**Product Description**

Sirenza Microdevices’ SGA-6289 is a high performance SiGe HBT MMIC Amplifier. A Darlington configuration featuring 1 micron emitters provides high \( F_t \) and 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. At 850 MHz and 75mA, the SGA-6289 typically provides +34.4 dBm output IP3, 13.9 dB of gain, and +18.1 dBm of 1dB compressed power using a single positive voltage supply. Only 2 DC-blocking capacitors, a bias resistor and an optional RF choke are required for operation.

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**SGA-6289**

**DC-4500 MHz, Cascadable SiGe HBT MMIC Amplifier**

**Product Features**
- Broadband Operation: DC-4500 MHz
- Cascadable 50 Ohm
- Patented SiGe Technology
- Operates From Single Supply
- Low Thermal Resistance Package

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

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**Gain & Return Loss vs. Frequency**

\[ V_C = 4.0 \text{ V}, I_C = 75 \text{ mA (Typ.)} \]

![Gain & Return Loss vs. Frequency Graph](image)

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**Table:**

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Units</th>
<th>Frequency</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>( G )</td>
<td>Small Signal Gain</td>
<td>dB</td>
<td>850 MHz</td>
<td>12.3</td>
<td>13.9</td>
<td>15.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1950 MHz</td>
<td>12.6</td>
<td></td>
<td>12.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2400 MHz</td>
<td></td>
<td>12.3</td>
<td></td>
</tr>
<tr>
<td>( P_{1dB} )</td>
<td>Output Power at 1dB Compression</td>
<td>dBm</td>
<td>850 MHz</td>
<td>18.1</td>
<td>17.8</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1950 MHz</td>
<td></td>
<td>17.8</td>
<td>16.0</td>
</tr>
<tr>
<td>( OIP_3 )</td>
<td>Output Third Order Intercept Point</td>
<td>dBm</td>
<td>850 MHz</td>
<td>34.4</td>
<td>32.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1950 MHz</td>
<td></td>
<td>32.0</td>
<td>30.0</td>
</tr>
<tr>
<td>Bandwidth</td>
<td>Determined by Return Loss (&gt;10dB)</td>
<td>MHz</td>
<td></td>
<td>4500</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( IRL )</td>
<td>Input Return Loss</td>
<td>dB</td>
<td>1950 MHz</td>
<td>18.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( ORL )</td>
<td>Output Return Loss</td>
<td>dB</td>
<td>1950 MHz</td>
<td>13.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( NF )</td>
<td>Noise Figure</td>
<td>dB</td>
<td>1950 MHz</td>
<td>4.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( V_D )</td>
<td>Device Operating Voltage</td>
<td>V</td>
<td>3.6</td>
<td>4.0</td>
<td>4.4</td>
<td></td>
</tr>
<tr>
<td>( I_D )</td>
<td>Device Operating Current</td>
<td>mA</td>
<td>67</td>
<td>75</td>
<td>83</td>
<td></td>
</tr>
<tr>
<td>( R_{TH, j-l} )</td>
<td>Thermal Resistance (junction to lead)</td>
<td>°C/W</td>
<td></td>
<td>97</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Test Conditions:**
- \( V_C = 8 \text{ V} \)
- \( R_{\text{BIAS}} = 51 \text{ Ohms} \)
- \( T_L = 25^\circ \text{C} \)
- \( OIP_3 \) Tone Spacing = 1 MHz, \( P_{\text{out per tone}} = 0 \text{ dBm} \)
- \( Z_S = Z_L = 50 \text{ Ohms} \)

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EDS-100619 Rev E
Typical RF Performance at Key Operating Frequencies

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Unit</th>
<th>Frequency (MHz)</th>
</tr>
</thead>
<tbody>
<tr>
<td>G</td>
<td>Small Signal Gain</td>
<td>dB</td>
<td>100  500  850  1950  2400  3500</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>13.5  14.0  13.9  12.6  12.2  10.6</td>
</tr>
<tr>
<td>OIP₃</td>
<td>Output Third Order Intercept Point</td>
<td>dBm</td>
<td>36.0  35.0  34.4  32.0  31.2  28.2</td>
</tr>
<tr>
<td>P₁dB</td>
<td>Output Power at 1dB Compression</td>
<td>dBm</td>
<td>18.7  18.6  18.1  17.8  17.1  15.6</td>
</tr>
<tr>
<td>IRL</td>
<td>Input Return Loss</td>
<td>dB</td>
<td>20.8  19.5  19.3  18.5  17.9  14.7</td>
</tr>
<tr>
<td>ORL</td>
<td>Output Return Loss</td>
<td>dB</td>
<td>32.8  25.6  20.6  13.1  12.2  12.6</td>
</tr>
<tr>
<td>S₁₂</td>
<td>Reverse Isolation</td>
<td>dB</td>
<td>17.4  18.6  18.9  19.2  19.1  18.1</td>
</tr>
<tr>
<td>NF</td>
<td>Noise Figure</td>
<td>dB</td>
<td>3.9   3.8   3.7   4.0   4.6   5.1</td>
</tr>
</tbody>
</table>

