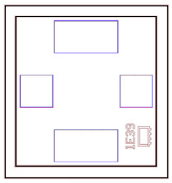
Wideband

Monolithic Amplifier Die

GALI-39-D+

50Ω DC to 7 GHz



The Big Deal

- Frequency range, DC to 7 GHz
- Output power, 10.5 dBm typ.
- High Gain, 19.7 dB at 2 GHz

Product Overview

GALI-39-D+ (RoHS compliant) is a wideband amplifier Die offering high dynamic range. It uses patented Transient Protected Darlington configuration and is fabricated using InGaP HBT technology. GALI-39-D+ is designed to be rugged for supply switch-on transients.

Key Features

Feature	Advantages
Broad Band: DC to 7 GHz	Broadband covering primary wireless communications bands: Cellular, PCS, LTE
Low Noise Figure, 2.4 dB typ. at 2 GHz	A unique feature of the GALI-39-D+ which separates this design from all competitors is the low noise figure performance in combination with the high IP3 resulting in high dynamic range.
Unpackaged Die	Enables the user to integrate the amplifier directly into hybrids

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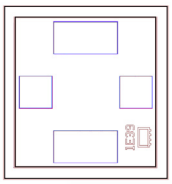


Product Features

- Frequency range, DC to 7 GHz
- Internally Matched to 50 Ohms
- Output power, 10.5 dBm typ.
- High Gain, 19.7 dB at 2GHz
- Protected by 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

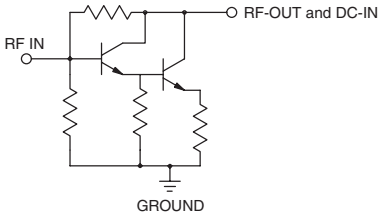
Typical Applications

- Cellular infrastructure
- Military/Defense
- VHF/UHF Transmitter/Receiver

General Description

GALI-39-D+ (RoHS compliant) is a wideband amplifier Die offering high dynamic range. It uses patented Transient Protected Darlington configuration and is fabricated using InGaP HBT technology. GALI-39-D+ is designed to be rugged for supply switch-on transients.

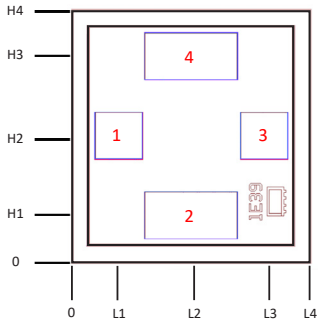
Simplified Schematic and Pad description



Pad #	Function	Description
1	RF IN	RF input pad. This pad requires the use of an external DC blocking capacitor chosen for the frequency of operation.
3	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 and Bias resistor are needed to feed DC bias without loss of RF signal due to the bias connection, as shown in "Recommended Application Circuit".
2,4	GROUND	Ground pads. Connect to ground per assembly diagram.

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

Bonding Pad Position



Dimensions in µm, Typical

L1	L2	L3	L4	H1	H2	H3	H4
95.0	245.0	395.0	490.0	95.0	260.0	425.0	520.0
Bond pad #1&#3		Bond pad #2&#4		Die size		Thickness	
95.0 x 95.0		190.0 x 95.0		490.0 x 520.0		100	

Electrical Specifications[1] at 25°C and 35mA, unless noted

Parameter		Min.	Typ.	Max.	Units
Frequency Range*		DC		7	GHz
Gain	f=0.1 GHz	—	20.8	—	dB
	f=1 GHz	—	21.1	—	
	f=2 GHz	—	19.7	—	
	f=3 GHz	—	17.7	—	
	f=4 GHz	—	17.0	—	
	f=5 GHz	—	16.1	—	
	f=7 GHz	—	17.6	—	
	f=10 GHz	—	9.8	—	
Input Return Loss	f= DC to 3 GHz		12.5		dB
	f= 3 to 7 GHz		11		
Output Return Loss	f= DC to 3 GHz		14		dB
	f= 3 to 7 GHz		8.0		
Output Power @ 1 dB compression	f=7 GHz	—	10.5	—	dBm
Output IP3	f=2 GHz		22.9		dBm
Noise Figure	f=2 GHz		2.4		dB
Recommended Device Operating Current			35		mA
Device Operating Voltage		3.1	3.5	3.9	V
Device Voltage Variation vs. Temperature at 35 mA			-2.5		mV/°C
Device Voltage Variation vs. Current at 25°C			2.9		mV/mA
Thermal Resistance, junction-to-case[1]			127		°C/W

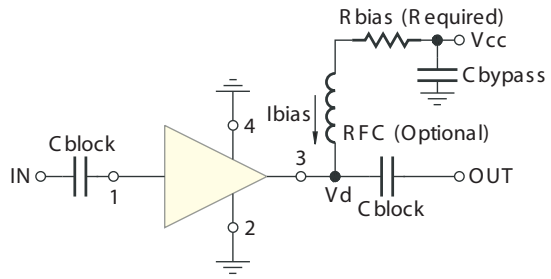
1. Measured on Mini-Circuits characterization test board TB-313, DUT packaged in industry standard SOT-89 package. See characterization test circuit (Fig. 1)
2. Guaranteed specification DC-7 GHz. Low frequency cut off determined by external coupling capacitors.

Absolute Maximum Ratings[3]

Parameter	Ratings
Operating Temperature	-45°C to 85°C
Storage Temperature	-65°C to 150°C
Operating Current	55 mA
Input Power	13 dBm

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

Recommended Application and Characterization Test Circuit



Test Board includes case, connectors, and components (in bold) soldered to PCB

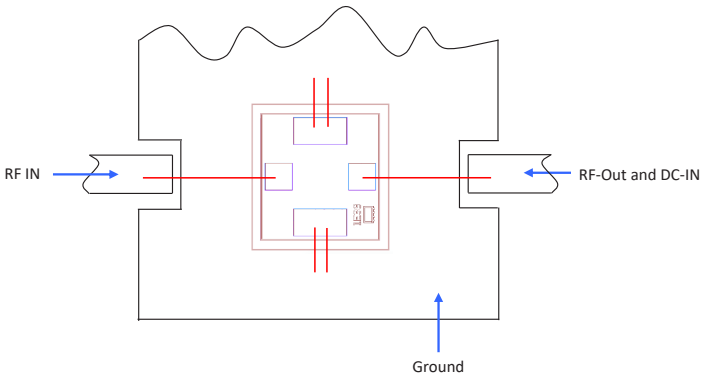
R BIAS	
Vcc	**"1%" Res. Values (ohms) for Optimum Biasing**
7	107
8	133
9	162
10	191
11	221
12	249
13	280
14	309
15	340
16	365
17	392
18	422
19	453
20	475

Fig 1. Block Diagram of Test Circuit used for characterization. (DUT, Die packaged in SOT-89 package, soldered on Mini-Circuits Characterization test board TB-313)

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, -5 dBm/tone at output.

Assembly Diagram



Assembly and Handling Procedure

1. Storage
   Dice should be stored in a dry nitrogen purged desiccators or equivalent.
2. ESD
   MMIC HBT 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.

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: 5,10,50,100 KGD*	GALI-39-DG+
	Medium†, Partial wafer: KGD*<3020	GALI-39-DP+
	Large†, Full Wafer	GALI-39-DF+
	†*Available upon request contact sales representative*	
	Refer to AN-60-067	
Environmental Ratings	ENV80	

*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 (250V to <500V) 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.

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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