# Millimeter Wave Precision Fixed Attenuator Die

## **KAT-D-Series**

50 $\Omega$  Up to 2W DC to 50 GHz

### **The Big Deal**

- Ultra-wide band, DC to 50 GHz
- · Excellent power handling, up to 2W
- · Contiguous ground plane for easy installation



### **Product Overview**

Mini-Circuits' KAT-D-series MMIC attenuator dice (RoHS compliant) are fixed value, absorptive attenuators fabricated using highly repetitive MMIC processing with thin film resistors on GaAs substrates. Providing precise attenuation from DC up to 50 GHz, these attenuators are ideal for a very wide range of applications up to millimeter wave bands including 5G systems and more. KAT-D-series attenuator dice are available from stock with nominal attenuation values of 0 to 10 dB (in 1 dB steps), and 12, 15, 20, and 30 dB.

### **Key Features**

Feature	Advantages
Ultra-wide band operation, DC to 50 GHz	KAT-D-series attenuator dice support a wide array of applications including 5G systems, microwave communications, satellite, defense and aerospace, medical broad- band and optical applications
Single, contiguous ground plane	The attenuators achieve ultra-wide band performance up to 50 GHz with single, con- tiguous ground plane, simplifying installation into customer hybrids.
High power handling, up to 2W	Power handling up to 2W makes KAT attenuator dice suitable for a wide range of system power requirements.
Wide range of nominal attenuation values: 0 to 10 dB (in 1 dB steps) and 12, 15, 20 and 30 dB	Small increment offerings enable circuit designers to change attenuation values with- out motherboard redesign, making the KAT-D-series ideal for adjusting attenuation values based on test results.
Excellent attenuation flatness	Provides precise, consistent attenuation across the entire frequency band, ideal for broadband and multi-band usage.

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### 50Ω 1.1W 12dB DC to 50 GHz

#### **Product Features**

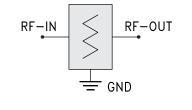
- Wide bandwidth, DC to 50 GHz
- Excellent attenuation accuracy & flatness
- Exceptional power handling, up to 1.1W

#### **Typical Applications**

- Cellular
- PCS
- Communications
- Radar
- Defense
- 5G

#### **General Description**

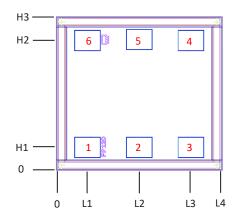
KAT-12-D+ is an absorptive attenuator Die fabricated using highly repetitive MMIC process including thin film resistors on GaAs substrate. KAT-12-D+ attenuator Die contains through-wafer vias to realize low thermal resistance and wideband operation.



Pad #	Description
2	RF-IN
5	RF-OUT
1,3,4,6	Ground
Die bottom	Ground

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

#### **Bonding Pad Position / Description**



Die dimensions in µm								
L1	L2	L3	L4	H1	H2	H3	Thickness	Bond pad size
125	375	625	750	85	615	700	100	125 x 100

(Numbers on bond pads are for identification only, not marked on Die)



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Simplified Schematic



**KAT-12-D+** 

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

Ordering Information: Refer to Last Page



#### Electrical Specifications at 25°C, 50Ω

Parameter		Condition (GHz) Die Typ.1		Die Eval Board Typ. <sup>2</sup>	Unit	
Frequency Range			DC-50	DC-50	GHz	
		DC-5	12.0 ± 0.1	12.2 ± 0.2		
		5-15	12.0 ± 0.1	12.4 ± 0.2	JD	
Attenuetien		15-18	12.0 ± 0.1	12.6 ± 0.2		
Attenuation		18-26.5	12.0 ± 0.2	12.9 ± 0.2	dB	
		26.5-43.5	11.8 ± 0.6	12.8 ± 0.4		
				12.7 ± 0.2		
VSWR		DC-5	1.2	1.1	:1	
		5-15	1.2	1.1		
		15-18	1.2	1.4		
		18-26.5	1.2	1.5		
		26.5-43.5	1.2	1.3		
		43.5-50		1.3		
Operating Input Deway at3	25°C	DC-50	1.1	1.1	W	
Operating Input Power at <sup>3</sup> :	85°C	DC-50	0.8	0.8	W	

1. Electrical specifications are typical measured characteristics on die using MPI Titan Series 250 µm pitch GSG probe.

2. Measured on X-Microwave Drop-In / Evaluation Block, XM-B1A8-0204D

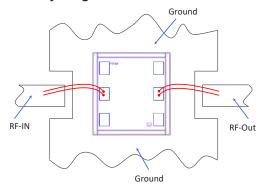
3. Tested in industry standard 2x2 mm, 6-lead MCLP package

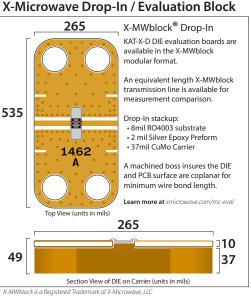
#### **Absolute Maximum Ratings**

Operating Temperature (ground)	-40°C to 85°C
RF Input Power	1.1W

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

#### **Assembly Diagram**





(Ground Bond Wires are optional)

#### **Assembly and Handling Procedure**

1. Storage

Dice should be stored in a dry nitrogen purged desiccators or equivalent.

