

BFU630F

NPN wideband silicon RF transistor

Rev. 1 — 15 December 2010

Product data sheet

1. Product profile

1.1 General description

NPN silicon 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) = 0.85 dB at 2.4 GHz
- High maximum stable gain 26 dB at 1.8 GHz
- 40 GHz f_T silicon technology

1.3 Applications

- Low noise amplifiers for microwave communications systems
- WLAN and CDMA applications
- Analog/digital cordless applications
- Ku band oscillators DRO's
- LNB
- RKE
- AMR
- GPS
- ZigBee
- LTE, cellular, UMTS
- FM radio
- Mobile TV
- Bluetooth



1.4 Quick reference data

Table 1. Quick reference data

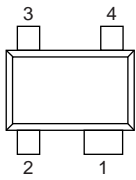
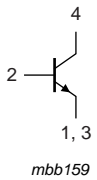
| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------------|---------------------------------------|---|-----|------|-----|------|
| V_{CBO} | collector-base voltage | open emitter | - | - | 16 | V |
| V_{CEO} | collector-emitter voltage | open base | - | - | 5.5 | V |
| V_{EBO} | emitter-base voltage | open collector | - | - | 2.5 | V |
| I_C | collector current | | - | 3 | 30 | mA |
| P_{tot} | total power dissipation | $T_{sp} \leq 90\text{ }^\circ\text{C}$ | [1] | - | 200 | mW |
| h_{FE} | DC current gain | $I_C = 5\text{ mA}; V_{CE} = 2\text{ V}; T_j = 25\text{ }^\circ\text{C}$ | 90 | 135 | 180 | |
| C_{CBS} | collector-base capacitance | $V_{CB} = 2\text{ V}; f = 1\text{ MHz}$ | - | 47 | - | fF |
| f_T | transition frequency | $I_C = 10\text{ mA}; V_{CE} = 2\text{ V}; f = 2\text{ GHz}; T_{amb} = 25\text{ }^\circ\text{C}$ | - | 21 | - | GHz |
| $G_{p(max)}$ | maximum power gain | $I_C = 15\text{ mA}; V_{CE} = 2\text{ V}; f = 2.4\text{ GHz}; T_{amb} = 25\text{ }^\circ\text{C}$ | [2] | 24.5 | - | dB |
| NF | noise figure | $I_C = 3\text{ mA}; V_{CE} = 2\text{ V}; f = 2.4\text{ GHz}; \Gamma_S = \Gamma_{opt}$ | - | 0.85 | - | dB |
| $P_{L(1dB)}$ | output power at 1 dB gain compression | $I_C = 30\text{ mA}; V_{CE} = 2.5\text{ V}; Z_S = Z_L = 50\text{ }\Omega; f = 2.4\text{ GHz}; T_{amb} = 25\text{ }^\circ\text{C}$ | - | 11.5 | - | dBm |

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

[2] $G_{p(max)}$ is the maximum power gain, if $K > 1$. If $K < 1$ then $G_{p(max)}$ = Maximum Stable Gain (MSG).

2. Pinning information

Table 2. Discrete pinning

| Pin | Description | Simplified outline | Graphic symbol |
|-----|-------------|---|---|
| 1 | emitter |  |  |
| 2 | base | | |
| 3 | emitter | | |
| 4 | collector | | |

3. Ordering information

Table 3. Ordering information

| Type number | Package | | Version |
|-------------|---------|---|---------|
| | Name | Description | |
| BFU630F | - | plastic surface-mounted flat pack package; reverse pinning; 4 leads | SOT343F |

4. Marking

Table 4. Marking

| Type number | Marking | Description |
|-------------|---------|--|
| BFU630F | D2* | * = p : made in Hong Kong * = t : made in Malaysia * = w : made in China |

5. Limiting values

Table 5. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134).

| Symbol | Parameter | Conditions | Min | Max | Unit |
|-----------|---------------------------|----------------------------|-----|------|------|
| V_{CBO} | collector-base voltage | open emitter | - | 16 | V |
| V_{CEO} | collector-emitter voltage | open base | - | 5.5 | V |
| V_{EBO} | emitter-base voltage | open collector | - | 2.5 | V |
| I_C | collector current | | - | 30 | mA |
| P_{tot} | total power dissipation | $T_{sp} \leq 90\text{ °C}$ | [1] | 200 | mW |
| T_{stg} | storage temperature | | -65 | +150 | °C |
| T_j | junction temperature | | - | 150 | °C |

