

2 Way-0° 50Ω 2 to 26.5 GHz

The Big Deal

- Ultra-Wide Bandwidth, usable over 1.8 to 28 GHz
- Tiny Size, 4 x 4 x 1 mm
- High Power Handling, 2.5 W as a Splitter



CASE STYLE: DG1847

Product Overview

Mini-Circuits EP2K1+ is a MMIC splitter/combiner designed for wideband operation from 2 to 26.5 GHz. This model provides excellent power ratings in a tiny device package (4x4x1 mm), with up to 2.5 W power handling (as a splitter) and up to 1.2A DC current passing. Manufactured using GaAs IPD technology, it provides a high level of ESD protection and excellent reliability.

Key Features

| Feature | Advantages |
|---|---|
| Wideband, 2 to 26.5 GHz | One power splitter can be used in many applications, saving component count. Also ideal for wideband applications such as military and instrumentation. |
| Excellent power handling 2.5W as a splitter at 25°C 1.7W internal dissipation as a combiner at 25°C | In power combiner applications, half the power is dissipated internally. EP2K1+ is designed to handle 1.7W internal dissipation as a combiner allowing reliable operation without excessive temperature rise. Similar splitters implemented as Wilkinson splitters on PCB require big resistors and additional heat sinking. As a splitter, EP2K1+ can handle up to 2.5W in a very small package. |
| DC Passing up to 1.2A | DC current passing is helpful in applications where both RF & DC need to pass through the DUT, such as antenna mounted hardware. |
| Small size 4 x 4mm QFN package | Tiny footprint saves space in dense layouts while providing low inductance, repeatable transitions, and excellent thermal contact to the PCB. |

2 Way-0° 50Ω 2 to 26.5 GHz**Features**

- Wide bandwidth, 2 to 26.5 GHz, usable over 1.8 to 28 GHz
- Excellent amplitude unbalance, 0.1 dB typ.
- Good phase unbalance, 1 to 5 deg. typ.
- Small size, 4x4 mm
- High ESD level*
- Aqueous washable
- DC passing

Applications

- WIMAX
- ISM
- Instrumentation
- Radar
- WLAN
- Satellite communications
- LTE



CASE STYLE: DG1847

+RoHS Compliant

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

Electrical Specifications¹ at 25°C

| Parameter | Frequency (GHz) | Min. | Typ. | Max. | Unit |
|--|-----------------|------|------|------|--------|
| Frequency Range | | 2 | | 26.5 | GHz |
| Insertion Loss ² above 3.0 dB | 2 - 5 | — | 0.8 | 1.3 | dB |
| | 5 - 10 | — | 1.1 | 1.6 | |
| | 10 - 18 | — | 1.7 | 2.5 | |
| | 18 - 26.5 | — | 2.4 | 3.2 | |
| Isolation | 2 - 5 | 6 | 14 | — | dB |
| | 5 - 10 | 13 | 22 | — | |
| | 10 - 18 | 14 | 20 | — | |
| | 18 - 26.5 | 14 | 21 | — | |
| Phase Unbalance | 2 - 5 | — | 1.5 | 4 | Degree |
| | 5 - 10 | — | 2.3 | 6 | |
| | 10 - 18 | — | 3.7 | 8 | |
| | 18 - 26.5 | — | 5.4 | 9 | |
| Amplitude Unbalance | 2 - 5 | — | 0.1 | 0.3 | dB |
| | 5 - 10 | — | 0.1 | 0.3 | |
| | 10 - 18 | — | 0.1 | 0.5 | |
| | 18 - 26.5 | — | 0.3 | 0.7 | |
| VSWR (Port S) | 2 - 5 | — | 1.5 | — | :1 |
| | 5 - 10 | — | 1.4 | — | |
| | 10 - 18 | — | 1.4 | — | |
| | 18 - 26.5 | — | 1.4 | — | |
| VSWR (Port 1-2) | 2 - 5 | — | 1.5 | — | :1 |
| | 5 - 10 | — | 1.3 | — | |
| | 10 - 18 | — | 1.4 | — | |
| | 18 - 26.5 | — | 1.5 | — | |

1. Tested on Mini-Circuits Test Board TB-840+

2. Insertion Loss Values are de-embedded from Test Board Loss; 0.3 dB at 2 GHz, 0.5 dB at 5 GHz, 0.8 dB at 10 GHz and 1.3 dB at 18 GHz & 2 dB at 26.5 GHz

