Preliminary

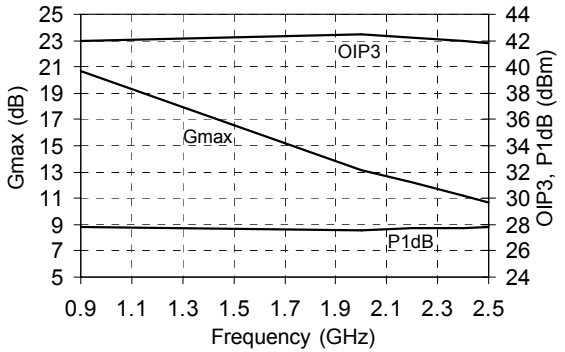
SGA-9289

Silicon Germanium HBT Amplifier

Product Description

Sirenza Microdevices' SGA-9289 is a high performance amplifier designed for operation from DC to 3 GHz. With optimal matching at 2 GHz, OIP3=42.5 dBm and P1dB=28 dBm. This RF device uses the latest Silicon Germanium Heterostructure Bipolar Transistor (SiGe HBT) process. The SGA-9289 is cost-effective for applications requiring high linearity even at moderate biasing levels. It is well suited for operation at both 5V and 3V.

Typical Gmax, OIP3, P1dB @ 5V,270mA



Product Features

- **DC-3 GHz Operation**
- **42.5 dBm Ouput IP3 Typical at 1.96 GHz**
- **11.0 dB Gain Typical at 1.96 GHz**
- **28 dBm P1dB Typical at 1.96 GHz**
- **2.9 dB NF Typical at 0.9 GHz**
- **Cost Effective**
- **3-5 V Operation**

Applications

- **Wireless Infrastructure Driver Amplifiers**
- **CATV Amplifiers**
- **Wireless Data, WLL Amplifiers**
- **AN-022 contains detailed application circuits**

Symbol	Device Characteristics, T = 25ºC V_{CE} = 5V, I_{CQ} =270mA (unless otherwise noted)	Test Frequency [1] 100% Tested [2] Sample Tested	Units	Min.	Typ.	Max.
G_{MAX}	Maximum Available Gain $Z_S=Z_S^*$, $Z_L=Z_L^*$	f = 900 MHz f = 1960 MHz	dB		20.6 13.1	
G	Power Gain $Z_S=Z_{SOPT}$, $Z_L=Z_{LOPT}$	f = 900 MHz [1] f = 1960 MHz [2]	dB		17.1 10.8	
P1dB	Output 1dB Compression Point $Z_S=Z_{SOPT}$, $Z_L=Z_{LOPT}$	f = 900 MHz f = 1960 MHz [2]	dBm		28.0 27.9	
OIP_3	Output Third Order Intercept Point $Z_S=Z_{SOPT}$, $Z_L=Z_{LOPT}$, P_{OUT}= +13 dBm per tone	f = 900 MHz f = 1960 MHz [2]	dBm		42.0 42.5	
NF	Noise Figure $Z_S=Z_{SOPT}$, $Z_L=Z_{LOPT}$	f = 900 MHz f = 1960 MHz	dB		2.9 3.3	
BV_{CEO}	Collector - Emitter Breakdown Voltage		V	7.5	8.5	
h_{FE}	DC current gain			120	180	300
Rth	Thermal Resistance (junction-to-lead)		ºC/W		32	
V_{CE}	Device Operating Voltage (collector-to-emitter)		V			5.5
I_{CE}	Device Operating Current (collector-to-emitter)		mA			350

Absolute Maximum Ratings

MTTF is inversely proportional to the device junction temperature. For junction temperature and MTTF considerations the device operating conditions should also satisfy the following expression:

$$P_{DC} - P_{OUT} < (T_J - T_L) / R_{TH}$$

where:

$P_{DC} = I_{CE} * V_{CE}$ (W)
P_{OUT} = RF Output Power (W)
T_J = Junction Temperature (C)
T_L = Lead Temperature (pin 4) (C)
R_{TH} = Thermal Resistance (C/W)

Parameter	Symbol	Value	Unit
Base Current	I_B	10	mA
Collector Current	I_{CE}	400	mA
Collector - Emitter Voltage	V_{CEO}	7.0	V
Collector - Base Voltage	V_{CBO}	20	V
Emitter - Base Voltage	V_{EBO}	4.8	V
Operating Temperature	T_{OP}	-40 to +85	C
Storage Temperature Range	T_{stor}	-40 to +150	C
Operating Junction Temperature	T_J	+150	C
Power Dissipation	P_{DISS}	2.8	W

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 1.

Typical Performance - Engineering Application Circuits (See AN-022)

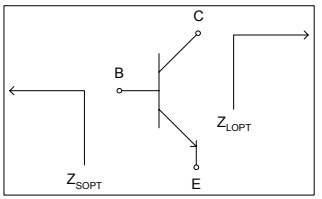
Freq (MHz)	V_{CE} (V)	I_{CQ} (mA)	P1dB (dBm)	OIP3[1] (dBm)	Gain (dB)	S11 (dB)	S22 (dB)	NF (dB)	Z_{SOPT} (Ω)	Z_{LOPT} (Ω)
945	5	287	27.8	42.0	17.8	-19	-11	2.5	2.93 - j3.92	15.81 + j1.57
1960	5	292	27.6	42.9	11.3	-18	-14	3.3	4.75 - j9.12	10.3 - j4.87
2140	5	293	28.0	41.7	11.1	-17	-18	3.2	4.30 - j9.09	13.4 + j2.31
2440	5	287	28.0	41.6	9.1	-20	-14	3.1	4.05 - j13.78	11.76 - j9.2

