BGA2001
Silicon MMIC amplifier

Product specification
Supersedes data of 1999 Jul 23
FEATURES

- Low current, low voltage
- Very high power gain
- Low noise figure
- Integrated temperature compensated biasing
- Supply and RF output pin combined.

APPLICATIONS

- RF front end
- Wideband applications, e.g. analog and digital cellular telephones, cordless telephones (PHS, DECT, etc.)
- Radar detectors
- Low noise amplifiers
- Satellite television tuners (SATV)
- High frequency oscillators.

DESCRIPTION

Silicon MMIC amplifier consisting of an NPN double polysilicon transistor with integrated biasing for low voltage applications in a plastic, 4-pin dual-emitter SOT343R package.

PINNING

<table>
<thead>
<tr>
<th>PIN</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>GND</td>
</tr>
<tr>
<td>2</td>
<td>RF in</td>
</tr>
<tr>
<td>3</td>
<td>GND</td>
</tr>
<tr>
<td>4</td>
<td>VS + RFout</td>
</tr>
</tbody>
</table>

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>PARAMETER</th>
<th>CONDITIONS</th>
<th>TYP.</th>
<th>MAX.</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>VS</td>
<td>DC supply voltage</td>
<td>RF input AC coupled</td>
<td>–</td>
<td>4.5</td>
<td>V</td>
</tr>
<tr>
<td>IS</td>
<td>DC supply current</td>
<td>VS-OUT = 2.5 V; RF input AC coupled</td>
<td>4.5</td>
<td>–</td>
<td>mA</td>
</tr>
<tr>
<td>MSG</td>
<td>maximum stable gain</td>
<td>VS-OUT = 2.5 V; f = 1.8 GHz; Tamb = 25 °C</td>
<td>19.5</td>
<td>–</td>
<td>dB</td>
</tr>
<tr>
<td>NF</td>
<td>noise figure</td>
<td>VS-OUT = 2.5 V; f = 1.8 GHz; ΓS = Γopt</td>
<td>1.3</td>
<td>–</td>
<td>dB</td>
</tr>
</tbody>
</table>


Fig.1 Simplified outline (SOT343R) and symbol.
### LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

<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_S</td>
<td>supply voltage</td>
<td>RF input AC coupled</td>
<td>–</td>
<td>4.5</td>
<td>V</td>
</tr>
<tr>
<td>I_S</td>
<td>supply current (DC)</td>
<td>forced by DC voltage on RF input</td>
<td>–</td>
<td>30</td>
<td>mA</td>
</tr>
<tr>
<td>P_tot</td>
<td>total power dissipation</td>
<td>T_s ≤ 100 °C</td>
<td>–</td>
<td>135</td>
<td>mW</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>operating junction temperature</td>
<td></td>
<td>–</td>
<td>150</td>
<td>°C</td>
</tr>
</tbody>
</table>

### THERMAL CHARACTERISTICS

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>PARAMETER</th>
<th>VALUE</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rth,j-s</td>
<td>thermal resistance from junction to soldering point</td>
<td>350</td>
<td>K/W</td>
</tr>
</tbody>
</table>

### CHARACTERISTICS

RF input AC coupled; T_j = 25 °C; unless otherwise specified.

<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>I_S</td>
<td>supply current</td>
<td>V_VS-OUT = 1 V</td>
<td>–</td>
<td>0.7</td>
<td>–</td>
<td>mA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>V_VS-OUT = 2.5 V</td>
<td>3</td>
<td>4.5</td>
<td>6</td>
<td>mA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>V_VS-OUT = 4.5 V</td>
<td>–</td>
<td>11</td>
<td>–</td>
<td>mA</td>
</tr>
<tr>
<td>MSG</td>
<td>maximum stable gain</td>
<td>V_VS-OUT = 2.5 V; I_VS-OUT = 4 mA; f = 900 MHz</td>
<td>–</td>
<td>22</td>
<td>–</td>
<td>dB</td>
</tr>
<tr>
<td></td>
<td></td>
<td>V_VS-OUT = 2.5 V; I_VS-OUT = 4 mA; f = 1.8 GHz</td>
<td>–</td>
<td>19.5</td>
<td>–</td>
<td>dB</td>
</tr>
<tr>
<td></td>
<td></td>
<td>insertion power gain</td>
<td>V_VS-OUT = 2.5 V; I_VS-OUT = 4 mA; f = 900 MHz</td>
<td>–</td>
<td>18</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>V_VS-OUT = 2.5 V; I_VS-OUT = 4 mA; f = 1.8 GHz</td>
<td>–</td>
<td>14</td>
<td>–</td>
</tr>
<tr>
<td>P_L</td>
<td>load power</td>
<td>at 1 dB gain compression point; V_VS-OUT = 2.5 V; I_VS-OUT = 4.4 mA; f = 900 MHz;</td>
<td>–</td>
<td>–2</td>
<td>–</td>
<td>dBm</td>
</tr>
<tr>
<td>NF</td>
<td>noise figure</td>
<td>V_VS-OUT = 2.5 V; I_VS-OUT = 4 mA; f = 900 MHz; ( \Gamma = \Gamma_{\text{opt}} )</td>
<td>–</td>
<td>1.3</td>
<td>–</td>
<td>dB</td>
</tr>
<tr>
<td></td>
<td></td>
<td>V_VS-OUT = 2.5 V; I_VS-OUT = 4 mA; f = 1.8 GHz; ( \Gamma = \Gamma_{\text{opt}} )</td>
<td>–</td>
<td>1.3</td>
<td>–</td>
<td>dB</td>
</tr>
<tr>
<td>IP3_{(in)}</td>
<td>input intercept point; note 1</td>
<td>V_VS-OUT = 2.5 V; I_VS-OUT = 4.4 mA; f = 900 MHz</td>
<td>–</td>
<td>–7.4</td>
<td>–</td>
<td>dBm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>V_VS-OUT = 2.5 V; I_VS-OUT = 4.5 mA; f = 1800 MHz</td>
<td>–</td>
<td>–4.5</td>
<td>–</td>
<td>dBm</td>
</tr>
</tbody>
</table>

**Note**

Fig.2  Typical application circuit.

