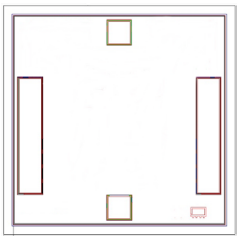
Flat Gain, High IP3

Monolithic Amplifier Die

GVA-60-D+

50Ω 0.01 to 6 GHz



The Big Deal

- Excellent Gain flatness and Return Loss over 50-1000 MHz
- High IP3 vs. DC Power consumption
- Broadband High Dynamic Range without external Matching Components

Product Overview

GVA-60-D+ (RoHS compliant) is a wideband amplifier die fabricated using HBT technology offering ultra flat gain over a broad frequency range and with high IP3. In addition, the GVA-60-D+, has good input and Output return loss over a broad frequency range without the need for external matching components and has demonstrated excellent reliability.

Key Features

Feature	Advantages
Broad Band: 0.01 to 6 GHz	Broadband covering a broad range of IF frequencies and the primary wireless communications bands: Cellular, PCS, LTE, WiMAX
High IP3 vs. DC power Consumption 39 dBm typical at 0.05 GHz 36 dBm typical at 0.85 GHz	The GVA-60-D+ matches industry leading IP3 performance relative to device size and power consumption. The combination of the design and HBT Structure provides enhanced linearity over a broad frequency range as evidenced in the IP3 being typically 16 dB above the P 1dB point to 0.85 GHz. This feature makes this amplifier ideal for use in: • Driver amplifiers for complex waveform up converter paths • Drivers in linearized transmit systems
Outstanding Input return loss up to 1 GHz: better than 19 dB.	The GVA-60-D+ provides excellent Input return loss: 19 dB up to 1 GHz and 15.0 dB up to 2 GHz making this amplifier an ideal IF gain block that can be embedded in RF chains that have highly reflective components, and still maintain good system performance
No External Matching Components Required 9-25 dB to 2 GHz	GVA-60-D+ provides good Input and Output return loss without the need for any external matching components

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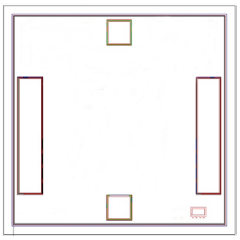


+RoHS Compliant

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

Ordering Information: Refer to Last Page

Product Features

- Gain, 20 dB typ. at 0.4 GHz
- Gain flatness: ±0.3 dB over 50-1000 MHz
- Excellent Input return loss, up to 2 GHz, 14-25 dB
- High Pout, P1dB 20.0 dBm typ. at 0.4 GHz
- High IP3, 40 dBm typ. at 400 MHz
- Excellent ESD protection, Class 1C for HBM
- No external matching components required

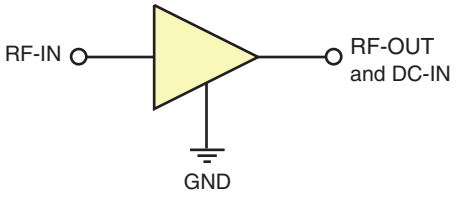
Typical Applications

- Base station infrastructure
- Portable Wireless
- CATV & DBS
- MMDS & Wireless LAN
- LTE

General Description

GVA-60-D+ (RoHS compliant) is an advanced wideband amplifier die fabricated using HBT technology that offers flat gain over a broad frequency range with high IP3. In addition, the GVA-60-D+ has excellent input and Output return loss over a broad frequency range without the need for external matching components.

simplified schematic and pin 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 pin; 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, as shown in “Recommended Application Circuit”, Fig. 2
GROUND	Connections to ground. Use via holes as shown in “Suggested Layout for PCB Design” to reduce ground path inductance for best performance.

