1. **Product profile**

1.1 **General description**

The BGU7031 MMIC is a wideband amplifier with internal biasing. It is designed specifically for high linearity, low-noise applications over a frequency range of 40 MHz to 1 GHz. It is especially suited to Set-Top Box applications.

The LNA is housed in a 6-pin SOT363 plastic SMD package.

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**CAUTION**

This device is sensitive to ElectroStatic Discharge (ESD). Therefore care should be taken during transport and handling.

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1.2 **Features and benefits**

- Internally biased
- Flat gain between 40 MHz and 1 GHz
- Noise figure of 4.5 dB
- High linearity with an IP3O of 29 dBm
- 75 Ω input and output impedance
- ESD protection > 2 kV Human Body Model (HBM) on all pins

1.3 **Applications**

- Terrestrial and cable Set-Top Boxes (STB)
- Silicon and “Can” tuners
- Personal and Digital Video Recorders (PVR and DVR)
- Home networking and in-house signal distribution
1.4 Quick reference data

Table 1. Quick reference data

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Conditions</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>VCC</td>
<td>supply voltage</td>
<td>RF input AC coupled</td>
<td>4.75</td>
<td>5.0</td>
<td>5.25</td>
<td>V</td>
</tr>
<tr>
<td>ICC(tot)</td>
<td>total supply current</td>
<td>[1]</td>
<td>-4</td>
<td>3</td>
<td>-</td>
<td>mA</td>
</tr>
<tr>
<td>Tamb</td>
<td>ambient temperature</td>
<td>−10 to +70 °C</td>
<td></td>
<td></td>
<td></td>
<td>°C</td>
</tr>
<tr>
<td>NF</td>
<td>noise figure</td>
<td></td>
<td>-</td>
<td>4.5</td>
<td>-</td>
<td>dB</td>
</tr>
<tr>
<td>PL(1dB)</td>
<td>output power at 1 dB gain</td>
<td>compression</td>
<td>1 GHz</td>
<td>13</td>
<td>-</td>
<td>dBm</td>
</tr>
<tr>
<td>IP3O</td>
<td>output third-order intercept point</td>
<td>[2]</td>
<td>-29</td>
<td>-29</td>
<td>-</td>
<td>dBm</td>
</tr>
</tbody>
</table>

[1] ICC(tot) is configurable with external resistor.
[2] The fundamental frequency (f1) lies between 40 MHz and 1000 MHz. The intermodulation product (IM3) is 2 × f2 − f1, where f2 = f1 ± 1 MHz. Input power P1 = −10 dBm.

2. Pinning information

Table 2. Pinning

<table>
<thead>
<tr>
<th>Pin</th>
<th>Description</th>
<th>Simplified outline</th>
<th>Graphic symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>RF_OUT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>VCC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>n.c.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>n.c.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>GND</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>RF_IN</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3. Ordering information

Table 3. Ordering information

<table>
<thead>
<tr>
<th>Type number</th>
<th>Package Name</th>
<th>Description</th>
<th>Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>BGU7031</td>
<td>-</td>
<td>plastic surface-mounted package; 6 leads</td>
<td>SOT363</td>
</tr>
</tbody>
</table>

4. Marking

Table 4. Marking codes

<table>
<thead>
<tr>
<th>Type number</th>
<th>Marking code</th>
</tr>
</thead>
<tbody>
<tr>
<td>BGU7031</td>
<td>SC%</td>
</tr>
</tbody>
</table>

Note: % character indicates the location of production.
5. Limiting values

Table 5. Limiting values
In accordance with the Absolute Maximum Rating System (IEC 60134).

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Conditions</th>
<th>Min</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>V_{CC}</td>
<td>supply voltage</td>
<td>RF input AC coupled</td>
<td>−0.6</td>
<td>5.25</td>
<td>V</td>
</tr>
<tr>
<td>I_{CC(tot)}</td>
<td>total supply current</td>
<td>configurable with external resistor</td>
<td>−</td>
<td>60</td>
<td>mA</td>
</tr>
<tr>
<td>P_{tot}</td>
<td>total power dissipation</td>
<td>T_{sp} ≤ 100 °C</td>
<td>[1]</td>
<td>−250</td>
<td>mW</td>
</tr>
<tr>
<td>P_{i}</td>
<td>input power</td>
<td>single tone</td>
<td>−</td>
<td>10</td>
<td>dBm</td>
</tr>
<tr>
<td>T_{stg}</td>
<td>storage temperature</td>
<td></td>
<td>−65</td>
<td>+150</td>
<td>°C</td>
</tr>
<tr>
<td>T_{j}</td>
<td>junction temperature</td>
<td></td>
<td>−</td>
<td>150</td>
<td>°C</td>
</tr>
<tr>
<td>T_{amb}</td>
<td>ambient temperature</td>
<td></td>
<td>−10</td>
<td>+70</td>
<td>°C</td>
</tr>
<tr>
<td>V_{ESD}</td>
<td>electrostatic discharge voltage</td>
<td>Human Body Model (HBM); according to JEDEC standard 22-A114E</td>
<td>2</td>
<td>−</td>
<td>kV</td>
</tr>
</tbody>
</table>

[1] T_{sp} is the temperature at the solder point of the ground lead.

