

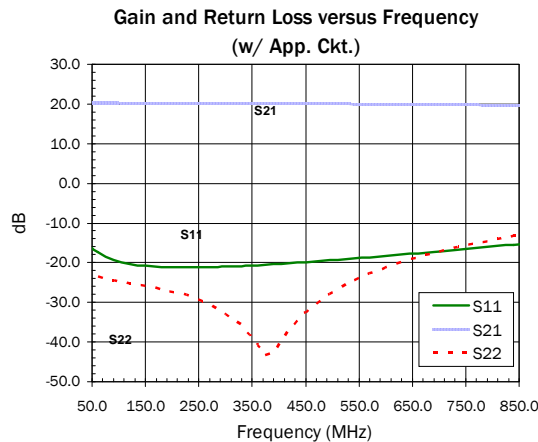


Product Description

RFMD's SBB2089Z 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 SBB2089Z does not require a dropping resistor as compared to typical Darlington amplifiers. The SBB2089Z product is designed for high linearity 5V gain block applications that require small size and minimal external components. It is internally matched to 50Ω.

Optimum Technology Matching® Applied

- GaAs HBT
- GaAs MESFET
- InGaP HBT
- SiGe BiCMOS
- Si BiCMOS
- SiGe HBT
- GaAs pHEMT
- Si CMOS
- Si BJT
- GaN HEMT
- InP HBT
- RF MEMS
- LDMOS



Features

- $OIP_3 = 42.8\text{dBm}$ at 240MHz
- $P_{1\text{dB}} = 20.8\text{dBm}$ at 500MHz
- Single Fixed 5V Supply
- Robust 2000V ESD, Class 2
- Patented Thermal Design and Bias Circuit
- Low Thermal Resistance

Applications

- Receiver IF Amplifier
- Cellular, PCS, GSM, UMTS
- Wireless Data, Satellite Terminals

| Parameter | Specification | | | Unit | Condition |
|---------------------------------|---------------|-----------|------|------|------------------|
| | Min. | Typ. | Max. | | |
| Small Signal Gain | | 20.0 | | dB | 70MHz |
| | 18.5 | 20.0 | 21.5 | dB | 240MHz |
| | 18.5 | 20.0 | 21.5 | dB | 400MHz |
| Output Power at 1dB Compression | | 20.0 | | dBm | 70MHz |
| | | 20.0 | | dBm | 240MHz |
| | 18.5 | 21.0 | | dBm | 400MHz |
| Third Order Intercept Point | | 41.0 | | dBm | 70MHz |
| | | 43.0 | | dBm | 240MHz |
| | 39.0 | 41.0 | | dBm | 400MHz |
| Return Loss | | 50 to 850 | | MHz | Minimum 10dB |
| Input Return Loss | 15.0 | 20.0 | | dB | 70MHz to 5000MHz |
| Output Return Loss | 11.0 | 14.0 | | dB | 70MHz to 5000MHz |
| Noise Figure | | 2.7 | 3.7 | dB | 500MHz |
| Reverse Isolation | | 22.0 | | dB | 70MHz to 5000MHz |
| Thermal Resistance | | 48.8 | | °C/W | junction - lead |
| Device Operating Voltage | | 5.0 | 5.3 | V | |
| Device Operating Current | 82.0 | 90.0 | 98.0 | mA | |

Test Conditions: $V_D = 5\text{V}$, $I_D = 90\text{mA}$ Typ., OIP_3 Tone Spacing=1MHz, P_{OUT} per tone=0dBm, $T_L = 25^\circ\text{C}$, $Z_S = Z_L = 50\Omega$, Tested with Bias Tees

Absolute Maximum Ratings

| Parameter | Rating | Unit |
|-------------------------------------|------------|------|
| Device Current (I_D) | 110 | mA |
| Device Voltage (V_D) | 5.5 | V |
| RF Input Power | 24 | dBm |
| Junction Temp (T_J) | +150 | °C |
| Operating Temp Range (T_L) | -40 to +85 | °C |
| Storage Temp | +150 | °C |
| Power Dissipation | 0.61 | W |
| ESD Rating - Human Body Model (HBM) | Class 2 | |
| 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.

