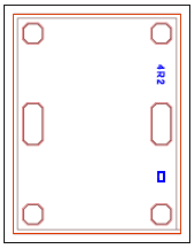
MMIC

Power Splitter/Combiner Die

WP4R-D+

4 Way-0° 50Ω 2000 to 3000 MHz



The Big Deal

- Wide Bandwidth, 2000 to 3000 MHz
- Excellent Amplitude & Phase Unbalance, 0.1 dB typ. and 2° typ.
- Good isolation, 20 dB typ.

Product Overview

Mini-Circuits' WP4R-D+ is a MMIC 4-way 0˚ splitter/combiner Die designed for operation over 2000 to 3000 MHz. Manufactured using Si IPD technology. Its compact size saves valuable space in hybrids.

Key Features

Feature	Advantages
Excellent Amplitude Unbalance, 0.1 dB typ. and Good Phase Unbalance, 2 deg. typ.	Excellent Amplitude and phase unbalance helps to accurately divide the input signals which is essential in test and measurement circuits.
Unpackaged Die, 0.805 x 1.032 mm	Enables user to integrate it directly into hybrids. Small die size saves space on customer hybrid.

*IPD: Integrated Passive Device

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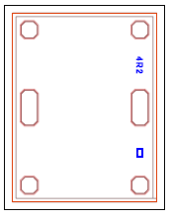
4 Way-0° 50Ω 2000 to 3000 MHz



Product Features

- Wide bandwidth, 2000 to 3000 MHz
- Excellent amplitude & phase unbalance, 0.1 dB typ. and 2° typ.
- Good isolation, 20 dB typ.

Applications

- WLAN
- WIMAX
- ISM

+RoHS Compliant

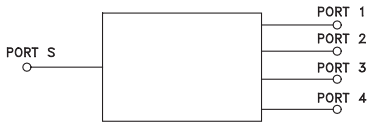
The +Suffix identifies RoHS Compliance. See our web site for RoHS Compliance methodologies and qualifications

Ordering Information: Refer to Last Page

General Description

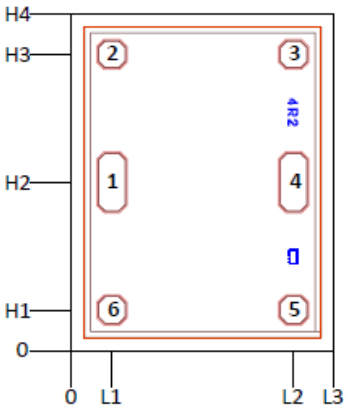
Mini-Circuits' WP4R-D+ is a MMIC 4-way 0˚ splitter/combiner Die designed for operation over 2000 to 3000 MHz. Manufactured using Si IPD technology, Its compact size saves valuable space in hybrids.

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 µm, Typical

L1	L2	L3	H1	H2	H3	H4	Thickness	Die Size	Pad Size 1 & 4	Pad Size 2,3,5 & 6
124	681	805	124	516	907.6	1032	254	805x1032	82 x 177	82 x 82

Electrical Specifications at 25°C[1]

Parameter	Frequency (MHz)	Min.	Typ.	Max.	Unit
Frequency Range		2000		3000	MHz
Insertion Loss above 3.0 dB	2000 - 3000		0.7		dB
Isolation	2000 - 3000		24		dB
Phase Unbalance	2000 - 3000		2		Degree
Amplitude Unbalance	2000 - 3000		0.1		dB
VSWR (Port S)	2000 - 3000		1.35		:1
VSWR (Ports 1,2,3,4)	2000 - 3000		1.35		:1

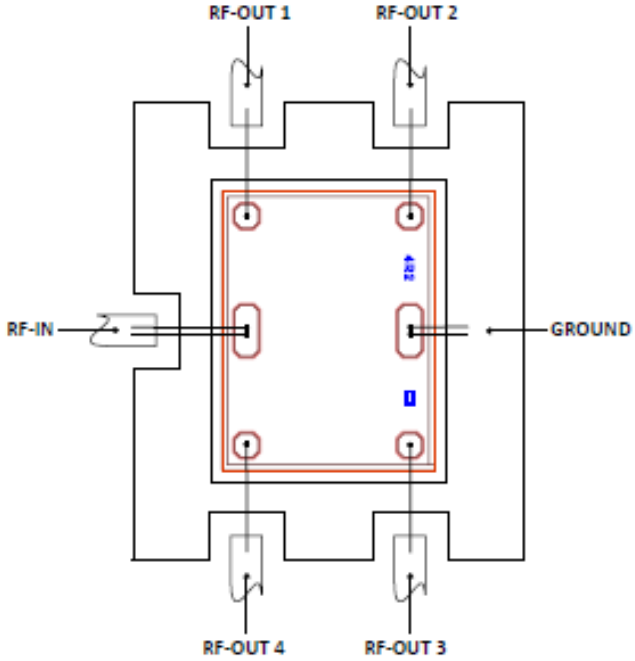
1. Tested in 3x3mm, Mini-Circuits 12-lead MCLP package.