Maximum Ratings

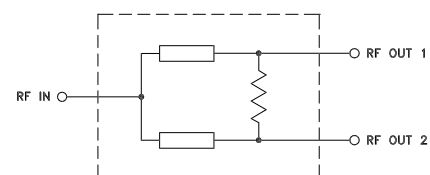
| Parameter | Ratings |
|-----------------------------|--|
| Operating Temperature | -40°C to 85°C |
| Storage Temperature | -65°C to 150°C |
| Power Input (as a splitter) | 2.5W max. at 25°C. Derate linearly to 1.25W at 85°C |
| Internal Dissipation | 1.7W max. at 25°C. Derate linearly to 1.1W at 85°C |
| DC Current | 1.2A max. at 25°C. Derate linearly to 0.6A at 85°C |

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

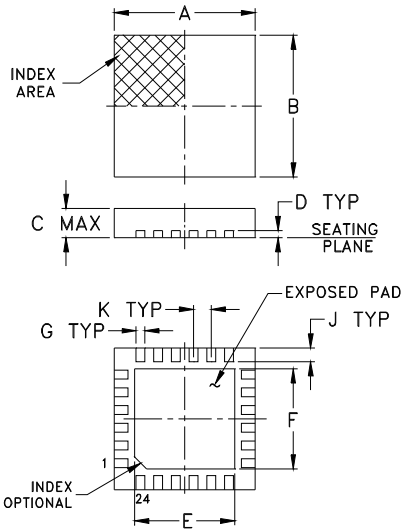
* ESD rating

Human body model (HBM): Class 2(2000 to <4000 V) in accordance with ANSI/ESD 5.1-2001
Machine model (MM): Class M3 (200 to <400 V) in accordance with ANSI/ESD 5.2-1999**Pad Connections**

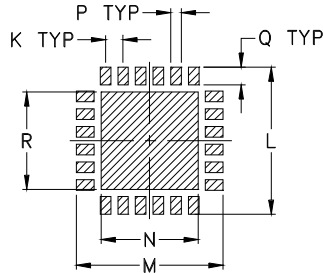
| Function | Pad Number |
|--------------------------------|----------------------------------|
| SUM PORT | 3 |
| PORT 1 | 14 |
| PORT 2 | 17 |
| NOT USED, GROUND EXTERNALLY | 1, 2, 4-13, 15-16, 18-24, Paddle |

Simplified Electrical Schematic

Outline Drawing



PCB Land Pattern



Suggested Layout, Tolerance to be within ±.002

Product Marking

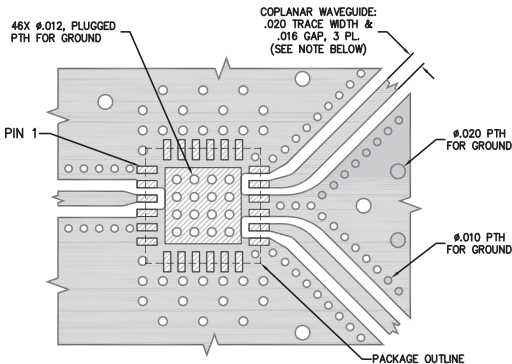


Lead finish: Tin-Silver over Nickel

Outline Dimensions (inch/mm)

| | | | | | | | | |
|------|------|------|------|------|------|------|----|-------|
| A | B | C | D | E | F | G | H | J |
| .157 | .157 | .039 | .008 | .104 | .104 | .009 | -- | .016 |
| 4.0 | 4.0 | 1.0 | 0.20 | 2.64 | 2.64 | 0.23 | -- | 0.41 |
| K | L | M | N | P | Q | R | | wt |
| .020 | .166 | .166 | .102 | .012 | .020 | .102 | | grams |
| 0.50 | 4.22 | 4.22 | 2.59 | 0.30 | 0.51 | 2.59 | | 0.04 |

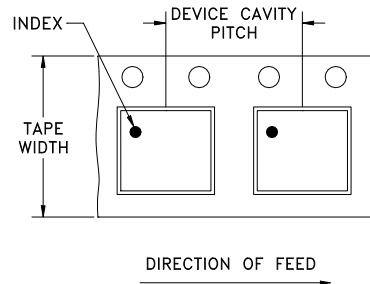
Demo Board MCL P/N: TB-845-1+ Suggested PCB Layout (PL-472)



- NOTES:
- TRACE WIDTH IS SHOWN FOR ROGERS R04350B WITH DIELECTRIC THICKNESS .010"±.001"; COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH AND GAP MAY NEED TO BE MODIFIED.
 - BOTTOM SIDE OF THE PCB IS CONTINUOUS GROUND PLANE.
- DENOTES PCB COPPER LAYOUT WITH SMOBC (SOLDER MASK OVER BARE COPPER).
 - DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK.

