



# BFU550X

NPN wideband silicon RF transistor

Rev. 2 — 12 April 2019

Product data sheet

## 1 Product profile

### 1.1 General description

NPN silicon RF transistor for high speed, low noise applications in a plastic, 4-pin dual-emitter SOT143B package.

The BFU550X is part of the BFU5 family of transistors, suitable for small signal to medium power applications up to 2 GHz.

### 1.2 Features and benefits

- Low noise, high breakdown RF transistor
- AEC-Q101 qualified
- Minimum noise figure ( $NF_{min}$ ) = 0.75 dB at 900 MHz
- Maximum stable gain 21.5 dB at 900 MHz
- 11 GHz  $f_T$  silicon technology

### 1.3 Applications

- Applications requiring high supply voltages and high breakdown voltages
- Broadband amplifiers up to 2 GHz
- Low noise amplifiers for ISM applications
- ISM band oscillators

### 1.4 Quick reference data

Table 1. Quick reference data

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

| Symbol    | Parameter                 | Conditions  | Min | Typ  | Max | Unit |
|-----------|---------------------------|---|-----|------|-----|------|
| $V_{CB}$  | collector-base voltage    | open emitter  | -   | -    | 24  | V    |
| $V_{CE}$  | collector-emitter voltage | open base   | -   | -    | 12  | V    |
|           |                           | shorted base  | -   | -    | 24  | V    |
| $V_{EB}$  | emitter-base voltage      | open collector  | -   | -    | 2   | V    |
| $I_C$     | collector current         |   | -   | 15   | 50  | mA   |
| $P_{tot}$ | total power dissipation   | $T_{sp} \leq 87\text{ °C}$                                    | [1] | -    | 450 | mW   |
| $h_{FE}$  | DC current gain           | $I_C = 15\text{ mA}; V_{CE} = 8\text{ V}$                     | 60  | 95   | 200 |      |
| $C_c$     | collector capacitance     | $V_{CB} = 8\text{ V}; f = 1\text{ MHz}$                       | -   | 0.72 | -   | pF   |
| $f_T$     | transition frequency      | $I_C = 25\text{ mA}; V_{CE} = 8\text{ V}; f = 900\text{ MHz}$ | -   | 11   | -   | GHz  |

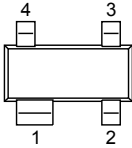
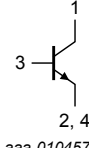


| Symbol       | Parameter                             | Conditions   | Min   | Typ  | Max | Unit |
|--------------|---------------------------------------|--|-------|------|-----|------|
| $G_{p(max)}$ | maximum power gain                    | $I_C = 15 \text{ mA}; V_{CE} = 8 \text{ V}; f = 900 \text{ MHz}$                         | [2] - | 21.5 | -   | dB   |
| $NF_{min}$   | minimum noise figure                  | $I_C = 1 \text{ mA}; V_{CE} = 8 \text{ V}; f = 900 \text{ MHz}; \Gamma_S = \Gamma_{opt}$ | -     | 0.75 | -   | dB   |
| $P_{L(1dB)}$ | output power at 1 dB gain compression | $I_C = 25 \text{ mA}; V_{CE} = 8 \text{ V}; Z_S = Z_L = 50 \Omega; f = 900 \text{ MHz}$  | -     | 13.5 | -   | dBm  |

[1]  $T_{sp}$  is the temperature at the solder point of the collector lead.  
 [2] If  $K > 1$  then  $G_{p(max)}$  is the maximum power gain. If  $K < 1$  then  $G_{p(max)} = MSG$ .

## 2 Pinning information

Table 2. Discrete pinning

| Pin | Description | Simplified outline  | Graphic symbol  |
|-----|-------------|---|---|
| 1   | collector   |  | <br>aaa-010457 |
| 2   | emitter     |   |   |
| 3   | base        |   |   |
| 4   | emitter     |   |   |

## 3 Ordering information

Table 3. Ordering information

| Type number | Package |  | Version |
|-------------|---------|--|---------|
|             | Name    | Description  |         |
| BFU550X     | -       | plastic surface-mounted package; 4 leads                     | SOT143B |
| OM7963      | -       | Customer evaluation kit for BFU520X, BFU530X and BFU550X [1] | -       |

[1] The customer evaluation kit contains the following:

- Unpopulated RF amplifier Printed-Circuit Board (PCB)
  - Unpopulated RF amplifier Printed-Circuit Board (PCB) with emitter degeneration
    - Four SMA connectors for fitting unpopulated Printed-Circuit Board (PCB)
    - BFU520X, BFU530X and BFU550X samples
    - USB stick with data sheets, application notes, models, S-parameter and noise files

## 4 Marking

Table 4. Marking

| Type number | Marking | Description              |
|-------------|---------|--------------------------|
| BFU550X     | *TG     | * = t : made in Malaysia |
|             |         | * = w : made in China    |

## 5 Design support

**Table 5. Available design support**

Download from the BFU550X product information page on <http://www.nxp.com>.

| Support item                            | Available | Remarks   |
|---|-----------|---|
| Device models for Agilent EEsof EDA ADS | yes       | Based on Mextram device model.                                      |
| SPICE model                             | yes       | Based on Gummel-Poon device model.                                  |
| S-parameters                            | yes       |   |
| Noise parameters                        | yes       |   |
| Customer evaluation kit                 | yes       | See <a href="#">Section 3</a> and <a href="#">Section 10</a> .      |
| Solder pattern                          | yes       |   |
| Application notes                       | yes       | See <a href="#">Section 10.1</a> and <a href="#">Section 10.2</a> . |

## 6 Limiting values

**Table 6. Limiting values**

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

| Symbol           | Parameter                       | Conditions  | Min | Max  | Unit |
|------------------|---------------------------------|---|-----|------|------|
| V <sub>CB</sub>  | collector-base voltage          | open emitter  | -   | 30   | V    |
| V <sub>CE</sub>  | collector-emitter voltage       | open base   | -   | 16   | V    |
|                  |                                 | shorted base  | -   | 30   | V    |
| V <sub>EB</sub>  | emitter-base voltage            | open collector  | -   | 3    | V    |
| I <sub>C</sub>   | collector current               |   | -   | 80   | mA   |
| T <sub>stg</sub> | storage temperature             |   | -65 | +150 | °C   |
| V <sub>ESD</sub> | electrostatic discharge voltage | Human Body Model (HBM) According to JEDEC standard 22-A114E     | -   | ±150 | V    |
|                  |                                 | Charged Device Model (CDM) According to JEDEC standard 22-C101B | -   | ±2   | kV   |

## 7 Recommended operating conditions

**Table 7. Characteristics**

| Symbol          | Parameter                 | Conditions            | Min | Typ | Max  | Unit |
|-----------------|---------------------------|-----------------------|-----|-----|------|------|
| V <sub>CB</sub> | collector-base voltage    | open emitter          | -   | -   | 24   | V    |
| V <sub>CE</sub> | collector-emitter voltage | open base             | -   | -   | 12   | V    |
|                 |                           | shorted base          | -   | -   | 24   | V    |
| V <sub>EB</sub> | emitter-base voltage      | open collector        | -   | -   | 2    | V    |
| I <sub>C</sub>  | collector current         |                       | -   | -   | 50   | mA   |
| P <sub>i</sub>  | input power               | Z <sub>S</sub> = 50 Ω | -   | -   | 10   | dBm  |
| T <sub>j</sub>  | junction temperature      |                       | -40 | -   | +150 | °C   |

| Symbol           | Parameter               | Conditions              | Min | Typ | Max | Unit |
|------------------|-------------------------|-------------------------|-----|-----|-----|------|
| P <sub>tot</sub> | total power dissipation | T <sub>sp</sub> ≤ 87 °C | [1] | -   | 450 | mW   |

[1] T<sub>sp</sub> is the temperature at the solder point of the controller lead.

## 8 Thermal characteristics

**Table 8. Thermal characteristics**

| Symbol                | Parameter  | Conditions | Typ     | Unit |
|-----------------------|--|------------|---------|------|
| R <sub>th(j-sp)</sub> | thermal resistance from junction to solder point |            | [1] 140 | K/W  |

[1] T<sub>sp</sub> is the temperature at the solder point of the collector lead.

