

Surface Mount

# Phase Shifter

## SCPHS-180+

50Ω 360° Voltage Variable 90 to 180 MHz

### The Big Deal

- Low insertion loss, 2.2 dB typ.
- Wide phase shift, 360°
- Low frequency and small size



CASE STYLE: HU1371

### Product Overview

Mini-Circuits' SCPHS-180+ is a voltage variable phase shifter providing 360° phase control from 90 to 180 MHz in a miniature surface mount package. This model has a control bandwidth of DC to 30 kHz and a control voltage range from 0 to +10V. Housed in a shielded, 12-lead package with wrap-around terminations, the unit measures only 0.87 x 0.80 x 0.25", offering a space-efficient, low-cost alternative to larger, expensive connectorized phase shifters typical for low frequency operation.

| Feature  | Advantages  |
|--|---|
| Low insertion loss, 2.2 dB typ.                            | Enables good transmission of signal power from input to output and minimizes effect on system noise figure.   |
| Wide phase shift, 360°                                     | In test environments, 360° phase control allows the user to experiment with various incident phases. This can be used to test residual phase noise of amplifiers and to determine the influence of phase between two mismatched components in a system. |
| Low frequency operation and tiny size, 0.87 x 0.80 x 0.25" | Typically, lower frequency phase shifters are large, connectorized designs. SCPHS-180+ provides low frequency phase shift capability in a tiny surface mount package, saving space and reducing system cost.  |

#### 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.  
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# Surface Mount Phase Shifter

50Ω 360° Voltage Variable 90 to 180 MHz

## SCPHS-180+



Generic photo used for illustration purposes only

CASE STYLE: HU1371

**+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 |
| 13"       | 200          |

### Maximum Ratings

|                       |                |
|-----------------------|----------------|
| Operating Temperature | -40°C to 85°C  |
| Storage Temperature   | -55°C to 100°C |
| RF Input Power        | 24 dBm max.    |
| Control Voltage       | 15V            |

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

### Pin Connections

|        |                        |
|--------|------------------------|
| IN     | 1                      |
| OUT    | 6                      |
| BIAS   | 10,11 <sup>^</sup>     |
| GROUND | 2,3,4,5,7,8,9,12,13,14 |

<sup>^</sup> proper operation is achieved with pins 10 or 11 or both connected to BIAS.

### Features

- low insertion loss, 2.2 dB typ.
- wide phase shift, 360°
- aqueous washable

### Applications

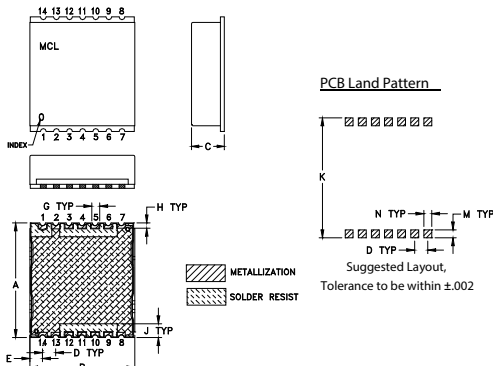
- FM Broadcast
- Aircraft Communication
- VHF

### Electrical Specifications at 25°C

| Parameter         | Condition (MHz) | Min. | Typ.  | Max. | Unit    |
|-------------------|-----------------|------|-------|------|---------|
| Frequency Range   |                 | 90   |       | 180  | MHz     |
| Phase Range       | 90-180          | 360  | —     | —    | Degrees |
| Insertion Loss    | 90-180          | —    | 2.2   | 5    | dB      |
| Control Voltage   | 90-180          | —    | 0-10  | —    | V       |
| Control Bandwidth | 90-180          | —    | DC-30 | —    | kHz     |
| VSWR              | 90-180          | —    | 1.7   | —    | :1      |

DC input resistance at Control port: 1460 ohms typ.

