*MMIC Surface Mount*

# Power Splitter/Combiner

# NP2G+

2 Way-0° 50Ω 1150 to 1950 MHz

## The Big Deal

- Exceptional amplitude unbalance, 0.05 dB typ. at 1550 MHz
- Good phase unbalance, 0.8 deg. typ.
- Tiny Size, 1.4 mm x 2.0 mm
- Excellent power handling, 1.5W

CASE STYLE: MC2601

## Product Overview

Mini-Circuits' NP2G+ is a MMIC 2-way 0˚ splitter/combiner designed for narrowband operation from 1150 to 1950 MHz supporting many applications requiring high performance across a narrowband frequency range including the GPS, Radar, mobile and radio navigation. This model provides excellent power handling up to 1.5W (as a splitter) with low insertion loss, good isolation, and low phase and amplitude unbalance in a tiny 1.4 x 2.0 mm, 6-Lead MCLP package. Manufactured using Silicon IPD* process technology.

## Key Features

| Feature | Advantages |
|---|---|
| Wide range of applications | One power splitter can be used in the GPS, Radar, mobile and radio navigation. |
| Tiny size, 1.4 x 2.0 mm, 6-Lead MCLP package | Tiny foot print saves space in dense layouts while providing low inductance, repeatable transitions, and excellent thermal contact to the PCB. |
| Good Isolation, 19 dB typ. 1400 to 1650 MHz | Minimizes interference between input ports. |

*IPD (Integrated passive device)

*MMIC Surface Mount*

# Power Splitter/Combiner

# NP2G+

## 2 Way-0° 50Ω 1150 to 1950 MHz

### Features

- Excellent amplitude unbalance, 0.05 dB typ. at 1550 MHz
- Good phase unbalance, 0.8 deg. typ.
- Small size, 1.4mm x 2.0mm
- Aqueous washable

### Applications

- GPS
- Radar
- Mobile
- Radio navigation

CASE STYLE: MC2601

***+RoHS Compliant***

*The +Suffix identifies RoHS Compliance. See our web site for RoHS Compliance methodologies and qualifications*

### Electrical Specifications[1] at 25°C

| Parameter | Frequency (MHz) | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| Frequency Range | | 1150 | | 1950 | MHz |
| Insertion Loss above 3.0 dB | 1150 - 1950<br>1400 - 1650 | —<br>— | 0.4<br>0.3 | 1.1<br>0.9 | dB |
| Isolation | 1150 - 1950<br>1400 - 1650 | 9<br>18 | 20<br>29 | —<br>— | dB |
| Phase Unbalance | 1150 - 1950<br>1400 - 1650 | —<br>— | 0.8<br>0.6 | 4<br>4 | Degree |
| Amplitude Unbalance | 1150 - 1950<br>1400 - 1650 | —<br>— | 0.1<br>0.1 | 0.4<br>0.4 | dB |
| VSWR (Input) | 1150 - 1950<br>1400 - 1650 | —<br>— | 1.3<br>1.2 | —<br>— | dB |
| VSWR (Output) | 1150 - 1950<br>1400 - 1650 | —<br>— | 1.3<br>1.2 | —<br>— | dB |

1. Tested on Mini-Circuits Test Board TB-1059+

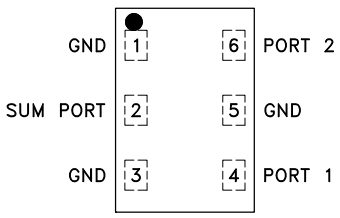
### Maximum Ratings

| Parameter | Ratings |
|---|---|
| Operating Temperature | -40°C to 85°C |
| Storage Temperature | -65°C to 150°C |
| Power Input (as a splitter) | 1.5W at 25°C |
| Internal Dissipation (as a combiner) | 0.75W at 25°C |

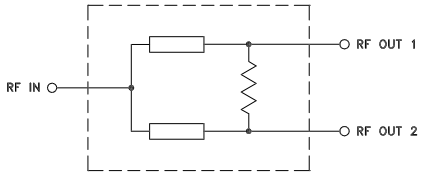
Permanent damage may occur if any of these limits are exceeded

### Pad Connections

| Function | Pad Number |
|---|---|
| SUM PORT | 2 |
| PORT 1 | 4 |
| PORT 2 | 6 |
| GND | 1,3,5 |