T<sub>sp</sub> has the following relation to the ambient temperature T<sub>amb</sub>:

$$T_{sp} = T_{amb} + P \times R_{th(sp-a)}$$

With P being the power dissipation and R<sub>th(sp-a)</sub> being the thermal resistance between the solder point and ambient. R<sub>th(sp-a)</sub> is determined by the heat transfer properties in the application.

The heat transfer properties are set by the application board materials, the board layout and the environment e.g. housing.

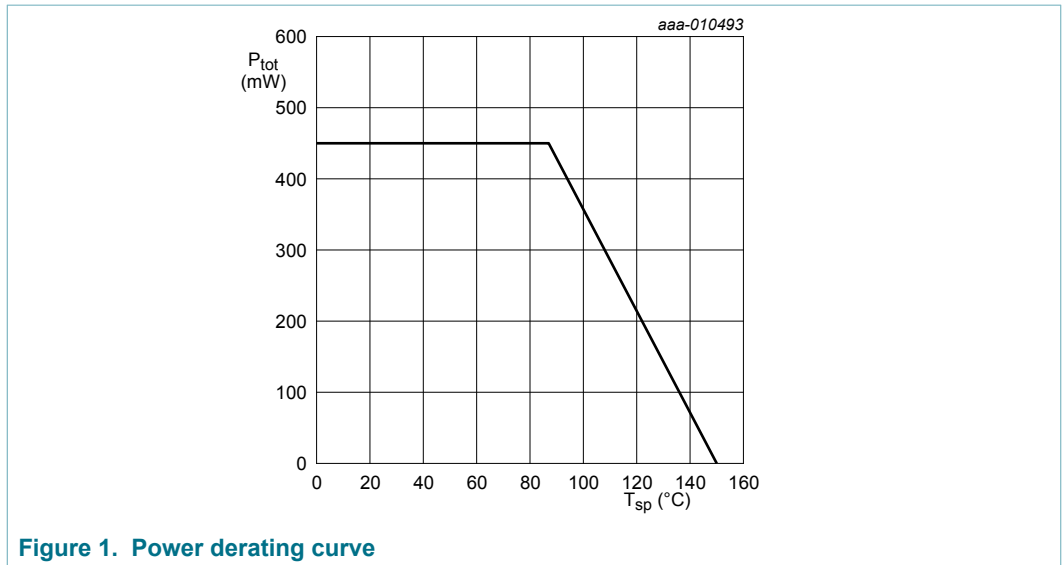


Figure 1. Power derating curve

## 9 Characteristics

**Table 9. Characteristics**

T<sub>amb</sub> = 25 °C unless otherwise specified

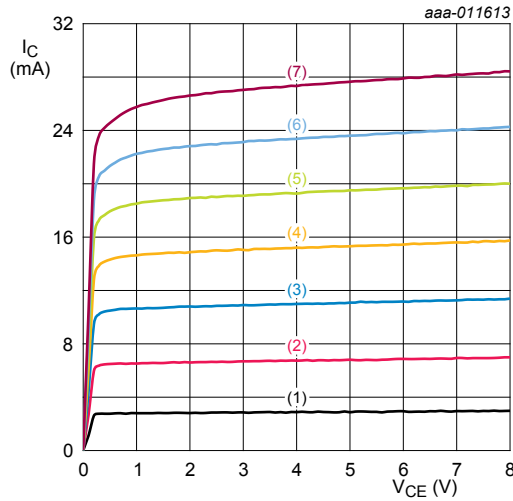
| Symbol               | Parameter                           | Conditions                                     | Min | Typ | Max | Unit |
|----------------------|-------------------------------------|--|-----|-----|-----|------|
| V <sub>(BR)CBO</sub> | collector-base breakdown voltage    | I <sub>C</sub> = 100 nA; I <sub>E</sub> = 0 mA | 24  | -   | -   | V    |
| V <sub>(BR)CEO</sub> | collector-emitter breakdown voltage | I <sub>C</sub> = 150 nA; I <sub>B</sub> = 0 mA | 12  | -   | -   | V    |
| I <sub>C</sub>       | collector current                   |  | -   | 15  | 50  | mA   |
| I <sub>CBO</sub>     | collector-base cut-off current      | I <sub>E</sub> = 0 mA; V <sub>CB</sub> = 8 V   | -   | <1  | -   | nA   |

| Symbol       | Parameter             | Conditions   | Min | Typ  | Max | Unit |
|--------------|-----------------------|--|-----|------|-----|------|
| $h_{FE}$     | DC current gain       | $I_C = 15 \text{ mA}; V_{CE} = 8 \text{ V}$                          | 60  | 95   | 200 |      |
| $C_e$        | emitter capacitance   | $V_{EB} = 0.5 \text{ V}; f = 1 \text{ MHz}$                          | -   | 1.11 | -   | pF   |
| $C_{re}$     | feedback capacitance  | $V_{CE} = 8 \text{ V}; f = 1 \text{ MHz}$                            | -   | 0.41 | -   | pF   |
| $C_c$        | collector capacitance | $V_{CB} = 8 \text{ V}; f = 1 \text{ MHz}$                            | -   | 0.72 | -   | pF   |
| $f_T$        | transition frequency  | $I_C = 25 \text{ mA}; V_{CE} = 8 \text{ V}; f = 900 \text{ MHz}$     | -   | 11   | -   | GHz  |
| $G_{p(max)}$ | maximum power gain    | $f = 433 \text{ MHz}; V_{CE} = 8 \text{ V}$ [1]                      |     |      |     |      |
|              |                       | $I_C = 1 \text{ mA}$   | -   | 15   | -   | dB   |
|              |                       | $I_C = 15 \text{ mA}$  | -   | 25.5 | -   | dB   |
|              |                       | $I_C = 25 \text{ mA}$  | -   | 26.5 | -   | dB   |
|              |                       | $f = 900 \text{ MHz}; V_{CE} = 8 \text{ V}$ [1]                      |     |      |     |      |
|              |                       | $I_C = 1 \text{ mA}$   | -   | 12   | -   | dB   |
|              |                       | $I_C = 15 \text{ mA}$  | -   | 21.5 | -   | dB   |
|              |                       | $I_C = 25 \text{ mA}$  | -   | 22   | -   | dB   |
|              |                       | $f = 1800 \text{ MHz}; V_{CE} = 8 \text{ V}$ [1]                     |     |      |     |      |
|              |                       | $I_C = 1 \text{ mA}$   | -   | 10   | -   | dB   |
|              |                       | $I_C = 15 \text{ mA}$  | -   | 16   | -   | dB   |
|              |                       | $I_C = 25 \text{ mA}$  | -   | 15.5 | -   | dB   |
| $ s_{21} ^2$ | insertion power gain  | $f = 433 \text{ MHz}; V_{CE} = 8 \text{ V}$                          |     |      |     |      |
|              |                       | $I_C = 1 \text{ mA}$   | -   | 10   | -   | dB   |
|              |                       | $I_C = 15 \text{ mA}$  | -   | 23.5 | -   | dB   |
|              |                       | $I_C = 25 \text{ mA}$  | -   | 24   | -   | dB   |
|              |                       | $f = 900 \text{ MHz}; V_{CE} = 8 \text{ V}$                          |     |      |     |      |
|              |                       | $I_C = 1 \text{ mA}$   | -   | 8    | -   | dB   |
|              |                       | $I_C = 15 \text{ mA}$  | -   | 17.5 | -   | dB   |
|              |                       | $I_C = 25 \text{ mA}$  | -   | 18   | -   | dB   |
|              |                       | $f = 1800 \text{ MHz}; V_{CE} = 8 \text{ V}$                         |     |      |     |      |
|              |                       | $I_C = 1 \text{ mA}$   | -   | 4.5  | -   | dB   |
|              |                       | $I_C = 15 \text{ mA}$  | -   | 12   | -   | dB   |
|              |                       | $I_C = 25 \text{ mA}$  | -   | 12   | -   | dB   |
| $NF_{min}$   | minimum noise figure  | $f = 433 \text{ MHz}; V_{CE} = 8 \text{ V}; \Gamma_S = \Gamma_{opt}$ |     |      |     |      |
|              |                       | $I_C = 1 \text{ mA}$   | -   | 0.6  | -   | dB   |
|              |                       | $I_C = 15 \text{ mA}$  | -   | 0.9  | -   | dB   |
|              |                       | $I_C = 25 \text{ mA}$  | -   | 1.1  | -   | dB   |
|              |                       | $f = 900 \text{ MHz}; V_{CE} = 8 \text{ V}; \Gamma_S = \Gamma_{opt}$ |     |      |     |      |
|              |                       | $I_C = 1 \text{ mA}$   | -   | 0.75 | -   | dB   |
|              |                       | $I_C = 15 \text{ mA}$  | -   | 1    | -   | dB   |
|              |                       | $I_C = 25 \text{ mA}$  | -   | 1.2  | -   | dB   |

