

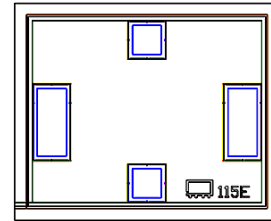
# 5 Volt, High Gain Monolithic Amplifier Die

## GVA-84-D+

50Ω DC to 7 GHz

### Product Features

- High Gain, 24 dB typ. at 100 MHz
- High Pout, P1dB 20.5 dBm typ. at 100 MHz
- High IP3, 37 dBm typ. at 100 MHz
- Ruggedized design
- Fixed 5V operation
- Transient protected, US patent 6,943,629



#### +RoHS Compliant

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

Ordering Information: Refer to Last Page

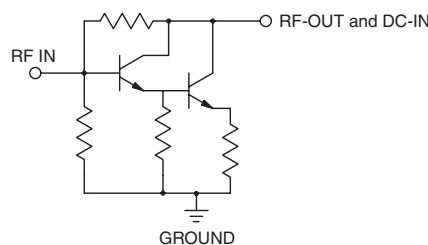
### Typical Applications

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

### General Description

GVA-84-D+ (RoHS compliant) is a wideband high gain amplifier die offering high dynamic range. It uses patented Transient Protected Darlington configuration and is fabricated using InGaP HBT technology.

### 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. Use via holes as shown in "Suggested Layout for PCB Design" to reduce ground path inductance for best performance.

**Electrical Specifications<sup>1</sup> at 25°C and 5V, unless noted**

Parameter	Condition (GHz)	Min.	Typ.	Max.	Units
Frequency Range <sup>2</sup>		DC		7	GHz
Gain	0.1		24.1		dB
	1.0		21.7		
	2.0		18.4		
	3.0		16.0		
	4.0		14.6		
	6.0		12.5		
	7.0		10.5		
Magnitude of Gain Variation versus Temperature <sup>3</sup> (values are negative)	0.1		0.0004		dB/°C
	1.0		0.0021		
	2.0		0.0032		
	3.0		0.0044		
	4.0		0.0058		
	6.0		0.0131		
	7.0		0.0175		
Input Return Loss	0.1		22.9		dB
	1.0		20.6		
	2.0		18.5		
	3.0		18.1		
	4.0		19.1		
	6.0		17.9		
	7.0		11.9		
Output Return Loss	0.1		23.3		dB
	1.0		10.7		
	2.0		7.7		
	3.0		7.1		
	4.0		7.0		
	6.0		6.3		
	7.0		5.6		
Reverse Isolation	2.0		26.5		dB
Output Power @1 dB compression	0.1		20.4		dBm
	1.0		20.5		
	2.0		20.6		
	3.0		21.0		
	4.0		19.9		
	6.0		17.0		
	7.0		15.6		
Saturated Output Power (at 3dB compression)	0.1		21.7		dBm
	1.0		22.3		
	2.0		22.3		
	3.0		22.2		
	4.0		21.0		
	6.0		18.9		
	7.0		17.2		
Output IP3	0.1		36.7		dBm
	1.0		35.8		
	2.0		36.6		
	3.0		35.8		
	4.0		34.9		
	6.0		33.0		
	7.0		32.0		
Noise Figure	0.1		5.5		dB
	1.0		5.6		
	2.0		5.5		
	3.0		5.5		
	4.0		5.6		
	6.0		6.2		
	7.0		6.8		
Group Delay	2.0		94		psec
Device Operating Voltage		4.8	5.0	5.2	V
Device Operating Current		85	108	130	mA
Device Current Variation vs. Temperature			61.8		µA/°C
Device Current Variation vs Voltage			0.058		mA/mV
Thermal Resistance, junction-to-ground lead			64		°C/W

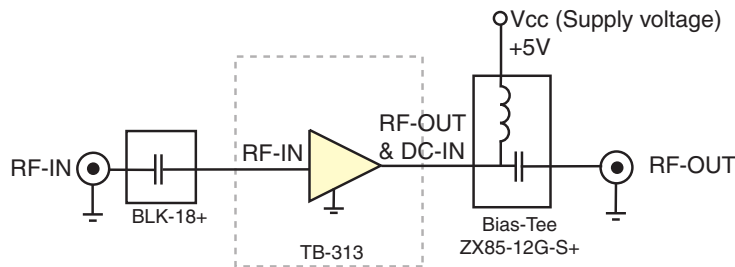
1. Measured on Mini-Circuits characterization test board. Die packaged in SOT-89 Package and soldered on test board TB-313.  
 2. Guaranteed specification DC-7 GHz. Low frequency cut off determined by external coupling capacitors and external bias choke.  
 3. (Gain at 85°C - Gain at -45°C)/130

