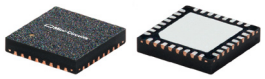
MMIC SURFACE MOUNT

# Power Splitter/Combiner EP4KA+

4 Way-0° 50Ω 10.7 to 31 GHz

## THE BIG DEAL

- Wide Bandwidth, 10.7 to 31 GHz
- Excellent Isolation, 20 dB Typ. at 21 GHz
- Excellent Amplitude Unbalance, 0.2 dB Typ. at 21 GHz
- Small Size, 5x5 mm
- Aqueous Washable



*Generic photo used for illustration purposes only*

CASE STYLE: DG1677-2

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

## APPLICATIONS

- Instrumentation
- Radar
- Satellite Communications
- 5G

## PRODUCT OVERVIEW

Mini-Circuits' EP4KA+ is a MMIC 4-way 0° splitter/combiner designed for wideband operation from 10.7 to 31 GHz supporting many applications requiring high performance across a wide frequency range including LTE bands through phased array radars, 5G, as well as instrumentation and more. This model provides good isolation, and low phase and amplitude unbalance in a small 5x5 mm QFN package. Manufactured using GaAs IPD technology, the EP4KA+ not only provides repeatable performance, but also a high level of ESD protection.

## KEY FEATURES

| Feature | Advantages |
|---|---|
| Wideband, 10.7 to 31 GHz | One power splitter can be used for wideband applications such as 5G, phased array radars, military and instrumentation. |
| Excellent Amplitude and Phase Unbalance:<br>Amplitude Unbalance, 0.2 dB Typ. at 21 GHz<br>Phase Unbalance, 4.7° Typ. at 21 GHz | Ideal for applications such as MIMO & phased array radars. |
| DC Passing | DC current passing is helpful in applications where both RF & DC need to pass through the DUT, such as antenna mounted hardware. |
| Small Size, 5x5 mm QFN Package | Tiny footprint saves space in dense layouts while providing low inductance, repeatable transitions, and excellent thermal contact to the PCB. |

REV. B
ECO-012188
EP4KA+
MCL NY
250904

# Power Splitter/Combiner EP4KA+

## ELECTRICAL SPECIFICATIONS[1] AT +25°C

| Parameter | | Frequency (GHz) | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Frequency Range | | | 10.7 | | 31 | GHz |
| Insertion Loss Above 6.0 dB | | 10.7-13<br>13-22<br>22-31 | | 0.4<br>0.6<br>1.1 | 2.1<br>2.4<br>2.6 | dB |
| Isolation | | 10.7-13<br>13-22<br>22-31 | 9<br>11<br>14 | 13.1<br>19.3<br>21.5 | | dB |
| Phase Unbalance | | 10.7-13<br>13-22<br>22-31 | | 2.7<br>4.7<br>7.8 | | Degree |
| Amplitude Unbalance | | 10.7-13<br>13-22<br>22-31 | | 0.3<br>0.2<br>0.2 | 0.8<br>0.8<br>0.9 | dB |
| VSWR (Port S) | | 10.7-13<br>13-22<br>22-31 | | 1.2<br>1.3<br>1.2 | | :1 |
| VSWR (Port 1-4) | | 10.7-13<br>13-22<br>22-31 | | 1.4<br>1.3<br>1.2 | | :1 |
| Power Handling | As a Splitter | 10.7-31 | | | 0.6 | W |
| | Per Port as a Combiner | 10.7-31 | | | 0.6 | |

1. Tested on Mini-Circuits Test Board TB-EP4KAC+.

## ABSOLUTE MAXIMUM RATINGS

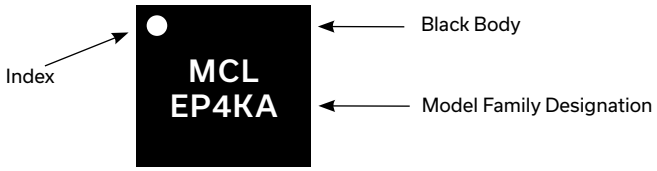
| Parameter | Ratings |
|---|---|
| Operating Temperature | -55°C to +105°C |
| Storage Temperature | -65°C to +150°C |
| DC Current | 100 mA |

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

## PAD CONNECTIONS

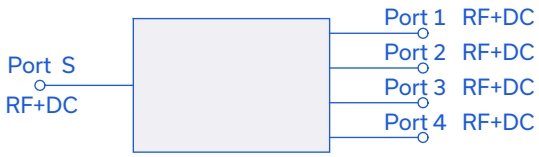
| Function | Pad Number |
|---|---|
| SUM PORT | 21 |
| PORT 1 | 14 |
| PORT 2 | 10 |
| PORT 3 | 31 |
| PORT 4 | 27 |
| GROUND | 9,11,13,15,20,22,26,28,30,32 and Paddle |
| NOT USED, GROUND EXTERNALLY | 1-8, 12, 16-19, 23-25, 29 |

## PRODUCT MARKING




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

## SIMPLIFIED ELECTRICAL SCHEMATIC



# Power Splitter/Combiner EP4KA+

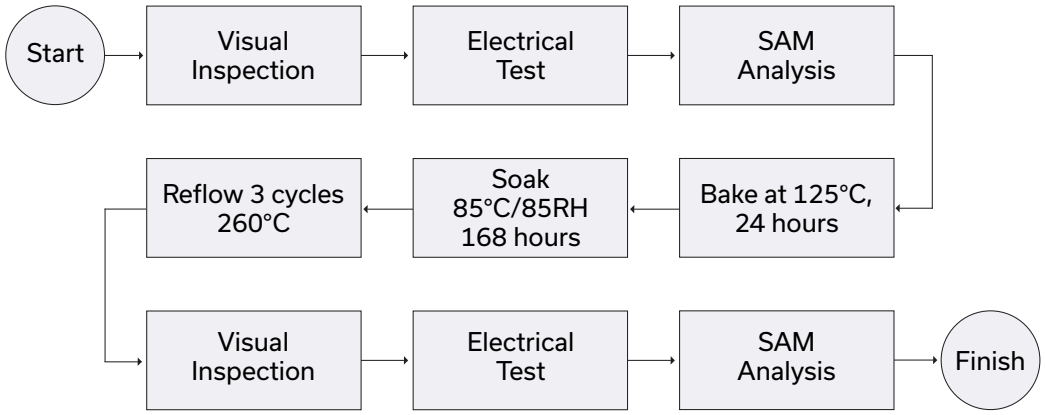
## ADDITIONAL DETAILED TECHNICAL INFORMATION IS AVAILABLE ON OUR DASHBOARD. TO ACCESS CLICK HERE

| | |
|---|---|
| **Performance Data** | Data Table<br><br>Swept Graphs<br><br>S-Parameter (S3P Files) Data Set (.zip file) |
| **Case Style** | DG1677-2 Plastic package, exposed paddle; Lead Finish: Matte Tin |
| **Tape & Reel**<br>**Standard Quantities Available on Reel** | F68<br>7" Reels with 20, 50, 100, 200, 500 & 1000 devices<br>13" Reels with 2000, 3000 & 4000 devices |
| **Suggested Layout for PCB Design** | PL-649 |
| **Evaluation Board** | TB-EP4KA+ (Without connectors)<br>TB-EP4KAC+ (With connectors) |
| **Environmental Ratings** | ENV08T1 |

## ESD RATING

Human Body Model (HBM): Class 2 (Pass 2000 V) in accordance with ANSI/ESD STM 5.1 - 2001

