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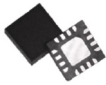
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RFMD Green, RoHS Compliant, Pb-Free (Z Part Number)

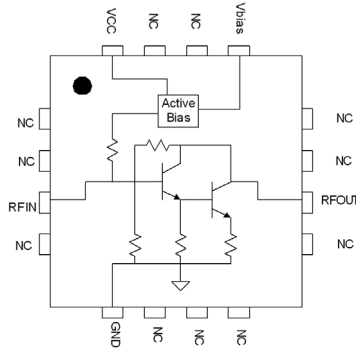
Package: 3x3 QFN, 16-Pin

Product Description

RFMD's SGB-6533 is a high performance SiGe HBT MMIC amplifier utilizing a Darlington configuration with an active bias network. The active bias network provides stable current over temperature and process Beta variations. Designed to run directly from a 5V supply the SGB-6533 does not require a drop resistor as compared to typical Darlington amplifiers. This robust amplifier features a Class 1C ESD rating, low thermal resistance, and unconditional stability. The SGB-6533 product is designed for high linearity 5V gain block applications that require small size and minimal external components. It is on chip matched to 50Ω and an external bias inductor choke is required for the application band.

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 Reliability SiGe HBT Technology
- Robust Class 1C ESD
- Simple and Small Size
- $P_{1dB} = 18.5\text{dBm}$ at 1950MHz
- $IP_3 = 32\text{dBm}$ at 1950MHz
- Low Thermal Resistance = 60°C/W

Applications

- 5V Applications
- LO Buffer Amp
- RF Pre-Driver and RF Receive Path

| Parameter | Specification | | | Unit | Condition |
|------------------------------------|---------------|------|------|--------------------|----------------------|
| | Min. | Typ. | Max. | | |
| Small Signal Gain | | 25.0 | | dB | 850MHz |
| | 17.0 | 18.5 | 20.0 | dB | 1950MHz |
| | | 17.0 | | dB | 2400MHz |
| Output Power at 1dB Compression | | 19.0 | | dBm | 850MHz |
| | 17.0 | 18.5 | | dBm | 1950MHz |
| | | 18.0 | | dBm | 2400MHz |
| Output Third Order Intercept Point | | 32.0 | | dB | 850MHz |
| | 30.0 | 32.0 | | dB | 1950MHz |
| | | 32.0 | | dB | 2400MHz |
| Noise Figure | | 3.7 | 4.7 | dB | 1950MHz |
| Frequency of Operation | DC | | 3000 | MHz | |
| Current | 76.0 | 88.0 | 98.0 | mA | |
| Input Return Loss | 11.0 | 15.0 | | dB | 1950MHz |
| Output Return Loss | 10.0 | 14.0 | | dB | 1950MHz |
| Thermal Resistance | | 60 | | $^\circ\text{C/W}$ | junction to backside |

Test Conditions: $Z_0 = 50\Omega$, $V_{CC} = 5V$, $I_C = 88\text{mA}$, $T = 30^\circ\text{C}$

Absolute Maximum Ratings

| Parameter | Rating | Unit |
|---------------------------------------|-------------|-------------|
| Current (I_C total) | 150 | mA |
| Max Device Voltage (V_D) | 6.5 | V |
| RF Input Power, $Z_{LOAD}=50\Omega$ | 15 | dBm |
| RF Input Power, $Z_{LOAD}>10:1$ VSWR | 7 | dBm |
| Power Dissipation | 0.75 | W |
| Max Junction Temperature (T_J) | 150 | $^{\circ}C$ |
| Operating Temperature Range (T_L) | -40 to +85 | $^{\circ}C$ |
| Max Storage Temperature | -40 to +150 | $^{\circ}C$ |



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 EU Directive 2002/95/EC (at time of this document revision).

