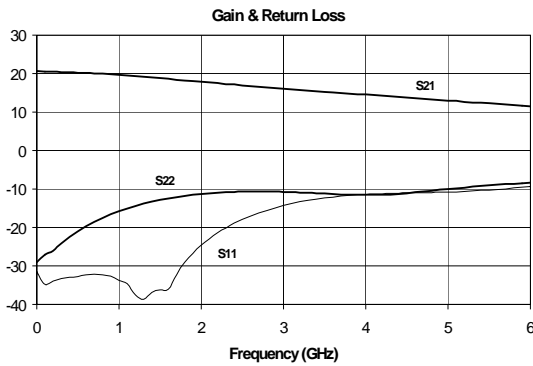




Product Description

Sirenza Microdevices' SBA-5089 is a high performance InGaP/GaAs Heterojunction Bipolar Transistor MMIC Amplifier. A Darlington configuration designed with InGaP process technology provides broadband performance up to 5 GHz with excellent thermal performance. The heterojunction increases breakdown voltage and minimizes leakage current between junctions. Cancellation of emitter junction non-linearities results in higher suppression of intermodulation products. Only a single positive supply voltage, DC-blocking capacitors, a bias resistor, and an optional RF choke are required for operation.

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.



SBA-5089

SBA-5089Z RoHS Compliant & Green Package

DC-5 GHz, Cascadable InGaP/GaAs HBT MMIC Amplifier



Product Features

- Now available in Lead Free, RoHS Compliant, & Green Packaging
- IP₃ = 34.0dBm @ 1950MHz
- P_{out}=13.0 dBm @-45dBc ACP IS-95 1950MHz
- Robust 1000V ESD, Class 1C
- Operates From Single Supply
- Patented Thermal Design

Applications

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

| Symbol | Parameter | Units | Frequency | Min. | Typ. | Max. |
|--|--|-------|---------------------|--------------|--------------|--------------|
| G | Small Signal Gain | dB | 850 MHz 1950 MHz | 18.5 16.5 | 20.0 18.0 | 21.5 19.5 |
| P _{1dB} | Output Power at 1dB Compression | dBm | 850 MHz 1950 MHz | 18.0 | 19.7 19.5 | |
| OIP ₃ | Output Third Order Intercept Point | dBm | 850 MHz 1950 MHz | 32.0 | 36.0 34.0 | |
| P _{OUT} | Output Power @ -45dBc ACP IS-95 9 Forward Channels | dBm | 1950 MHz | | 13.0 | |
| Bandwidth | Determined by Return Loss (>10dB) | MHz | | | 4400 | |
| IRL | Input Return Loss | dB | 1950 MHz | 14.0 | 20.0 | |
| ORL | Output Return Loss | dB | 1950 MHz | 9.0 | 11.0 | |
| NF | Noise Figure | dB | 1950 MHz | | 4.5 | 5.5 |
| V _D | Device Operating Voltage | V | | 4.7 | 4.9 | 5.3 |
| I _D | Device Operating Current | mA | | 72 | 80 | 88 |
| R _{TH, j-l} | Thermal Resistance (junction to lead) | °C/W | | | 70 | |
| Test Conditions: V _S = 8 V I _D = 80 mA Typ. OIP ₃ Tone Spacing = 1 MHz, P _{out} per tone = 0 dBm R _{BIAS} = 39 Ohms T _L = 25°C Z _S = Z _L = 50 Ohms | | | | | | |

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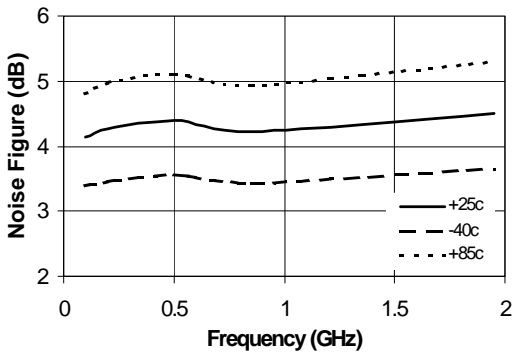
SBA-5089 DC-5 GHz Cascadable MMIC Amplifier