## MSL TEST FLOW CHART




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

# 4 Way-0° Power Splitter/Combiner

**EP4KA+**

*Typical Performance Data*

TEST CONDITIONS: Input Power = -10dBm @Temperature = +25°C

| FREQ. (MHz) | TOTAL LOSS[1] (dB) | | | | AMP. UNBAL. (dB) | PHASE UNBAL. (deg.) | ISOLATION (dB) | | | VSWR (:1) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | S-1 | S-2 | S-3 | S-4 | | | 1-2 | 2-3 | 3-4 | S | 1 | 2 | 3 | 4 |
| 10700 | 6.52 | 6.57 | 6.31 | 6.31 | 0.27 | 4.83 | 19.58 | 11.80 | 19.40 | 1.24 | 1.48 | 1.47 | 1.43 | 1.57 |
| 10800 | 6.52 | 6.56 | 6.32 | 6.30 | 0.26 | 4.84 | 19.69 | 11.88 | 19.52 | 1.25 | 1.47 | 1.44 | 1.42 | 1.54 |
| 11000 | 6.52 | 6.53 | 6.36 | 6.32 | 0.21 | 4.91 | 19.81 | 12.03 | 19.67 | 1.24 | 1.42 | 1.41 | 1.40 | 1.51 |
| 11500 | 6.56 | 6.51 | 6.49 | 6.39 | 0.17 | 5.35 | 19.87 | 12.50 | 19.84 | 1.32 | 1.32 | 1.29 | 1.32 | 1.40 |
| 12000 | 6.62 | 6.58 | 6.54 | 6.43 | 0.19 | 5.91 | 19.82 | 13.24 | 19.79 | 1.38 | 1.24 | 1.24 | 1.27 | 1.29 |
| 12500 | 6.62 | 6.61 | 6.49 | 6.40 | 0.22 | 6.13 | 19.86 | 14.35 | 19.77 | 1.33 | 1.22 | 1.28 | 1.29 | 1.22 |
| 13000 | 6.68 | 6.57 | 6.45 | 6.40 | 0.27 | 6.17 | 20.29 | 15.52 | 20.08 | 1.30 | 1.32 | 1.39 | 1.39 | 1.27 |
| 13500 | 6.77 | 6.57 | 6.50 | 6.48 | 0.28 | 6.05 | 21.30 | 16.21 | 21.04 | 1.39 | 1.45 | 1.53 | 1.51 | 1.42 |
| 14000 | 6.78 | 6.61 | 6.50 | 6.49 | 0.29 | 5.91 | 22.67 | 16.38 | 22.40 | 1.37 | 1.53 | 1.58 | 1.55 | 1.51 |
| 14500 | 6.74 | 6.65 | 6.48 | 6.49 | 0.26 | 5.75 | 23.57 | 16.61 | 23.36 | 1.26 | 1.51 | 1.55 | 1.48 | 1.48 |
| 15000 | 6.75 | 6.67 | 6.56 | 6.57 | 0.19 | 5.89 | 23.33 | 17.29 | 23.22 | 1.28 | 1.41 | 1.46 | 1.40 | 1.43 |
| 15500 | 6.77 | 6.64 | 6.61 | 6.63 | 0.15 | 6.21 | 22.67 | 18.34 | 22.62 | 1.39 | 1.26 | 1.34 | 1.29 | 1.33 |
| 16000 | 6.70 | 6.56 | 6.56 | 6.58 | 0.14 | 6.63 | 22.51 | 19.23 | 22.50 | 1.39 | 1.10 | 1.17 | 1.16 | 1.16 |
| 16500 | 6.75 | 6.61 | 6.59 | 6.62 | 0.16 | 7.01 | 23.43 | 19.15 | 23.37 | 1.47 | 1.12 | 1.13 | 1.19 | 1.09 |
| 17000 | 7.01 | 6.83 | 6.81 | 6.84 | 0.20 | 7.27 | 25.45 | 18.65 | 25.34 | 1.66 | 1.33 | 1.34 | 1.35 | 1.27 |
| 17500 | 7.16 | 6.94 | 6.93 | 6.97 | 0.24 | 7.26 | 28.37 | 18.52 | 28.24 | 1.66 | 1.47 | 1.49 | 1.46 | 1.42 |
| 18000 | 7.02 | 6.85 | 6.81 | 6.85 | 0.21 | 7.32 | 31.00 | 18.97 | 31.00 | 1.44 | 1.48 | 1.54 | 1.46 | 1.46 |
| 18500 | 6.84 | 6.70 | 6.66 | 6.67 | 0.19 | 7.49 | 30.76 | 19.89 | 30.74 | 1.25 | 1.41 | 1.51 | 1.41 | 1.42 |
| 19000 | 6.79 | 6.64 | 6.64 | 6.64 | 0.15 | 7.63 | 29.33 | 20.80 | 29.26 | 1.28 | 1.33 | 1.41 | 1.32 | 1.33 |
| 19500 | 6.79 | 6.67 | 6.67 | 6.67 | 0.12 | 7.86 | 29.14 | 20.94 | 29.03 | 1.28 | 1.19 | 1.26 | 1.17 | 1.18 |
| 20000 | 6.88 | 6.80 | 6.76 | 6.76 | 0.11 | 8.11 | 30.87 | 20.42 | 30.69 | 1.34 | 1.01 | 1.07 | 1.01 | 1.02 |
| 20500 | 7.06 | 6.96 | 6.93 | 6.95 | 0.13 | 8.35 | 34.62 | 20.10 | 34.57 | 1.53 | 1.17 | 1.16 | 1.16 | 1.18 |
| 21000 | 7.14 | 6.95 | 7.00 | 7.03 | 0.19 | 8.56 | 42.83 | 20.26 | 43.16 | 1.58 | 1.34 | 1.33 | 1.28 | 1.34 |
| 21500 | 7.07 | 6.82 | 6.92 | 6.95 | 0.25 | 8.80 | 44.81 | 20.90 | 45.27 | 1.41 | 1.45 | 1.43 | 1.35 | 1.44 |
| 22000 | 6.99 | 6.79 | 6.84 | 6.88 | 0.20 | 9.34 | 37.59 | 21.78 | 37.55 | 1.20 | 1.49 | 1.48 | 1.38 | 1.48 |
| 22500 | 6.99 | 6.84 | 6.84 | 6.88 | 0.14 | 9.49 | 35.32 | 22.54 | 35.10 | 1.20 | 1.50 | 1.49 | 1.40 | 1.51 |
| 23000 | 7.01 | 6.87 | 6.87 | 6.92 | 0.14 | 9.49 | 34.92 | 22.79 | 34.81 | 1.27 | 1.49 | 1.42 | 1.39 | 1.50 |
| 23500 | 6.96 | 6.83 | 6.87 | 6.90 | 0.13 | 9.85 | 35.66 | 22.56 | 35.66 | 1.21 | 1.39 | 1.34 | 1.30 | 1.42 |
| 24000 | 6.86 | 6.79 | 6.86 | 6.85 | 0.08 | 10.25 | 37.41 | 22.11 | 37.58 | 1.07 | 1.24 | 1.21 | 1.20 | 1.31 |
| 24500 | 6.84 | 6.81 | 6.90 | 6.85 | 0.09 | 10.56 | 38.06 | 21.73 | 38.40 | 1.10 | 1.15 | 1.14 | 1.12 | 1.21 |
| 25000 | 6.85 | 6.83 | 6.96 | 6.87 | 0.13 | 10.75 | 36.20 | 21.56 | 36.23 | 1.20 | 1.09 | 1.11 | 1.11 | 1.13 |
| 25500 | 6.89 | 6.85 | 7.01 | 6.88 | 0.16 | 11.05 | 33.97 | 21.77 | 33.87 | 1.20 | 1.08 | 1.12 | 1.13 | 1.06 |
| 26000 | 6.91 | 6.87 | 7.02 | 6.87 | 0.16 | 11.26 | 32.73 | 22.01 | 32.81 | 1.10 | 1.12 | 1.15 | 1.16 | 1.04 |
| 26500 | 6.95 | 6.89 | 7.02 | 6.89 | 0.14 | 11.31 | 33.03 | 21.96 | 33.11 | 1.06 | 1.17 | 1.20 | 1.18 | 1.11 |
| 27000 | 6.98 | 6.89 | 7.03 | 6.93 | 0.15 | 11.42 | 35.24 | 21.21 | 35.50 | 1.16 | 1.18 | 1.20 | 1.18 | 1.18 |
| 27500 | 6.97 | 6.87 | 7.04 | 6.94 | 0.17 | 11.59 | 39.47 | 20.22 | 39.99 | 1.21 | 1.14 | 1.12 | 1.11 | 1.17 |
| 28000 | 7.08 | 7.00 | 7.19 | 7.09 | 0.19 | 11.91 | 38.49 | 19.42 | 38.75 | 1.38 | 1.19 | 1.11 | 1.09 | 1.14 |
| 28500 | 7.36 | 7.32 | 7.51 | 7.38 | 0.20 | 12.55 | 33.08 | 19.22 | 33.13 | 1.64 | 1.31 | 1.26 | 1.20 | 1.20 |
| 29000 | 7.59 | 7.59 | 7.77 | 7.57 | 0.20 | 12.92 | 30.40 | 19.55 | 30.52 | 1.73 | 1.43 | 1.43 | 1.35 | 1.32 |
| 29500 | 7.57 | 7.55 | 7.72 | 7.50 | 0.22 | 13.33 | 29.12 | 20.21 | 29.13 | 1.55 | 1.55 | 1.60 | 1.48 | 1.42 |
| 30000 | 7.44 | 7.33 | 7.51 | 7.33 | 0.18 | 13.48 | 28.71 | 20.79 | 28.79 | 1.28 | 1.61 | 1.71 | 1.58 | 1.49 |
| 30500 | 7.44 | 7.22 | 7.42 | 7.28 | 0.23 | 13.30 | 28.85 | 20.90 | 28.76 | 1.26 | 1.71 | 1.79 | 1.66 | 1.57 |
| 31000 | 7.46 | 7.23 | 7.40 | 7.32 | 0.24 | 13.27 | 28.28 | 20.59 | 28.28 | 1.32 | 1.65 | 1.73 | 1.62 | 1.57 |
| 31500 | 7.46 | 7.22 | 7.42 | 7.33 | 0.24 | 13.14 | 26.31 | 20.67 | 26.35 | 1.21 | 1.52 | 1.59 | 1.52 | 1.49 |
| 32000 | 7.50 | 7.22 | 7.58 | 7.40 | 0.36 | 13.32 | 24.14 | 21.52 | 24.27 | 1.18 | 1.38 | 1.41 | 1.38 | 1.37 |