| Symbol              | Parameter                             | Conditions  | Min | Typ  | Max | Unit |
|---------------------|---------------------------------------|---|-----|------|-----|------|
|                     |                                       | f = 1800 MHz; V <sub>CE</sub> = 8 V; $\Gamma_S = \Gamma_{opt}$  |     |      |     |      |
|                     |                                       | I <sub>C</sub> = 1 mA   | -   | 1    | -   | dB   |
|                     |                                       | I <sub>C</sub> = 15 mA  | -   | 1.1  | -   | dB   |
|                     |                                       | I <sub>C</sub> = 25 mA  | -   | 1.3  | -   | dB   |
| G <sub>ass</sub>    | associated gain                       | f = 433 MHz; V <sub>CE</sub> = 8 V; $\Gamma_S = \Gamma_{opt}$   |     |      |     |      |
|                     |                                       | I <sub>C</sub> = 1 mA   | -   | 22.5 | -   | dB   |
|                     |                                       | I <sub>C</sub> = 15 mA  | -   | 25   | -   | dB   |
|                     |                                       | I <sub>C</sub> = 25 mA  | -   | 25.5 | -   | dB   |
|                     |                                       | f = 900 MHz; V <sub>CE</sub> = 8 V; $\Gamma_S = \Gamma_{opt}$   |     |      |     |      |
|                     |                                       | I <sub>C</sub> = 1 mA   | -   | 15   | -   | dB   |
|                     |                                       | I <sub>C</sub> = 15 mA  | -   | 19   | -   | dB   |
|                     |                                       | I <sub>C</sub> = 25 mA  | -   | 19.5 | -   | dB   |
|                     |                                       | f = 1800 MHz; V <sub>CE</sub> = 8 V; $\Gamma_S = \Gamma_{opt}$  |     |      |     |      |
|                     |                                       | I <sub>C</sub> = 1 mA   | -   | 9.5  | -   | dB   |
|                     |                                       | I <sub>C</sub> = 15 mA  | -   | 13.5 | -   | dB   |
|                     |                                       | I <sub>C</sub> = 25 mA  | -   | 14   | -   | dB   |
| P <sub>L(1dB)</sub> | output power at 1 dB gain compression | f = 433 MHz; V <sub>CE</sub> = 8 V; Z <sub>S</sub> = Z <sub>L</sub> = 50 Ω  |     |      |     |      |
|                     |                                       | I <sub>C</sub> = 15 mA  | -   | 9.5  | -   | dBm  |
|                     |                                       | I <sub>C</sub> = 25 mA  | -   | 13   | -   | dBm  |
|                     |                                       | f = 900 MHz; V <sub>CE</sub> = 8 V; Z <sub>S</sub> = Z <sub>L</sub> = 50 Ω  |     |      |     |      |
|                     |                                       | I <sub>C</sub> = 15 mA  | -   | 10   | -   | dBm  |
|                     |                                       | I <sub>C</sub> = 25 mA  | -   | 13.5 | -   | dBm  |
|                     |                                       | f = 1800 MHz; V <sub>CE</sub> = 8 V; Z <sub>S</sub> = Z <sub>L</sub> = 50 Ω   |     |      |     |      |
|                     |                                       | I <sub>C</sub> = 15 mA  | -   | 10   | -   | dBm  |
|                     |                                       | I <sub>C</sub> = 25 mA  | -   | 13.5 | -   | dBm  |
| IP <sub>3o</sub>    | output third-order intercept point    | f <sub>1</sub> = 433 MHz; f <sub>2</sub> = 434 MHz; V <sub>CE</sub> = 8 V; Z <sub>S</sub> = Z <sub>L</sub> = 50 Ω   |     |      |     |      |
|                     |                                       | I <sub>C</sub> = 15 mA  | -   | 19   | -   | dBm  |
|                     |                                       | I <sub>C</sub> = 25 mA  | -   | 22.5 | -   | dBm  |
|                     |                                       | f <sub>1</sub> = 900 MHz; f <sub>2</sub> = 901 MHz; V <sub>CE</sub> = 8 V; Z <sub>S</sub> = Z <sub>L</sub> = 50 Ω   |     |      |     |      |
|                     |                                       | I <sub>C</sub> = 15 mA  | -   | 20   | -   | dBm  |
|                     |                                       | I <sub>C</sub> = 25 mA  | -   | 23   | -   | dBm  |
|                     |                                       | f <sub>1</sub> = 1800 MHz; f <sub>2</sub> = 1801 MHz; V <sub>CE</sub> = 8 V; Z <sub>S</sub> = Z <sub>L</sub> = 50 Ω |     |      |     |      |
|                     |                                       | I <sub>C</sub> = 15 mA  | -   | 19.5 | -   | dBm  |
|                     |                                       | I <sub>C</sub> = 25 mA  | -   | 23   | -   | dBm  |

[1] If K > 1 then G<sub>p(max)</sub> is the maximum power gain. If K < 1 then G<sub>p(max)</sub> = MSG.

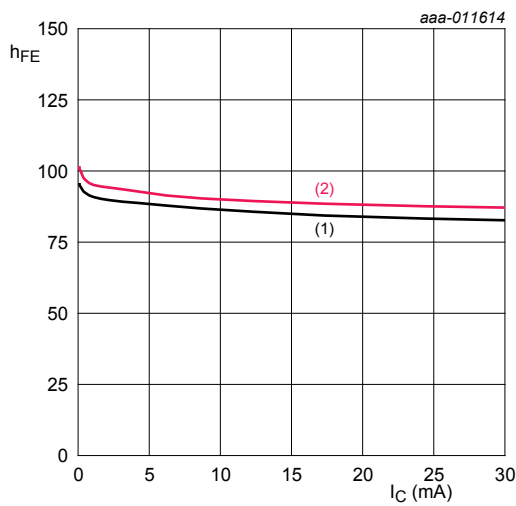
9.1 Graphs



$T_{amb} = 25\text{ }^\circ\text{C}$ .

1.  $I_B = 25\text{ }\mu\text{A}$
2.  $I_B = 75\text{ }\mu\text{A}$
3.  $I_B = 125\text{ }\mu\text{A}$
4.  $I_B = 175\text{ }\mu\text{A}$
5.  $I_B = 225\text{ }\mu\text{A}$
6.  $I_B = 275\text{ }\mu\text{A}$
7.  $I_B = 325\text{ }\mu\text{A}$

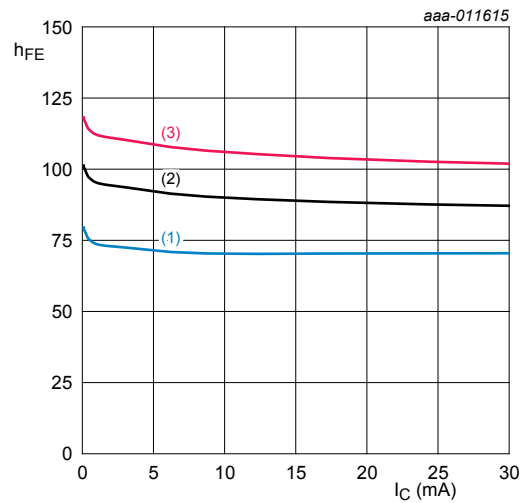
Figure 2. Collector current as a function of collector-emitter voltage; typical values



$T_{amb} = 25\text{ }^\circ\text{C}$ .

