

# BFU530XR

NPN wideband silicon RF transistor

Rev. 1 — 5 March 2014

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 SOT143R package.

The BFU530XR 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 ( $NF_{min}$ ) = 0.65 dB at 900 MHz
- Maximum stable gain 21 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         |   | -   | 10   | 40  | mA   |
| $P_{tot}$ | total power dissipation   | $T_{sp} \leq 87\text{ °C}$ [1]                                      | -   | -    | 450 | mW   |
| $h_{FE}$  | DC current gain           | $I_C = 10\text{ mA}$ ; $V_{CE} = 8\text{ V}$                        | 60  | 95   | 200 |      |
| $C_c$     | collector capacitance     | $V_{CB} = 8\text{ V}$ ; $f = 1\text{ MHz}$                          | -   | 0.36 | -   | pF   |
| $f_T$     | transition frequency      | $I_C = 15\text{ mA}$ ; $V_{CE} = 8\text{ V}$ ; $f = 900\text{ MHz}$ | -   | 11   | -   | GHz  |



**Table 1. Quick reference data ...continued**

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

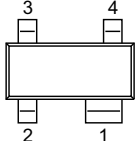
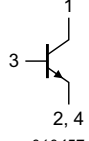
| Symbol       | Parameter                             | Conditions   | Min | Typ  | Max | Unit |
|--------------|---------------------------------------|--|-----|------|-----|------|
| $G_{p(max)}$ | maximum power gain                    | $I_C = 10\text{ mA}$ ; $V_{CE} = 8\text{ V}$ ; $f = 900\text{ MHz}$                                  | -   | 21   | -   | dB   |
| $NF_{min}$   | minimum noise figure                  | $I_C = 1\text{ mA}$ ; $V_{CE} = 8\text{ V}$ ; $f = 900\text{ MHz}$ ; $\Gamma_S = \Gamma_{opt}$       | -   | 0.65 | -   | dB   |
| $P_{L(1dB)}$ | output power at 1 dB gain compression | $I_C = 15\text{ mA}$ ; $V_{CE} = 8\text{ V}$ ; $Z_S = Z_L = 50\text{ }\Omega$ ; $f = 900\text{ MHz}$ | -   | 10.5 | -   | 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   |  |  |
| 2   | emitter     |  |  |
| 3   | base        |  |  |
| 4   | emitter     |  |  |

## 3. Ordering information

**Table 3. Ordering information**

| Type number | Package |   | Version |
|-------------|---------|---|---------|
|             | Name    | Description   |         |
| BFU530XR    | -       | plastic surface-mounted package; reverse pinning; 4 leads                       | SOT143R |
| OM7964      | -       | Customer evaluation kit for BFU520XR, BFU530XR and BFU550XR <a href="#">[1]</a> | -       |

[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)
- BFU520XR, BFU530XR and BFU550XR samples
- USB stick with data sheets, application notes, models, S-parameter and noise files

## 4. Marking

**Table 4. Marking**

| Type number | Marking | Description              |
|-------------|---------|--------------------------|
| BFU530XR    | *TK     | * = t : made in Malaysia |
|             |         | * = w : made in China    |

## 5. Design support

**Table 5. Available design support**

Download from the BFU530XR 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 |
|-----------|---------------------------------|---|-----|------|------|
| $V_{CB}$  | collector-base voltage          | open emitter  | -   | 30   | V    |
| $V_{CE}$  | collector-emitter voltage       | open base   | -   | 16   | V    |
|           |                                 | shorted base  | -   | 30   | V    |
| $V_{EB}$  | emitter-base voltage            | open collector  | -   | 3    | V    |
| $I_C$     | collector current               |   | -   | 65   | mA   |
| $T_{stg}$ | storage temperature             |   | -65 | +150 | °C   |
| $V_{ESD}$ | 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 |
|-----------|---------------------------|-----------------------------|-----|-----|------|------|
| $V_{CB}$  | 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         |                             | -   | -   | 40   | mA   |
| $P_i$     | input power               | $Z_S = 50 \Omega$           | -   | -   | 10   | dBm  |
| $T_j$     | junction temperature      |                             | -40 | -   | +150 | °C   |
| $P_{tot}$ | total power dissipation   | $T_{sp} \leq 87 \text{ °C}$ | [1] | -   | 450  | mW   |

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

## 8. Thermal characteristics

**Table 8. Thermal characteristics**

| Symbol         | Parameter  | Conditions | Typ     | Unit |
|----------------|--|------------|---------|------|
| $R_{th(j-sp)}$ | thermal resistance from junction to solder point |            | [1] 140 | K/W  |

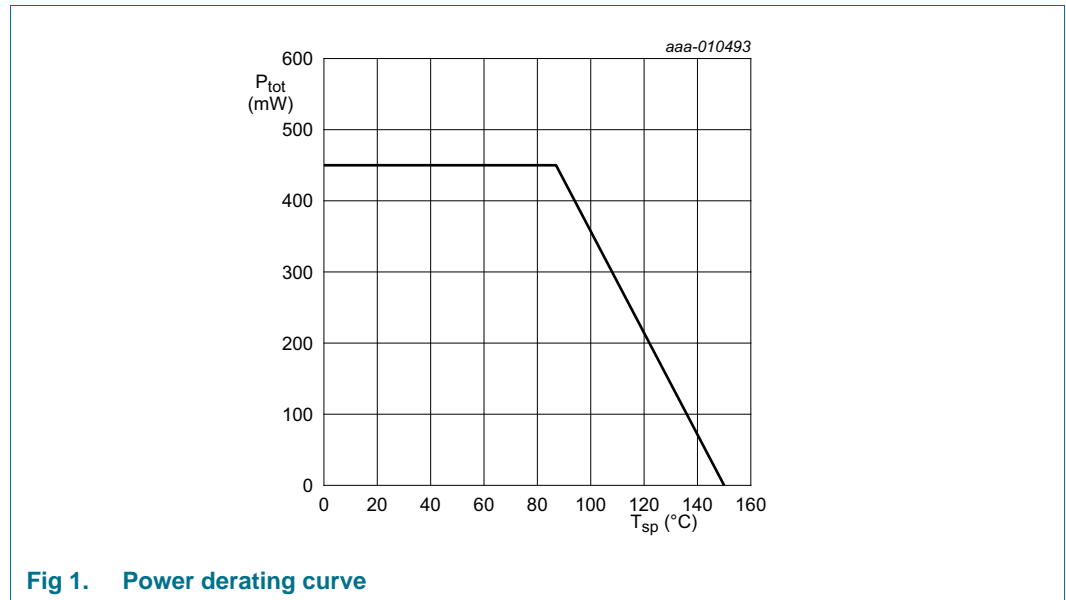
[1]  $T_{sp}$  is the temperature at the solder point of the collector lead.

