

MMIC

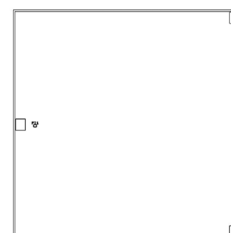
# Power Splitter/Combiner Die

EP2W-D+

2 Way-0° 50Ω 0.5 to 9.5 GHz

## The Big Deal

- Ultra-Wide Bandwidth, 0.5 to 9.5 GHz
- High Power Handling, 2.5W as a splitter



## Product Overview

Mini-Circuits' EP2W-D+ is a MMIC 2-way 0° splitter/combiner Die designed for wideband operation from 0.5 to 9.5 GHz supporting many applications requiring high performance across a wide frequency range including all the LTE bands through WiMax an WiFi, as well as instrumentation and more. This model provides excellent power handling up to 2.5W (as a splitter) with low insertion loss, good isolation, and low phase and amplitude unbalance. Manufactured using GaAs IPD technology, the EP2W-D+ provides a high level of ESD protection and excellent repeatability.

## Key Features

Feature	Advantages
Wideband, 0.5 to 9.5 GHz	One power splitter can be used in all the LTE bands through WiMAX and WiFi, saving component count. Also ideal for wideband applications such as military and instrumentation.
Excellent power handling <ul style="list-style-type: none"><li>• 2.5W as a splitter</li><li>• 1.7W internal dissipation as a combiner</li></ul>	In power combiner applications, half the power is dissipated internally. EP2W-D+ 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, EP2W-D+ can handle up to 2.5W.
DC Passing	DC current passing is helpful in applications where both RF & DC need to pass through the DUT, such as antenna mounted hardware.
Unpackaged Die	Enables user to integrate it directly into hybrids.



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## Product Features

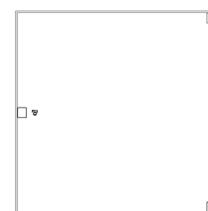
- Wide bandwidth, 0.5 to 9.5 GHz
- Excellent amplitude unbalance, 0.1 dB typ. to 6 GHz
- Good phase unbalance, 1 to 3 deg. typ.
- DC passing
- High ESD level

## Typical Applications

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

## General Description

Mini-Circuits' EP2W-D+ is a MMIC 2-way 0° splitter/combiner Die designed for wideband operation from 0.5 to 9.5 GHz supporting many applications requiring high performance across a wide frequency range including all the LTE bands through WiMax and WiFi, as well as instrumentation and more. This model provides excellent power handling up to 2.5W (as a splitter) with low insertion loss, good isolation, and low phase and amplitude unbalance. Manufactured using GaAs IPD technology, the EP2W-D+ provides a high level of ESD protection and excellent repeatability.

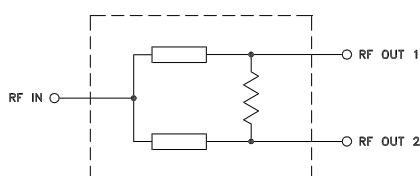


+RoHS Compliant

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

Ordering Information: Refer to Last Page

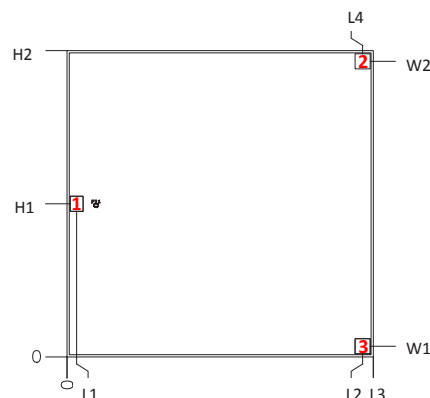
## Simplified Schematic and Pad Description



Pad#	Function
1	SUM PORT (RF IN 1)
2	PORT 1 (RF OUT 1)
3	PORT 2 (RF OUT 2)

Note: 1. Bond Pad material - Gold  
2. Bottom of Die is ground - Gold plated

## Bonding Pad Position



Dimensions in  $\mu\text{m}$ , Typical

L1	L2	L3	L4	W1	W2	H1	H2	Thickness	Width	Length	Bond Pad Size, RF-IN	Bond Pad Size, RF-OUT
112	3426	3550	3426	124	3426	1775	3550	200	3550	3550	150 x 175	175 x 175