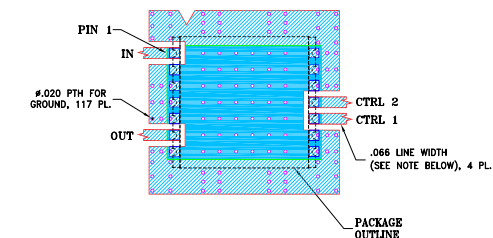
### Outline Drawing



### Outline Dimensions (inch mm)

|       |       |      |      |      |   |      |       |
|-------|-------|------|------|------|---|------|-------|
| A     | B     | C    | D    | E    | F | G    | H     |
| .870  | .800  | .250 | .100 | .097 | - | .060 | .040  |
| 22.10 | 20.32 | 6.35 | 2.54 | 2.46 | - | 1.52 | 1.02  |
| J     | K     | L    | M    | N    | P |      | wt    |
| .105  | .910  | -    | .060 | .060 | - |      | grams |
| 2.67  | 23.11 | -    | 1.52 | 1.52 | - |      | 2.85  |

Demo Board MCL P/N: TB-1141+  
Suggested PCB Layout (PL-690)

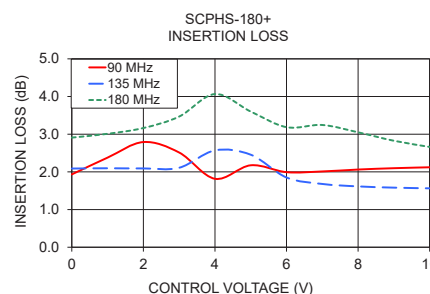
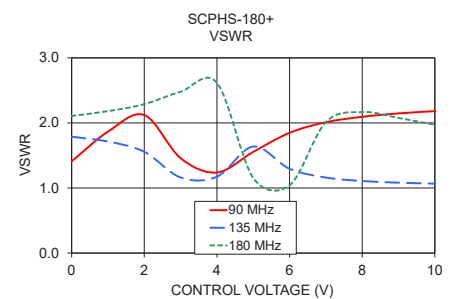
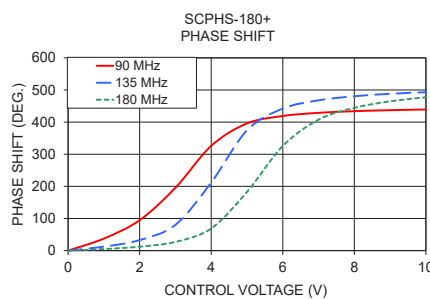


- NOTES:
- TRACE WIDTH IS SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS 0.002±0.002"; COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH MAY NEED TO BE MODIFIED.
  - BOTTOM SIDE OF THE PCB IS CONTINUOUS GROUND PLANE.
- DENOTES PCB COPPER LAYOUT WITH SMOBC (SOLDER MASK OVER BARE COPPER).  
■ DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK.

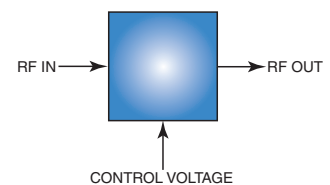
### Typical Performance Data

| Control Voltage (V) | Phase Shift* (Degrees) |         |         | VSWR (:1) |         |         | Insertion Loss (dB) |         |         |
|---------------------|------------------------|---------|---------|-----------|---------|---------|---------------------|---------|---------|
|                     | 90 MHz                 | 135 MHz | 180 MHz | 90 MHz    | 135 MHz | 180 MHz | 90 MHz              | 135 MHz | 180 MHz |
| 0                   | 0.0                    | 0.0     | 0.0     | 1.4       | 1.8     | 2.1     | 1.9                 | 2.1     | 2.9     |
| 1                   | 37.5                   | 12.4    | 4.9     | 1.9       | 1.7     | 2.2     | 2.4                 | 2.1     | 3.0     |
| 2                   | 94.8                   | 32.8    | 12.3    | 2.1       | 1.6     | 2.3     | 2.8                 | 2.1     | 3.2     |
| 3                   | 195.8                  | 80.3    | 27.1    | 1.5       | 1.2     | 2.5     | 2.5                 | 2.1     | 3.5     |
| 4                   | 326.1                  | 212.1   | 69.0    | 1.2       | 1.2     | 2.6     | 1.8                 | 2.6     | 4.1     |
| 5                   | 395.9                  | 374.3   | 182.8   | 1.6       | 1.6     | 1.2     | 2.2                 | 2.5     | 3.6     |
| 6                   | 419.0                  | 442.1   | 325.7   | 1.8       | 1.3     | 1.0     | 2.0                 | 1.9     | 3.2     |
| 7                   | 428.9                  | 467.8   | 407.7   | 2.0       | 1.2     | 2.0     | 2.0                 | 1.7     | 3.2     |
| 8                   | 434.1                  | 480.6   | 444.4   | 2.1       | 1.1     | 2.2     | 2.1                 | 1.6     | 3.0     |
| 9                   | 437.2                  | 488.2   | 464.7   | 2.1       | 1.1     | 2.1     | 2.1                 | 1.6     | 2.8     |
| 10                  | 439.2                  | 493.1   | 477.3   | 2.2       | 1.1     | 2.0     | 2.1                 | 1.6     | 2.7     |

