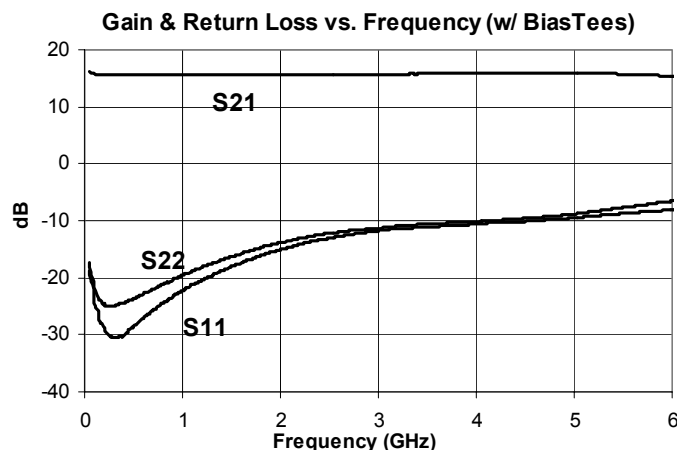




## Product Description

Sirenza Microdevices' SBB-4089 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 SBB-4089 does not require a dropping resistor as compared to typical Darlington amplifiers. The SBB-4089 product is designed for high linearity 5V gain block applications that require small size and minimal external components. It is internally matched to 50 ohms.

The matte tin finish on Sirenza's lead-free package utilizes a post annealing process to mitigate tin whisker formation and is RoHS compliant per EU Directive 2002/95. This package is also manufactured with green molding compounds that contain no antimony trioxide nor halogenated fire retardants.



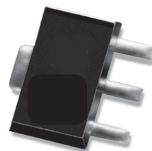
## SBB-4089

## SBB-4089Z



**0.05-6 GHz, Cascadable**

**Active Bias InGaP/GaAs HBT MMIC Amplifier**



## Product Features

- Available in Lead Free, RoHS compliant, & Green packaging
- IP3 = 35.2 dBm @ 1950MHz
- P1dB = 19.3 dBm @ 1950MHz
- Single Fixed 5V Supply
- Robust 1000V ESD, Class 1C
- Patented Thermal Design & Patent Pending Bias Circuit
- Low Thermal Resistance
- MSL 1 moisture rating