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REV. OR  
M163099  
EP2W-D+  
MCL NY  
171011  
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Electrical Specifications at 25°C<sup>1</sup>

Parameter	Frequency (GHz)	Min.	Typ.	Max.	Unit
Frequency Range		0.5		9.5	GHz
Insertion Loss, above 3.0 dB	0.5 - 1.5	—	1.0	—	dB
	1.5 - 3.0	—	1.3	—	
	3.0 - 6.0	—	1.8	—	
	6.0 - 9.5	—	3.4	—	
Isolation	0.5 - 1.5	—	9.3	—	dB
	1.5 - 3.0	—	19.8	—	
	3.0 - 6.0	—	19.4	—	
	6.0 - 9.5	—	10.2	—	
Phase Unbalance	0.5 - 1.5	—	0.5	—	Degree
	1.5 - 3.0	—	0.9	—	
	3.0 - 6.0	—	1.7	—	
	6.0 - 9.5	—	2.5	—	
Amplitude Unbalance	0.5 - 1.5	—	0.1	—	dB
	1.5 - 3.0	—	0.1	—	
	3.0 - 6.0	—	0.1	—	
	6.0 - 9.5	—	0.5	—	
VSWR (Port S)	0.5 - 1.5	—	1.6	—	:1
	1.5 - 3.0	—	1.5	—	
	3.0 - 6.0	—	1.6	—	
	6.0 - 9.5	—	1.7	—	
VSWR (Port 1-2)	0.5 - 1.5	—	1.3	—	:1
	1.5 - 3.0	—	1.3	—	
	3.0 - 6.0	—	1.4	—	
	6.0 - 9.5	—	1.5	—	

1. Measured on Mini-Circuits Die Characterization Test Board. Die packaged in 5x5 mm, 32-lead MCLP package.

## Maximum Ratings

Parameter	Ratings
Operating Temperature	-40°C to 85°C
Power Input (as a splitter)	2.5W <sup>2</sup> max.
Internal Dissipation	1.75W <sup>3</sup> max.
DC Current	0.4A max

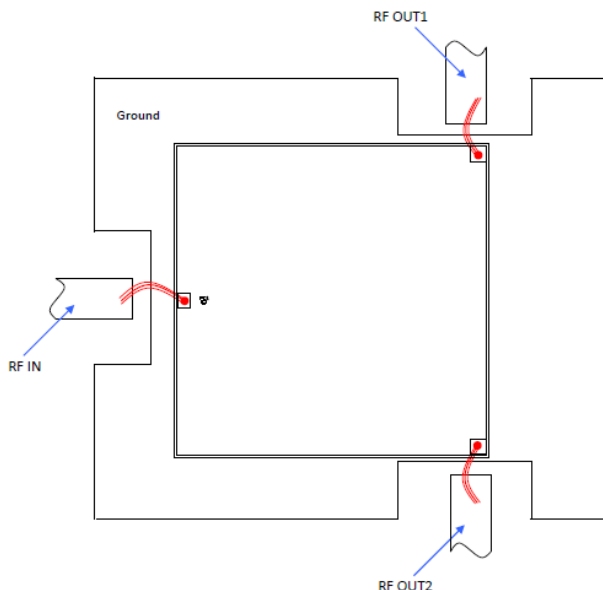
2. Derate linearly to 1.25W at 85°C

3. Derate linearly to 1.1W at 85°C

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



## Assembly Diagram



## Assembly and Handling Procedure

- 1. Storage**  
Dice should be stored in a dry nitrogen purged desiccators or equivalent.
- 2. ESD**  
MMIC dice are susceptible to electrostatic and mechanical damage. Die are supplied in antistatic protected material, which should be opened in clean room conditions at an appropriately grounded anti-static workstation. Devices need careful handling using correctly designed collets, vacuum pickup tips or sharp antistatic tweezers to deter ESD damage to dice.
- 3. Die Attach**  
The Die mounting surface must be clean and flat. Using conductive silver filled epoxy, recommended epoxies are DieMat DM6030HK-PT/H579 or Ablestik 84-1LMISR4. Apply sufficient epoxy to meet required epoxy bond line thickness, epoxy fillet height and epoxy coverage around total Die periphery. Parts shall be cured in a nitrogen filled atmosphere per manufacturer's cure condition. It is recommended to use antistatic Die pick up tools only.
- 4. Wire Bonding**  
Bond pad openings in the surface passivation above the bond pads are provided to allow wire bonding to the dice gold bond pads. Thermosonic bonding is used with minimized ultrasonic content. Bond force, time, ultrasonic power and temperature are all critical parameters. Suggested wire is pure gold, 1 mil diameter. Bonds must be made from the bond pads on the Die to the package or substrate. All bond wires should be kept as short as low as reasonable to minimize performance degradation due to undesirable series inductance.

