

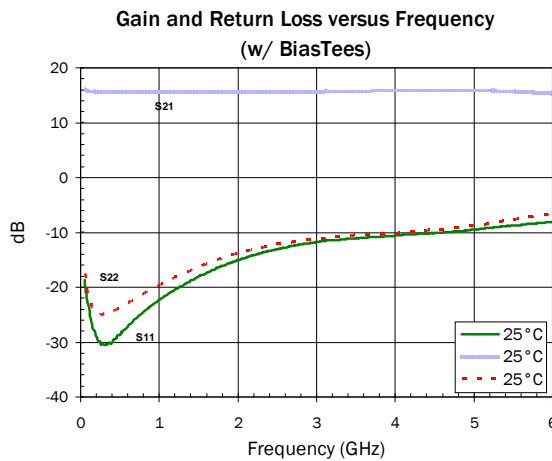


Product Description

RFMD's SBB4089Z is a high performance InGaP 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 SBB4089Z does not require a dropping resistor as compared to typical Darlington amplifiers. The SBB4089Z product is designed for high linearity 5V gain block applications that require small size and minimal external components. It is internally matched to 50Ωs.

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

- OIP₃ = 35.2 dBm at 1950 MHz
- P_{1dB} = 19.3 dBm at 1950 MHz
- Single Fixed 5V Supply
- Robust 1000V ESD, Class 1C
- Patented Thermal Design & Bias Circuit
- Low Thermal Resistance

Applications

- PA Driver Amplifier
- Cellular, PCS, GSM, UMTS
- Wideband Instrumentation
- Wireless Data, Satellite Terminals

| Parameter | Specification | | | Unit | Condition |
|------------------------------------|---------------|------|------|------|-----------------|
| | Min. | Typ. | Max. | | |
| Small Signal Gain | 14.0 | 15.0 | 17.0 | dB | 850MHz |
| | 14.0 | 15.5 | 17.0 | dB | 1950MHz |
| | 13.5 | 15.5 | 17.5 | dB | 2000MHz |
| Output Power at 1dB Compression | | 19.0 | | dBm | 850MHz |
| | 18.0 | 19.5 | | dBm | 1950MHz |
| Output Third Order Intercept Point | | 39.0 | | dBm | 850MHz |
| | 33.0 | 35.0 | | dBm | 1950MHz |
| Return Loss | | 4500 | | MHz | Minimum 10dB |
| Input Return Loss | 10.0 | 17.5 | | dB | 1950MHz |
| Output Return Loss | 10.0 | 17.5 | | dB | 1950MHz |
| Reverse Isolation | | 18.5 | | dB | 1950MHz |
| Noise Figure | | 4.5 | 5.5 | dB | 1950MHz |
| Device Operating Voltage | | 5.0 | 5.25 | V | |
| Device Operating Current | 72.0 | 80.0 | 92.0 | mA | |
| Thermal Resistance | | 69.9 | | °C/W | junction - lead |

Test Conditions: V_D = 5V I_D = 80mA Typ. OIP₃ Tone Spacing = 1MHz, P_{OUT} per tone = 0dBm T_L = 25°C, Z_S = Z_L = 50Ω, Tested with Bias Tees

Absolute Maximum Ratings

| Parameter | Rating | Unit |
|-------------------------------------|------------|------|
| Device Current (I_D) | 100 | mA |
| Max Device Voltage (VD) | 5.5 | V |
| Max RF Input Power | 24 | dBm |
| Max Operating Dissipated Power | 0.55 | W |
| Junction Temp (T_J) | +150 | °C |
| Operating Temp Range (T_L) | -40 to +85 | °C |
| Storage Temp | +150 | °C |
| ESD Rating - Human Body Model (HBM) | Class 1C | |
| Moisture Sensitivity Level | MSL2 | |



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, < 1000ppm each of antimony trioxide in polymeric materials and red phosphorus as a flame retardant, and <2% antimony in solder.