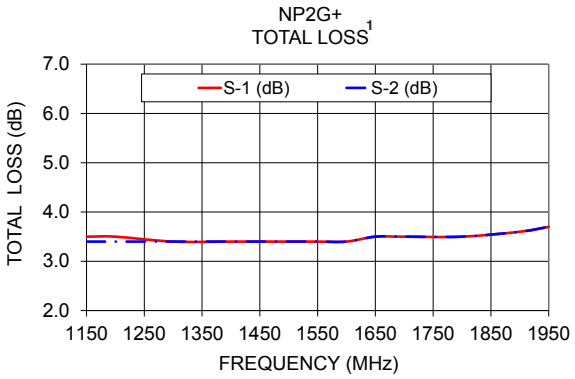

### Simplified Electrical Schematic

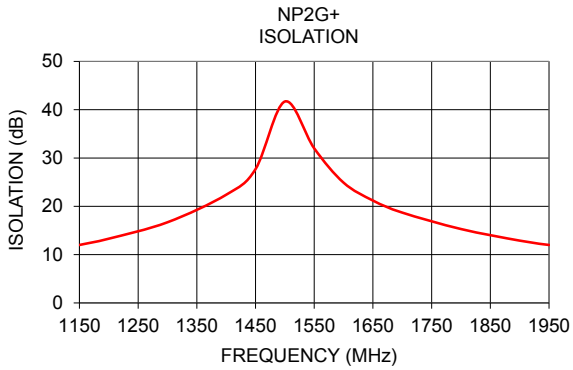


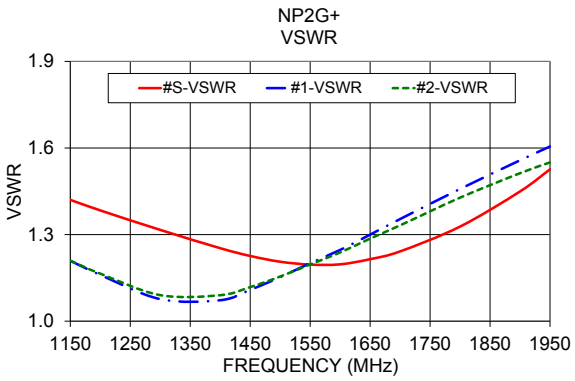
## Typical Performance Data

| Frequency (MHz) | Total Loss[1] (dB) | | Amplitude Unbalance (dB) | Isolation (dB) | Phase Unbalance (deg.) | VSWR S | VSWR 1 | VSWR 2 |
|---|---|---|---|---|---|---|---|---|
| | S-1 | S-2 | | | | | | |
| 1150 | 3.50 | 3.40 | 0.03 | 12.00 | 0.20 | 1.42 | 1.21 | 1.21 |
| 1200 | 3.50 | 3.40 | 0.02 | 13.30 | 0.20 | 1.38 | 1.16 | 1.16 |
| 1300 | 3.40 | 3.40 | 0.02 | 16.70 | 0.20 | 1.32 | 1.08 | 1.09 |
| 1400 | 3.40 | 3.40 | 0.01 | 22.40 | 0.30 | 1.25 | 1.07 | 1.09 |
| 1450 | 3.40 | 3.40 | 0.01 | 27.70 | 0.40 | 1.23 | 1.11 | 1.12 |
| 1500 | 3.40 | 3.40 | 0.01 | 41.70 | 0.40 | 1.21 | 1.15 | 1.15 |
| 1550 | 3.40 | 3.40 | 0.01 | 32.00 | 0.50 | 1.20 | 1.20 | 1.20 |
| 1600 | 3.40 | 3.40 | 0.01 | 24.90 | 0.50 | 1.20 | 1.25 | 1.24 |
| 1650 | 3.50 | 3.50 | 0.01 | 21.20 | 0.60 | 1.21 | 1.30 | 1.29 |
| 1700 | 3.50 | 3.50 | 0.01 | 18.70 | 0.60 | 1.24 | 1.35 | 1.33 |
| 1800 | 3.50 | 3.50 | 0.02 | 15.30 | 0.70 | 1.33 | 1.46 | 1.43 |
| 1900 | 3.60 | 3.60 | 0.05 | 12.90 | 0.80 | 1.45 | 1.56 | 1.51 |
| 1950 | 3.70 | 3.70 | 0.07 | 12.00 | 0.80 | 1.53 | 1.61 | 1.55 |

1. Total Loss = Insertion Loss + 3dB splitter loss.



| Additional Detailed Technical Information<br>*additional information is available on our dash board. To access this information click here* | |
|---|---|
| **Performance Data** | Data Table |
| | Swept Graphs |
| | S-Parameter (S3P Files) Data Set (.zip file) |
| **Case Style** | MC2601 *Plastic package, exposed paddle*<br>*lead finish: Matte Tin* |
| **Tape & Reel**<br>**Standard quantities available on reel** | F104<br>*7" reels with 20, 50, 100, 200, 500, 1000 and 2000 devices* |
| **Suggested Layout for PCB Design** | PL-609 |
| **Evaluation Board** | TB-1059+ |
| **Environmental Ratings** | ENV12 |

