

Surface Mount

# Monolithic Amplifier

DC-4 GHz

## Product Features

- InGaP HBT microwave amplifier
- Miniature SOT-89 package
- Internally Matched to 50 Ohms
- Frequency range, DC to 4 GHz
- Output power, 15.3 dBm typ.
- Excellent package for heat dissipation, exposed metal bottom
- Low thermal resistance for high reliability
- Aqueous washable
- Protected by US Patent 6,943,629

## Typical Applications

- Cellular
- PCS
- Communication receivers & transmitters

## General Description

Gali<sup>+</sup>4F+ (RoHS compliant) is a wideband amplifier offering high dynamic range. Lead finish is SnAgNi. It has repeatable performance from lot to lot, and is enclosed in a SOT-89 package. It uses patented Transient Protected Darlington configuration and is fabricated using InGaP HBT technology. Expected MTBF is 10,000 years at 85°C case temperature. Gali<sup>+</sup>4F+ is designed to be rugged for ESD and supply switch-on transients.



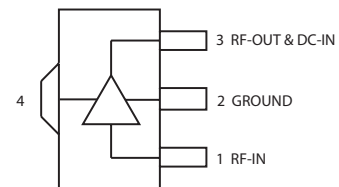
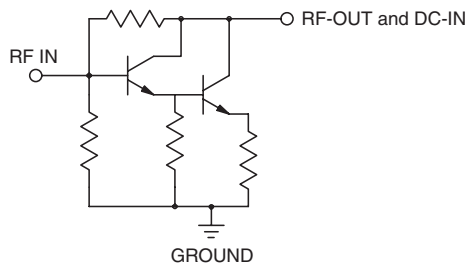
**Gali<sup>+</sup>4F+**

CASE STYLE: DF782

**+RoHS Compliant**

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

## simplified schematic and pin description



Function	Pin Number	Description
RF IN	1	RF input pin. This pin requires the use of an external DC blocking capacitor chosen for the frequency of operation.
RF-OUT and DC-IN	3	RF output and bias pin. 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".
GND	2,4	Connections to ground. Use via holes as shown in "Suggested Layout for PCB Design" to reduce ground path inductance for best performance.

### Notes

- 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.
- Electrical specifications and performance data contained in this specification document are based on Mini-Circuit's applicable established test performance criteria and measurement instructions.
- The parts covered by this specification document are subject to Mini-Circuits standard limited warranty and terms and conditions (collectively, "Standard Terms"); Purchasers of this part are entitled to the rights and benefits contained therein. For a full statement of the Standard Terms and the exclusive rights and remedies thereunder, please visit Mini-Circuits' website at [www.minicircuits.com/MCLStore/terms.jsp](http://www.minicircuits.com/MCLStore/terms.jsp)



**Electrical Specifications at 25°C and 50mA, unless noted**

Parameter		Min.	Typ.	Max.	Units
Frequency Range*		DC		4	GHz
Gain	f=0.1 GHz	—	14.3	—	dB
	f=1 GHz	—	14.0	—	
	f=2 GHz	11	13.4	—	
	f=3 GHz	—	13.0	—	
	f=4 GHz	—	12.3	—	
	f=6 GHz	—	13.2	—	
Input Return Loss	f= DC to 3 GHz		21		dB
	f= 3 to 4 GHz		21		
Output Return Loss	f= DC to 3 GHz		14		dB
	f= 3 to 4 GHz		11		
Output Power @ 1 dB compression	f=1 GHz	13.8	15.3	—	dBm
Output IP3	f=1 GHz		34		dBm
Noise Figure	f=1 GHz		4.0		dB
Recommended Device Operating Current			50		mA
Device Operating Voltage		4.0	4.4	5.0	V
Device Voltage Variation vs. Temperature at 50 mA			-3.1		mV/°C
Device Voltage Variation vs. Current at 25°C			10.0		mV/mA
Thermal Resistance, junction-to-case <sup>1</sup>			93		°C/W

\*Guaranteed specification DC-4 GHz. Low frequency cut off determined by external coupling capacitors.