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:

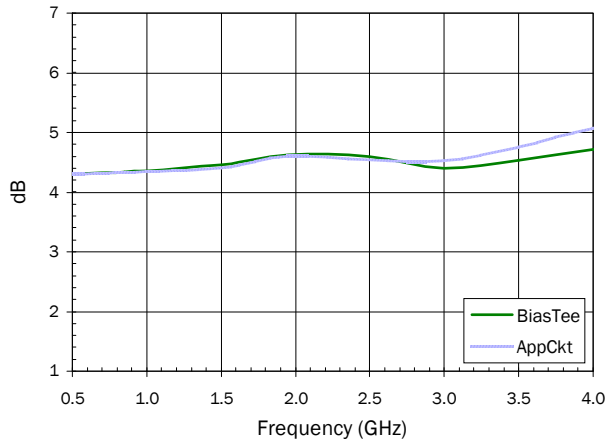
$$I_D V_D < (T_J - T_L) / R_{TH, J-L} \text{ and } T_L = T_{LEAD}$$

Typical Performance at Key Operating Frequencies (With 0.5GHz to 3.5GHz Application Circuit)

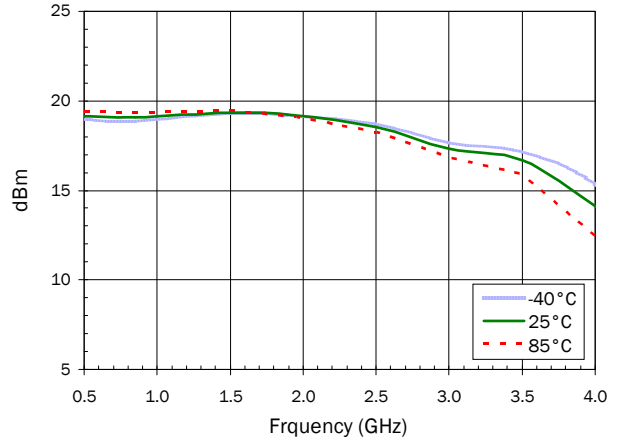
| Parameter | Unit | 50 MHz | 100 MHz | 200 MHz | 500 MHz | 850 MHz | 1950 MHz | 2500 MHz | 3500 MHz | 4000 MHz |
|------------------------------------|------|--------|---------|---------|---------|---------|----------|----------|----------|----------|
| Small Signal Gain | dB | 16.3 | 15.7 | 15.7 | 15.6 | 15.6 | 15.5 | 15.5 | 15.5 | 15.0 |
| Output Third Order Intercept Point | dBm | 38.7 | 40.6 | 39.7 | 38.8 | 39.3 | 35.2 | 32.8 | 29.1 | 26.1 |
| Output Power at 1dB Compression | dBm | 18.5 | 18.7 | 19 | 19.2 | 19.1 | 19.2 | 18.6 | 16.7 | 14.1 |
| Input Return Loss | dB | 11.2 | 16.3 | 22.4 | 25.1 | 29.9 | 19.4 | 17.6 | 14.9 | 21.3 |
| Output Return Loss | dB | 19.4 | 25.4 | 29.8 | 32.1 | 26.4 | 17.2 | 14.7 | 13.2 | 17.4 |
| Reverse Isolation | dB | 17.7 | 17.8 | 17.8 | 18.4 | 18.4 | 18.9 | 19.1 | 19.8 | 20.8 |
| Noise Figure | dB | 4.3 | 4.3 | 4.3 | 4.3 | 4.3 | 4.6 | 4.5 | 4.8 | 5.1 |

Test Conditions: VCC=5V, I_D =80mA Typ., OIP₃ Tone Spacing=1MHz, P_{OUT} per tone=0dBm, T_L=25°C, Z_S=Z_L=50Ω

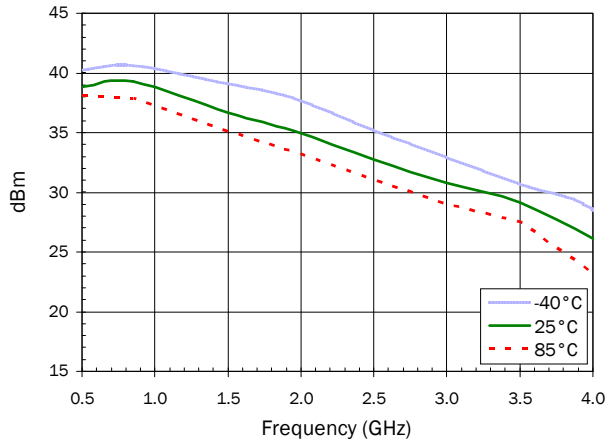
Noise Figure @ 25 °C



P1dB versus Frequency with App. Ckt.