\* Normalized at control voltage = 0V



### Electrical Schematic



### Notes

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REV. OR  
ECO-006945  
SCPHS-180+  
ZL/CP/AM  
210419

# PHASE SHIFTER

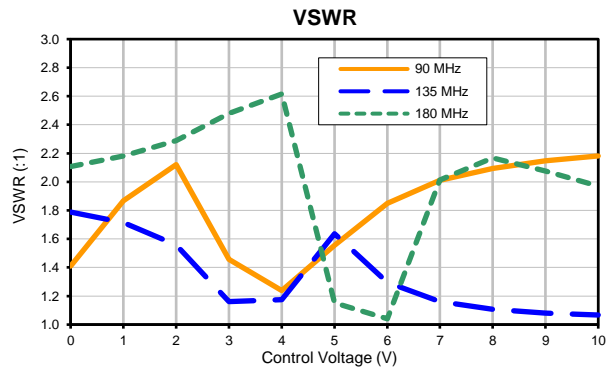
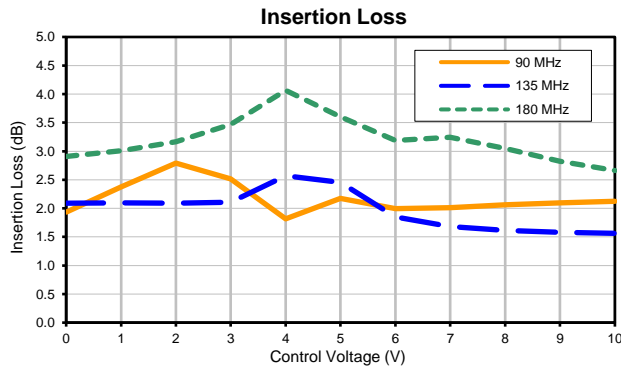
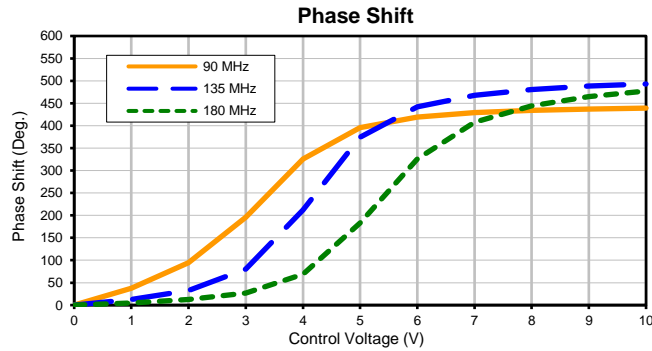
# SCPHS-180+

## Typical Performance Data

| CONTROL VOLTAGE (V) | PHASE SHIFT* (Deg.) |         |         | VSWR (:1) |         |         | INSERTION LOSS (dB) |         |         |
|---------------------|---------------------|---------|---------|-----------|---------|---------|---------------------|---------|---------|
|                     | 90 MHz              | 135 MHz | 180 MHz | 90 MHz    | 135 MHz | 180 MHz | 90 MHz              | 135 MHz | 180 MHz |
| 0                   | 0.00                | 0.00    | 0.00    | 1.41      | 1.79    | 2.11    | 1.93                | 2.09    | 2.91    |
| 1                   | 37.50               | 12.41   | 4.89    | 1.87      | 1.71    | 2.18    | 2.38                | 2.10    | 3.01    |
| 2                   | 94.76               | 32.84   | 12.26   | 2.12      | 1.56    | 2.29    | 2.79                | 2.09    | 3.16    |
| 3                   | 195.76              | 80.28   | 27.10   | 1.46      | 1.16    | 2.48    | 2.51                | 2.11    | 3.47    |
| 4                   | 326.11              | 212.07  | 68.99   | 1.24      | 1.17    | 2.62    | 1.82                | 2.57    | 4.07    |
| 5                   | 395.90              | 374.31  | 182.81  | 1.56      | 1.64    | 1.15    | 2.17                | 2.46    | 3.60    |
| 6                   | 419.04              | 442.14  | 325.70  | 1.85      | 1.30    | 1.04    | 1.99                | 1.85    | 3.19    |
| 7                   | 428.93              | 467.80  | 407.67  | 2.01      | 1.16    | 2.01    | 2.01                | 1.68    | 3.24    |
| 8                   | 434.06              | 480.58  | 444.42  | 2.09      | 1.11    | 2.17    | 2.06                | 1.61    | 3.05    |
| 9                   | 437.19              | 488.17  | 464.75  | 2.15      | 1.08    | 2.08    | 2.10                | 1.58    | 2.83    |
| 10                  | 439.25              | 493.08  | 477.35  | 2.18      | 1.07    | 1.97    | 2.12                | 1.56    | 2.66    |