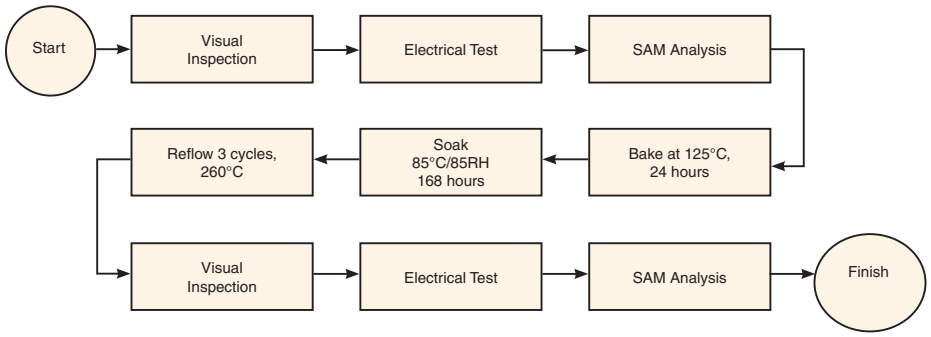
## ESD Rating

Human Body Model (HBM): Class 1 (250 to <500V) in accordance with ANSI/ESD STM 5.1 - 2001

## MCL Rating

Moisture Sensitivity: MSL1 in accordance with IPC/JEDEC J-STD-020D

## MSL Test Flow Chart




### Additional 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

# 2 Way-0° Power Splitter/Combiner NP2G+

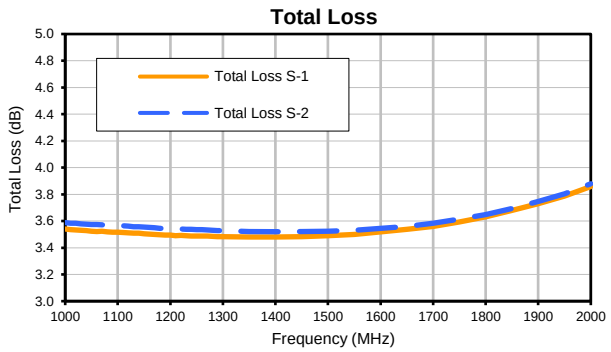
## *Typical Performance Data*

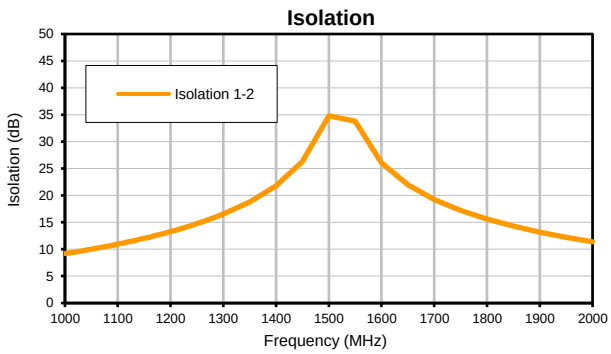
| FREQUENCY (MHz) | TOTAL LOSS[1] (dB) | | AMPLITUDE UNBALANCE (dB) | ISOLATION (dB) | PHASE UNBALANCE (deg.) | FREQUENCY (MHz) | VSWR (:1) | | |
|---|---|---|---|---|---|---|---|---|---|
| | S-1 | S-2 | | 1-2 | | | S | 1 | 2 |
| 1000 | 3.54 | 3.59 | 0.05 | 9.19 | 0.32 | 1000 | 1.50 | 1.32 | 1.34 |
| 1010 | 3.53 | 3.58 | 0.05 | 9.35 | 0.24 | 1010 | 1.50 | 1.32 | 1.33 |
| 1020 | 3.53 | 3.58 | 0.05 | 9.51 | 0.24 | 1020 | 1.49 | 1.31 | 1.32 |
| 1030 | 3.53 | 3.58 | 0.05 | 9.67 | 0.23 | 1030 | 1.48 | 1.30 | 1.31 |
| 1040 | 3.53 | 3.58 | 0.05 | 9.84 | 0.25 | 1040 | 1.47 | 1.29 | 1.30 |
| 1050 | 3.52 | 3.57 | 0.05 | 10.01 | 0.23 | 1050 | 1.47 | 1.28 | 1.29 |
| 1060 | 3.52 | 3.57 | 0.05 | 10.19 | 0.25 | 1060 | 1.46 | 1.27 | 1.28 |
| 1070 | 3.52 | 3.57 | 0.05 | 10.37 | 0.24 | 1070 | 1.45 | 1.26 | 1.27 |
| 1080 | 3.52 | 3.57 | 0.05 | 10.56 | 0.25 | 1080 | 1.45 | 1.25 | 1.27 |
| 1090 | 3.52 | 3.57 | 0.05 | 10.75 | 0.25 | 1090 | 1.44 | 1.24 | 1.26 |
| 1100 | 3.52 | 3.56 | 0.05 | 10.95 | 0.25 | 1100 | 1.43 | 1.23 | 1.25 |
| 1110 | 3.51 | 3.56 | 0.05 | 11.16 | 0.26 | 1110 | 1.42 | 1.23 | 1.24 |
| 1120 | 3.51 | 3.56 | 0.05 | 11.36 | 0.25 | 1120 | 1.42 | 1.22 | 1.23 |
| 1130 | 3.51 | 3.56 | 0.05 | 11.57 | 0.25 | 1130 | 1.41 | 1.21 | 1.22 |
| 1140 | 3.51 | 3.56 | 0.05 | 11.79 | 0.26 | 1140 | 1.40 | 1.20 | 1.22 |
| 1150 | 3.51 | 3.55 | 0.05 | 12.02 | 0.27 | 1150 | 1.39 | 1.19 | 1.21 |
| 1160 | 3.50 | 3.55 | 0.05 | 12.25 | 0.25 | 1160 | 1.39 | 1.18 | 1.20 |
| 1170 | 3.50 | 3.55 | 0.05 | 12.49 | 0.26 | 1170 | 1.38 | 1.17 | 1.19 |
