



Mini-Circuits

MMIC SURFACE MOUNT

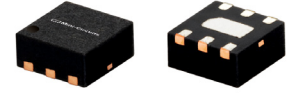
# Power Splitter/Combiner

EP2-5G+

2 Way-0° 50Ω 24 to 30 GHz

## THE BIG DEAL

- Wide bandwidth, 24 to 30 GHz
- High isolation, 24 dB typ. at 27 GHz
- Low cost splitter for 5G Application
- Excellent amplitude unbalance, 0.1 dB typ. at 27 GHz
- Good phase unbalance, 4° at 27 GHz
- Small size, 2x2 mm
- Aqueous washable



Generic photo used for illustration purposes only

CASE STYLE: MC1630-1

## +RoHS Compliant

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

## APPLICATIONS

- 5G
- Phased array
- Instrumentation
- Radar
- Satellite communications

## PRODUCT OVERVIEW

Mini-Circuits' EP2-5G+ is a MMIC 2-way 0° splitter/combiner designed for wideband operation from 24 to 30 GHz supporting many applications requiring high performance across a wide frequency range including phased array radars, 5G applications, as well as instrumentation and more. This model provides excellent power handling up to 0.5W (as a splitter/combiner) with good isolation, and low phase and amplitude unbalance in a tiny 2 x 2 mm 6 lead-QFN package. Manufactured using GaAs IPD technology, the EP2-5G+ not only provides a repeatable performance, but also a high level of ESD protection.

## KEY FEATURES

| Feature                                                                                             | Advantages                                                                                                                                                                                                      |
|-----------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Wideband, 24 to 30 GHz                                                                              | Low cost power splitter designed for phased array radars and 5G applications.                                                                                                                                   |
| High isolation, 24 dB typ. at 27 GHz<br>Excellent power handling,<br>0.5 W as a splitter / combiner | In power combiner applications, half the power is dissipated internally. EP2-5G+ is designed to handle 0.5 W internal dissipation as a combiner allowing reliable operation without excessive temperature rise. |
| Excellent Amplitude unbalance,<br>0.1 dB typ. at 27 GHz<br>Good phase unbalance, 4° typ. at 27 GHz  | Ideal for Applications such as MIMO & phased array radars                                                                                                                                                       |
| Tiny size, 2X2mm QFN package                                                                        | Tiny footprint saves space in dense layouts while providing low inductance, repeatable transitions, and excellent thermal contact to the PCB.                                                                   |





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# Power Splitter/Combiner

EP2-5G+

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

| Parameter                      |               | Frequency (GHz) | Min. | Typ. | Max. | Unit |
|--------------------------------|---------------|-----------------|------|------|------|------|
| Frequency Range                |               |                 | 24   |      | 30   | GHz  |
| Insertion Loss, (above 3.0 dB) |               | 24 - 30         | —    | 1.3  | 2.1  | dB   |
| Isolation                      |               | 24 - 30         | 16   | 23   |      | dB   |
| Amplitude Unbalance            |               | 24 - 30         | —    | 0.1  | 0.7  | dB   |
| Phase Unbalance                |               | 24 - 30         | —    | 1.7  | 13   | deg  |
| VSWR (Port S)                  |               | 24 - 30         | —    | 1.7  | —    | :1   |
| VSWR (Port 1-2)                |               | 24 - 30         | —    | 1.5  | —    | :1   |
| Power Handling                 | As a splitter | 24 - 30         | —    | —    | 0.5  | W    |
|                                | As a combiner | 24 - 30         | —    | —    | 0.5  |      |

1. Tested on Mini-Circuits Test Board TB-EP2-5GC+

## MAXIMUM RATINGS

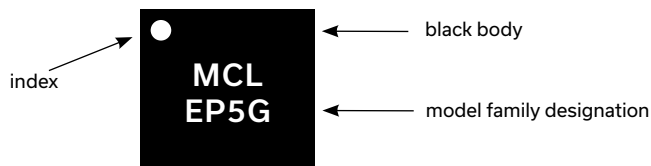
| Parameter             | Ratings        |
|-----------------------|----------------|
| Operating temperature | -55°C to 105°C |
| Storage temperature   | -65°C to 150°C |

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

## PAD CONNECTIONS

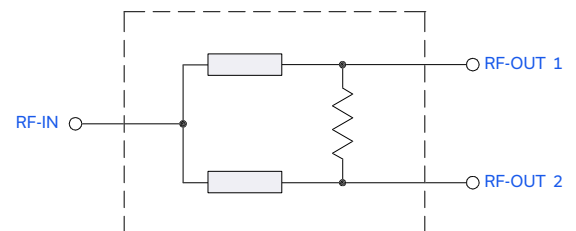
| Function                       | Pad Number |
|--------------------------------|------------|
| SUM PORT                       | 5          |
| PORT 1                         | 1          |
| PORT 2                         | 3          |
| GROUND                         | Paddle     |
| NOT USED,<br>GROUND EXTERNALLY | 2,4,6      |

## PRODUCT MARKING



Marking may contain other features or characters for internal lot control

## SIMPLIFIED ELECTRICAL SCHEMATIC





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## Power Splitter/Combiner

EP2-5G+

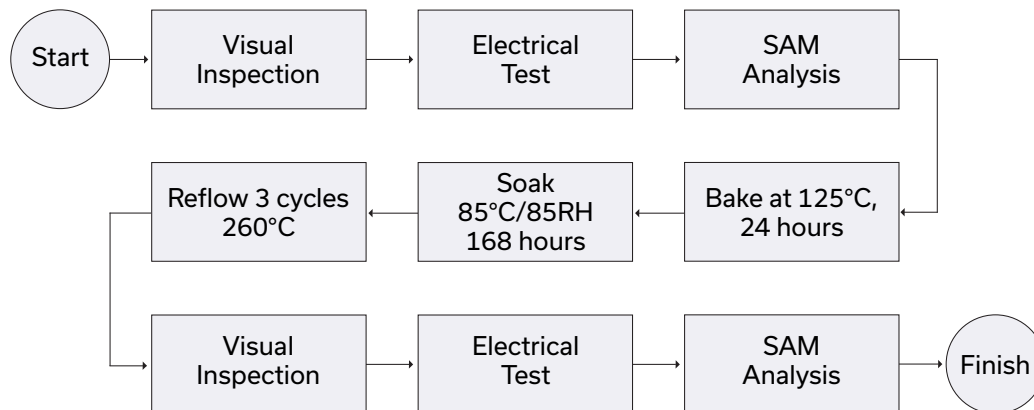
ADDITIONAL DETAILED TECHNICAL INFORMATION IS AVAILABLE ON OUR DASH BOARD. TO ACCESS [CLICK HERE](#)

|                                                      |                                                                  |
|------------------------------------------------------|------------------------------------------------------------------|
| Performance Data                                     | Data Table                                                       |
|                                                      | Swept Graphs                                                     |
|                                                      | S-Parameter (S3P Files) Data Set (.zip file)                     |
| Case Style                                           | MC1630-1 Plastic package, exposed paddle; lead finish: Matte Tin |
| Tape & Reel<br>Standard quantities available on reel | F66<br>7" reels with 20, 50, 100, 200, 500, 1000 & 2000 devices  |
| Suggested Layout for PCB Design                      | PL-667                                                           |
| Evaluation Board                                     | TB-EP2-5G+ (without connectors)<br>TB-EP2-5GC+ (with connectors) |
| Environmental Ratings                                | ENV82                                                            |