[1] Total Loss = Insertion Loss + 6dB Splitter Loss

*Typical Performance Data*

TEST CONDITIONS: Input Power = -10dBm @Temperature = -55°C

| FREQ. (MHz) | TOTAL LOSS[1] (dB) | | | | AMP. UNBAL. (dB) | PHASE UNBAL. (deg.) | ISOLATION (dB) | | | VSWR (:1) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | S-1 | S-2 | S-3 | S-4 | | | 1-2 | 2-3 | 3-4 | S | 1 | 2 | 3 | 4 |
| 10700 | 6.29 | 6.44 | 6.04 | 6.01 | 0.44 | 4.66 | 19.65 | 11.51 | 19.06 | 1.26 | 1.50 | 1.49 | 1.46 | 1.60 |
| 10800 | 6.28 | 6.44 | 6.04 | 6.00 | 0.44 | 4.49 | 19.76 | 11.58 | 19.19 | 1.26 | 1.49 | 1.47 | 1.45 | 1.58 |
| 11000 | 6.28 | 6.41 | 6.07 | 6.00 | 0.41 | 4.55 | 19.91 | 11.72 | 19.39 | 1.25 | 1.45 | 1.44 | 1.43 | 1.56 |
| 11500 | 6.31 | 6.37 | 6.18 | 6.05 | 0.32 | 4.94 | 20.03 | 12.13 | 19.59 | 1.32 | 1.34 | 1.31 | 1.35 | 1.45 |
| 12000 | 6.38 | 6.43 | 6.25 | 6.11 | 0.31 | 5.48 | 19.93 | 12.79 | 19.48 | 1.41 | 1.25 | 1.24 | 1.27 | 1.31 |
| 12500 | 6.38 | 6.46 | 6.20 | 6.08 | 0.38 | 5.69 | 19.90 | 13.86 | 19.39 | 1.37 | 1.21 | 1.25 | 1.28 | 1.21 |
| 13000 | 6.39 | 6.41 | 6.12 | 6.04 | 0.37 | 5.69 | 20.25 | 15.11 | 19.63 | 1.31 | 1.30 | 1.36 | 1.37 | 1.26 |
| 13500 | 6.47 | 6.40 | 6.17 | 6.11 | 0.36 | 5.55 | 21.22 | 15.90 | 20.52 | 1.41 | 1.45 | 1.52 | 1.52 | 1.41 |
| 14000 | 6.51 | 6.44 | 6.17 | 6.13 | 0.38 | 5.73 | 22.65 | 16.05 | 21.91 | 1.43 | 1.54 | 1.60 | 1.59 | 1.53 |
| 14500 | 6.46 | 6.47 | 6.13 | 6.11 | 0.36 | 5.76 | 23.74 | 16.17 | 23.07 | 1.29 | 1.53 | 1.58 | 1.53 | 1.53 |
| 15000 | 6.44 | 6.49 | 6.19 | 6.16 | 0.34 | 5.51 | 23.56 | 16.79 | 22.99 | 1.27 | 1.44 | 1.49 | 1.43 | 1.46 |
| 15500 | 6.45 | 6.45 | 6.24 | 6.21 | 0.24 | 5.61 | 22.78 | 17.85 | 22.28 | 1.40 | 1.29 | 1.36 | 1.32 | 1.36 |
| 16000 | 6.38 | 6.34 | 6.19 | 6.16 | 0.22 | 6.24 | 22.46 | 18.85 | 21.99 | 1.42 | 1.12 | 1.19 | 1.17 | 1.19 |
| 16500 | 6.41 | 6.37 | 6.18 | 6.17 | 0.23 | 6.81 | 23.23 | 18.88 | 22.69 | 1.47 | 1.10 | 1.11 | 1.17 | 1.07 |
| 17000 | 6.65 | 6.61 | 6.40 | 6.38 | 0.27 | 7.02 | 25.17 | 18.31 | 24.57 | 1.69 | 1.32 | 1.32 | 1.35 | 1.26 |
| 17500 | 6.83 | 6.75 | 6.53 | 6.53 | 0.30 | 7.26 | 28.12 | 18.08 | 27.50 | 1.74 | 1.47 | 1.49 | 1.48 | 1.43 |
| 18000 | 6.69 | 6.64 | 6.42 | 6.41 | 0.28 | 7.60 | 31.01 | 18.44 | 30.42 | 1.53 | 1.49 | 1.55 | 1.49 | 1.48 |
| 18500 | 6.48 | 6.46 | 6.23 | 6.21 | 0.27 | 7.84 | 31.11 | 19.31 | 30.52 | 1.29 | 1.42 | 1.53 | 1.44 | 1.44 |
| 19000 | 6.41 | 6.40 | 6.19 | 6.16 | 0.26 | 8.00 | 29.52 | 20.29 | 28.97 | 1.28 | 1.35 | 1.45 | 1.35 | 1.36 |
| 19500 | 6.40 | 6.42 | 6.22 | 6.17 | 0.24 | 8.33 | 29.01 | 20.57 | 28.45 | 1.30 | 1.21 | 1.29 | 1.21 | 1.22 |
| 20000 | 6.46 | 6.52 | 6.28 | 6.24 | 0.28 | 8.46 | 30.38 | 20.07 | 29.75 | 1.33 | 1.04 | 1.09 | 1.03 | 1.04 |
| 20500 | 6.62 | 6.68 | 6.44 | 6.41 | 0.28 | 8.28 | 33.68 | 19.64 | 33.08 | 1.54 | 1.15 | 1.14 | 1.14 | 1.16 |
| 21000 | 6.73 | 6.72 | 6.54 | 6.52 | 0.21 | 8.29 | 41.06 | 19.67 | 40.35 | 1.66 | 1.32 | 1.32 | 1.28 | 1.34 |
| 21500 | 6.67 | 6.58 | 6.46 | 6.45 | 0.22 | 8.96 | 48.17 | 20.23 | 48.81 | 1.50 | 1.45 | 1.44 | 1.37 | 1.45 |
| 22000 | 6.57 | 6.51 | 6.35 | 6.35 | 0.22 | 9.69 | 38.03 | 21.12 | 37.75 | 1.25 | 1.48 | 1.50 | 1.41 | 1.51 |
| 22500 | 6.54 | 6.55 | 6.34 | 6.33 | 0.22 | 9.96 | 35.22 | 22.00 | 34.65 | 1.21 | 1.51 | 1.52 | 1.43 | 1.54 |
| 23000 | 6.55 | 6.59 | 6.36 | 6.36 | 0.24 | 9.84 | 34.59 | 22.38 | 34.04 | 1.30 | 1.51 | 1.46 | 1.43 | 1.54 |
| 23500 | 6.50 | 6.55 | 6.35 | 6.34 | 0.22 | 10.10 | 35.42 | 22.15 | 34.94 | 1.25 | 1.42 | 1.38 | 1.35 | 1.47 |
| 24000 | 6.38 | 6.48 | 6.32 | 6.28 | 0.20 | 10.60 | 37.46 | 21.65 | 37.00 | 1.10 | 1.26 | 1.24 | 1.24 | 1.36 |
| 24500 | 6.34 | 6.49 | 6.33 | 6.25 | 0.24 | 10.94 | 38.49 | 21.22 | 38.17 | 1.07 | 1.17 | 1.15 | 1.14 | 1.25 |
| 25000 | 6.34 | 6.51 | 6.39 | 6.26 | 0.26 | 11.12 | 36.43 | 21.02 | 36.01 | 1.19 | 1.09 | 1.11 | 1.11 | 1.16 |
| 25500 | 6.36 | 6.52 | 6.43 | 6.26 | 0.26 | 11.26 | 33.96 | 21.21 | 33.60 | 1.21 | 1.07 | 1.12 | 1.12 | 1.07 |
| 26000 | 6.38 | 6.52 | 6.44 | 6.24 | 0.27 | 11.45 | 32.60 | 21.48 | 32.33 | 1.12 | 1.10 | 1.14 | 1.16 | 1.03 |
| 26500 | 6.40 | 6.53 | 6.43 | 6.25 | 0.29 | 11.48 | 32.73 | 21.54 | 32.33 | 1.04 | 1.16 | 1.19 | 1.19 | 1.10 |
| 27000 | 6.41 | 6.53 | 6.43 | 6.27 | 0.26 | 11.49 | 34.79 | 20.87 | 34.36 | 1.15 | 1.19 | 1.20 | 1.20 | 1.19 |
| 27500 | 6.39 | 6.49 | 6.41 | 6.27 | 0.22 | 11.70 | 39.21 | 19.86 | 38.69 | 1.21 | 1.16 | 1.14 | 1.14 | 1.20 |
| 28000 | 6.46 | 6.58 | 6.51 | 6.37 | 0.21 | 12.17 | 40.29 | 18.95 | 40.21 | 1.34 | 1.16 | 1.10 | 1.08 | 1.15 |
| 28500 | 6.72 | 6.90 | 6.83 | 6.66 | 0.24 | 12.76 | 34.00 | 18.60 | 33.68 | 1.65 | 1.27 | 1.24 | 1.18 | 1.19 |
| 29000 | 6.99 | 7.21 | 7.14 | 6.90 | 0.32 | 12.90 | 30.88 | 18.82 | 30.54 | 1.84 | 1.40 | 1.41 | 1.34 | 1.31 |
| 29500 | 6.99 | 7.20 | 7.12 | 6.85 | 0.35 | 12.73 | 29.36 | 19.44 | 28.85 | 1.71 | 1.54 | 1.57 | 1.49 | 1.43 |
| 30000 | 6.84 | 6.97 | 6.89 | 6.66 | 0.31 | 12.58 | 28.81 | 20.04 | 28.29 | 1.40 | 1.59 | 1.69 | 1.59 | 1.51 |
| 30500 | 6.81 | 6.82 | 6.77 | 6.58 | 0.25 | 12.62 | 28.99 | 20.26 | 28.27 | 1.27 | 1.70 | 1.78 | 1.69 | 1.60 |
| 31000 | 6.84 | 6.83 | 6.75 | 6.61 | 0.23 | 12.94 | 28.66 | 19.90 | 28.20 | 1.38 | 1.68 | 1.74 | 1.69 | 1.62 |
| 31500 | 6.81 | 6.79 | 6.73 | 6.59 | 0.22 | 13.09 | 26.74 | 19.78 | 26.37 | 1.31 | 1.56 | 1.62 | 1.58 | 1.55 |
| 32000 | 6.78 | 6.74 | 6.78 | 6.58 | 0.20 | 13.15 | 24.33 | 20.28 | 24.01 | 1.18 | 1.42 | 1.42 | 1.42 | 1.41 |