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

6. Thermal characteristics

Table 6. Thermal characteristics

| Symbol | Parameter | Conditions | Typ | Unit |
|----------------|--|------------|-----|------|
| $R_{th(j-sp)}$ | thermal resistance from junction to solder point | | 300 | K/W |

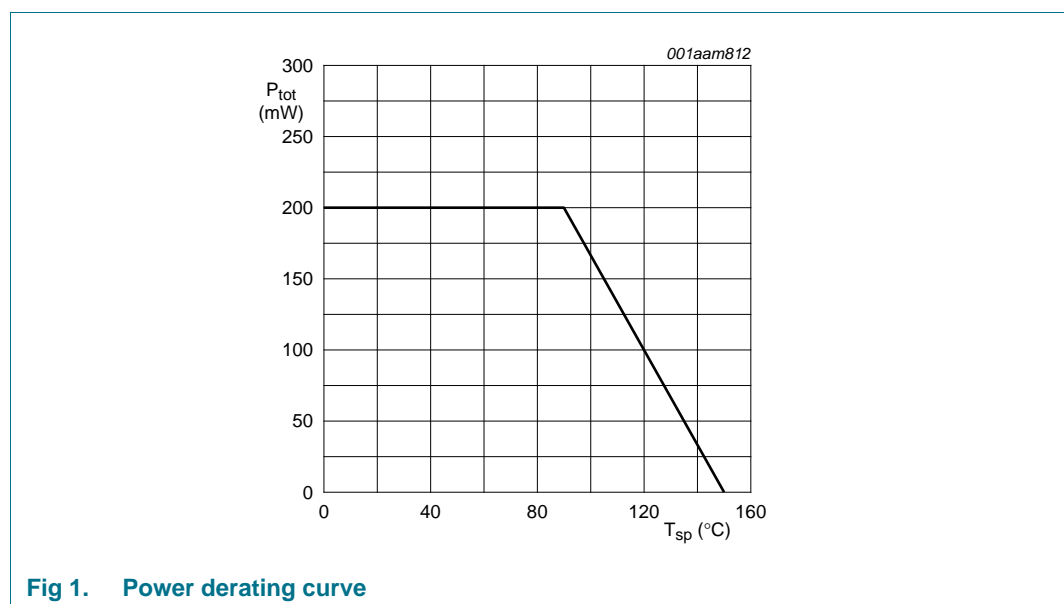


Fig 1. Power derating curve

7. Characteristics

Table 7. Characteristics

$T_j = 25\text{ °C}$ unless otherwise specified

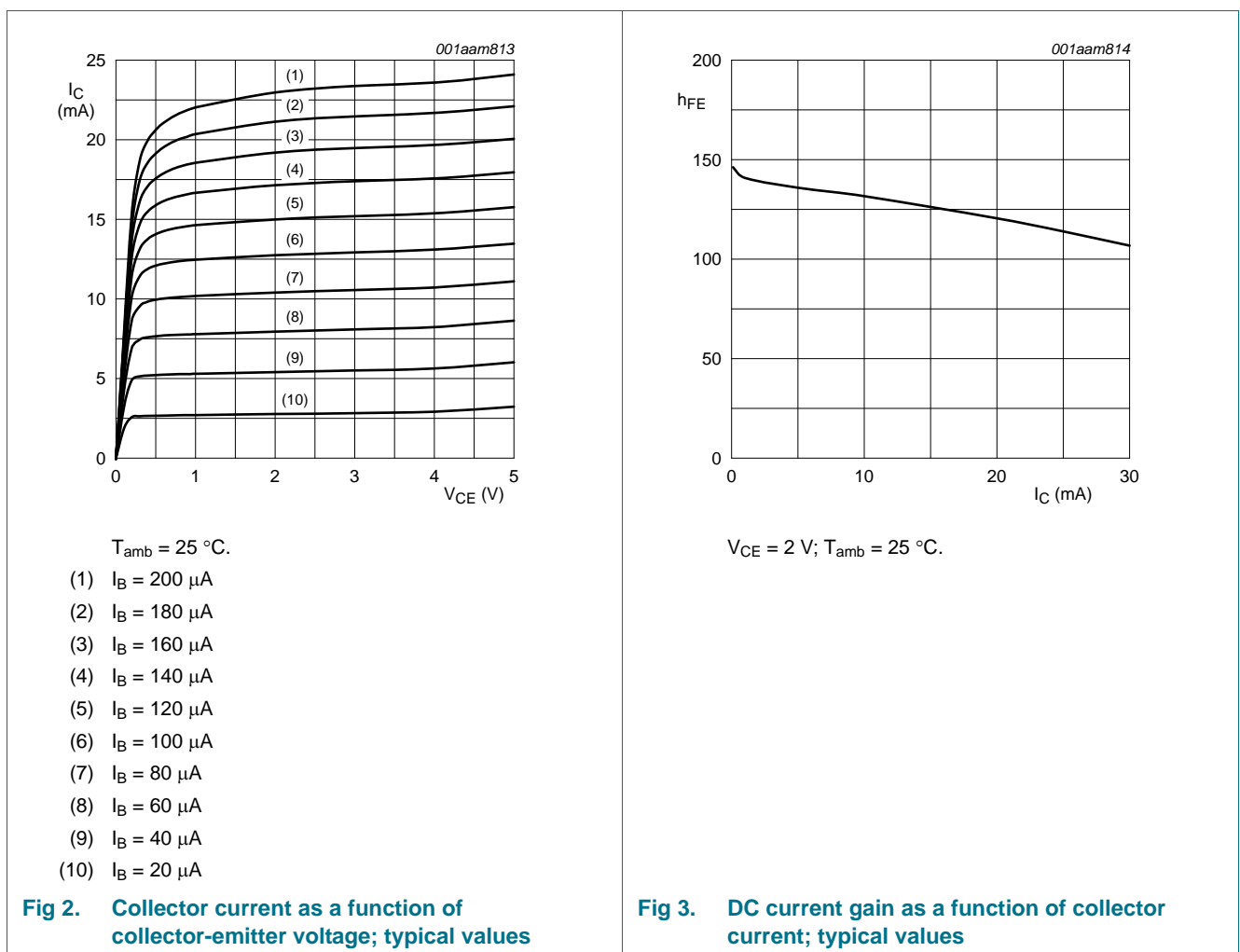
| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---------------|---------------------------------------|---|-----|------|-----|------|
| $V_{(BR)CBO}$ | collector-base breakdown voltage | $I_C = 2.5\ \mu\text{A}; I_E = 0\ \text{mA}$ | 16 | - | - | V |
| $V_{(BR)CEO}$ | collector-emitter breakdown voltage | $I_C = 1\ \text{mA}; I_B = 0\ \text{mA}$ | 5.5 | - | - | V |
| I_C | collector current | | - | 3 | 30 | mA |
| I_{CBO} | collector-base cut-off current | $I_E = 0\ \text{mA}; V_{CB} = 8\ \text{V}$ | - | - | 100 | nA |
| h_{FE} | DC current gain | $I_C = 5\ \text{mA}; V_{CE} = 2\ \text{V}$ | 90 | 135 | 180 | |
| C_{CES} | collector-emitter capacitance | $V_{CB} = 2\ \text{V}; f = 1\ \text{MHz}$ | - | 264 | - | fF |
| C_{EBS} | emitter-base capacitance | $V_{EB} = 0.5\ \text{V}; f = 1\ \text{MHz}$ | - | 332 | - | fF |
| C_{CBS} | collector-base capacitance | $V_{CB} = 2\ \text{V}; f = 1\ \text{MHz}$ | - | 47 | - | fF |
| f_T | transition frequency | $I_C = 10\ \text{mA}; V_{CE} = 2\ \text{V}; f = 2\ \text{GHz}; T_{amb} = 25\text{ °C}$ | - | 21 | - | GHz |