<b>Additional Detailed Technical Information</b> <i>additional information is available on our dash board.</i>	
<b>Performance Data</b>	Data Table
	Swept Graphs
	S-Parameter (S2P Files) Data Set with and without port extension(.zip file)
<b>Case Style</b>	Die
<b>Die Ordering and packaging information (Note 5)</b>	Quantity, Package                      Model No.
	Small, Gel - Pak: 5,10                      EP2W-DG+
	Medium†, Partial wafer: 160 Max.                      EP2W-DP+
	Large†, Full wafer                      EP2W-DF+
	†Available upon request contact sales representative
	Refer to <a href="#">AN-60-067</a>
<b>Environmental Ratings</b>	ENV-80

5. Dice taken from PCM good wafer. No RF or DC test performed.

## ESD Rating\*\*

Human Body Model (HBM): Class 2 (2000V to <4000V) in accordance with ANSI/ESD STM 5.1 - 2001

\*\* Tested in industry standard, 5x5mm, 32-lead MCLP package.

## 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.
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# 2 Way-0° Power Splitter/Combiner Die EP2W-D+

## Typical Performance Data <sup>(2)</sup>

TEST CONDITIONS: INPUT POWER = -10 dBm @Temperature = +25°C

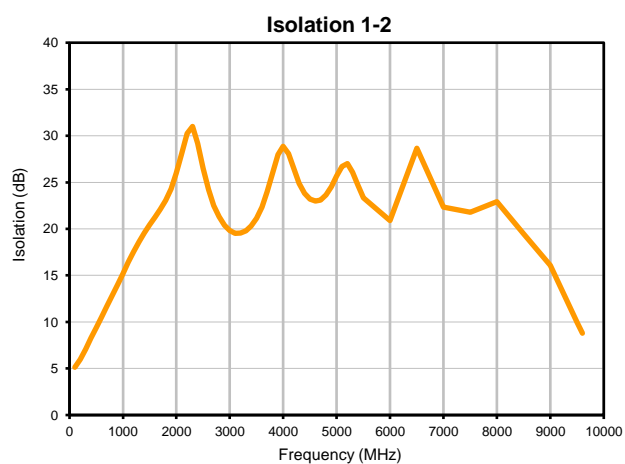
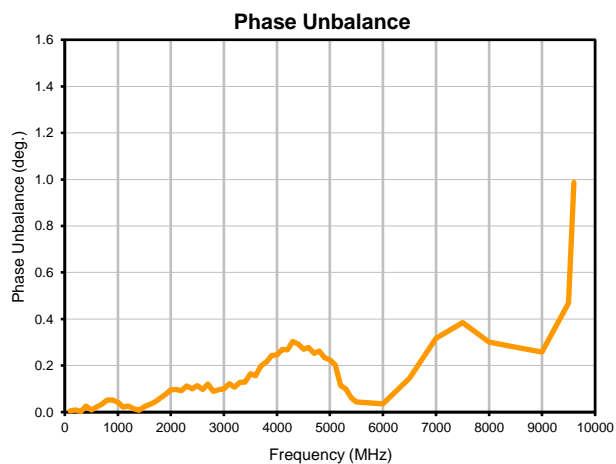
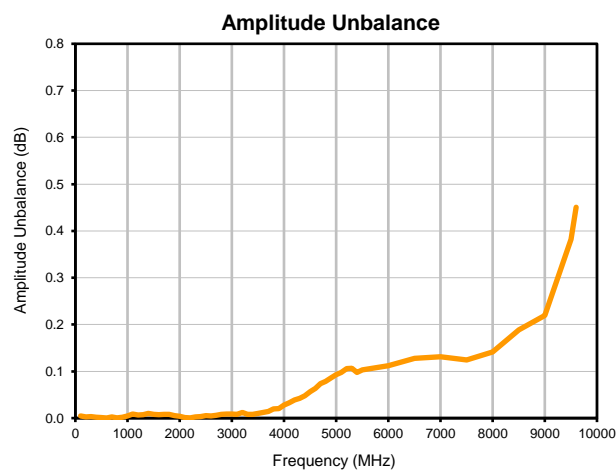
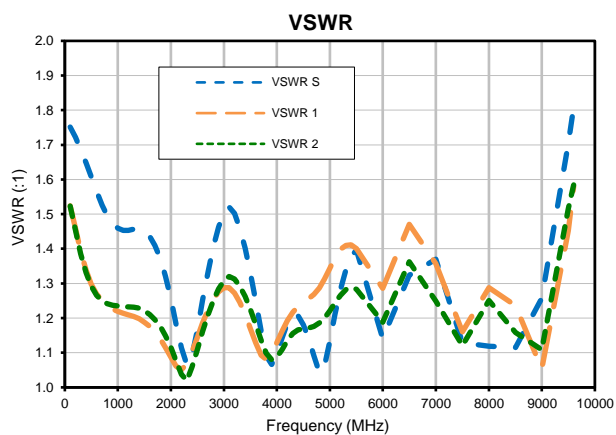
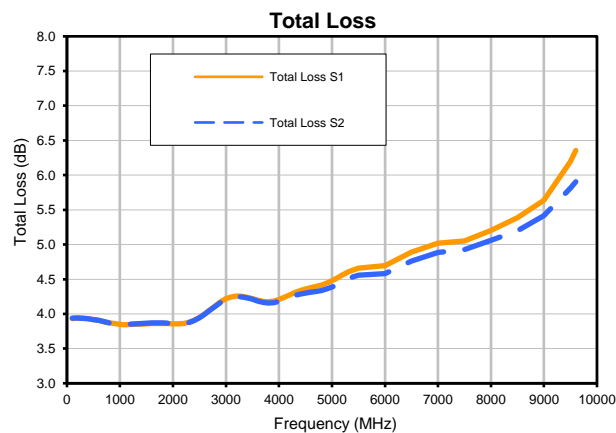
FREQ. (MHz)	TOTAL LOSS <sup>(1)</sup> (dB)		AMP. UNBAL. (dB)	PHASE UNBAL. (deg.)	ISOLATION (dB)	VSWR (:1)		
	S-1	S-2				S	1	2
100	3.93	3.94	0.00	0.00	5.13	1.75	1.52	1.52
200	3.94	3.94	0.00	0.01	5.99	1.72	1.46	1.45
300	3.94	3.93	0.00	0.00	7.07	1.69	1.39	1.39
400	3.93	3.93	0.00	0.03	8.22	1.65	1.34	1.33