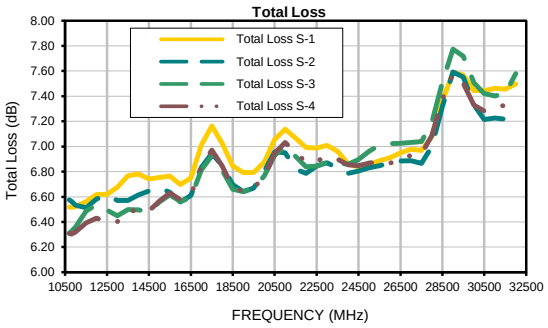
[1] Total Loss = Insertion Loss + 6dB Splitter Loss

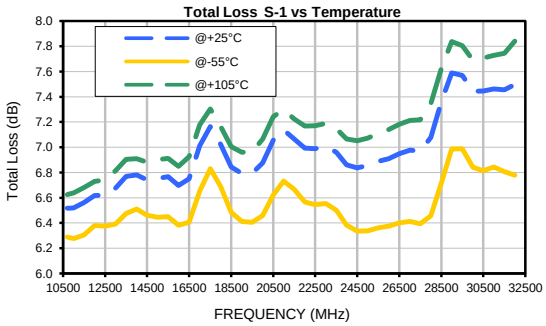
TEST CONDITIONS: Input Power = -10dBm @Temperature = +105°C