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

Parameter	Condition (GHz)	Min.	Typ.	Max.	Units
Frequency Range		0.01		6	GHz
Gain	0.05		20.6		dB
	0.85		20.0		
	2.0		19.3		
	3.0		18.0		
	4.0		15.9		
	5.0		13.6		
	6.0		11.2		
Input return loss	0.05		23.2		dB
	0.85		20.4		
	2.0		14.78		
	3.0		15.5		
	4.0		14.9		
	5.0		14.8		
	6.0		16.2		
Output return loss	0.05		11.0		dB
	0.85		10.5		
	2.0		8.6		
	3.0		8.1		
	4.0		7.6		
	5.0		8.1		
	6.0		7.2		
Reverse isolation	2.0		24.6		dB
Output power at 1dB compression	0.05		20.0		dBm
	0.85		20.6		
	2.0		18.2		
	3.0		14.7		
	4.0		11.9		
	5.0		9.7		
	6.0		7.9		
Output IP3	0.05		38.6		dBm
	0.85		36.4		
	2.0		29.0		
	3.0		23.5		
	4.0		20.7		
	5.0		18.2		
	6.0		16.3		
Noise figure	0.05		3.7		dB
	0.85		3.9		
	2.0		3.9		
	3.0		4.1		
	4.0		4.3		
	5.0		4.4		
	6.0		4.7		
Device Operating Voltage			5.0		V
Device Operating Current		—	93	100	mA
Device Current Variation vs. Voltage			0.040		mA/mW
Thermal Resistance, junction-to-ground lead			37		°C/W

1. Measured on Mini-Circuits Die Characterization test board . See Characterization Test Circuit (Fig. 1)

Absolute Maximum Ratings[2]

Parameter	Ratings
Operating Temperature (ground lead)	-40°C to 85°C
Operating Current at 5V	140 mA
Power Dissipation	0.7 W
Input Power (CW)	28 dBm (10-1000 MHz, +5 minutes) 13 dBm (1000-5000 MHz, +5 minutes) 8 dBm (continuous) 28 dBm (10-1000 MHz, +5 minutes)
DC Voltage on RF OUT Pad 3	6V

2. Permanent damage may occur if any of these limits are exceeded.
Electrical maximum ratings are not intended for continuous normal operation.
For continuous operation, do not exceed 5.2V device voltage.
Die performance measured in industry standard SOT-89 package.

Characterization Test Circuit

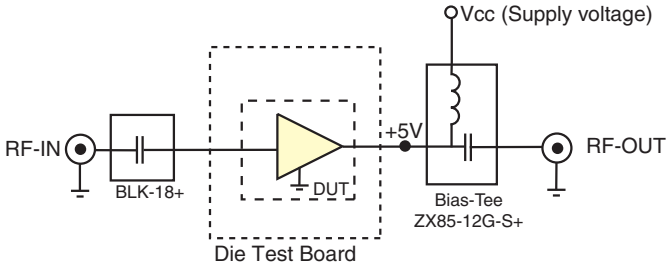


Fig 1. Block Diagram of Test Circuit used for characterization.
Gain, Return loss, Output power at 1dB compression (P1 dB) , output IP3 (OIP3) and Noise figure measured using Agilent's N5242A PNA-X microwave network analyzer.

Conditions:
1. Gain and Return loss: Pin= -25dBm
2. Output IP3 (OIP3): Two tones, spaced 1 MHz apart, -18 dBm/tone at input.

Recommended Application Circuit

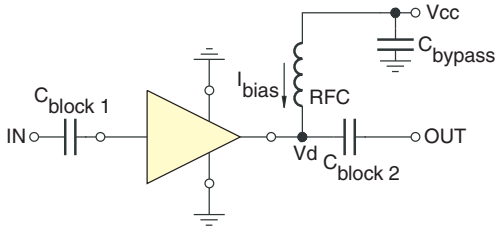


Fig 2. Test Board includes case, connectors, and Components soldered to PCB
Cblock1: 1000 pF
Cblock 2 & RFC: TCBT-14+
Cbypass: 0.1µF