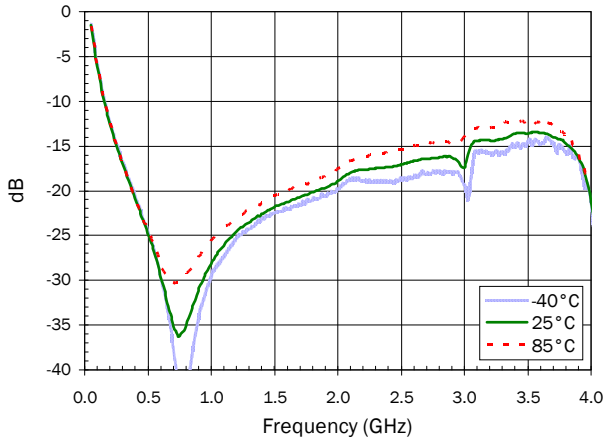


OIP3 versus Frequency with App. Ckt.

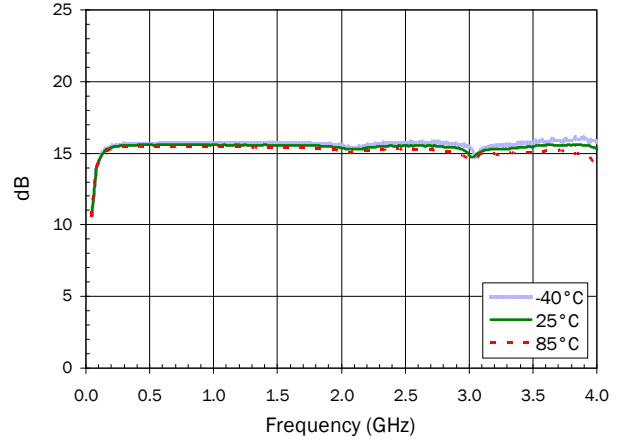


0.5GHz to 3.5GHz Application Circuit S-Parameters over Temperature

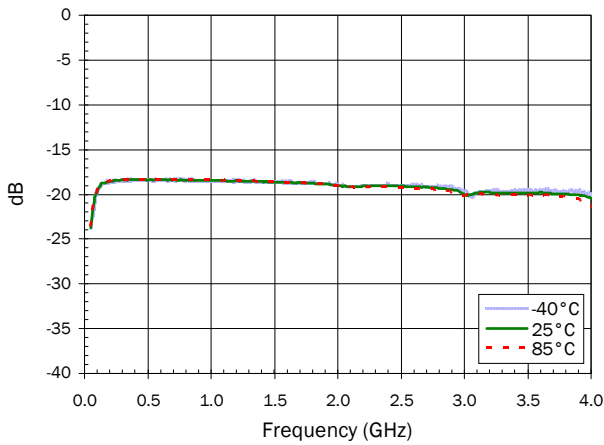
S11 versus Frequency



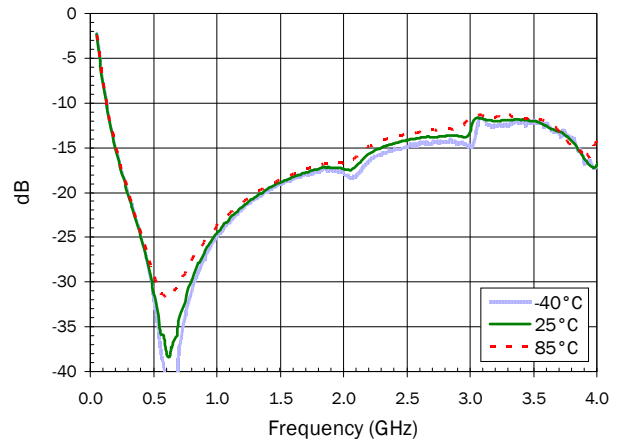
S21 versus Frequency