The information in this publication is believed to be accurate and reliable. However, no responsibility is assumed by RF Micro Devices, Inc. ("RFMD") for its use, nor for any infringement of patents, or other rights of third parties, resulting from its use. No license is granted by implication or otherwise under any patent or patent rights of RFMD. RFMD reserves the right to change component circuitry, recommended application circuitry and specifications at any time without prior notice.

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.

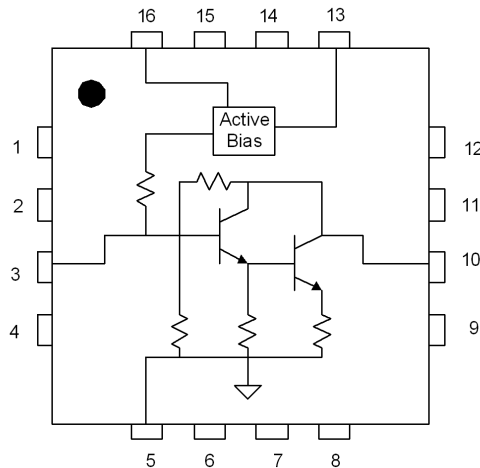
Bias Conditions should also satisfy the following expression:

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

Detailed Performance Table: $V_{CC}=5V$, $I_C=88mA$, $T=25^{\circ}C$, $Z=50\Omega$

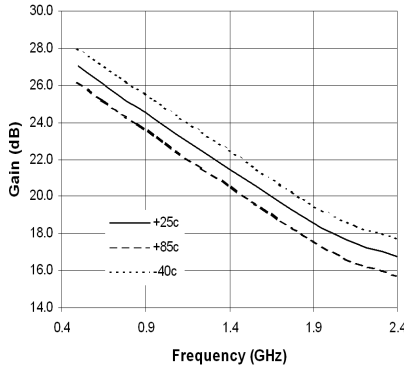
| Parameter | Unit | Frequency | | | | | |
|--|------|-----------|---------|---------|----------|----------|----------|
| | | 100 MHz | 500 MHz | 850 MHz | 1950 MHz | 2400 MHz | 3500 MHz |
| Small Signal Gain (G) | dB | 28.4 | 26.9 | 25.0 | 18.5 | 17.0 | 13.1 |
| Output 3rd Order Intercept Point (OIP ₃) | dBm | | 32.0 | 32.0 | 32.0 | 32.0 | |
| Output Power at 1dB Compression (P _{1dB}) | dBm | | 19.1 | 19.0 | 18.5 | 18.0 | |
| Input Return Loss (IRL) | dB | 15.1 | 19.1 | 26.4 | 15.0 | 13.5 | 8.7 |
| Output Return Loss (ORL) | dB | 21.4 | 18.5 | 15.3 | 14.0 | 11.9 | 13.6 |
| Reverse Isolation (S ₁₂) | dB | 30.8 | 30.3 | 29.7 | 26.2 | 25.4 | 22.9 |
| Noise Figure (NF) | dB | 4.6 | 3.1 | 3.1 | 3.7 | 4.2 | 4.9 |

Simplified Device Schematic

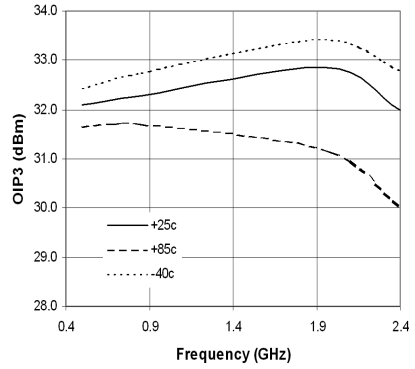


Evaluation Board Data ($V_{CC}=V_{BIAS}=5.0V$, $I_C=88\text{ mA}$) Bias Tee substituted for DC feed inductor (L1)