1.  $V_{CE} = 3.0\text{ V}$
2.  $V_{CE} = 8.0\text{ V}$

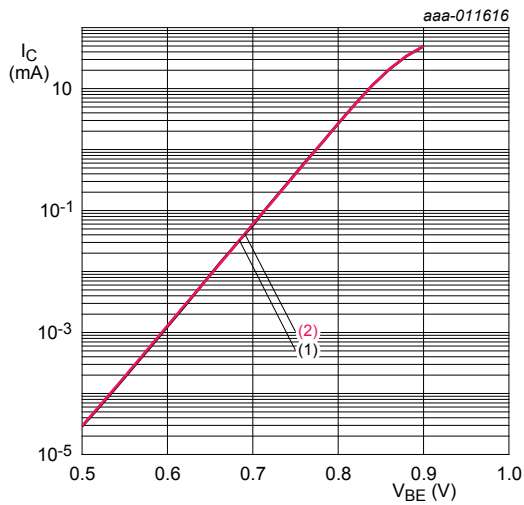
Figure 3. DC current gain as function of collector current; typical values



$V_{CE} = 8\text{ V}$ .

1.  $T_{amb} = -40\text{ }^\circ\text{C}$
2.  $T_{amb} = +25\text{ }^\circ\text{C}$
3.  $T_{amb} = +125\text{ }^\circ\text{C}$

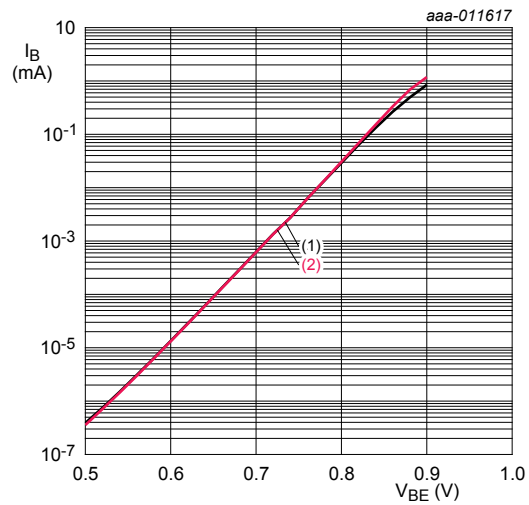
Figure 4. DC current gain as function of collector current; typical values



$T_{amb} = 25\text{ }^{\circ}\text{C}$ .

1.  $V_{CE} = 3.0\text{ V}$
2.  $V_{CE} = 8.0\text{ V}$

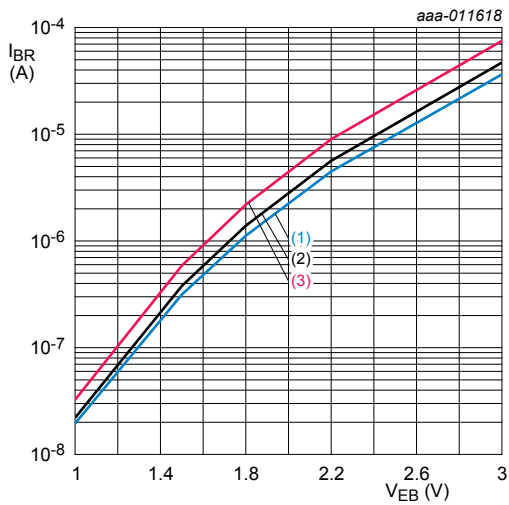
**Figure 5. Collector current as a function of base-emitter voltage; typical values**



$T_{amb} = 25\text{ }^{\circ}\text{C}$ .

1.  $V_{CE} = 3.0\text{ V}$
2.  $V_{CE} = 8.0\text{ V}$

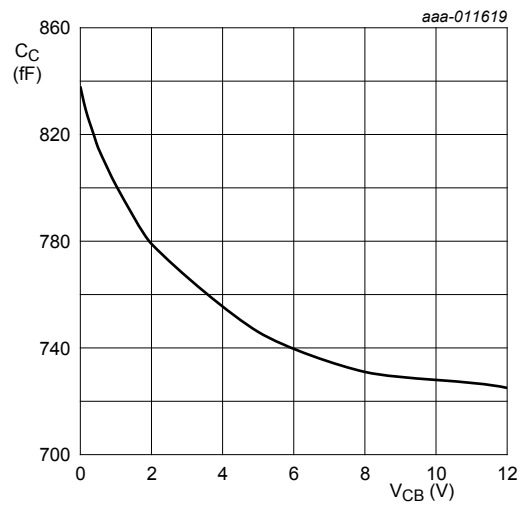
**Figure 6. Base current as a function of base-emitter voltage; typical values**



$V_{CE} = 3\text{ V}$ .

1.  $T_{amb} = -40\text{ }^{\circ}\text{C}$
2.  $T_{amb} = +25\text{ }^{\circ}\text{C}$
3.  $T_{amb} = +125\text{ }^{\circ}\text{C}$

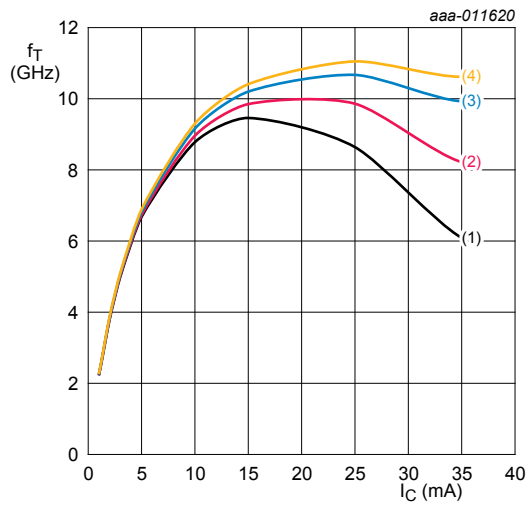
**Figure 7. Reverse base current as a function of emitter-base voltage; typical values**



$I_C = 0\text{ mA}$ ;  $f = 1\text{ MHz}$ ;  $T_{amb} = 25\text{ }^{\circ}\text{C}$ .

**Figure 8. Collector capacitance as a function of collector-base voltage; typical values**

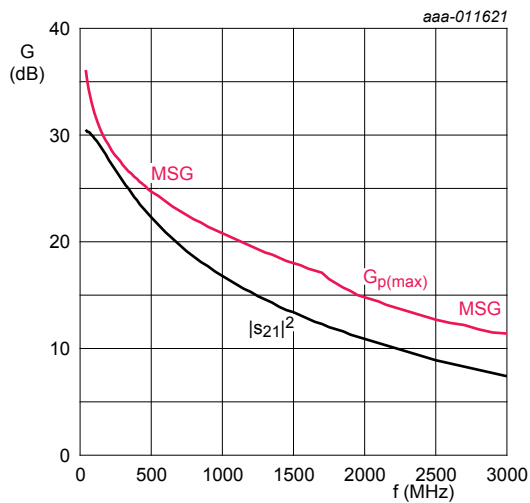




$T_{amb} = 25\text{ }^{\circ}\text{C}$ .

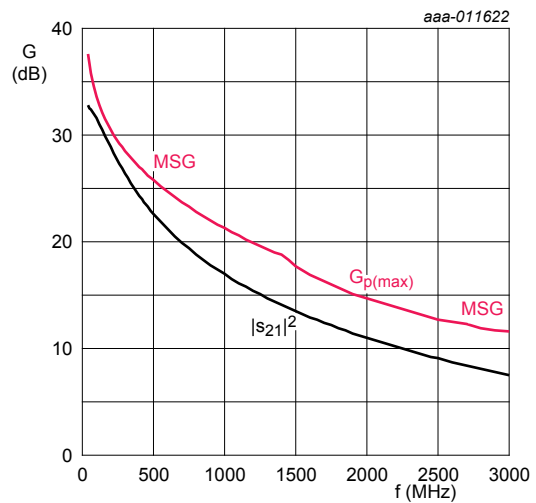
1.  $V_{CE} = 3.3\text{ V}$
2.  $V_{CE} = 5.0\text{ V}$
3.  $V_{CE} = 8.0\text{ V}$
4.  $V_{CE} = 12.0\text{ V}$

**Figure 9. Transition frequency as a function of collector current; typical values**



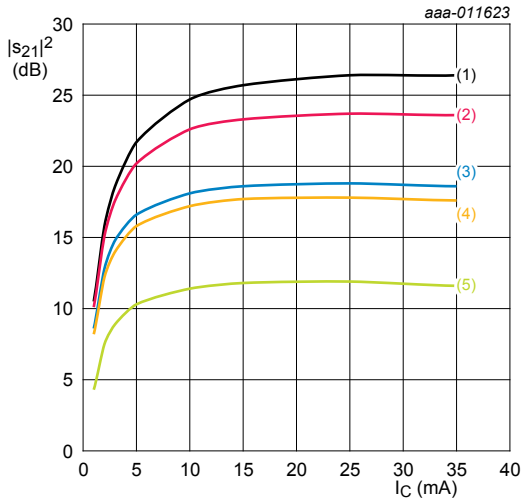
$I_C = 15\text{ mA}$ ;  $V_{CE} = 8\text{ V}$ ;  $T_{amb} = 25\text{ }^{\circ}\text{C}$ .

