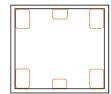
### Microwave Precision

# Fixed Attenuator Die YAT-D-SERIES

 $50\Omega$  Up to 2W DC to 26.5 GHz

### **The Big Deal**

- Excellent power handling, up to 2W
- · Wideband, DC to 26.5 GHz
- Usable to 40 GHz
- Unpackaged die form



### **Product Overview**

YAT-D-series MMIC attenuator dice (RoHS compliant) are fixed value, absorptive attenuators fabricated using highly repetitive MMIC processing with thin film resistors on Silicon substrates. They contain throughwafer Cu metallization vias to realize low thermal resistance and very wideband operation. YAT 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
Wideband operation, DC to 26.5 GHz Usable to 40 GHz	YAT-D-series attenuator dice support a wide array of applications including wireless cellular, microwave communications, satellite, defense and aerospace, medical broadband and optical applications. They are also usable in applications up to 40 GHz such as 5G systems (See application note AN-70-019).
High power handling, up to 2W	Power handling up to 2W makes YAT 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 without motherboard redesign, making the YAT-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.
Unpackaged die	Enables the user to integrate the attenuator die directly into hybrids.

### Microwave Precision

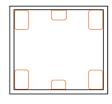
# **Fixed Attenuator Die**

## **YAT-0-D+**

 $50\Omega$  2W 0dB DC to 26.5 GHz

#### **Product Features**

- wide bandwidth, DC-26.5 GHz
- excellent attenuation accuracy & flatness
- exceptional power handling, up to 2W



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

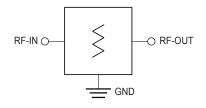
#### **Typical Applications**

- Cellular
- PCS
- communications
- radar
- defense

#### **General Description**

YAT-0-D+ is a absorptive attenuator die fabricated using highly repetitive MMIC process including thin film resistors on Silicon substrate. YAT-0-D+ attenuator die contains through-wafer Cu metallization vias to realize low thermal resistance and wideband operation.

#### **Simplified Schematic and Pad description**



Pad	Description
RF-IN	RF input pad
RF-OUT	RF output pad
GND	GND pads

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



#### Electrical Specifications at 25°C, $50\Omega$

Parameter		Condition (GHz)	Min.	Тур.	Max.	Unit
Frequency Range			DC		26.5	GHz
		DC - 5		0.0		
Attenuation <sup>1</sup>		5 - 15		0.3		dB
		15 - 18		0.4		
		18 - 26.5		0.6		
		DC - 5		1.1		
VSWR <sup>1</sup>		5 - 15		1.4		
	15 - 18		1.5		:1	
		18 - 26.5		1.7		
Operating Input Power at <sup>2</sup> :	25°C	DC - 18		2		W
	85°C	DC - 18		1		W

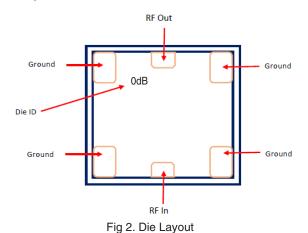
Electrical specifications are typical measured characteristics on die using MPI Titan Series 250 µm pitch GSG probe.
 Tested in industry standard 2x2 mm, 6-lead MCLP package.

#### **Absolute Maximum Ratings**

Operating Temperature (ground)	-40°C to 85°C
RF Input Power	2W

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

#### **Die Layout**



Note: Alternate Die ID: ATN3590\_00

#### **Critical Dimensions**

Parameter	Values
Die Thickness, µm	100
Die Width, µm	725
Die Length, μm	700
RF IN and RF OUT Bond Pad Size, µm	110 x 75
Ground Bond Pad Size, µm	110 x 150

# **Bonding Pad Position**

(Dimensions in µm, Typical)

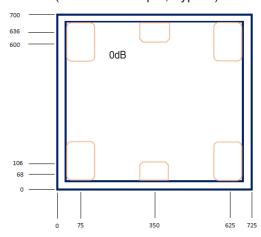


Fig 3. Bonding Pad Positions

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

#### Storage

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

#### 2. ESD

MMIC Silicon 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 worksta tion. Devices need careful handling using correctly designed collets, vacuum pickup tips or sharp antistatic tweezers to deter ESD damage to dice.

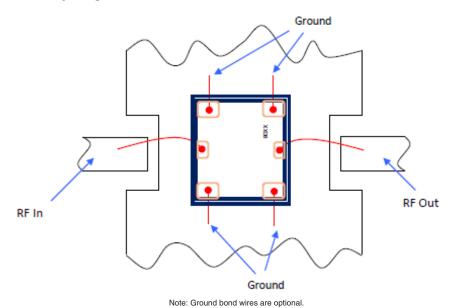
#### 3. Die Attach

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.