Maximum Ratings[1,2]

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.

Additional Detailed Technical Information

additional information is available on our dash board.

Performance Data	Data Table	
	Swept Graphs	
	S-Parameter (S5P Files) Data Set with and without port extension(.zip file)	
Case Style	Die	
Die Ordering and packaging information (Note 5)	Quantity, Package	Model No.
	Small, Gel - Pak: 5,10,50,100 KGD*	WP4R-DG+
	Medium†, Partial wafer: KGD*<1672	WP4R-DP+
	†**Available upon request contact sales representative**	
	Refer to AN-60-067	
Environmental Ratings	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

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.

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4 Way-0° Power Splitter/Combiner Die WP4R-D+

Typical Performance Data

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

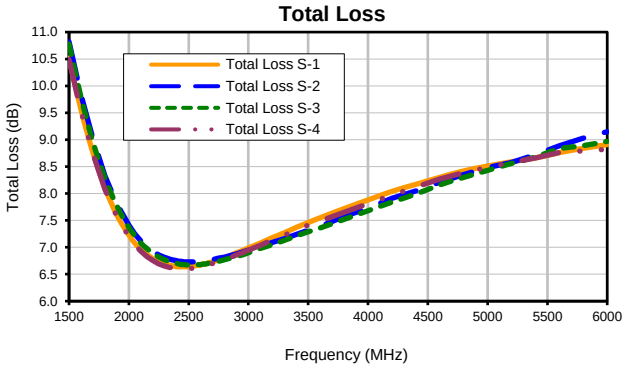
FREQ. (MHz)	TOTAL LOSS[1] (dB)				AMP. UNBAL. (dB)	ISOLATION (dB)			PHASE UNBAL. (deg.)
	S-1	S-2	S-3	S-4		1-2	2-3	3-4	
1500	10.52	10.82	10.78	10.49	0.32	16.84	14.86	16.39	3.82
1600	9.56	9.84	9.79	9.53	0.31	18.10	15.83	17.60	3.27
1700	8.76	9.01	8.96	8.73	0.28	19.73	17.04	19.13	2.68
1800	8.11	8.33	8.29	8.08	0.26	21.86	18.53	21.09	2.14
1900	7.60	7.81	7.77	7.57	0.23	24.67	20.36	23.62	1.66
2000	7.23	7.41	7.37	7.20	0.21	28.59	22.51	26.99	1.25
2050	7.08	7.25	7.22	7.05	0.20	31.26	23.72	29.10	1.05
2100	6.96	7.12	7.08	6.93	0.19	34.57	24.99	31.44	0.88
2150	6.87	7.02	6.98	6.83	0.19	37.86	26.22	33.72	0.64
2200	6.79	6.93	6.89	6.76	0.18	37.91	27.37	34.68	0.46
2250	6.73	6.86	6.82	6.69	0.17	34.86	28.15	33.63	0.33
2300	6.69	6.81	6.77	6.65	0.16	32.12	28.55	31.65	0.32
2320	6.68	6.80	6.75	6.64	0.15	31.17	28.48	30.88	0.35
2340	6.67	6.78	6.73	6.63	0.15	30.34	28.34	30.13	0.44
2360	6.66	6.77	6.72	6.62	0.15	29.63	28.20	29.44	0.53
2400	6.64	6.75	6.70	6.60	0.14	28.26	27.73	28.16	0.67
2420	6.64	6.74	6.69	6.60	0.14	27.61	27.37	27.57	0.76
2440	6.64	6.74	6.68	6.60	0.14	27.12	27.02	27.01	0.82
2460	6.64	6.73	6.68	6.60	0.13	26.66	26.72	26.51	0.89
2500	6.64	6.73	6.67	6.60	0.13	25.79	26.05	25.65	1.03
2520	6.65	6.73	6.68	6.61	0.12	25.38	25.66	25.24	1.09
2540	6.66	6.73	6.68	6.61	0.11	25.01	25.32	24.88	1.16
2560	6.66	6.73	6.68	6.62	0.11	24.68	24.99	24.51	1.22
2580	6.67	6.73	6.68	6.63	0.10	24.35	24.67	24.19	1.31
2600	6.67	6.74	6.68	6.63	0.11	24.01	24.37	23.87	1.37
2620	6.69	6.74	6.69	6.65	0.10	23.75	24.02	23.57	1.44
2640	6.69	6.75	6.69	6.65	0.09	23.50	23.74	23.30	1.52
2660	6.71	6.76	6.70	6.67	0.09	23.26	23.44	23.03	1.58
2680	6.72	6.77	6.71	6.68	0.08	23.00	23.17	22.78	1.63
2700	6.73	6.77	6.72	6.70	0.07	22.79	22.90	22.57	1.71
2750	6.77	6.80	6.74	6.73	0.07	22.25	22.28	22.01	1.87
2800	6.81	6.82	6.77	6.77	0.05	21.78	21.70	21.54	2.08
2850	6.85	6.85	6.80	6.81	0.05	21.33	21.19	21.11	2.23
2900	6.90	6.88	6.83	6.86	0.06	20.94	20.70	20.73	2.37
2950	6.94	6.91	6.86	6.90	0.07	20.61	20.29	20.39	2.53
3000	6.99	6.95	6.90	6.95	0.08	20.29	19.84	20.08	2.70
3100	7.08	7.01	6.98	7.04	0.10	19.71	19.12	19.54	3.01
3200	7.18	7.09	7.05	7.14	0.13	19.20	18.46	19.09	3.31
3300	7.27	7.16	7.13	7.23	0.15	18.77	17.90	18.68	3.64
3400	7.37	7.24	7.21	7.32	0.16	18.38	17.35	18.32	3.93
3500	7.46	7.32	7.29	7.41	0.17	18.02	16.84	18.01	4.24
3600	7.55	7.39	7.36	7.49	0.18	17.69	16.38	17.72	4.51
3800	7.72	7.57	7.52	7.65	0.20	17.10	15.54	17.19	5.06
4000	7.88	7.73	7.68	7.81	0.19	16.60	14.82	16.71	5.59
4200	8.04	7.91	7.84	7.97	0.20	16.20	14.14	16.27	6.09
4400	8.17	8.05	7.99	8.12	0.18	15.79	13.57	15.82	6.54
4600	8.30	8.21	8.16	8.27	0.15	15.30	13.01	15.36	7.07
4800	8.42	8.35	8.30	8.39	0.13	14.78	12.51	14.85	7.50
5000	8.51	8.48	8.43	8.49	0.08	14.24	12.09	14.31	8.00
5200	8.59	8.58	8.56	8.58	0.02	13.64	11.74	13.75	8.40
5400	8.66	8.72	8.68	8.66	0.06	13.04	11.46	13.16	8.84
5600	8.76	8.89	8.83	8.76	0.13	12.42	11.19	12.54	9.30
5800	8.84	9.03	8.89	8.79	0.24	11.84	10.96	11.92	9.73
6000	8.91	9.15	8.97	8.82	0.33	11.28	10.80	11.34	10.13

