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# SGA3563Z

## DC to 5000MHz, CASCADABLE SiGe HBT MMIC AMPLIFIER

Package: SOT-363

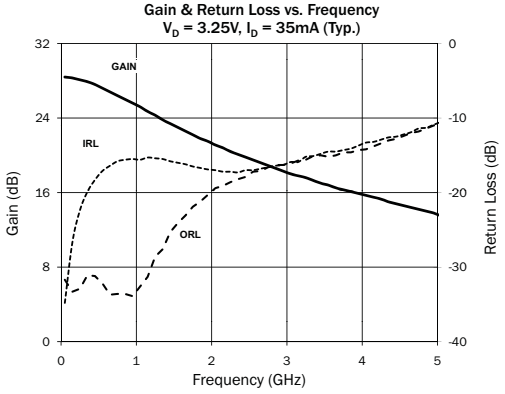


## Product Description

The SGA3563Z is a high performance SiGe HBT MMIC Amplifier. A Darlington configuration featuring one-micron emitters provides high $F_T$ and excellent thermal performance. 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 two DC-blocking capacitors, a bias resistor, and an optional RF choke are required for operation.

**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

- High Gain: 25.5dB at 850MHz
- Cascadable 50Ω Gain Block
- High Output $IP_3$: 24.5dBm typ. at 1950MHz
- Low Noise Figure: 2.7dB typ. at 1950MHz
- Low Current Draw: 35mA typ.
- Single Voltage Supply Operation

## Applications

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

| Parameter | Specification | | | Unit | Condition |
|---|---|---|---|---|---|
| | Min. | Typ. | Max. | | |
| Small Signal Gain | 23.5 | 25.5 | 27.5 | dB | 850MHz |
| | 19.5 | 21.5 | 23.5 | dB | 1950MHz |
| | | 20.0 | | dB | 2400MHz |
| Output Power at 1dB Compression | | 13.0 | | dBm | 850MHz |
| | 11.0 | 12.5 | | dBm | 1950MHz |
| Output Third Intercept Point | | 24.0 | | dBm | 850MHz |
| | 22.5 | 24.5 | | dBm | 1950MHz |
| Bandwidth Determined by Return Loss | | 5000 | | MHz | >10dB |
| Input Return Loss | 11.2 | 15.5 | | dB | 1950MHz |
| Output Return Loss | 11.2 | 20.0 | | dB | 1950MHz |
| Noise Figure | | 2.7 | 3.7 | dB | 1950MHz |
| Device Operating Voltage | 3.0 | 3.25 | 3.5 | V | |
| Device Operating Current | 31 | 35 | 39 | mA | |
| Thermal Resistance (Junction - Lead) | | 255 | | °C/W | |

Test Conditions: $I_D$=35mA Typ., $T_L$=25°C, $Z_S$=$Z_L$=50Ω, $P_{OUT}$ per tone=-5dBm, $OIP_3$ Tone Spacing=1MHz

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## Absolute Maximum Ratings

| Parameter | Rating | Unit |
|---|---|---|
| Max Device Current ($I_D$) | 70 | mA |
| Max Device Voltage ($V_D$) | 6 | V |
| Max RF Input Power | +18 | dBm |
| Max Junction Temp ($T_J$) | +150 | °C |
| Operating Temp Range ($T_L$) | -40 to +85 | °C |
| Max Storage Temp | +150 | °C |
| ESD Rating - Human Body Model (HBM) | Class 1A | |
| Moisture Sensitivity Level (MSL) | MSL 1 | |

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

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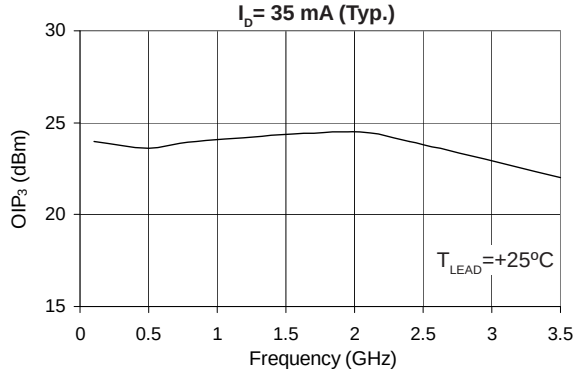
RFMD Green: RoHS compliant per EU Directive 2002/95/EC, halogen free per IEC 61249-2-21, < 1000 ppm each of antimony trioxide in polymeric materials and red phosphorus as a flame retardant, and <2% antimony in solder.