**Figure 10. Gain as a function of frequency; typical values**



$I_C = 25\text{ mA}$ ;  $V_{CE} = 8\text{ V}$ ;  $T_{amb} = 25\text{ }^{\circ}\text{C}$ .

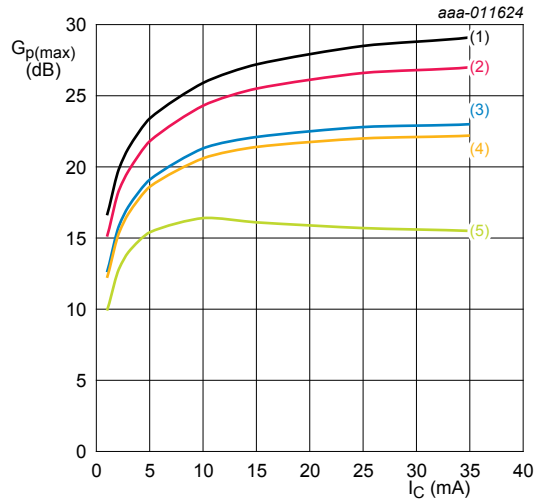
**Figure 11. Gain as a function of frequency; typical values**



$V_{CE} = 8\text{ V}; T_{amb} = 25\text{ }^\circ\text{C}.$

1.  $f = 300\text{ MHz}$
2.  $f = 433\text{ MHz}$
3.  $f = 800\text{ MHz}$
4.  $f = 900\text{ MHz}$
5.  $f = 1800\text{ MHz}$

**Figure 12. Insertion power gain as a function of collector current; typical values**

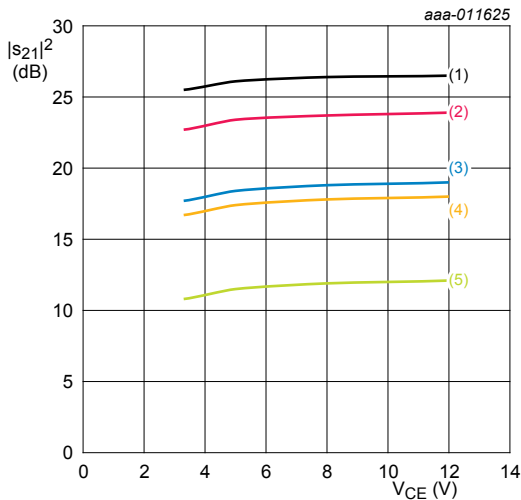


$V_{CE} = 8\text{ V}; T_{amb} = 25\text{ }^\circ\text{C}.$

If  $K > 1$  then  $G_{p(max)}$  = maximum power gain. If  $K < 1$  then  $G_{p(max)}$  = MSG.

1.  $f = 300\text{ MHz}$
2.  $f = 433\text{ MHz}$
3.  $f = 800\text{ MHz}$
4.  $f = 900\text{ MHz}$
5.  $f = 1800\text{ MHz}$

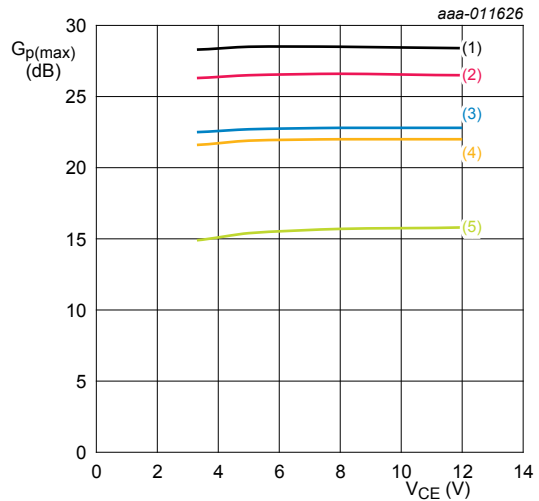
**Figure 13. Maximum power gain as a function of collector current; typical values**



$I_C = 25\text{ mA}; T_{amb} = 25\text{ }^\circ\text{C}.$

1.  $f = 300\text{ MHz}$
2.  $f = 433\text{ MHz}$
3.  $f = 800\text{ MHz}$
4.  $f = 900\text{ MHz}$
5.  $f = 1800\text{ MHz}$

**Figure 14. Insertion power gain as a function of collector-emitter voltage; typical values**

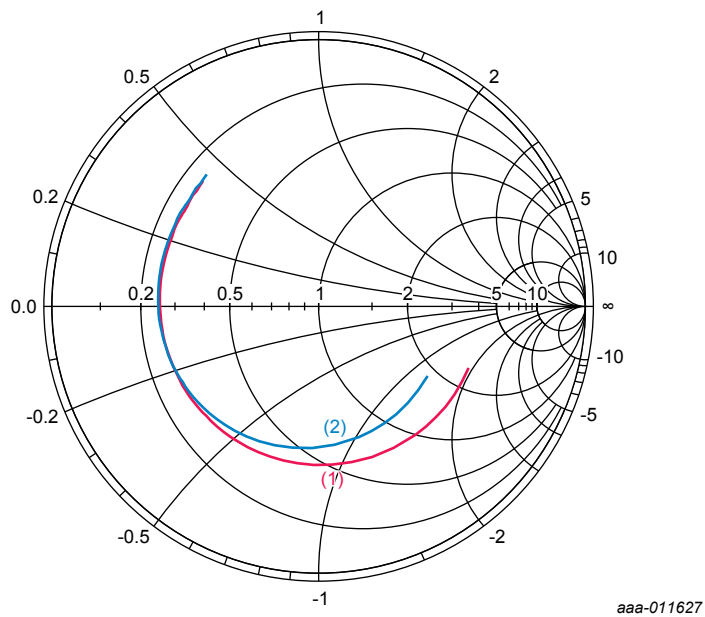


$I_C = 25\text{ mA}; T_{amb} = 25\text{ }^\circ\text{C}.$

If  $K > 1$  then  $G_{p(max)}$  = maximum power gain. If  $K < 1$  then  $G_{p(max)}$  = MSG.

1.  $f = 300\text{ MHz}$
2.  $f = 433\text{ MHz}$
3.  $f = 800\text{ MHz}$
4.  $f = 900\text{ MHz}$
5.  $f = 1800\text{ MHz}$

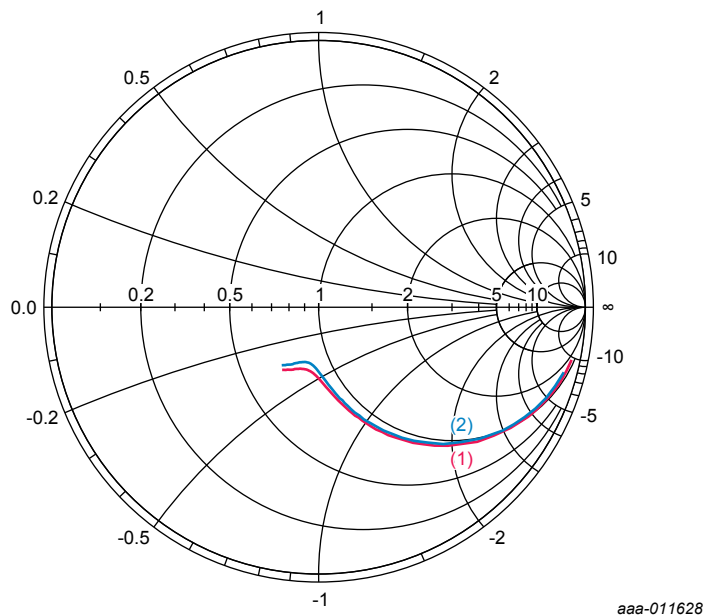
**Figure 15. Maximum power gain as a function of collector-emitter voltage; typical values**