Fig.3  Power derating curve.

Fig.4  Bias current ($I_{\text{VS-OUT}}$) as a function of ambient temperature with $V_{\text{VS-OUT}}$ as parameter; typical values.

Fig.5  Bias current ($I_{\text{VS-OUT}}$) as a function of voltage at the output pin ($V_{\text{VS-OUT}}$); typical values.
Silicon MMIC amplifier

Fig. 6  Gain as a function of bias current (I_{VS-OUT}); typical values.  

\[ f = 900 \text{ MHz}. \]

Fig. 7  Gain as a function of bias current (I_{VS-OUT}); typical values.  

\[ f = 1800 \text{ MHz}. \]

Fig. 8  Gain as a function of frequency; typical values.  

\[ V_{VS-OUT} = 2.5 \text{ V}; I_{VS-OUT} = 4 \text{ mA}. \]

Fig. 9  Minimum noise figure as a function of bias current (I_{VS-OUT}); typical values.  

(1) \( f = 2400 \text{ MHz} \)  
(2) \( f = 1000 \text{ MHz} \)  
(3) \( f = 900 \text{ MHz} \)  
(4) \( f = 1800 \text{ MHz}. \)
**Fig. 10** Noise, stability and gain circles; typical values.

- $f = 900$ MHz; $V_{VS-OUT} = 2.5$ V; $I_{VS-OUT} = 4$ mA; $Z_0 = 50 \, \Omega$.
- (1) $G = 22$ dB
- (2) $G = 21$ dB
- (3) $G = 20$ dB
- (4) $NF = 1.3$ dB
- (5) $NF = 1.5$ dB
- (6) $NF = 1.7$ dB.

**Fig. 11** Noise, stability and gain circles; typical values.

- $f = 1800$ MHz; $V_{VS-OUT} = 2.5$ V; $I_{VS-OUT} = 4$ mA; $Z_0 = 50 \, \Omega$.
- (1) $G = 19$ dB
- (2) $G = 18$ dB
- (3) $G = 17$ dB
- (4) $NF = 1.3$ dB
- (5) $NF = 1.5$ dB
- (6) $NF = 1.7$ dB.
Fig. 12 Common emitter input reflection coefficient ($s_{11}$); typical values.

$V_{\text{VS-OUT}} = 2.5 \, \text{V}; \, I_{\text{VS-OUT}} = 4 \, \text{mA}; \, Z_0 = 50 \, \Omega$.

Fig. 13 Common emitter forward transmission coefficient ($s_{21}$); typical values.

$V_{\text{VS-OUT}} = 2.5 \, \text{V}; \, I_{\text{VS-OUT}} = 4 \, \text{mA}; \, Z_0 = 50 \, \Omega$. 
Fig.14 Common emitter reverse transmission coefficient ($s_{12}$); typical values.

\[ V_{\text{VS-OUT}} = 2.5 \text{ V}; \quad I_{\text{VS-OUT}} = 4 \text{ mA}; \quad Z_0 = 50 \Omega. \]

Fig.15 Common emitter output reflection coefficient ($s_{22}$); typical values.

\[ V_{\text{VS-OUT}} = 2.5 \text{ V}; \quad I_{\text{VS-OUT}} = 4 \text{ mA}; \quad Z_0 = 50 \Omega. \]
PACKAGE OUTLINE

Plastic surface-mounted package; reverse pinning; 4 leads

SOT343R

DIMENSIONS (mm are the original dimensions)

<table>
<thead>
<tr>
<th>UNIT</th>
<th>A</th>
<th>A₁</th>
<th>b₁</th>
<th>c</th>
<th>D</th>
<th>E</th>
<th>e</th>
<th>e₁</th>
<th>Hₑ</th>
<th>Lₑ</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>0.1</td>
<td>0.4</td>
<td>0.7</td>
<td>0.25</td>
<td>2.2</td>
<td>1.35</td>
<td>1.3</td>
<td>1.15</td>
<td>2.2</td>
<td>0.45</td>
<td>0.23</td>
<td>0.2</td>
<td>0.1</td>
</tr>
<tr>
<td></td>
<td>0.8</td>
<td></td>
<td>0.3</td>
<td>0.5</td>
<td>0.10</td>
<td>1.8</td>
<td>1.15</td>
<td>1.35</td>
<td>1.15</td>
<td>2.0</td>
<td>0.15</td>
<td>0.13</td>
<td>0.2</td>
<td>0.1</td>
</tr>
</tbody>
</table>

OUTLINE VERSION | REFERENCES | EUROPEAN PROJECTION | ISSUE DATE
SOT343R          | IEC         | JEDEC               | EIAJ          | 07-06-91 | 06-03-16

1999 Aug 11
DATA SHEET STATUS

<table>
<thead>
<tr>
<th>DOCUMENT STATUS(1)</th>
<th>PRODUCT STATUS(2)</th>
<th>DEFINITION</th>
</tr>
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<tbody>
<tr>
<td>Objective data sheet</td>
<td>Development</td>
<td>This document contains data from the objective specification for product development.</td>
</tr>
<tr>
<td>Preliminary data sheet</td>
<td>Qualification</td>
<td>This document contains data from the preliminary specification.</td>
</tr>
<tr>
<td>Product data sheet</td>
<td>Production</td>
<td>This document contains the product specification.</td>
</tr>
</tbody>
</table>

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