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:

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

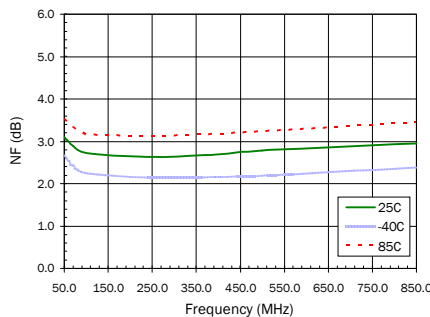
Typical RF Performance at Key Operating Frequencies (With Application Circuit)

| Parameter | Unit | 50MHz | 70MHz | 100 MHz | 240 MHz | 400 MHz | 500 MHz | 850 MHz |
|---|------|-------|-------|---------|---------|---------|---------|---------|
| Small Signal Gain, S_{21} | dB | 20.0 | 20.0 | 20.0 | 20.0 | 20.0 | 20.0 | 20.0 |
| Output Third Order Intercept Point, OIP_3 | dBm | 40.0 | 40.0 | 41.0 | 42.0 | 41.0 | 40.0 | 35.0 |
| Output Power at 1dB Compression, P_{1dB} | dBm | 20.0 | 20.0 | 20.0 | 20.0 | 20.0 | 20.0 | 19.0 |
| Input Return Loss, IRL | dB | 15.0 | 18.0 | 19.0 | 20.0 | 20.0 | 19.0 | 16.0 |
| Output Return Loss, ORL | dB | 21.0 | 23.0 | 24.0 | 27.0 | 34.0 | 30.0 | 14.0 |
| Reverse Isolation, S_{12} | dB | 22.0 | 22.0 | 22.0 | 22.0 | 22.0 | 22.0 | 22.0 |
| Noise Figure, NF | dB | 3.1 | 2.9 | 2.7 | 2.6 | 2.7 | 2.8 | 2.9 |

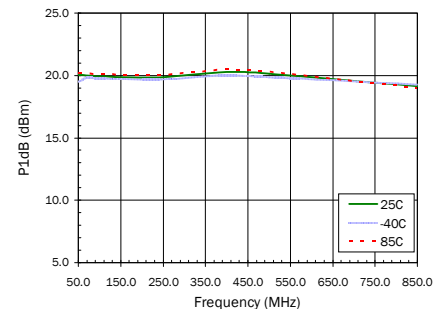
Test Conditions: $V_{CC}=5V$ $I_D=90mA$ Typ. OIP_3 Tone Spacing=1MHz, P_{OUT} per tone=0dBm $T_L=25^\circ C$ $Z_S=Z_L=50\Omega$

