# SGA-5386

# SGA-5386Z

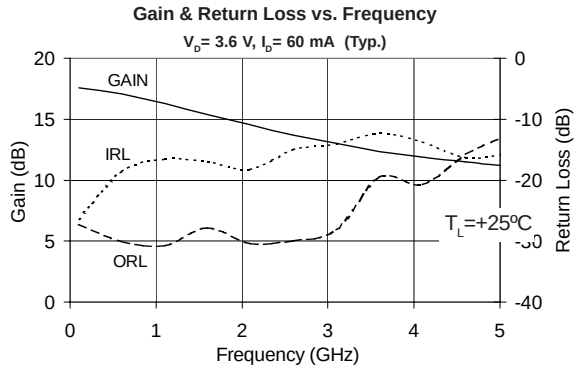
RoHS Compliant & Green Package

## DC-5000 MHz, Cascadable SiGe HBT MMIC Amplifier

## Product Description

The SGA-5386 is a high performance SiGe HBT MMIC Amplifier. A Darlington configuration featuring 1 micron emitters provides high $F_T$ and excellent thermal perfomance. The heterojunction increases breakdown voltage and minimizes leakage current between junctions. Cancellation of emitter junction non-linearities results in higher suppression of intermodulation products. Only 2 DC-blocking capacitors, a bias resistor and an optional RF choke are required for operation.

The matte tin finish on Sirenza's 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.




## Product Features

- **Now available in Lead Free, RoHS Compliant, & Green Packaging**
- **High Gain : 14.9 dB at 1950 MHz**
- **Cascadable 50 Ohm**
- **Operates From Single Supply**
- **Low Thermal Resistance Package**

## Applications

- **PA Driver Amplifier**
- **Cellular, PCS, GSM, UMTS**
- **IF Amplifier**
- **Wireless Data, Satellite**

| Symbol | Parameter | Units | Frequency | Min. | Typ. | Max. |
|---|---|---|---|---|---|---|
| G | Small Signal Gain | dB<br>dB<br>dB | 850 MHz<br>1950 MHz<br>2400 MHz | 15.2 | 16.6<br>14.9<br>14.0 | 18.3 |
| $P_{1dB}$ | Output Power at 1dB Compression | dBm<br>dBm | 850 MHz<br>1950 MHz | | 17.0<br>14.7 | |
| $OIP_3$ | Output Third Order Intercept Point | dBm<br>dBm | 850 MHz<br>1950 MHz | | 32.0<br>29.0 | |
| Bandwidth | Determined by Return Loss (>10dB) | MHz | | | 5000 | |
| IRL | Input Return Loss | dB | 1950 MHz | | 18.5 | |
| ORL | Output Return Loss | dB | 1950 MHz | | 30.0 | |
| NF | Noise Figure | dB | 1950 MHz | | 4.0 | |
| $V_D$ | Device Operating Voltage | V | | 3.1 | 3.6 | 4.1 |
| $I_D$ | Device Operating Current | mA | | 54 | 60 | 66 |
| $R_{TH}$, j-l | Thermal Resistance (junction to lead) | °C/W | | | 97 | |

**Test Conditions:** $V_S$ = 8 V, $R_{BIAS}$ = 75 Ohms, $I_D$ = 60 mA Typ., $T_L$ = 25ºC, $OIP_3$ Tone Spacing = 1 MHz, Pout per tone = 0 dBm, $Z_S = Z_L$ = 50 Ohms

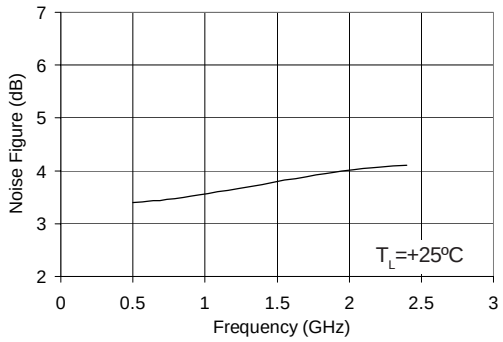
## Typical RF Performance at Key Operating Frequencies

| Symbol | Parameter | Unit | Frequency (MHz) 100 | 500 | 850 | 1950 | 2400 | 3500 |
|---|---|---|---|---|---|---|---|---|
| G | Small Signal Gain | dB | 17.6 | 17.2 | 16.6 | 14.7 | 14.0 | 12.5 |
| $OIP_3$ | Output Third Order Intercept Point | dBm | | 32.0 | 32.0 | 29.0 | 27.0 | |
| $P_{1dB}$ | Output Power at 1dB Compression | dBm | | 17.0 | 17.0 | 14.7 | 13.6 | |
| IRL | Input Return Loss | dB | 26.4 | 19.6 | 16.9 | 18.5 | 15.8 | 11.6 |
| ORL | Output Return Loss | dB | 27.3 | 29.5 | 31.0 | 30.0 | 33.4 | 19.1 |
| $S_{12}$ | Reverse Isolation | dB | 20.6 | 20.8 | 21.1 | 21.2 | 21.2 | 19.8 |
| NF | Noise Figure | dB | | 3.4 | 3.5 | 4.0 | 4.1 | |