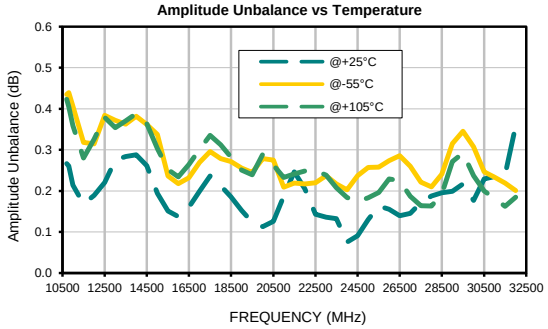
| FREQ. (MHz) | TOTAL LOSS[1] (dB) | | | | AMP. UNBAL. (dB) | PHASE UNBAL. (deg.) | ISOLATION (dB) | | | VSWR (:1) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | S-1 | S-2 | S-3 | S-4 | | | 1-2 | 2-3 | 3-4 | S | 1 | 2 | 3 | 4 |
| 10700 | 6.62 | 6.75 | 6.33 | 6.34 | 0.42 | 5.64 | 19.83 | 11.80 | 19.46 | 1.24 | 1.46 | 1.44 | 1.42 | 1.55 |
| 10800 | 6.63 | 6.74 | 6.34 | 6.34 | 0.40 | 5.52 | 19.93 | 11.88 | 19.56 | 1.24 | 1.45 | 1.41 | 1.41 | 1.53 |
| 11000 | 6.64 | 6.71 | 6.38 | 6.35 | 0.36 | 5.46 | 20.03 | 12.03 | 19.70 | 1.24 | 1.40 | 1.38 | 1.39 | 1.50 |
| 11500 | 6.68 | 6.71 | 6.50 | 6.43 | 0.28 | 6.04 | 20.06 | 12.55 | 19.84 | 1.32 | 1.30 | 1.27 | 1.32 | 1.40 |
| 12000 | 6.73 | 6.78 | 6.54 | 6.46 | 0.33 | 6.66 | 20.05 | 13.33 | 19.82 | 1.36 | 1.23 | 1.25 | 1.28 | 1.28 |
| 12500 | 6.74 | 6.81 | 6.50 | 6.44 | 0.38 | 6.51 | 20.18 | 14.46 | 19.85 | 1.31 | 1.23 | 1.30 | 1.32 | 1.23 |
| 13000 | 6.81 | 6.79 | 6.48 | 6.46 | 0.35 | 6.27 | 20.67 | 15.58 | 20.22 | 1.30 | 1.33 | 1.41 | 1.41 | 1.28 |
| 13500 | 6.90 | 6.80 | 6.53 | 6.54 | 0.37 | 6.80 | 21.73 | 16.20 | 21.21 | 1.38 | 1.45 | 1.52 | 1.53 | 1.42 |
| 14000 | 6.91 | 6.85 | 6.52 | 6.55 | 0.39 | 7.32 | 23.04 | 16.38 | 22.53 | 1.35 | 1.52 | 1.56 | 1.56 | 1.50 |
| 14500 | 6.88 | 6.88 | 6.52 | 6.55 | 0.36 | 7.23 | 23.76 | 16.67 | 23.37 | 1.25 | 1.49 | 1.52 | 1.48 | 1.48 |
| 15000 | 6.90 | 6.91 | 6.61 | 6.64 | 0.30 | 7.19 | 23.47 | 17.41 | 23.20 | 1.28 | 1.39 | 1.44 | 1.39 | 1.42 |
| 15500 | 6.91 | 6.89 | 6.66 | 6.70 | 0.25 | 7.65 | 22.92 | 18.46 | 22.67 | 1.39 | 1.25 | 1.31 | 1.28 | 1.31 |
| 16000 | 6.85 | 6.83 | 6.61 | 6.66 | 0.23 | 8.21 | 22.91 | 19.24 | 22.65 | 1.39 | 1.08 | 1.15 | 1.15 | 1.15 |
| 16500 | 6.92 | 6.91 | 6.66 | 6.72 | 0.26 | 8.54 | 23.99 | 19.07 | 23.62 | 1.48 | 1.13 | 1.15 | 1.21 | 1.10 |
| 17000 | 7.18 | 7.11 | 6.88 | 6.94 | 0.30 | 8.83 | 26.12 | 18.61 | 25.66 | 1.65 | 1.33 | 1.34 | 1.37 | 1.28 |
| 17500 | 7.30 | 7.21 | 6.97 | 7.05 | 0.34 | 9.34 | 29.02 | 18.57 | 28.55 | 1.62 | 1.46 | 1.47 | 1.47 | 1.42 |
| 18000 | 7.16 | 7.12 | 6.85 | 6.92 | 0.31 | 9.79 | 31.26 | 19.09 | 31.05 | 1.40 | 1.46 | 1.52 | 1.46 | 1.45 |
| 18500 | 7.00 | 6.99 | 6.72 | 6.77 | 0.28 | 9.95 | 30.74 | 20.03 | 30.60 | 1.24 | 1.39 | 1.48 | 1.41 | 1.41 |
| 19000 | 6.96 | 6.94 | 6.71 | 6.75 | 0.25 | 10.21 | 29.56 | 20.86 | 29.30 | 1.28 | 1.31 | 1.38 | 1.31 | 1.31 |
| 19500 | 6.96 | 6.98 | 6.74 | 6.78 | 0.24 | 10.67 | 29.73 | 20.89 | 29.32 | 1.28 | 1.16 | 1.22 | 1.15 | 1.17 |
| 20000 | 7.07 | 7.14 | 6.85 | 6.89 | 0.29 | 10.74 | 31.89 | 20.36 | 31.26 | 1.35 | 1.00 | 1.06 | 1.02 | 1.02 |
| 20500 | 7.24 | 7.28 | 7.02 | 7.07 | 0.26 | 10.53 | 36.13 | 20.15 | 35.45 | 1.53 | 1.18 | 1.17 | 1.18 | 1.20 |
| 21000 | 7.30 | 7.24 | 7.06 | 7.14 | 0.23 | 10.86 | 44.95 | 20.40 | 44.57 | 1.54 | 1.34 | 1.32 | 1.30 | 1.34 |
| 21500 | 7.22 | 7.13 | 6.98 | 7.06 | 0.24 | 11.77 | 42.91 | 21.09 | 43.69 | 1.36 | 1.43 | 1.42 | 1.36 | 1.43 |
| 22000 | 7.17 | 7.13 | 6.92 | 7.00 | 0.25 | 12.48 | 37.56 | 21.95 | 37.45 | 1.18 | 1.47 | 1.46 | 1.39 | 1.47 |
| 22500 | 7.17 | 7.19 | 6.94 | 7.02 | 0.25 | 12.62 | 35.83 | 22.58 | 35.37 | 1.19 | 1.47 | 1.46 | 1.40 | 1.49 |
| 23000 | 7.19 | 7.21 | 6.97 | 7.05 | 0.24 | 12.71 | 35.68 | 22.73 | 35.23 | 1.24 | 1.46 | 1.38 | 1.37 | 1.48 |
| 23500 | 7.15 | 7.18 | 6.97 | 7.04 | 0.21 | 13.20 | 36.33 | 22.50 | 36.02 | 1.17 | 1.36 | 1.30 | 1.28 | 1.39 |
| 24000 | 7.06 | 7.16 | 6.98 | 7.01 | 0.18 | 13.66 | 37.57 | 22.10 | 37.56 | 1.05 | 1.21 | 1.18 | 1.18 | 1.29 |
| 24500 | 7.05 | 7.19 | 7.03 | 7.01 | 0.17 | 13.98 | 37.69 | 21.78 | 37.99 | 1.11 | 1.14 | 1.13 | 1.11 | 1.20 |
| 25000 | 7.07 | 7.22 | 7.09 | 7.04 | 0.18 | 14.26 | 36.15 | 21.64 | 36.08 | 1.19 | 1.09 | 1.11 | 1.11 | 1.12 |
| 25500 | 7.11 | 7.25 | 7.15 | 7.06 | 0.20 | 14.63 | 34.33 | 21.82 | 34.00 | 1.19 | 1.09 | 1.13 | 1.14 | 1.06 |
| 26000 | 7.14 | 7.28 | 7.16 | 7.05 | 0.23 | 14.74 | 33.27 | 22.00 | 33.06 | 1.10 | 1.11 | 1.15 | 1.17 | 1.05 |
| 26500 | 7.18 | 7.31 | 7.17 | 7.08 | 0.23 | 14.77 | 33.70 | 21.88 | 33.44 | 1.06 | 1.16 | 1.20 | 1.19 | 1.11 |
| 27000 | 7.21 | 7.31 | 7.18 | 7.13 | 0.19 | 14.94 | 35.94 | 21.12 | 35.87 | 1.15 | 1.16 | 1.19 | 1.18 | 1.17 |
| 27500 | 7.22 | 7.31 | 7.21 | 7.15 | 0.16 | 15.25 | 39.45 | 20.18 | 39.72 | 1.21 | 1.13 | 1.10 | 1.10 | 1.16 |
| 28000 | 7.34 | 7.47 | 7.38 | 7.31 | 0.16 | 15.80 | 37.48 | 19.46 | 37.77 | 1.39 | 1.18 | 1.11 | 1.10 | 1.13 |
| 28500 | 7.63 | 7.79 | 7.71 | 7.60 | 0.19 | 16.45 | 32.72 | 19.34 | 32.73 | 1.64 | 1.31 | 1.27 | 1.22 | 1.21 |
| 29000 | 7.84 | 8.05 | 7.94 | 7.78 | 0.27 | 16.61 | 30.33 | 19.74 | 30.32 | 1.70 | 1.42 | 1.43 | 1.37 | 1.32 |
| 29500 | 7.80 | 7.98 | 7.86 | 7.69 | 0.29 | 16.40 | 29.20 | 20.44 | 29.05 | 1.50 | 1.55 | 1.60 | 1.52 | 1.42 |
| 30000 | 7.69 | 7.77 | 7.66 | 7.53 | 0.24 | 16.32 | 28.90 | 21.02 | 28.76 | 1.22 | 1.61 | 1.71 | 1.62 | 1.50 |
| 30500 | 7.71 | 7.68 | 7.60 | 7.51 | 0.20 | 16.55 | 28.99 | 21.09 | 28.68 | 1.24 | 1.71 | 1.79 | 1.70 | 1.58 |
| 31000 | 7.73 | 7.70 | 7.59 | 7.54 | 0.18 | 17.04 | 28.18 | 20.84 | 28.10 | 1.28 | 1.63 | 1.70 | 1.64 | 1.57 |
| 31500 | 7.74 | 7.72 | 7.64 | 7.58 | 0.16 | 17.26 | 26.22 | 21.09 | 26.17 | 1.16 | 1.51 | 1.56 | 1.52 | 1.49 |
| 32000 | 7.84 | 7.80 | 7.89 | 7.71 | 0.18 | 17.47 | 24.26 | 22.17 | 24.28 | 1.20 | 1.38 | 1.40 | 1.38 | 1.38 |