Data on charts taken with Application Circuit

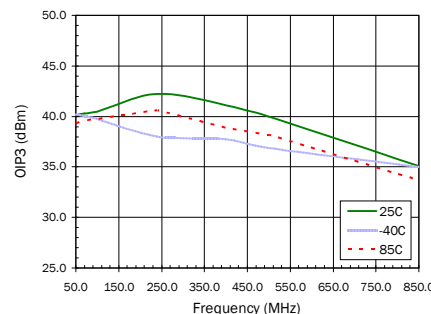
Noise Figure versus Frequency



P_{1dB} versus Frequency

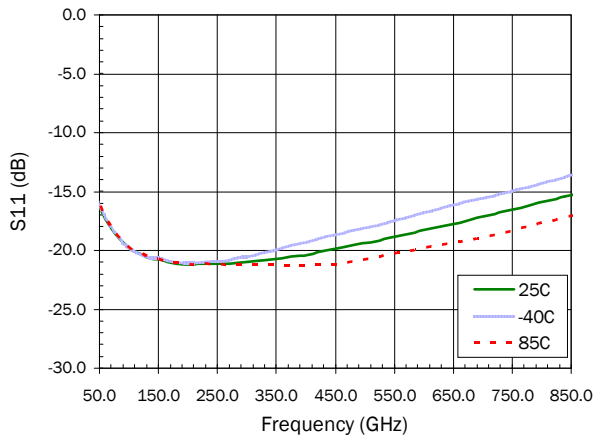


OIP_3 versus Frequency

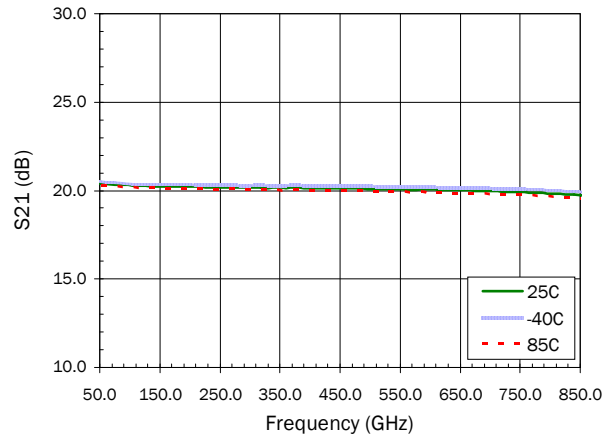


Application Circuit S-Parameters Over Temperature

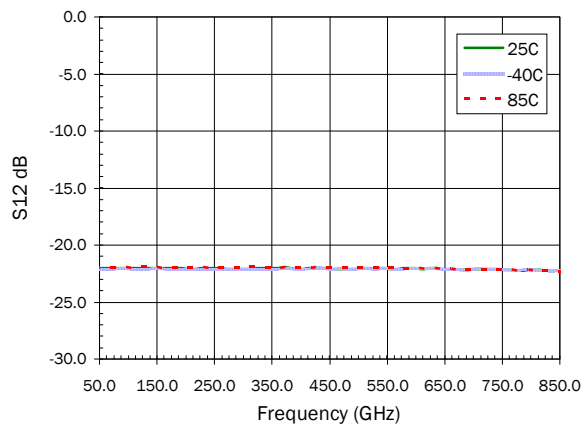
S11 versus Frequency



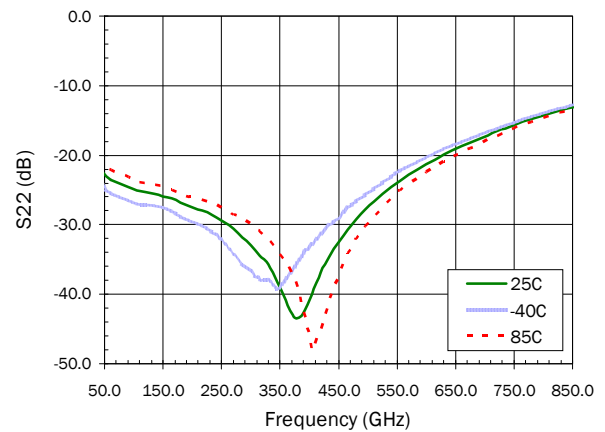
