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# SGA-4300

## DC-4.5GHZ, CASCADABLE SiGe HBT MMIC AMPLIFIER

**Package: Bare Die**

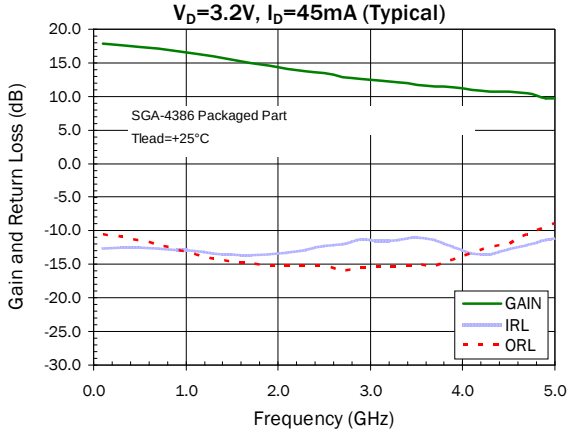
## Product Description

The SGA-4300 is a high performance SiGe HBT MMIC Amplifier in die form (0.66mmx0.38mm). A Darlington configuration featuring 1 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 high suppression of intermodulation products.
RFMD can provide 100% DC screening, various levels of visual inspection, and Hi-Rel wafer qualification. Die can be delivered at the wafer level, diced or undiced, or picked to gel or waffle packs.

**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

**Gain and Return Loss versus Frequency**
**$V_D$=3.2V, $I_D$=45mA (Typical)**




## Features

- 50Ω Cascadable Gain Block
- High Gain: 14.6dB Typical at 1950MHz
- High Output IP3: 26.9dBm Typical at 1950MHz
- Low Noise Figure: 3.1dB Typical at 1950MHz
- Low Current Draw: 45mA Typical
- Single Voltage Supply Operation

## Applications

- PA Driver Amp
- RF Pre-Driver and RF Receive Path
- Military Communications
- Test and Instrumentation

| Parameter | Specification | | | Unit | Condition |
|---|---|---|---|---|---|
| | Min. | Typ. | Max. | | |
| Frequency of Operation | DC | | 4500 | MHz | |
| Small Signal Gain | | 17.0 | | dB | Freq=850MHz |
| | | 14.6 | | dB | Freq=1950MHz |
| | | 13.7 | | dB | Freq=2400MHz |
| Output Power at 1dB Compression | | 15.3 | | dBm | Freq=850MHz |
| | | 13.0 | | dBm | Freq=1950MHz |
| Output $IP_3$ | | 28.9 | | dBm | Freq=850MHz |
| | | 26.9 | | dBm | Freq=1950MHz |
| Input Return Loss | | 13.2 | | dB | Freq=1950MHz |
| Output Return Loss | | 15.2 | | dB | Freq=1950MHz |
| Device Operating Voltage | 2.9 | 3.2 | 3.5 | V | |
| Device Operating Current | 41 | 45 | 49 | mA | |
| Noise Figure | | 3.1 | | dB | Freq=1950MHz |
| Thermal Resistance | | 97 | | °C/W | Junction to lead (86 pkg.) |

Test Conditions: $Z_O$=50Ω, $I_D$=45mA, T=25°C, $V_S$=8V, $R_{BIAS}$=110. Output IP3 $P_{OUT}$/Tone=-5dBm with 1MHz tone spacing.

Note: Above data for SGA-4386Z packaged part.





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## Absolute Maximum Ratings

| Parameter | Rating | Unit |
|---|---|---|
| Total Current ($I_D$) | 90 | mA |
| Device Voltage ($V_D$) | 5 | V |
| Operating Lead Temperature ($T_L$) | -40 to +85 | °C |
| RF Input Power | +18 | dBm |
| Storage Temperature Range | -55 to +150 | °C |
| Operating Junction Temp ($T_J$) | +150 | °C |

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.

RoHS status based on EUDirective2002/95/EC (at time of this document revision).