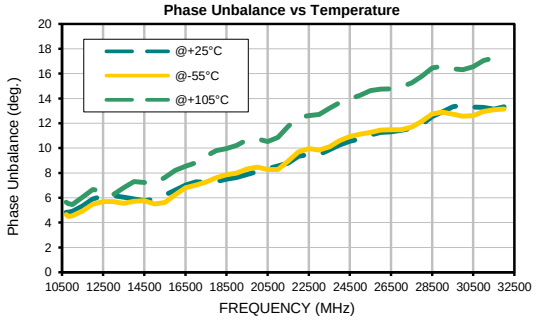
[1] Total Loss = Insertion Loss + 6dB Splitter Loss

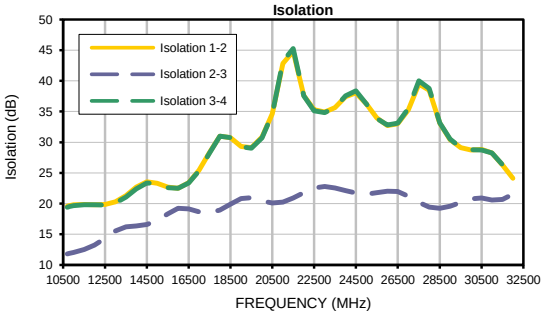
## *Typical Performance Curves*

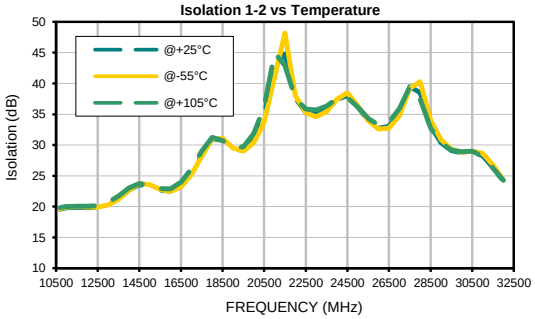


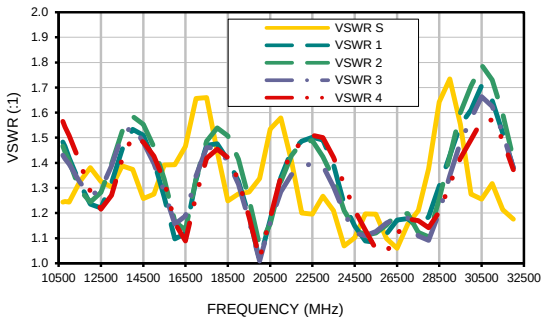



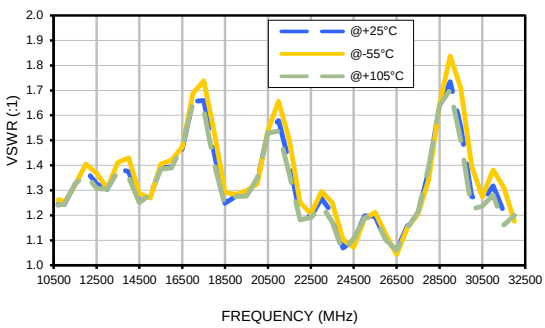



## *Typical Performance Curves*

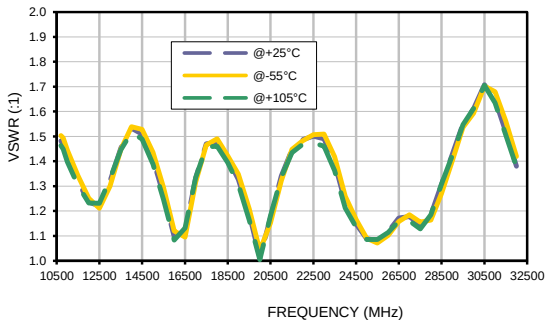
**VSWR**




**VSWR SUM vs Temperature**

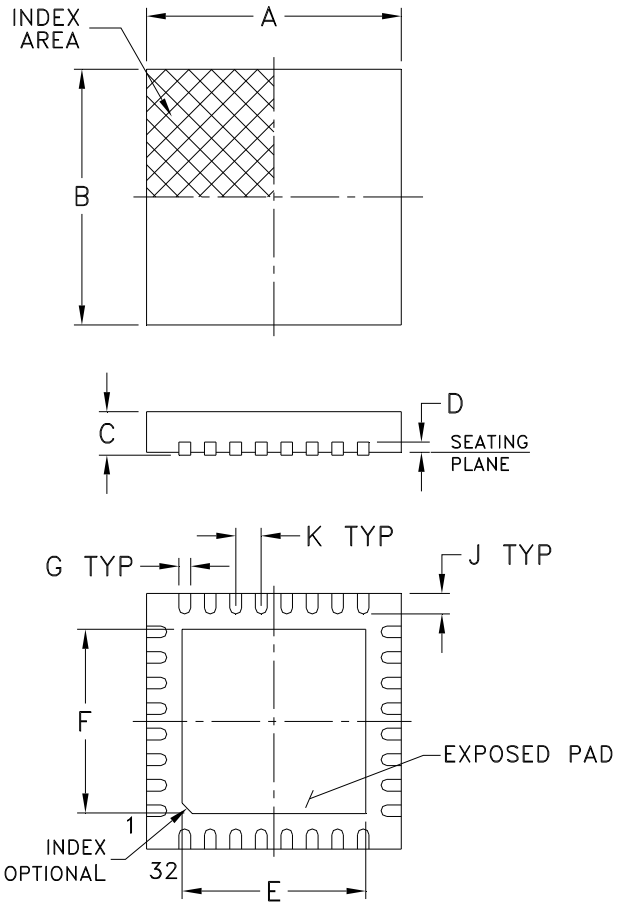



**VSWR Out1 vs Temperature**

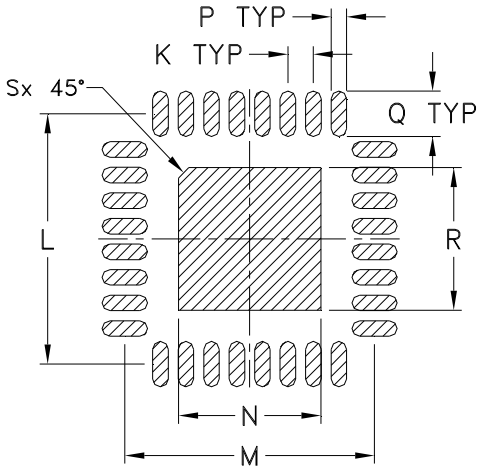


**DG1677-2**

## Outline Dimensions




### PCB Land Pattern




Suggested Layout,
Tolerance to be within ±.002

| CASE # | A | B | C MAX | C MIN | D | E | F | G | H | J |
|---|---|---|---|---|---|---|---|---|---|---|
| DG1677-2 | .197 (5.00) | .197 (5.00) | .039 (1.00) | .031 (0.80) | .008 (0.20) | .142 (3.60) | .142 (3.60) | .009 (0.23) | - - | .016 (0.40) |

| CASE # | K | L | M | N | P | Q | R | S | WT. GRAM |
|---|---|---|---|---|---|---|---|---|---|
| DG1677-2 | .020 (0.50) | .193 (4.90) | .193 (4.90) | .110 (2.79) | .012 (0.30) | .035 (0.89) | .110 (2.79) | .008 (0.20) | .05 |

