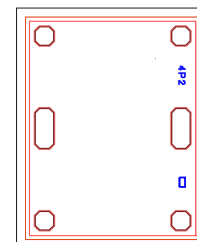


MMIC

# Power Splitter/Combiner Die

WP4P1-D+

4 Way-0° 50Ω 1525 to 2375 MHz



## The Big Deal

- Wide Bandwidth, 1525 to 2375 MHz
- Excellent Amplitude Unbalance, 0.15 dB typ.

## Product Overview

Mini-Circuits' WP4P1-D+ is a MMIC 4-way 0° splitter/combiner Die designed for wideband operation from 1525 to 2375 MHz. Manufactured using Si IPD technology, its compact size saves valuable space in hybrids.

## Key Features

Feature	Advantages
Bandwidth, 1525 to 2375 MHz	One power splitter can be used in many applications, saving component count.
Excellent Amplitude Unbalance, 0.15 dB typ. and Good Phase Unbalance, 1 deg. typ.	Excellent Amplitude and phase unbalance helps to accurately divide the input signals which is essential in test and measurement circuits.
Unpackaged Die, 0.855 x 1.069 mm	Enables user to integrate it directly into hybrids. Small die size saves space in customer hybrids.



# MMIC Power Splitter/Combiner Die

## WP4P1-D+

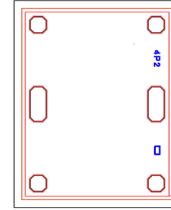
4 Way-0° 50Ω 1525 to 2375 MHz

### Product Features

- Wide bandwidth, 1525 to 2375 MHz
- Excellent amplitude unbalance, 0.15 dB typ.

### Applications

- PCS/DCS
- WCDMA
- GPS



**+RoHS Compliant**

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

**Ordering Information: Refer to Last Page**

### General Description

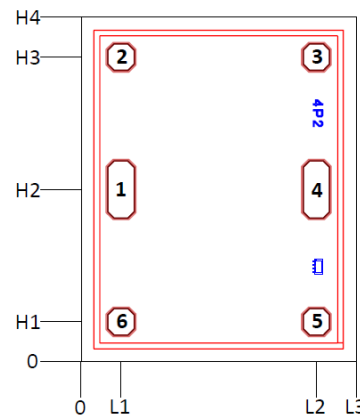
Mini-Circuits' WP4P1-D+ is a MMIC 4-way 0° splitter/combiner Die designed for wideband operation from 1525 to 2375 MHz. Manufactured using Si IPD technology, its compact size saves valuable space in hybrids.

### Simplified Schematic and Pad Description



Pad#	Function
1	RF IN
2	RF OUT 1
3	RF OUT 2
5	RF OUT 3
6	RF OUT 4
4	Ground

### Bonding Pad Position



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

L1	L2	L3	H1	H2	H3	H4	Thickness	Die Size	Pad Size 1 & 4	Pad Size 2,3,5 & 6
124	731	855	124	534	945	1069	254	855x1069	82 x 177	82 x 82



**Electrical Specifications at 25°C<sup>1</sup>**

Parameter	Frequency (MHz)	Min.	Typ.	Max.	Unit
Frequency Range		1525		2375	MHz
Insertion Loss above 3.0 dB	1525 - 2375		0.9		dB
Isolation	1525 - 2375		26		dB
Phase Unbalance	1525 - 2375		2.0		Degree
Amplitude Unbalance	1525 - 2375		0.2		dB
VSWR (Port S)	1525 - 2375		1.5		:1
VSWR (Port 1,2,3,4)	1525 - 2375		1.4		:1

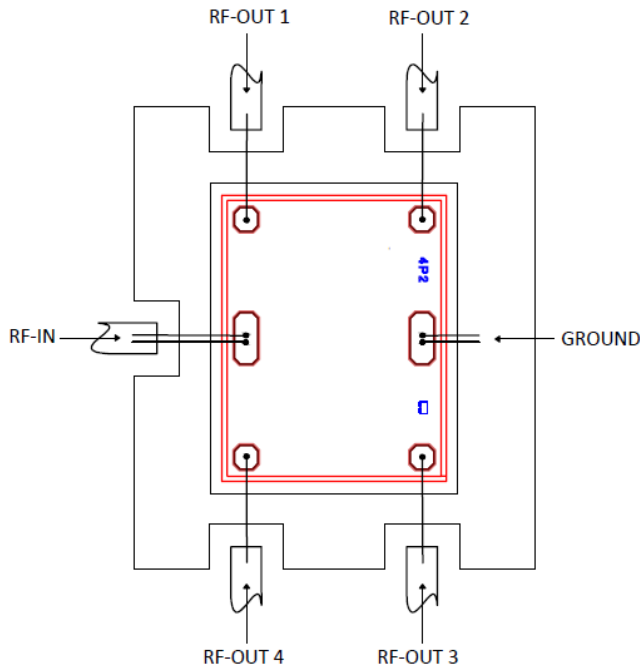
1. Tested in 3x3mm, Mini-Circuits 12-lead MCLP package.