| 1180 | 3.50 | 3.55 | 0.05 | 12.74 | 0.26 | 1180 | 1.37 | 1.16 | 1.18 |
| 1190 | 3.49 | 3.54 | 0.05 | 13.00 | 0.27 | 1190 | 1.37 | 1.15 | 1.17 |
| 1200 | 3.49 | 3.54 | 0.05 | 13.27 | 0.25 | 1200 | 1.36 | 1.15 | 1.17 |
| 1210 | 3.49 | 3.54 | 0.05 | 13.55 | 0.27 | 1210 | 1.35 | 1.14 | 1.16 |
| 1220 | 3.49 | 3.54 | 0.05 | 13.83 | 0.25 | 1220 | 1.34 | 1.13 | 1.15 |
| 1230 | 3.49 | 3.54 | 0.05 | 14.12 | 0.26 | 1230 | 1.34 | 1.12 | 1.14 |
| 1240 | 3.49 | 3.54 | 0.05 | 14.44 | 0.28 | 1240 | 1.33 | 1.12 | 1.14 |
| 1250 | 3.49 | 3.53 | 0.05 | 14.75 | 0.27 | 1250 | 1.32 | 1.11 | 1.13 |
| 1260 | 3.49 | 3.54 | 0.05 | 15.08 | 0.27 | 1260 | 1.31 | 1.10 | 1.12 |
| 1270 | 3.49 | 3.53 | 0.05 | 15.42 | 0.26 | 1270 | 1.31 | 1.09 | 1.11 |
| 1280 | 3.49 | 3.53 | 0.04 | 15.78 | 0.28 | 1280 | 1.30 | 1.09 | 1.11 |
| 1290 | 3.48 | 3.53 | 0.05 | 16.15 | 0.28 | 1290 | 1.29 | 1.08 | 1.10 |
| 1300 | 3.48 | 3.53 | 0.05 | 16.54 | 0.28 | 1300 | 1.29 | 1.08 | 1.09 |
| 1350 | 3.48 | 3.52 | 0.04 | 18.78 | 0.29 | 1350 | 1.25 | 1.06 | 1.07 |
| 1400 | 3.48 | 3.52 | 0.04 | 21.78 | 0.31 | 1400 | 1.22 | 1.06 | 1.06 |
| 1450 | 3.48 | 3.52 | 0.04 | 26.29 | 0.32 | 1450 | 1.20 | 1.09 | 1.07 |
| 1500 | 3.49 | 3.52 | 0.03 | 34.80 | 0.34 | 1500 | 1.18 | 1.12 | 1.10 |
| 1550 | 3.50 | 3.53 | 0.03 | 33.83 | 0.38 | 1550 | 1.17 | 1.15 | 1.13 |
| 1600 | 3.52 | 3.54 | 0.03 | 26.08 | 0.44 | 1600 | 1.18 | 1.19 | 1.16 |
| 1650 | 3.54 | 3.56 | 0.02 | 21.94 | 0.48 | 1650 | 1.20 | 1.23 | 1.20 |
| 1700 | 3.56 | 3.58 | 0.02 | 19.24 | 0.51 | 1700 | 1.23 | 1.26 | 1.23 |
| 1750 | 3.59 | 3.61 | 0.02 | 17.21 | 0.56 | 1750 | 1.28 | 1.30 | 1.27 |
| 1800 | 3.63 | 3.65 | 0.02 | 15.61 | 0.62 | 1800 | 1.33 | 1.33 | 1.30 |
| 1850 | 3.68 | 3.69 | 0.02 | 14.28 | 0.67 | 1850 | 1.39 | 1.37 | 1.34 |
| 1900 | 3.73 | 3.75 | 0.02 | 13.17 | 0.74 | 1900 | 1.45 | 1.40 | 1.37 |
| 1950 | 3.79 | 3.80 | 0.02 | 12.21 | 0.82 | 1950 | 1.53 | 1.43 | 1.41 |
| 2000 | 3.86 | 3.88 | 0.02 | 11.37 | 0.89 | 2000 | 1.61 | 1.46 | 1.44 |