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

**Notes:**

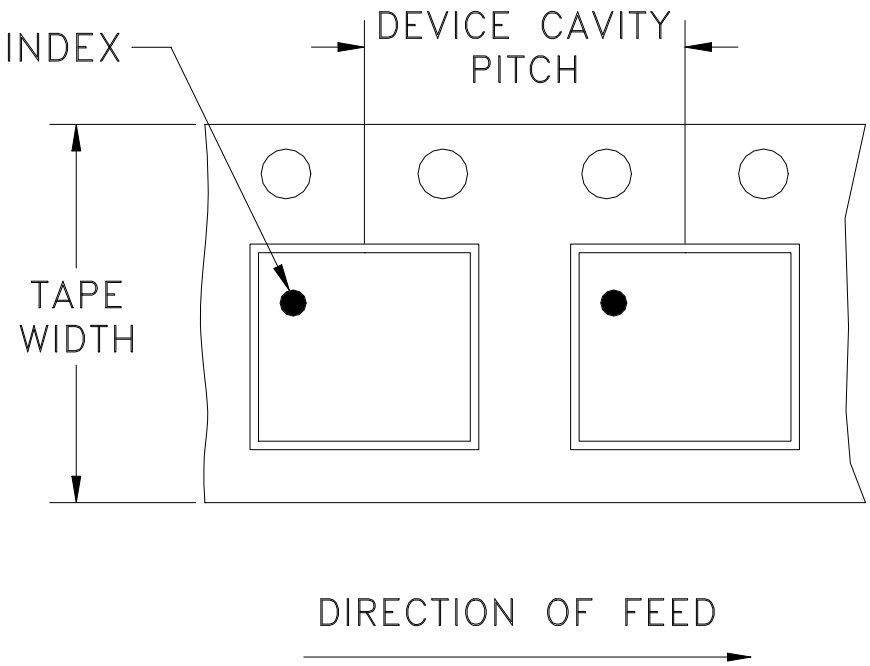
1. Case material: Plastic.
4. Termination finish:

For RoHS Case Styles: Tin-Silver alloy plate over Nickel barrier transitioning to Matte-Tin. All models, (+) suffix. See Data sheet.

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

# Tape & Reel Packaging TR-F68

DEVICE ORIENTATION IN T&R




| Tape Width, mm | Device Cavity Pitch, mm | Reel Size, inches | Devices per Reel see note | |
|---|---|---|---|---|
| 12 | 8 | 7 | Small quantity standard | 20 |
| | | | | 50 |
| | | | | 100 |
| | | | | 200 |
| | | | | 500 |
| | | 7 | Standard | 1000 |
| | | 13 | Standard | 2000 |
| | | | | 3000 |
| | | | | 4000 |

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

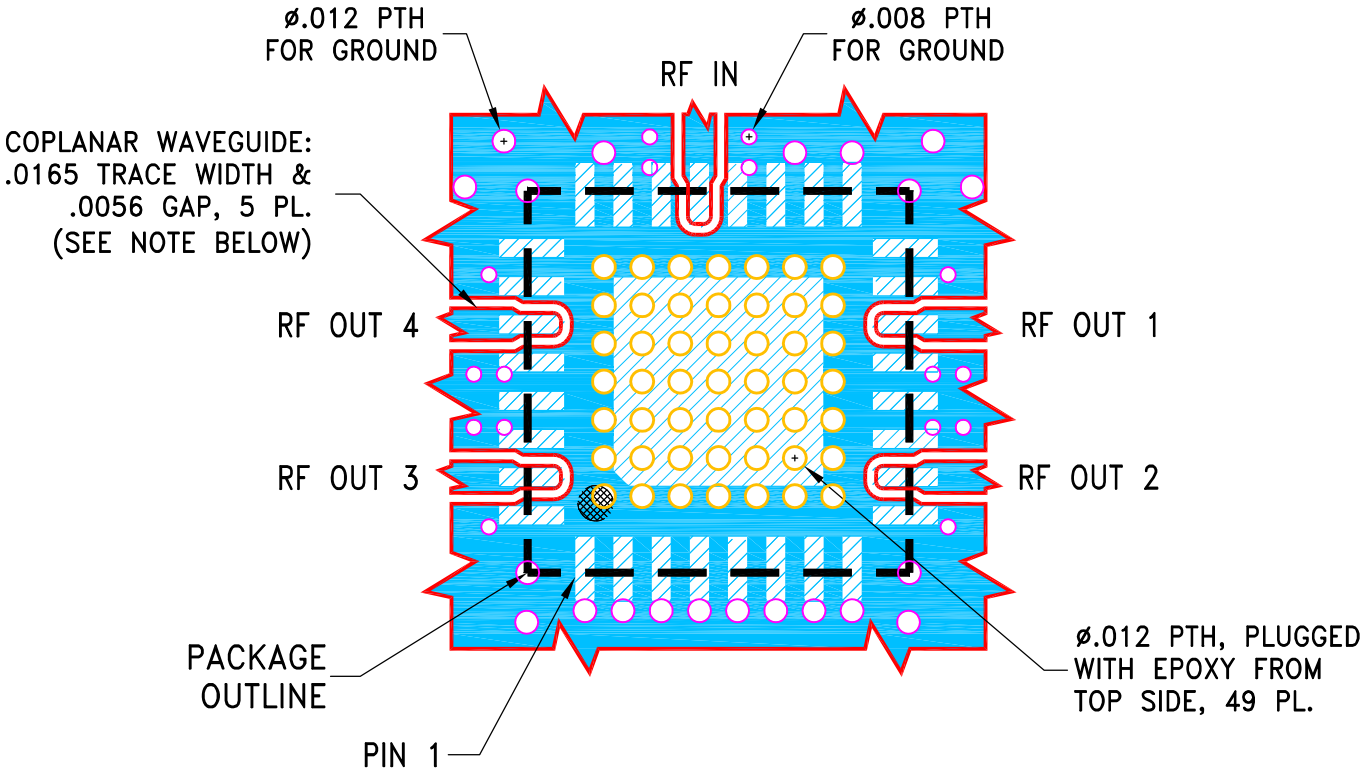
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THIRD ANGLE PROJECTION

| REVISIONS | | | | | |
|---|---|---|---|---|---|
| REV | ECN No. | DESCRIPTION | DATE | DR | AUTH |
| OR | M175739 | NEW RELEASE | 09/10/19 | ITG | CM |

## SUGGESTED MOUNTING CONFIGURATION FOR DG1677-2 CASE STYLE




NOTES:

1. TRACE WIDTH & GAP ARE SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS .010"±.001"; 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 |
|---|---|---|---|
| DIMENSIONS ARE IN INCHES | DRAWN | ITG | 08/28/19 |
| TOLERANCES ON: | CHECKED | GF | 09/03/19 |
| 2 PL DECIMALS ± | APPROVED | CM | 09/10/19 |
| 3 PL DECIMALS ± .005 | | | |
| ANGLES ± | | | |
| FRACTIONS ± | | | |

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

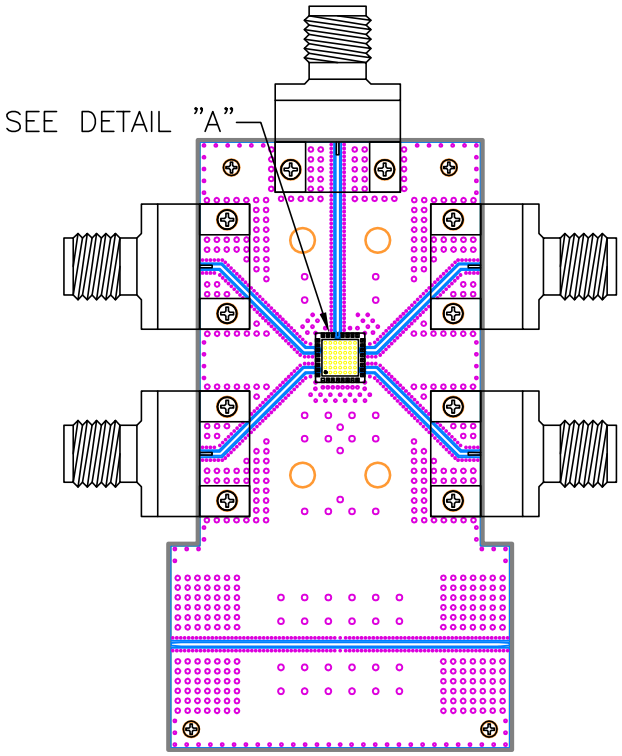
Mini-Circuits® 13 Neptune Avenue Brooklyn NY 11235

