1. Product profile

1.1 General description

NPN silicon germanium microwave transistor for high speed, low noise applications in a plastic, 4-pin dual-emitter SOT343F package.

CAUTION

This device is sensitive to ElectroStatic Discharge (ESD). Observe precautions for handling electrostatic sensitive devices.
Such precautions are described in the ANSI/ESD S20.20, IEC/ST 61340-5, JESD625-A or equivalent standards.

1.2 Features and benefits

- Low noise high gain microwave transistor
- Noise figure (NF) = 0.7 dB at 5.8 GHz
- High maximum stable gain 27 dB at 1.8 GHz
- 110 GHz \( f_T \) silicon germanium technology

1.3 Applications

- 2nd LNA stage and mixer stage in DBS LNB’s
- Satellite radio
- Low noise amplifiers for microwave communications systems
- WLAN and CDMA applications
- Analog/digital cordless applications
- Ka band oscillators (DRO’s)

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>( V_{CBO} )</td>
<td>collector-base voltage</td>
<td>open emitter</td>
<td>-</td>
<td>-</td>
<td>10</td>
<td>V</td>
</tr>
<tr>
<td>( V_{CEO} )</td>
<td>collector-emitter voltage</td>
<td>open base</td>
<td>-</td>
<td>-</td>
<td>2.8</td>
<td>V</td>
</tr>
<tr>
<td>( V_{EBO} )</td>
<td>emitter-base voltage</td>
<td>open collector</td>
<td>-</td>
<td>-</td>
<td>1.0</td>
<td>V</td>
</tr>
<tr>
<td>( I_C )</td>
<td>collector current</td>
<td>-</td>
<td>25</td>
<td>40</td>
<td>mA</td>
<td></td>
</tr>
<tr>
<td>( P_{tot} )</td>
<td>total power dissipation</td>
<td>( T_{sp} \leq 90 , ^\circ C )</td>
<td>15</td>
<td>-</td>
<td>136</td>
<td>mW</td>
</tr>
<tr>
<td>( h_{FE} )</td>
<td>DC current gain</td>
<td>( I_C = 10 , mA; , V_{CE} = 2 , V; , T_J = 25 , ^\circ C )</td>
<td>160</td>
<td>280</td>
<td>400</td>
<td></td>
</tr>
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NXP Semiconductors

BFU725F/N1

NPN wideband silicon germanium RF transistor

2. Pinning information

Table 2. Discrete pinning

<table>
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<th>Pin</th>
<th>Description</th>
<th>Simplified outline</th>
<th>Graphic symbol</th>
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<tr>
<td>1</td>
<td>emitter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>base</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>emitter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>collector</td>
<td></td>
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</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>
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<tr>
<td>BFU725F/N1</td>
<td>plastic surface-mounted flat pack package; reverse pinning; 4 leads</td>
<td>SOT343F</td>
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4. Marking

Table 4. Marking

<table>
<thead>
<tr>
<th>Type number</th>
<th>Marking</th>
<th>Description</th>
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</thead>
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<tr>
<td>BFU725F/N1</td>
<td>B7*</td>
<td>* = p : made in Hong Kong</td>
</tr>
<tr>
<td></td>
<td></td>
<td>* = t : made in Malaysia</td>
</tr>
<tr>
<td></td>
<td></td>
<td>* = W : made in China</td>
</tr>
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</table>

[1] $T_{sp}$ is the temperature at the solder point of the emitter lead.
[2] $G_{p(\text{max})}$ is the maximum power gain, if $K > 1$. If $K < 1$ then $G_{p(\text{max})} = \text{Maximum Stable Gain (MSG)}$. 