Typical RF Performance at Key Operating Frequencies

| Symbol | Parameter | Unit | Frequency (MHz) | | | | | |
|------------------|------------------------------------|------|-----------------|------|------|------|------|------|
| | | | 100 | 500 | 850 | 1950 | 2400 | 3500 |
| G | Small Signal Gain | dB | 20.5 | 20.2 | 19.9 | 18.0 | 17.1 | 15.3 |
| OIP ₃ | Output Third Order Intercept Point | dBm | 36.3 | 35.8 | 36.0 | 34.0 | 32.7 | 30.9 |
| P _{1dB} | Output Power at 1dB Compression | dBm | 19.8 | 19.8 | 19.7 | 19.5 | 18.8 | 17.1 |
| IRL | Input Return Loss | dB | 29 | 27 | 25 | 20 | 17 | 11.8 |
| ORL | Output Return Loss | dB | 27 | 21 | 17 | 11 | 11 | 11 |
| S ₂₁ | Reverse Isolation | dB | 22 | 22 | 23 | 23 | 23 | 23 |
| NF | Noise Figure | dB | 4.1 | 4.3 | 4.2 | 4.5 | --- | --- |

Test Conditions: V_S = 8 V, I_D = 80 mA Typ., OIP₃ Tone Spacing = 1 MHz, P_{out} per tone = 0 dBm
R_{BIAS} = 39 Ohms, T_L = 25°C, Z_S = Z_L = 50 Ohms

Noise Figure vs. Frequency

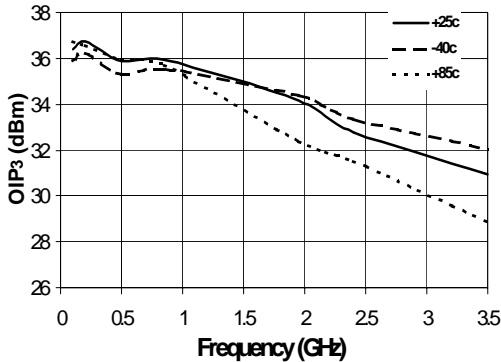


Absolute Maximum Ratings

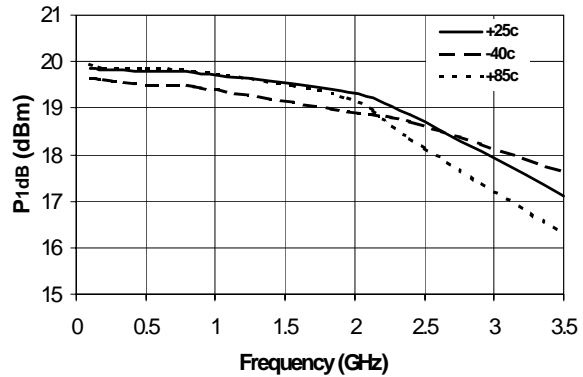
| Parameter | Absolute Limit |
|---|----------------|
| Max. Device Current (I _D) | 130 mA |
| Max. Device Voltage (V _D) | 6 V |
| Max. RF Input Power | +17 dBm |
| Max Operating Dissipated Power | 0.65 W |
| Max. Junction Temp. (T _J) | +150°C |
| Operating Temp. Range (T _L) | -40°C to +85°C |
| 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:
 $I_D V_D < (T_J - T_L) / R_{TH} j$ $T_L = T_{LEAD}$

