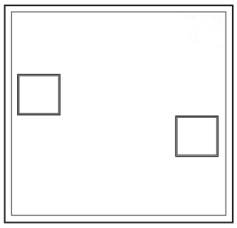
Flat Gain, Ultra-Wideband

Monolithic Amplifier Die GVA-123-D+

50Ω 0.01 to 12 GHz



The Big Deal

- Ultra broadband performance
- Outstanding Gain flatness, ±0.7 dB over 0.05 to 6 GHz
- Broadband high dynamic range without external matching components
- Unpackaged die form

Product Overview

Mini-Circuits' GVA-123-D+ is a wideband amplifier die fabricated using InGaP GaAs HBT technology offering outstanding Gain flatness across a very wide frequency range from 0.01 to 12 GHz. It provides good input and Output return loss over wideband without the need for external matching components. Provided as an unpackaged amplifier die, this model gives users the advantage of extremely tiny size and allows easy integration directly into customer hybrids.

Key Features

Feature	Advantages
Ultra broadband, 0.01 to 12 GHz	Covers the primary wireless communications bands: cellular, PCS, LTE, and WiMAX in a single amplifier.
Excellent Gain flatness: •±0.7 dB over 0.05 to 6 GHz •±1.5 dB over 0.05 to 8 GHz	Eliminates the need for gain flattening using external components.
No external matching components required.	GVA-123-D+ provides input and Output return loss of 12 to 24 dB up to 6 GHz without the need for external matching components, saving board real estate and reducing component count.
Unpackaged die	Enables the user to integrate the amplifier directly into hybrids.

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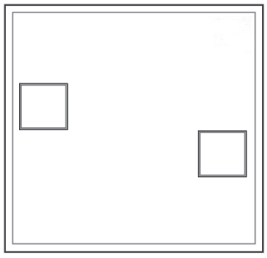


Product Features

- Gain, 16.7 dB typ. at 2 GHz
- Excellent Gain flatness, ±0.7 dB 0.05-6 GHz
- Excellent return loss, 24 dB at 2 GHz

Typical Applications

- Base station infrastructure
- Test instruments
- Satellite communications
- MMDS & Wireless LAN
- LTE

+RoHS Compliant

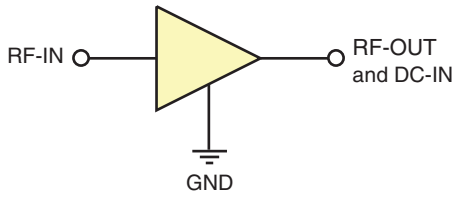
The +Suffix identifies RoHS Compliance. See our web site for RoHS Compliance methodologies and qualifications

Ordering Information: Refer to Last Page

General Description

GVA-123-D+ (RoHS compliant) is an advanced ultra wideband amplifier die fabricated using InGap HBT technology offering excellent Gain flatness over a broad frequency range and high IP3. In addition, the GVA-123-D+ has good input and Output return loss over a broad frequency range without the need for external matching components.

Simplified Schematic and Pad description



Pad	Description
RF IN	RF input pad. This pad requires the use of an external DC blocking capacitor chosen for the frequency of operation.
RF-OUT and DC-IN	RF output and bias pad. DC voltage is present on this pad; therefore a DC blocking capacitor is necessary for proper operation. An RF choke is needed to feed DC bias without loss of RF signal due to the bias connection.
GND	Connections to ground. Bottom of die.