| $G_{p(max)}$ | maximum power gain | $I_C = 15\ \text{mA}; V_{CE} = 2\ \text{V}; T_{amb} = 25\text{ °C}$ [1] | | | | |
| | | $f = 1.5\ \text{GHz}$ | - | 27 | - | dB |
| | | $f = 1.8\ \text{GHz}$ | - | 26 | - | dB |
| | | $f = 2.4\ \text{GHz}$ | - | 24.5 | - | dB |
| | | $f = 5.8\ \text{GHz}$ | - | 16 | - | dB |
| $ S_{21} ^2$ | insertion power gain | $I_C = 15\ \text{mA}; V_{CE} = 2\ \text{V}; T_{amb} = 25\text{ °C}$ | | | | |
| | | $f = 1.5\ \text{GHz}$ | - | 22.5 | - | dB |
| | | $f = 1.8\ \text{GHz}$ | - | 21 | - | dB |
| | | $f = 2.4\ \text{GHz}$ | - | 19 | - | dB |
| | | $f = 5.8\ \text{GHz}$ | - | 12 | - | dB |
| NF | noise figure | $I_C = 3\ \text{mA}; V_{CE} = 2\ \text{V}; \Gamma_S = \Gamma_{opt}; T_{amb} = 25\text{ °C}$ | | | | |
| | | $f = 1.5\ \text{GHz}$ | - | 0.75 | - | dB |
| | | $f = 1.8\ \text{GHz}$ | - | 0.80 | - | dB |
| | | $f = 2.4\ \text{GHz}$ | - | 0.85 | - | dB |
| | | $f = 5.8\ \text{GHz}$ | - | 1.30 | - | dB |
| G_{ass} | associated gain | $I_C = 3\ \text{mA}; V_{CE} = 2\ \text{V}; \Gamma_S = \Gamma_{opt}; T_{amb} = 25\text{ °C}$ | | | | |
| | | $f = 1.5\ \text{GHz}$ | - | 22.5 | - | dB |
| | | $f = 1.8\ \text{GHz}$ | - | 21 | - | dB |
| | | $f = 2.4\ \text{GHz}$ | - | 19 | - | dB |
| | | $f = 5.8\ \text{GHz}$ | - | 13 | - | dB |
| $P_{L(1dB)}$ | output power at 1 dB gain compression | $I_C = 30\ \text{mA}; V_{CE} = 2.5\ \text{V}; Z_S = Z_L = 50\ \Omega; T_{amb} = 25\text{ °C}$ | | | | |
| | | $f = 1.5\ \text{GHz}$ | - | 12.5 | - | dBm |
| | | $f = 1.8\ \text{GHz}$ | - | 12.5 | - | dBm |
| | | $f = 2.4\ \text{GHz}$ | - | 11.5 | - | dBm |
| | | $f = 5.8\ \text{GHz}$ | - | 12.5 | - | dBm |