## ESD RATING

Human Body Model (HBM): Class 2 (Pass 2000V) 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/MCLStore/terms.jsp](http://www.minicircuits.com/MCLStore/terms.jsp)



## Typical Performance Data

TEST CONDITIONS: Input Power = 0dBm @Temperature = +25°C

| FREQ. | TOTAL LOSS <sup>(1)</sup> |             | AMP. UNBAL. | PHASE UNBAL. | ISOLATION   | VSWR      |           |           |
|-------|---------------------------|-------------|-------------|--------------|-------------|-----------|-----------|-----------|
| (MHz) | (dB)<br>S-1               | (dB)<br>S-2 | (dB)        | (deg.)       | (dB)<br>1-2 | (:1)<br>S | (:1)<br>1 | (:1)<br>2 |
| 14000 | 3.46                      | 3.49        | 0.04        | 3.71         | 11.21       | 1.47      | 1.29      | 1.30      |
| 14500 | 3.57                      | 3.64        | 0.07        | 3.97         | 11.29       | 1.61      | 1.39      | 1.41      |
| 15000 | 3.76                      | 3.84        | 0.09        | 4.31         | 11.54       | 1.83      | 1.51      | 1.55      |
| 15500 | 3.97                      | 4.05        | 0.08        | 4.62         | 11.94       | 2.05      | 1.61      | 1.66      |
| 16000 | 4.12                      | 4.19        | 0.07        | 4.86         | 12.45       | 2.19      | 1.66      | 1.70      |
| 16500 | 4.16                      | 4.21        | 0.05        | 5.09         | 13.01       | 2.19      | 1.64      | 1.66      |
| 17000 | 4.10                      | 4.14        | 0.03        | 5.21         | 13.58       | 2.09      | 1.56      | 1.56      |
| 17500 | 3.98                      | 4.00        | 0.02        | 5.30         | 14.13       | 1.93      | 1.47      | 1.45      |
| 18000 | 3.86                      | 3.88        | 0.02        | 5.33         | 14.58       | 1.79      | 1.41      | 1.37      |
| 18500 | 3.80                      | 3.84        | 0.04        | 5.40         | 14.94       | 1.72      | 1.39      | 1.35      |
| 19000 | 3.81                      | 3.87        | 0.06        | 5.55         | 15.24       | 1.73      | 1.42      | 1.40      |
| 19500 | 3.91                      | 3.99        | 0.08        | 5.87         | 15.56       | 1.80      | 1.49      | 1.50      |
| 20000 | 4.05                      | 4.14        | 0.08        | 6.21         | 15.97       | 1.89      | 1.56      | 1.60      |
| 20500 | 4.19                      | 4.25        | 0.07        | 6.57         | 16.43       | 1.98      | 1.62      | 1.65      |
| 21000 | 4.25                      | 4.29        | 0.04        | 6.73         | 16.92       | 2.01      | 1.66      | 1.65      |
| 21500 | 4.26                      | 4.28        | 0.02        | 6.82         | 17.37       | 2.01      | 1.68      | 1.60      |
| 22000 | 4.25                      | 4.28        | 0.03        | 6.76         | 17.78       | 2.02      | 1.69      | 1.58      |
| 22500 | 4.26                      | 4.31        | 0.05        | 6.86         | 18.16       | 2.03      | 1.69      | 1.61      |
| 23000 | 4.29                      | 4.38        | 0.08        | 7.11         | 18.51       | 2.08      | 1.69      | 1.67      |
| 23500 | 4.35                      | 4.45        | 0.10        | 7.42         | 18.86       | 2.13      | 1.69      | 1.73      |
| 24000 | 4.37                      | 4.48        | 0.11        | 7.88         | 19.20       | 2.13      | 1.65      | 1.72      |
| 24500 | 4.33                      | 4.42        | 0.09        | 8.22         | 19.57       | 2.07      | 1.60      | 1.65      |
| 25000 | 4.22                      | 4.30        | 0.08        | 8.46         | 19.98       | 1.95      | 1.52      | 1.49      |
| 25500 | 4.12                      | 4.19        | 0.07        | 8.59         | 20.50       | 1.82      | 1.45      | 1.39      |
| 26000 | 4.09                      | 4.16        | 0.08        | 8.84         | 21.01       | 1.74      | 1.41      | 1.40      |
| 26500 | 4.12                      | 4.22        | 0.10        | 9.00         | 21.44       | 1.72      | 1.40      | 1.51      |
| 27000 | 4.18                      | 4.30        | 0.12        | 9.33         | 21.63       | 1.74      | 1.46      | 1.60      |
| 27500 | 4.22                      | 4.34        | 0.12        | 9.75         | 21.50       | 1.79      | 1.51      | 1.65      |
| 28000 | 4.24                      | 4.34        | 0.10        | 9.98         | 21.15       | 1.83      | 1.59      | 1.61      |
| 28500 | 4.22                      | 4.28        | 0.07        | 10.20        | 20.76       | 1.84      | 1.61      | 1.56      |
| 29000 | 4.17                      | 4.22        | 0.05        | 10.25        | 20.38       | 1.81      | 1.59      | 1.52      |
| 29500 | 4.09                      | 4.12        | 0.03        | 10.31        | 20.14       | 1.73      | 1.54      | 1.50      |
| 30000 | 3.99                      | 4.02        | 0.03        | 10.32        | 19.96       | 1.61      | 1.44      | 1.48      |
| 30500 | 3.88                      | 3.92        | 0.04        | 10.34        | 19.81       | 1.47      | 1.35      | 1.42      |
| 31000 | 3.79                      | 3.87        | 0.07        | 10.55        | 19.65       | 1.35      | 1.26      | 1.35      |
| 31500 | 3.76                      | 3.84        | 0.08        | 10.78        | 19.44       | 1.25      | 1.19      | 1.24      |
| 32000 | 3.78                      | 3.84        | 0.05        | 11.06        | 19.09       | 1.21      | 1.15      | 1.14      |
| 32500 | 3.85                      | 3.86        | 0.02        | 11.05        | 18.60       | 1.22      | 1.15      | 1.09      |
| 33000 | 3.89                      | 3.89        | 0.00        | 10.84        | 18.02       | 1.26      | 1.19      | 1.18      |
| 33500 | 3.91                      | 3.94        | 0.03        | 10.57        | 17.42       | 1.28      | 1.26      | 1.31      |
| 34000 | 3.86                      | 3.96        | 0.09        | 10.45        | 16.87       | 1.26      | 1.34      | 1.45      |
| 34500 | 3.81                      | 3.97        | 0.17        | 10.45        | 16.39       | 1.18      | 1.41      | 1.56      |
| 35000 | 3.77                      | 4.01        | 0.23        | 10.91        | 15.98       | 1.12      | 1.49      | 1.66      |
| 35500 | 3.79                      | 4.05        | 0.26        | 11.27        | 15.60       | 1.17      | 1.58      | 1.69      |
| 36000 | 3.84                      | 4.06        | 0.22        | 11.93        | 15.21       | 1.24      | 1.64      | 1.73      |
| 36500 | 3.92                      | 4.09        | 0.17        | 12.19        | 14.66       | 1.28      | 1.67      | 1.69      |
| 37000 | 3.99                      | 4.08        | 0.09        | 11.85        | 14.03       | 1.31      | 1.70      | 1.63      |
| 37500 | 4.06                      | 4.18        | 0.11        | 11.20        | 13.35       | 1.34      | 1.69      | 1.58      |
| 38000 | 4.09                      | 4.31        | 0.21        | 10.72        | 12.77       | 1.39      | 1.71      | 1.64      |
| 38500 | 4.07                      | 4.47        | 0.40        | 10.62        | 12.23       | 1.44      | 1.71      | 1.76      |
| 39000 | 4.06                      | 4.65        | 0.59        | 11.37        | 11.81       | 1.48      | 1.72      | 1.91      |
| 39500 | 4.09                      | 4.81        | 0.72        | 12.83        | 11.43       | 1.50      | 1.74      | 1.99      |
| 40000 | 4.18                      | 4.87        | 0.70        | 14.30        | 11.08       | 1.51      | 1.77      | 1.99      |