**Absolute Maximum Ratings**

Parameter	Ratings
Operating Temperature (ground lead)	-45°C to 85°C
Operating Current at 5V	160mA
Power Dissipation	1W
Input Power	13 dBm
DC Voltage at RF-OUT and DC-IN pad	5.8V

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

**Characterization Test Circuit**



**Fig 1.** Block Diagram of Test Circuit used for characterization. (Measured on Mini-Circuits characterization test board. Die packaged in SOT-89 Package and soldered on test board TB-313). Gain, Output power at 1dB compression (P1 dB) and output IP3 (OIP3) are measured using R&S Network Analyzer ZVA-24. 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, 0 dBm/tone at output.

**Die Layout**

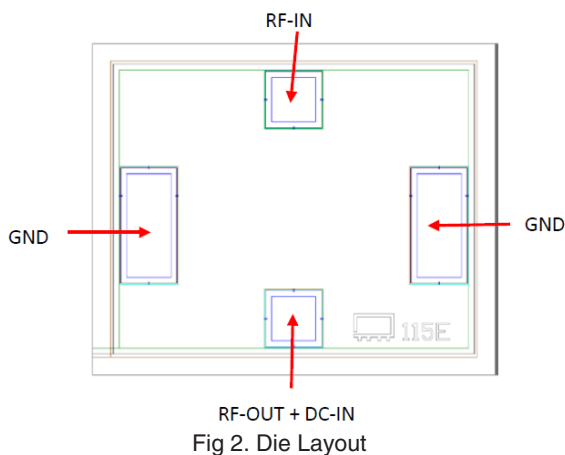


Fig 2. Die Layout

**Bonding Pad Position  
 (Dimensions in μm, Typical)**

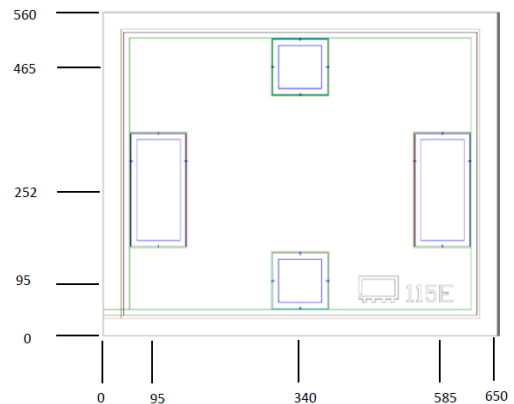


Fig 3. Bonding Pad Positions

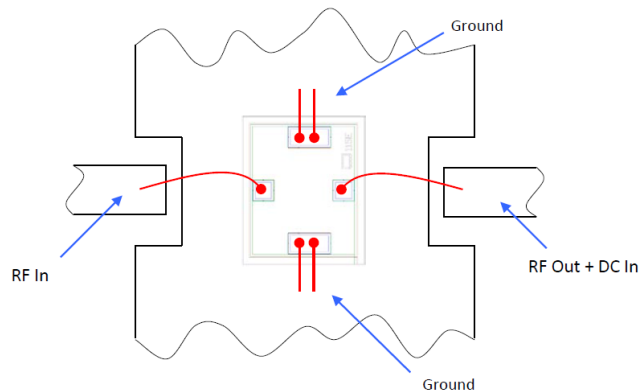
**Critical Dimensions**

Parameter	Values
Die Thickness, μm	100
Die Width, μm	560
Die Length, μm	680
Bond Pad Size (RF In, RF Out+DC In, μm	100 x 100
Bond Pad Size (Ground pad), μm	100 x 200

### 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 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.

### Assembly Diagram



### Recommended Wire Length, Typical

Wire	Wire Length (mm)	Wire Loop Height (mm)
Ground	0.25	0.15
RF In, RF Out + DC In	1.20	0.15

<b>Additional Detailed Technical Information</b> <i>additional information is available on our dash board.</i>	
<b>Performance Data</b>	Data Table
	Swept Graphs
	S-Parameter (S2P Files) Data Set with and without port extension(.zip file)
<b>Case Style</b>	Die
<b>Die Ordering and packaging information</b>	Quantity, Package <span style="float:right">Model No.</span>
	Small, Gel - Pak: 5,10,50,100 KGD* <span style="float:right">GVA-84-DG+</span> Medium†, Partial wafer: KGD*<5K <span style="float:right">GVA-84-DP+</span> Large†, Full Wafer <span style="float:right">GVA-84-DF+</span>
	†Available upon request contact sales representative
	Refer to <a href="#">AN-60-067</a>
<b>Environmental Ratings</b>	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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