



# BFU520X

NPN wideband silicon RF transistor

Rev. 2 — 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 SOT143B package.

The BFU520X 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 ( $NF_{min}$ ) = 0.7 dB at 900 MHz
- Maximum stable gain 20 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		-	5	30	mA
$P_{tot}$	total power dissipation	$T_{sp} \leq 87\text{ °C}$ [1]	-	-	450	mW
$h_{FE}$	DC current gain	$I_C = 5\text{ mA}$ ; $V_{CE} = 8\text{ V}$	60	95	200	
$C_c$	collector capacitance	$V_{CB} = 8\text{ V}$ ; $f = 1\text{ MHz}$	-	0.52	-	pF
$f_T$	transition frequency	$I_C = 10\text{ mA}$ ; $V_{CE} = 8\text{ V}$ ; $f = 900\text{ MHz}$	-	10.5	-	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	$I_C = 5\text{ mA}$ ; $V_{CE} = 8\text{ V}$ ; $f = 900\text{ MHz}$	-	20	-	dB
$NF_{min}$	minimum noise figure	$I_C = 1\text{ mA}$ ; $V_{CE} = 8\text{ V}$ ; $f = 900\text{ MHz}$ ; $\Gamma_S = \Gamma_{opt}$	-	0.7	-	dB
$P_{L(1dB)}$	output power at 1 dB gain compression	$I_C = 10\text{ mA}$ ; $V_{CE} = 8\text{ V}$ ; $Z_S = Z_L = 50\text{ }\Omega$ ; $f = 900\text{ MHz}$	-	6.5	-	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		 aaa-010457
2	emitter		
3	base		
4	emitter		

## 3. Ordering information

**Table 3. Ordering information**

Type number	Package		Version
	Name	Description	
BFU520X	-	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:
  - a) Unpopulated RF amplifier Printed-Circuit Board (PCB)
  - b) Unpopulated RF amplifier Printed-Circuit Board (PCB) with emitter degeneration
  - c) Four SMA connectors for fitting unpopulated Printed-Circuit Board (PCB)
  - d) BFU520X, BFU530X and BFU550X samples
  - e) USB stick with data sheets, application notes, models, S-parameter and noise files

## 4. Marking

**Table 4. Marking**

Type number	Marking	Description
BFU520X	*TE	* = t : made in Malaysia
		* = w : made in China

## 5. Design support

**Table 5. Available design support**

Download from the BFU520X 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		-	50	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		-	-	30	mA
P <sub>i</sub>	input power	Z <sub>S</sub> = 50 Ω	-	-	10	dBm
T <sub>j</sub>	junction temperature		-40	-	+150	°C
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 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

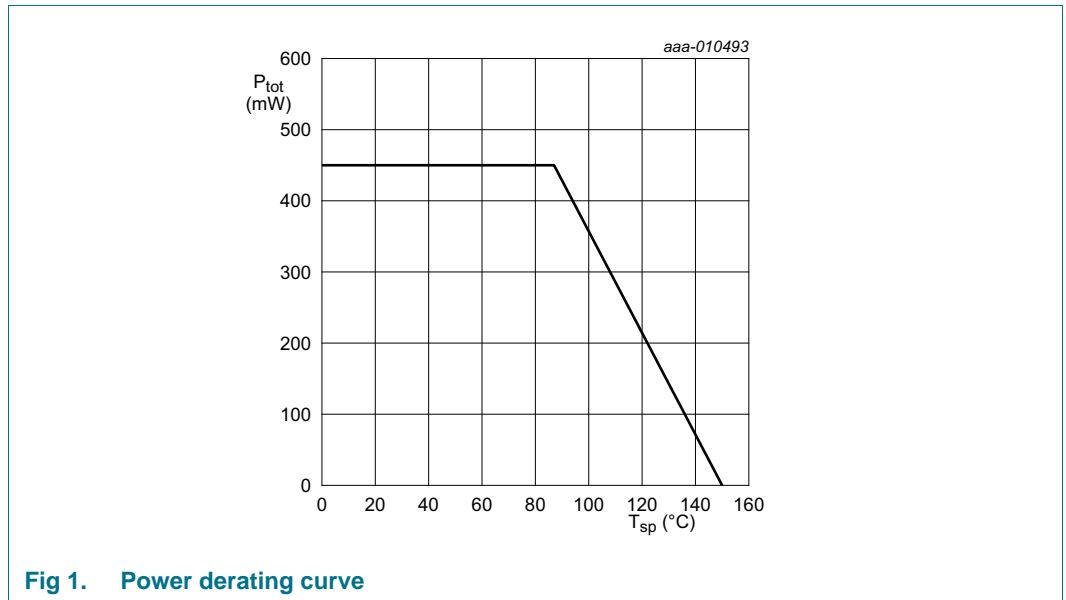
[1]  $T_{sp}$  is the temperature at the solder point of the collector lead.