\*Normalized at control voltage = 0V

## Typical Performance Curves

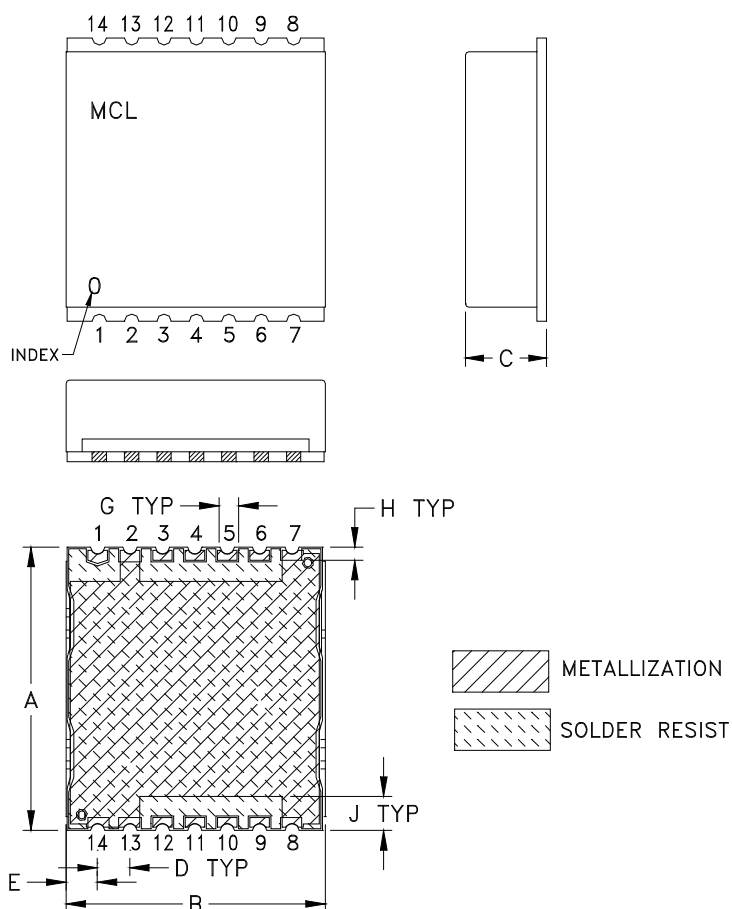


# Case Style

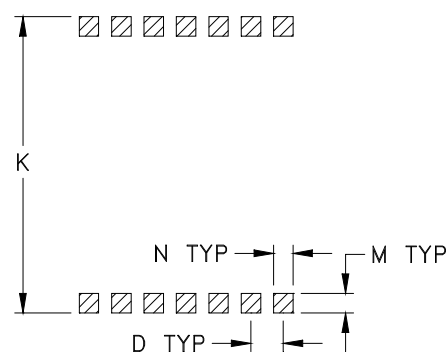
# HU

## Outline Dimensions

## HU1371



## PCB Land Pattern



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

| CASE#  | A               | B               | C             | D              | E              | F | G              | H              | J              | K               | L | M              | N              | P | WT, GRAM |
|--------|-----------------|-----------------|---------------|----------------|----------------|---|----------------|----------------|----------------|-----------------|---|----------------|----------------|---|----------|
| HU1371 | .870<br>(22.10) | .800<br>(20.32) | .25<br>(6.35) | .100<br>(2.54) | .097<br>(2.46) | - | .060<br>(1.52) | .040<br>(1.02) | .105<br>(2.67) | .910<br>(23.11) | - | .060<br>(1.52) | .060<br>(1.52) | - | 2.85     |

Dimensions are in inches (mm). Tolerances: 2PL. +/- .03; 3PL. +/- .015

### Notes:

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

For RoHS Case Styles: 2-5  $\mu$  inch (.05-.13 microns) Gold over .120-.240  $\mu$  inch (3.05-6.10 microns) Nickel plate. All models (+) suffix.