[1] P_{OUT}= +13 dBm per tone for V_{CE}=5V, 1 MHz tone spacing

Freq (MHz)	V_{CE} (V)	I_{CQ} (mA)	P1dB (dBm)	OIP3[1] (dBm)	Gain (dB)	S11 (dB)	S22 (dB)	NF (dB)	Z_{SOPT} (Ω)	Z_{LOPT} (Ω)
945	3	312	25.4	38.6	16.8	-18	-9	2.6	5.61 - j4.75	6.51 + j2.58
1960	3	315	26.0	39.3	11.0	-18	-15	2.9	3.23 - j5.67	4.95 + j1.73
2440	3	315	26.1	38.0	9.4	-29	-17	3.4	4.07 - 14.25	11.62 - j11.83

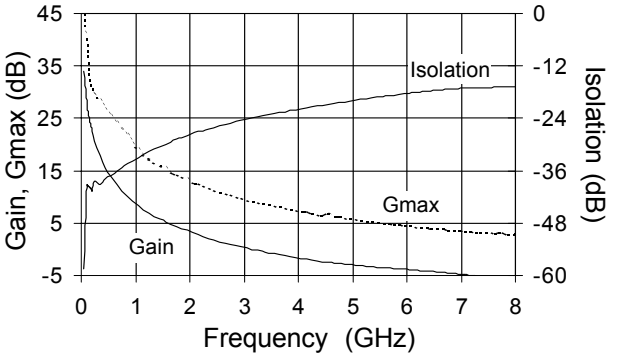
[2] P_{OUT}= +10 dBm per tone for V_{CE}=3V, 1 MHz tone spacing

Data above represents typical performance of the application circuits noted in Application Note AN-022. 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 www.sirenza.com or call your local sales representative.

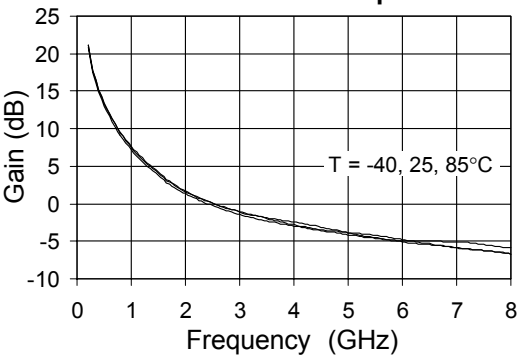


De-embedded S-Parameters (Z_S=Z_L=50 Ohms, V_{CE}=5V, I_{CQ}=270mA, 25° C)

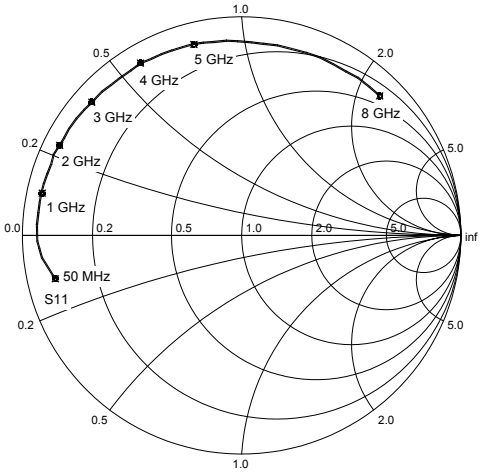
Insertion Gain & Isolation



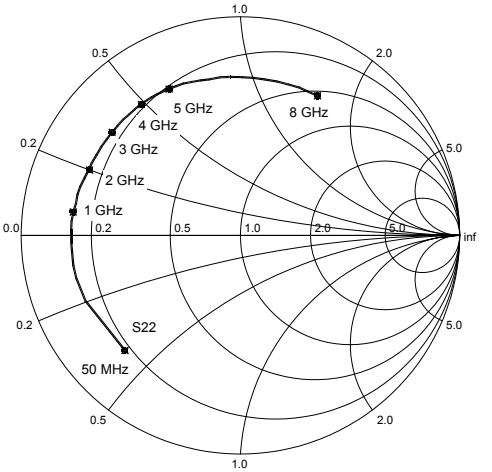
Insertion Gain vs Temperature



S11 vs Frequency

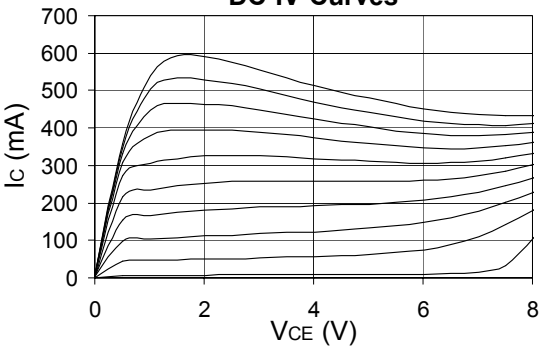


S22 vs Frequency



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 (www.sirenza.com).

DC-IV Curves



I_b = 0.2 - 2.0 mA , 0.2 mA steps
T=25°C

Caution: ESD sensitive
Appropriate precautions in handling, packaging and testing devices must be observed.

Pin Description

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

Part Number Ordering Information

Part Number	Reel Size	Devices/Reel
SGA-9289	7"	1000

Part Symbolization

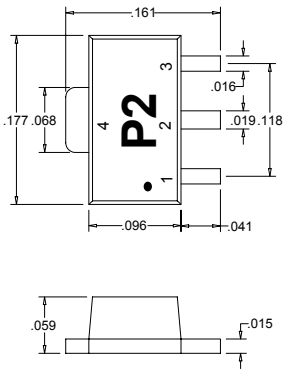
The part will be symbolized with the "P2" designator and a dot signifying pin 1 on the top surface of the package.

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]

Package Dimensions



DIMENSIONS ARE IN INCHES

Recommended Mounting Configuration for Optimum RF and Thermal Performance