$T_{sp}$  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		-	5	30	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	$I_C = 5\text{ mA}$ ; $V_{CE} = 8\text{ V}$	60	95	200	
$C_e$	emitter capacitance	$V_{EB} = 0.5\text{ V}$ ; $f = 1\text{ MHz}$	-	0.74	-	pF
$C_{re}$	feedback capacitance	$V_{CE} = 8\text{ V}$ ; $f = 1\text{ MHz}$	-	0.28	-	pF
$C_c$	collector capacitance	$V_{CB} = 8\text{ V}$ ; $f = 1\text{ MHz}$	-	0.52	-	pF
$f_T$	transition frequency	$I_C = 10\text{ mA}$ ; $V_{CE} = 8\text{ V}$ ; $f = 900\text{ MHz}$	-	10.5	-	GHz

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

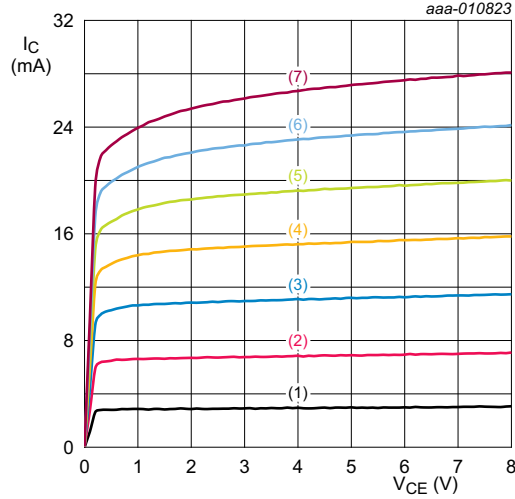
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$G_{p(max)}$	maximum power gain	$f = 433\text{ MHz}; V_{CE} = 8\text{ V}$ [1]				
		$I_C = 1\text{ mA}$	-	17	-	dB
		$I_C = 5\text{ mA}$	-	23.5	-	dB
		$I_C = 10\text{ mA}$	-	26	-	dB
		$f = 900\text{ MHz}; V_{CE} = 8\text{ V}$ [1]				
		$I_C = 1\text{ mA}$	-	14	-	dB
		$I_C = 5\text{ mA}$	-	20	-	dB
		$I_C = 10\text{ mA}$	-	22	-	dB
		$f = 1800\text{ MHz}; V_{CE} = 8\text{ V}$ [1]				
		$I_C = 1\text{ mA}$	-	11.5	-	dB
		$I_C = 5\text{ mA}$	-	17	-	dB
		$I_C = 10\text{ mA}$	-	18	-	dB
$ S_{21} ^2$	insertion power gain	$f = 433\text{ MHz}; V_{CE} = 8\text{ V}$				
		$I_C = 1\text{ mA}$	-	10.5	-	dB
		$I_C = 5\text{ mA}$	-	21	-	dB
		$I_C = 10\text{ mA}$	-	23.5	-	dB
		$f = 900\text{ MHz}; V_{CE} = 8\text{ V}$				
		$I_C = 1\text{ mA}$	-	9.5	-	dB
		$I_C = 5\text{ mA}$	-	17.5	-	dB
		$I_C = 10\text{ mA}$	-	19	-	dB
		$f = 1800\text{ MHz}; V_{CE} = 8\text{ V}$				
		$I_C = 1\text{ mA}$	-	6.5	-	dB
		$I_C = 5\text{ mA}$	-	12.5	-	dB
		$I_C = 10\text{ mA}$	-	13	-	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
		$I_C = 5\text{ mA}$	-	0.75	-	dB
		$I_C = 10\text{ mA}$	-	0.95	-	dB
		$f = 900\text{ MHz}; V_{CE} = 8\text{ V}; \Gamma_S = \Gamma_{opt}$				
		$I_C = 1\text{ mA}$	-	0.7	-	dB
		$I_C = 5\text{ mA}$	-	0.8	-	dB
		$I_C = 10\text{ mA}$	-	1	-	dB
		$f = 1800\text{ MHz}; V_{CE} = 8\text{ V}; \Gamma_S = \Gamma_{opt}$				
		$I_C = 1\text{ mA}$	-	0.9	-	dB
		$I_C = 5\text{ mA}$	-	0.95	-	dB
		$I_C = 10\text{ mA}$	-	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	-	25.5	-	dB
		I <sub>C</sub> = 5 mA	-	25.5	-	dB
		I <sub>C</sub> = 10 mA	-	26	-	dB
		f = 900 MHz; V <sub>CE</sub> = 8 V; $\Gamma_S = \Gamma_{opt}$				
		I <sub>C</sub> = 1 mA	-	18	-	dB
		I <sub>C</sub> = 5 mA	-	19	-	dB
		I <sub>C</sub> = 10 mA	-	20	-	dB
		f = 1800 MHz; V <sub>CE</sub> = 8 V; $\Gamma_S = \Gamma_{opt}$				
		I <sub>C</sub> = 1 mA	-	11.5	-	dB
		I <sub>C</sub> = 5 mA	-	13.5	-	dB
		I <sub>C</sub> = 10 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> = 5 mA	-	1	-	dBm
		I <sub>C</sub> = 10 mA	-	5.5	-	dBm
		f = 900 MHz; V <sub>CE</sub> = 8 V; Z <sub>S</sub> = Z <sub>L</sub> = 50 $\Omega$				
		I <sub>C</sub> = 5 mA	-	0	-	dBm
		I <sub>C</sub> = 10 mA	-	6.5	-	dBm
		f = 1800 MHz; V <sub>CE</sub> = 8 V; Z <sub>S</sub> = Z <sub>L</sub> = 50 $\Omega$				
		I <sub>C</sub> = 5 mA	-	3.5	-	dBm
		I <sub>C</sub> = 10 mA	-	9.5	-	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 $\Omega$				
		I <sub>C</sub> = 5 mA	-	10.5	-	dBm
		I <sub>C</sub> = 10 mA	-	15	-	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> = 5 mA	-	9.5	-	dBm
		I <sub>C</sub> = 10 mA	-	16	-	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> = 5 mA	-	13	-	dBm
		I <sub>C</sub> = 10 mA	-	19.5	-	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.

