

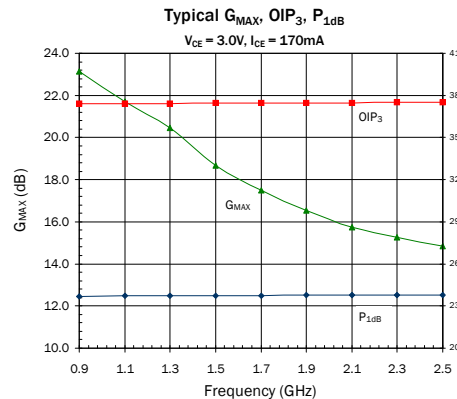


### Product Description

RFMD's SGA9089Z is a high performance Silicon Germanium Heterostructure Bipolar Transistor (SiGe HBT) designed for operation from 50MHz to 4.0GHz. The SGA9089Z is optimized for 3V operation. The device provides excellent linearity at a low cost. It can be operated over a wide range of currents depending on the power and linearity requirements.

#### Optimum Technology Matching® Applied

- ☐ GaAs HBT
- ☐ GaAs MESFET
- ☐ InGaP HBT
- ☐ SiGe BiCMOS
- ☐ Si BiCMOS
- ☒ SiGe HBT
- ☐ GaAs pHEMT
- ☐ Si CMOS
- ☐ Si BJT
- ☐ GaN HEMT
- ☐ InP HBT
- ☐ RF MEMS
- ☐ LDMOS



### Features

- 0.05GHz to 4GHz Operation
- 15.0dB  $G_{MAX}$  at 2.44GHz
- $P_{1dB} = +23.8dBm$  at 2.44GHz
- $OIP_3 = +37.5dBm$  at 2.44GHz
- 3.1dB NF at 2.44GHz
- Low Cost, High Performance, Versatility

### Applications

- Analog and Digital Wireless Systems
- 3G, Cellular, PCS, RFID
- Fixed Wireless, Pager Systems
- PA Stage for Medium Power Applications

Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
Maximum Available Gain, $Z_S = Z_S^*$ , $Z_L = Z_L^*$		23.2		dB	880MHz
		16.4		dB	1960MHz
		15.0		dB	2440MHz
Output Power at 1dB Compression <sup>[2]</sup> , $Z_S = Z_{SOPT}$ , $Z_L = Z_{LOPT}$		23.7		dBm	880MHz and 1960MHz
		23.8		dBm	2440MHz
Output Third Order Intercept Point, $Z_S = Z_{SOPT}$ , $Z_L = Z_{LOPT}$		37.4		dBm	880MHz
		37.5		dBm	1960MHz and 2440MHz
Power Gain, $Z_S = Z_{SOPT}$ , $Z_L = Z_{LOPT}$		18.0		dB	880MHz <sup>[1]</sup>
		13.0		dB	1960MHz <sup>[2]</sup>
		11.0		dB	2440MHz <sup>[2]</sup>
Noise Figure <sup>[2]</sup> , $Z_S = Z_{SOPT}$ , $Z_L = Z_{LOPT}$		3.2		dB	880MHz
		3.1		dB	1960MHz
		3.1		dB	2440MHz
DC Current Gain	100	180	300		
Thermal Resistance		48		°C/W	Junction - lead
Breakdown Voltage	5.7	6.0		V	Collector - Emitter
Device Operating Voltage			3.8	V	Collector - Emitter
Device Operating Current			220	mA	Collector - Emitter

Test Conditions:  $V_{CE} = 3V$ ,  $I_{CE} = 170mA$  Typ. (unless otherwise noted),  $T_L = 25^\circ C$   $OIP_3$  Tone Spacing = 1MHz,  $P_{OUT}$  per tone = 10dBm

[1] 100% production tested with Application Circuit [2] Data with Application Circuit

## Absolute Maximum Ratings

Parameter	Rating	Unit
Device Current ( $I_{CE}$ )	235	mA
Base Current ( $I_B$ )	2.5	mA
Device Voltage ( $V_{CE}$ )	4.5	V
Collector - Base Voltage ( $V_{CB}$ )	12	V
Emitter - Base Voltage ( $V_{EB}$ )	4.5	V
RF Input Power* (See Note)	24	dBm
Junction Temp ( $T_J$ )	+150	°C
Operating Temp Range ( $T_L$ )	See Graph	°C
Storage Temp	+150	°C
ESD Rating - Human Body Model (HBM)	Class 1C	
Moisture Sensitivity Level	MSL 2	

\*Note: Load condition  $Z_L = 50\Omega$

Operation of this device beyond any one of these limits may cause permanent damage. For reliable continuous operation, the device voltage and current must not exceed the maximum operating values specified in the table on page one.