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

Electrical Specifications[1] at 25°C and Vcc=5V, R=16.5Ω unless noted

Parameter	Condition (GHz)	Min.	Typ.	Max.	Units
Frequency Range		0.01		12.0	GHz
Gain	0.05		16.2		dB
	0.85		17.0		
	2.0		16.7		
	6.0		16.1		
	8.0		14.6		
	10.0		12.3		
	12.0		8.7		
Gain flatness	0.05-6		±0.7		dB
Input return loss	0.05		12.7		dB
	0.85		30.9		
	2.0		26.1		
	6.0		17.7		
	8.0		13.2		
	10.0		8.7		
	12.0		6.1		
Output return loss	0.05		14.0		dB
	0.85		25.3		
	2.0		24.3		
	6.0		12.1		
	8.0		10.6		
	10.0		9.7		
	12.0		7.7		
Reverse isolation	6.0		20.1		dB
Output power at 1dB compression	0.05		17.1		dBm
	0.85		16.3		
	2.0		15.9		
	6.0		13.0		
	8.0		10.3		
	10.0		8.3		
	12.0		5.9		
Output IP3	0.2		29.7		dBm
	0.85		29.8		
	2.0		29.1		
	6.0		23.8		
	8.0		21.9		
	10.0		20.0		
	12.0		14.6		
Noise figure	0.2		3.9		dB
	0.85		3.9		
	2.0		3.9		
	6.0		4.4		
	8.0		4.7		
	12.0		6.0		
Supply operating voltage (Vcc)[2]		4.8	5.0	5.2	V
Device operating current at Vcc=5V		42	48	57	mA
Device current variation vs. voltage			0.019		mA/mW
Thermal resistance, junction-to-ground lead			149		°C/W

1. Measured on Mini-Circuits Die Characterization test board . See Characterization Test Circuit (Fig. 1)
2. 16.5Ω series resistor from VCC to RF-OUT & DC-IN Pad is required. See Figure 1

Absolute Maximum Ratings[3]

Parameter	Ratings
Operating Temperature	-40°C to 85°C
Operating Current at 5V (Vcc) & 16.5Ω resistor	100 mA
Power Dissipation	0.34 W
Input Power (CW)	28 dBm (5 min max.) 11 dBm (continuous)
DC Voltage on RF-OUT & DC-IN Pad[4]	6 V

3. Permanent damage may occur if any of these limits are exceeded.
4. For continuous operation, Vcc≤ 5.2V

Characterization Test Circuit

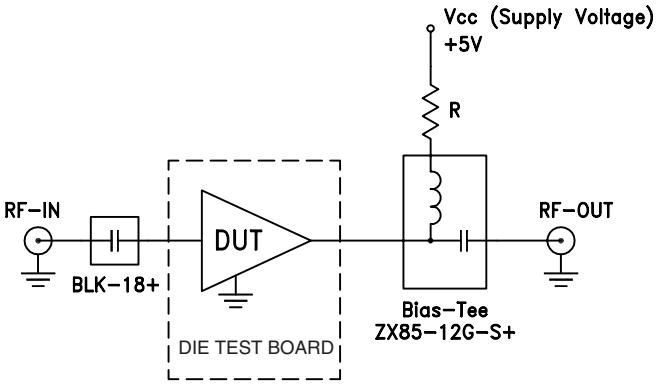


Fig 1. Block Diagram of Test Circuit used for characterization. DUT soldered on Mini-Circuits Characterization test board. Gain, Return loss, Output power at 1dB compression (P1 dB) , output IP3 (OIP3) and Noise figure measured using Agilent's N5242A PNA-X microwave network analyzer.(R=16.5Ω)

Conditions:
1. Gain and Return loss: Pin= -25dBm
2. Output IP3 (OIP3): Two tones, spaced 1 MHz apart, 0 dBm/tone at output.

Die Layout

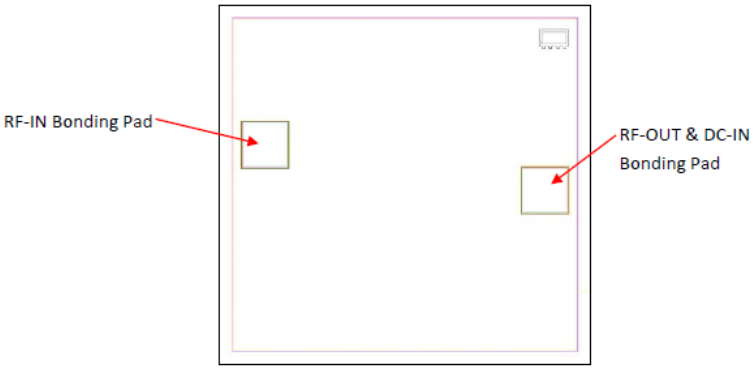


Fig 2. Die Layout

Bonding Pad Position

(Dimensions in µm, Typical)