$T_{sp}$  has the following relation to the ambient temperature  $T_{amb}$ :

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

With P being the power dissipation and  $R_{th(sp-a)}$  being the thermal resistance between the solder point and ambient.  $R_{th(sp-a)}$  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.



**Fig 1. Power derating curve**

## 9. Characteristics

**Table 9. Characteristics**

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

| Symbol        | Parameter                           | Conditions  | Min | Typ  | Max | Unit |
|---------------|-------------------------------------|---|-----|------|-----|------|
| $V_{(BR)CBO}$ | collector-base breakdown voltage    | $I_C = 100\text{ nA}; I_E = 0\text{ mA}$                      | 24  | -    | -   | V    |
| $V_{(BR)CEO}$ | collector-emitter breakdown voltage | $I_C = 150\text{ nA}; I_B = 0\text{ mA}$                      | 12  | -    | -   | V    |
| $I_C$         | collector current                   |   | -   | 10   | 40  | mA   |
| $I_{CBO}$     | collector-base cut-off current      | $I_E = 0\text{ mA}; V_{CB} = 8\text{ V}$                      | -   | <1   | -   | nA   |
| $h_{FE}$      | DC current gain                     | $I_C = 10\text{ mA}; V_{CE} = 8\text{ V}$                     | 60  | 95   | 200 |      |
| $C_{EBS}$     | emitter-base capacitance            | $V_{CE} = 8\text{ V}; f = 1\text{ MHz}$                       | -   | 0.71 | -   | pF   |
| $C_{CES}$     | collector-emitter capacitance       | $V_{EB} = 0.5\text{ V}; f = 1\text{ MHz}$                     | -   | 0.44 | -   | pF   |
| $C_{CBS}$     | collector-base capacitance          | $V_{CB} = 8\text{ V}; f = 1\text{ MHz}$                       | -   | 0.36 | -   | pF   |
| $f_T$         | transition frequency                | $I_C = 15\text{ mA}; V_{CE} = 8\text{ V}; f = 900\text{ MHz}$ | -   | 11   | -   | GHz  |

**Table 9. Characteristics ...continued**  
 $T_{amb} = 25\text{ }^{\circ}\text{C}$  unless otherwise specified

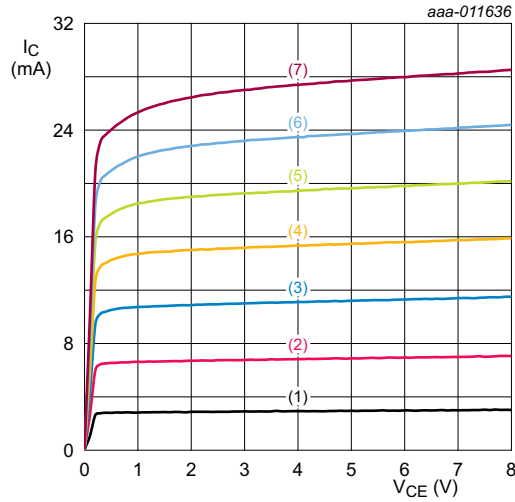
| Symbol       | Parameter            | Conditions  | Min | Typ  | Max | Unit |
|--------------|----------------------|---|-----|------|-----|------|
| $G_{p(max)}$ | maximum power gain   | $f = 433\text{ MHz}; V_{CE} = 8\text{ V}$ [1]                       |     |      |     |      |
|              |                      | $I_C = 1\text{ mA}$   | -   | 15.5 | -   | dB   |
|              |                      | $I_C = 10\text{ mA}$  | -   | 24.5 | -   | dB   |
|              |                      | $I_C = 15\text{ mA}$  | -   | 26   | -   | dB   |
|              |                      | $f = 900\text{ MHz}; V_{CE} = 8\text{ V}$ [1]                       |     |      |     |      |
|              |                      | $I_C = 1\text{ mA}$   | -   | 12.5 | -   | dB   |
|              |                      | $I_C = 10\text{ mA}$  | -   | 21   | -   | dB   |
|              |                      | $I_C = 15\text{ mA}$  | -   | 21.5 | -   | dB   |
|              |                      | $f = 1800\text{ MHz}; V_{CE} = 8\text{ V}$ [1]                      |     |      |     |      |
|              |                      | $I_C = 1\text{ mA}$   | -   | 10.5 | -   | dB   |
|              |                      | $I_C = 10\text{ mA}$  | -   | 17   | -   | dB   |
|              |                      | $I_C = 15\text{ mA}$  | -   | 16.5 | -   | dB   |
| $ S_{21} ^2$ | insertion power gain | $f = 433\text{ MHz}; V_{CE} = 8\text{ V}$                           |     |      |     |      |
|              |                      | $I_C = 1\text{ mA}$   | -   | 10.5 | -   | dB   |
|              |                      | $I_C = 10\text{ mA}$  | -   | 23   | -   | dB   |
|              |                      | $I_C = 15\text{ mA}$  | -   | 23.5 | -   | dB   |
|              |                      | $f = 900\text{ MHz}; V_{CE} = 8\text{ V}$                           |     |      |     |      |
|              |                      | $I_C = 1\text{ mA}$   | -   | 8.5  | -   | dB   |
|              |                      | $I_C = 10\text{ mA}$  | -   | 18   | -   | dB   |
|              |                      | $I_C = 15\text{ mA}$  | -   | 18   | -   | dB   |
|              |                      | $f = 1800\text{ MHz}; V_{CE} = 8\text{ V}$                          |     |      |     |      |
|              |                      | $I_C = 1\text{ mA}$   | -   | 5.5  | -   | dB   |
|              |                      | $I_C = 10\text{ mA}$  | -   | 12   | -   | dB   |
|              |                      | $I_C = 15\text{ mA}$  | -   | 12.5 | -   | dB   |
| $NF_{min}$   | minimum noise figure | $f = 433\text{ MHz}; V_{CE} = 8\text{ V}; \Gamma_S = \Gamma_{opt}$  |     |      |     |      |
|              |                      | $I_C = 1\text{ mA}$   | -   | 0.55 | -   | dB   |
|              |                      | $I_C = 10\text{ mA}$  | -   | 0.85 | -   | dB   |
|              |                      | $I_C = 15\text{ mA}$  | -   | 0.95 | -   | dB   |
|              |                      | $f = 900\text{ MHz}; V_{CE} = 8\text{ V}; \Gamma_S = \Gamma_{opt}$  |     |      |     |      |
|              |                      | $I_C = 1\text{ mA}$   | -   | 0.65 | -   | dB   |
|              |                      | $I_C = 10\text{ mA}$  | -   | 0.9  | -   | dB   |
|              |                      | $I_C = 15\text{ mA}$  | -   | 1.0  | -   | dB   |
|              |                      | $f = 1800\text{ MHz}; V_{CE} = 8\text{ V}; \Gamma_S = \Gamma_{opt}$ |     |      |     |      |
|              |                      | $I_C = 1\text{ mA}$   | -   | 0.85 | -   | dB   |
|              |                      | $I_C = 10\text{ mA}$  | -   | 1.0  | -   | dB   |
|              |                      | $I_C = 15\text{ mA}$  | -   | 1.1  | -   | dB   |