Bias Conditions should also satisfy the following expression:

$$I_D V_D < (T_J - T_L) / R_{TH}, j-l \text{ and } T_L = T_{LEAD}$$



## Caution! ESD sensitive device.

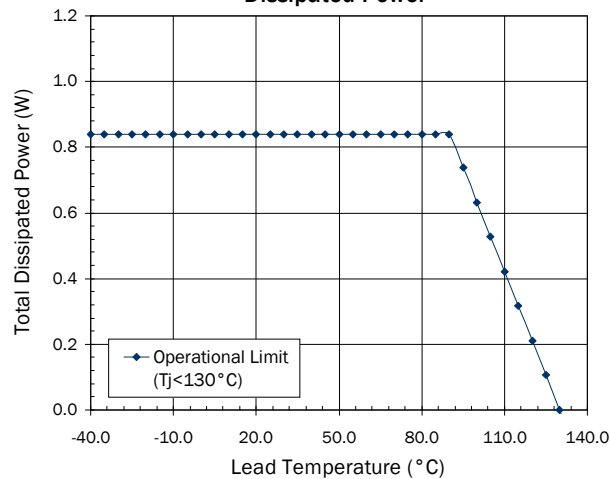
Exceeding any one or a combination of the Absolute Maximum Rating conditions may cause permanent damage to the device. Extended application of Absolute Maximum Rating conditions to the device may reduce device reliability. Specified typical performance or functional operation of the device under Absolute Maximum Rating conditions is not implied.

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RFMD Green: RoHS compliant per EU Directive 2002/95/EC, halogen free per IEC 61249-2-21, < 1000ppm each of antimony trioxide in polymeric materials and red phosphorus as a flame retardant, and <2% antimony in solder.

Maximum Recommended Operational  
Dissipated Power



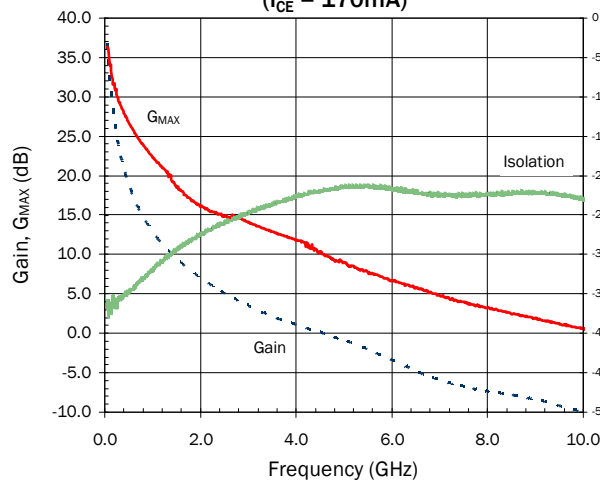
## Typical Performance with 2.45GHz Application Circuit

Freq (MHz)	VCE (v)	ICE (mA)	P1dB (dBm)	OIP3 (dBm)	Gain (dB)	S11 (dB)	S22 (dB)	NF (dB)	ZSOPT (Ω)	ZLOPT (Ω)
880	3.0	170.0	23.7	37.4	18.0	-18.6	-18.7	3.2	15 - j5.9	14.2 - j2.8
2440	3.0	170.0	23.8	37.5	11.0	-18.7	-23.9	3.1	11.8 - j27.6	16.4 - j14.2

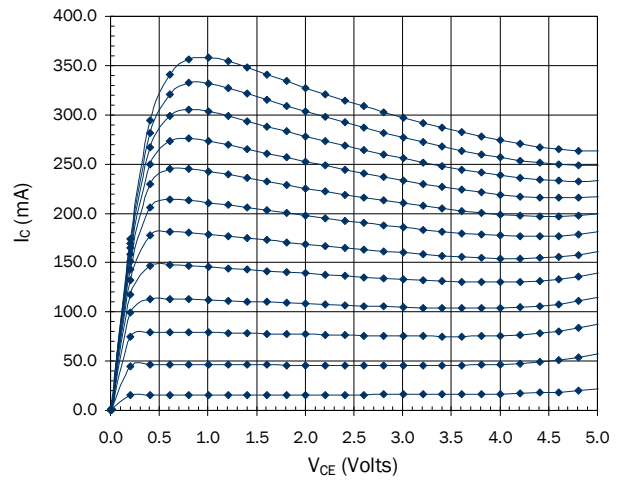
Test Conditions:  $V_S = 5V$   $I_S = 180mA$  Typ.  $OIP_3$  Tone Spacing = 1MHz,  $P_{OUT}$  per tone = 10dBm  $T_L = 25^\circ C$