## Applications

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

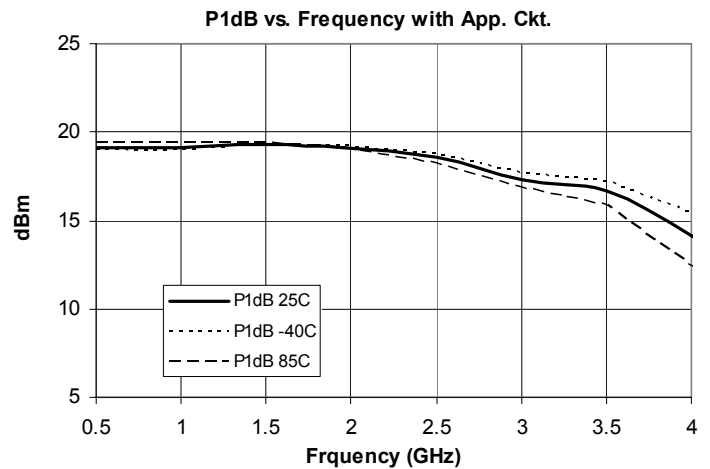
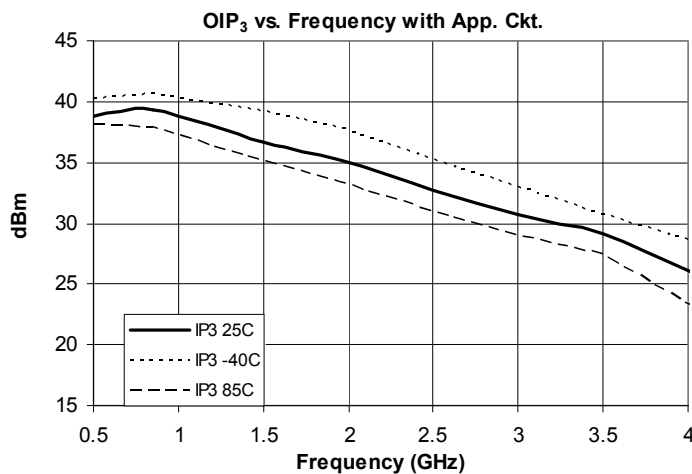
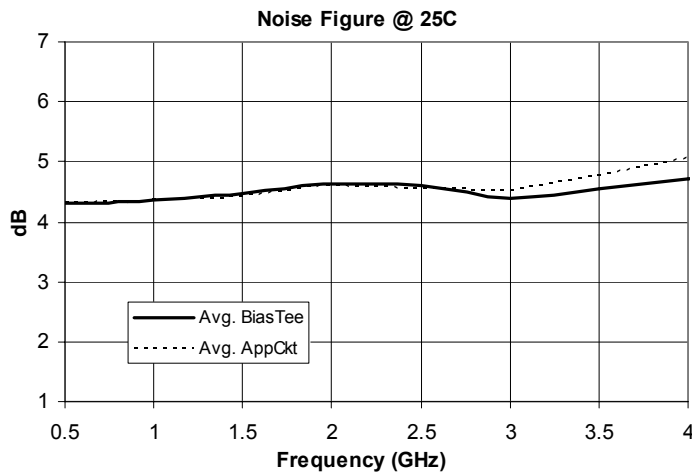
| Symbol                                                                                                                                                                      | Parameter                                             | Units | Frequency                      | Min.                 | Typ.                 | Max.                 |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------|-------|--------------------------------|----------------------|----------------------|----------------------|
| $S_{21}$                                                                                                                                                                    | Small Signal Gain                                     | dB    | 850MHz<br>1950 MHz<br>2000 MHz | 14.0<br>14.0<br>13.5 | 15.0<br>15.5<br>15.5 | 17.0<br>17.0<br>17.5 |
| $P_{1dB}$                                                                                                                                                                   | Output Power at 1dB Compression                       | dBm   | 850MHz<br>1950 MHz             | 18                   | 19.0<br>19.5         |                      |
| $OIP_3$                                                                                                                                                                     | Output Third Order Intercept Point                    | dBm   | 850MHz<br>1950 MHz             | 33.0                 | 39.0<br>35.0         |                      |
| Bandwidth                                                                                                                                                                   | $S_{11}$ , $S_{22}$ : Minimum 10dB Return Loss (typ.) | MHz   |                                |                      | 4500                 |                      |
| $S_{11}$                                                                                                                                                                    | Input Return Loss                                     | dB    | 1950 MHz                       | 10.0                 | 17.5                 |                      |
| $S_{22}$                                                                                                                                                                    | Output Return Loss                                    | dB    | 1950 MHz                       | 10.0                 | 17.5                 |                      |
| $S_{12}$                                                                                                                                                                    | Reverse Isolation                                     | dB    | 1950 MHz                       |                      | 18.5                 |                      |
| NF                                                                                                                                                                          | Noise Figure                                          | dB    | 1950 MHz                       |                      | 4.5                  | 5.5                  |
| $V_D$                                                                                                                                                                       | Device Operating Voltage                              | V     |                                |                      | 5                    | 5.25                 |
| $I_D$                                                                                                                                                                       | Device Operating Current                              | mA    |                                | 72                   | 80                   | 92                   |
| $R_{TH}$ , j-l                                                                                                                                                              | Thermal Resistance (junction to lead)                 | °C/W  |                                |                      | 69.9                 |                      |
| <b>Test Conditions:</b> $V_D = 5V$ $I_D = 80$ mA Typ. $OIP_3$ Tone Spacing = 1 MHz, Pout per tone = 0 dBm<br>$T_L = 25^\circ C$ $Z_S = Z_L = 50$ Ohms Tested with Bias Tees |                                                       |       |                                |                      |                      |                      |