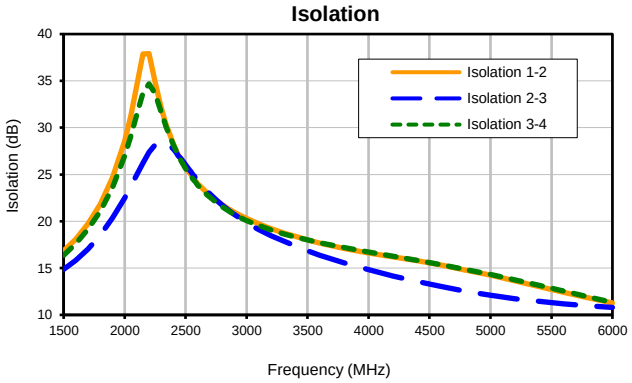
FREQ. (MHz)	VSWR (:1)				
	S	1	2	3	4
1500	5.61	1.89	1.74	1.74	1.80
1600	4.39	1.84	1.71	1.71	1.76
1700	3.47	1.78	1.66	1.67	1.71
1800	2.78	1.72	1.61	1.62	1.66
1900	2.26	1.67	1.55	1.57	1.61
2000	1.88	1.62	1.50	1.52	1.56
2050	1.73	1.59	1.48	1.49	1.53
2100	1.60	1.57	1.45	1.47	1.51
2150	1.49	1.55	1.43	1.44	1.49
2200	1.39	1.54	1.41	1.43	1.48
2250	1.33	1.52	1.39	1.41	1.46
2300	1.27	1.51	1.37	1.39	1.45
2320	1.26	1.50	1.36	1.38	1.44
2340	1.25	1.50	1.36	1.38	1.44
2360	1.25	1.49	1.35	1.37	1.43
2400	1.24	1.49	1.34	1.36	1.43
2420	1.25	1.48	1.33	1.35	1.42
2440	1.26	1.48	1.33	1.35	1.42
2460	1.27	1.48	1.32	1.34	1.42
2500	1.29	1.47	1.31	1.33	1.41
2520	1.31	1.47	1.31	1.33	1.41
2540	1.33	1.47	1.30	1.32	1.41
2560	1.35	1.47	1.30	1.32	1.41
2580	1.37	1.47	1.29	1.32	1.41
2600	1.39	1.46	1.29	1.31	1.40
2620	1.41	1.46	1.29	1.31	1.40
2640	1.44	1.46	1.29	1.30	1.40
2660	1.46	1.46	1.28	1.30	1.40
2680	1.48	1.46	1.28	1.30	1.40
2700	1.50	1.46	1.28	1.30	1.40
2750	1.56	1.45	1.27	1.29	1.39
2800	1.62	1.46	1.26	1.29	1.39
2850	1.68	1.45	1.25	1.28	1.39
2900	1.74	1.45	1.25	1.27	1.39
2950	1.80	1.45	1.24	1.27	1.39
3000	1.85	1.45	1.24	1.26	1.39
3100	1.96	1.44	1.23	1.25	1.38
3200	2.07	1.44	1.22	1.24	1.38
3300	2.17	1.43	1.20	1.23	1.37
3400	2.27	1.42	1.19	1.22	1.35
3500	2.37	1.41	1.18	1.20	1.34
3600	2.48	1.39	1.16	1.18	1.32
3800	2.69	1.35	1.13	1.14	1.28
4000	2.90	1.30	1.09	1.09	1.22
4200	3.11	1.24	1.05	1.04	1.16
4400	3.30	1.18	1.05	1.04	1.11
4600	3.50	1.11	1.10	1.10	1.06
4800	3.69	1.08	1.18	1.17	1.08
5000	3.83	1.11	1.26	1.26	1.14
5200	3.96	1.18	1.35	1.35	1.22
5400	4.09	1.28	1.46	1.46	1.31
5600	4.31	1.38	1.57	1.58	1.40
5800	4.43	1.49	1.69	1.69	1.49
6000	4.52	1.61	1.81	1.81	1.59