**Absolute Maximum Ratings**

Parameter	Ratings
Operating Temperature*	-45°C to 85°C
Storage Temperature	-65°C to 150°C
Operating Current	65mA
Input Power	20dBm

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

These ratings are not intended for continuous normal operation.

<sup>1</sup>Case is defined as ground leads.

\*Based on typical case temperature rise 3°C above ambient.

**Notes**

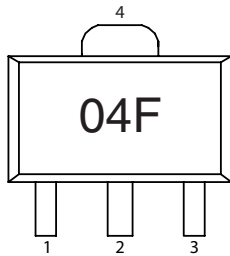
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**Product Marking**



Markings in addition to model number designation may appear for internal quality control purposes.

**Additional Detailed Technical Information**

Additional information is available on our web site. To access this information enter the model number on our web site home page.

**Performance data, graphs, s-parameter data set (.zip file)**

**Case Style: DF782**

Plastic package, exposed paddle, lead finish: tin-silver over nickel

**Tape & Reel: F55**

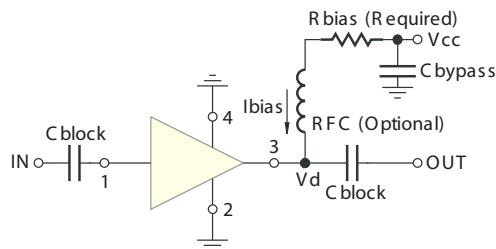
7” reels with 20, 50, 100, 200, 500, 1K devices.

**Suggested Layout for PCB Design: PL-019**

**Evaluation Board: TB-409-4F+**

**Environmental Ratings: ENV08T2**

**Recommended Application Circuit**



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

R BIAS	
Vcc	“1%” Res. Values (ohms) for Optimum Biasing
7	51.1
8	69.8
9	90.9
10	110
11	130
12	150
13	169
14	191
15	210
16	232
17	249
18	274
19	294
20	316

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**ESD Rating**

Human Body Model (HBM): Class 1A (250v to <500v) in accordance with ANSI/ESD STM 5.1 - 2001

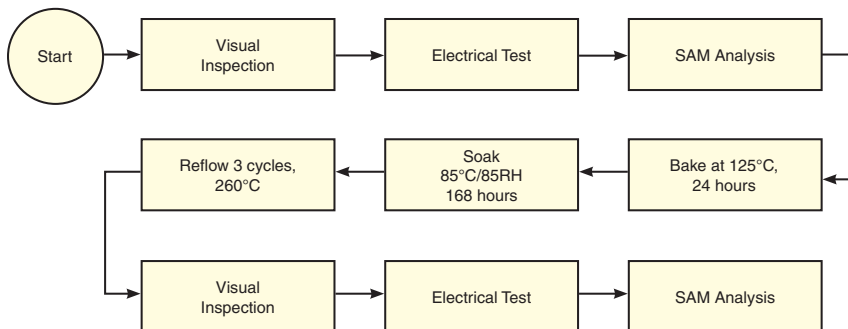
Machine Model (MM): Class M1 (< 100v) in accordance with ANSI/ESD STM 5.2 - 1999

**MSL Rating**

Moisture Sensitivity: MSL1 in accordance with IPC/JEDECJ-STD-020C

No.	Test Required	Condition	Standard	Quantity
1	Visual Inspection	Low Power Microscope Magnification 40x	MIP-IN-0003 (MCT spec)	45 units
2	Electrical Test	Room Temperature	SCD (MCL spec)	45 units
3	SAM Analysis	Less than 10% growth in term of delamination	J-Std-020C (Jedec Standard)	45 units
4	Moisture Sensitivity Level 1	Bake at 125°C for 24 hours Soak at 85°C/85%RH for 168 hours Reflow 3 cycles at 260°C peak	J-Std-020C (Jedec Standard)	45 units

**MSL Test Flow Chart**



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