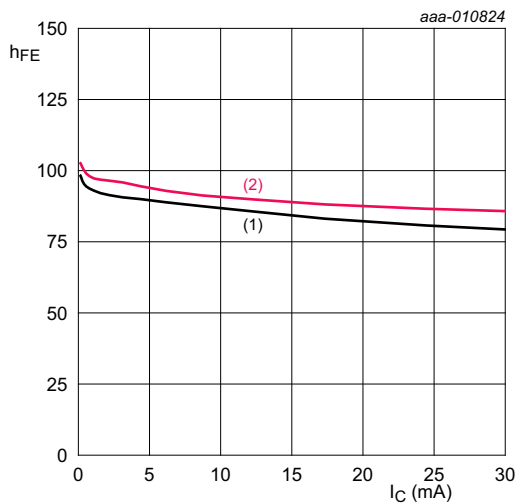
9.1 Graphs



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

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

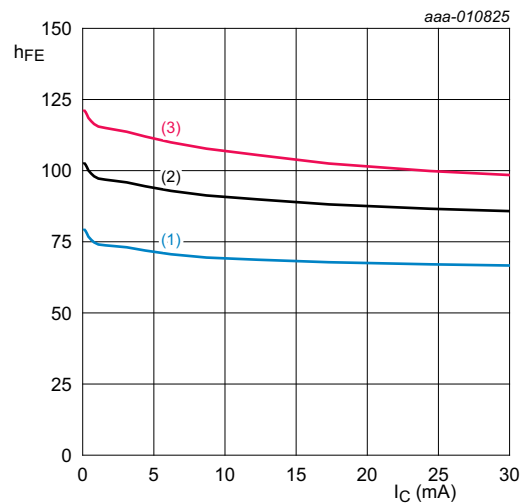
Fig 2. Collector current as a function of collector-emitter voltage; typical values



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

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

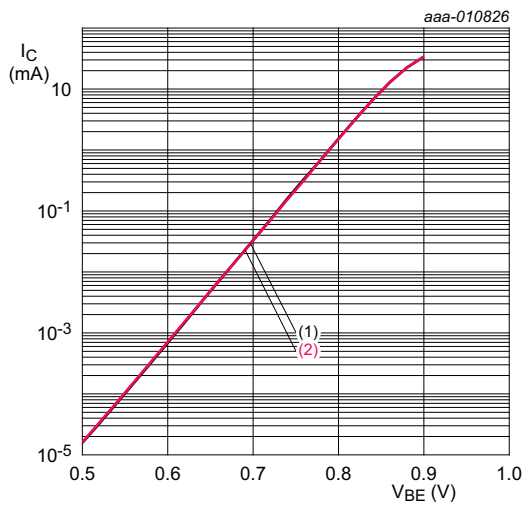
Fig 3. DC current gain as function of collector current; typical values



