RFMD
rfmd.com

SGA9189Z

MEDIUM POWER DISCRETE SiGe TRANSISTOR

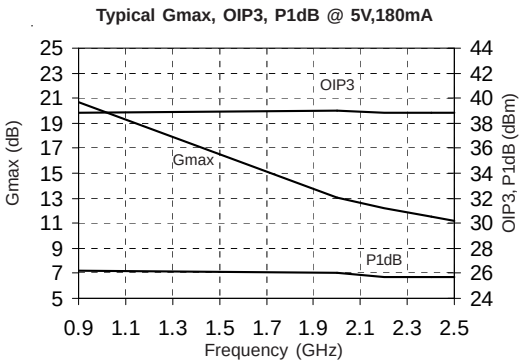
Package: SOT-89

Product Description

RFMD's SGA9189Z is a high performance transistor designed for operation to 3GHz. With optimal matching at 2GHz, OIP_3=39dBm, and P_{1dB}=25.5dBm. This RF device is based on a Silicon Germanium Heterostructure Bipolar Transistor (SiGe HBT) process. The SGA9189Z is cost-effective for applications requiring high linearity even at moderate biasing levels. It is well suited for operation at both 5V and 3V. The matte tin finish on the lead-free package utilizes a post annealing process to mitigate tin whisker formation and is RoHS compliant per EU Directive 2002/95. This package is also manufactured with green molding compounds that contain no antimony trioxide nor halogenated fire retardants.

Optimum Technology Matching® Applied

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



Features

- 50MHz to 3000MHz Operation
- 39dBm Output IP_3 Typ. at 1.96GHz
- 12.2dB Gain Typ. at 1.96GHz
- 25.5dBm P_{1dB} Typ. at 1.96GHz
- 2.1dB NF Typ. at 0.9GHz
- Cost-Effective
- 3V to 5V Operation

Applications

- Wireless Infrastructure Driver Amplifiers
- CATV Amplifiers
- Wireless Data, WLL Amplifiers
- AN-021 Contains Detailed Application Circuits

Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
Maximum Available Gain		20.5		dB	900MHz, $Z_S=Z_S^*$, $Z_L=Z_L^*$
		13.2		dB	1960MHz
Power Gain	17.5	19.0	20.5	dB	900MHz [1], $Z_S=Z_{SOPT}$, $Z_L=Z_{LOPT}$
	11.2	12.2	13.2	dB	1960MHz [2]
Output Power at 1dB Compression		40		dBm	900MHz, $Z_S=Z_{SOPT}$, $Z_L=Z_{LOPT}$
	23.5	25.5		dBm	1960MHz [2]
Output Third Order Intercept Point		40.0		dBm	900MHz, $Z_S=Z_{SOPT}$, $Z_L=Z_{LOPT}$, P_{OUT}=+10dBm per tone
	36.5	39.0		dBm	1960MHz [2]
Noise Figure		2.1		dB	900MHz, $Z_S=Z_{SOPT}$, $Z_L=Z_{LOPT}$
		2.6		dB	1960MHz
DC Current Gain	100	180	300		
Breakdown Voltage	7.5	8.5		V	collector - emitter
Thermal Resistance		47		°C/W	junction - lead
Device Operating Voltage		5.5		V	collector - emitter
Operating Current	155	180	195	mA	

Test Conditions: V_{CE}=5V, I_{CQ}=180mA (unless otherwise noted), T_L=25°C.
[1] 100% Tested [2] Sample Tested

7628 Thorndike Road, Greensboro, NC 27409-9421 · For sales or technical support, contact RFMD at (+1) 336.678-5570 or sales-support@rfmd.com.

Absolute Maximum Ratings

Parameter	Rating	Unit
Max Base Current (IB)	5	mA
Max Device Current (ICE)	200	mA
Max Collector-Emitter Voltage (VCEO)	7	V
Max Collector-Base Voltage (VCBO)	20	V
Max Emitter-Base Voltage (VEBO)	4.8	V
Max Junction Temp (TJ)	+150	°C
Operating Temp Range (TL)	See Graph	
Max Storage Temp	+150	°C

*Note: Load condition1, $Z_L = 50\Omega$.
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 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.