<sup>(1)</sup> Total Loss = Insertion Loss + 3dB Splitter Loss

## Typical Performance Data

TEST CONDITIONS: Input Power = 0dBm @Temperature = -55°C

| FREQ. | TOTAL LOSS <sup>(1)</sup> |             | AMP. UNBAL. | PHASE UNBAL. | ISOLATION   | VSWR      |      |      |
|-------|---------------------------|-------------|-------------|--------------|-------------|-----------|------|------|
| (MHz) | (dB)<br>S-1               | (dB)<br>S-2 | (dB)        | (deg.)       | (dB)<br>1-2 | (:1)<br>S | 1    | 2    |
| 14000 | 3.08                      | 3.17        | 0.09        | 3.32         | 10.83       | 1.47      | 1.30 | 1.31 |
| 14500 | 3.19                      | 3.31        | 0.12        | 3.53         | 10.86       | 1.63      | 1.40 | 1.42 |
| 15000 | 3.37                      | 3.50        | 0.13        | 3.82         | 11.07       | 1.87      | 1.53 | 1.57 |
| 15500 | 3.59                      | 3.71        | 0.12        | 4.07         | 11.45       | 2.14      | 1.66 | 1.70 |
| 16000 | 3.75                      | 3.86        | 0.12        | 4.28         | 11.96       | 2.31      | 1.72 | 1.77 |
| 16500 | 3.79                      | 3.88        | 0.09        | 4.44         | 12.51       | 2.32      | 1.70 | 1.73 |
| 17000 | 3.71                      | 3.79        | 0.08        | 4.51         | 13.09       | 2.19      | 1.61 | 1.62 |
| 17500 | 3.56                      | 3.63        | 0.08        | 4.52         | 13.65       | 2.01      | 1.51 | 1.49 |
| 18000 | 3.41                      | 3.49        | 0.08        | 4.53         | 14.09       | 1.85      | 1.43 | 1.38 |
| 18500 | 3.32                      | 3.42        | 0.10        | 4.58         | 14.45       | 1.76      | 1.41 | 1.34 |
| 19000 | 3.32                      | 3.45        | 0.13        | 4.73         | 14.72       | 1.76      | 1.44 | 1.39 |
| 19500 | 3.40                      | 3.55        | 0.15        | 4.97         | 15.00       | 1.83      | 1.51 | 1.49 |
| 20000 | 3.54                      | 3.69        | 0.16        | 5.29         | 15.35       | 1.94      | 1.58 | 1.60 |
| 20500 | 3.67                      | 3.81        | 0.14        | 5.60         | 15.78       | 2.04      | 1.65 | 1.69 |
| 21000 | 3.75                      | 3.87        | 0.12        | 5.73         | 16.24       | 2.11      | 1.72 | 1.73 |
| 21500 | 3.79                      | 3.89        | 0.10        | 5.84         | 16.68       | 2.16      | 1.75 | 1.72 |
| 22000 | 3.80                      | 3.90        | 0.10        | 5.83         | 17.09       | 2.19      | 1.77 | 1.71 |
| 22500 | 3.79                      | 3.90        | 0.11        | 5.88         | 17.49       | 2.19      | 1.77 | 1.68 |
| 23000 | 3.78                      | 3.90        | 0.13        | 6.02         | 17.87       | 2.20      | 1.76 | 1.69 |
| 23500 | 3.77                      | 3.91        | 0.14        | 6.13         | 18.18       | 2.22      | 1.75 | 1.71 |
| 24000 | 3.75                      | 3.90        | 0.15        | 6.34         | 18.52       | 2.20      | 1.70 | 1.71 |
| 24500 | 3.72                      | 3.88        | 0.15        | 6.51         | 18.87       | 2.17      | 1.66 | 1.69 |
| 25000 | 3.66                      | 3.82        | 0.16        | 6.72         | 19.26       | 2.09      | 1.58 | 1.60 |
| 25500 | 3.57                      | 3.74        | 0.17        | 6.83         | 19.79       | 1.96      | 1.51 | 1.51 |
| 26000 | 3.53                      | 3.70        | 0.17        | 7.11         | 20.19       | 1.88      | 1.46 | 1.44 |
| 26500 | 3.52                      | 3.69        | 0.18        | 7.31         | 20.65       | 1.81      | 1.44 | 1.46 |
| 27000 | 3.53                      | 3.71        | 0.18        | 7.51         | 20.90       | 1.80      | 1.49 | 1.52 |
| 27500 | 3.56                      | 3.73        | 0.18        | 7.77         | 20.82       | 1.84      | 1.54 | 1.63 |
| 28000 | 3.61                      | 3.78        | 0.17        | 7.89         | 20.52       | 1.93      | 1.63 | 1.71 |
| 28500 | 3.63                      | 3.80        | 0.17        | 7.93         | 20.15       | 1.99      | 1.68 | 1.77 |
| 29000 | 3.61                      | 3.78        | 0.17        | 8.11         | 19.75       | 2.00      | 1.69 | 1.77 |
| 29500 | 3.50                      | 3.66        | 0.16        | 8.30         | 19.45       | 1.91      | 1.64 | 1.69 |
| 30000 | 3.33                      | 3.49        | 0.16        | 8.47         | 19.21       | 1.72      | 1.52 | 1.55 |
| 30500 | 3.18                      | 3.33        | 0.15        | 8.68         | 19.08       | 1.53      | 1.40 | 1.40 |
| 31000 | 3.09                      | 3.23        | 0.14        | 8.79         | 18.97       | 1.38      | 1.29 | 1.28 |
| 31500 | 3.07                      | 3.19        | 0.12        | 8.87         | 18.91       | 1.28      | 1.21 | 1.18 |
| 32000 | 3.10                      | 3.21        | 0.11        | 8.90         | 18.63       | 1.25      | 1.16 | 1.14 |
| 32500 | 3.15                      | 3.25        | 0.10        | 8.80         | 18.17       | 1.27      | 1.16 | 1.17 |
| 33000 | 3.16                      | 3.28        | 0.12        | 8.67         | 17.56       | 1.32      | 1.20 | 1.25 |
| 33500 | 3.16                      | 3.31        | 0.15        | 8.73         | 16.94       | 1.33      | 1.28 | 1.33 |
| 34000 | 3.10                      | 3.30        | 0.20        | 8.80         | 16.28       | 1.31      | 1.35 | 1.43 |
| 34500 | 3.04                      | 3.28        | 0.25        | 9.04         | 15.76       | 1.22      | 1.42 | 1.51 |
| 35000 | 3.02                      | 3.28        | 0.27        | 9.38         | 15.33       | 1.14      | 1.50 | 1.60 |
| 35500 | 3.04                      | 3.29        | 0.25        | 9.63         | 14.96       | 1.15      | 1.61 | 1.66 |
| 36000 | 3.04                      | 3.30        | 0.25        | 9.87         | 14.55       | 1.22      | 1.69 | 1.77 |
| 36500 | 3.09                      | 3.33        | 0.24        | 10.10        | 14.08       | 1.29      | 1.74 | 1.82 |
| 37000 | 3.12                      | 3.35        | 0.22        | 10.04        | 13.50       | 1.36      | 1.80 | 1.84 |
| 37500 | 3.21                      | 3.44        | 0.23        | 9.81         | 12.91       | 1.42      | 1.80 | 1.79 |
| 38000 | 3.28                      | 3.53        | 0.25        | 9.63         | 12.31       | 1.47      | 1.83 | 1.76 |
| 38500 | 3.27                      | 3.62        | 0.35        | 9.34         | 11.69       | 1.49      | 1.81 | 1.74 |
| 39000 | 3.24                      | 3.72        | 0.48        | 9.46         | 11.16       | 1.50      | 1.80 | 1.82 |
| 39500 | 3.22                      | 3.85        | 0.63        | 10.04        | 10.71       | 1.48      | 1.81 | 1.98 |
| 40000 | 3.20                      | 3.96        | 0.76        | 10.91        | 10.37       | 1.50      | 1.85 | 2.14 |