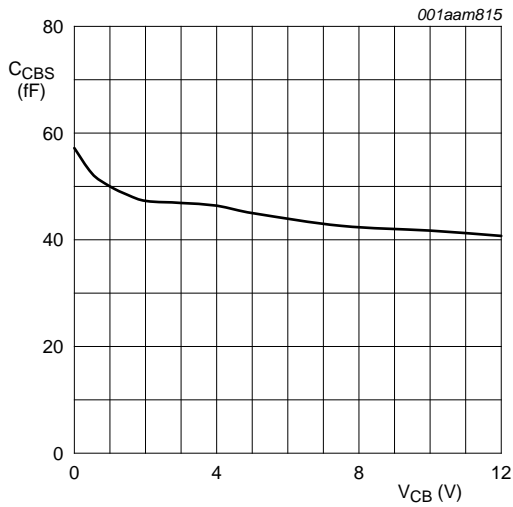
Table 7. Characteristics ...continued

$T_j = 25\text{ }^\circ\text{C}$ unless otherwise specified

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------|-----------------------------|--|-----|------|-----|------|
| IP3 | third-order intercept point | $I_C = 30\text{ mA}; V_{CE} = 2.5\text{ V};$ $Z_S = Z_L = 50\text{ }\Omega; T_{amb} = 25\text{ }^\circ\text{C}$ | | | | |
| | | $f = 1.5\text{ GHz}$ | - | 25.5 | - | dBm |
| | | $f = 1.8\text{ GHz}$ | - | 26 | - | dBm |
| | | $f = 2.4\text{ GHz}$ | - | 26.5 | - | dBm |
| | | $f = 5.8\text{ GHz}$ | - | 27.5 | - | dBm |