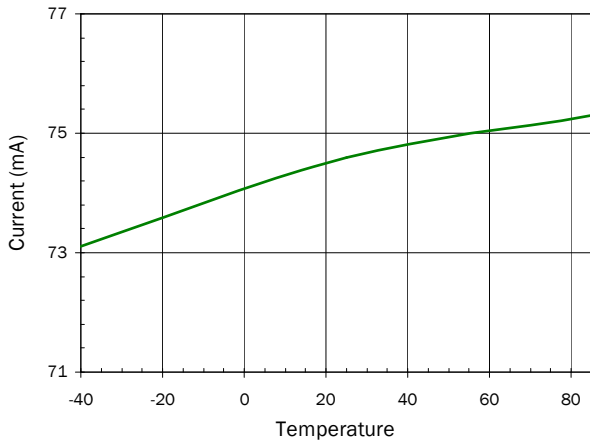
S12 versus Frequency



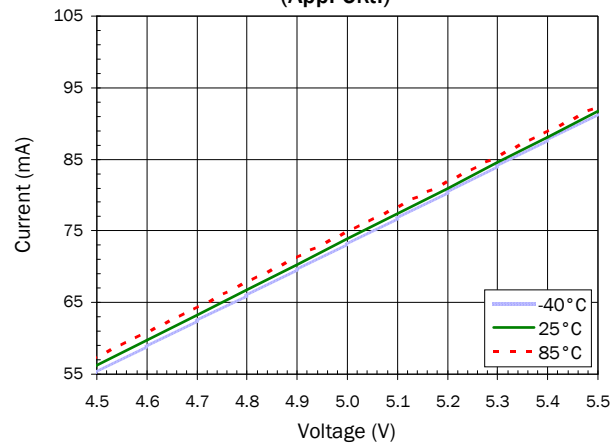
S22 versus Frequency



I_D versus Temperature

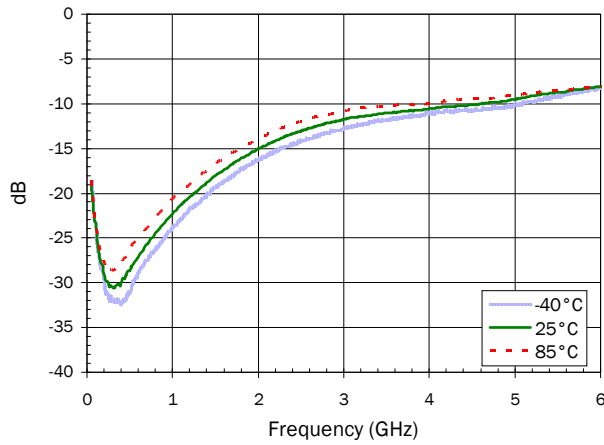


**Current versus Voltage Over Temp.
(App. Ckt.)**

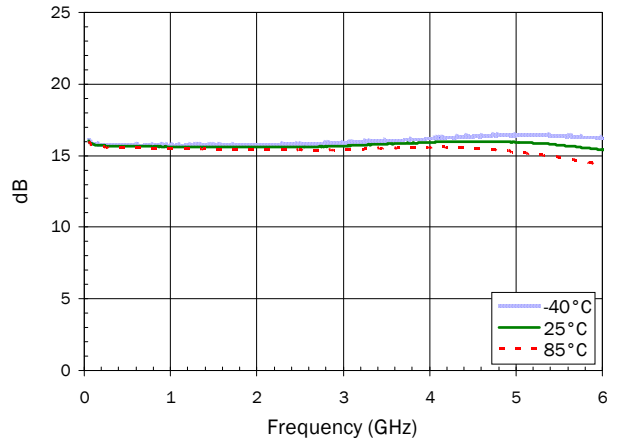


S-Parameters over Temperature (Bias Tee)