**Typical Performance of SGA-4386Z Packaged Part: $V_S$=8V, $R_{BIAS}$=110Ω, $I_D$=45mA, T=25°C, Z=50Ω, Tone Spacing=1MHz, $P_{OUT}$ per Tone=-5dBm**

| Parameter | Units | 100MHz | 500MHz | 850MHz | 1950MHz | 2400MHz | 3500MHz |
|---|---|---|---|---|---|---|---|
| Small Signal Gain | dB | 17.9 | 17.4 | 17.0 | 14.6 | 13.7 | 11.8 |
| Output 3rd Order Intercept Point | dBm | | 29.1 | 28.9 | 26.9 | 25.9 | |
| Output Power at 1dB Compression | dBm | | 14.8 | 15.3 | 13.0 | 11.9 | |
| Input Return Loss | dB | 12.5 | 12.5 | 12.8 | 13.2 | 12.4 | 10.9 |
| Output Return Loss | dB | 10.6 | 11.4 | 12.9 | 15.2 | 15.2 | 15.0 |
| Reverse Isolation | dB | 21.3 | 21.5 | 21.6 | 20.8 | 19.9 | 17.3 |
| Noise Figure | dB | | 2.8 | 2.9 | 3.1 | 3.4 | |


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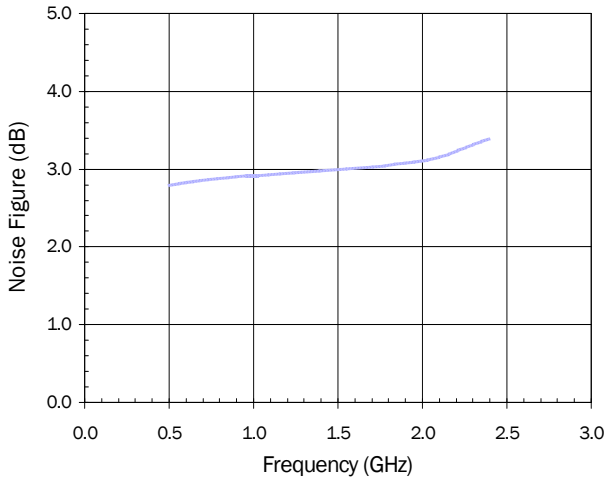
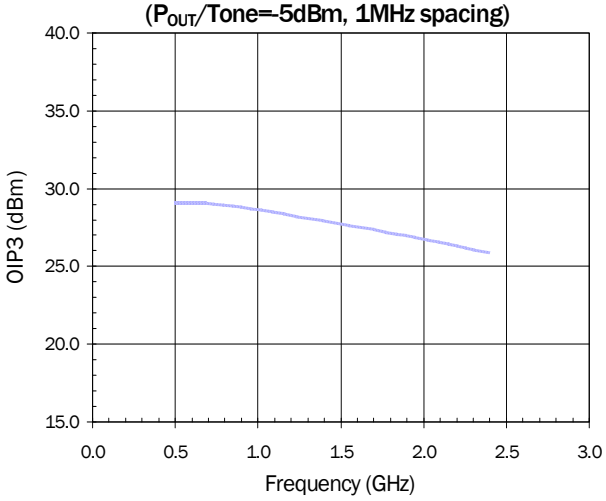
SGA-4386 Packaged Part Data ($T_{LEAD}$=+25°C, $V_{DEVICE}$=3.2V, $I_D$=45mA)

Noise Figure versus Frequency

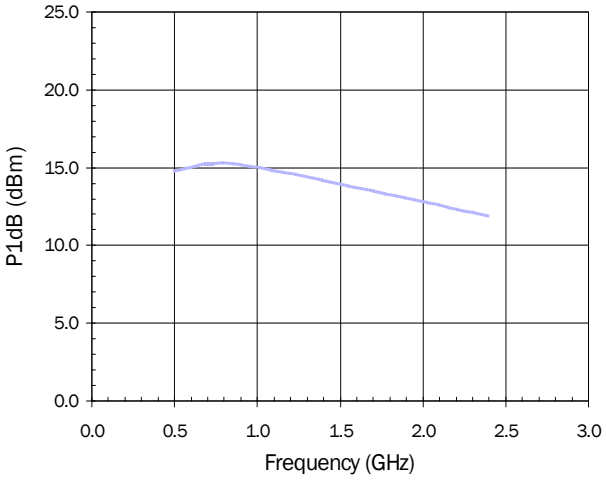



OIP3 versus Frequency

($P_{OUT}$/Tone=-5dBm, 1MHz spacing)