6. Thermal characteristics

Table 6. Thermal characteristics

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Conditions</th>
<th></th>
<th>Typ</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>R_{th(j-sp)}</td>
<td>thermal resistance from junction to solder point</td>
<td></td>
<td></td>
<td>240</td>
<td>K/W</td>
</tr>
</tbody>
</table>

7. Characteristics

Table 7. Characteristics
T_{amb} = 25 °C; typical values at V_{CC} = 5 V; Z_S = Z_L = 75 Ω; R_{bias} = 43 Ω; 40 MHz ≤ f_1 ≤ 1000 MHz.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Conditions</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>V_{CC}</td>
<td>supply voltage</td>
<td>RF input AC coupled</td>
<td>4.75</td>
<td>5.0</td>
<td>5.25</td>
<td>V</td>
</tr>
<tr>
<td>I_{CC(tot)}</td>
<td>total supply current</td>
<td></td>
<td>−</td>
<td>43</td>
<td>−</td>
<td>mA</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IL_{(2)}</td>
<td>insertion power gain</td>
<td></td>
<td>−</td>
<td>10</td>
<td>−</td>
<td>dB</td>
</tr>
<tr>
<td>SL_{sl}</td>
<td>slope straight line</td>
<td></td>
<td>−</td>
<td>−1</td>
<td>−</td>
<td>dB</td>
</tr>
<tr>
<td>FL</td>
<td>flatness of frequency response</td>
<td></td>
<td>−</td>
<td>−0.2</td>
<td>−</td>
<td>dB</td>
</tr>
<tr>
<td>NF</td>
<td>noise figure</td>
<td></td>
<td>−</td>
<td>4.5</td>
<td>−</td>
<td>dB</td>
</tr>
<tr>
<td>RL_{in}</td>
<td>input return loss</td>
<td></td>
<td>−</td>
<td>18</td>
<td>−</td>
<td>dB</td>
</tr>
<tr>
<td>RL_{out}</td>
<td>output return loss</td>
<td></td>
<td>−</td>
<td>12</td>
<td>−</td>
<td>dB</td>
</tr>
<tr>
<td>P_{L(1dB)}</td>
<td>output power at 1 dB gain compression</td>
<td>1 GHz</td>
<td>−</td>
<td>14</td>
<td>−</td>
<td>dBm</td>
</tr>
</tbody>
</table>

[1] The fundamental frequency (f_1) lies between 40 MHz and 1000 MHz. The intermodulation product (IM3) is 2 \times f_2 − f_1, where f_2 = f_1 ± 1 MHz. Input power P_{i} = −10 dBm.
8. Application information

Other applications are possible. Please contact your local sales representative for more information. Application notes are available on the NXP website.

8.1 Application circuit

All control and supply lines must be decoupled properly. The decoupling capacitors must be placed as close to the device as possible.

8.2 Application circuit board layout

PCB material = FR4.
PCB thickness = 1.6 mm.
PCB size = 30 mm × 30 mm.
εr = 4.5; thickness of copper layer = 35 μm.
Components are listed in Table 8.
### Table 8. List of components

See Figure 1 and Figure 2.

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
<th>Value</th>
<th>Remarks</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1, C2</td>
<td>capacitor</td>
<td>10 nF</td>
<td></td>
<td>DC blocking</td>
</tr>
<tr>
<td>C3</td>
<td>capacitor</td>
<td>10 nF</td>
<td></td>
<td>decoupling</td>
</tr>
<tr>
<td>C4</td>
<td>capacitor</td>
<td>10 μF</td>
<td>[1] Murata BLM18HE152SN1DF</td>
<td>RF choke</td>
</tr>
<tr>
<td>L1</td>
<td>chip ferrite bead</td>
<td>1.5 kΩ [1]</td>
<td>Murata BLM18HE152SN1DF</td>
<td>RF choke</td>
</tr>
<tr>
<td>R1</td>
<td>resistor</td>
<td>43 Ω [1]</td>
<td>Rbias</td>
<td>bias setting</td>
</tr>
<tr>
<td>X1, X2</td>
<td>connector</td>
<td>75 Ω reflow type, Bomar 861V509ERG</td>
<td>F-connector, edge mount PCB</td>
<td>input/output</td>
</tr>
</tbody>
</table>