Test Conditions:  
Vₘᵋ = 8 V  
Iᵣᵋ = 75 mA Typ.  
OIP₃ Tone Spacing = 1 MHz, Pout per tone = 0 dBm  
Zₛ = Zᵣᵋ = 50 Ohms

Absolute Maximum Ratings

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Absolute Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. Device Current (Iᵣᵋ)</td>
<td>150 mA</td>
</tr>
<tr>
<td>Max. Device Voltage (Vᵢᵋ)</td>
<td>6 V</td>
</tr>
<tr>
<td>Max. RF Input Power</td>
<td>+18 dBm</td>
</tr>
<tr>
<td>Max. Junction Temp. (Tᵣᵋ)</td>
<td>+150°C</td>
</tr>
<tr>
<td>Operating Temp. Range (Tᵣᵋ)</td>
<td>-40°C to +85°C</td>
</tr>
<tr>
<td>Max. Storage Temp.</td>
<td>+150°C</td>
</tr>
</tbody>
</table>

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:  
IᵣᵋVᵢᵋ < (Tᵣᵋ - Tᵣᵋ) / Rᵣᵋ
**|S_{11}| vs. Frequency**
\[V_d = 4.0 \text{ V}, \ I_d = 75 \text{ mA}\]

**|S_{21}| vs. Frequency**
\[V_d = 4.0 \text{ V}, \ I_d = 75 \text{ mA}\]

**|S_{12}| vs. Frequency**
\[V_d = 4.0 \text{ V}, \ I_d = 75 \text{ mA}\]

**|S_{22}| vs. Frequency**
\[V_d = 4.0 \text{ V}, \ I_d = 75 \text{ mA}\]

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**V_d vs. I_d over Temperature** for fixed
\[V_s = 8 \text{ V}, \ R_{\text{BIAS}} = 51 \text{ Ohms}\]

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*Note: In the applications circuit on page 4, R_{\text{BIAS}} compensates for voltage and current variation over temperature.*
Basic Application Circuit

Application Circuit Element Values

<table>
<thead>
<tr>
<th>Reference Designator</th>
<th>Frequency (MHz)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>500</td>
</tr>
<tr>
<td>C_b</td>
<td>220 pF</td>
</tr>
<tr>
<td>C_d</td>
<td>100 pF</td>
</tr>
<tr>
<td>L_C</td>
<td>68 nH</td>
</tr>
</tbody>
</table>

Recommended Bias Resistor Values for I_D = 75mA

\[ R_{\text{BIAS}} = \frac{V_S - V_D}{I_D} \]

Supply Voltage (V_D) | 6 V | 8 V | 10 V | 12 V |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>R_{\text{BIAS}}</td>
<td>27 Ω</td>
<td>51 Ω</td>
<td>82 Ω</td>
<td>110 Ω</td>
</tr>
</tbody>
</table>

Note: R_{\text{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. Measurements for this data sheet were made on a 31 mil thick FR-4 board with 1 ounce copper on both sides.

Part Identification Marking

The part will be marked with an “A62” designator on the top surface of the package.

Caution: ESD sensitive

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

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. For optimum RF performance, use via holes as close to ground leads as possible to reduce lead inductance.
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

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Reel Size</th>
<th>Devices/Reel</th>
</tr>
</thead>
<tbody>
<tr>
<td>SGA-6289</td>
<td>13&quot;</td>
<td>3000</td>
</tr>
</tbody>
</table>

http://www.sirenza.com

EDS-100619 Rev D
SGA-6289 DC-4500 MHz Cascadable MMIC Amplifier

PCB Pad Layout
Dimensions in inches [millimeters]

Nominal Package Dimensions
Dimensions in inches [millimeters]
Refer to package drawing posted at www.sirenza.com for tolerances.