<sup>(1)</sup> Total Loss = Insertion Loss + 3dB Splitter Loss

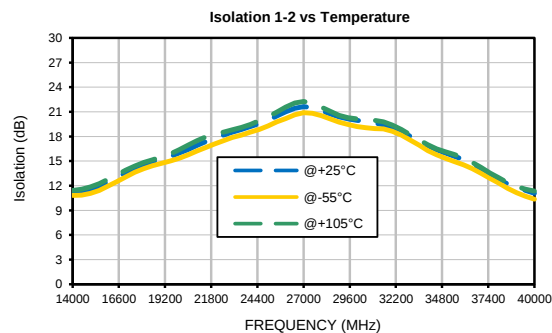
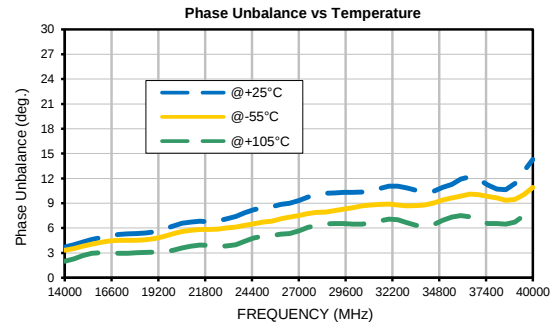
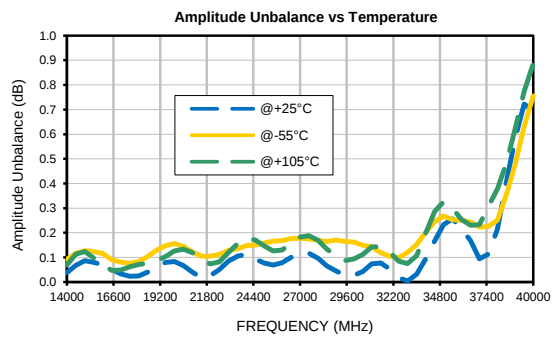
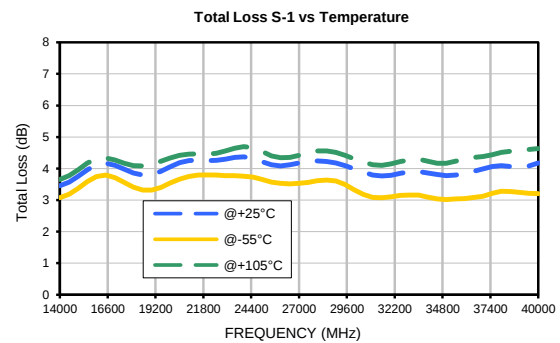
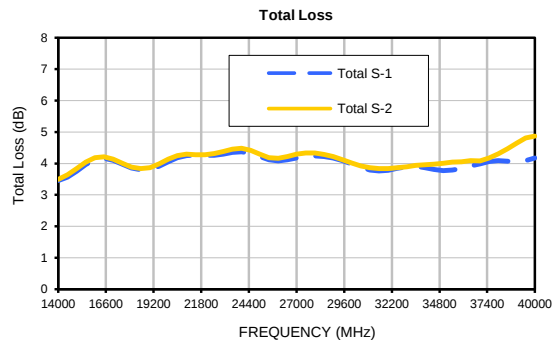
## Typical Performance Data