$V_{CE} = 8\text{ V}; 40\text{ MHz} \leq f \leq 3\text{ GHz}.$

1.  $I_C = 15\text{ mA}$
2.  $I_C = 25\text{ mA}$

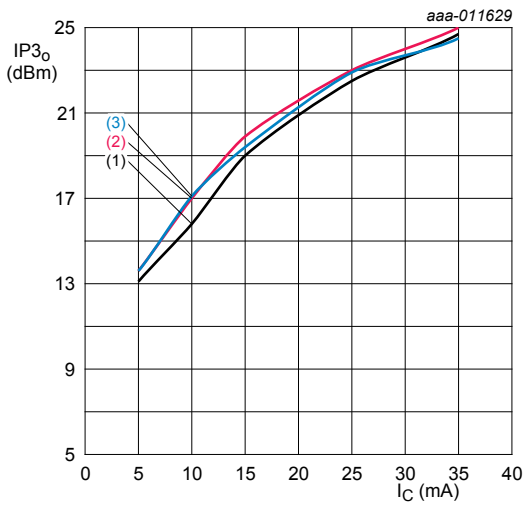
**Figure 16. Input reflection coefficient ( $s_{11}$ ); typical values**



$V_{CE} = 8\text{ V}; 40\text{ MHz} \leq f \leq 3\text{ GHz}.$

1.  $I_C = 15\text{ mA}$
2.  $I_C = 25\text{ mA}$

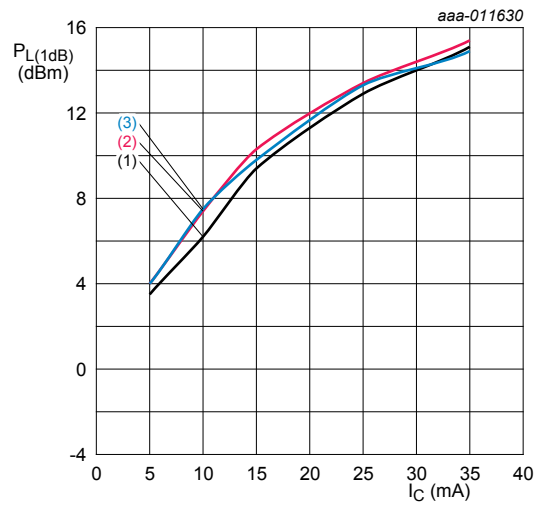
**Figure 17. Output reflection coefficient ( $s_{22}$ ); typical values**



$V_{CE} = 8\text{ V}$ ;  $T_{amb} = 25\text{ }^{\circ}\text{C}$ .

1.  $f_1 = 433\text{ MHz}$ ;  $f_2 = 434\text{ MHz}$
2.  $f_1 = 900\text{ MHz}$ ;  $f_2 = 901\text{ MHz}$
3.  $f_1 = 1800\text{ MHz}$ ;  $f_2 = 1801\text{ MHz}$

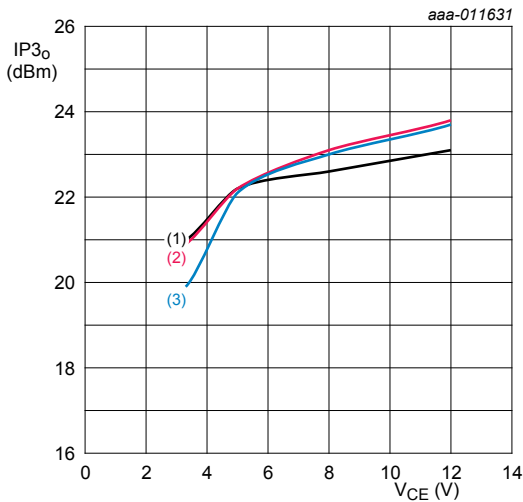
**Figure 18. Output third-order intercept point as a function of collector current; typical values**



$V_{CE} = 8\text{ V}$ ;  $T_{amb} = 25\text{ }^{\circ}\text{C}$ .

1.  $f = 433\text{ MHz}$
2.  $f = 900\text{ MHz}$
3.  $f = 1800\text{ MHz}$

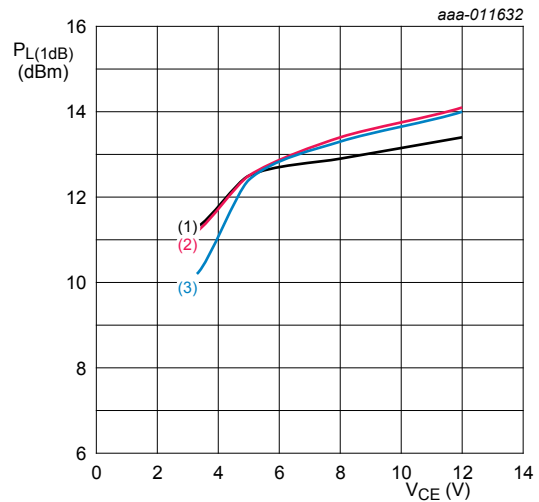
**Figure 19. Output power at 1 dB gain compression as a function of collector current; typical values**



$I_C = 25\text{ mA}$ ;  $T_{amb} = 25\text{ }^{\circ}\text{C}$ .

1.  $f_1 = 433\text{ MHz}$ ;  $f_2 = 434\text{ MHz}$
2.  $f_1 = 900\text{ MHz}$ ;  $f_2 = 901\text{ MHz}$
3.  $f_1 = 1800\text{ MHz}$ ;  $f_2 = 1801\text{ MHz}$

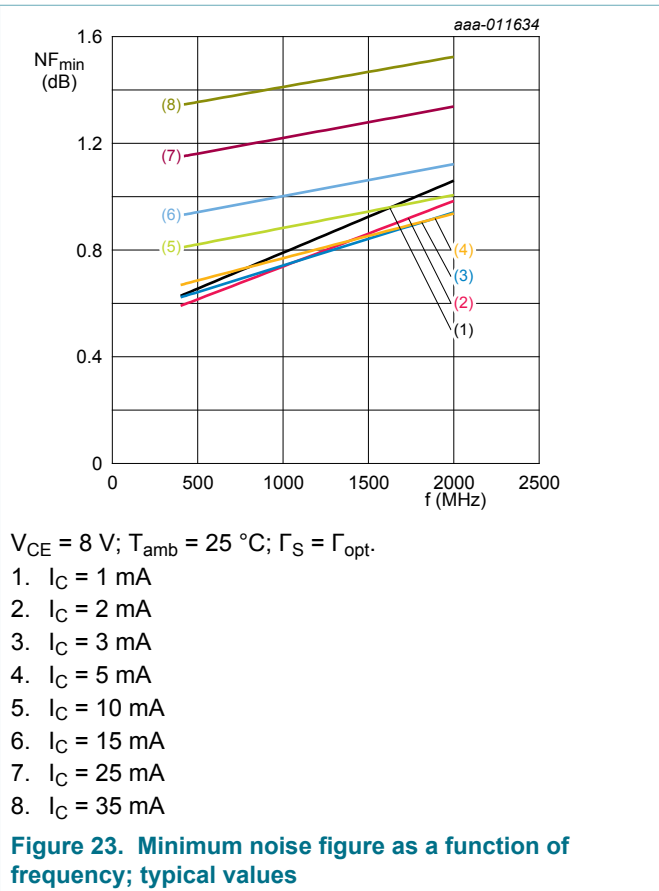
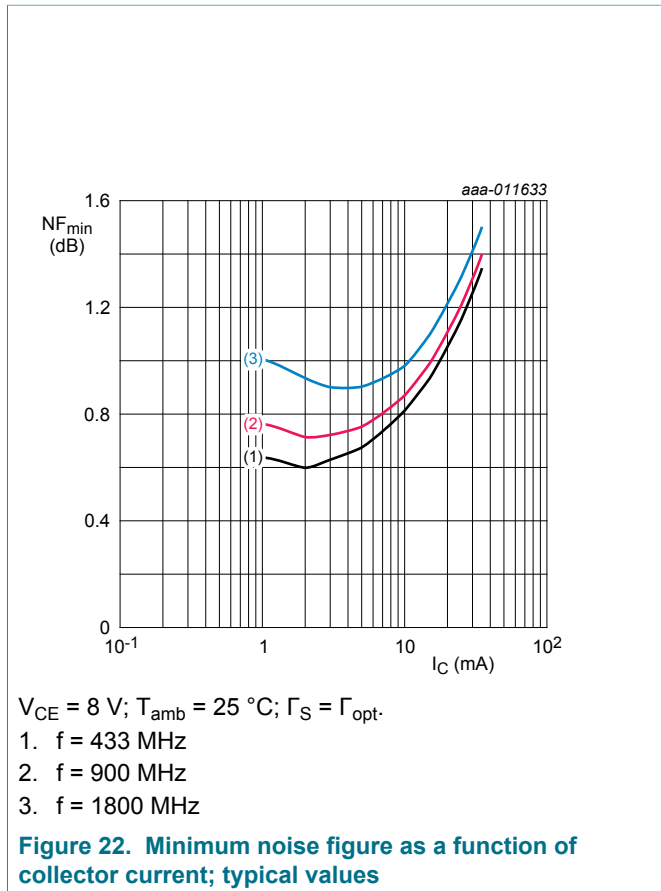
**Figure 20. Output third-order intercept point as a function of collector-emitter voltage; typical values**