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

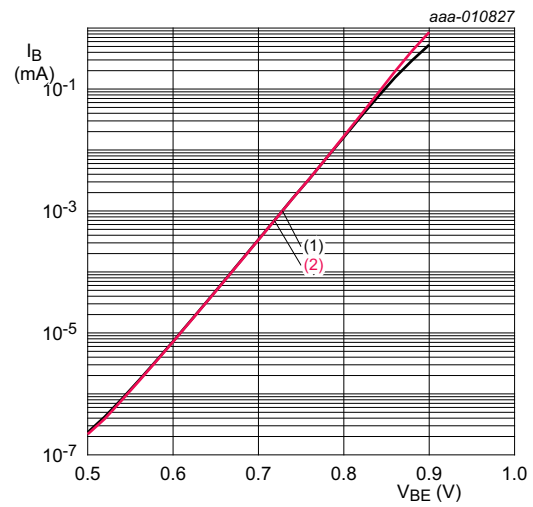
- (1)  $T_{amb} = -40\text{ }^\circ\text{C}$
- (2)  $T_{amb} = +25\text{ }^\circ\text{C}$
- (3)  $T_{amb} = +125\text{ }^\circ\text{C}$

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



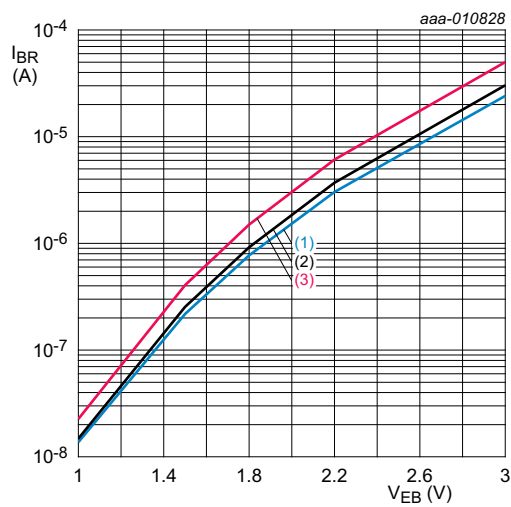
$T_{amb} = 25\text{ }^{\circ}\text{C}$ .  
 (1)  $V_{CE} = 3.0\text{ V}$   
 (2)  $V_{CE} = 8.0\text{ V}$

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



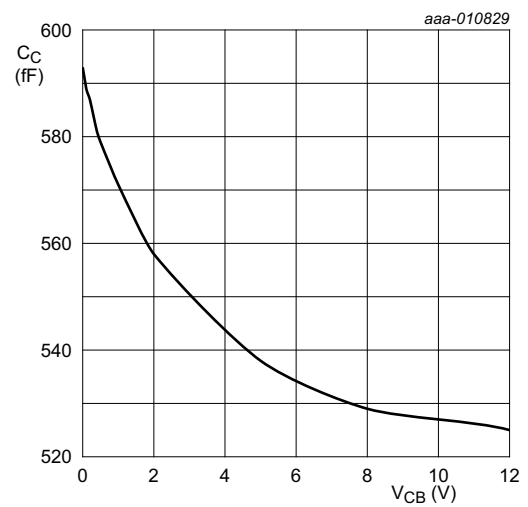
$T_{amb} = 25\text{ }^{\circ}\text{C}$ .  
 (1)  $V_{CE} = 3.0\text{ V}$   
 (2)  $V_{CE} = 8.0\text{ V}$

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



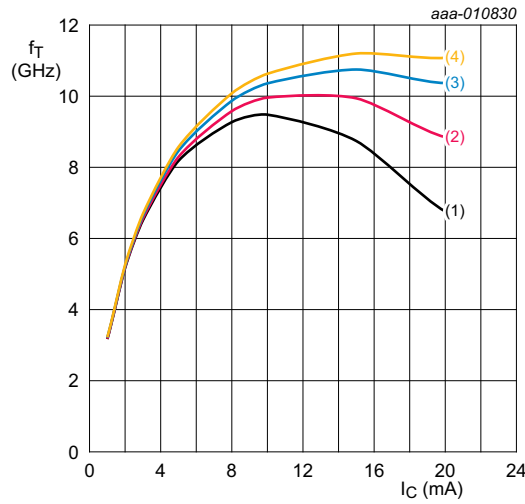
$V_{CE} = 3\text{ V}$ .  
 (1)  $T_{amb} = -40\text{ }^{\circ}\text{C}$   
 (2)  $T_{amb} = +25\text{ }^{\circ}\text{C}$   
 (3)  $T_{amb} = +125\text{ }^{\circ}\text{C}$