**Table 9. Characteristics ...continued**  
 $T_{amb} = 25\text{ }^{\circ}\text{C}$  unless otherwise specified

| Symbol              | Parameter                             | Conditions   | Min | Typ  | Max | Unit |
|---------------------|---------------------------------------|--|-----|------|-----|------|
| 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  | -   | 23.5 | -   | dB   |
|                     |                                       | I <sub>C</sub> = 10 mA   | -   | 25   | -   | dB   |
|                     |                                       | I <sub>C</sub> = 15 mA   | -   | 25   | -   | dB   |
|                     |                                       | f = 900 MHz; V <sub>CE</sub> = 8 V; $\Gamma_S = \Gamma_{opt}$  |     |      |     |      |
|                     |                                       | I <sub>C</sub> = 1 mA  | -   | 16   | -   | dB   |
|                     |                                       | I <sub>C</sub> = 10 mA   | -   | 19   | -   | dB   |
|                     |                                       | I <sub>C</sub> = 15 mA   | -   | 19.5 | -   | dB   |
|                     |                                       | f = 1800 MHz; V <sub>CE</sub> = 8 V; $\Gamma_S = \Gamma_{opt}$   |     |      |     |      |
|                     |                                       | I <sub>C</sub> = 1 mA  | -   | 10   | -   | dB   |
|                     |                                       | I <sub>C</sub> = 10 mA   | -   | 13.5 | -   | dB   |
|                     |                                       | I <sub>C</sub> = 15 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 $\Omega$  |     |      |     |      |
|                     |                                       | I <sub>C</sub> = 10 mA   | -   | 6.5  | -   | dBm  |
|                     |                                       | I <sub>C</sub> = 15 mA   | -   | 9.5  | -   | dBm  |
|                     |                                       | f = 900 MHz; V <sub>CE</sub> = 8 V; Z <sub>S</sub> = Z <sub>L</sub> = 50 $\Omega$  |     |      |     |      |
|                     |                                       | I <sub>C</sub> = 10 mA   | -   | 7.5  | -   | dBm  |
|                     |                                       | I <sub>C</sub> = 15 mA   | -   | 10.5 | -   | dBm  |
|                     |                                       | f = 1800 MHz; V <sub>CE</sub> = 8 V; Z <sub>S</sub> = Z <sub>L</sub> = 50 $\Omega$   |     |      |     |      |
|                     |                                       | I <sub>C</sub> = 10 mA   | -   | 8    | -   | dBm  |
|                     |                                       | I <sub>C</sub> = 15 mA   | -   | 10   | -   | 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 $\Omega$   |     |      |     |      |
|                     |                                       | I <sub>C</sub> = 10 mA   | -   | 16   | -   | dBm  |
|                     |                                       | I <sub>C</sub> = 15 mA   | -   | 19   | -   | 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 $\Omega$   |     |      |     |      |
|                     |                                       | I <sub>C</sub> = 10 mA   | -   | 17   | -   | dBm  |
|                     |                                       | I <sub>C</sub> = 15 mA   | -   | 20   | -   | 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 $\Omega$ |     |      |     |      |
|                     |                                       | I <sub>C</sub> = 10 mA   | -   | 18   | -   | dBm  |
|                     |                                       | I <sub>C</sub> = 15 mA   | -   | 20   | -   | 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.

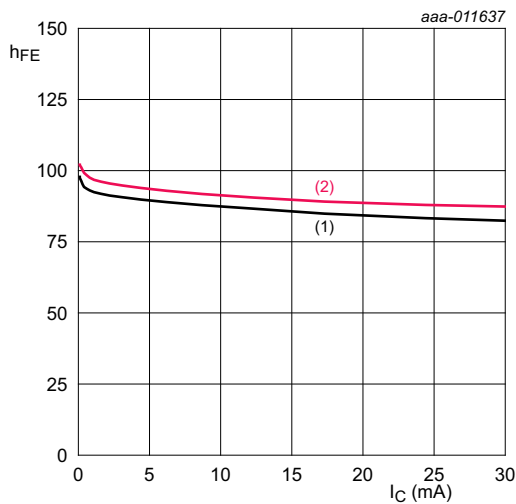
9.1 Graphs



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

- (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)  $I_B = 325\text{ }\mu\text{A}$

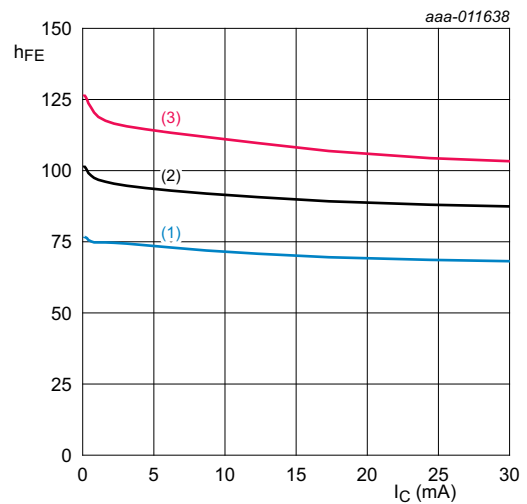
**Fig 2. Collector current as a function of collector-emitter voltage; typical values**



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

- (1)  $V_{CE} = 3.0\text{ V}$
- (2)  $V_{CE} = 8.0\text{ V}$

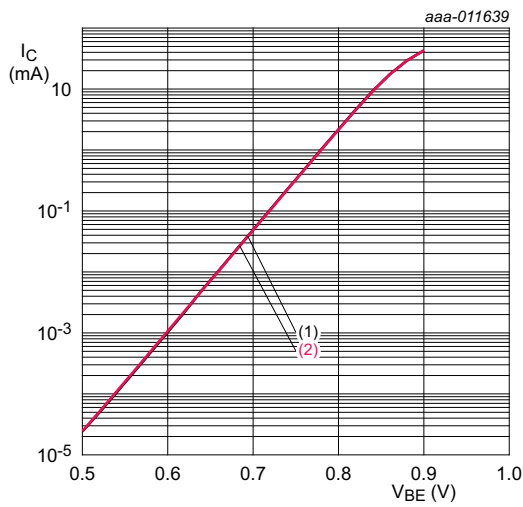
**Fig 3. DC current gain as function of collector current; typical values**