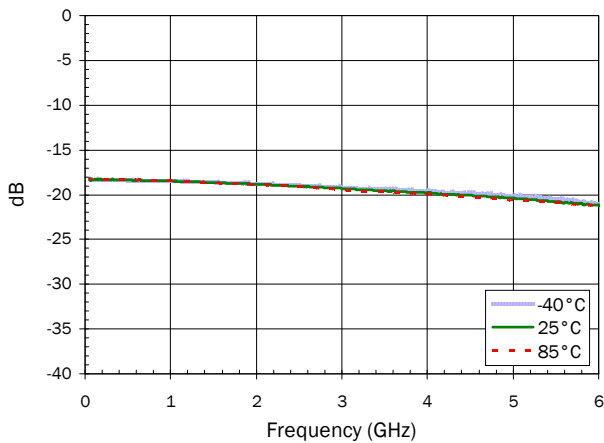
S11 versus Frequency



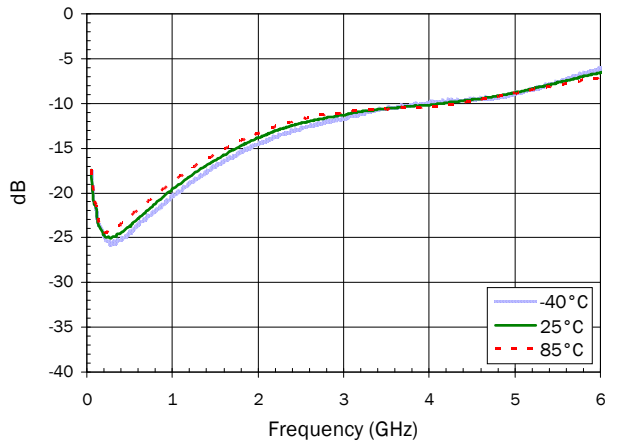
S21 versus Frequency



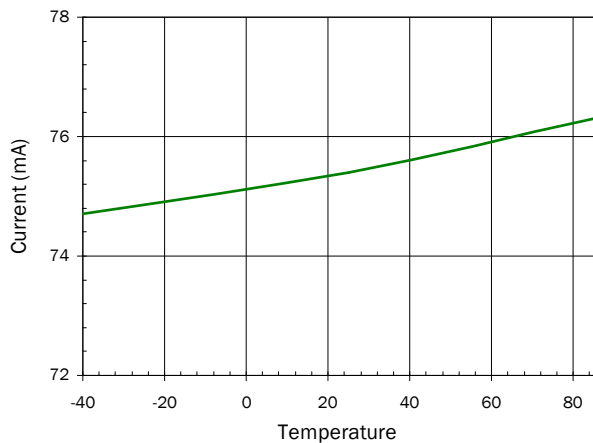
S12 versus Frequency



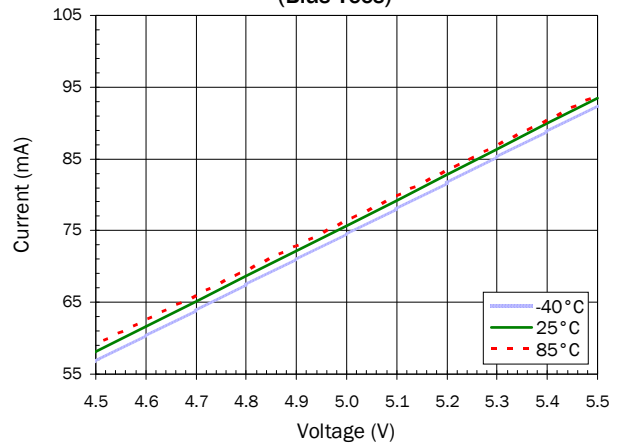
S22 versus Frequency



I_D versus Temperature

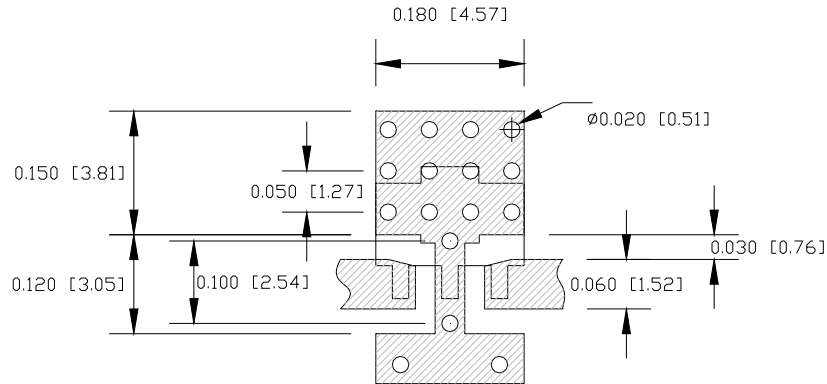


Current versus Voltage Over Temp. (Bias Tees)