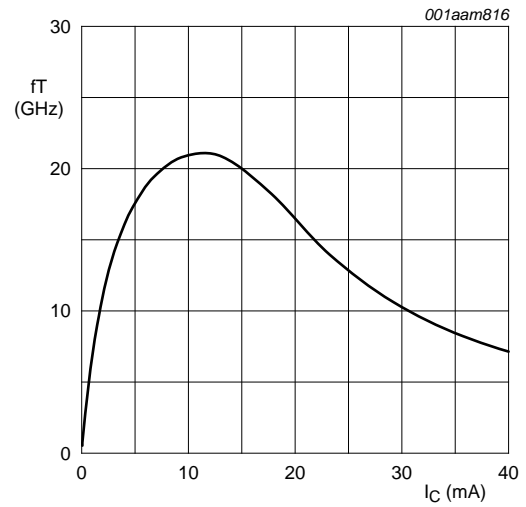
[1] $G_{p(max)}$ is the maximum power gain, if $K > 1$. If $K < 1$ then $G_{p(max)} = MSG$.





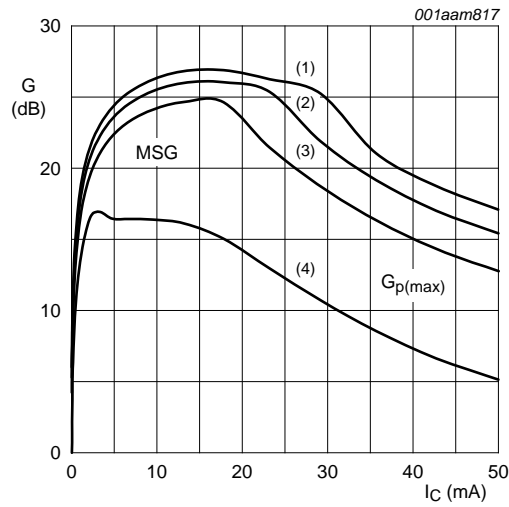
$f = 1 \text{ MHz}$, $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$.

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



$V_{\text{CE}} = 2 \text{ V}$; $f = 2 \text{ GHz}$; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$.

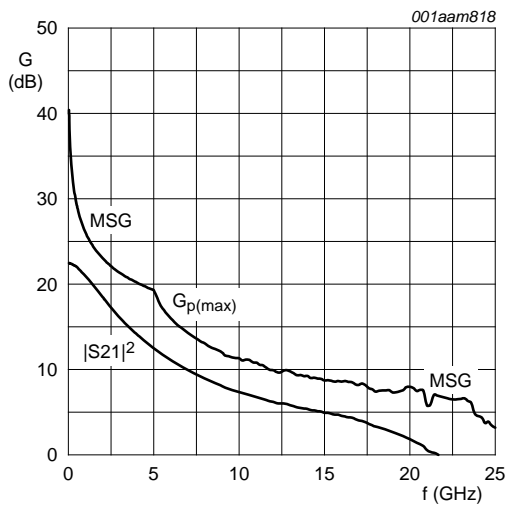
Fig 5. Transition frequency as a function of collector current; typical values



$V_{\text{CE}} = 2 \text{ V}$; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$.

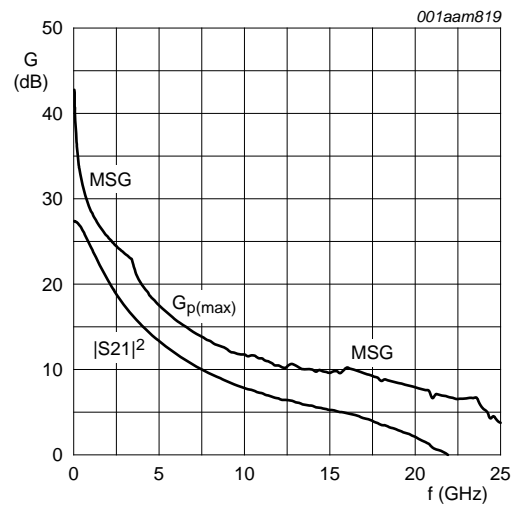
- (1) $f = 1.5 \text{ GHz}$
- (2) $f = 1.8 \text{ GHz}$
- (3) $f = 2.4 \text{ GHz}$
- (4) $f = 5.8 \text{ GHz}$