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

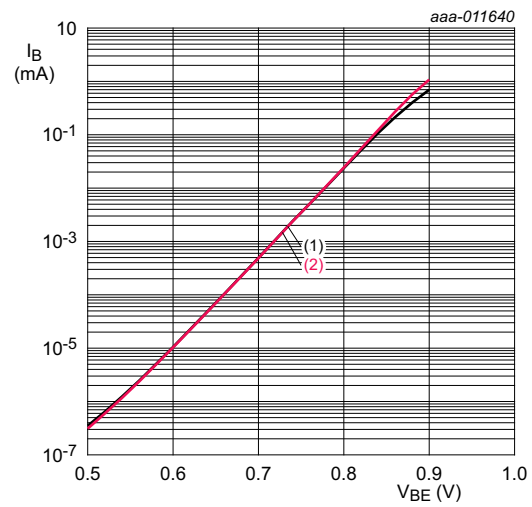
- (1)  $T_{amb} = -40\text{ }^\circ\text{C}$
- (2)  $T_{amb} = +25\text{ }^\circ\text{C}$
- (3)  $T_{amb} = +125\text{ }^\circ\text{C}$

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



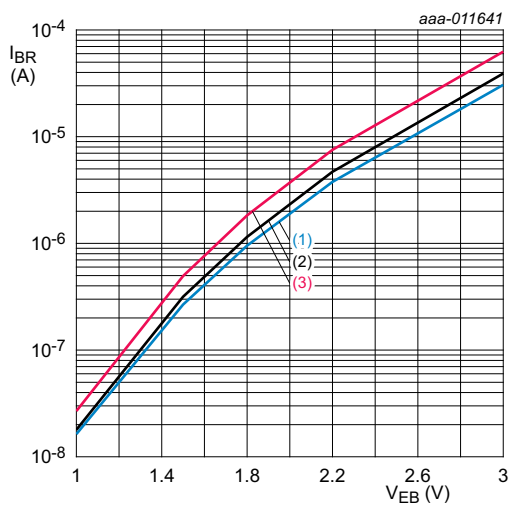
$T_{amb} = 25$  °C.  
 (1)  $V_{CE} = 3.0$  V  
 (2)  $V_{CE} = 8.0$  V

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



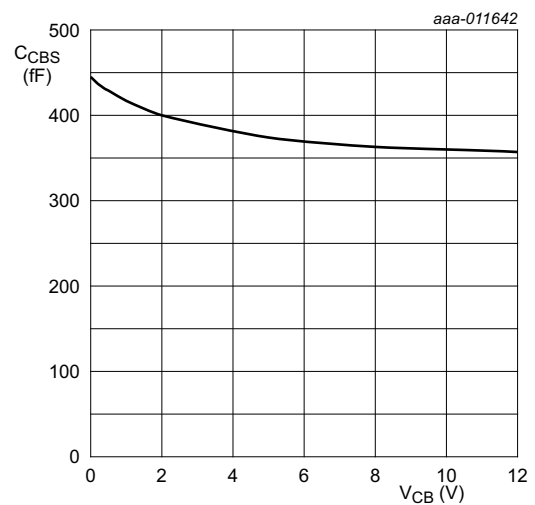
$T_{amb} = 25$  °C.  
 (1)  $V_{CE} = 3.0$  V  
 (2)  $V_{CE} = 8.0$  V

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



$V_{CE} = 3$  V.  
 (1)  $T_{amb} = -40$  °C  
 (2)  $T_{amb} = +25$  °C  
 (3)  $T_{amb} = +125$  °C

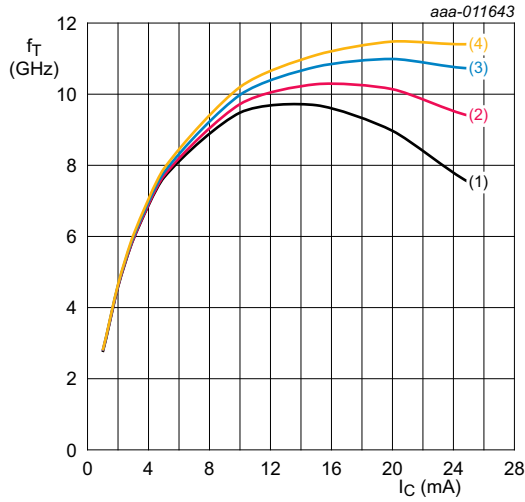
**Fig 7. Reverse base current as a function of emitter-base voltage; typical values**



$I_C = 0$  mA;  $f = 1$  MHz;  $T_{amb} = 25$  °C.

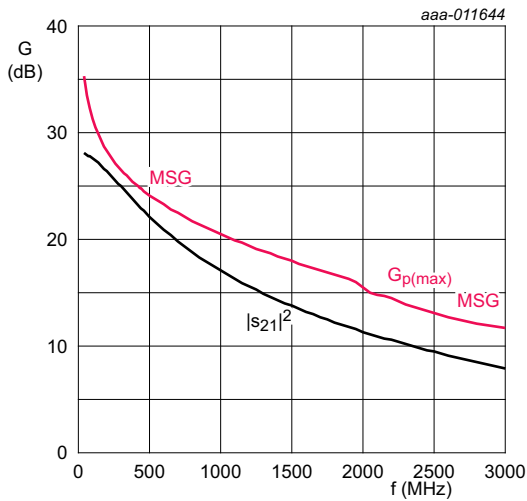
**Fig 8. Collector-base capacitance as a function of collector-base voltage; typical values**





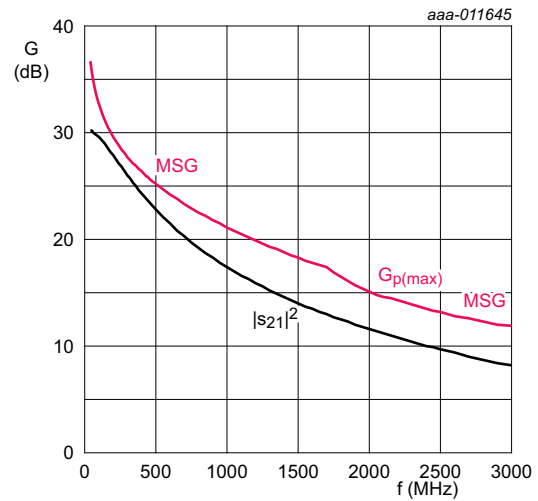
- $T_{amb} = 25\text{ }^{\circ}\text{C}.$
- (1)  $V_{CE} = 3.3\text{ V}$
  - (2)  $V_{CE} = 5.0\text{ V}$
  - (3)  $V_{CE} = 8.0\text{ V}$
  - (4)  $V_{CE} = 12.0\text{ V}$