#### **Assembly Diagram**



#### **Recommended Wire Length, Typical**

Wire	Wire Length (mm)	Wire Loop Height (mm)
ALL WIRES	0.25	0.15



Additional Detailed Technical Information additional information is available on our dash board.			
	Data Table		
Performance Data	Swept Graphs		
	S-Parameter (S2P Files) Data Set with port extension(.zip file)		
Case Style	Die		
	Quantity, Package		
	Small, Gel - Pak: 5,10,50,100 KGD*	YAT-0-DG+	
Die Ordering and packaging	Medium <sup>†</sup> , Partial wafer: KGD*<2160		
information	Large <sup>†</sup> , Full Wafer	YAT-0-DF+	
	†Available upon request contact sales representative		
	Refer to <u>AN-60-067</u>		
Environmental Ratings	ENV-80		

<sup>\*</sup>Known Good Dice ("KGD") means that the dice in question have been subjected to Mini-Circuits DC test performance criteria and measurement instructions and that the parametric data of such dice fall within a predefined range. While DC testing 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 (250 to 500V) in accordance with JESD22 - A114

#### **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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<sup>\*\*</sup> Tested in industry standard 2x2 mm, 6-lead MCLP package.

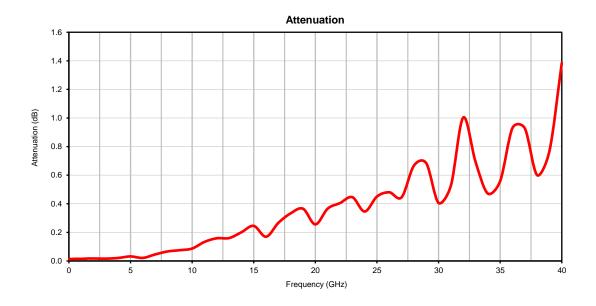
# Typical Performance Data

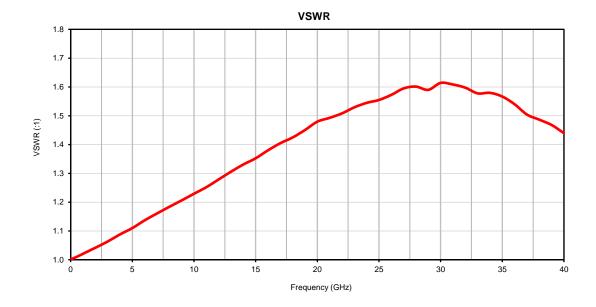
FREQUENCY (GHz)	ATTENUATION (dB)	VSWR (:1)
0.01	0.01	1.00
0.02	0.01 0.01	1.00 1.00
0.04		1.00
0.06	0.01	
0.08	0.01 0.01	1.00
0.10		1.00 1.00
0.20 0.40	0.01 0.01	1.01
0.40	0.01	1.01
0.80	0.02	1.02
1.00	0.01	1.02
1.20	0.01	1.02
1.40	0.02	1.03
1.60	0.02	1.03
1.80	0.02	1.04
2.00	0.02	1.04
3.00	0.02	1.06
4.00	0.02	1.09
5.00	0.03	1.11
6.00	0.02	1.14
7.00	0.05	1.16
8.00	0.07	1.18
9.00	0.08	1.21
10.0	0.09	1.23
11.0	0.13	1.25
12.0	0.16	1.28
13.0	0.16	1.31
14.0	0.20	1.33
15.0	0.25	1.35
16.0	0.17	1.38
17.0	0.27	1.40
18.0	0.33	1.42
19.0	0.37	1.45
20.0	0.26	1.48
21.0	0.37	1.49
22.0	0.41	1.51
23.0	0.45	1.53
24.0	0.35	1.54
25.0	0.45	1.55
26.0	0.48	1.57
27.0	0.45	1.59
28.0	0.67	1.60
29.0	0.68	1.59
30.0	0.41	1.61
31.0	0.53	1.61
32.0	1.00	1.60
33.0	0.69	1.58
34.0	0.47	1.58
35.0	0.56	1.57
36.0	0.93	1.54
37.0	0.93	1.50
38.0	0.60	1.49
39.0	0.77	1.47
40.0	1.39	1.44





# Typical Performance Curves











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 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)		

ENV80 Rev: C

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