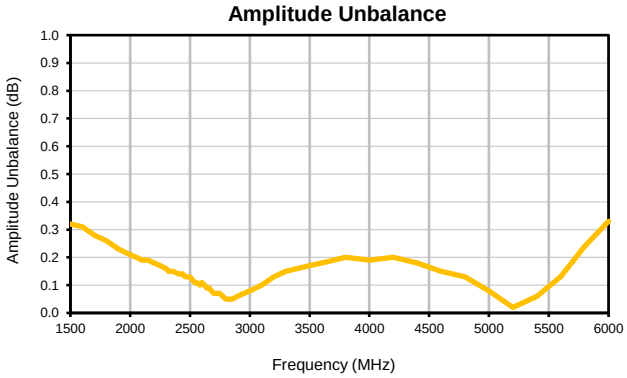
[1]Total Loss = Insertion Loss + 6dB Splitter Loss

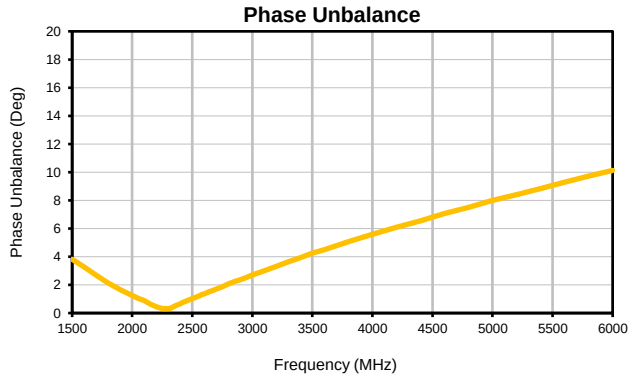
Note: Test data of Die packaged in industry standard, 3x3 mm, 12-lead MCLP package

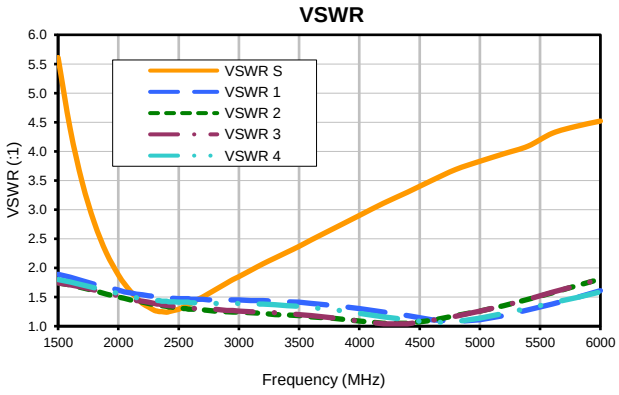
Typical Performance Curves











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

Mini-Circuits

Environmental Specifications ENV80

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