Die Layout

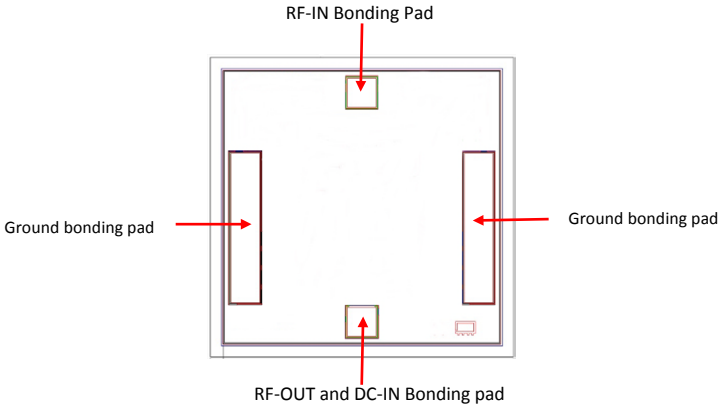


Fig 3. Die Layout

Bonding Pad Position

(Dimensions in µm, Typical)

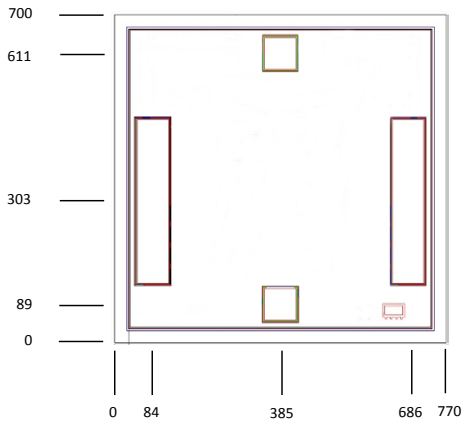


Fig 4. Bonding Pad Positions

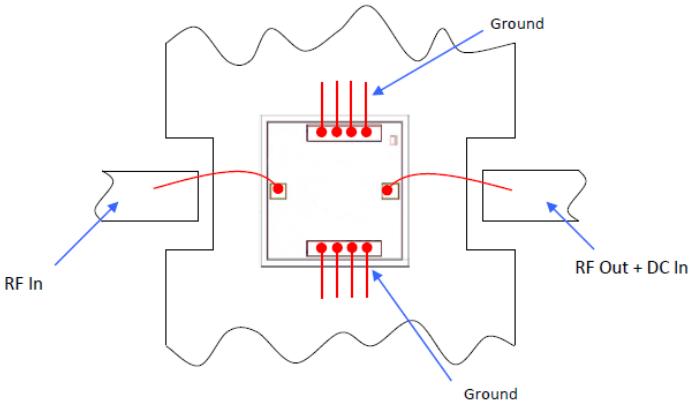
Critical Dimensions

Parameter	Values
Die Thickness, µm	100
Die Width, µm	770
Die Length, µm	700
Bond Pad Size (RF-IN), RF-OUT and DC IN), µm	75 x 75
Bond Pad Size (Ground pad), µm	75 x 350

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.

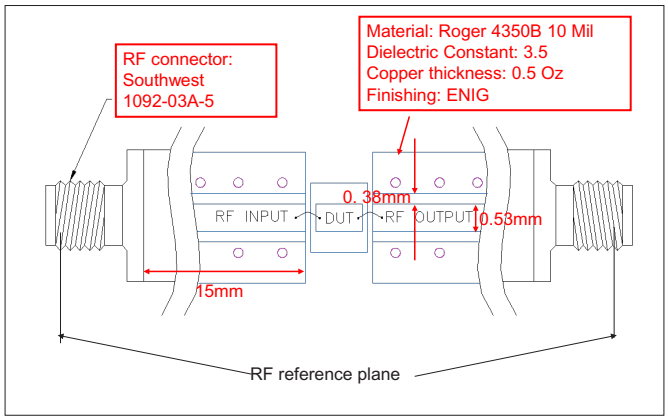
Assembly Diagram



Recommended Wire Length, Typical

Wire	Wire Length (mm)	Wire Loop Height (mm)
RF-IN, RF-OUT + DC-IN	0.5	0.15
GROUND	0.3	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-60-DG+
	Medium†, Partial wafer: KGD*<5K	GVA-60-DP+
	Large†, Full Wafer	GVA-60-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

Machine Model (MM): Class M2 (100 to <200V) in accordance with ANSI/ESD STM5.2-1999

** 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.

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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