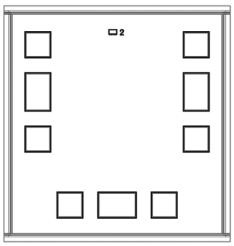
MMIC, Wideband

Power Tap Die

HK-PT54-D+

50Ω 26.5 dB DC to 50 GHz



The Big Deal

- Ultra-Wide Bandwidth, DC to 50 GHz
- Excellent Coupling Flatness 26.5±1.4 dB typ.
- Excellent VSWR, 1.2:1 typ.

Product Overview

Mini-Circuits' HK-PT54-D+ is a 26.5 dB Power Tap die that operates from DC to 50 GHz. It provides excellent coupling flatness over a broad bandwidth and excellent VSWR. Manufactured using IPD process, it has excellent repeatability and excellent reliability. It is ideal for lab testing applications as well as for power monitoring over wide bands in many other applications.

Key Features

Feature	Advantages
Ultra Wideband, DC - 50 GHz	HK-PT54-D+ can be used in many applications saving component count. Also ideal for wideband applications such as 5G, military and instrumentation.
Excellent coupling flatness, 26.5±1.4 dB	Excellent coupling flatness yields higher accuracy.
Bi-Directional	HK-PT54-D+ can sample power from signals travelling from both the input and output port. Ideal for use in instrumentation applications for measuring ratio of the two powers (return loss)
Unpackaged die	Enables user to integrate it directly into hybrids.

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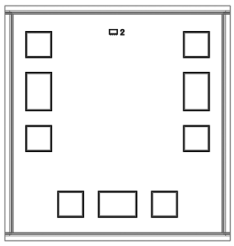


Product Features

- Wide bandwidth, DC to 50 GHz
- Excellent Coupling Flatness, 26.5±1.4 dB typ.
- Excellent VSWR, 1.2:1 typ.

Typical Applications

- 5G
- Satellite communications
- Wireless infrastructure
- Test and Measurements

+RoHS Compliant

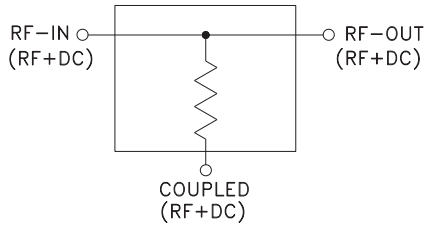
The +Suffix identifies RoHS Compliance. See our web site for RoHS Compliance methodologies and qualifications

Ordering Information: Refer to Last Page

General Description

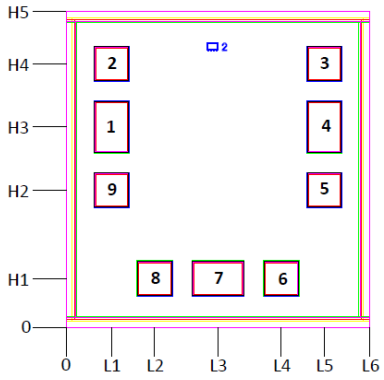
Mini-Circuits' HK-PT54-D+ is a 26.5 dB Power Tap die that operates from DC to 50 GHz. It provides excellent coupling flatness over a broad bandwidth and excellent VSWR. Manufactured using IPD process, it has excellent repeatability and excellent reliability. It is ideal for lab testing applications as well as for power monitoring over wide bands in many other applications.

Simplified Schematic and Pad description



Pad#	Function
1	RF-IN
4	RF-OUT
7	Coupled
2,3,5,6,8,9 and bottom of die	Ground

Bonding Pad Position



Dimensions in µm, Typical

L1	L2	L3	L4	L5	L6	H1	H2	H3	H4	H5
108	210	360	510	612	720	117	327	477	627	750

Thickness	Die size	Pad Size 1 & 4	Pad size 2,3,5,6,8&9	Pad Size 7
100	720 x 750	75 x 115	75 x 75	115 X 75

Electrical Specifications[1] at 25°C

Parameter	Frequency (GHz)	Min.	Typ.	Max.	Units
Frequency Range		DC		50	GHz
Mainline Loss	0.01-10		0.6		dB
	10-20		0.7		
	20-30		0.8		
	30-40		1.0		
	40-50		1.1		
Nominal Coupling	0.01-10		25.1		dB
	10-20		25.7		
	20-30		26.7		
	30-40		27.9		
	40-50		27.6		
Coupling Flatness (±)	0.01-50		1.4		dB
VSWR (Mainline)	0.01-10		1.15		dB
	10-20		1.21		
	20-30		1.27		
	30-40		1.25		
	40-50		1.21		
VSWR (Coupled)	0.01-10		1.17		dB
	10-20		1.20		
	20-30		1.27		
	30-40		1.35		
	40-50		1.39		