Fig 6. Gain as a function of collector current; typical value



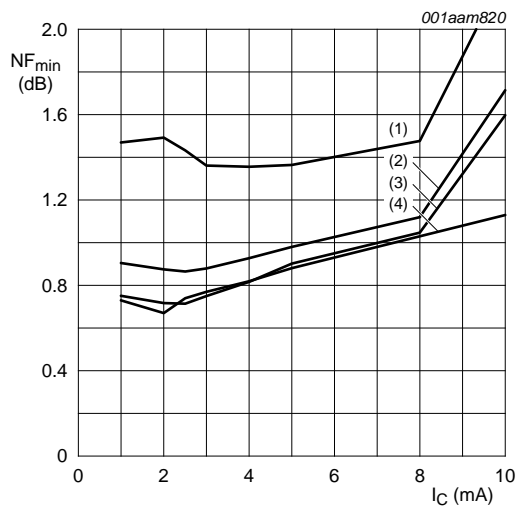
$V_{CE} = 2\text{ V}; I_C = 5\text{ mA}; T_{amb} = 25\text{ }^\circ\text{C}.$

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



$V_{CE} = 2\text{ V}; I_C = 15\text{ mA}; T_{amb} = 25\text{ }^\circ\text{C}.$

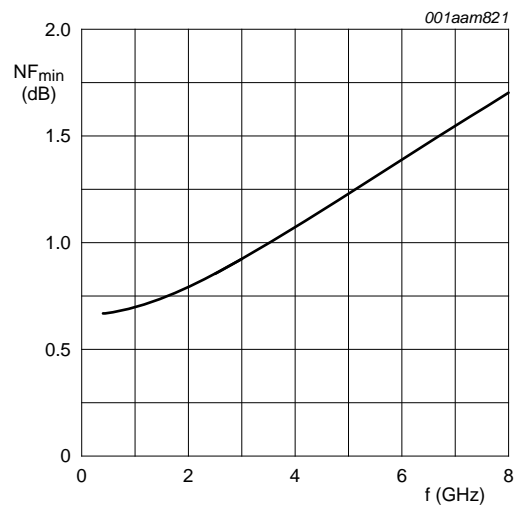
Fig 8. Gain as a function of frequency; typical values



$V_{CE} = 2\text{ V}; T_{amb} = 25\text{ }^\circ\text{C}.$

- (1) $f = 5.8\text{ GHz}$
- (2) $f = 2.4\text{ GHz}$
- (3) $f = 1.8\text{ GHz}$
- (4) $f = 1.5\text{ GHz}$