**Maximum Ratings<sup>1,2</sup>**

Parameter	Ratings
Operating Temperature	-40°C to 85°C
Power Input (as a splitter)	1.5W
Internal Dissipation	0.375W

2. 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 (S5P Files) Data Set with and without port extension(.zip file)						
<b>Case Style</b>	Die						
<b>Die Ordering and packaging information (Note 5)</b>	<table> <tr> <td>Quantity, Package</td> <td>Model No.</td> </tr> <tr> <td>Small, Gel - Pak: 5,10,50,100 KGD*</td> <td>WP4P1-DG+</td> </tr> <tr> <td>Medium†, Partial wafer: KGD*&lt;1554</td> <td>WP4P1-DP+</td> </tr> </table> <p>†Available upon request contact sales representative</p> <p>Refer to <a href="#">AN-60-067</a></p>	Quantity, Package	Model No.	Small, Gel - Pak: 5,10,50,100 KGD*	WP4P1-DG+	Medium†, Partial wafer: KGD*<1554	WP4P1-DP+
Quantity, Package	Model No.						
Small, Gel - Pak: 5,10,50,100 KGD*	WP4P1-DG+						
Medium†, Partial wafer: KGD*<1554	WP4P1-DP+						
<b>Environmental Ratings</b>	ENV-80						

\*Known Good Dice ("KGD") means that the dice are taken from PCM good wafer and visually inspected in question have been subjected to Mini-Circuits while this is not definitive, it does help to provide a higher degree of confidence that dice are capable of meeting typical RF electrical parameters specified by Mini-Circuits.

## ESD Rating\*\*

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

\*\* Tested in 3x3mm, Mini-Circuits 12-lead MCLP package.

### Additional Notes

- 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.
- Electrical specifications and performance data contained in this specification document are based on Mini-Circuit's applicable established test performance criteria and measurement instructions.
- 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)
- Mini-Circuits does not warrant the accuracy or completeness of the information, text, graphics and other items contained within this document and same are provided as an accommodation and on an "As is" basis, with all faults.
- Purchasers of this part are solely responsible for proper storing, handling, assembly and processing of Known Good Dice (including, without limitation, proper ESD preventative measures, Die preparation, Die attach, wire bonding and related assembly and test activities), and Mini-Circuits assumes no responsibility therefor or for environmental effects on Known Good Dice.
- Mini-Circuits and the Mini-Circuits logo are registered trademarks of Scientific Components Corporation d/b/a Mini-Circuits. All other third-party trademarks are the property of their respective owners. A reference to any third-party trademark does not constitute or imply any endorsement, affiliation, sponsorship, or recommendation by any such third-party of Mini-Circuits or its products.