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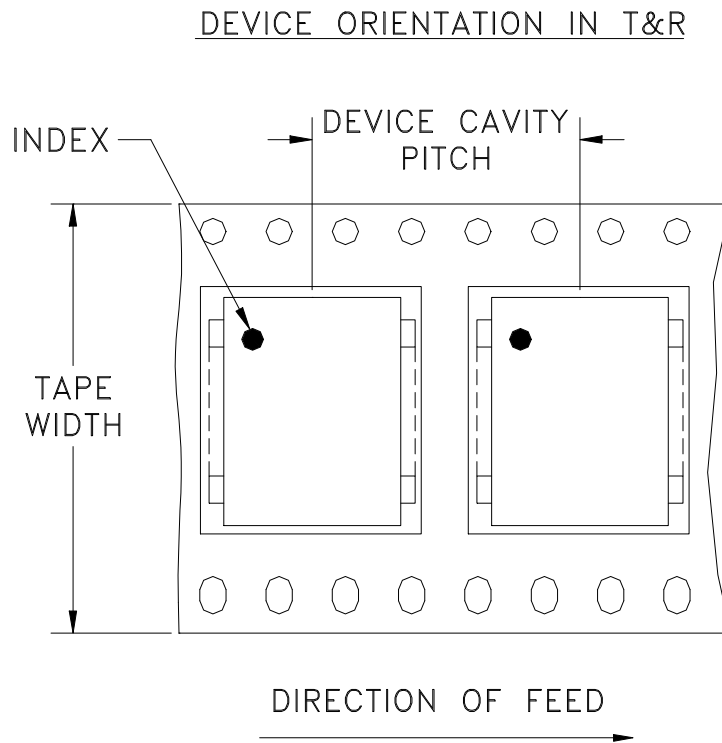
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RF/IF MICROWAVE COMPONENTS

# Tape & Reel Packaging TR-F21



| <b>Tape Width,<br/>mm</b> | <b>Device Cavity<br/>Pitch, mm</b> | <b>Reel Size,<br/>inches</b> | <b>Devices per Reel</b> |
|---------------------------|------------------------------------|------------------------------|-------------------------|
| 32                        | 32                                 | 13                           | 200                     |