TEST CONDITIONS: Input Power = 0dBm @Temperature = +105°C

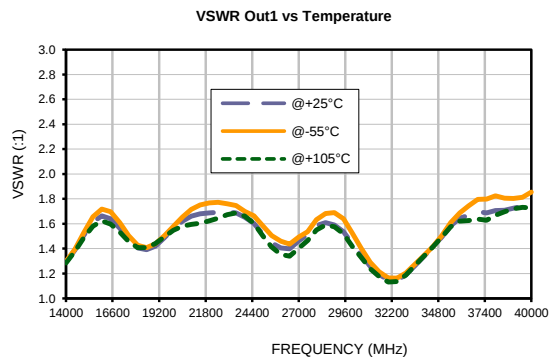
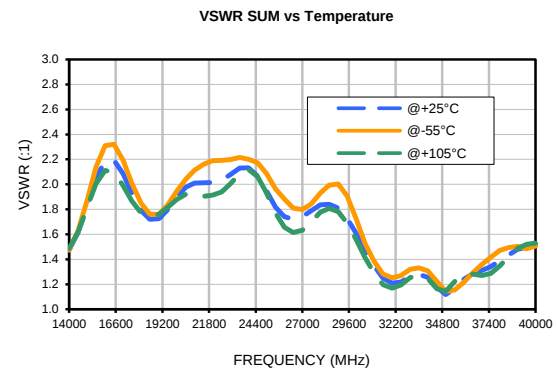
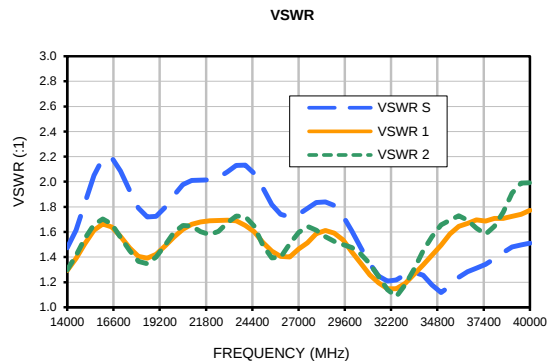
| FREQ. | TOTAL LOSS <sup>(1)</sup> |             | AMP.<br>UNBAL. | PHASE<br>UNBAL. | ISOLATION   | VSWR      |      |      |
|-------|---------------------------|-------------|----------------|-----------------|-------------|-----------|------|------|
| (MHz) | (dB)<br>S-1               | (dB)<br>S-2 | (dB)           | (deg.)          | (dB)<br>1-2 | (:1)<br>S | 1    | 2    |
| 14000 | 3.65                      | 3.72        | 0.07           | 2.00            | 11.41       | 1.49      | 1.29 | 1.29 |
| 14500 | 3.77                      | 3.88        | 0.11           | 2.28            | 11.56       | 1.62      | 1.38 | 1.42 |
| 15000 | 3.96                      | 4.09        | 0.12           | 2.67            | 11.84       | 1.82      | 1.49 | 1.56 |
| 15500 | 4.17                      | 4.27        | 0.10           | 2.96            | 12.27       | 2.01      | 1.58 | 1.65 |
| 16000 | 4.31                      | 4.38        | 0.07           | 3.02            | 12.78       | 2.11      | 1.62 | 1.66 |
| 16500 | 4.34                      | 4.38        | 0.05           | 3.00            | 13.33       | 2.09      | 1.60 | 1.59 |
| 17000 | 4.27                      | 4.32        | 0.05           | 2.95            | 13.89       | 1.99      | 1.53 | 1.49 |
| 17500 | 4.17                      | 4.23        | 0.06           | 2.96            | 14.41       | 1.87      | 1.46 | 1.42 |
| 18000 | 4.10                      | 4.17        | 0.07           | 3.01            | 14.84       | 1.77      | 1.41 | 1.39 |
| 18500 | 4.09                      | 4.16        | 0.08           | 3.06            | 15.17       | 1.74      | 1.41 | 1.39 |
| 19000 | 4.13                      | 4.21        | 0.09           | 3.08            | 15.50       | 1.76      | 1.44 | 1.43 |
| 19500 | 4.23                      | 4.33        | 0.10           | 3.13            | 15.88       | 1.82      | 1.50 | 1.48 |
| 20000 | 4.33                      | 4.46        | 0.13           | 3.31            | 16.38       | 1.88      | 1.55 | 1.54 |
| 20500 | 4.42                      | 4.55        | 0.13           | 3.60            | 16.94       | 1.92      | 1.58 | 1.59 |
| 21000 | 4.46                      | 4.58        | 0.12           | 3.80            | 17.50       | 1.92      | 1.60 | 1.61 |
| 21500 | 4.47                      | 4.56        | 0.09           | 3.94            | 17.97       | 1.91      | 1.60 | 1.58 |
| 22000 | 4.46                      | 4.53        | 0.07           | 3.90            | 18.29       | 1.91      | 1.62 | 1.56 |
| 22500 | 4.49                      | 4.57        | 0.08           | 3.79            | 18.54       | 1.94      | 1.65 | 1.55 |
| 23000 | 4.55                      | 4.67        | 0.12           | 3.85            | 18.80       | 2.01      | 1.67 | 1.60 |
| 23500 | 4.64                      | 4.80        | 0.15           | 4.00            | 19.11       | 2.08      | 1.69 | 1.67 |
| 24000 | 4.69                      | 4.87        | 0.18           | 4.42            | 19.48       | 2.12      | 1.66 | 1.70 |
| 24500 | 4.66                      | 4.83        | 0.17           | 4.79            | 19.92       | 2.06      | 1.60 | 1.68 |
| 25000 | 4.54                      | 4.68        | 0.15           | 5.03            | 20.38       | 1.93      | 1.50 | 1.54 |
| 25500 | 4.40                      | 4.53        | 0.13           | 5.09            | 20.97       | 1.77      | 1.41 | 1.39 |
| 26000 | 4.34                      | 4.47        | 0.13           | 5.26            | 21.58       | 1.66      | 1.35 | 1.32 |
| 26500 | 4.36                      | 4.51        | 0.16           | 5.35            | 22.08       | 1.61      | 1.34 | 1.39 |
| 27000 | 4.42                      | 4.61        | 0.18           | 5.65            | 22.26       | 1.63      | 1.40 | 1.49 |
| 27500 | 4.50                      | 4.68        | 0.19           | 6.10            | 22.05       | 1.70      | 1.47 | 1.59 |
| 28000 | 4.56                      | 4.73        | 0.17           | 6.35            | 21.56       | 1.78      | 1.55 | 1.62 |
| 28500 | 4.55                      | 4.69        | 0.13           | 6.50            | 21.06       | 1.81      | 1.59 | 1.60 |
| 29000 | 4.51                      | 4.62        | 0.11           | 6.56            | 20.57       | 1.78      | 1.58 | 1.54 |
| 29500 | 4.42                      | 4.51        | 0.09           | 6.54            | 20.30       | 1.69      | 1.52 | 1.48 |
| 30000 | 4.31                      | 4.40        | 0.09           | 6.48            | 20.14       | 1.56      | 1.42 | 1.42 |
| 30500 | 4.21                      | 4.32        | 0.11           | 6.47            | 20.05       | 1.41      | 1.33 | 1.37 |
| 31000 | 4.12                      | 4.27        | 0.14           | 6.61            | 19.96       | 1.29      | 1.24 | 1.31 |
| 31500 | 4.10                      | 4.25        | 0.14           | 6.85            | 19.79       | 1.20      | 1.18 | 1.22 |
| 32000 | 4.15                      | 4.27        | 0.12           | 7.07            | 19.40       | 1.17      | 1.13 | 1.12 |
| 32500 | 4.22                      | 4.30        | 0.08           | 6.99            | 18.85       | 1.19      | 1.14 | 1.06 |
| 33000 | 4.27                      | 4.35        | 0.07           | 6.67            | 18.20       | 1.25      | 1.19 | 1.19 |
| 33500 | 4.30                      | 4.40        | 0.11           | 6.35            | 17.60       | 1.27      | 1.27 | 1.33 |
| 34000 | 4.23                      | 4.43        | 0.20           | 6.19            | 16.97       | 1.25      | 1.34 | 1.49 |
| 34500 | 4.17                      | 4.45        | 0.29           | 6.43            | 16.50       | 1.16      | 1.42 | 1.60 |
| 35000 | 4.16                      | 4.49        | 0.33           | 6.94            | 16.13       | 1.14      | 1.49 | 1.68 |
| 35500 | 4.24                      | 4.53        | 0.30           | 7.34            | 15.80       | 1.22      | 1.58 | 1.68 |
| 36000 | 4.30                      | 4.55        | 0.25           | 7.52            | 15.37       | 1.27      | 1.62 | 1.66 |
| 36500 | 4.35                      | 4.58        | 0.23           | 7.36            | 14.84       | 1.28      | 1.63 | 1.58 |
| 37000 | 4.38                      | 4.62        | 0.23           | 6.96            | 14.22       | 1.27      | 1.64 | 1.55 |
| 37500 | 4.44                      | 4.74        | 0.31           | 6.55            | 13.55       | 1.29      | 1.63 | 1.58 |
| 38000 | 4.51                      | 4.89        | 0.38           | 6.56            | 12.97       | 1.35      | 1.67 | 1.69 |
| 38500 | 4.55                      | 5.03        | 0.48           | 6.47            | 12.36       | 1.42      | 1.70 | 1.78 |
| 39000 | 4.57                      | 5.20        | 0.63           | 6.72            | 11.90       | 1.49      | 1.72 | 1.84 |
| 39500 | 4.60                      | 5.38        | 0.77           | 7.50            | 11.56       | 1.52      | 1.73 | 1.86 |
| 40000 | 4.64                      | 5.52        | 0.89           | 8.79            | 11.35       | 1.53      | 1.73 | 1.90 |