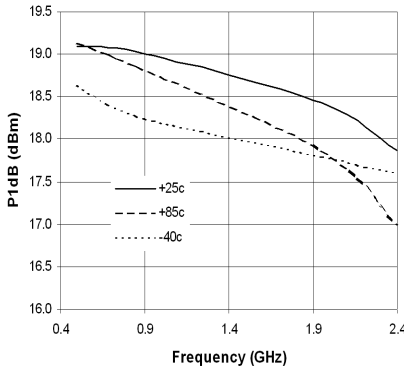
Gain vs. Frequency



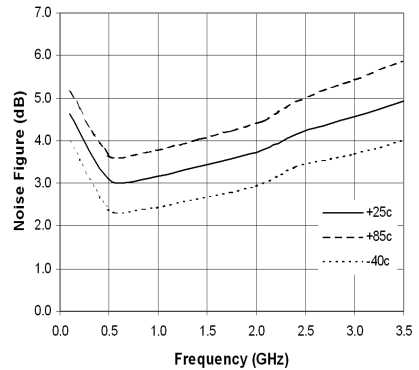
OIP3 vs. Frequency



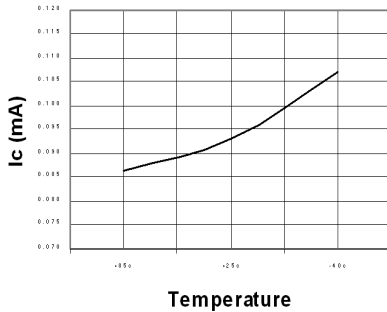
P1dB vs. Frequency



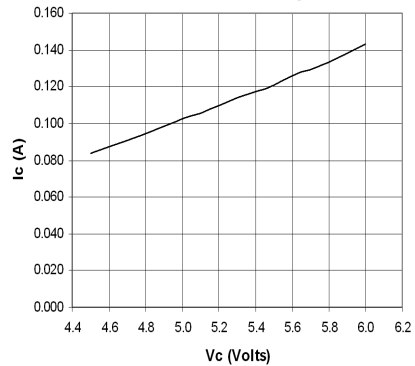
Noise Figure vs. Frequency



Ic vs. Temperature

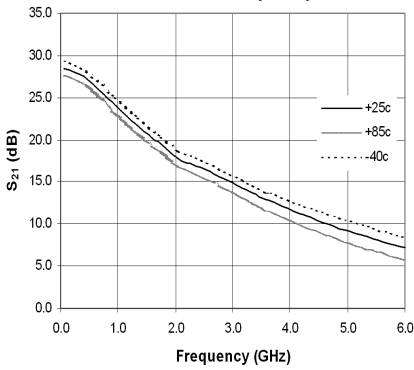


Current vs. Voltage

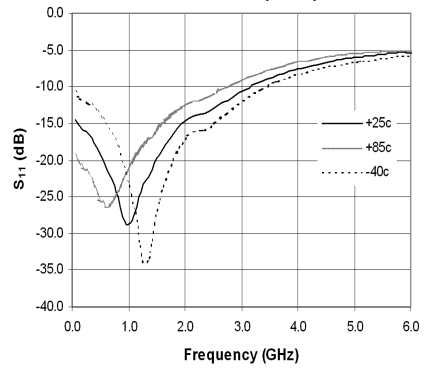


Evaluation Board Data ($V_{CC}=V_{BIAS}=5.0V$, $I_C=88mA$) Bias Tee substituted for DC feed inductor (L1) cont