# 4 Way-0° Power Splitter/Combiner Die

# WP4P1-D+

## Typical Performance Data

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

FREQ. (MHz)	TOTAL LOSS <sup>1</sup> (dB)				AMP. UNBAL. (dB)	ISOLATION (dB)			PHASE UNBAL. (deg.)	FREQ. (MHz)	VSWR (:1)				
	S-1	S-2	S-3	S-4		1-2	2-3	3-4			S	1	2	3	4
1200	9.98	10.24	10.15	9.95	0.29	17.01	15.25	16.97	3.76	1200	4.82	1.76	1.69	1.70	1.68
1300	8.85	9.09	9.00	8.82	0.27	18.94	16.81	18.87	3.22	1300	3.51	1.70	1.64	1.65	1.63
1400	7.99	8.21	8.12	7.97	0.25	21.67	18.89	21.52	2.75	1400	2.61	1.63	1.59	1.60	1.57
1500	7.38	7.58	7.49	7.35	0.23	25.63	21.61	25.36	2.30	1500	2.00	1.56	1.53	1.53	1.52
1525	7.26	7.46	7.37	7.23	0.22	26.91	22.40	26.61	2.19	1525	1.88	1.55	1.51	1.52	1.50
1575	7.07	7.25	7.16	7.04	0.21	29.98	24.11	29.61	1.98	1575	1.68	1.52	1.48	1.49	1.48
1600	6.98	7.16	7.08	6.95	0.21	31.75	25.01	31.40	1.88	1600	1.58	1.50	1.47	1.48	1.47
1650	6.85	7.01	6.93	6.82	0.20	34.91	26.76	35.09	1.69	1650	1.42	1.48	1.44	1.45	1.44
1675	6.80	6.95	6.87	6.76	0.19	35.19	27.49	35.99	1.60	1675	1.36	1.47	1.43	1.44	1.43
1710	6.73	6.89	6.80	6.70	0.19	33.76	28.19	34.96	1.49	1710	1.27	1.45	1.41	1.42	1.41
1720	6.72	6.87	6.79	6.68	0.18	33.16	28.30	34.34	1.46	1720	1.25	1.45	1.41	1.42	1.41
1740	6.69	6.84	6.76	6.66	0.18	31.91	28.38	33.00	1.39	1740	1.22	1.44	1.40	1.41	1.40
1760	6.67	6.81	6.73	6.63	0.18	30.71	28.28	31.68	1.33	1760	1.18	1.43	1.39	1.40	1.39
1780	6.65	6.79	6.71	6.62	0.17	29.60	28.02	30.45	1.27	1780	1.16	1.43	1.38	1.39	1.39
1800	6.64	6.77	6.69	6.60	0.17	28.61	27.64	29.36	1.21	1800	1.14	1.42	1.38	1.38	1.38
1820	6.62	6.75	6.67	6.59	0.16	27.72	27.17	28.38	1.15	1820	1.13	1.42	1.37	1.38	1.37
1840	6.62	6.74	6.66	6.58	0.16	26.92	26.66	27.50	1.09	1840	1.13	1.41	1.36	1.37	1.37
1860	6.61	6.73	6.65	6.58	0.16	26.20	26.13	26.72	1.03	1860	1.14	1.41	1.36	1.36	1.36
1880	6.61	6.73	6.65	6.57	0.15	25.54	25.59	26.01	0.97	1880	1.16	1.40	1.35	1.36	1.35
1900	6.61	6.72	6.64	6.57	0.15	24.95	25.06	25.36	0.91	1900	1.18	1.40	1.34	1.35	1.35
1920	6.61	6.72	6.64	6.58	0.15	24.40	24.55	24.78	0.86	1920	1.21	1.40	1.34	1.35	1.34
1940	6.61	6.72	6.64	6.58	0.14	23.91	24.08	24.25	0.80	1940	1.24	1.40	1.34	1.34	1.34
1960	6.62	6.72	6.64	6.58	0.14	23.45	23.62	23.76	0.75	1960	1.27	1.39	1.33	1.34	1.33
1980	6.63	6.73	6.64	6.59	0.13	23.03	23.19	23.31	0.69	1980	1.30	1.39	1.33	1.33	1.33
2000	6.63	6.73	6.65	6.60	0.13	22.64	22.77	22.89	0.64	2000	1.33	1.39	1.32	1.33	1.32