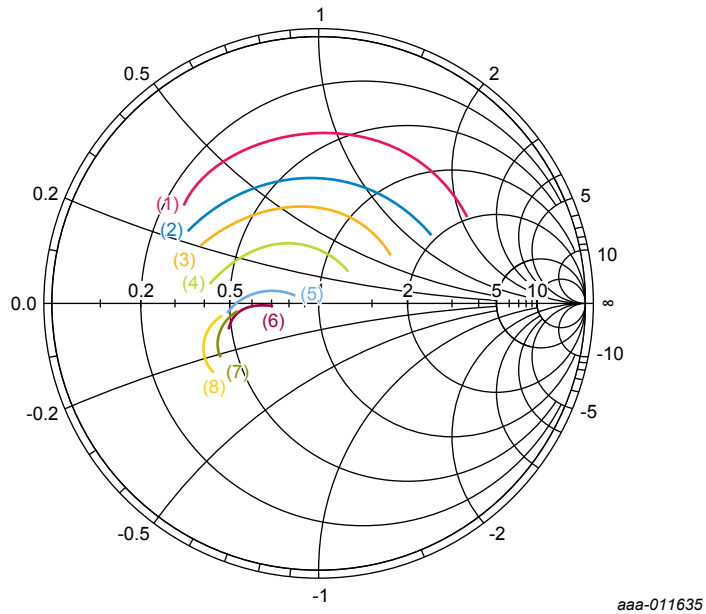


$I_C = 25\text{ mA}$ ;  $T_{amb} = 25\text{ }^{\circ}\text{C}$ .

1.  $f = 433\text{ MHz}$
2.  $f = 900\text{ MHz}$
3.  $f = 1800\text{ MHz}$

**Figure 21. Output power at 1 dB gain compression as a function of collector-emitter voltage; typical values**





$V_{CE} = 8 \text{ V}; 400 \text{ MHz} \leq f \leq 2 \text{ GHz}.$

- 1.  $I_C = 1 \text{ mA}$
- 2.  $I_C = 2 \text{ mA}$
- 3.  $I_C = 3 \text{ mA}$
- 4.  $I_C = 5 \text{ mA}$
- 5.  $I_C = 10 \text{ mA}$
- 6.  $I_C = 15 \text{ mA}$
- 7.  $I_C = 25 \text{ mA}$
- 8.  $I_C = 35 \text{ mA}$

**Figure 24. Optimum reflection coefficient ( $\Gamma_{opt}$ ); typical values**

## 10 Application information

More information about the following application example can be found in the application notes. See [Section 5 "Design support"](#).

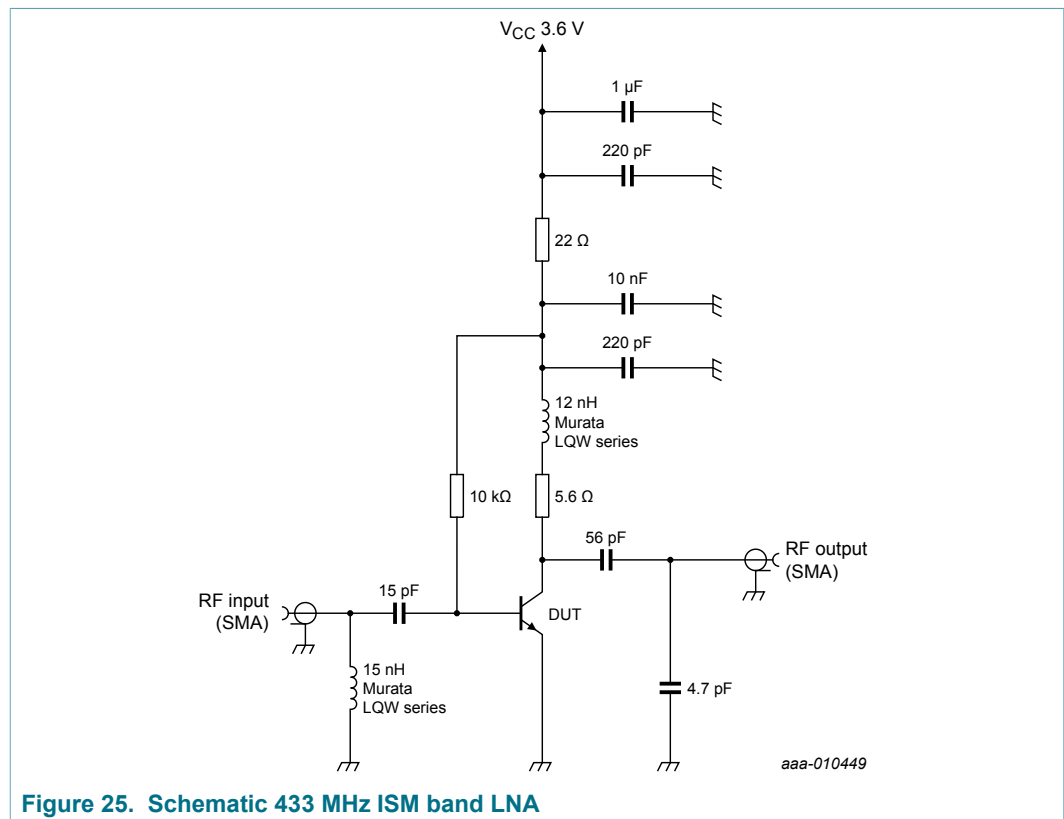
The following application example can be implemented using the evaluation kit. See [Section 3 "Ordering information"](#) for the order type number.

The following application example can be simulated using the simulation package. See [Section 5 "Design support"](#).

### 10.1 Application example: 433 ISM band LNA

433 ISM band LNA, optimized for low noise.

More detailed information of the application example can be found in the application note: [AN11437](#).



**Figure 25. Schematic 433 MHz ISM band LNA**

Remark: fine tuning of components may be required depending on PCB parasitics.