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



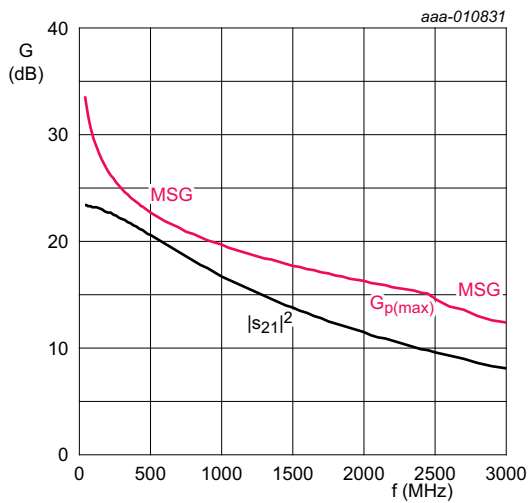
$I_C = 0\text{ mA}$ ;  $f = 1\text{ MHz}$ ;  $T_{amb} = 25\text{ }^{\circ}\text{C}$ .

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



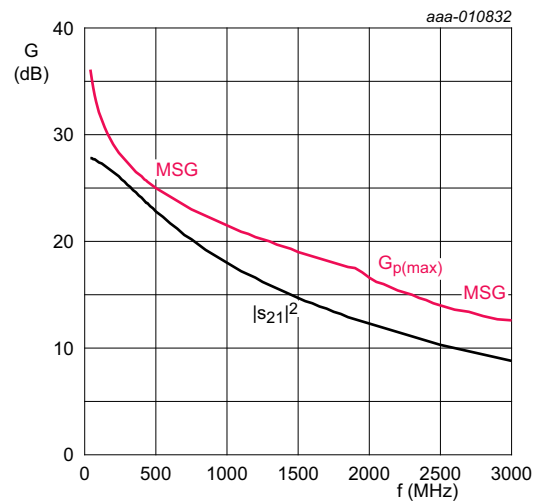
- $T_{amb} = 25\text{ }^\circ\text{C}$ .
- (1)  $V_{CE} = 3.3\text{ V}$
  - (2)  $V_{CE} = 5.0\text{ V}$
  - (3)  $V_{CE} = 8.0\text{ V}$
  - (4)  $V_{CE} = 12.0\text{ V}$

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



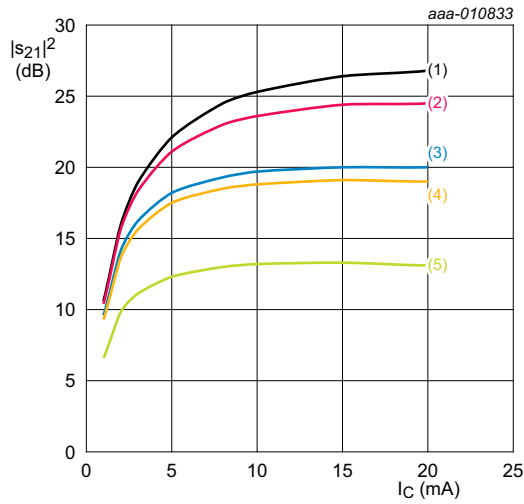
$I_C = 5\text{ mA}$ ;  $V_{CE} = 8\text{ V}$ ;  $T_{amb} = 25\text{ }^\circ\text{C}$ .

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



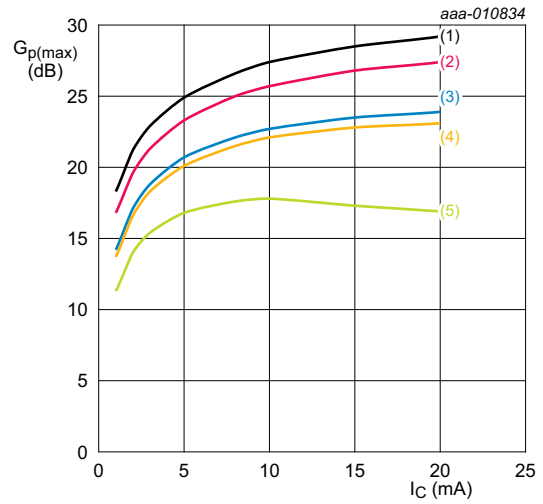
$I_C = 10\text{ mA}$ ;  $V_{CE} = 8\text{ V}$ ;  $T_{amb} = 25\text{ }^\circ\text{C}$ .