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



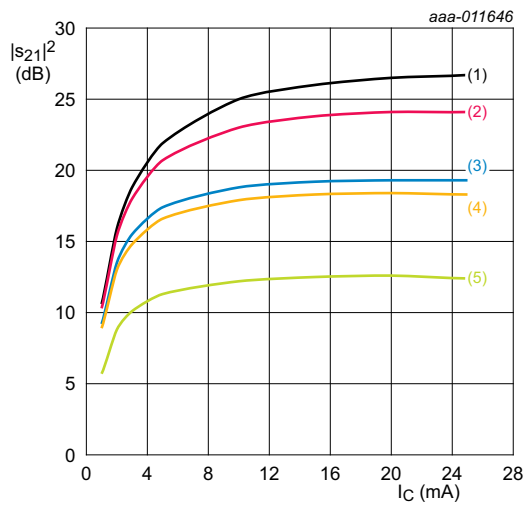
$I_C = 10\text{ mA}; V_{CE} = 8\text{ V}; T_{amb} = 25\text{ }^{\circ}\text{C}.$

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



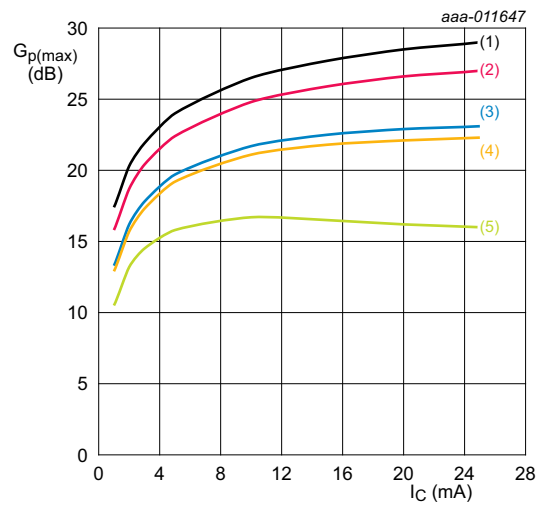
$I_C = 15\text{ mA}; V_{CE} = 8\text{ V}; T_{amb} = 25\text{ }^{\circ}\text{C}.$

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



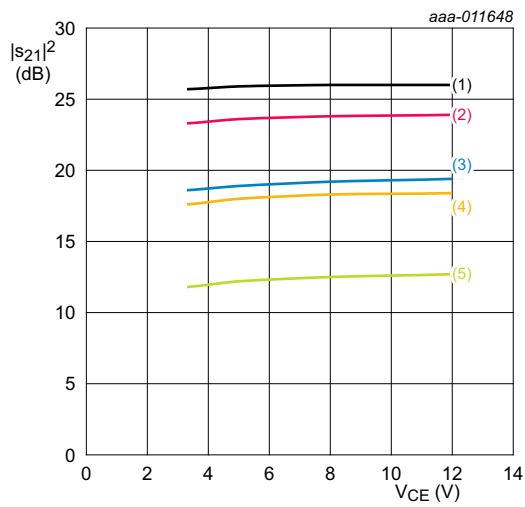
$V_{CE} = 8\text{ V}; T_{amb} = 25\text{ }^{\circ}\text{C}.$   
 (1)  $f = 300\text{ MHz}$   
 (2)  $f = 433\text{ MHz}$   
 (3)  $f = 800\text{ MHz}$   
 (4)  $f = 900\text{ MHz}$   
 (5)  $f = 1800\text{ MHz}$

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



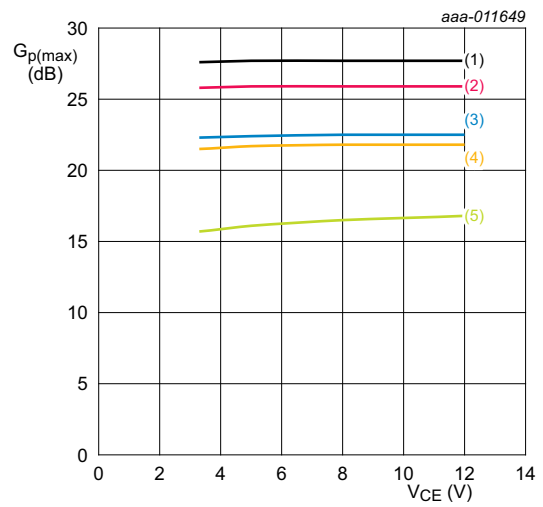
$V_{CE} = 8\text{ V}; T_{amb} = 25\text{ }^{\circ}\text{C}.$   
 If  $K > 1$  then  $G_{p(max)}$  = maximum power gain. If  $K < 1$  then  $G_{p(max)}$  = MSG.  
 (1)  $f = 300\text{ MHz}$   
 (2)  $f = 433\text{ MHz}$   
 (3)  $f = 800\text{ MHz}$   
 (4)  $f = 900\text{ MHz}$   
 (5)  $f = 1800\text{ MHz}$

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



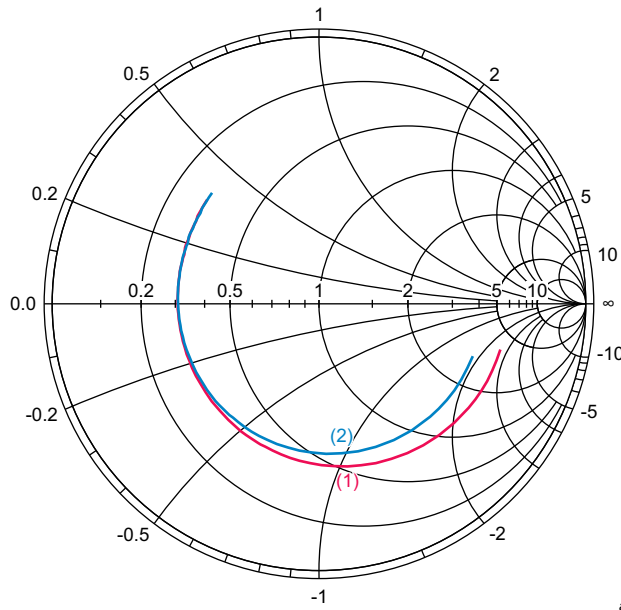
$I_C = 15 \text{ mA}; T_{\text{amb}} = 25 \text{ }^\circ\text{C}.$   
 (1)  $f = 300 \text{ MHz}$   
 (2)  $f = 433 \text{ MHz}$   
 (3)  $f = 800 \text{ MHz}$   
 (4)  $f = 900 \text{ MHz}$   
 (5)  $f = 1800 \text{ MHz}$