2025	6.65	6.74	6.66	6.61	0.12	22.19	22.29	22.40	0.63	2025	1.37	1.39	1.32	1.32	1.32
2050	6.66	6.75	6.67	6.63	0.12	21.79	21.84	21.97	0.64	2050	1.41	1.39	1.31	1.32	1.32
2100	6.70	6.77	6.69	6.66	0.11	21.07	21.03	21.19	0.65	2100	1.49	1.39	1.31	1.31	1.31
2150	6.74	6.80	6.72	6.71	0.10	20.47	20.32	20.53	0.72	2150	1.57	1.39	1.30	1.31	1.30
2200	6.78	6.84	6.75	6.75	0.09	19.94	19.70	19.97	0.85	2200	1.65	1.39	1.30	1.30	1.30
2250	6.83	6.88	6.79	6.80	0.09	19.50	19.15	19.48	0.98	2250	1.73	1.39	1.30	1.30	1.30
2300	6.88	6.92	6.83	6.85	0.09	19.12	18.67	19.06	1.10	2300	1.80	1.39	1.30	1.30	1.30
2350	6.93	6.96	6.87	6.90	0.09	18.78	18.23	18.69	1.24	2350	1.88	1.40	1.30	1.30	1.29
2375	6.96	6.98	6.89	6.93	0.10	18.63	18.02	18.52	1.32	2375	1.92	1.40	1.29	1.30	1.29
2400	6.99	7.01	6.91	6.95	0.10	18.50	17.83	18.36	1.40	2400	1.95	1.40	1.29	1.30	1.29
2500	7.09	7.10	6.99	7.06	0.11	18.01	17.15	17.82	1.72	2500	2.09	1.41	1.30	1.29	1.29
2600	7.20	7.19	7.08	7.17	0.13	17.63	16.56	17.39	2.03	2600	2.24	1.41	1.30	1.29	1.29
2700	7.32	7.29	7.17	7.27	0.15	17.32	16.05	17.07	2.34	2700	2.37	1.41	1.29	1.29	1.29
2800	7.42	7.37	7.25	7.37	0.18	17.06	15.60	16.81	2.65	2800	2.48	1.42	1.29	1.28	1.29
3000	7.64	7.54	7.41	7.56	0.22	16.63	14.79	16.42	3.24	3000	2.71	1.41	1.28	1.27	1.28
3200	7.83	7.69	7.56	7.73	0.27	16.28	14.07	16.14	3.75	3200	2.91	1.39	1.26	1.25	1.26
3400	8.00	7.82	7.70	7.88	0.30	15.95	13.39	15.89	4.25	3400	3.07	1.37	1.24	1.23	1.24
3600	8.17	7.96	7.84	8.03	0.34	15.59	12.75	15.61	4.65	3600	3.24	1.35	1.22	1.21	1.23
3800	8.34	8.10	7.97	8.17	0.37	15.21	12.15	15.26	5.11	3800	3.42	1.33	1.21	1.21	1.23
4000	8.50	8.27	8.12	8.32	0.39	14.78	11.60	14.81	5.63	4000	3.62	1.32	1.22	1.22	1.25
4200	8.65	8.42	8.24	8.45	0.41	14.27	11.12	14.26	6.27	4200	3.80	1.32	1.26	1.25	1.28
4400	8.76	8.55	8.36	8.59	0.41	13.65	10.71	13.57	7.00	4400	3.94	1.33	1.32	1.30	1.33
4600	8.86	8.67	8.47	8.66	0.39	12.90	10.36	12.82	7.74	4600	4.10	1.37	1.42	1.38	1.42
4800	8.92	8.77	8.56	8.73	0.36	12.12	10.11	12.04	8.40	4800	4.22	1.42	1.54	1.47	1.52
5000	8.94	8.82	8.64	8.73	0.30	11.33	9.98	11.27	8.96	5000	4.28	1.49	1.67	1.60	1.65
5200	8.91	8.86	8.70	8.73	0.21	10.61	9.97	10.55	9.35	5200	4.29	1.58	1.82	1.75	1.82
5400	8.89	8.94	8.78	8.74	0.20	9.97	10.05	9.90	9.55	5400	4.34	1.68	1.99	1.92	1.99
5600	8.88	9.02	8.85	8.73	0.29	9.41	10.16	9.32	9.81	5600	4.39	1.79	2.15	2.09	2.17
5800	8.86	9.13	8.93	8.77	0.37	8.93	10.25	8.82	10.22	5800	4.45	1.88	2.29	2.24	2.34