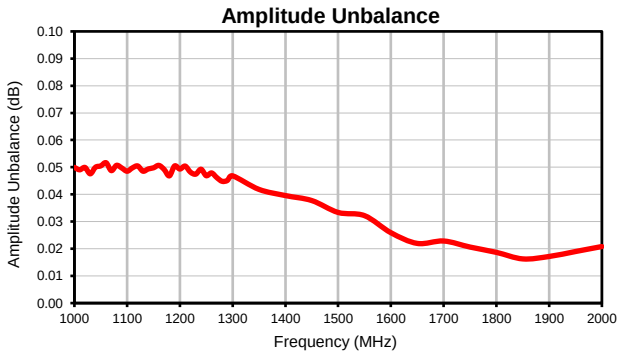
[1]Total Loss = Insertion Loss + 3dB Splitter Loss

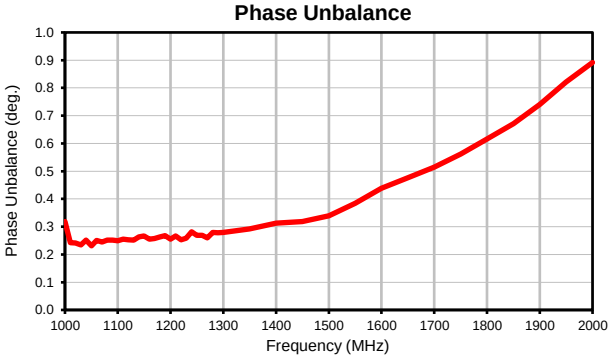
# 2 Way-0° Power Splitter/Combiner NP2G+