2. ESD

MMIC GaAs Attenuator 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 Bondina

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.

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Additional Detailed Technic additional information is available on our					
	Data Table				
Performance Data	Swept Graphs				
	S-Parameter (S2P Files)				
Case Style	Die				
	Quantity, Package				
	Small, Gel - Pak: 5,10,50,100 KGD*	KAT-12-DG+			
Die Ordering and packaging information	Medium <sup>†</sup> , Partial wafer: KGD*<2.115K	KAT-12-DP+			
mormation	Large <sup>†</sup> , Full Wafer	KAT-12-DF+			
	<sup>†</sup> Available upon request contact sales representative				
	Refer to AN-60-067				
Die TB Reference	XM-B1A8-0204D (Please check X-Microwave's Website)				
Environmental Ratings	ENV-80				

\*Known Good Dice ("KGD") means that the dice are taken from PCM good wafer and then visually inspected per Mini-Circuits' criteria. Though this is not definitive, it does provide a higher degree of confidence that the dice are capable of meeting typical RF electrical parameters specified by Mini-Circuits.

### ESD Rating\*\*

Human Body Model (HBM): Class 2 (Pass 2000V) in accordance with ANSI/ESD STM5.1-2001

\*\* Tested in industry standard 2x2 mm, 6-lead MCLP package.

#### **Additional Notes**

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## **Fixed Attenuator Die**

Typical Performance Data

FREQUENCY	ATTENUATION	VSWR
(GHz)	(dB)	(:1)
0.01	12.03	1.18
0.02	12.03	1.18
0.04	12.04	1.18
0.06	12.05	1.18
0.08	12.05	1.18
0.10	12.05	1.18
0.20	12.05	1.18
0.40	12.05	1.18
0.60	12.05	1.18
0.80	12.05	1.18
1.00	12.05	1.18
1.20	12.05	1.18
1.40	12.05	1.18
1.60	12.05	1.18
1.80	12.05	1.18
2.00	12.06	1.18
3.00	12.05	1.18
4.00	12.05	1.18
5.00	12.05	1.18
6.00	12.04	1.17
7.00	12.04	1.17
8.00	12.04	1.17
9.00	12.04	1.17
10.0 11.0	12.04 12.05	1.17 1.16
12.0	12.03	1.16
13.0	12.08	1.15
14.0	12.12	1.15
15.0	12.08	1.14
16.0	12.08	1.14
17.0	12.09	1.13
18.0	12.12	1.12
19.0	12.10	1.12
20.0	12.08	1.11
21.0	12.06	1.11
22.0	12.04	1.11
23.0	12.03	1.10
24.0	12.02	1.09
25.0	12.00	1.09
26.0	12.03	1.09
27.0	12.05	1.08
28.0	12.05	1.08
29.0	12.03	1.08
30.0	12.00	1.07
31.0	12.05	1.07
32.0	12.05	1.06
33.0	11.97	1.06
34.0	11.90	1.06
35.0	11.84	1.06
36.0	11.86	1.06
37.0	11.77	1.07
38.0	11.72	1.08
39.0	11.65	1.09
40.0	11.57	1.10
41.0	11.65	1.10
42.0	11.56	1.11
43.0	11.53	1.11
43.5	11.50	1.12



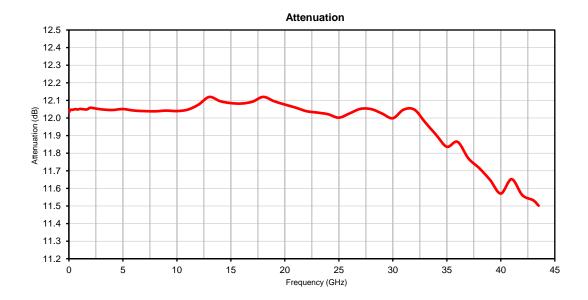


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## **Fixed Attenuator Die**

Typical Performance Curves



VSWR 1.30 1.28 1.26 1.24 1.22 1.20 (1.18) 1.16 MS/ 1.14 1.12 1.10 1.08 1.06 1.04 1.02 1.00 10 15 30 0 5 20 25 35 40 45 Frequency (GHz)





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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)	

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