| 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. Use via holes for best performance to reduce lead inductance as close to ground leads as possible |
| 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 |

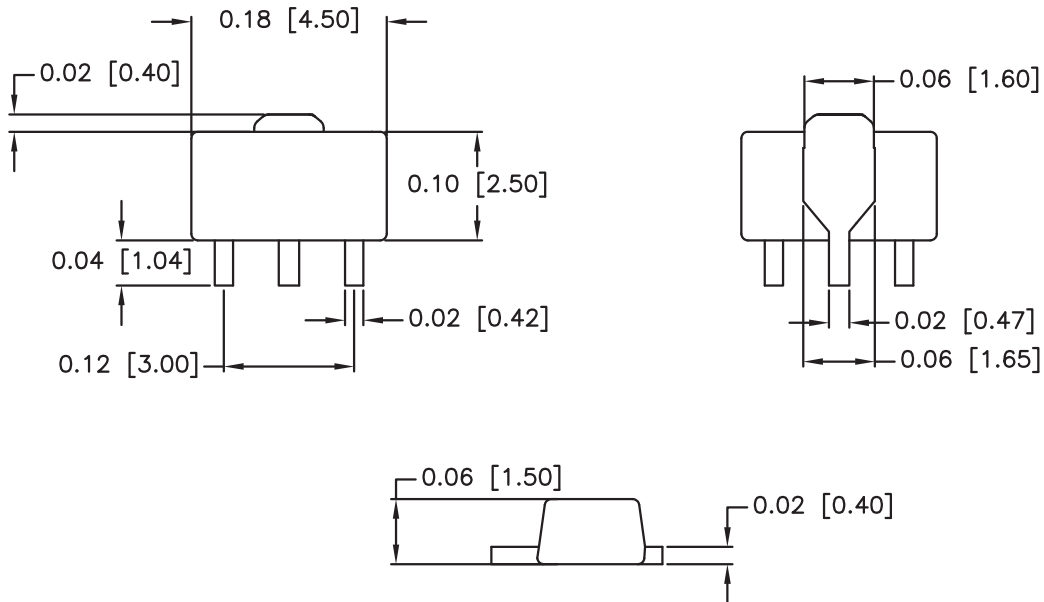
Suggested PCB Pad Layout



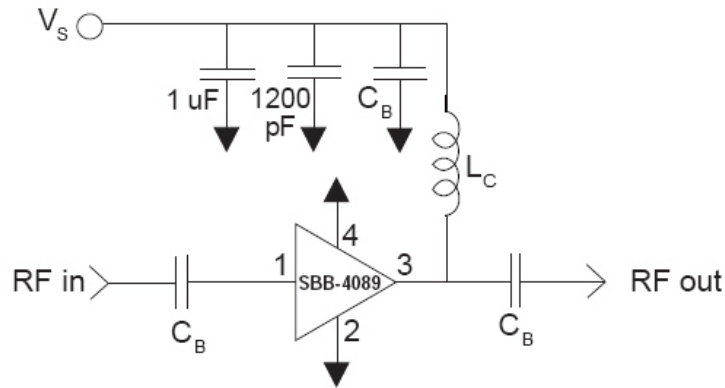
Package Drawing

Dimensions in inches (millimeters)