## Typical Performance at Key Operating Frequencies

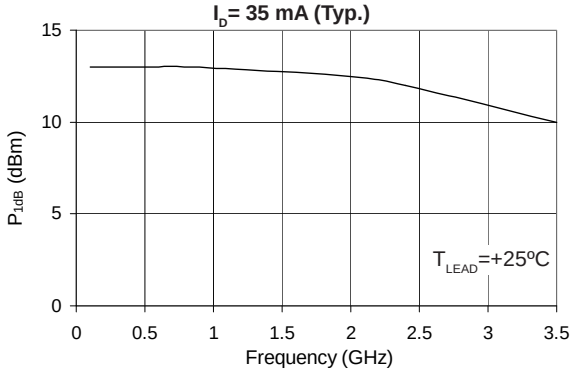
| Parameter | Unit | 100 MHz | 500 MHz | 850 MHz | 1950 MHz | 2400 MHz | 3500 MHz |
|---|---|---|---|---|---|---|---|
| Small Signal Gain | dB | 28.5 | 27.5 | 25.5 | 21.5 | 20.0 | 17.0 |
| Output Third Order Intercept Point | dBm | 24.0 | 23.6 | 24.0 | 24.5 | 24.0 | 22.0 |
| Output Power at 1dB Compression | dBm | 13.0 | 13.0 | 13.0 | 12.5 | 12.0 | 10.0 |
| Input Return Loss | dB | 29.7 | 17.6 | 15.6 | 15.5 | 17.2 | 14.7 |
| Output Return Loss | dB | 31.8 | 31.1 | 33.6 | 20.0 | 17.9 | 15.0 |
| Reverse Isolation | dB | 29.4 | 29.3 | 28.6 | 25.5 | 23.9 | 21.3 |
| Noise Figure | dB | 2.3 | 2.3 | 2.3 | 2.7 | | |

Test Conditions: $I_D$ = 35 mA Typ., $OIP_3$ Tone Spacing = 1 MHz, $P_{OUT}$ per tone = -5 dBm, $R_{BIAS}$ = 100Ω, $T_L$ = 25°C, $Z_S = Z_L$ = 50Ω

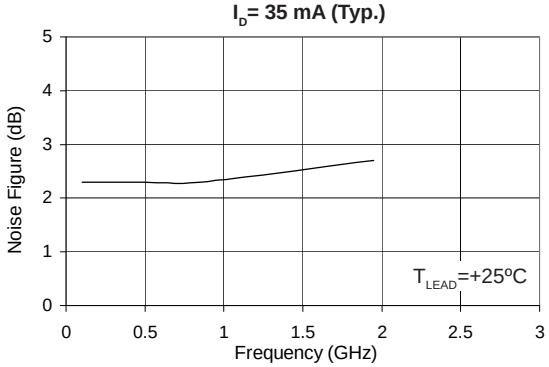
**$OIP_3$ vs. Frequency**
**$I_D$= 35 mA (Typ.)**