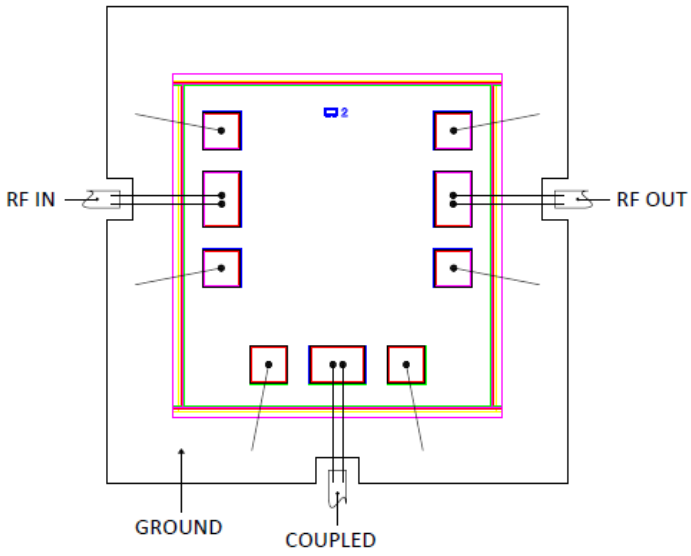
1. Electrical specifications are typical measured on characteristics on die using MPI Titan Series 150μm pitch GSG probe.

Absolute Maximum Ratings[2]

Parameter	Ratings
Operating Temperature	-55°C to 105°C
Input Power	31 dBm (5 minute max.) 28 dBm (continuous)
Internal dissipation	30 dBm (5 minute max.) 27 dBm (continuous)

2. Permanent damage may occur if any of these limits are exceeded.
Electrical maximum ratings are not intended for continuous normal operation.

Assembly Diagram



Assembly and Handling Procedure

1. Storage
   Dice should be stored in a dry nitrogen purged desiccators or equivalent.
2. ESD
   MMIC power tap 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 (S3P Files)	
Case Style	Die	
Die Ordering and packaging information (Note 5)	Quantity, Package	Model No.
	Small, Gel - Pak: 5,10,50,100 KGD*	HK-PT54-DG+
	Medium†, Partial wafer: KGD*<2070	HK-PT54-DP+
	Large†, Full wafer	HK-PT54-DF+
	†**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 according to Mini-Circuits inspection criteria. 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 1B (500V) in accordance with ANSI/ESD STM 5.1 - 2001

** Tested in industry standard 3.2x3.2 mm, 3-lead LTCC package. (Mini-Circuits case style DL2693-4).

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.

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

D. 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.

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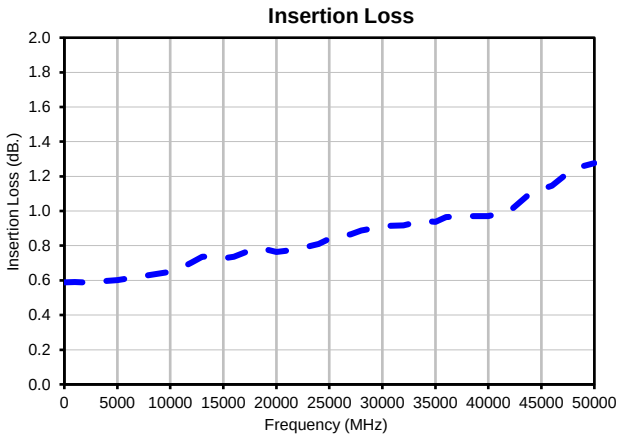
Power Tap Die HK-PT54-D+