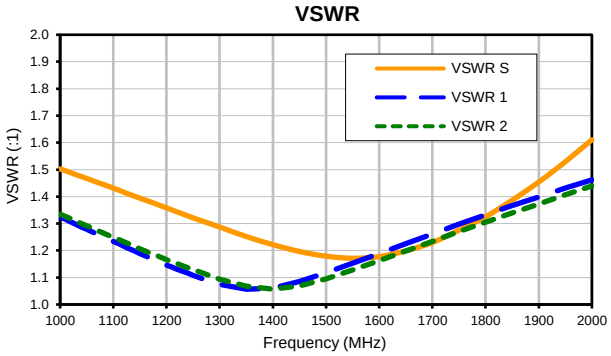
*Typical Performance Curves*



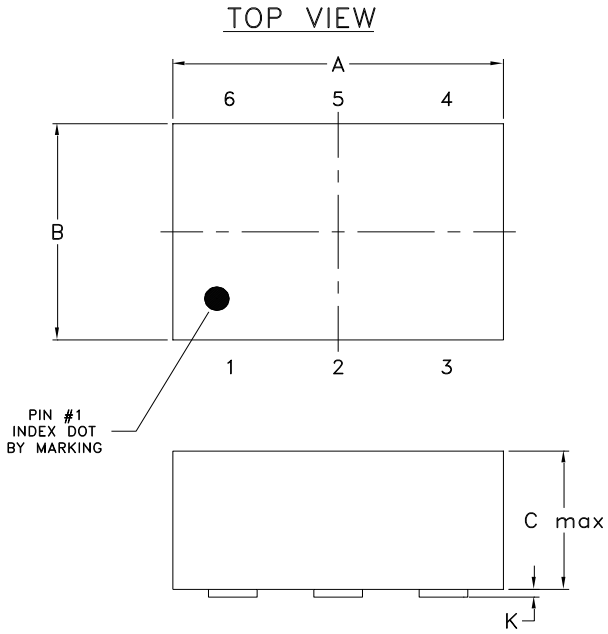



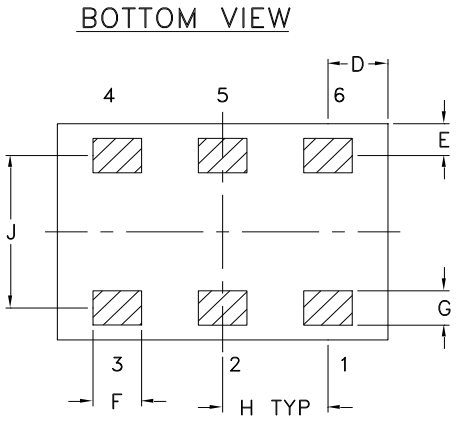



# Case Style MC

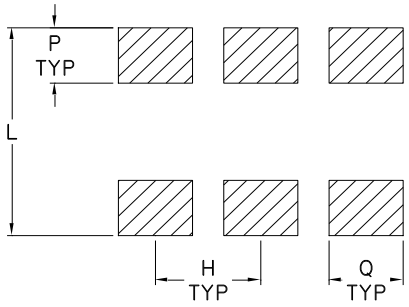
**MC2601**

## Outline Dimensions




## PCB Land Pattern




Suggested Layout,
Tolerance to be within ±.002

| CASE #. | A | B | C | D | E | F | G | H | J | K | L | M | N | P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MC2601 | .080 (2.040) | .055 (1.390) | .035 (0.90) | .015 (0.370) | .008 0.205 | .012 (0.300) | .009 (0.220) | .026 (0.650) | .039 (0.980) | .002 (0.050) | .053 (1.336) | - - | - - | .014 (0.356) |

| CASE #. | Q | R | WT, GRAM |
|---|---|---|---|
| MC2601 | .018 (0.457) | - - | .006 |

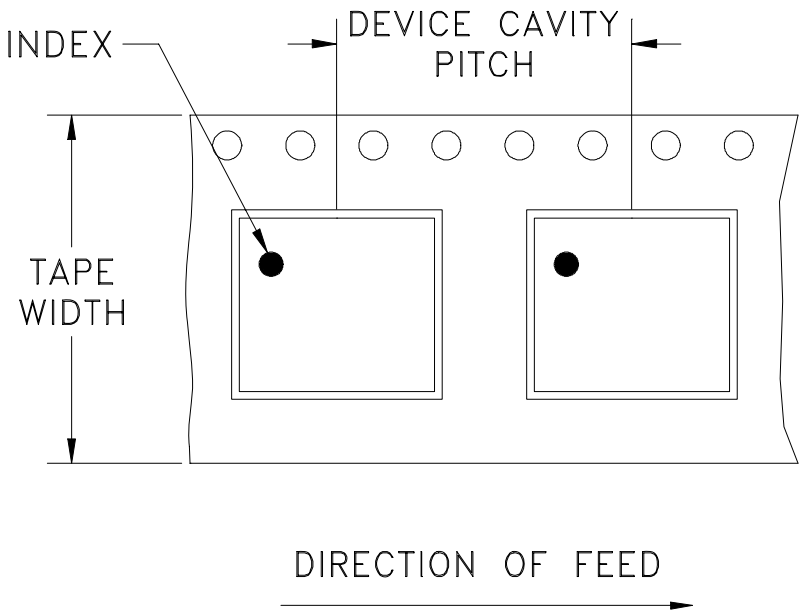
**Dimensions are in inches (mm). Tolerances: 2 Pl. ± .01; 3 Pl. ± .005**

**Notes:**

1. Case material: Plastic.
2. Termination finish:
   For RoHS Case Styles: Matte Tin plate. All models, (+) suffix.
3. The terminal #1 identifier may be either a molded or marked feature.
   The terminal #1 identifier must be located in the zone indicated.

# Tape & Reel Packaging TR-F104

DEVICE ORIENTATION IN T&R




| 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 |
| | | 7 | Standard | 2000 |

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.