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



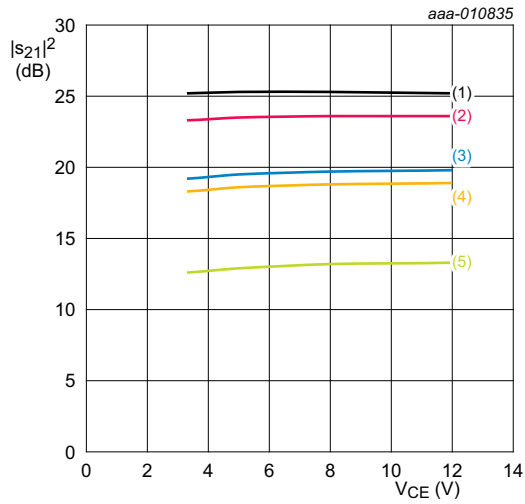
$V_{CE} = 8 \text{ V}; T_{amb} = 25 \text{ }^\circ\text{C}.$   
 (1)  $f = 300 \text{ MHz}$   
 (2)  $f = 433 \text{ MHz}$   
 (3)  $f = 800 \text{ MHz}$   
 (4)  $f = 900 \text{ MHz}$   
 (5)  $f = 1800 \text{ MHz}$

**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)  $f = 1800 \text{ MHz}$

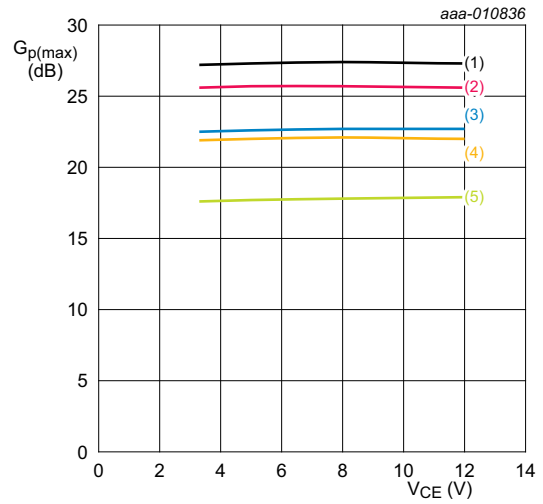
**Fig 13. Maximum power gain as a function of collector current; typical values**



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

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

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

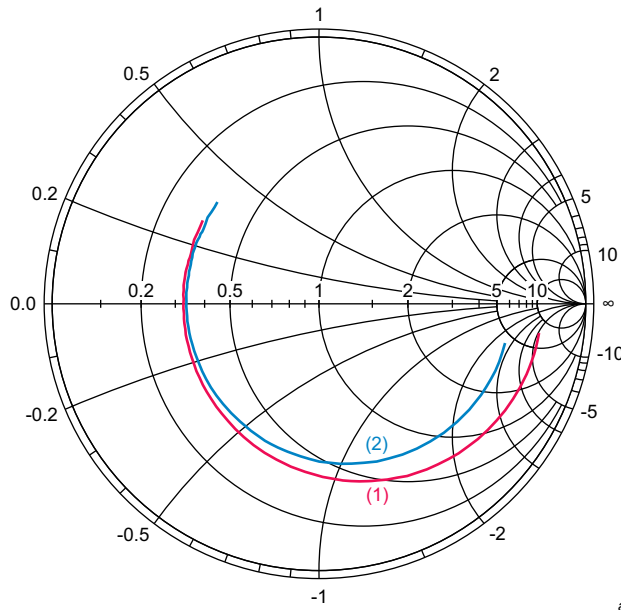


$I_C = 10 \text{ mA}; T_{amb} = 25 \text{ }^\circ\text{C}.$

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)  $f = 1800 \text{ MHz}$

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

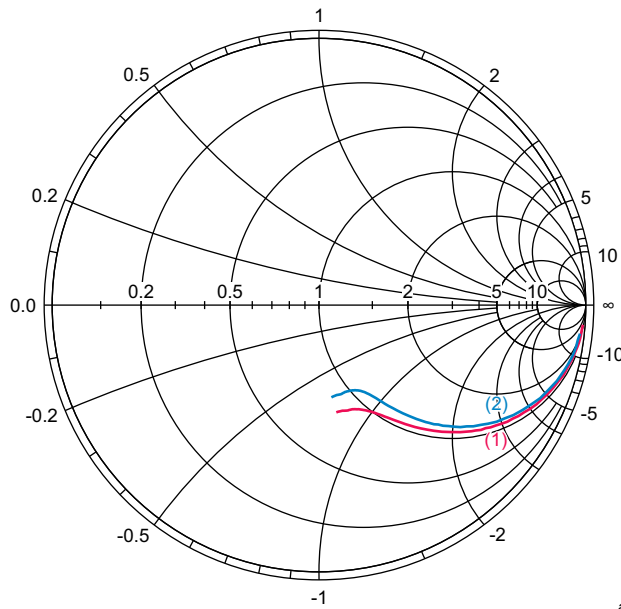


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$V_{CE} = 8\text{ V}; 40\text{ MHz} \leq f \leq 3\text{ GHz}.$