S21 versus Frequency



S12 versus Frequency

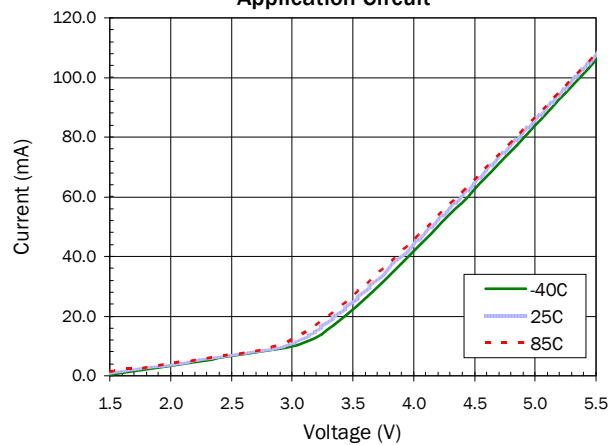


S22 versus Frequency

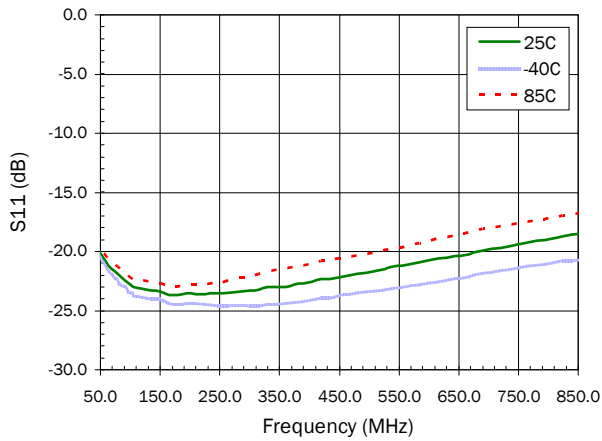


Device Current Over Temperature with Application Circuit

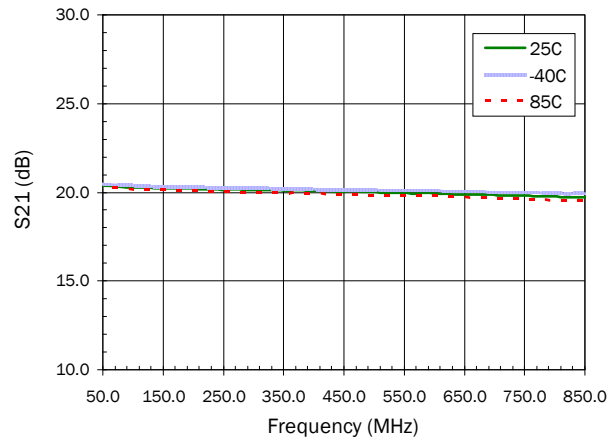
Current versus Voltage Over Temperature
Application Circuit



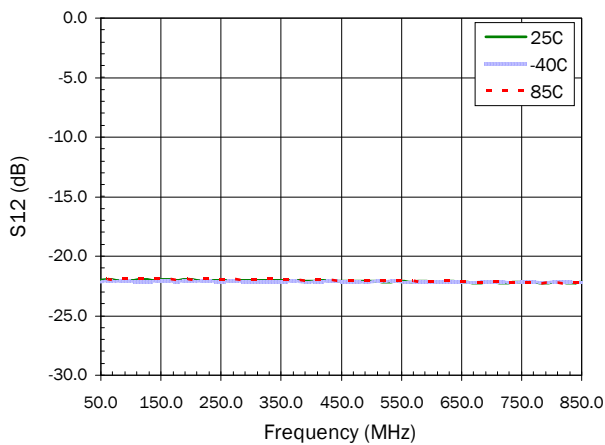
S-Parameters Over Temperature (Bias Tee) S11 versus Frequency