<sup>(1)</sup> Total Loss = Insertion Loss + 3dB Splitter Loss

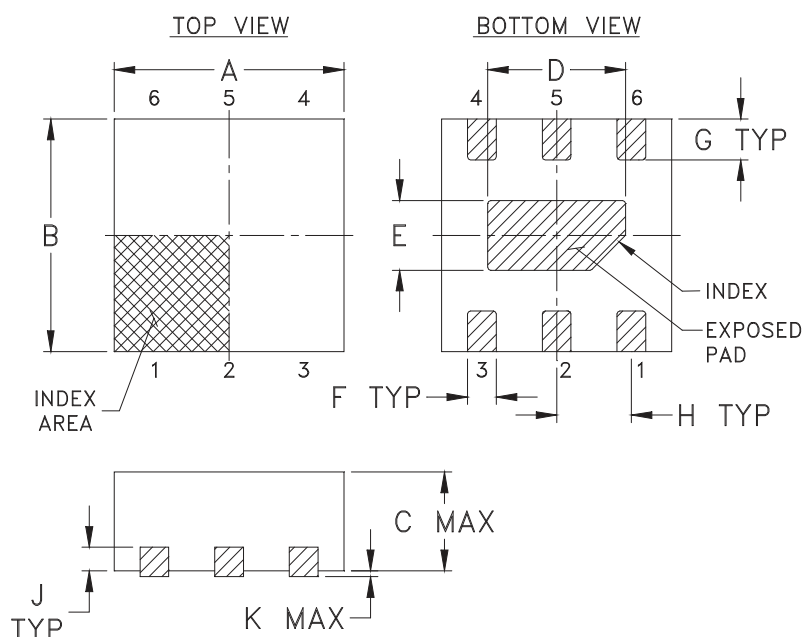
## Typical Performance Curves



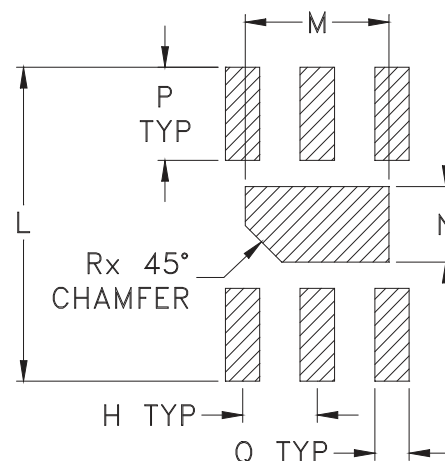
## Typical Performance Curves



### Outline Dimensions



### 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             |
|----------|----------------|----------------|----------------|----------------|---------------|---------------|---------------|---------------|---------------|---------------|----------------|----------------|---------------|---------------|
| MC1630-1 | .079<br>(2.00) | .079<br>(2.00) | .039<br>(1.00) | .047<br>(1.20) | .024<br>(.60) | .010<br>(.25) | .014<br>(.35) | .026<br>(.65) | .008<br>(.20) | .002<br>(.05) | .106<br>(2.70) | .049<br>(1.25) | .026<br>(.65) | .031<br>(.80) |

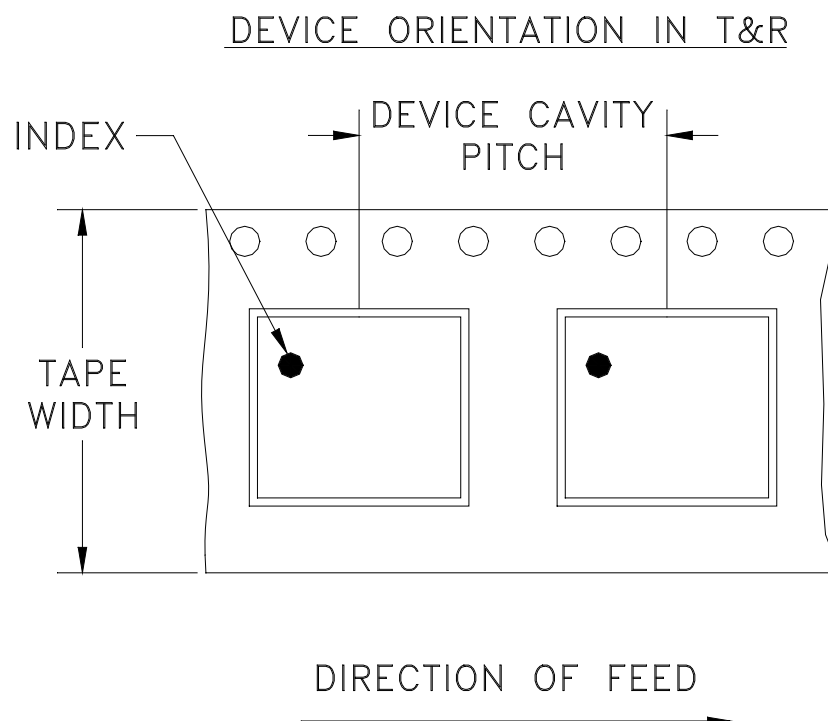
| CASE #.  | Q             | R             | WT, GRAM |
|----------|---------------|---------------|----------|
| MC1630-1 | .012<br>(.30) | .012<br>(.30) | .006     |

Dimensions are in inches (mm). Tolerances: 2 Pl.  $\pm .01$ ; 3 Pl.  $\pm .005$

### Notes:

- Case material: Plastic.
- Termination finish:  
For RoHS Case Styles: Tin-Silver over Nickel plated or Matte-Tin plated (See Data sheet).  
All models, (+) suffix.
- Lead #1 identifier shall be located in the cross-hatched area shown.  
Identifier may be either a molded or marked feature.