- (1)  $I_C = 5\text{ mA}$
- (2)  $I_C = 10\text{ mA}$

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

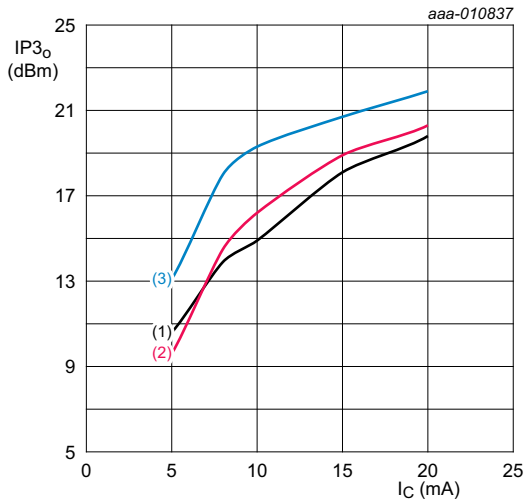


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$V_{CE} = 8\text{ V}; 40\text{ MHz} \leq f \leq 3\text{ GHz}.$

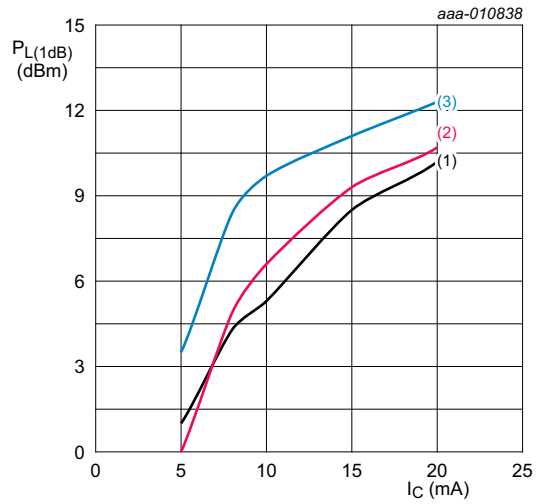
- (1)  $I_C = 5\text{ mA}$
- (2)  $I_C = 10\text{ mA}$

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



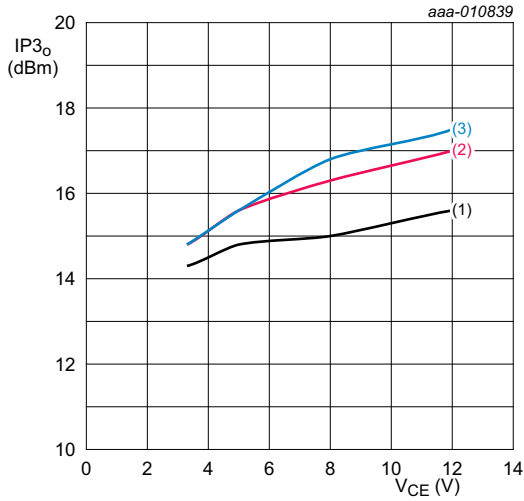
$V_{CE} = 8\text{ V}; T_{amb} = 25\text{ }^{\circ}\text{C}.$   
 (1)  $f_1 = 433\text{ MHz}; f_2 = 434\text{ MHz}$   
 (2)  $f_1 = 900\text{ MHz}; f_2 = 901\text{ MHz}$   
 (3)  $f_1 = 1800\text{ MHz}; f_2 = 1801\text{ MHz}$

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



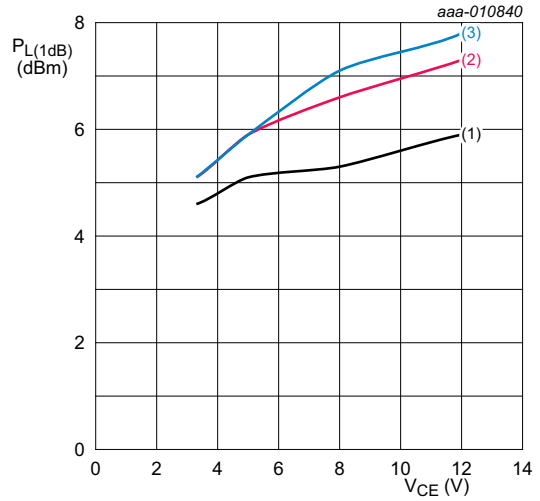
$V_{CE} = 8\text{ V}; T_{amb} = 25\text{ }^{\circ}\text{C}.$   
 (1)  $f = 433\text{ MHz}$   
 (2)  $f = 900\text{ MHz}$   
 (3)  $f = 1800\text{ MHz}$