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.

Typical Performance with Engineering Application Circuit

Freq (MHz)	VCE (V)	ICQ (mA)	P1dB (dBm)	OIP3[1] (dBm)	Gain (dB)	S11 (dB)	S22 (dB)	NF (dB)	ZSOPT (Ω)	ZSOPT (Ω)
945	5	184	25.8	39.5	18.8	-14	-26	2.1	6.8 -j0.85	16 + j5.9
1960	5	179	25.5	40.0	12.2	-23	-21	2.4	7.6 - j11.2	22.8 + j0.7
2140	5	180	25.4	39.0	11.3	-20	-14	2.6	18.1 + j3.4	23.8 - j9.0
2440	5	180	25.4	40.0	10.2	-20	-17	2.7	5.6 - j15.1	23.1 - j2.7

[1] P_{OUT}=+10dBm per tone for V_{CE}=5V, 1MHz tone spacing

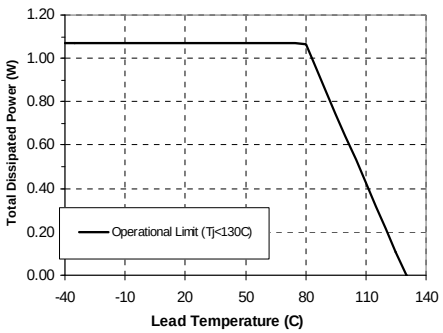
Typical Performance with Engineering Application Circuit

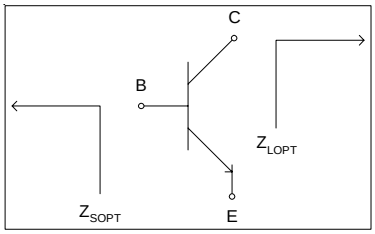
Freq (MHz)	VCE (V)	ICQ (mA)	P1dB (dBm)	OIP3[2] (dBm)	Gain (dB)	S11 (dB)	S22 (dB)	NF (dB)	ZSOPT (Ω)	ZSOPT (Ω)
945	3	165	22.1	34.3	17.7	-18	-11	2.1	9.6 - j1.6	11.0 + j1.4
1960	3	162	22.4	35.0	11.8	-18	-16	2.2	7.8 - j13.1	19.3 - j2.9
2440	3	165	23.2	35.3	9.9	-20	-15	2.6	8.1 - j16.0	21.0 - j6.5

[2] P_{OUT}=+6dBm per tone for V_{CE}=3V, 1MHz tone spacing

Data above represents typical performance of the application circuits notes in Application Note AN-021. Refer to the application note for additional RF data, PCB layouts, and BOMs for each application circuit. The application note also includes biasing instructions and other key issues to be considered. For the latest application notes please visit our site at wwww.RFMD.com or call your local sales representative.

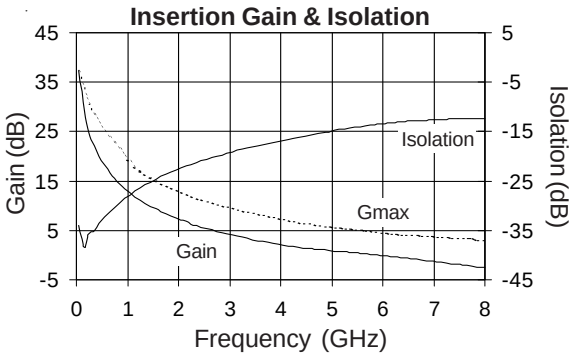
Maximum Recommended Operational Dissipated Power