# Tape & Reel Packaging TR-F66



| Tape Width,<br>mm | Device Cavity<br>Pitch, mm | Reel Size,<br>inches | Devices per Reel<br>see note  |                  |
|-------------------|----------------------------|----------------------|-------------------------------|------------------|
| 8                 | 4                          | 7                    | Small<br>quantity<br>standard | 20               |
|                   |                            |                      |                               | 50               |
|                   |                            |                      |                               | 100              |
|                   |                            |                      |                               | 200              |
|                   |                            |                      |                               | 500              |
|                   |                            | 7                    | Standard                      | 1000, 2000, 3000 |

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](http://www.minicircuits.com/pages/pdfs/tape.pdf)



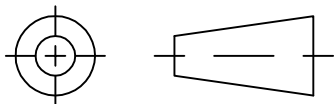
INTERNET <http://www.minicircuits.com>

P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661

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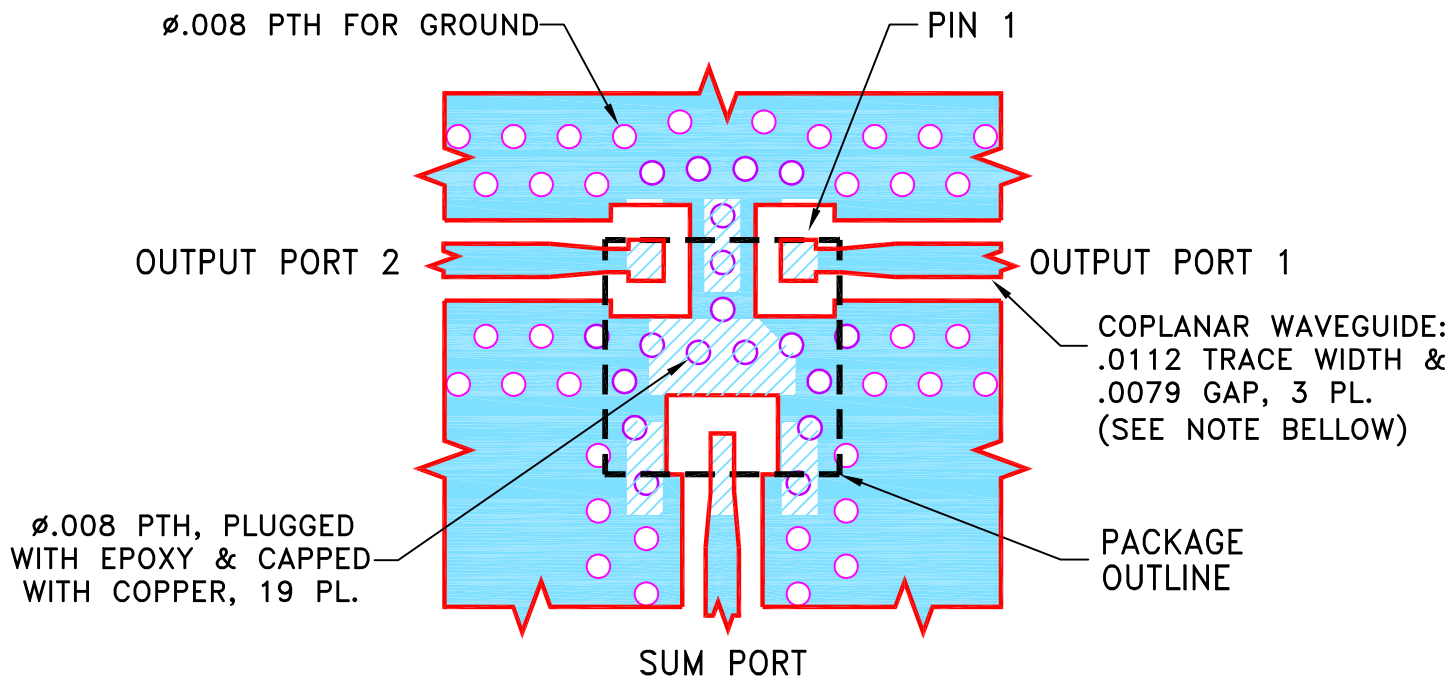
## THIRD ANGLE PROJECTION



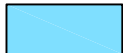
## REVISIONS

| REV | ECN No.    | DESCRIPTION | DATE     | DR  | AUTH |
|-----|------------|-------------|----------|-----|------|
| OR  | ECO-001451 | NEW RELEASE | 01/17/20 | ITG | IL   |
|     |            |             |          |     |      |
|     |            |             |          |     |      |

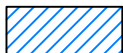
SUGGESTED MOUNTING CONFIGURATION  
FOR MC1630-1 CASE STYLE

**NOTES:**

1. TRACE WIDTH & GAP ARE SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS  $.0066 \pm .0007$ ". COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH & GAP MAY NEED TO BE MODIFIED.
2. UNIT FOOT PRINT IS OPTIMIZED FOR PERFORMANCE AND IS DIFFERENT FROM CASE STYLE MC1630-1 RECOMMENDATIONS.
3. BOTTOM SIDE OF THE PCB IS CONTINUOUS GROUND PLANE.



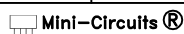
DENOTES PCB COPPER LAYOUT WITH SMOBC (SOLDER MASK OVER BARE COPPER).



DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK.

| UNLESS OTHERWISE SPECIFIED | INITIALS | DATE     |
|----------------------------|----------|----------|
| DRAWN                      | ITG      | 01/17/20 |
| CHECKED                    | GF       | 01/17/20 |
| APPROVED                   | IL       | 01/17/20 |

DIMENSIONS ARE IN INCHES  
 TOLERANCES ON:  
 2 PL DECIMALS  $\pm$   
 3 PL DECIMALS  $\pm$  .005  
 ANGLES  $\pm$   
 FRACTIONS  $\pm$



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



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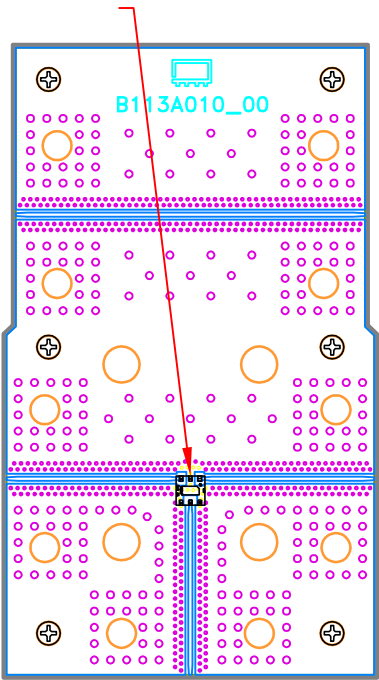
13 Neptune Avenue  
 Brooklyn NY 11235