Table 1. Quick reference data...continued

<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>$C_{CBS}$</td>
<td>collector-base capacitance</td>
<td>$V_C = 2 , \text{V}; f = 1 , \text{MHz}$</td>
<td>-</td>
<td>70</td>
<td>-</td>
<td>$\text{fF}$</td>
</tr>
<tr>
<td>$f_T$</td>
<td>transition frequency</td>
<td>$I_C = 25 , \text{mA}; V_{CE} = 2 , \text{V}; f = 2 , \text{GHz}; T_{amb} = 25 , ^\circ \text{C}$</td>
<td>-</td>
<td>55</td>
<td>-</td>
<td>$\text{GHz}$</td>
</tr>
<tr>
<td>$G_{p(\text{max})}$</td>
<td>maximum power gain</td>
<td>$I_C = 25 , \text{mA}; V_{CE} = 2 , \text{V}; f = 5.8 , \text{GHz}; T_{amb} = 25 , ^\circ \text{C}$</td>
<td>-</td>
<td>18</td>
<td>-</td>
<td>$\text{dB}$</td>
</tr>
<tr>
<td>NF</td>
<td>noise figure</td>
<td>$I_C = 5 , \text{mA}; V_{CE} = 2 , \text{V}; f = 5.8 , \text{GHz}; \Gamma_S = \Gamma_{\text{opt}}; T_{amb} = 25 , ^\circ \text{C}$</td>
<td>-</td>
<td>0.7</td>
<td>-</td>
<td>$\text{dB}$</td>
</tr>
</tbody>
</table>

Table 1. Quick reference data...continued
5. Limiting values

Table 5. Limiting values

<table>
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<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Conditions</th>
<th>Min</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{CBO}$</td>
<td>collector-base voltage</td>
<td>open emitter</td>
<td>-</td>
<td>10</td>
<td>V</td>
</tr>
<tr>
<td>$V_{CEO}$</td>
<td>collector-emitter voltage</td>
<td>open base</td>
<td>-</td>
<td>2.8</td>
<td>V</td>
</tr>
<tr>
<td>$V_{EBO}$</td>
<td>emitter-base voltage</td>
<td>open collector</td>
<td>-</td>
<td>1.0</td>
<td>V</td>
</tr>
<tr>
<td>$I_C$</td>
<td>collector current</td>
<td></td>
<td>-</td>
<td>40</td>
<td>mA</td>
</tr>
<tr>
<td>$P_{tot}$</td>
<td>total power dissipation</td>
<td>$T_{sp} \leq 90$°C</td>
<td>0</td>
<td>136</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>junction temperature</td>
<td></td>
<td>-</td>
<td>150</td>
<td>°C</td>
</tr>
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</table>

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

6. Thermal characteristics

Table 6. Thermal characteristics

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Conditions</th>
<th>Typ</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$R_{(h-j-sp)}$</td>
<td>thermal resistance from junction to solder point</td>
<td>440</td>
<td>K/W</td>
<td></td>
</tr>
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</table>