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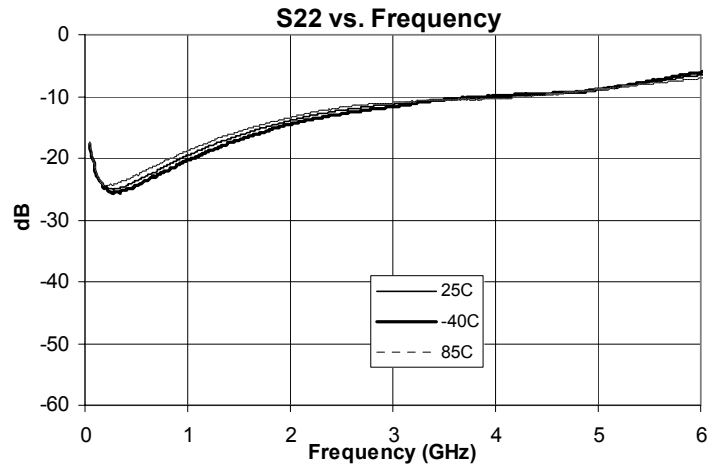
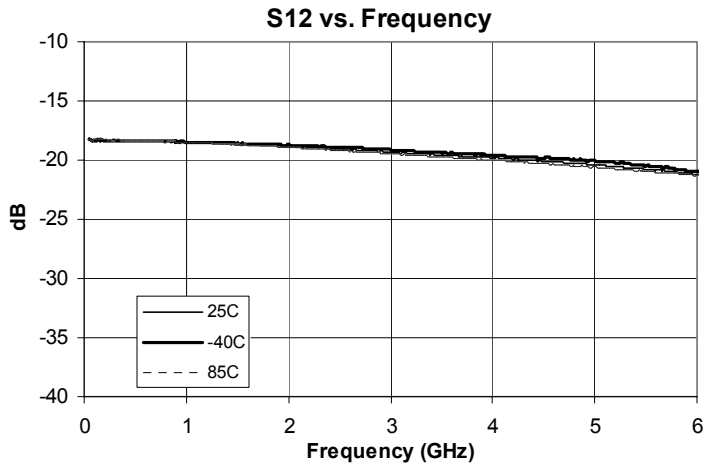
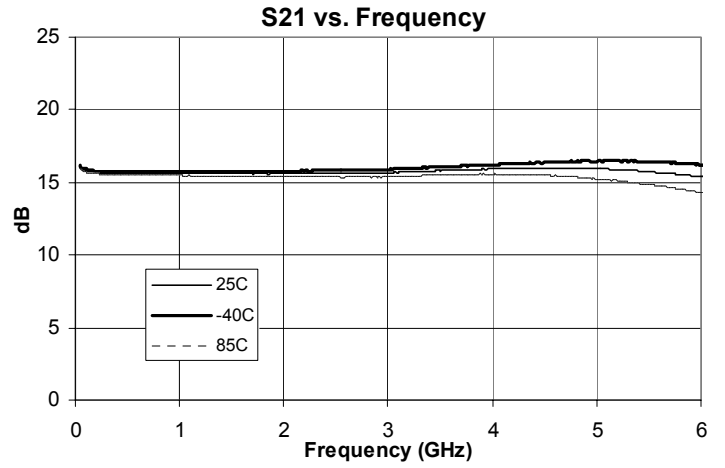
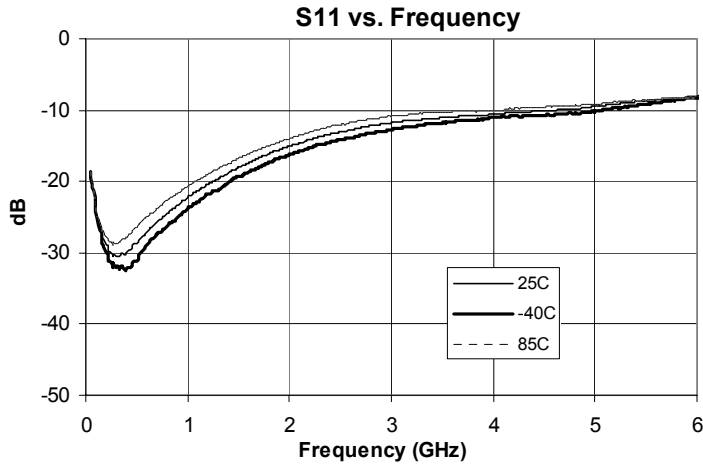
**Typical RF Performance at Key Operating Frequencies (With .5-3.5 GHz Application Circuit)**