Tape and Reel (F68)

DEVICE ORIENTATION IN T&R

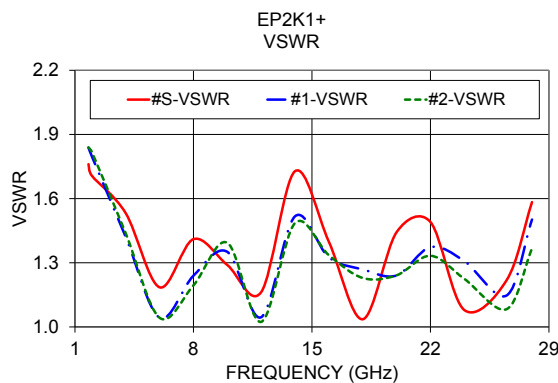
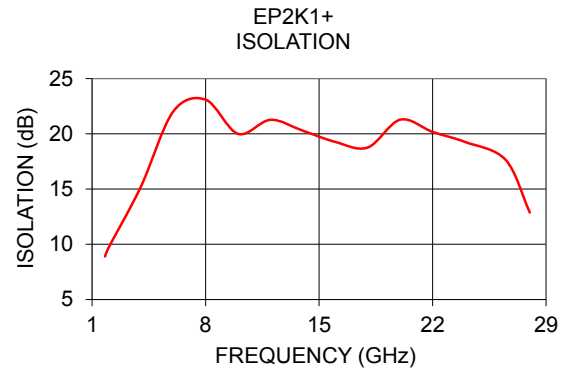
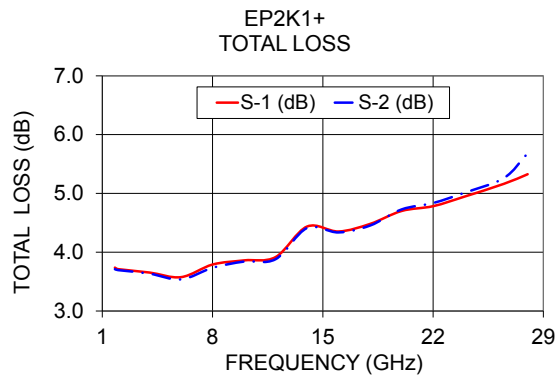


| Tape Width, mm | Device Cavity Pitch, mm | Reel Size, inches | Devices per Reel see note |
|----------------|-------------------------|-------------------|---------------------------|
| 12 | 8 | 7 | Small quantity standard |
| | | | 20 |
| | | | 50 |
| | | 13 | Standard |
| | | | 1000 |
| | | | 2000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

Typical Performance Data

| Frequency (GHz) | Total Loss ¹ (dB) | | Amplitude Unbalance (dB) | Isolation (dB) | Phase Unbalance (deg.) | VSWR S | VSWR 1 | VSWR 2 |
|-----------------|------------------------------|------|--------------------------|----------------|------------------------|--------|--------|--------|
| | S-1 | S-2 | | | | | | |
| 1.8 | 3.74 | 3.71 | 0.03 | 8.90 | 0.20 | 1.76 | 1.84 | 1.84 |
| 2.0 | 3.71 | 3.70 | 0.02 | 9.65 | 0.24 | 1.71 | 1.80 | 1.82 |
| 4.0 | 3.65 | 3.64 | 0.02 | 15.19 | 0.85 | 1.53 | 1.42 | 1.44 |
| 6.0 | 3.58 | 3.54 | 0.04 | 22.01 | 1.41 | 1.19 | 1.04 | 1.04 |
| 8.0 | 3.79 | 3.74 | 0.06 | 23.09 | 1.82 | 1.41 | 1.24 | 1.19 |
| 10.0 | 3.86 | 3.84 | 0.02 | 20.00 | 2.26 | 1.29 | 1.35 | 1.39 |
| 12.0 | 3.92 | 3.88 | 0.04 | 21.27 | 2.49 | 1.16 | 1.05 | 1.02 |
| 14.0 | 4.44 | 4.41 | 0.03 | 20.28 | 3.16 | 1.73 | 1.52 | 1.49 |
| 16.0 | 4.35 | 4.34 | 0.02 | 19.27 | 2.87 | 1.40 | 1.33 | 1.34 |
| 18.0 | 4.48 | 4.45 | 0.03 | 18.76 | 3.02 | 1.04 | 1.27 | 1.23 |
| 20.0 | 4.70 | 4.73 | 0.03 | 21.28 | 3.79 | 1.44 | 1.24 | 1.24 |
| 22.0 | 4.78 | 4.84 | 0.05 | 20.17 | 4.09 | 1.49 | 1.37 | 1.33 |
| 24.0 | 4.95 | 5.01 | 0.07 | 19.27 | 2.99 | 1.08 | 1.31 | 1.22 |
| 26.5 | 5.16 | 5.26 | 0.10 | 17.65 | 4.44 | 1.22 | 1.15 | 1.08 |
| 28.0 | 5.33 | 5.68 | 0.36 | 12.87 | 4.80 | 1.58 | 1.50 | 1.37 |

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



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-Circuits' applicable established test performance criteria and measurement instructions.
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