P1dB versus Frequency





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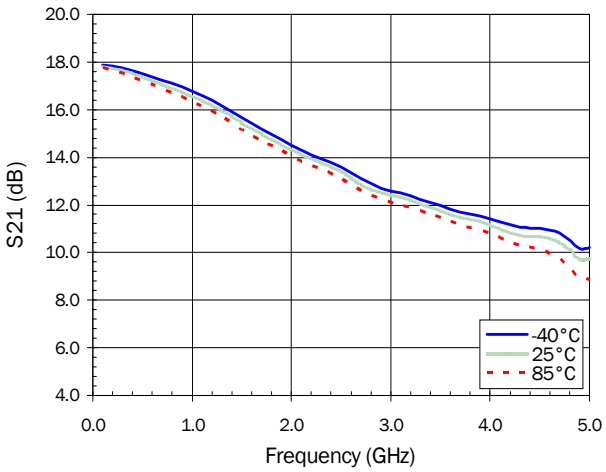
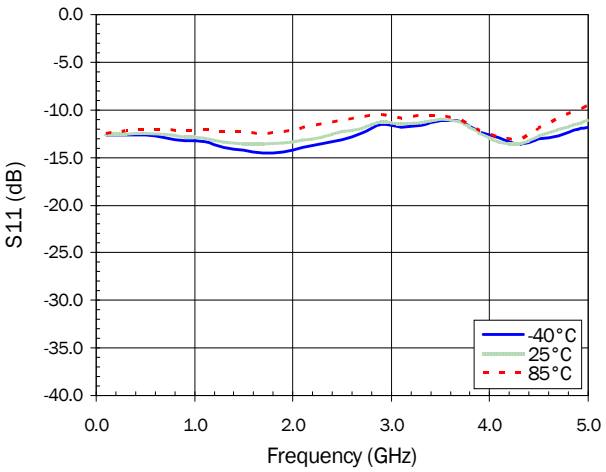
## SGA-4386 Packaged Part Data ($V_{DEVICE}$=3.2V, $I_D$=45mA)