| Symbol    | Parameter                          | Unit | Frequency (MHz) |      |      |      |      |      |
|-----------|------------------------------------|------|-----------------|------|------|------|------|------|
|           |                                    |      | 500             | 850  | 1950 | 2500 | 3500 | 4000 |
| $S_{21}$  | Small Signal Gain                  | dB   | 15.6            | 15.6 | 15.5 | 15.5 | 15.5 | 15.0 |
| $OIP_3$   | Output Third Order Intercept Point | dBm  | 38.8            | 39.3 | 35.2 | 32.8 | 29.1 | 26.1 |
| $P_{1dB}$ | Output Power at 1dB Compression    | dBm  | 19.2            | 19.1 | 19.2 | 18.6 | 16.7 | 14.1 |
| $S_{11}$  | Input Return Loss                  | dB   | 25.1            | 29.9 | 19.4 | 17.6 | 14.9 | 21.3 |
| $S_{22}$  | Output Return Loss                 | dB   | 32.1            | 26.4 | 17.2 | 14.7 | 13.2 | 17.4 |
| $S_{12}$  | Reverse Isolation                  | dB   | 18.4            | 18.4 | 18.9 | 19.1 | 19.8 | 20.8 |
| NF        | Noise Figure                       | dB   | 4.3             | 4.3  | 4.6  | 4.5  | 4.8  | 5.1  |

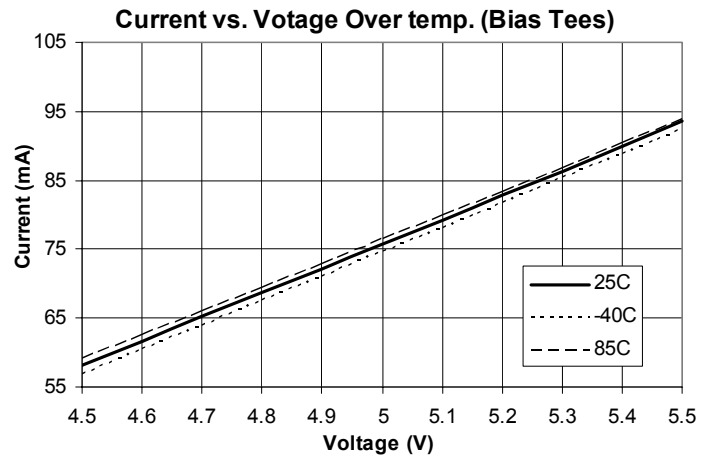
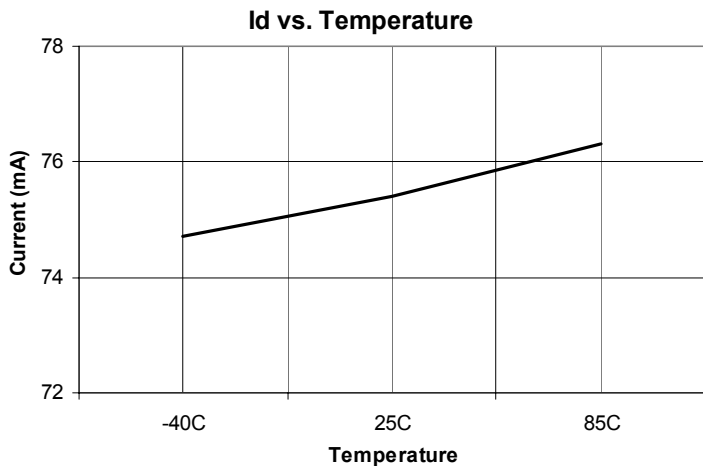
**Test Conditions:**  $V_{CC} = 5V$   $I_D = 80mA$  Typ.  $OIP_3$  Tone Spacing = 1MHz, Pout per tone = 0 dBm  
 $T_L = 25^\circ C$   $Z_S = Z_L = 50$  Ohms