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



Application Schematic



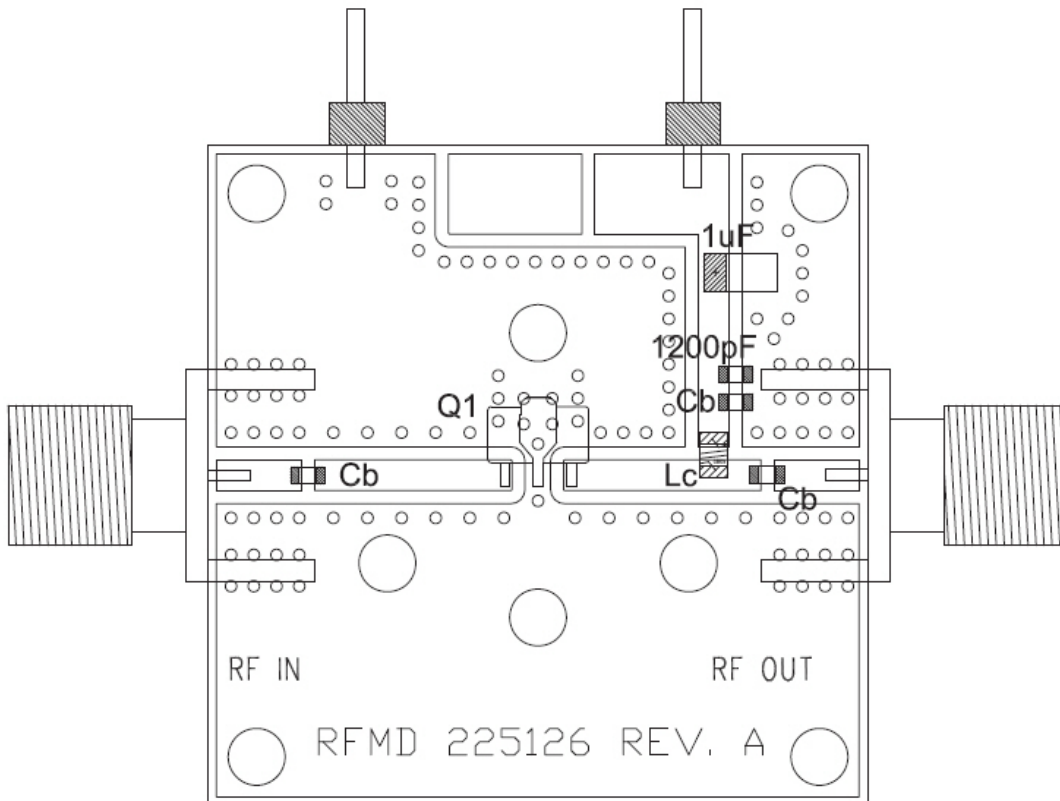
| Reference Designator | Frequency (MHz) 500 to 3500 |
|----------------------|--------------------------------|
| C _B | 68pF |
| L _C | 82nH 0805CS |

Note: For frequencies under 500MHz make the following changes:

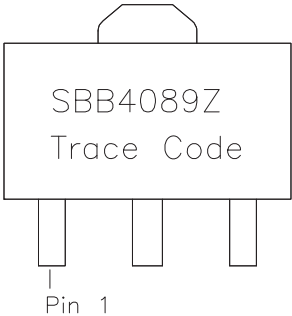
CB=.1uF

LC= 330nH

Evaluation Board Layout and Bill of Materials



Package Marking



Ordering Information

| Ordering Code | Description |
|---------------|----------------------------------------------------------------|
| SBB4089Z | 7" Reel with 1000 pieces |
| SBB4089ZSQ | Sample Bag with 25 pieces |
| SBB4089ZSR | 7" Reel with 100 pieces |
| SBB4089ZPCK1 | 1 Evaluation Board (500MHz to 3500MHz) with 5-piece Sample Bag |