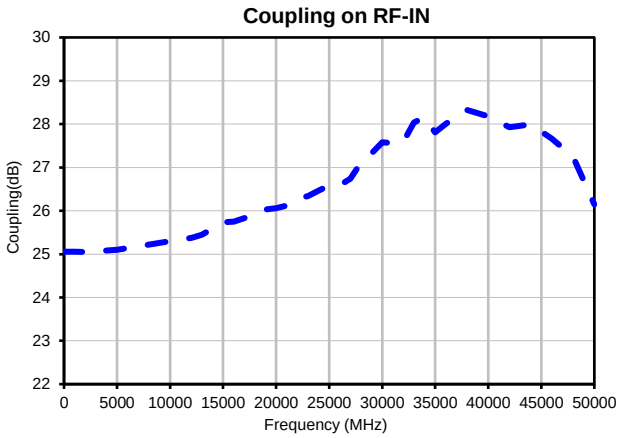
Typical Performance Data

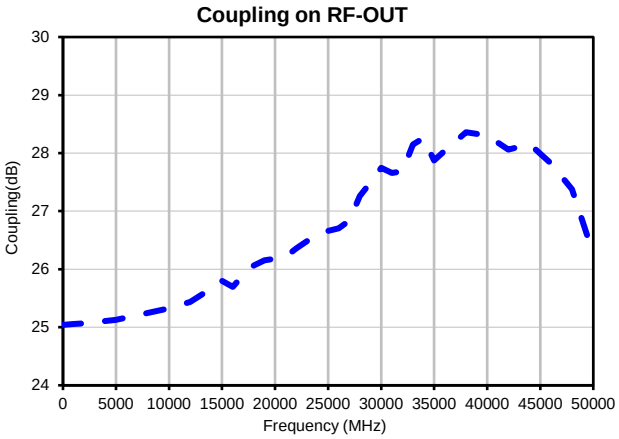
TEST CONDITIONS: INPUT POWER =0 dBm @Temperature = +25°C

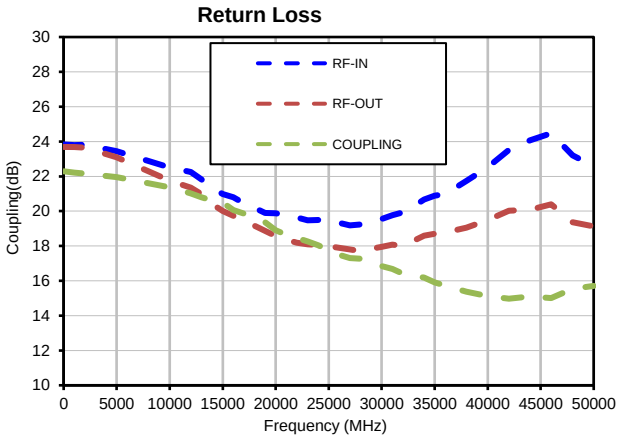
FREQUENCY (MHz)	INSERTION LOSS (dB)	COUPLING ON RF-IN (dB)	COUPLING ON RF-OUT (dB)	RETURN LOSS (dB)		
				IN	OUT	CPL
10	0.59	25.06	25.04	23.83	23.69	22.29
1000	0.59	25.05	25.06	23.79	23.69	22.21
2000	0.59	25.05	25.07	23.80	23.65	22.15
5000	0.60	25.10	25.13	23.45	23.09	21.96
10000	0.65	25.30	25.32	22.51	21.76	21.36
11000	0.67	25.34	25.38	22.37	21.54	21.20
12000	0.70	25.37	25.44	22.25	21.35	21.03
13000	0.74	25.45	25.55	21.83	20.98	20.79
14000	0.74	25.59	25.67	21.32	20.41	20.62
15000	0.73	25.73	25.80	20.98	20.00	20.48
16000	0.74	25.75	25.70	20.79	19.74	20.05
17000	0.76	25.83	25.91	20.44	19.40	19.86
18000	0.78	25.96	26.06	20.19	19.16	19.69
19000	0.78	26.03	26.15	19.90	18.87	19.36
20000	0.76	26.06	26.18	19.88	18.58	18.91
21000	0.77	26.12	26.21	19.76	18.37	18.65
22000	0.79	26.28	26.36	19.63	18.18	18.47
23000	0.80	26.34	26.48	19.47	18.09	18.26
24000	0.81	26.47	26.60	19.48	18.07	18.04
25000	0.84	26.58	26.66	19.50	17.99	17.75
26000	0.86	26.59	26.71	19.33	17.89	17.48
27000	0.86	26.74	26.84	19.18	17.80	17.30
28000	0.89	27.11	27.26	19.24	17.70	17.26
29000	0.90	27.33	27.50	19.37	17.84	17.07
30000	0.91	27.58	27.75	19.54	17.95	16.85
31000	0.92	27.56	27.66	19.77	18.08	16.68
32000	0.92	27.59	27.69	19.92	17.99	16.41
33000	0.93	28.04	28.15	20.28	18.29	16.30
34000	0.94	28.16	28.26	20.67	18.59	16.18
35000	0.94	27.81	27.87	20.89	18.70	15.91
36000	0.97	28.01	28.04	20.98	18.77	15.73
38000	0.97	28.33	28.36	21.74	19.06	15.37
40000	0.97	28.18	28.30	22.52	19.48	15.12
42000	1.00	27.93	28.06	23.51	20.02	14.97
44000	1.10	28.00	28.16	24.07	20.09	15.09
46000	1.15	27.67	27.82	24.47	20.38	15.02
48000	1.24	27.25	27.38	23.20	19.37	15.54
50000	1.28	26.15	26.26	22.58	19.12	15.70

Typical Performance Curves









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 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)	