500	3.92	3.92	0.00	0.01	9.39	1.61	1.30	1.29
600	3.91	3.91	0.00	0.02	10.53	1.57	1.27	1.27
700	3.89	3.89	0.00	0.03	11.70	1.53	1.25	1.25
800	3.87	3.87	0.00	0.05	12.86	1.50	1.24	1.24
900	3.86	3.86	0.00	0.05	14.03	1.47	1.23	1.24
1000	3.85	3.85	0.00	0.04	15.23	1.46	1.22	1.23
1100	3.84	3.85	0.01	0.02	16.42	1.45	1.21	1.23
1200	3.85	3.85	0.01	0.03	17.56	1.45	1.21	1.23
1300	3.85	3.86	0.01	0.01	18.61	1.46	1.20	1.23
1400	3.85	3.86	0.01	0.01	19.56	1.46	1.20	1.23
1500	3.86	3.87	0.01	0.02	20.43	1.45	1.19	1.22
1600	3.86	3.87	0.01	0.03	21.26	1.44	1.18	1.21
1700	3.86	3.87	0.01	0.04	22.08	1.41	1.16	1.20
1800	3.86	3.87	0.01	0.06	23.05	1.37	1.14	1.18
1900	3.86	3.87	0.01	0.08	24.30	1.32	1.12	1.15
2000	3.85	3.86	0.00	0.10	25.99	1.26	1.09	1.12
2100	3.86	3.86	0.00	0.10	28.07	1.18	1.06	1.08
2200	3.86	3.86	0.00	0.09	30.25	1.11	1.05	1.04
2300	3.88	3.88	0.00	0.11	31.00	1.07	1.07	1.02
2400	3.91	3.90	0.00	0.10	29.19	1.09	1.10	1.06
2500	3.95	3.94	0.01	0.11	26.49	1.17	1.14	1.11
2600	4.00	4.00	0.00	0.10	24.24	1.25	1.19	1.16
2700	4.06	4.05	0.01	0.12	22.52	1.33	1.22	1.21
2800	4.12	4.11	0.01	0.09	21.32	1.40	1.25	1.25
2900	4.17	4.17	0.01	0.10	20.39	1.46	1.28	1.28
3000	4.22	4.21	0.01	0.10	19.83	1.51	1.29	1.31
3100	4.24	4.24	0.01	0.12	19.52	1.52	1.29	1.32
3200	4.26	4.25	0.01	0.11	19.53	1.50	1.27	1.31
3300	4.25	4.24	0.01	0.13	19.81	1.46	1.25	1.29
3400	4.24	4.23	0.01	0.13	20.30	1.40	1.21	1.26
3500	4.22	4.21	0.01	0.16	21.14	1.33	1.17	1.23
3600	4.20	4.18	0.01	0.16	22.34	1.25	1.13	1.18
3700	4.18	4.17	0.01	0.20	23.99	1.16	1.09	1.14
3800	4.17	4.15	0.02	0.22	25.97	1.09	1.08	1.10
3900	4.18	4.16	0.02	0.24	27.97	1.07	1.10	1.08
4000	4.21	4.18	0.03	0.25	28.88	1.10	1.13	1.09
4100	4.24	4.21	0.03	0.27	28.07	1.14	1.16	1.11