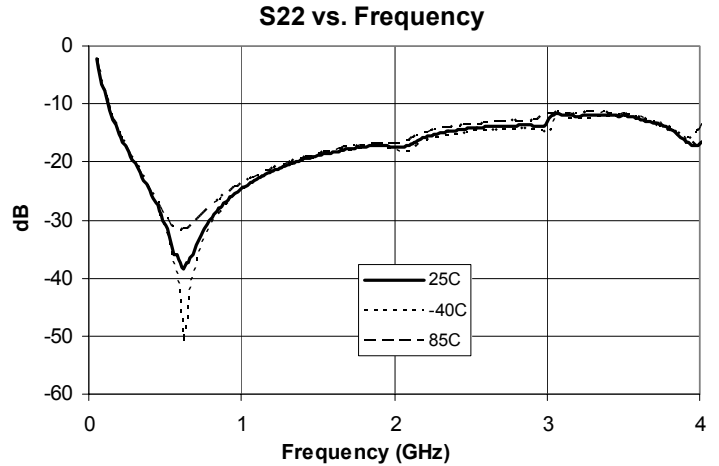
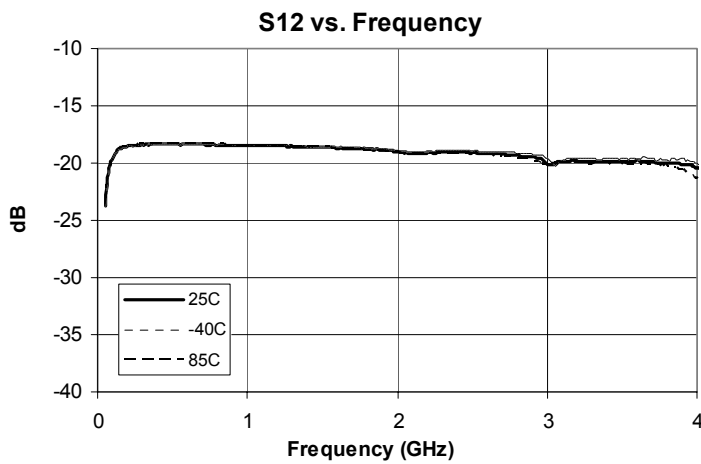
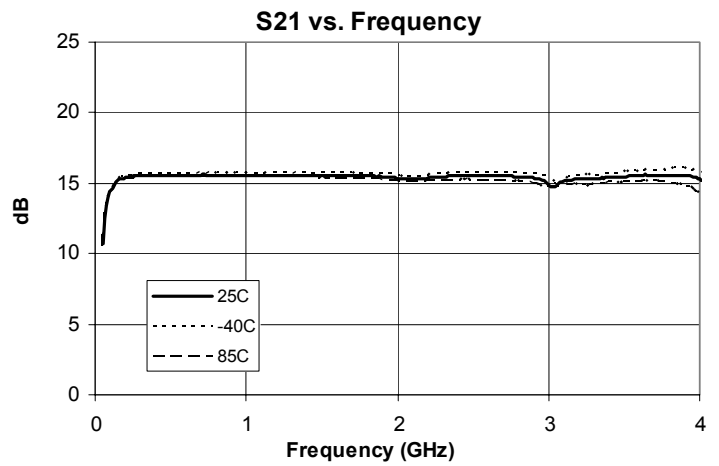
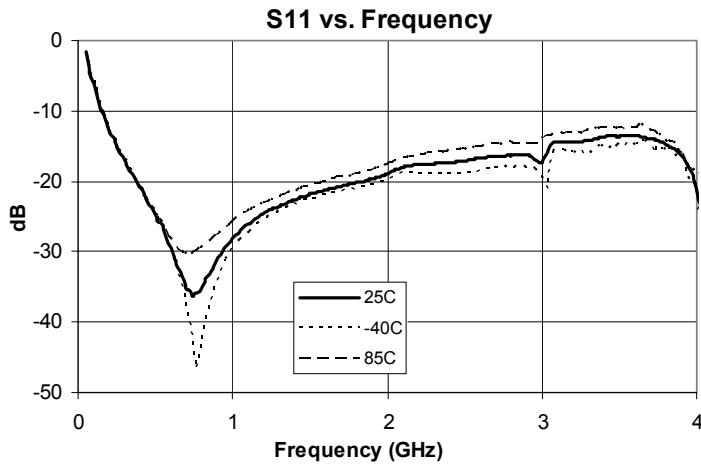
**S-Parameters taken with Bias Tee over Temperature**