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



$I_C = 15 \text{ mA}; T_{\text{amb}} = 25 \text{ }^\circ\text{C}.$   
 If  $K > 1$  then  $G_{p(\text{max})}$  = maximum power gain. If  $K < 1$  then  $G_{p(\text{max})}$  = MSG.  
 (1)  $f = 300 \text{ MHz}$   
 (2)  $f = 433 \text{ MHz}$   
 (3)  $f = 800 \text{ MHz}$   
 (4)  $f = 900 \text{ MHz}$   
 (5)  $f = 1800 \text{ MHz}$

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

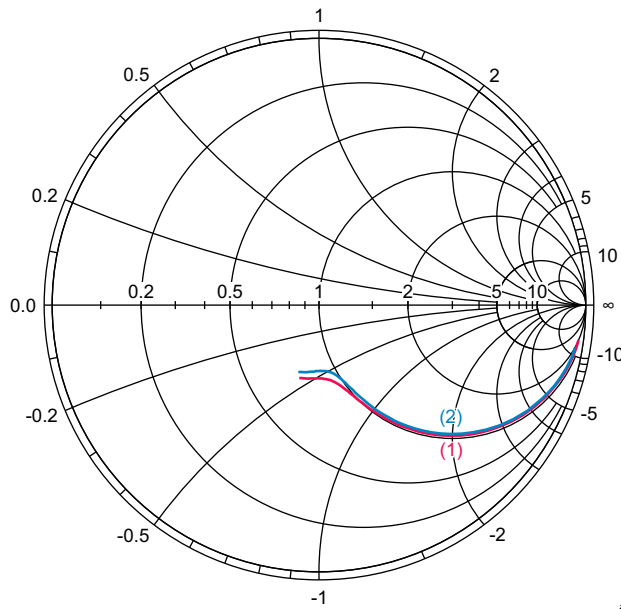


aaa-011650

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

- (1)  $I_C = 10\text{ mA}$
- (2)  $I_C = 15\text{ mA}$

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

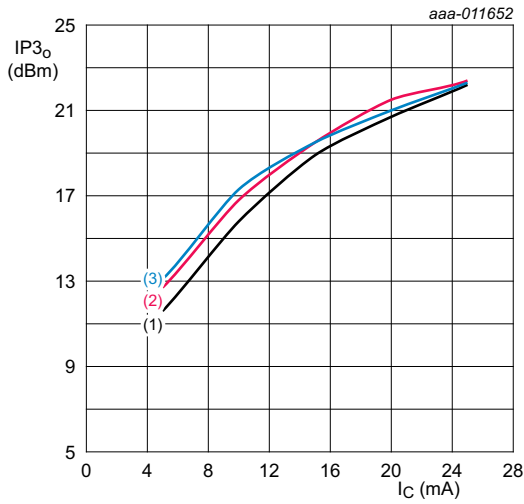


aaa-011651

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

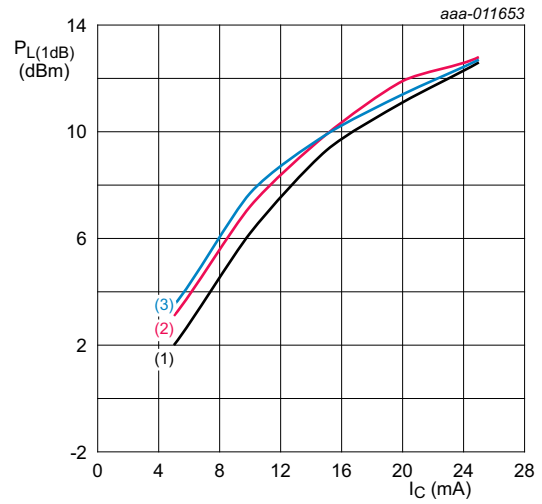
- (1)  $I_C = 10\text{ mA}$
- (2)  $I_C = 15\text{ mA}$

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



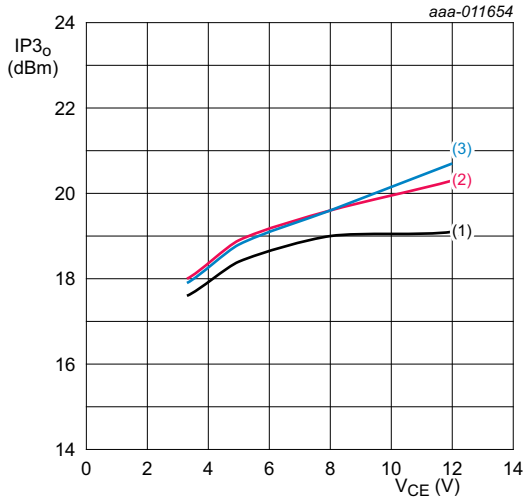
$V_{CE} = 8\text{ V}; T_{amb} = 25\text{ }^{\circ}\text{C}.$   
 (1)  $f_1 = 433\text{ MHz}; f_2 = 434\text{ MHz}$   
 (2)  $f_1 = 900\text{ MHz}; f_2 = 901\text{ MHz}$   
 (3)  $f_1 = 1800\text{ MHz}; f_2 = 1801\text{ MHz}$

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



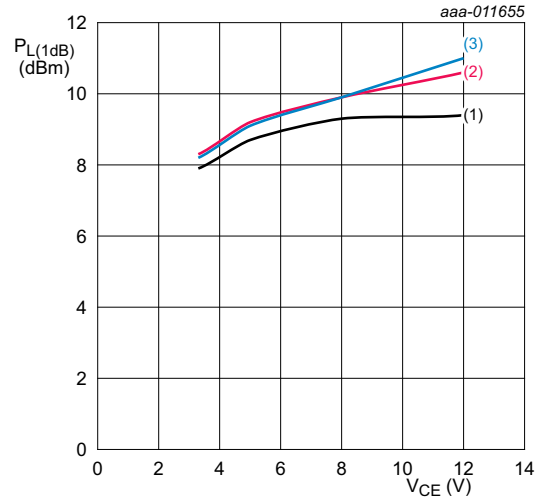
$V_{CE} = 8\text{ V}; T_{amb} = 25\text{ }^{\circ}\text{C}.$   
 (1)  $f = 433\text{ MHz}$   
 (2)  $f = 900\text{ MHz}$   
 (3)  $f = 1800\text{ MHz}$