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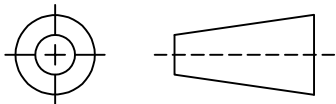
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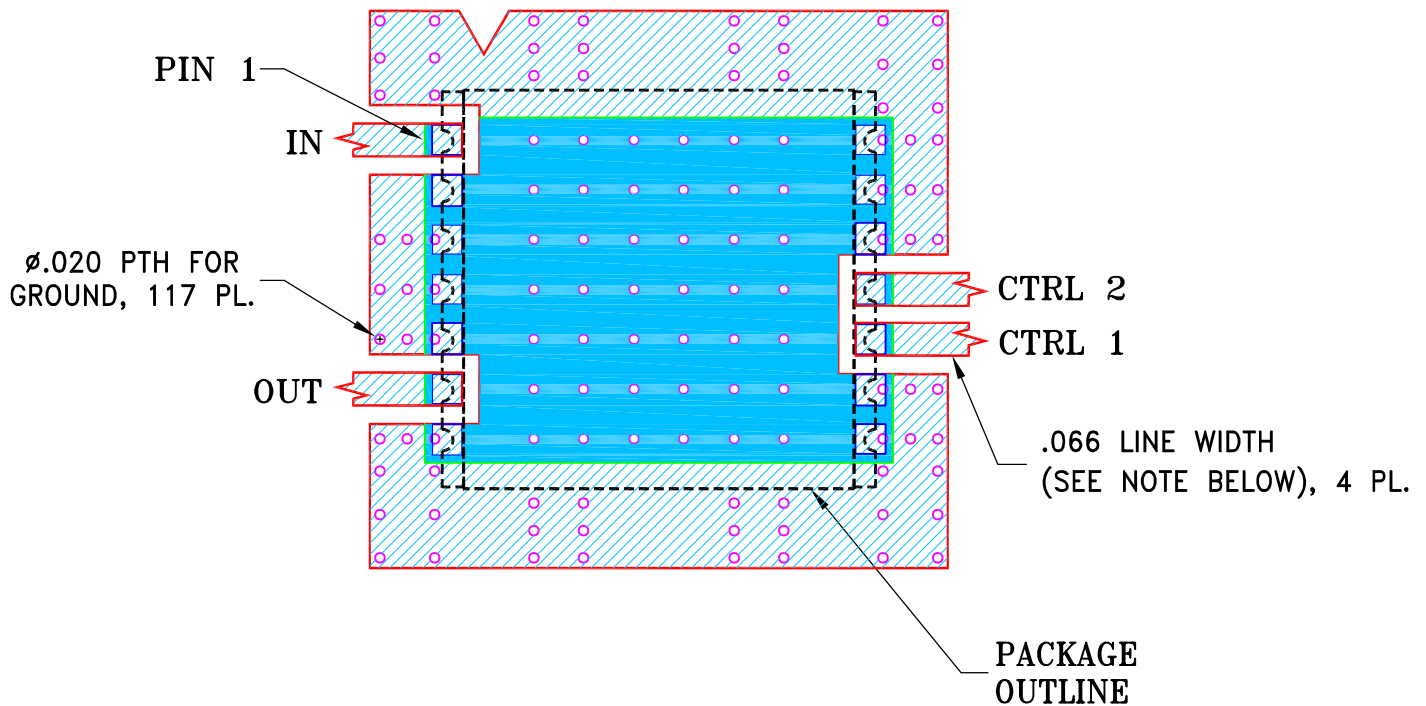
THIRD ANGLE PROJECTION



REVISIONS



| REV | ECN No.    | DESCRIPTION | DATE     | DR  | AUTH |
|-----|------------|-------------|----------|-----|------|
| OR  | ECO-003790 | NEW RELEASE | 08/24/20 | ITG | IL   |
|     |            |             |          |     |      |
|     |            |             |          |     |      |

SUGGESTED MOUNTING CONFIGURATION FOR  
HU1371 CASE STYLE



NOTES:

- TRACE WIDTH IS SHOWN FOR ROGERS R04350B WITH DIELECTRIC THICKNESS .030±.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   | DRAWN    | ITG | 08/24/20 |
| TOLERANCES ON:             | CHECKED  | GF  | 08/24/20 |
| 2 PL DECIMALS ±            | APPROVED | IL  | 08/24/20 |
| 3 PL DECIMALS ± .005       |          |     |          |
| ANGLES ±                   |          |     |          |
| FRACTIONS ±                |          |     |          |