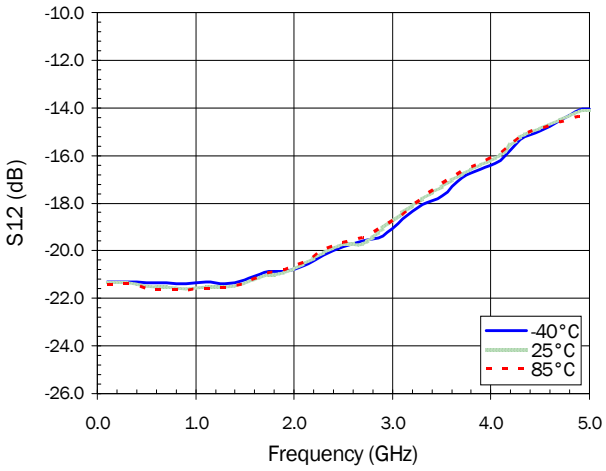
### S21 versus Frequency



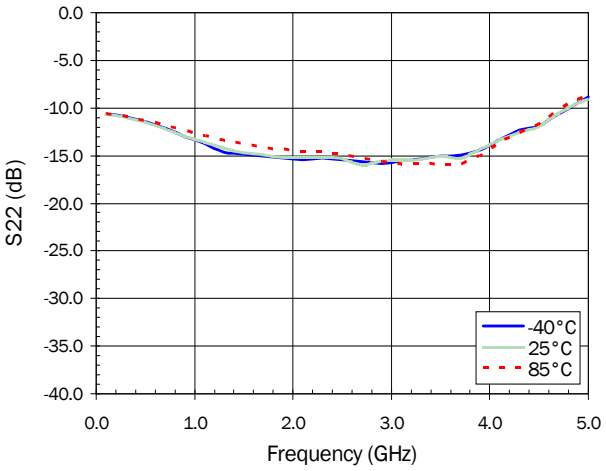

### S11 versus Frequency




### S12 versus Frequency




### S22 versus Frequency





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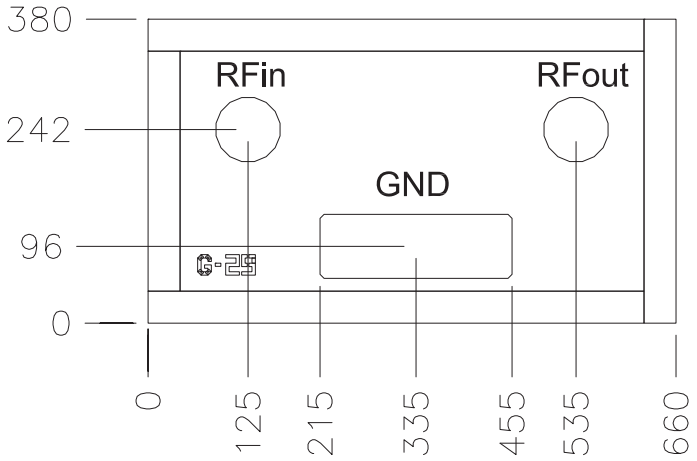
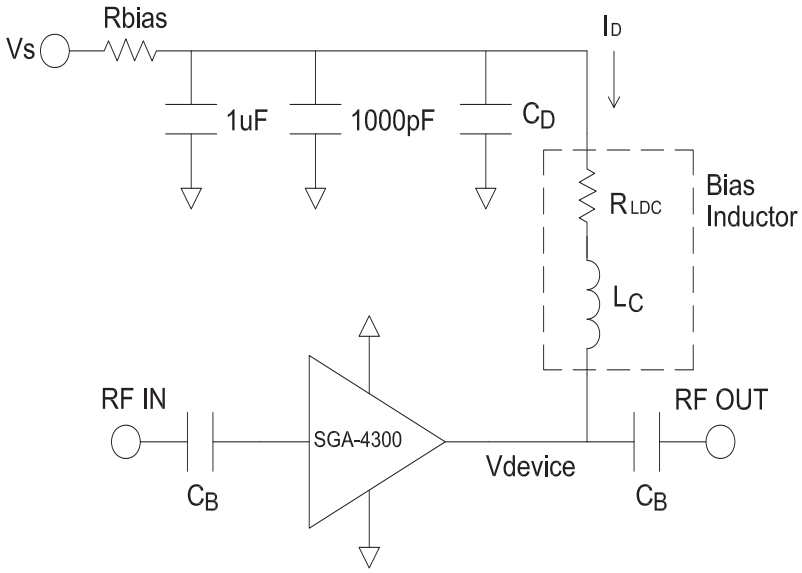
## Pad Description




**Bond Pad Description**

| Bond Pad | Function/Description |
|---|---|
| GND | DC and RF ground returns for the circuit. These pads must be downbonded to system ground. |
| RF IN | RF input pad. A DC block is required as voltage is present on this pad. |
| RF OUT | RF output and bias input pad. |

Notes:
1. All dimensions in microns [inches] unless otherwise shown.
2. Die Thickness is 203 [0.008].
3. Typical bond pad is 80 (0.003) round.
4. Backside metallization: none.
5. Bond pad metallization: Aluminum.



**SGA-4386 Application Circuit Element Values**

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

**Recommended Bias Resistance for $I_D$=45mA**

| Supply Voltage ($V_S$) (Volts) | <5 | 6 | 8 | 10 | 12 | | |
|---|---|---|---|---|---|---|---|
| Bias Resistance* (Ohms) | N/R | 62 | 110 | 150 | 200 | | |

*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 resistors or parallel combinations to attain the recommended bias resistance ±3%. $R_{BIAS}$ provides current stability over temperature.
*N/R=Not Recommended. Contact RFMD technical support for guidance when available supply voltage is less than 5V.

## Ordering Information

| Part Number | Description | Devices/Container |
|---|---|---|
| SGA-4300 | Bare Die | 100 |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