OIP₃ vs. Frequency



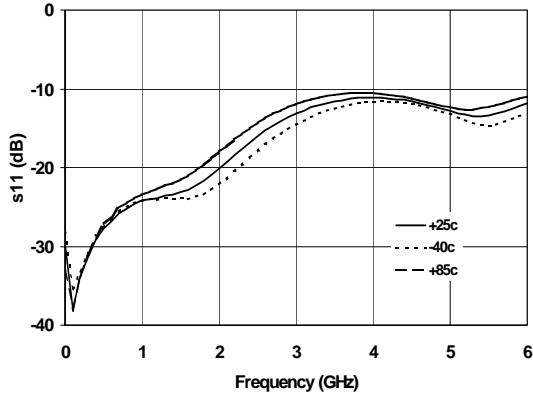
P1dB vs. Frequency



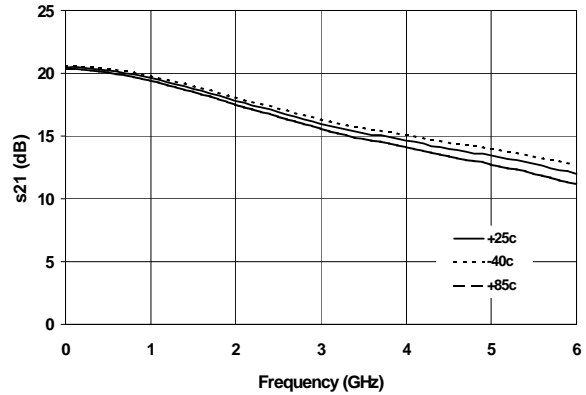


SBA-5089 DC-5 GHz Cascadable MMIC Amplifier

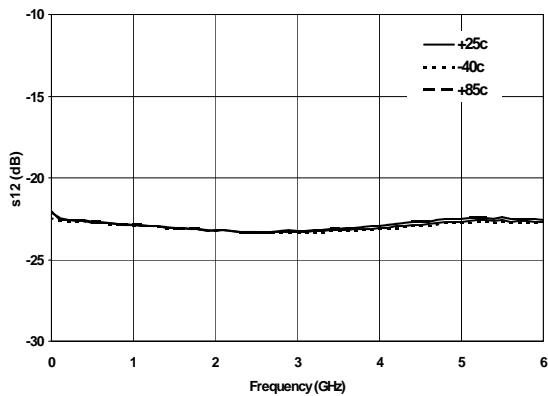
$|S_{11}|$ vs. Frequency



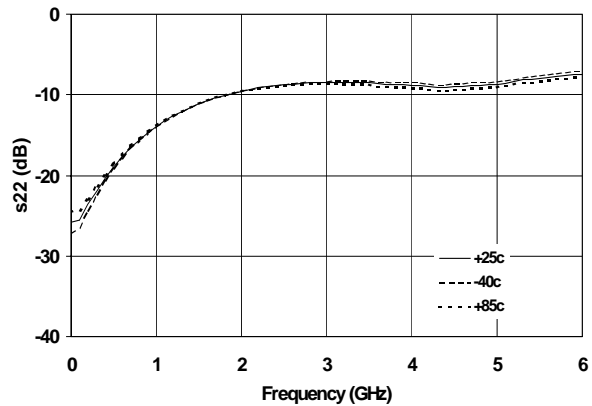
$|S_{21}|$ vs. Frequency



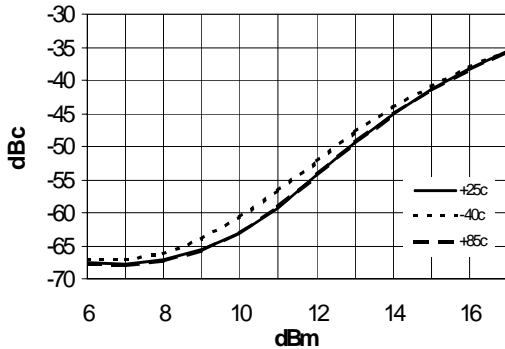
$|S_{12}|$ vs. Frequency



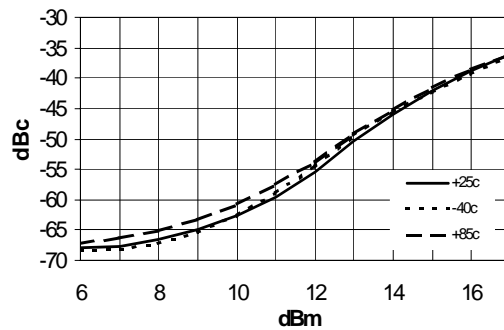
$|S_{22}|$ vs. Frequency



**IS-95 @ 850MHz
Adj. Channel Pwr. vs. Channel Output Pwr.**



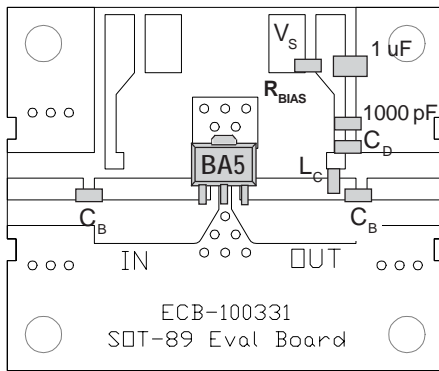
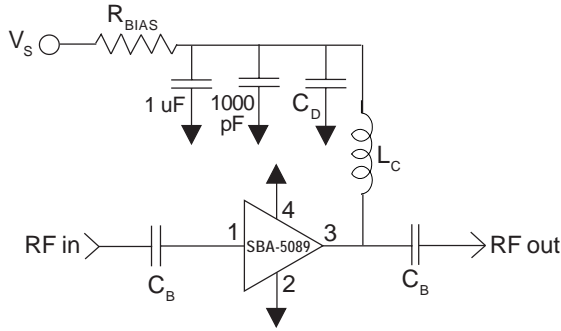
**IS-95 @ 1950MHz
Adj. Channel Pwr. vs. Channel Output Power**





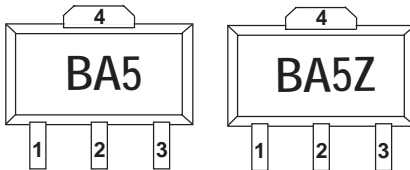
SBA-5089 DC-5 GHz Cascadable MMIC Amplifier

Basic Application Circuit



Part Identification Marking

The part will be marked with an "BA5" or "BA5Z" designator on the top surface of the package.



Caution: ESD sensitive
Appropriate precautions in handling, packaging and testing devices must be observed.

Application Circuit Element Values

| Reference Designator | Frequency (Mhz) | | | | |
|----------------------|-----------------|--------|-------|-------|-------|
| | 500 | 850 | 1950 | 2400 | 3500 |
| C _B | 220 pF | 100 pF | 68 pF | 56 pF | 39 pF |
| C _D | 100 pF | 68 pF | 22 pF | 22 pF | 15 pF |
| L _C | 68 nH | 33 nH | 22 nH | 18 nH | 15 nH |

Recommended Bias Resistor Values for I_b=80mA
 $R_{BIAS} = (V_S - V_D) / I_D$

| Supply Voltage(V _S) | 7.5 V | 8 V | 10 V | 12 V |
|---------------------------------|-------|------|------|------|
| R _{BIAS} | 33 Ω | 39 Ω | 68 Ω | 91 Ω |

Note: R_{BIAS} provides DC bias stability over temperature.

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 data sheet were made on a 31 mil thick FR-4 board with 1 ounce copper on both sides.