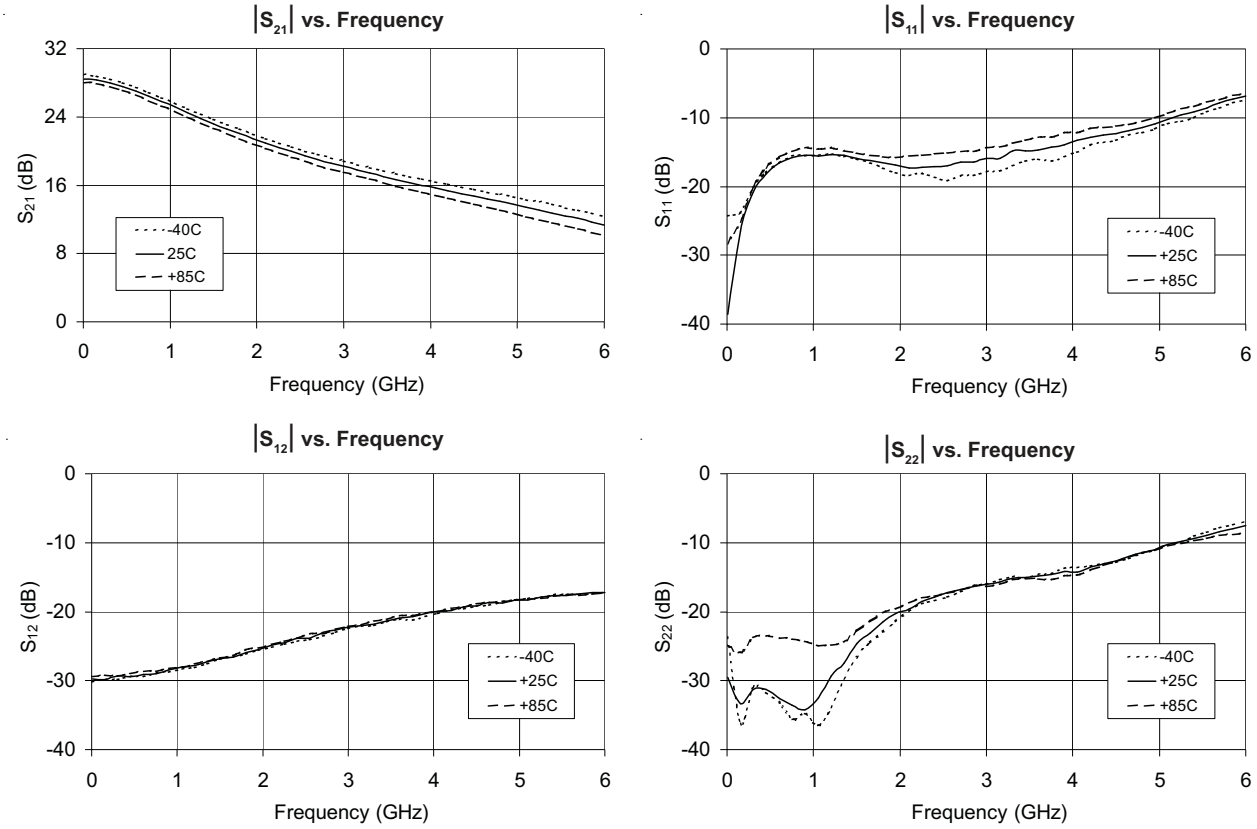

**$P_{1dB}$ vs. Frequency**
**$I_D$= 35 mA (Typ.)**




**Noise Figure vs. Frequency**
**$I_D$= 35 mA (Typ.)**



Typical RF Performance Over Lead Temperature – Bias: ID= 35 mA (Typ.) at TLEAD = +25ºC

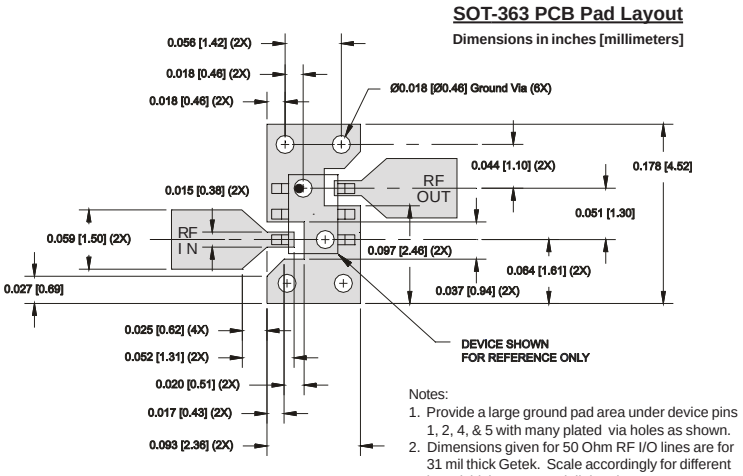





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| Pin | Function | Description |
|---|---|---|
| 3 | RF IN | RF input pin. This pin requires the use of an external DC-blocking capacitor chosen for the frequency of operation. |
| 1, 2, 4, 5 | GND | Connection to ground. For optimum RF performance, use via holes as close to ground leads as possible to reduce lead inductance. |
| 6 | RF OUT/BIAS | RF output and bias pin. DC voltage is present on this pin, therefor a DC-blocking capacitor is necessary for proper operation. |