4200	4.27	4.23	0.04	0.27	26.42	1.19	1.19	1.14
4300	4.31	4.26	0.04	0.30	24.86	1.21	1.22	1.16
4400	4.33	4.29	0.05	0.29	23.81	1.21	1.23	1.17
4500	4.36	4.30	0.06	0.27	23.19	1.18	1.25	1.17
4600	4.38	4.32	0.06	0.28	22.99	1.14	1.26	1.17
4700	4.40	4.32	0.07	0.25	23.10	1.09	1.27	1.18
4800	4.42	4.34	0.08	0.26	23.64	1.04	1.29	1.19
4900	4.44	4.36	0.09	0.23	24.52	1.06	1.31	1.20
5000	4.48	4.39	0.09	0.23	25.69	1.13	1.34	1.22
5100	4.52	4.42	0.10	0.20	26.69	1.21	1.38	1.24
5200	4.56	4.46	0.11	0.11	27.00	1.28	1.40	1.27
5300	4.60	4.50	0.11	0.10	26.08	1.34	1.41	1.28
5400	4.63	4.54	0.10	0.06	24.67	1.38	1.41	1.29
5500	4.66	4.56	0.10	0.04	23.32	1.40	1.40	1.28
6000	4.70	4.58	0.11	0.04	20.88	1.14	1.29	1.19
6500	4.89	4.76	0.13	0.15	28.67	1.32	1.47	1.36
7000	5.02	4.89	0.13	0.32	22.33	1.37	1.36	1.25
7500	5.05	4.93	0.12	0.38	21.80	1.13	1.16	1.12
8000	5.20	5.06	0.14	0.30	22.91	1.12	1.29	1.25
8500	5.39	5.20	0.19	0.28	19.44	1.12	1.24	1.16
9000	5.63	5.42	0.22	0.26	16.07	1.26	1.05	1.11
9500	6.19	5.81	0.38	0.47	9.92	1.70	1.45	1.52
9600	6.36	5.90	0.45	0.99	8.79	1.81	1.58	1.58

<sup>(1)</sup> Total Loss = Insertion Loss + 3dB splitter loss.

<sup>(2)</sup> Test data of Die packaged in industry standard, 5x5 mm, 32-lead MCLP package"



## Typical Performance Curves



Note: "Test data of Die packaged in industry standard, 5x5 mm, 32-lead MCLP package"



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 -40° to 105° C or -55° to 105° C or -45° to 105° C Ambient Environment	Refer to Individual Model Data Sheet
Storage Environment (Die)	-65° to 150°C	Individual Model Data Sheet
Storage Environment(Packaging)	-40° to 70°C and 40 to 60% humidity (In Factory Shipped Package)	