Fig 1. Power derating curve
## Characteristics

### Table 7. Characteristics

<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>$V_{(BR)CBO}$</td>
<td>collector-base breakdown voltage</td>
<td>$I_C = 2.5 \mu A; I_E = 0 , mA$</td>
<td>10</td>
<td>-</td>
<td>-</td>
<td>V</td>
</tr>
<tr>
<td>$V_{(BR)CEO}$</td>
<td>collector-emitter breakdown voltage</td>
<td>$I_C = 1 , mA; I_B = 0 , mA$</td>
<td>2.8</td>
<td>-</td>
<td>-</td>
<td>V</td>
</tr>
<tr>
<td>$I_C$</td>
<td>collector current</td>
<td>-</td>
<td>25</td>
<td>40</td>
<td>mA</td>
<td></td>
</tr>
<tr>
<td>$I_{CBO}$</td>
<td>collector-base cut-off current</td>
<td>$I_E = 0 , mA; V_{CB} = 4.5 , V$</td>
<td>-</td>
<td>-</td>
<td>100</td>
<td>nA</td>
</tr>
<tr>
<td>$h_{FE}$</td>
<td>DC current gain</td>
<td>$I_C = 10 , mA; V_{CE} = 2 , V$</td>
<td>16</td>
<td>280</td>
<td>400</td>
<td>V</td>
</tr>
<tr>
<td>$C_{CES}$</td>
<td>collector-emitter capacitance</td>
<td>$V_{CB} = 2 , V; f = 1 , MHz$</td>
<td>-</td>
<td>268</td>
<td>-</td>
<td>fF</td>
</tr>
<tr>
<td>$C_{EBS}$</td>
<td>emitter-base capacitance</td>
<td>$V_{EB} = 0.5 , V; f = 1 , MHz$</td>
<td>-</td>
<td>400</td>
<td>-</td>
<td>fF</td>
</tr>
<tr>
<td>$C_{CBS}$</td>
<td>collector-base capacitance</td>
<td>$V_{CB} = 2 , V; f = 1 , MHz$</td>
<td>-</td>
<td>70</td>
<td>-</td>
<td>fF</td>
</tr>
<tr>
<td>$f_T$</td>
<td>transition frequency</td>
<td>$I_C = 25 , mA; V_{CE} = 2 , V; f = 2 , GHz; T_{amb} = 25 , ^\circ C$</td>
<td>55</td>
<td>-</td>
<td>-</td>
<td>GHz</td>
</tr>
<tr>
<td>$G_{p(max)}$</td>
<td>maximum power gain</td>
<td>$I_C = 25 , mA; V_{CE} = 2 , V; T_{amb} = 25 , ^\circ C$</td>
<td>-</td>
<td>28</td>
<td>-</td>
<td>dB</td>
</tr>
<tr>
<td>$</td>
<td>S_{21}</td>
<td>^2$</td>
<td>insertion power gain</td>
<td>$I_C = 25 , mA; V_{CE} = 2 , V; T_{amb} = 25 , ^\circ C$</td>
<td>-</td>
<td>26.7</td>
</tr>
<tr>
<td>$NF$</td>
<td>noise figure</td>
<td>$I_C = 5 , mA; V_{CE} = 2 , V; , \Gamma_S = , \Gamma_{opt}; T_{amb} = 25 , ^\circ C$</td>
<td>-</td>
<td>0.42</td>
<td>-</td>
<td>dB</td>
</tr>
<tr>
<td>$G_{ass}$</td>
<td>associated gain</td>
<td>$I_C = 5 , mA; V_{CE} = 2 , V; , \Gamma_S = , \Gamma_{opt}; T_{amb} = 25 , ^\circ C$</td>
<td>-</td>
<td>24</td>
<td>-</td>
<td>dB</td>
</tr>
</tbody>
</table>
Table 7. Characteristics ...continued

<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>( P_{L(1dB)} )</td>
<td>output power at 1 dB gain compression</td>
<td>( I_C = 25 , mA; , V_{CE} = 2 , V; , Z_S = Z_L = 50 , \Omega; , T_{amb} = 25 , ^\circ C )</td>
<td>f = 1.5 GHz</td>
<td>-</td>
<td>8.5</td>
<td>dBm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>f = 1.8 GHz</td>
<td>-</td>
<td>9</td>
<td>dBm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>f = 2.4 GHz</td>
<td>-</td>
<td>8.5</td>
<td>dBm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>f = 5.8 GHz</td>
<td>-</td>
<td>8</td>
<td>dBm</td>
</tr>
<tr>
<td>IP3</td>
<td>third-order intercept point</td>
<td>( I_C = 25 , mA; , V_{CE} = 2 , V; , Z_S = Z_L = 50 , \Omega; , T_{amb} = 25 , ^\circ C ); ( f_2 = f_1 + 1 , MHz )</td>
<td>f = 1.5 GHz</td>
<td>-</td>
<td>17</td>
<td>dBm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>f = 1.8 GHz</td>
<td>-</td>
<td>17</td>
<td>dBm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>f = 2.4 GHz</td>
<td>-</td>
<td>17</td>
<td>dBm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>f = 5.8 GHz</td>
<td>-</td>
<td>19</td>
<td>dBm</td>
</tr>
</tbody>
</table>

[1] \( G_{p(max)} \) is the maximum power gain, if \( K > 1 \). If \( K < 1 \) then \( G_{p(max)} = MSG \).
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BFU725F/N1

NPN wideband silicon germanium RF transistor

V_{CE} = 2 V; f = 2 GHz; T_{amb} = 25 °C.

Fig 4. Collector-base capacitance as a function of collector-base voltage; typical values

Fig 5. Transition frequency as a function of collector current; typical values

V_{CE} = 2 V; T_{amb} = 25 °C.

(1) f = 1.5 GHz
(2) f = 1.8 GHz
(3) f = 2.4 GHz
(4) f = 5.8 GHz
(5) f = 12 GHz

Fig 6. Gain as a function of collector current; typical value
**BFU725F/N1**

NPN wideband silicon germanium RF transistor

---

**Fig 7.** Gain as a function of frequency; typical values

- $V_{CE} = 2\,\text{V}$; $I_{C} = 5\,\text{mA}$; $T_{amb} = 25\,\text{°C}$.