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



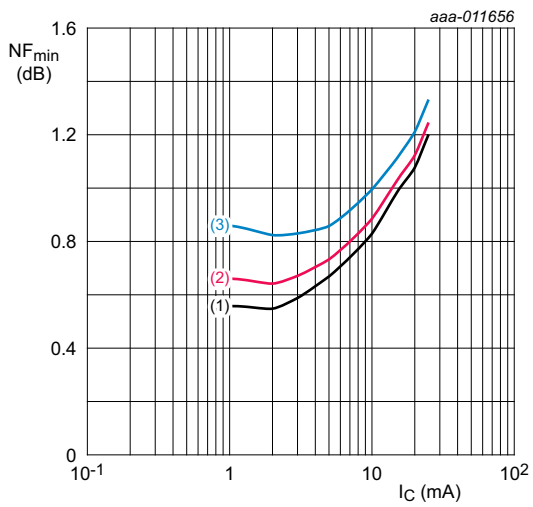
$I_C = 15\text{ mA}; T_{amb} = 25\text{ }^{\circ}\text{C}.$   
 (1)  $f_1 = 433\text{ MHz}; f_2 = 434\text{ MHz}$   
 (2)  $f_1 = 900\text{ MHz}; f_2 = 901\text{ MHz}$   
 (3)  $f_1 = 1800\text{ MHz}; f_2 = 1801\text{ MHz}$

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



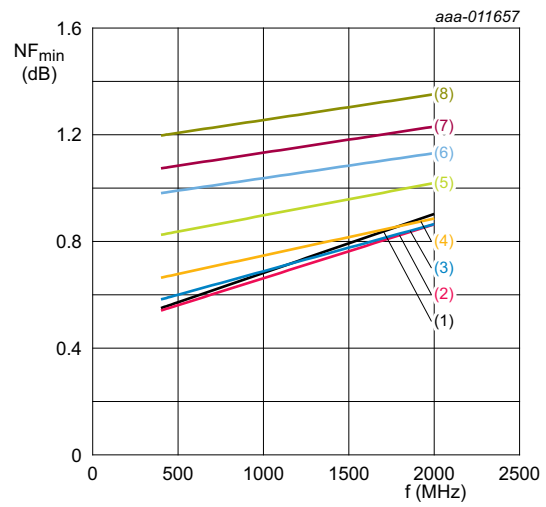
$I_C = 15\text{ mA}; T_{amb} = 25\text{ }^{\circ}\text{C}.$   
 (1)  $f = 433\text{ MHz}$   
 (2)  $f = 900\text{ MHz}$   
 (3)  $f = 1800\text{ MHz}$

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



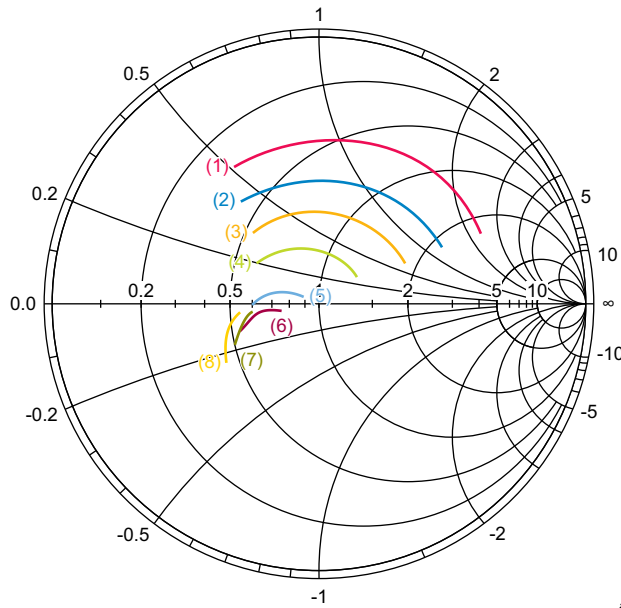
$V_{CE} = 8\text{ V}; T_{amb} = 25\text{ }^\circ\text{C}; \Gamma_S = \Gamma_{opt}$   
 (1)  $f = 433\text{ MHz}$   
 (2)  $f = 900\text{ MHz}$   
 (3)  $f = 1800\text{ MHz}$

**Fig 22. Minimum noise figure as a function of collector current; typical values**



$V_{CE} = 8\text{ V}; T_{amb} = 25\text{ }^\circ\text{C}; \Gamma_S = \Gamma_{opt}$   
 (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)  $I_C = 20\text{ mA}$   
 (8)  $I_C = 25\text{ mA}$

**Fig 23. Minimum noise figure as a function of frequency; 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)  $I_C = 20 \text{ mA}$
- (8)  $I_C = 25 \text{ mA}$

**Fig 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”](#).

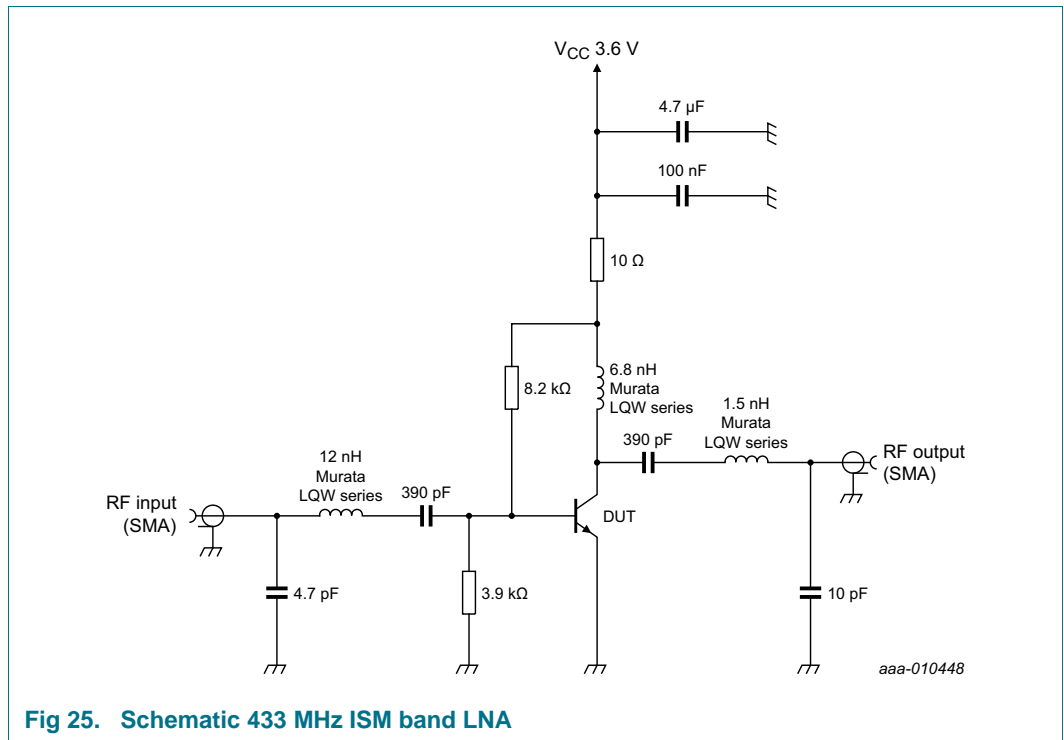
The following application example can be implemented using the evaluation kit. See [Section 3 “Ordering information”](#) for the order type number.

