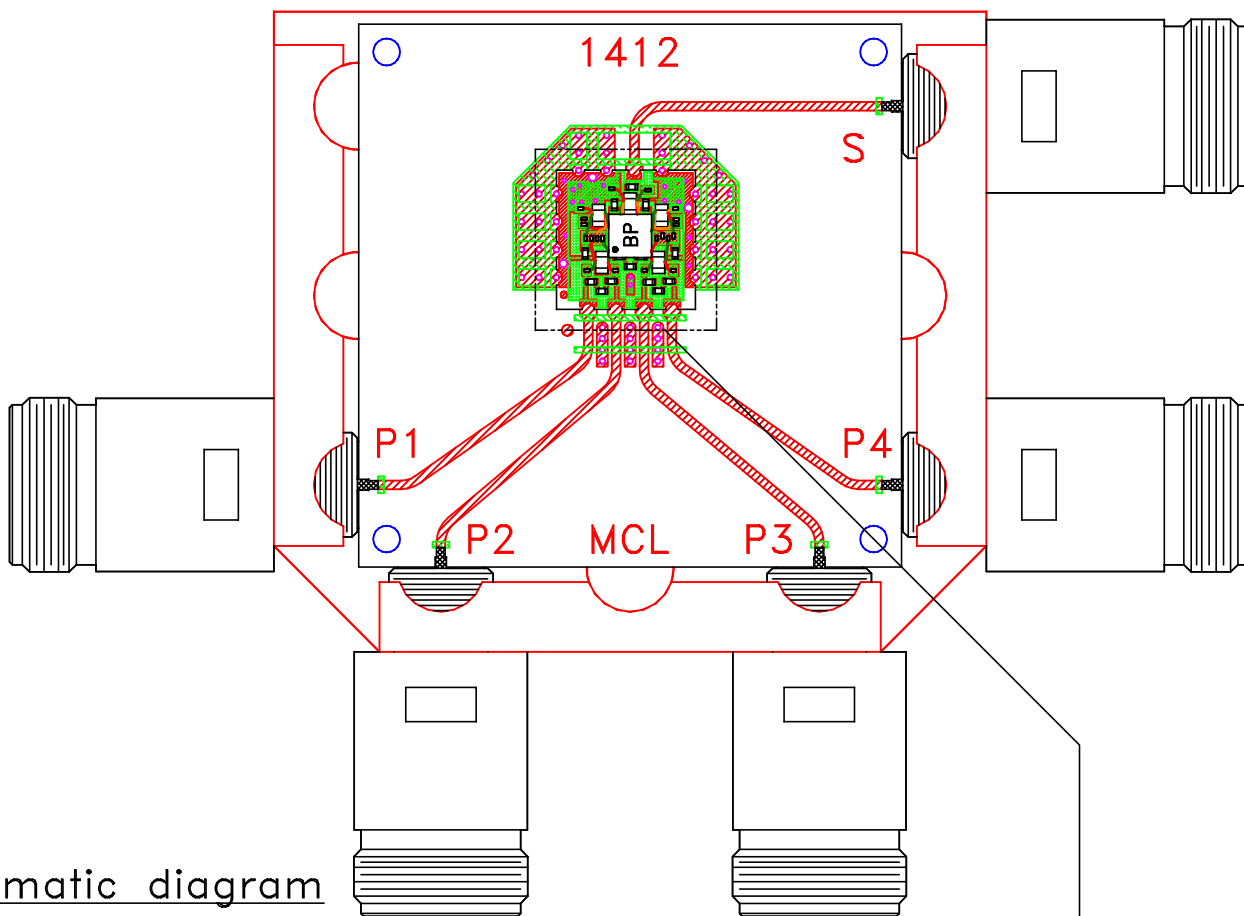


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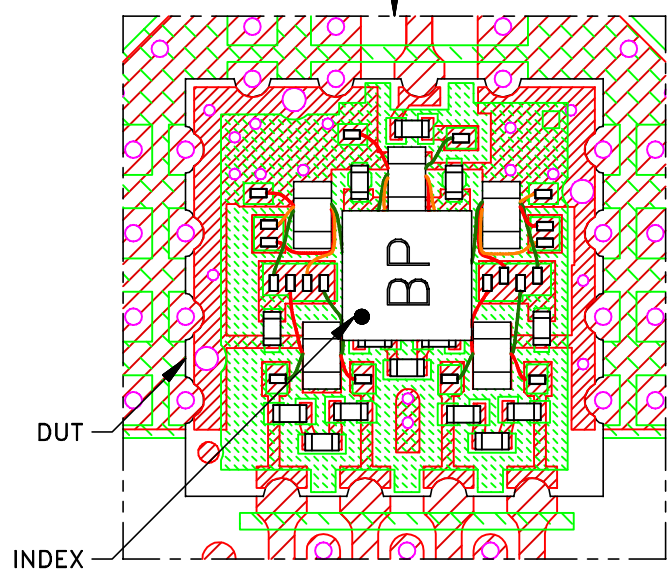
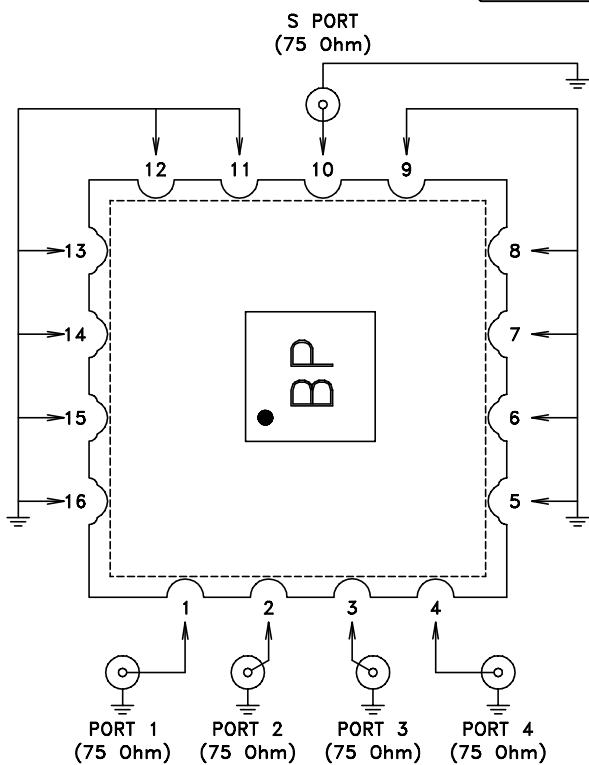
RF/IF MICROWAVE COMPONENTS

# Evaluation Board and Circuit

TB-SYPS418275X+

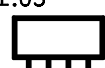


Schematic diagram



Notes:

1. PCB Material: ROGERS (RO4350B) OR Equivalent, Dielectric Constant=3.48±.05
2. Total finished thickness: .030±.002 inch
3. 75 Ohm N Female Connector.

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| 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  |