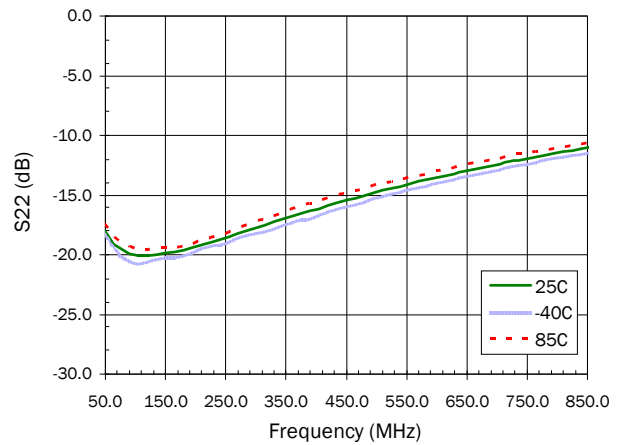
S21 versus Frequency



S12 versus Frequency

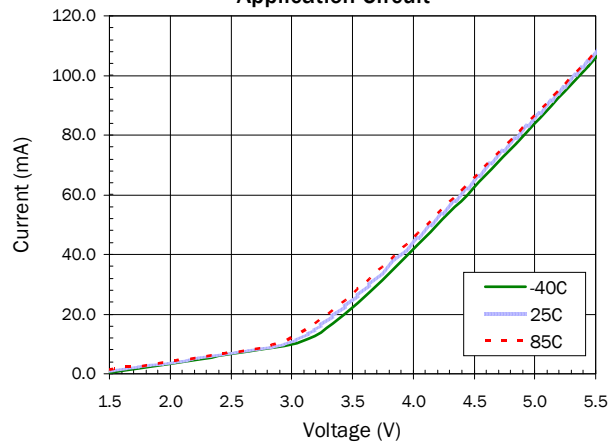


S22 versus Frequency



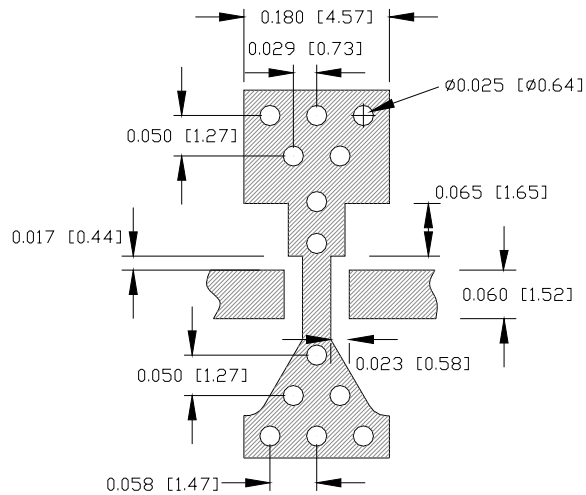
Device Current Over Temperature with Application Circuit

Current versus Voltage Over Temperature Application Circuit



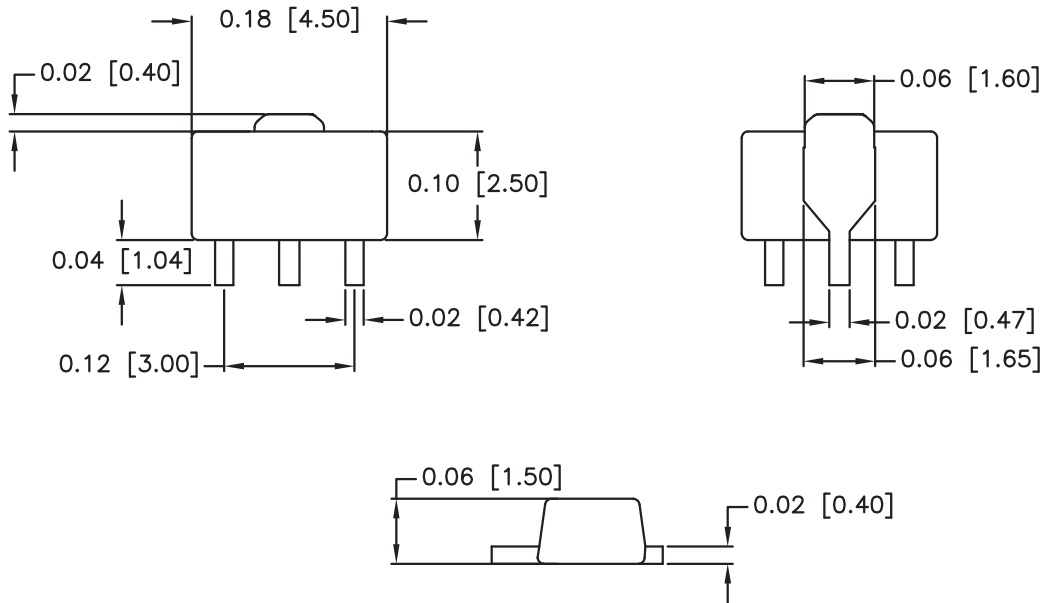
| Pin | Function | Description |
|------|-------------|---|
| 1 | RF IN | RF input pin. This pin requires the use of an external DC blocking capacitor chosen for the frequency of operation. |
| 2, 4 | GND | Connection to ground. Use via holes for best performance to reduce lead inductance as close to 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