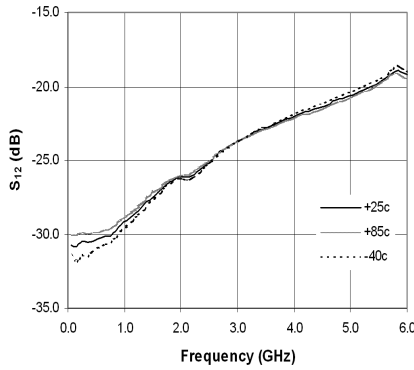
$|S_{21}|$ vs. Frequency



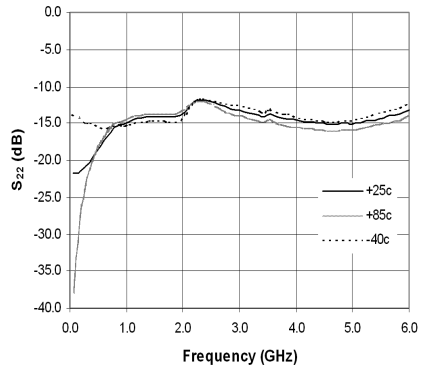
$|S_{11}|$ vs. Frequency



$|S_{12}|$ vs. Frequency



$|S_{22}|$ vs. Frequency

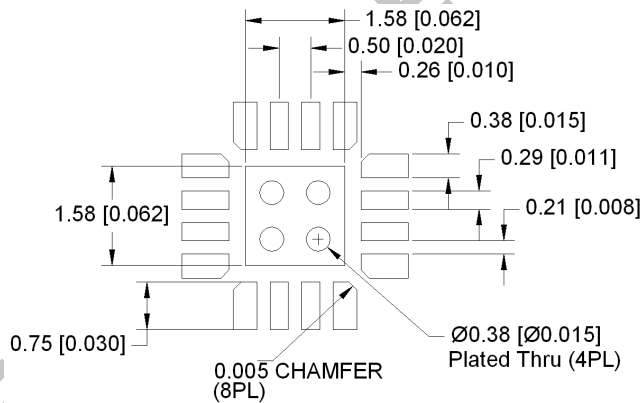


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NOT FOR SALE

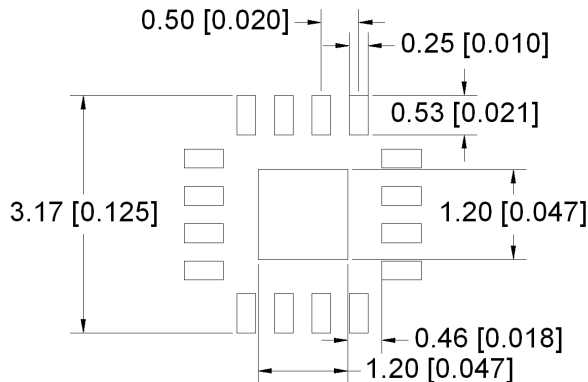
| Pin | Function | Description |
|--|----------|--|
| 1, 2, 4, 6, 7, 8, 11, 12, 14 | NC | These are no connect pins. Leave them unconnected on the PC board. |
| 3 | RF IN | RF input pin. A DC voltage should not be connected externally to this pin |
| 5 | GND | An extra ground pin that is connected to the backside exposed paddle. Connection is optional. |
| 10 | RF OUT | RF Output pin. Bias is applied to the Darlington stage thru this pin. |
| 13 | VBIAS | This pin sources the current from the active bias circuit. Connect to pin 10 thru an inductor choke. |
| 16 | VCC | This is Vcc for the active bias circuit. |
| Back-side | GND | The backside exposed paddle is the main electrical GND and requires multiple vias in the PC board to GND. It's also the main thermal path. |

Recommended Land Pattern

Dimensions in millimeters (inches)



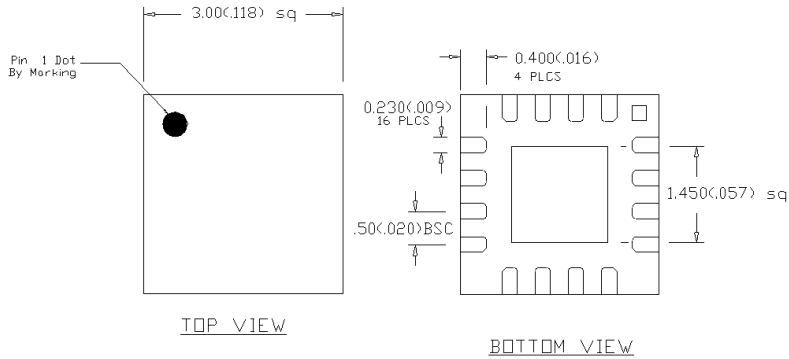
Recommended PCB Soldermask for Land Pattern