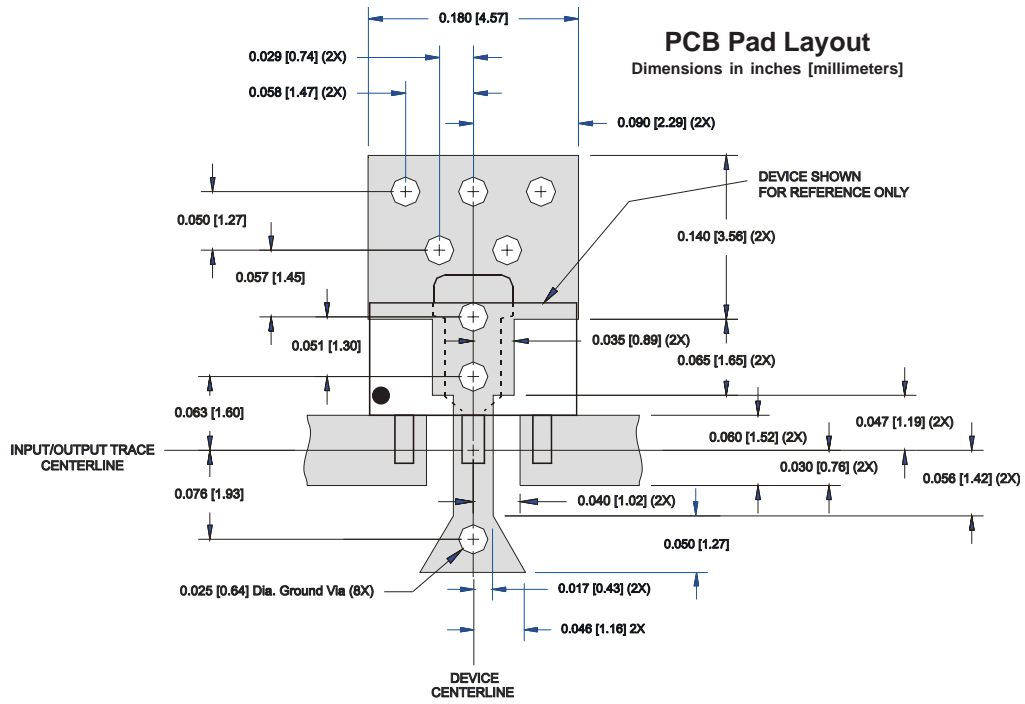
| Pin # | Function | Description |
|-------|-------------|---|
| 1 | RF IN | RF input pin. This pin requires the use of an external DC blocking capacitor chosen for the frequency of operation. |
| 2, 4 | GND | Connection to ground. Use via holes for best performance to reduce lead inductance as close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

Part Number Ordering Information

| Part Number | Reel Size | Devices/Reel |
|-------------|-----------|--------------|
| SBA-5089 | 7" | 1000 |
| SBA-5089Z | 7" | 1000 |



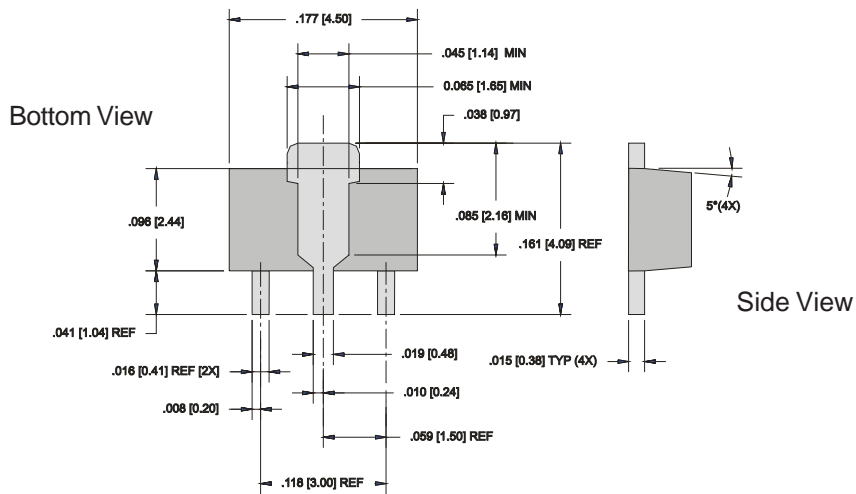
SBA-5089 DC-5 GHz Cascadable MMIC Amplifier



Nominal Package Dimensions

Dimensions in inches [millimeters]

Refer to package drawing posted at www.sirenza.com for tolerances.



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