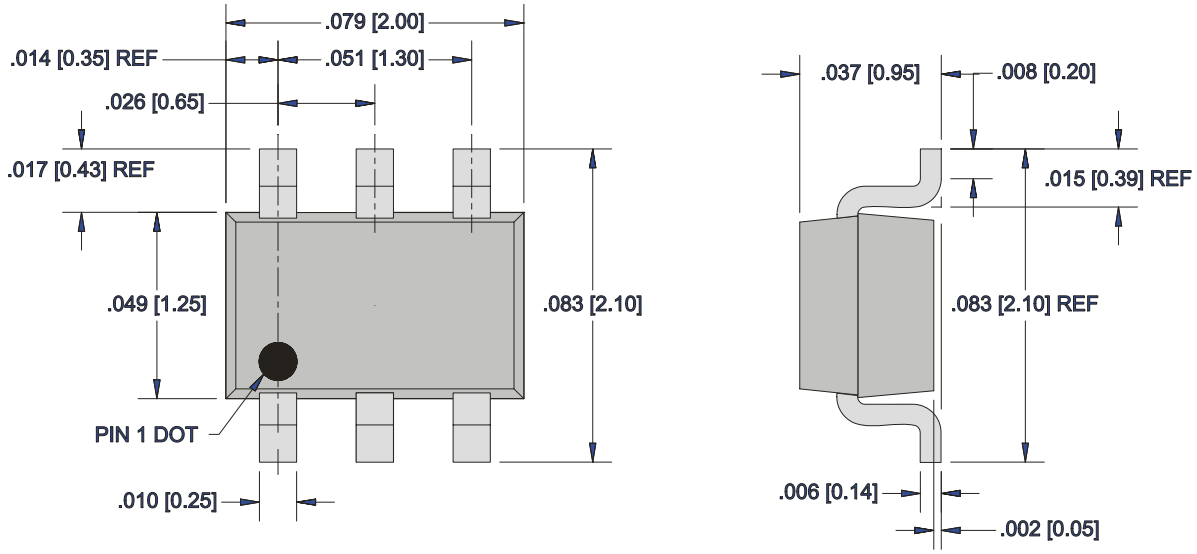
## Suggested Pad Layout



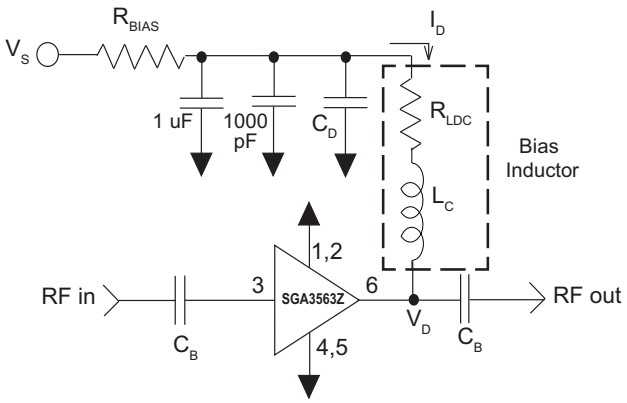

Notes:
1. Provide a large ground pad area under device pins 1, 2, 4, & 5 with many plated via holes as shown.
2. Dimensions given for 50 Ohm RF I/O lines are for 31 mil thick Getek. Scale accordingly for different board thicknesses and dielectric contants.
3. We recommend 1 or 2 ounce copper. Measurements for this data sheet were made on a 31 mil thick Getek with 1 ounce copper on both sides.