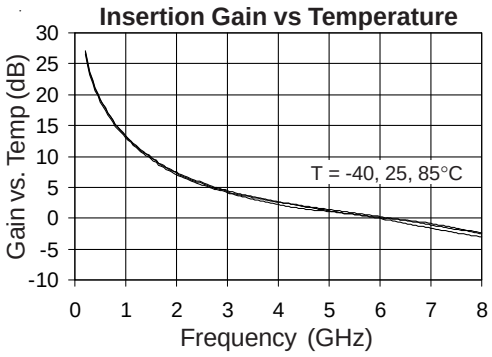


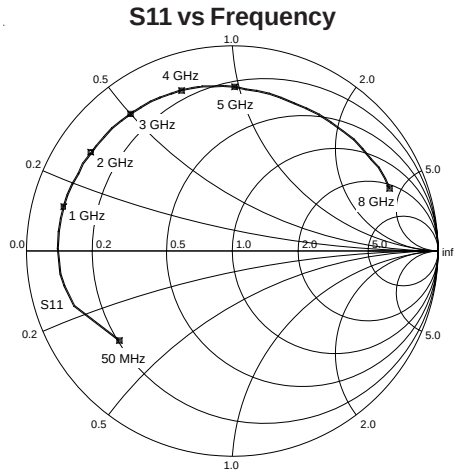


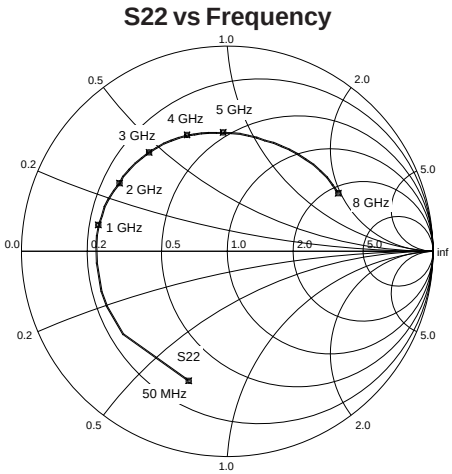
7628 Thorndike Road, Greensboro, NC 27409-9421 · For sales or technical support, contact RFMD at (+1) 336-678-5570 or sales-support@rfmd.com

De-embedded S-Parameters (Z_S=Z_L=50 Ohms, V_{CE}=5V, I_{CQ}=185mA, 25°C)

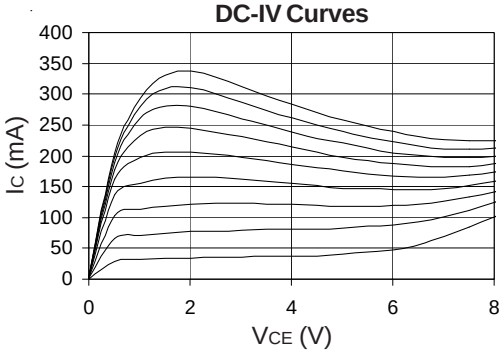








Note: S-parameters are de-embedded to the device leads with Z_s=Z_l=50Ω. The data represents typical performace of the device. De-embedded s-parameters can be downloaded from our website