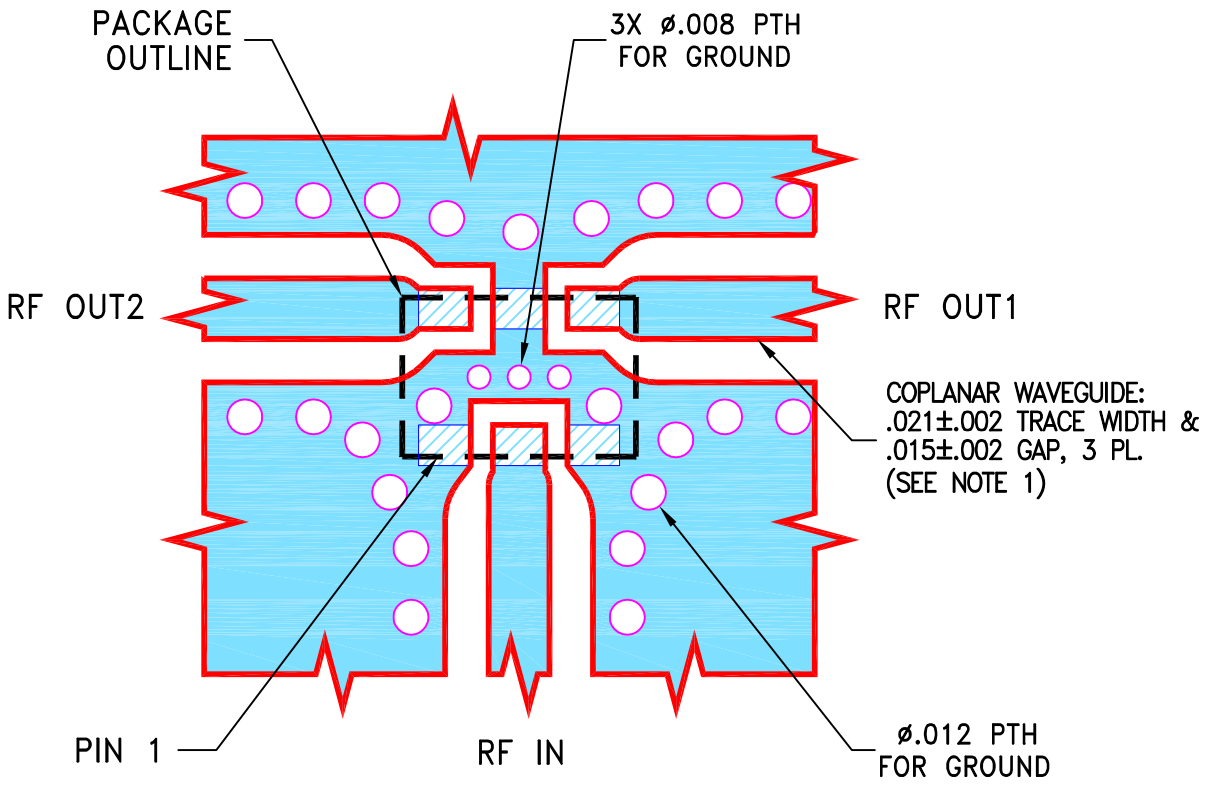
Go to: www.minicircuits.com/pages/pdfs/tape.pdf

Mini-Circuits®
INTERNET http://www.minicircuits.com
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers NORTH AMERICA 800-654-7949 • 417-335-5935 • Fax 417-335-5945 • EUROPE 44-1252-832600 • Fax 44-1252-837010
Mini-Circuits ISO 9001 & ISO 14001 Certified

THIRD ANGLE PROJECTION

| REVISIONS | | | | | |
|---|---|---|---|---|---|
| REV | ECN No. | DESCRIPTION | DATE | DR | AUTH |
| OR | M169871 | NEW RELEASE | 09/06/18 | ITG | RS |

## SUGGESTED MOUNTING CONFIGURATION
## FOR MC2601 CASE STYLE, "06SP14" PIN CODE




NOTES:
1. TRACE WIDTH AND GAP ARE SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS .010±.001. COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH AND 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 |
|---|---|---|---|
| DIMENSIONS ARE IN INCHES | DRAWN | ITG | 09/06/18 |
| TOLERANCES ON: | CHECKED | GF | 09/06/18 |
| 2 PL DECIMALS ± | APPROVED | RS | 09/06/18 |
| 3 PL DECIMALS ± .005 | | | |
| ANGLES ± | | | |
| FRACTIONS ± | | | |