**Insertion Gain and Isolation**

( $I_{CE} = 170\text{mA}$ )

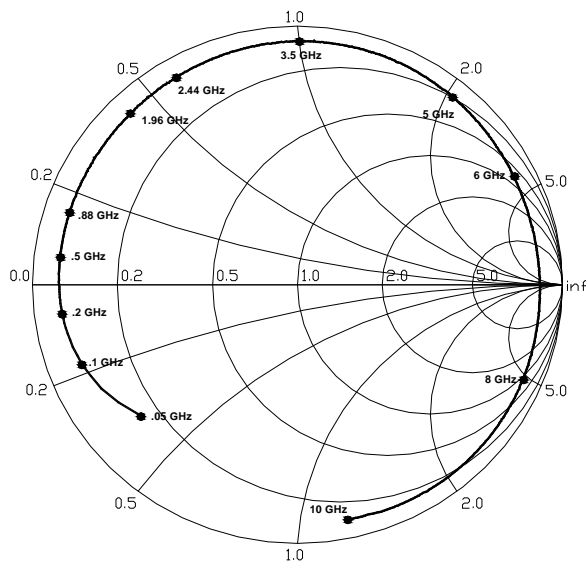


**DCIV Curves**



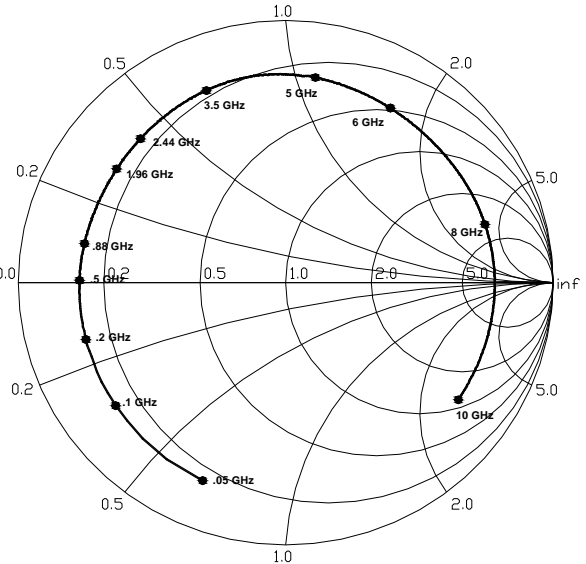
**S11 versus Frequency**

**S11 Vs.  
Frequency**



**S22 versus Frequency**

**S22 Vs.  
Frequency**

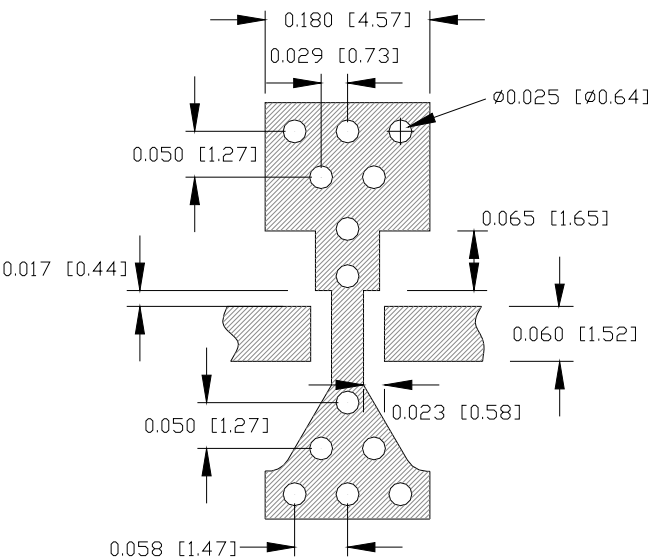


Note:

S-parameters are de-embedded to the device leads with  $Z_S = Z_L = 50\Omega$ . De-embedded S-parameters can be downloaded from our website ([www.rfmd.com](http://www.rfmd.com))

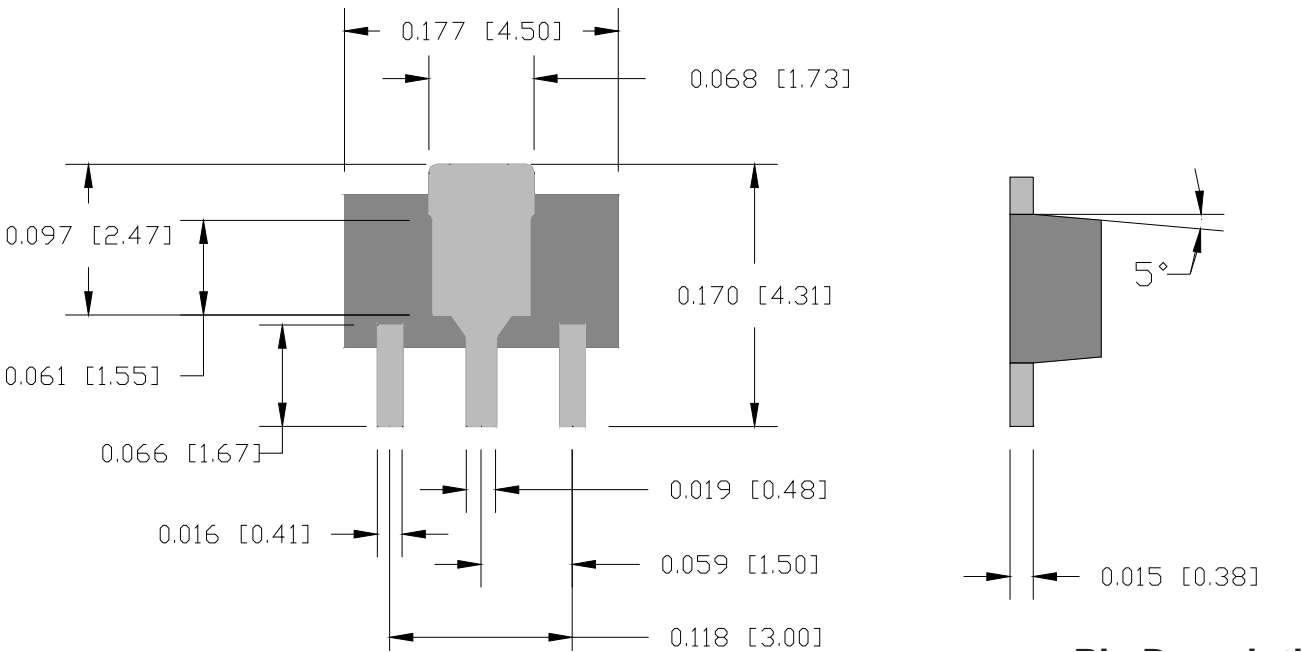
Pin	Function	Description
1	RF IN	RF input / Base Bias. External DC blocking capacitor required.
2, 4	GND	Connection to ground. Use via holes to reduce lead inductance. Place via holes as close to lead as possible.
3	RF OUT	RF Out / Collector bias. External DC blocking capacitor required.

Suggested Pad Layout

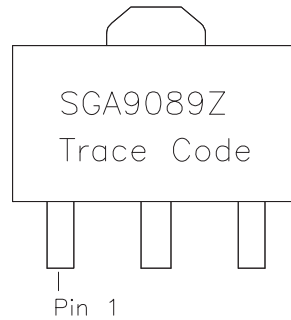


Package Drawing

Dimensions in inches (millimeters)  
Refer to drawing posted at [www.rfmd.com](http://www.rfmd.com) for tolerances.



## Part Identification



## Ordering Information

Ordering Code	Description
SGA9089Z	7" Reel with 3000 pieces
SGA9089ZSQ	Sample bag with 25 pieces
SGA9089ZSR	7" Reel with 100 pieces
SGA9089Z-EVB1	870MHz to 960MHz, , 8V Operation PCBA
SGA9089Z-EVB2	1930MHz to 1990MHz, , 8V Operation PCBA
SGA9089Z-EVB3	2110MHz to 2170MHz, , 8V Operation PCBA
SGA9089Z-EVB4	2400MHz to 2500MHz, , 8V Operation PCBA