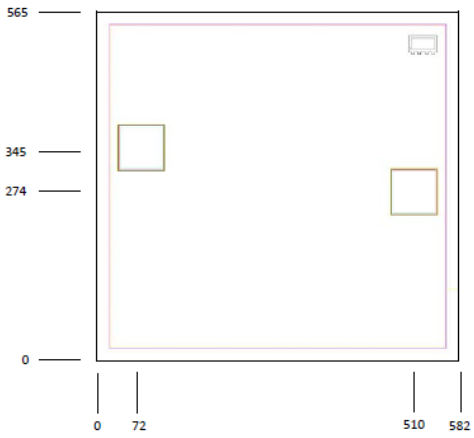


Fig 3. Bonding Pad Positions

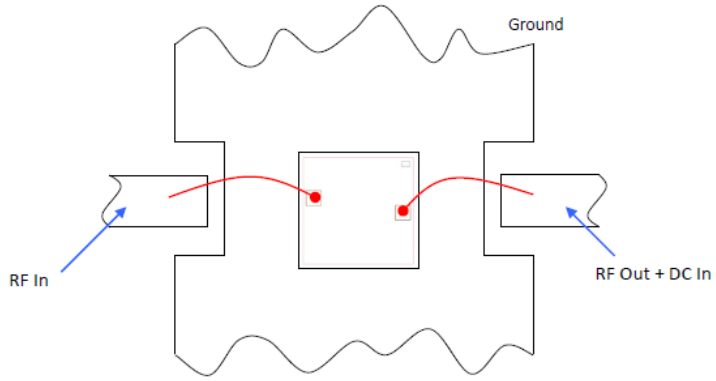
Critical Dimensions

Parameter	Values
Die Thickness, µm	100
Die Width, µm	582
Die Length, µm	565
Bond Pad Size, µm	75 x 75

Assembly and Handling Procedure

1. Storage
   Dice should be stored in a dry nitrogen purged desiccators or equivalent.
2. ESD
   MMIC Gallium Arsenide (GaAs) amplifier 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

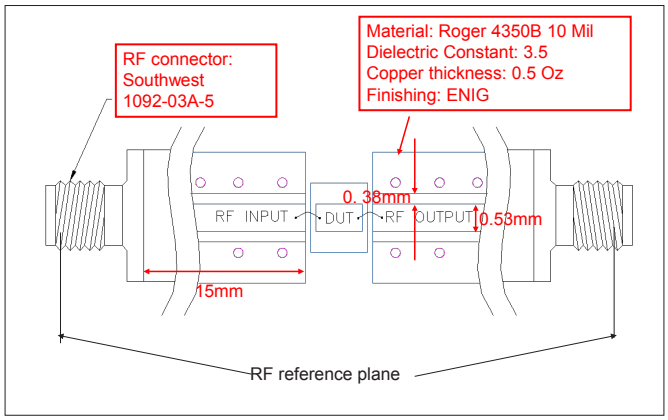


Note: Ground bond wires are optional.

Recommended Wire Length, Typical

Wire	Wire Length (mm)	Wire Loop Height (mm)
RF-IN, RF-OUT + DC-IN	0.6±0.1	0.15

RF Reference Plane - No port extension



Additional Detailed Technical Information

additional information is available on our dash board.

Performance Data	Data Table	
	Swept Graphs	
	S-Parameter (S2P Files) Data Set with and without port extension(.zip file)	
Case Style	Die	
Die Ordering and packaging information	Quantity, Package	Model No.
	Small, Gel - Pak: 10,50,100 KGD*	GVA-123-DG+
	Medium†, Partial wafer: KGD*<2700	GVA-123-DP+
	Large†, Full Wafer	GVA-123-DF+
	†*Available upon request contact sales representative*	
	Refer to AN-60-067	
Environmental Ratings	ENV-80	

*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 1C (1000 to <2000V) in accordance with ANSI/ESD STM 5.1 - 2001

** Tested in industry standard SOT-89 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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