**PL, MC1630-1, TB-EP2-5GC+**

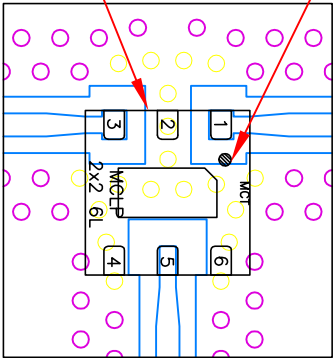
| SIZE   | CODE IDENT | DRAWING NO: | REV: |
|--------|------------|-------------|------|
| A      | 15542      | 98-PL-667   | OR   |
| FILE:  | 98PL667    | SCALE:      | 15:1 |
| SHEET: | 1          | OF          | 1    |

# Evaluation Board and Circuit

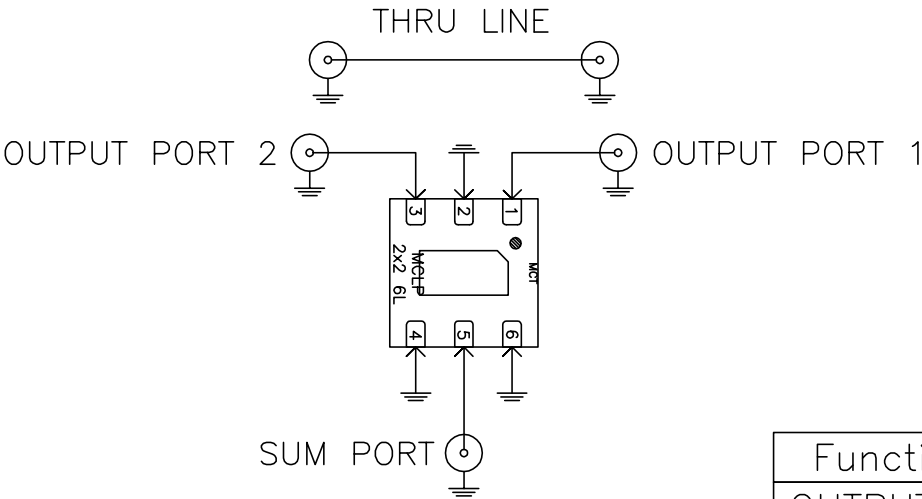
SEE DETAIL "A"



DUT INDEX



DETAIL "A"  
(SCALE 5:1)

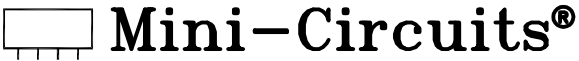


SCHEMATIC DIAGRAM

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

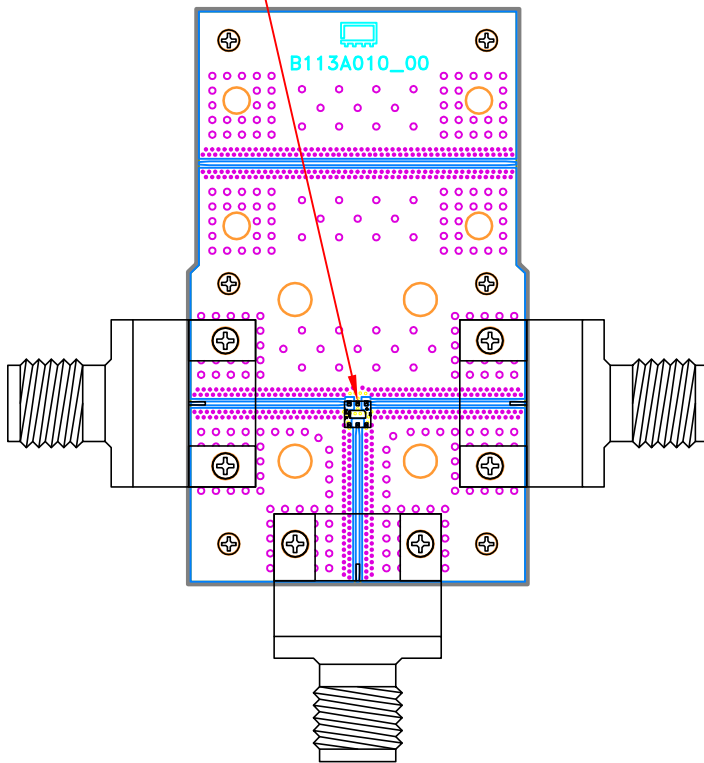
## Notes:

1. PCB Material: Roger R04350B or equivalent,  
Dielectric constant=3.5, Thickness=0.0066 inch

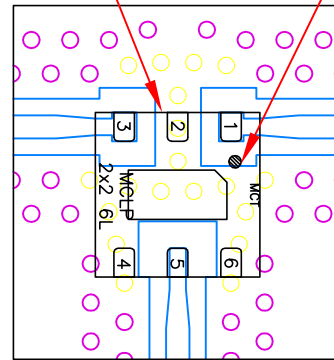


# Evaluation Board and Circuit

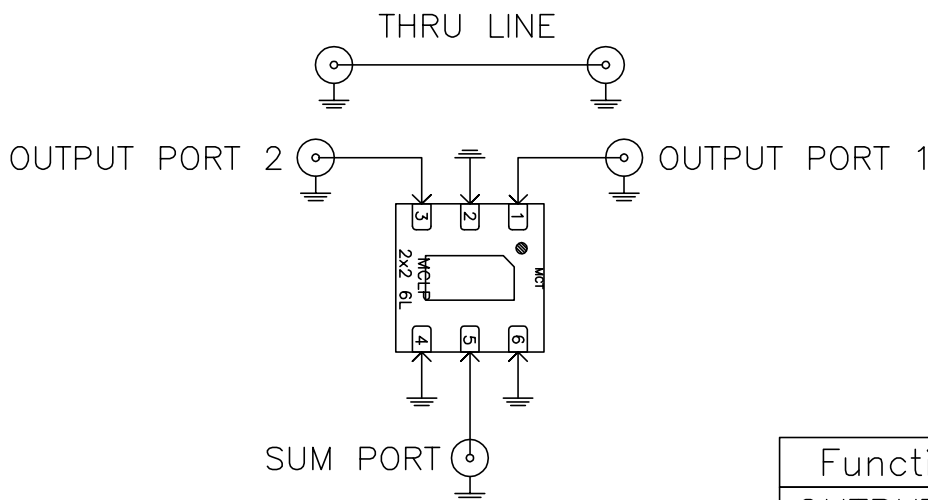
SEE DETAIL "A"



DUT INDEX



DETAIL "A"  
(SCALE 5:1)



SCHEMATIC DIAGRAM

## Notes:

1. 2.4mm Female Connectors.
2. PCB Material: Roger R04350B or equivalent,  
Dielectric constant=3.5, Thickness=0.0066 inch

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

 **Mini-Circuits®**



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          | -55° to 105°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-020C                                    |
| Solderability                  | 10X magnification, 95% coverage                                                                                                                                 | JESD22-B102, Method 1: Dip and Look Test      |
| 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                       |