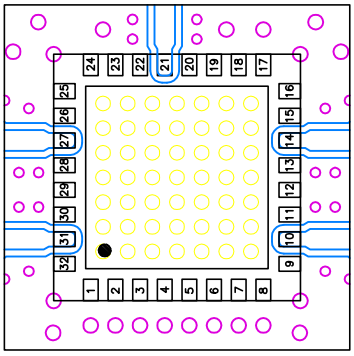
# PL, DG1677-2, TB-EP4RKU+/EP4KA+

| SIZE | CODE IDENT | DRAWING NO: | REV: |
|---|---|---|---|
| A | 15542 | 98-PL-649 | OR |

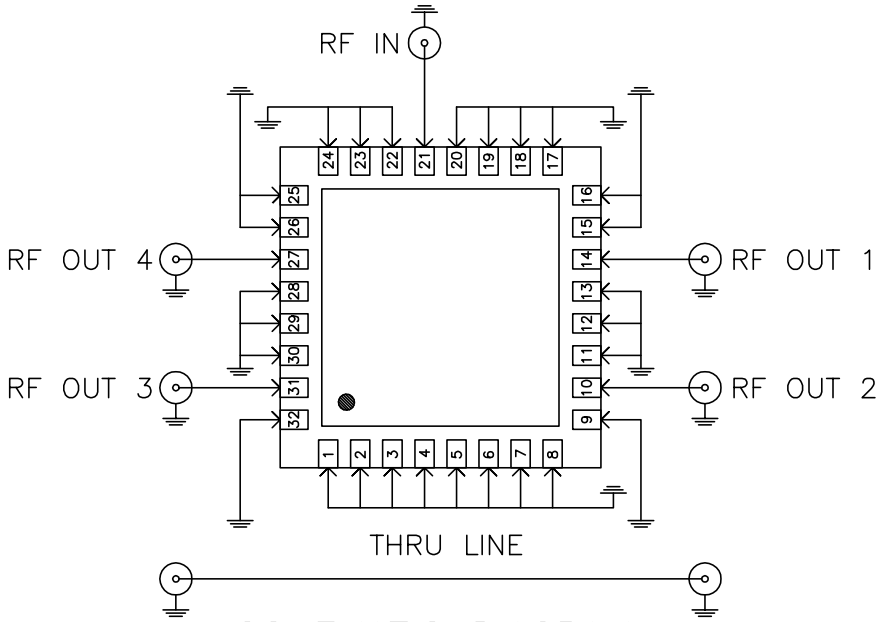
| FILE: | SCALE: | SHEET: |
|---|---|---|
| 98PL649 | 10:1 | 1 OF 1 |

# Evaluation Board and Circuit



DETAIL "A"
(SCALE 5:1)




SCHEMATIC DIAGRAM
(SCALE 5:1)

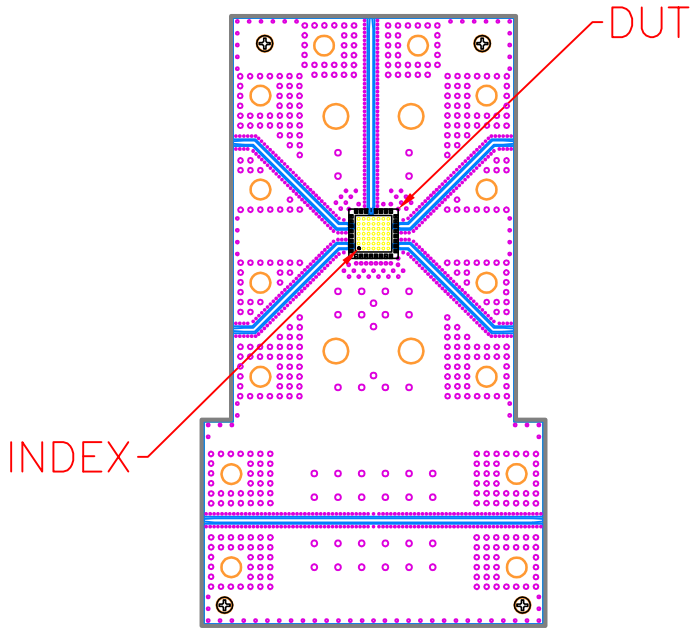
## Notes:

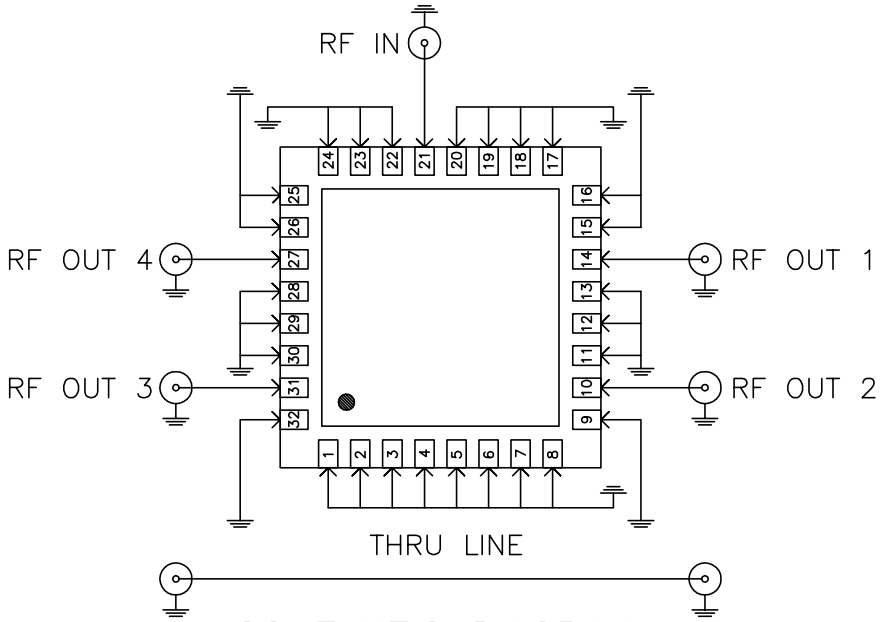
1. 2.92mm Female Connectors.
2. PCB Material: Roger RO4350B or equivalent, Dielectric constant=3.5, Thickness=0.010 inch

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# Evaluation Board and Circuit




SCHEMATIC DIAGRAM
(SCALE 5:1)

## Notes:

1. PCB Material: Roger RO4350B or equivalent, Dielectric constant=3.5, Thickness=0.010 inch

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**Environmental Specifications** **ENV08T1**

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 or -45° to 85° C or -55° to 105° C or -40° to 105° C or -40° to 95° C<br>Ambient Environment | Individual Model Data Sheet |
| Storage Temperature | -55° to 100° C or -65° to 150°<br>Ambient Environment | Individual Model Data Sheet |
| HTOL | 1000 hours at 125°C | MIL-STD-883, Method 1005, Condition B |
| Thermal Shock | -55° to 100°C, 100 cycles | MIL-STD-202, Method 107, Condition A-3, except +100°C |
| Mechanical Shock | 1.5Kg, 0.5 ms, 5 shock pulses, Y1 direction only | MIL-STD-883, Method 2002, Condition B, except Y1 direction only |
| Vibration (Variable Frequency) | 50g peak | MIL-STD-883, Method 2007, Condition B |
| Autoclave | 15 psig, 100% RH, 121°C, 96 hours | JESD22-A102, Condition C |
| HAST | 130°C, 85% RH, 96 hours | JESD22-A110 |
| Solderability | 10X Magnification | J-STD-002, Para 4.2.5, Test S, 95% Coverage |
| 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 260°C peak | J-STD-020 |


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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 |
|---|---|---|
| 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 |



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