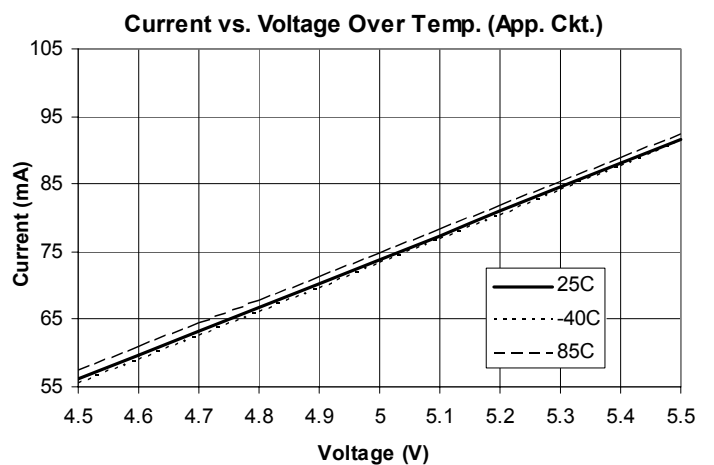
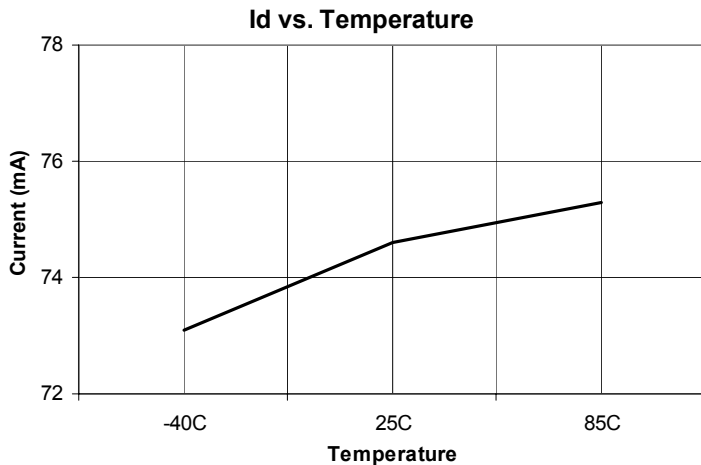
**Device Current over Temperature (w/Bias Tees)**



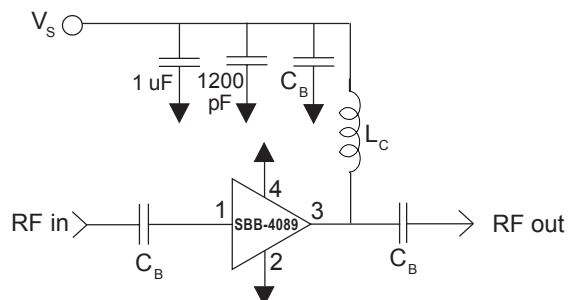
**0.5 to 3.5GHz Application Circuit S-Parameters over Temperature**



**Device Current over Temperature (w/App. Ckt.)**



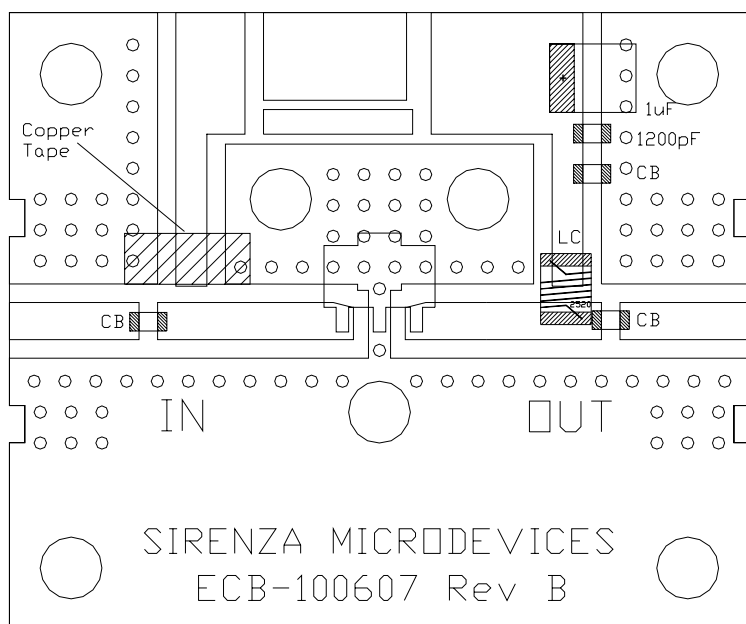
## Application Schematic



## Application Circuit Element Values

| Reference Designator | Frequency (MHz)<br>500 to 3500 |
|----------------------|--------------------------------|
| $C_B$                | 68pF                           |
| $L_C$                | 82nH 1008CS                    |