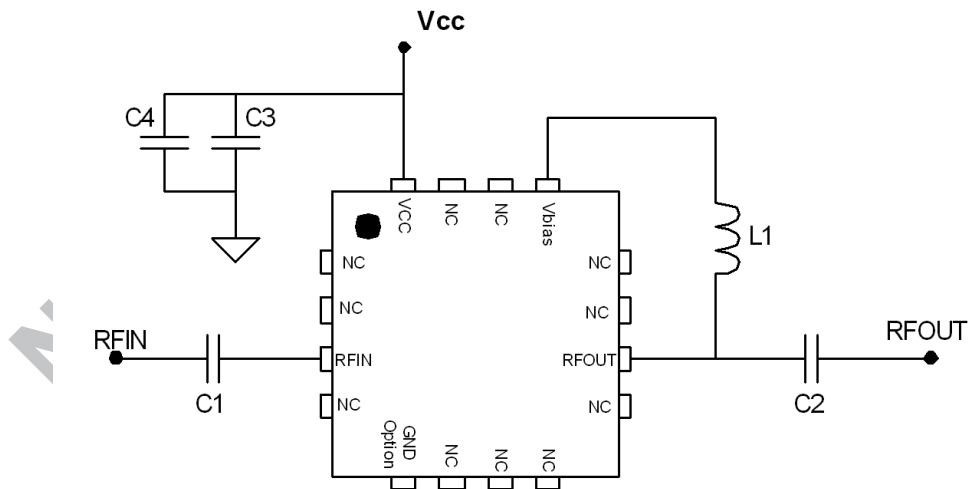
Package Drawing

Dimensions in millimeters (inches)

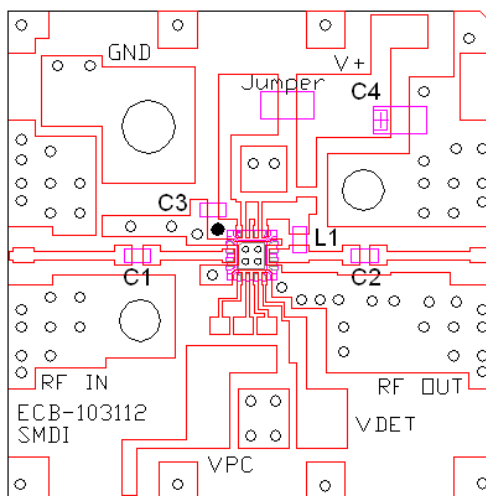
Refer to drawing posted at www.rfmd.com for tolerances.



Typical Evaluation Board Schematic for 3.0V



Evaluation Board Layout and Bill of Materials



Board material GETEK, 31mil thick, Dk=4.2, 1oz copper

Component Values By Band

| Designator | 500MHz | 850MHz | 1950MHz | 2400MHz |
|------------|--------|--------|---------|---------|
| C3 | 1000pF | 1000pF | 1000pF | 1000pF |
| C4* | 1uF | 1uF | 1uF | 1uF |
| C1, C2 | 220pF | 68pF | 43pF | 22pF |
| L1 | 68nH | 33nH | 22nH | 18nH |

*C4 is optional depending on application and filtering. Not required for SGB device operation.

Note: The amplifier can be run from a 8V supply by simply inserting a 33Ω resistor in series with V_{CC}.

Part Identification

The part will be symbolized with an “SGB6533” for Sn/Pb plating or “SGB65Z” for RoHS green compliant product. Marking designator will be on the top surface of the package.

Ordering Information

| Part Number | Reel Size | Devices/Reel |
|-------------|-----------|--------------|
| SGB-6533 | 13" | 3000 |
| SGB-6533Z | 13" | 3000 |

NOT FOR NEW DESIGNS