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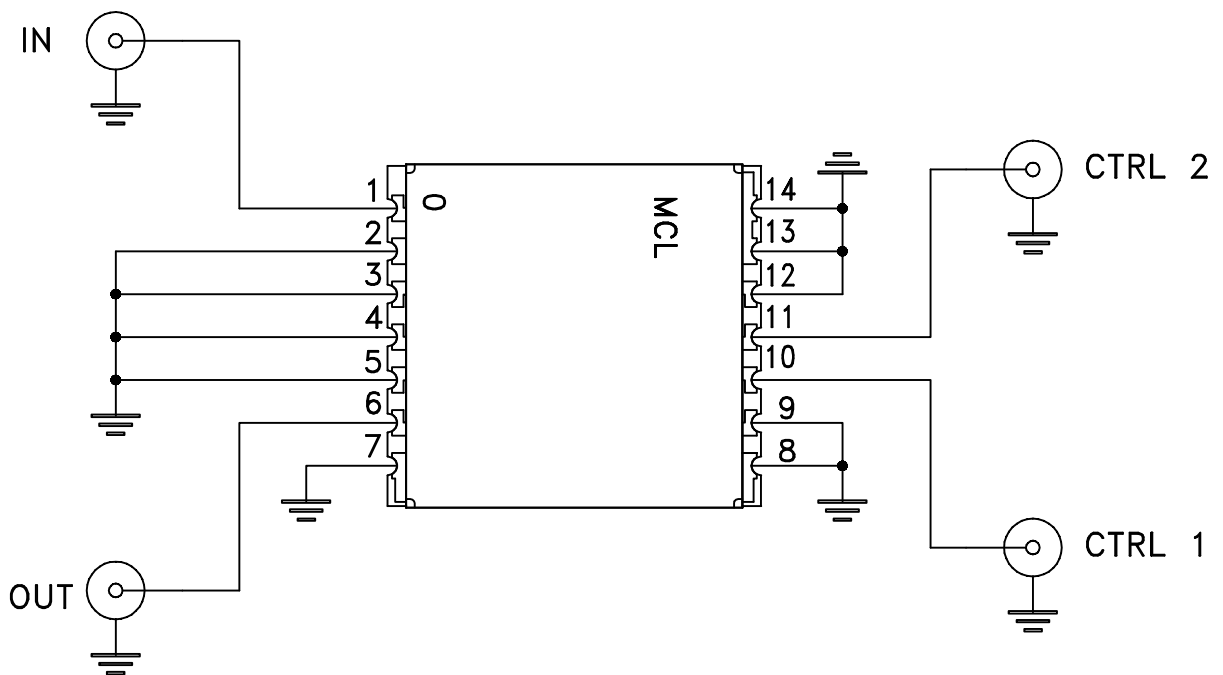
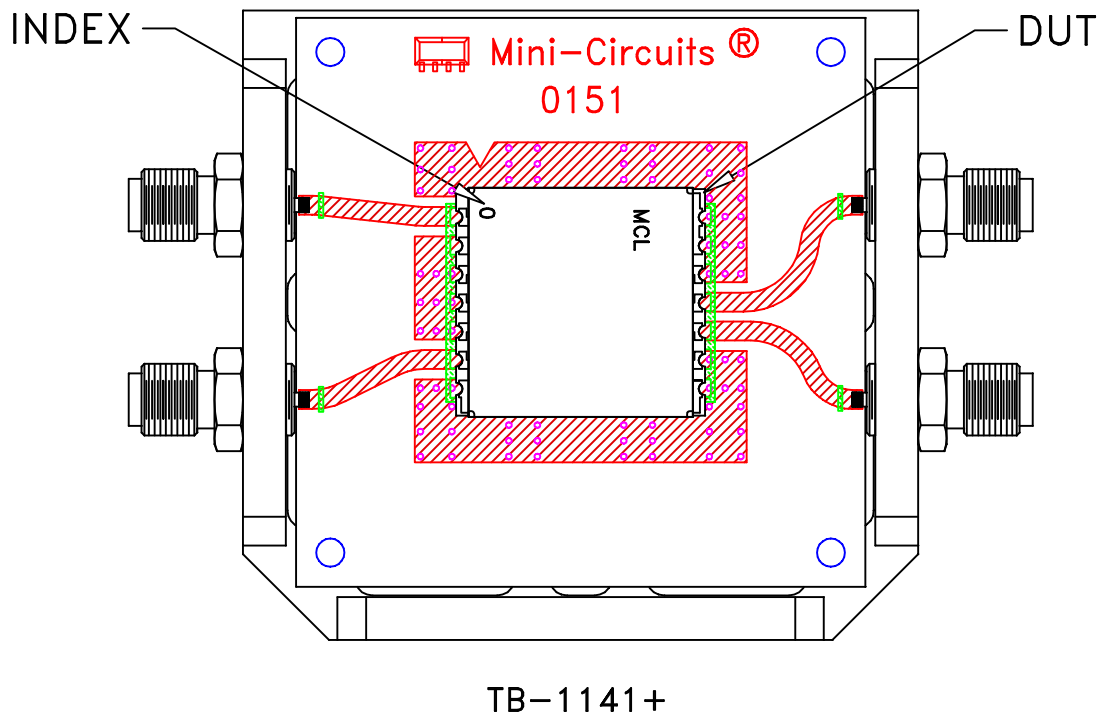
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PL, HU1371, TB-1141+

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| FILE: | 98PL690    | SCALE:      | SHEET: |
|       |            | 2.5:1       | 1 OF 1 |

# Evaluation Board and Circuit



Schematic Diagram

## Notes:

1. 50 Ohm SMA Female connectors.
2. PCB Material: 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  |