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

- $V_{CE} = 2\,\text{V}$; $I_{C} = 25\,\text{mA}$; $T_{amb} = 25\,\text{°C}$.

---

**Fig 9.** Minimum noise figure as a function of collector current; typical values

- $V_{CE} = 2\,\text{V}$; $T_{amb} = 25\,\text{°C}$.
  - (1) $f = 12\,\text{GHz}$
  - (2) $f = 5.8\,\text{GHz}$
  - (3) $f = 2.4\,\text{GHz}$
  - (4) $f = 1.8\,\text{GHz}$
  - (5) $f = 1.5\,\text{GHz}$

**Fig 10.** Minimum noise figure as a function of frequency; typical values

- $V_{CE} = 2\,\text{V}$; $T_{amb} = 25\,\text{°C}$.
  - (1) $I_{C} = 25\,\text{mA}$
  - (2) $I_{C} = 5\,\text{mA}$
8. Package outline

Plastic surface-mounted flat pack package; reverse pinning; 4 leads

**SOT343F**

![Package outline diagram](image)

**DIMENSIONS (mm are the original dimensions)**

<table>
<thead>
<tr>
<th>UNIT</th>
<th>A</th>
<th>b₀</th>
<th>b₁</th>
<th>c</th>
<th>D</th>
<th>E</th>
<th>e</th>
<th>e₁</th>
<th>Hₑ</th>
<th>Lₚ</th>
<th>w</th>
<th>y</th>
</tr>
</thead>
<tbody>
<tr>
<td>mm</td>
<td>0.75</td>
<td>0.65</td>
<td>0.4</td>
<td>0.3</td>
<td>0.7</td>
<td>0.25</td>
<td>0.10</td>
<td>2.2</td>
<td>1.8</td>
<td>1.35</td>
<td>1.15</td>
<td>1.3</td>
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</table>

**OUTLINE VERSION**

<table>
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<tr>
<th>REFERENCES</th>
<th>EUROPEAN PROJECTION</th>
<th>ISSUE DATE</th>
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<tbody>
<tr>
<td>IEC</td>
<td>JEDEC</td>
<td>JEITA</td>
</tr>
<tr>
<td>SOT343F</td>
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**Fig 11. Package outline SOT343F**
9. Abbreviations

Table 8. Abbreviations

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
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<tbody>
<tr>
<td>CDMA</td>
<td>Code Division Multiple Access</td>
</tr>
<tr>
<td>DBS</td>
<td>Direct Broadcast Satellite</td>
</tr>
<tr>
<td>DC</td>
<td>Direct Current</td>
</tr>
<tr>
<td>DRO</td>
<td>Dielectric Resonator Oscillator</td>
</tr>
<tr>
<td>LNA</td>
<td>Low Noise Amplifier</td>
</tr>
<tr>
<td>LNB</td>
<td>Low Noise Block</td>
</tr>
<tr>
<td>Ka</td>
<td>Kurtz above</td>
</tr>
<tr>
<td>NPN</td>
<td>Negative-Positive-Negative</td>
</tr>
<tr>
<td>RF</td>
<td>Radio Frequency</td>
</tr>
<tr>
<td>WLAN</td>
<td>Wireless Local Area Network</td>
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</table>

10. Revision history

Table 9. 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>
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<tbody>
<tr>
<td>BFU725F_N1 v.2</td>
<td>20111103</td>
<td>Product data sheet</td>
<td>-</td>
<td>BFU725F_N1 v.1</td>
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Modifications:

- Table 1 on page 1: The maximum value for $V_{EBO}$ has been changed to 1.0 V.
- Table 5 on page 3: The maximum value for $V_{EBO}$ has been changed to 1.0 V.

<table>
<thead>
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<th>Release date</th>
<th>Data sheet status</th>
<th>Change notice</th>
<th>Supersedes</th>
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11. Legal information

11.1 Data sheet status

<table>
<thead>
<tr>
<th>Document status</th>
<th>Product status</th>
<th>Definition</th>
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<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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12. Contact information

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

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