**Table 10. Application performance data at 433 MHz**

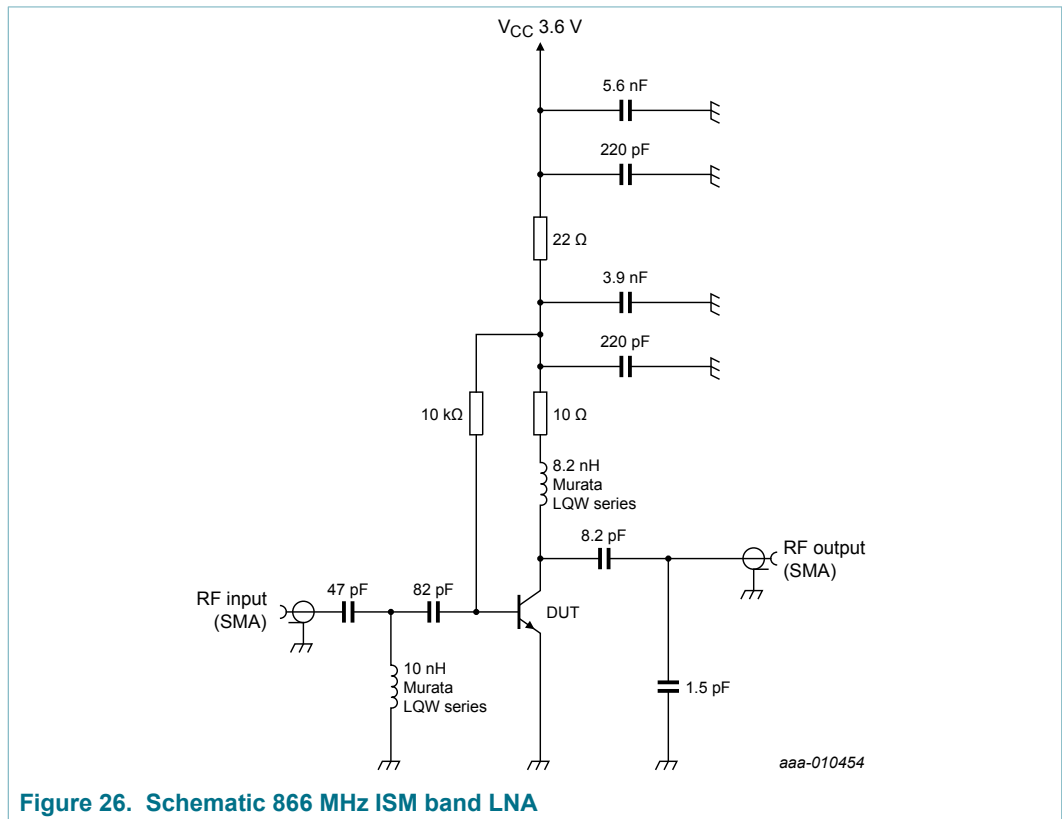
$I_{CC} = 20 \text{ mA}$ ;  $V_{CC} = 3.6 \text{ V}$

| Symbol           | Parameter                          | Conditions  | Min | Typ | Max | Unit |
|------------------|------------------------------------|---|-----|-----|-----|------|
| $ s_{21} ^2$     | insertion power gain               |   | -   | 21  | -   | dB   |
| NF               | noise figure                       |   | -   | 1.3 | -   | dB   |
| IP <sub>3o</sub> | output third-order intercept point | $f_1 = 433.1 \text{ MHz}$ ; $f_2 = 433.2 \text{ MHz}$ ; $P_1 = -30 \text{ dBm per carrier}$ | -   | 19  | -   | dBm  |

**10.2 Application example: 866 ISM band LNA**

866 ISM band LNA, optimized for low noise.

More detailed information of the application example can be found in the application note: AN11438.



**Figure 26. Schematic 866 MHz ISM band LNA**

Remark: fine tuning of components maybe required depending on PCB parasitics.

**Table 11. Application performance data at 866 MHz**

$I_{CC} = 20\text{ mA}$ ;  $V_{CC} = 3.6\text{ V}$

| Symbol           | Parameter                          | Conditions   | Min | Typ | Max | Unit |
|------------------|------------------------------------|--|-----|-----|-----|------|
| $ S_{21} ^2$     | insertion power gain               |  | -   | 15  | -   | dB   |
| NF               | noise figure                       |  | -   | 1.4 | -   | dB   |
| IP3 <sub>o</sub> | output third-order intercept point | $f_1 = 866.1\text{ MHz}$ ; $f_2 = 866.2\text{ MHz}$ ; $P_1 = -30\text{ dBm per carrier}$ | -   | 19  | -   | dBm  |



11 Package outline

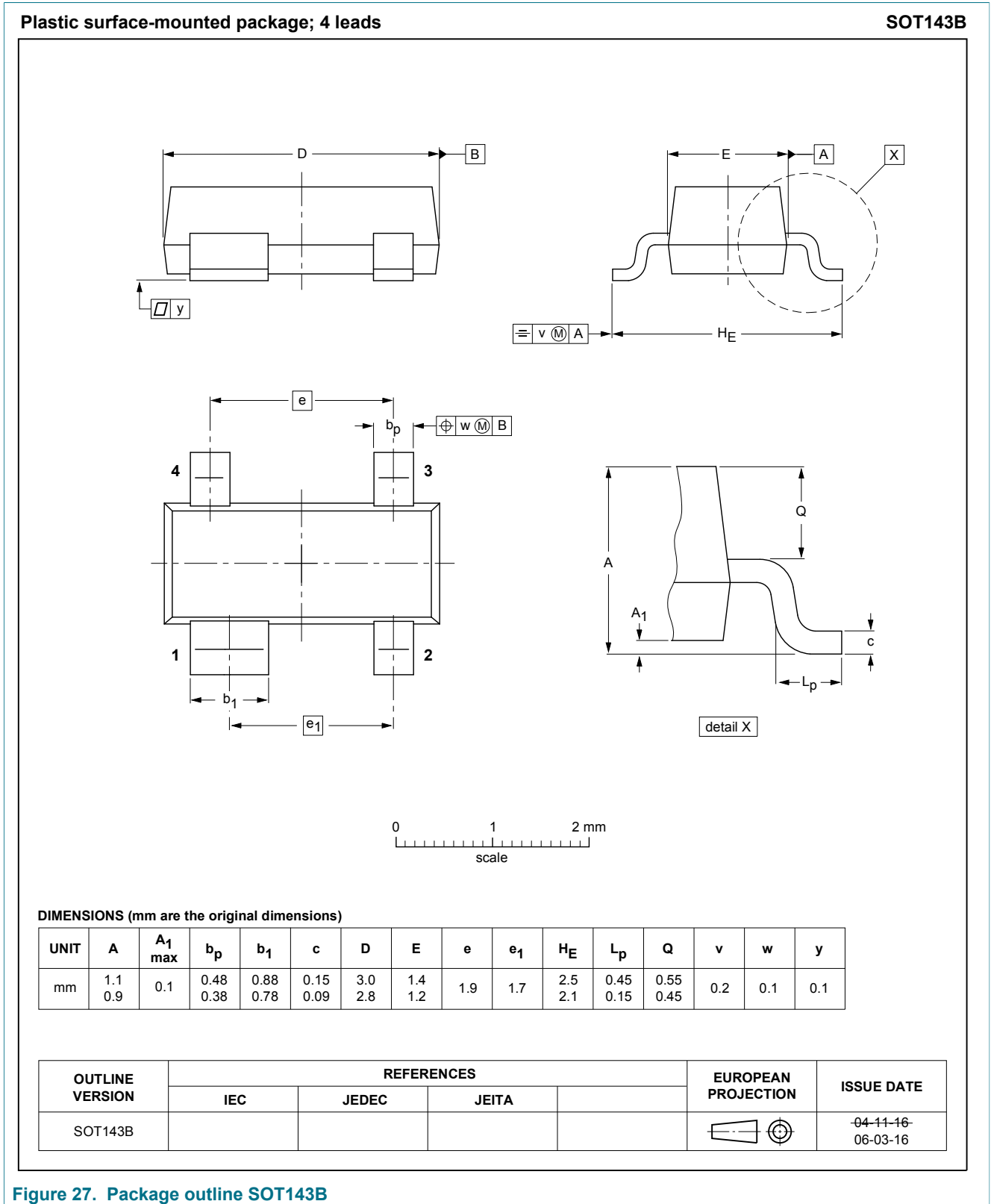



Figure 27. Package outline SOT143B

## 12 Handling information

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

## 13 Abbreviations

**Table 12. Abbreviations**

| Acronym | Description                         |
|---------|-------------------------------------|
| AEC     | automotive electronics council      |
| ISM     | industrial, scientific, and medical |
| LNA     | low-noise amplifier                 |
| MSG     | maximum stable gain                 |
| NPN     | negative-positive-negative          |
| SMA     | SubMiniature version A              |

## 14 Revision history

**Table 13. Revision history**

| Document ID  | Release date  | Data sheet status  | Change notice | Supersedes  |
|--------------|---|--------------------|---------------|-------------|
| BFU550X v.2  | 20190412  | Product data sheet | -             | BFU550X v.1 |
| modification | <ul style="list-style-type: none"> <li>Adapted Schematic 866 MHz ISM band LNA. Biasing on the schematic is adapted according the EVB to do the RF/DC. Connection of 10 K resistor moved to the other side of the 82 pF capacitor</li> </ul> |                    |               |             |
| BFU550X v.1  | 20140305  | Product data sheet | -             | -           |

## 15 Legal information

### 15.1 Data sheet status

| Document status <sup>[1][2]</sup> | Product status <sup>[3]</sup> | 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".

[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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