## Package Drawing

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



## Application Schematic




| Application Circuit Element Values | | | | | | |
|---|---|---|---|---|---|---|
| Reference Designator | Frequency (Mhz) | | | | | |
| | 100 | 500 | 850 | 1950 | 2400 | 3500 |
| $C_B$ | 1000 pF | 220 pF | 100 pF | 68 pF | 56 pF | 39 pF |
| $C_D$ | 100 pF | 100 pF | 68 pF | 22 pF | 22 pF | 15 pF |
| $L_C$ | 470 nH | 68 nH | 33 nH | 22 nH | 18 nH | 15 nH |

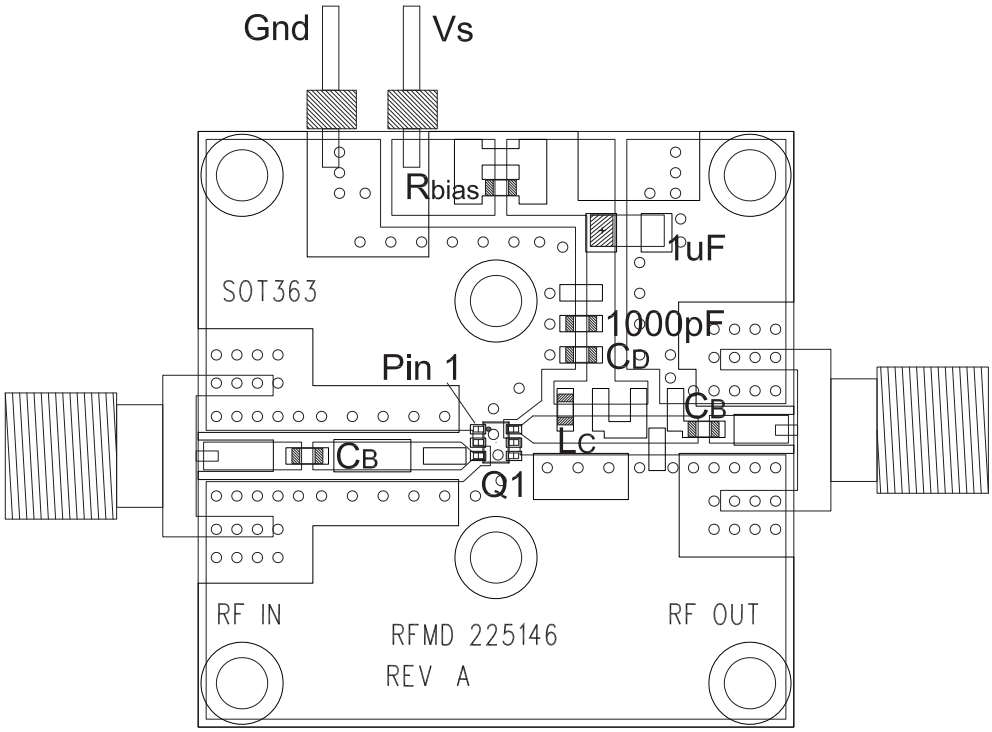
| Recommended Bias Resistance for $I_D$ = 35 mA | | | | | | | |
|---|---|---|---|---|---|---|---|
| Supply Voltage ($V_S$) (Volts) | < 5 | 5 | 6 | 7 | 8 | 9 | 10 |
| Bias Resistance* (Ohms) | N/R | 50 | 79 | 107 | 136 | 164 | 193 |

*** Bias Resistance = $R_{BIAS}$ + $R_{LDC}$ = ( $V_S$-$V_D$ ) / $I_D$**

Select $R_{BIAS}$ so that $R_{BIAS}$ + $R_{LDC}$ ~ the recommended bias resistance. Use 1% or 5 % tolerance resisistors or parallel combinations to attain the recommended bias resistance +/- 3%. $R_{BIAS}$ provides current stability over temperature.

* N/R=Not Recommended. Contact Sirenza technical support for guidance when available supply voltage is less than 5 Volts.

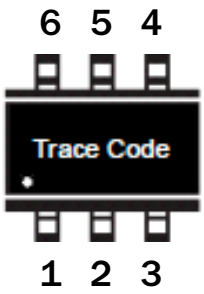
## Evaluation Board Layout





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## Part Identification




## Ordering Information

| Ordering Code | Description |
|---|---|
| SGA3563Z | 7" Reel with 3000 pieces |
| SGA3563ZSQ | Sample Bag with 25 pieces |
| SGA3563ZSR | 7” Reel with 100 pieces |
| SGA3563ZPCK1 | 850MHz, 5V Operation PCBA with 5-piece sample bag |

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