**Test Conditions:** $V_S$ = 8 V, $R_{BIAS}$ = 75 Ohms, $I_D$ = 60 mA Typ., $T_L$ = 25ºC, $OIP_3$ Tone Spacing = 1 MHz, Pout per tone = 0 dBm, $Z_S = Z_L$ = 50 Ohms

### Noise Figure vs. Frequency

**$V_D$= 3.6 V, $I_D$= 60 mA (Typ.)**




### Absolute Maximum Ratings

| Parameter | Absolute Limit |
|---|---|
| Max. Device Current ($I_D$) | 120 mA |
| Max. Device Voltage ($V_D$) | 5 V |
| Max. RF Input Power | +16 dBm |
| Max. Junction Temp. ($T_J$) | +150°C |
| Operating Temp. Range ($T_L$) | -40°C to +85°C |
| Max. Storage Temp. | +150°C |

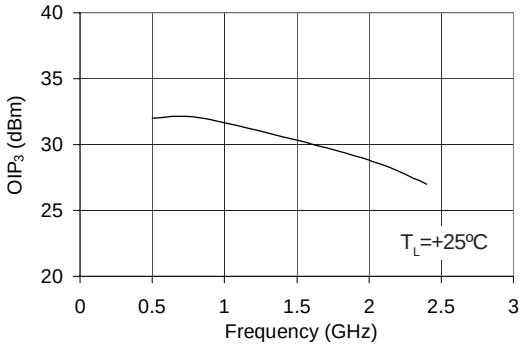
Operation of this device beyond any one of these limits may cause permanent damage. For reliable continous operation, the device voltage and current must not exceed the maximum operating values specified in the table on page one.

Bias Conditions should also satisfy the following expression:

$I_D V_D < (T_J - T_L) / R_{TH}$, j-l

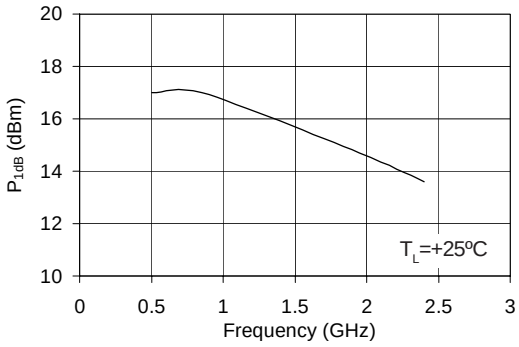
### $OIP_3$ vs. Frequency

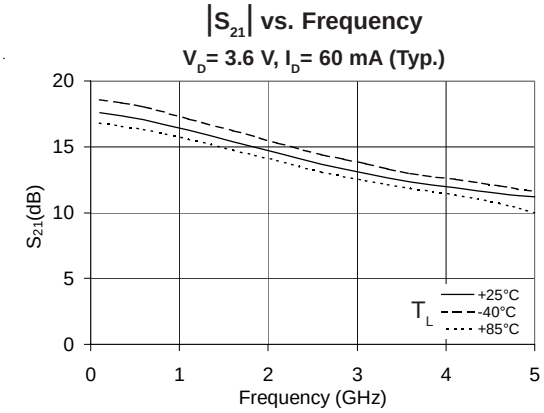
**$V_D$= 3.6 V, $I_D$= 60 mA (Typ.)**

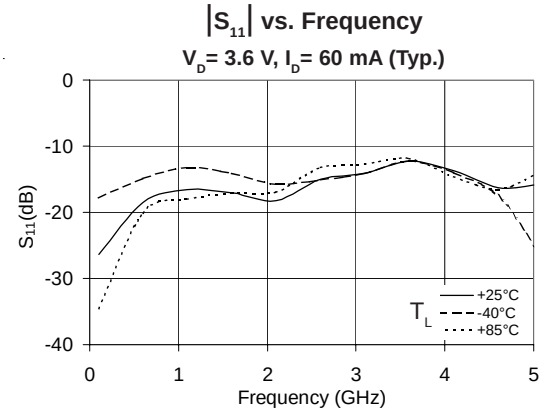


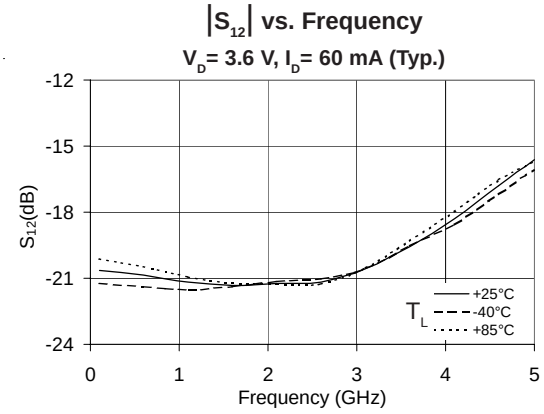

### $P_{1dB}$ vs. Frequency

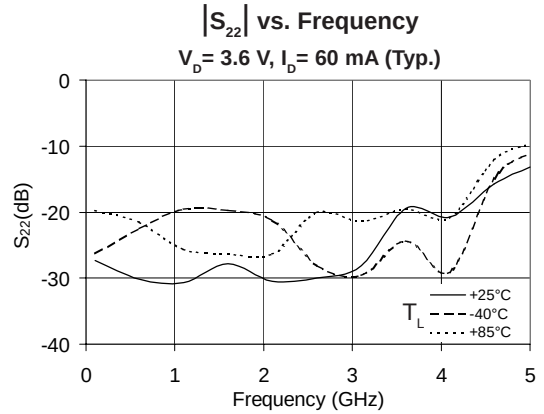
**$V_D$= 3.6 V, $I_D$= 60 mA (Typ.)**





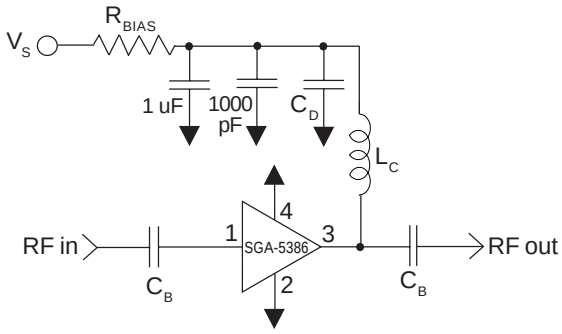



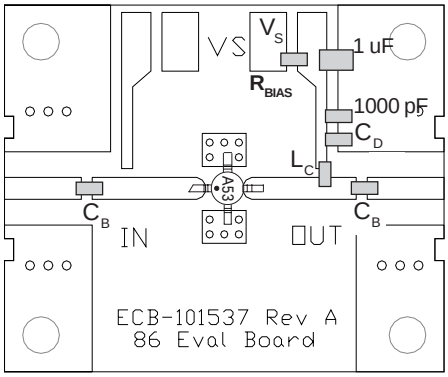



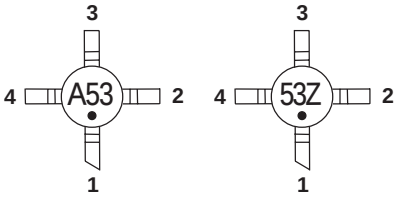

NOTE: Full S-parameter data available at *www.sirenza.com*

## Basic Application Circuit




### Part Identification Marking




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

**See Application Note AN-075 for Package Outline Drawing**

### Application Circuit Element Values

| Reference Designator | Frequency (Mhz) | | | | |
|---|---|---|---|---|---|
| | 500 | 850 | 1950 | 2400 | 3500 |
| $C_B$ | 220 pF | 100 pF | 68 pF | 56 pF | 39 pF |
| $C_D$ | 100 pF | 68 pF | 22 pF | 22 pF | 15 pF |
| $L_C$ | 68 nH | 33 nH | 22 nH | 18 nH | 15 nH |

| Recommended Bias Resistor Values for $I_D$=60mA $R_{BIAS}=(V_S-V_D)/I_D$ | | | | |
|---|---|---|---|---|
| Supply Voltage($V_S$) | 6 V | 8 V | 10 V | 12 V |
| $R_{BIAS}$ | 39 Ω | 75 Ω | 110 Ω | 150 Ω |
| Note: $R_{BIAS}$ provides DC bias stability over temperature. | | | | |

### Mounting Instructions

1. Use a large ground pad area under device pins 2 and 4 with many plated through-holes as shown.

2. We recommend 1 or 2 ounce copper. Measurements for this data sheet were made on a 31 mil thick FR-4 board with 1 ounce copper on both sides.

| Pin # | Function | Description |
|---|---|---|
| 1 | RF IN | RF input pin. This pin requires the use of an external DC blocking capacitor chosen for the frequency of operation. |
| 2, 4 | GND | Connection to ground. For optimum RF performance, use via holes as close to ground leads as possible to reduce lead inductance. |
| 3 | RF OUT/ BIAS | RF output and bias pin. DC voltage is present on this pin, therefore a DC blocking capacitor is necessary for proper operation. |

### Part Number Ordering Information

| Part Number | Reel Size | Devices/Reel |
|---|---|---|
| SGA-5386 | 13" | 3000 |
| SGA-5386Z | 13" | 3000 |