## Evaluation Board Layout



## Absolute Maximum Ratings

| Parameter                       | Absolute Limit |
|---------------------------------|----------------|
| Ma. Dvice Current ( $I_D$ )     | 100 mA         |
| Max Device Voltage ( $V_D$ )    | 5.5 V          |
| Max. RF Input Power             | +12 dBm        |
| Max. Operating Dissipated Power | 0.55 W         |
| Max. Junction Temp. ( $T_J$ )   | +150°C         |
| Operating Temp. Range ( $T_L$ ) | -40°C to +85°C |
| Max. Storage Temp.              | +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:

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


## ESD Class 1C

Appropriate precautions in handling, packaging and testing devices must be observed.

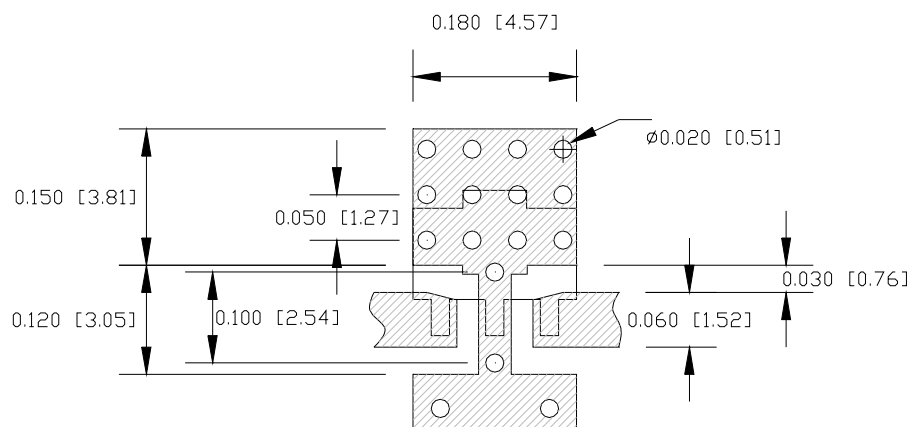
## Mounting Instructions

1. Solder the copper pad on the backside of the device package to the ground plane.
2. Use a large ground pad area with many plated through-holes as shown.
3. We recommend 1 or 2 ounce copper. Measurement for this datasheet were made on a 31 mil thick FR-4 board with 1 ounce copper on both sides.

**MSL (Moisture Sensitivity Level) Rating: Level 1**

### Suggested PCB Pad Layout

Dimensions in inches [millimeters]

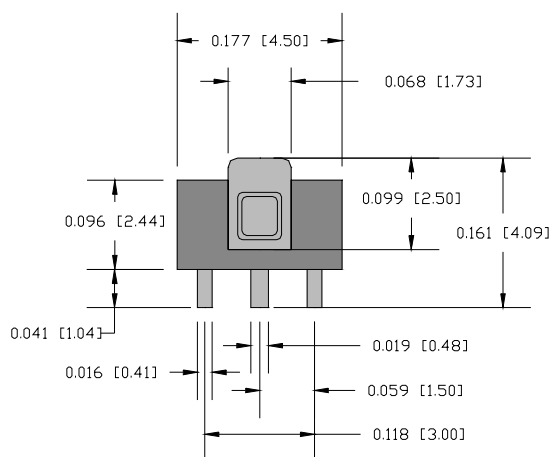


### Nominal Package Dimensions

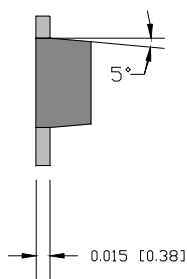
Dimensions in inches (millimeters)

Refer to package drawing posted at [www.sirenza.com](http://www.sirenza.com) for tolerances

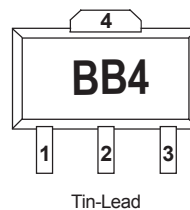
### Bottom View



### Side View



### Package Marking



### Part Number Ordering Information

| Part Number | Reel Size | Devices / Reel |
|-------------|-----------|----------------|
| SBB-4089    | 7"        | 1000           |
| SBB-4089Z   | 7"        | 1000           |

| 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. |