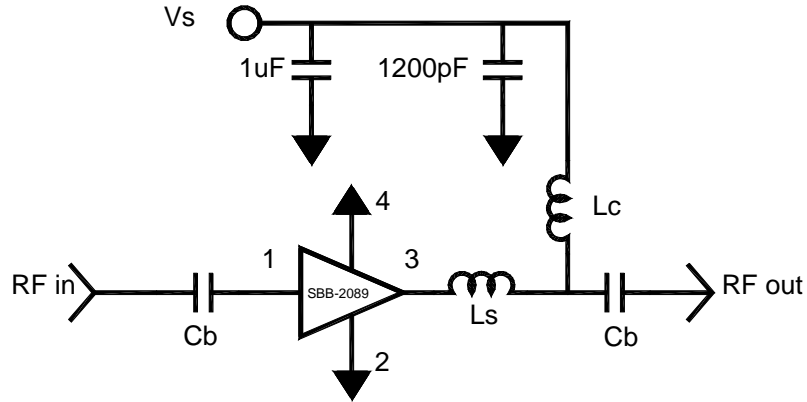
Dimensions in inches (millimeters)
 Refer to drawing posted at www.rfmd.com for tolerances.



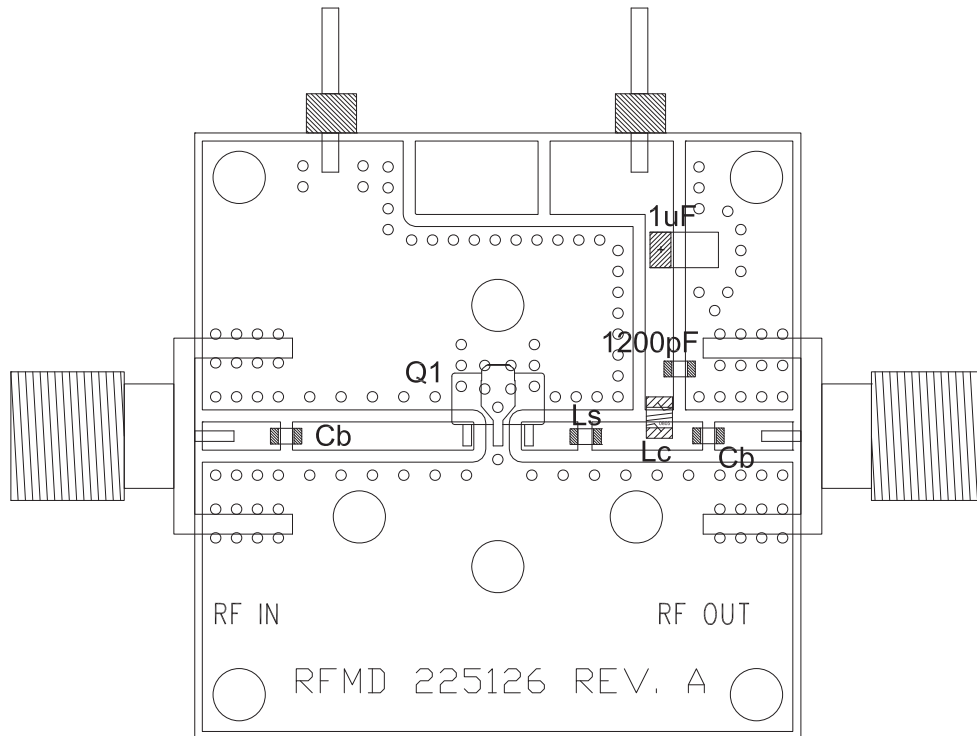
Application Circuit Element Values

| Reference Designator | Frequency (MHz) 50 to 850 |
|----------------------|------------------------------|
| CB | 8200pF |
| LC | 1500nH 0805LS Coilcraft |
| LS | 2.7nH Toko |

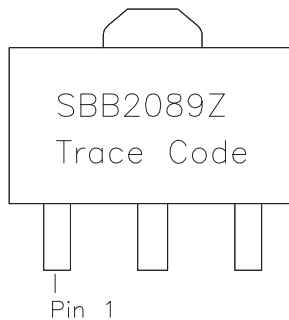
Application Schematic



Evaluation Board Layout



Package Marking



Ordering Information

| Ordering Code | Description |
|---------------|--|
| SBB2089Z | 7" Reel with 1000 pieces |
| SBB2089ZSQ | Sample bag with 25 pieces |
| SBB2089ZSR | 7" Reel with 100 pieces |
| SBB2089ZPCK1 | 50MHz to 850MHz PCBA with 5-piece sample bag |