<sup>1</sup>Total Loss = Insertion Loss + 6dB Splitter Loss

Note: Test data of Die packaged in industry standard, 3x3 mm, 12-lead MCLP package



P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 • Fax (718) 332-4661 For detailed performance specs & shopping online see Mini-Circuits web site

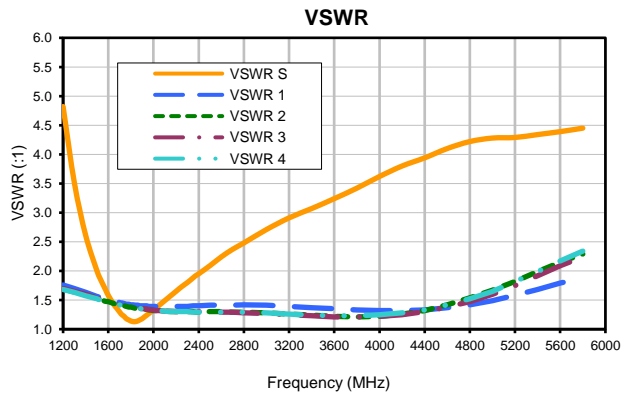
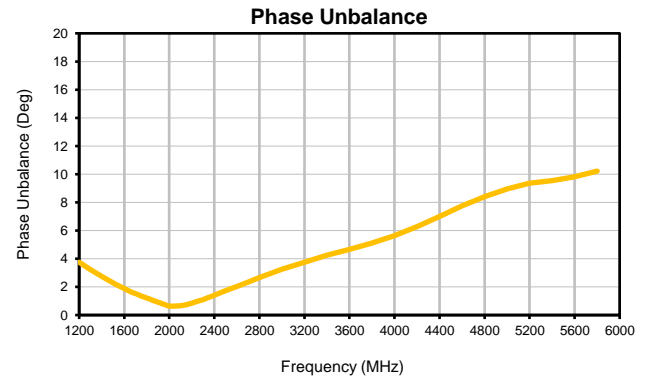
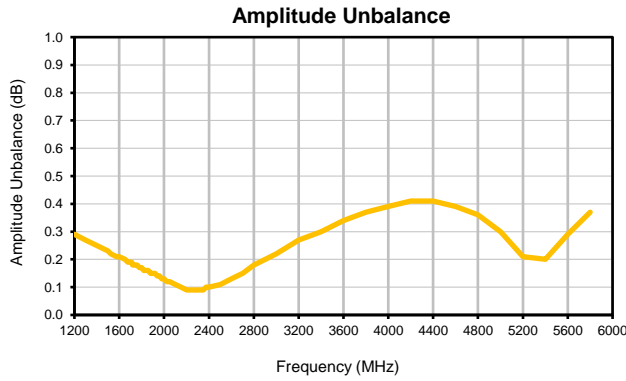
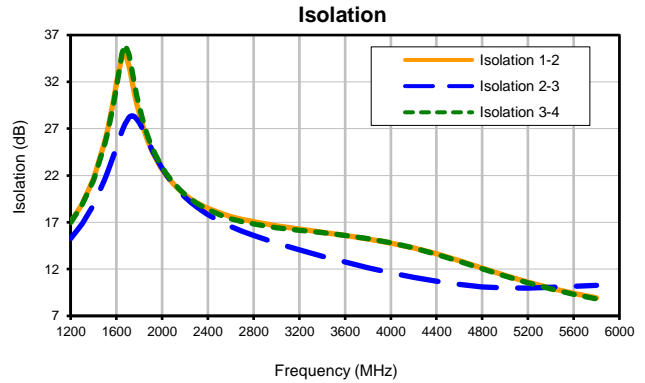
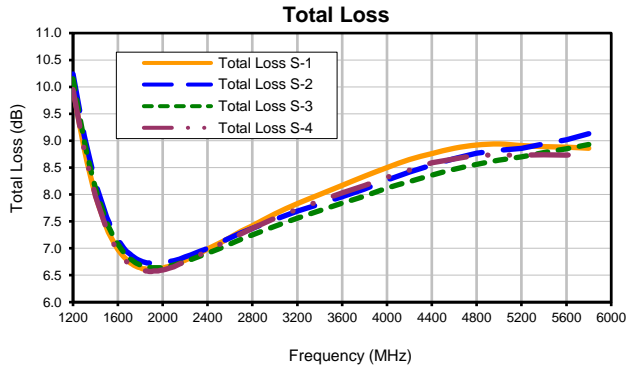


The Design Engineers Search Engine Provides ACTUAL Data Instantly From MINI-CIRCUITS At: www.minicircuits.com

IF/RF MICROWAVE COMPONENTS

REV. OR  
WP4P1-D+  
7/25/2019  
Page 1 of 1

## Typical Performance Curves



Note: Test data of Die packaged in industry standard, 3x3 mm, 12-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 Ambient Environment	Refer to Individual Model Data Sheet
Storage Environment	20° to 35° C and 40 to 60% humidity (In Factory Shipped Package)	Individual Model Data Sheet