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: *AN11441*



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

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

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

$I_{CC} = 10 \text{ mA}$ ;  $V_{CC} = 3.6 \text{ V}$

| Symbol           | Parameter                          | Conditions  | Min | Typ | Max | Unit |
|------------------|------------------------------------|---|-----|-----|-----|------|
| $ S_{21} ^2$     | insertion power gain               |   | -   | 18  | -   | dB   |
| NF               | noise figure                       |   | -   | 1.1 | -   | dB   |
| IP3 <sub>o</sub> | output third-order intercept point | $f_1 = 433 \text{ MHz}$ ; $f_2 = 433.1 \text{ MHz}$ ; $P_1 = -30 \text{ dBm per carrier}$ | -   | 9   | -   | 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: AN11442



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

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

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

$I_{CC} = 10 \text{ mA}$ ;  $V_{CC} = 3.6 \text{ V}$

| Symbol           | Parameter                          | Conditions  | Min | Typ | Max | Unit |
|------------------|------------------------------------|---|-----|-----|-----|------|
| $ S_{21} ^2$     | insertion power gain               |   | -   | 16  | -   | dB   |
| NF               | noise figure                       |   | -   | 1.1 | -   | dB   |
| IP <sub>3o</sub> | output third-order intercept point | $f_1 = 866.1 \text{ MHz}$ ; $f_2 = 866.2 \text{ MHz}$ ; $P_i = -30 \text{ dBm per carrier}$ | -   | 17  | -   | dBm  |

## 11. Package outline

Plastic surface-mounted package; reverse pinning; 4 leads

SOT143R

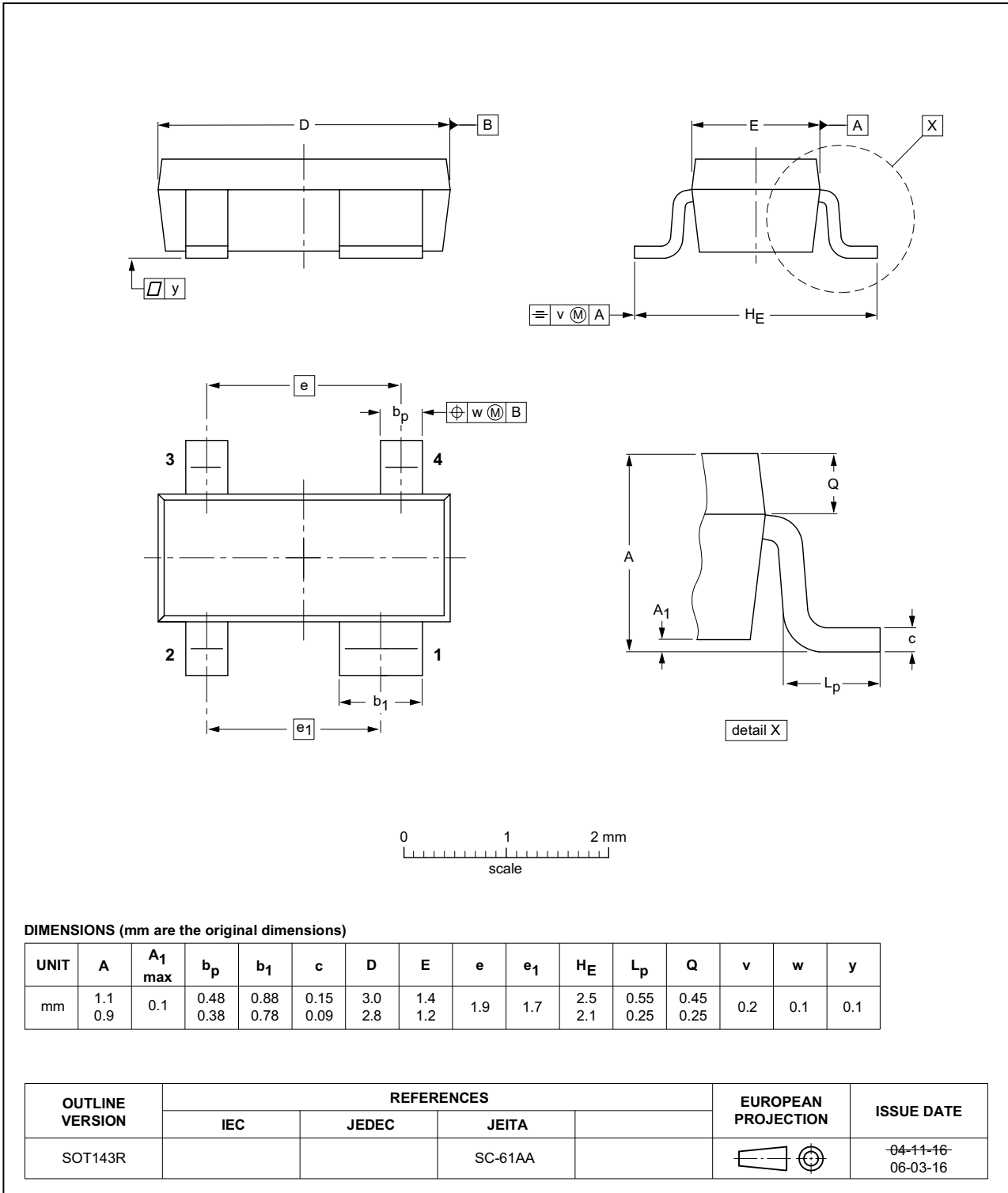


Fig 27. Package outline SOT143R

## 12. Handling information

### 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.

## 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 |
|--------------|--------------|--------------------|---------------|------------|
| BFU530XR v.1 | 20140305     | Product data sheet | -             | -          |

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### 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".

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