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

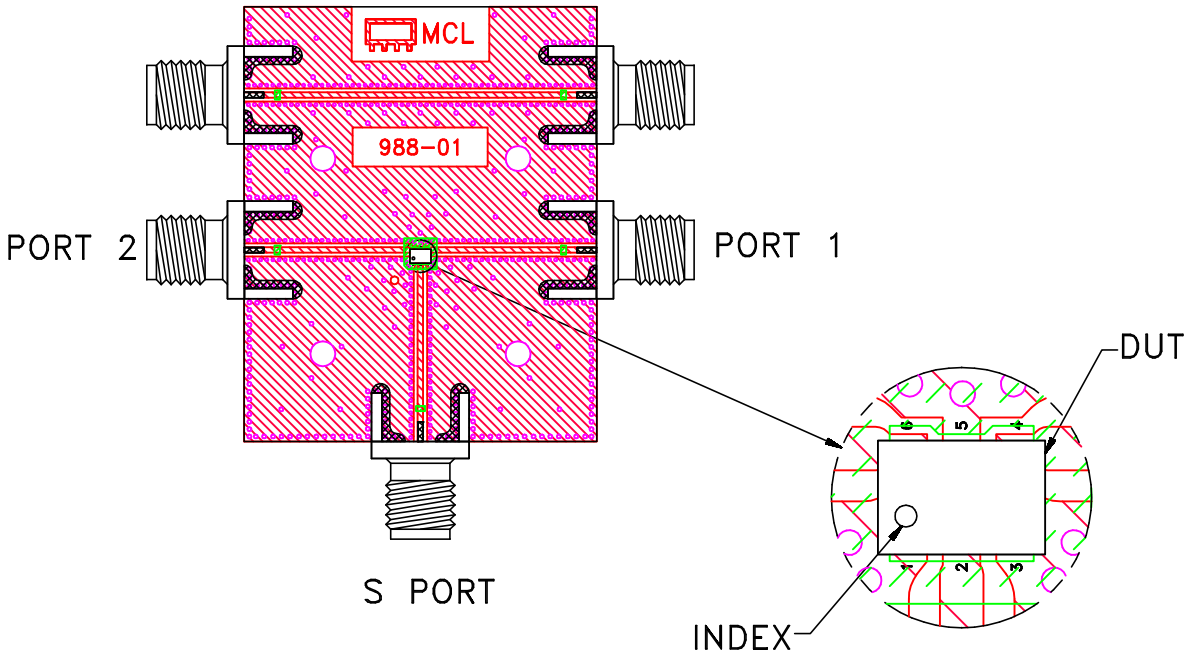
Mini-Circuits® 13 Neptune Avenue Brooklyn NY 11235

PL, 06SP14, MC2601, TB-1059+

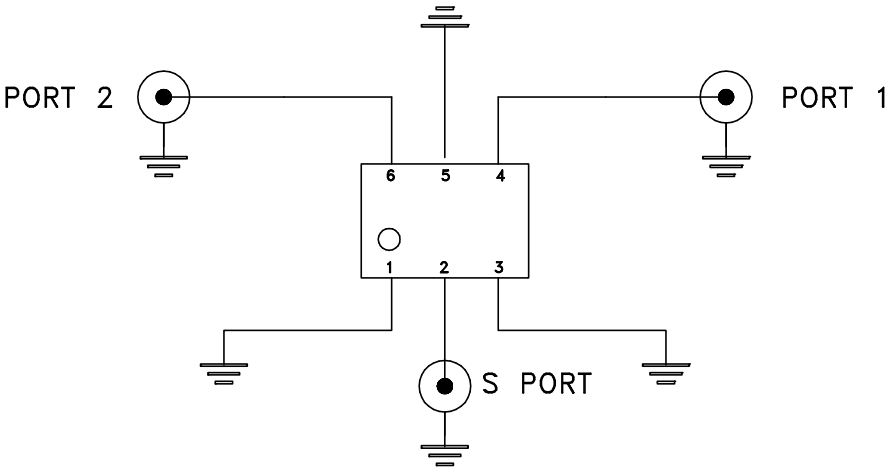
| SIZE | CODE IDENT | DRAWING NO: | REV: |
|---|---|---|---|
| A | 15542 | 98-PL-609 | OR |

| FILE: | SCALE: | SHEET: |
|---|---|---|
| 98PL609 | 15:1 | 1 OF 1 |

# Evaluation Board and Circuit




TB-1059+




Schematic Diagram

Notes:

1. 50 Ohm 2.40mm Female end launch connectors.
2. PCB Material: RO4350 or equivalent,
   Dielectric Constant=3.5, Thickness=.010 inch.

Mini-Circuits®

Mini-Circuits

# Environmental Specifications ENV12

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 | -65° to 150° C<br>Ambient Environment | Individual Model Data Sheet |
| Autoclave | 15 psig, 100% RH, 121°C, 96 hours | JESD22-A102-C, Condition C |
| Temperature Cycling | -65° to 150°C, 100 cycles | JESD22-A104 |
| Temperature Humidity | 85°C/ 85% RH, 168 hours | JESD22-113 |
| Solder Reflow Heat | Sn-Pb Eutetic Process: 240°C peak<br>Pb-Free Process: 260°C peak | J-STD-020, Table 4-1, 4-2 and 5-2; Figure 5-1 |
| Moisture Sensitivity: Level 1 | Bake at 125°C for 24 hours<br>Soak at 85°C/85% RH for 168 hours, Reflow 3 cycles at 240°C peak (Non-RoHS) or 260°C (RoHS) | J-STD-020 |
| Solderability | 10X magnification, 95% coverage | JESD22-B102, Method 1: Dip and Look Test |
| Mechanical Shock | 50g, 11 ms, 1/2-sine, 18 shocks: 3 each direction, each of 3 axes | MIL-STD-202, Method 213, Condition A |
| 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 |