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



$V_{CE} = 2\text{ V}; I_C = 3\text{ mA}; T_{amb} = 25\text{ }^\circ\text{C}.$

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

8. Package outline

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

SOT343F

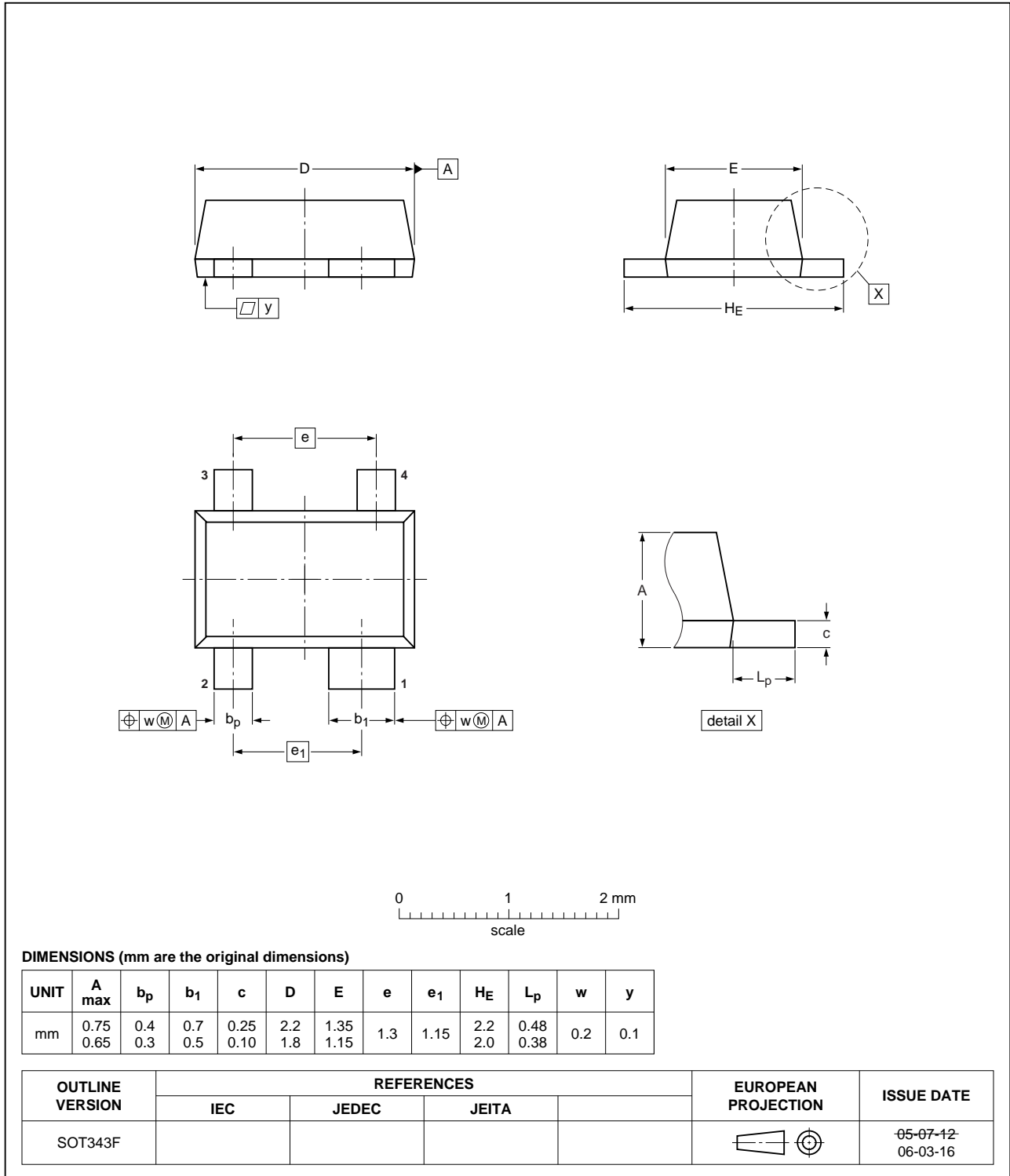


Fig 11. Package outline SOT343F

9. Abbreviations

Table 8. Abbreviations

| Acronym | Description |
|---------|--|
| AMR | Automatic Meter Reading |
| CDMA | Code Division Multiple Access |
| DC | Direct Current |
| DRO | Dielectric Resonator Oscillator |
| FM | Frequency Modulation |
| GPS | Global Positioning System |
| LNA | Low Noise Amplifier |
| LNB | Low Noise Block |
| LTE | Long Term Evolution |
| NPN | Negative-Positive-Negative |
| RF | Radio Frequency |
| RKE | Remote Keyless Entry |
| UMTS | Universal Mobile Telecommunications System |
| WLAN | Wireless Local Area Network |

10. Revision history

Table 9. Revision history

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|-------------|--------------|--------------------|---------------|------------|
| BFU630F v.1 | 20101215 | Product data sheet | - | - |

11. Legal information

11.1 Data sheet status

| Document status ^{[1][2]} | Product status ^[3] | Definition |
|-----------------------------------|-------------------------------|---|
| Objective [short] data sheet | Development | This document contains data from the objective specification for product development. |
| Preliminary [short] data sheet | Qualification | This document contains data from the preliminary specification. |
| Product [short] data sheet | Production | This document contains the product specification. |

[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".

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