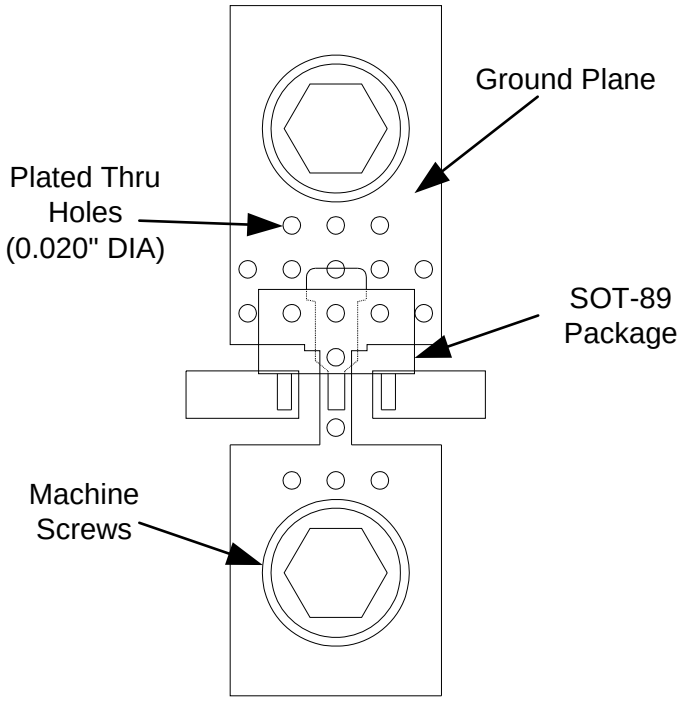


I_b = 0.4 - 3.6 mA , 0.4 mA steps
T=25C

7628 Thorndike Road, Greensboro, NC 27409-9421 · For sales or technical support, contact RFMD at (+1) 336.678-5570 or sales-support@rfmd.com.

Pin	Function	Description
1	Base	RF input.
2	Emitter	Connection to ground. Use via holes to reduce lead inductance. Place vias as close to ground leads as possible.
3	Collector	RF output.
4	Emitter	Same as pin 2.

Recommended Mounting Configuration for Optimum RF and Thermal Performance



Mounting and Thermal Considerations

It is very important that adequate heat sinking be provided to minimize the device junction temperature. The following items should be implemented to maximize MTTF and RF performance.

1. Multiple solder-filled vias are required directly below the ground tab (pin 4). [CRITICAL]

2. Incorporate a large ground pad area with multiple plated-through vias around pin 4 of the device. [CRITICAL]

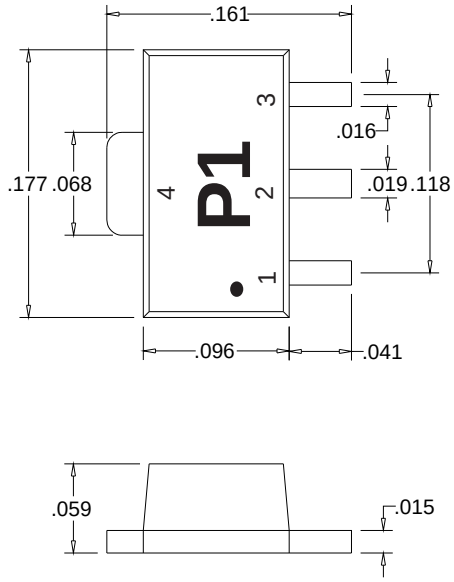
3. Use two point board seating to lower the thermal resistance between the PCB and mounting plate. Place machine screws as close to the ground tab (pin 4) as possible. [RECOMMENDED]

4. Use 2 ounce copper to improve the PCB's heat spreading capability. [RECOMMENDED]

7628 Thorndike Road, Greensboro, NC 27409-9421 · For sales or technical support, contact RFMD at (+1) 336-678-5570 or sales-support@rfmd.com

Package Drawing

Dimensions in inches (millimeters)
Refer to drawing posted at www.rfmd.com for tolerances.



Part Symbolization

The part will be symbolized with the “P1” (“P1Z” for RoHS version) designator and a dot signifying pin 1 on the top surface of the package. Alternate marking: “SGA9189Z” on line one with Trace Code on line two.

Ordering Information

Part Number	Description
SGA9189Z	13” Reel with 3000 pieces
SGA9189ZSQ	Sample Bag with 25 pieces
SGA9189ZSR	7” Reel with 100 pieces
SGA9189Z-EVB1	870MHz to 960MHz, 8V Operation PCBA
SGA9189Z-EVB2	1930MHz to 1990MHz, 8V Operation PCBA
SGA9189Z-EVB3	2110MHz to 2170MHz, 8V Operation PCBA
SGA9189Z-EVB4	2400MHz to 2500MHz, 8V Operation PCBA

7628 Thorndike Road, Greensboro, NC 27409-9421 · For sales or technical support, contact RFMD at (+1) 336.678-5570 or sales-support@rfmd.com.