[1] L1 and R1 must have a power rating of 0.1 W or higher.
9. Package outline

Plastic surface-mounted package; 6 leads

DIMENSIONS (mm are the original dimensions)

<table>
<thead>
<tr>
<th>UNIT</th>
<th>A</th>
<th>A₁max</th>
<th>bₚ</th>
<th>c</th>
<th>D</th>
<th>E</th>
<th>e</th>
<th>e₁</th>
<th>Hₑ</th>
<th>Lₚ</th>
<th>Q</th>
<th>v</th>
<th>w</th>
<th>y</th>
</tr>
</thead>
<tbody>
<tr>
<td>mm</td>
<td>1.1</td>
<td>0.8</td>
<td>0.30</td>
<td>0.20</td>
<td>0.25</td>
<td>1.35</td>
<td>1.15</td>
<td>1.3</td>
<td>0.65</td>
<td>2.2</td>
<td>0.45</td>
<td>0.25</td>
<td>0.2</td>
<td>0.2</td>
</tr>
</tbody>
</table>

Fig 3. Package outline SOT363
10. Abbreviations

Table 9. Abbreviations

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC</td>
<td>Alternating Current</td>
</tr>
<tr>
<td>DC</td>
<td>Direct Current</td>
</tr>
<tr>
<td>LNA</td>
<td>Low-Noise Amplifier</td>
</tr>
<tr>
<td>MMIC</td>
<td>Monolithic Microwave Integrated Circuit</td>
</tr>
<tr>
<td>PCB</td>
<td>Printed-Circuit Board</td>
</tr>
<tr>
<td>RF</td>
<td>Radio Frequency</td>
</tr>
<tr>
<td>SMD</td>
<td>Surface-Mounted Device</td>
</tr>
</tbody>
</table>

11. Revision history

Table 10. Revision history

<table>
<thead>
<tr>
<th>Document ID</th>
<th>Release date</th>
<th>Data sheet status</th>
<th>Change notice</th>
<th>Supersedes</th>
</tr>
</thead>
<tbody>
<tr>
<td>BGU7031 v.2</td>
<td>20100907</td>
<td>Product data sheet</td>
<td>-</td>
<td>BGU7031 v.1</td>
</tr>
</tbody>
</table>

Modifications:

- The status of this data sheet has been changed to Product data sheet.
- Table 5 on page 3: The minimum value for $V_{CC}$ has been added.

BGU7031 v.1 20100812 Preliminary data sheet - -
12. Legal information

12.1 Data sheet status

<table>
<thead>
<tr>
<th>Document status</th>
<th>Product status</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Objective [short] data sheet</td>
<td>Development</td>
<td>This document contains data from the objective specification for product development.</td>
</tr>
<tr>
<td>Preliminary [short] data sheet</td>
<td>Qualification</td>
<td>This document contains data from the preliminary specification.</td>
</tr>
<tr>
<td>Product [short] data sheet</td>
<td>Production</td>
<td>This document contains the product specification.</td>
</tr>
</tbody>
</table>

[1] Please consult the most recently issued document before initiating or completing a design.
[2] The term 'short data sheet' is explained in section "Definitions".
[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL http://www.nxp.com.

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13. Contact information

For more information, please visit: http://www.nxp.com

For sales office addresses, please send an email to: salesaddresses@nxp.com
14. Contents

1 Product profile ........................................ 1
1.1 General description .................................. 1
1.2 Features and benefits ................................ 1
1.3 Applications ........................................ 1
1.4 Quick reference data ................................. 2
2 Pinning information .................................... 2
3 Ordering information ................................... 2
4 Marking ................................................... 2
5 Limiting values .......................................... 3
6 Thermal characteristics ................................. 3
7 Characteristics .......................................... 3
8 Application information ............................... 4
  8.1 Application circuit .................................. 4
  8.2 Application circuit board layout .................. 4
9 Package outline ......................................... 6
10 Abbreviations .......................................... 7
11 Revision history ....................................... 7
12 Legal information ...................................... 8
  12.1 Data sheet status .................................. 8
  12.2 Definitions ....................................... 8
  12.3 Disclaimers ...................................... 8
  12.4 Trademarks ....................................... 9
13 Contact information ................................. 9
14 Contents ............................................. 10