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



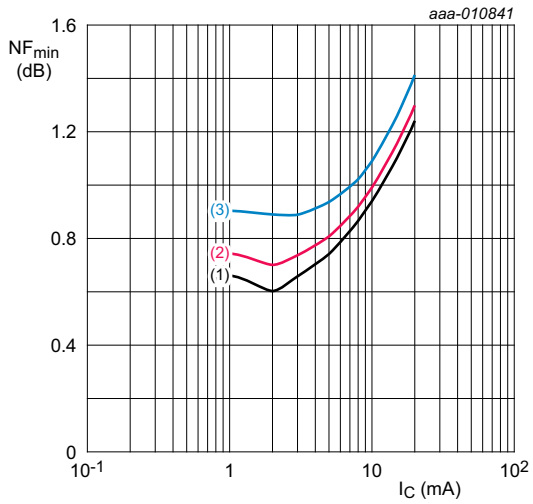
$I_C = 10\text{ mA}; T_{amb} = 25\text{ }^{\circ}\text{C}.$   
 (1)  $f_1 = 433\text{ MHz}; f_2 = 434\text{ MHz}$   
 (2)  $f_1 = 900\text{ MHz}; f_2 = 901\text{ MHz}$   
 (3)  $f_1 = 1800\text{ MHz}; f_2 = 1801\text{ MHz}$

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



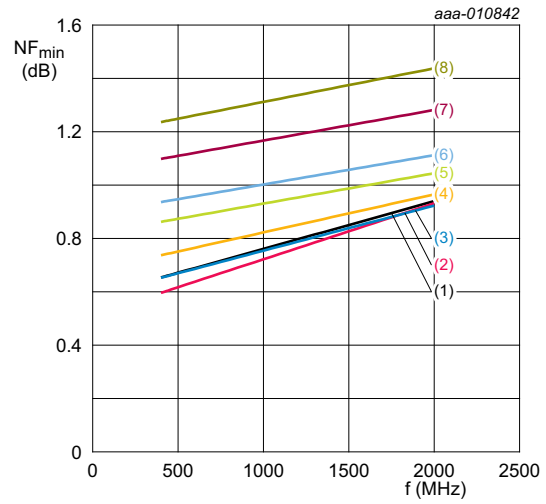
$I_C = 10\text{ mA}; T_{amb} = 25\text{ }^{\circ}\text{C}.$   
 (1)  $f = 433\text{ MHz}$   
 (2)  $f = 900\text{ MHz}$   
 (3)  $f = 1800\text{ MHz}$

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



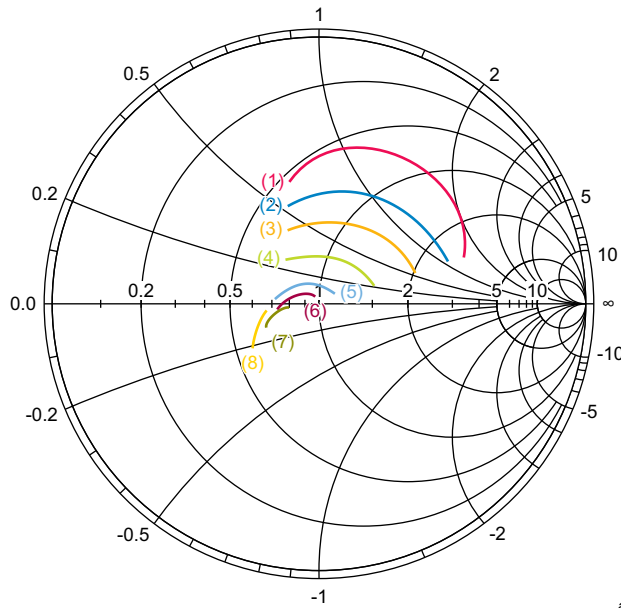
- $V_{CE} = 8\text{ V}; T_{amb} = 25\text{ }^\circ\text{C}; \Gamma_S = \Gamma_{opt}$
- (1)  $f = 433\text{ MHz}$
  - (2)  $f = 900\text{ MHz}$
  - (3)  $f = 1800\text{ MHz}$

**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)  $I_C = 8\text{ mA}$
  - (6)  $I_C = 10\text{ mA}$
  - (7)  $I_C = 15\text{ mA}$
  - (8)  $I_C = 20\text{ mA}$

**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)  $I_C = 8 \text{ mA}$
- (6)  $I_C = 10 \text{ mA}$
- (7)  $I_C = 15 \text{ mA}$
- (8)  $I_C = 20 \text{ mA}$

**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”](#).

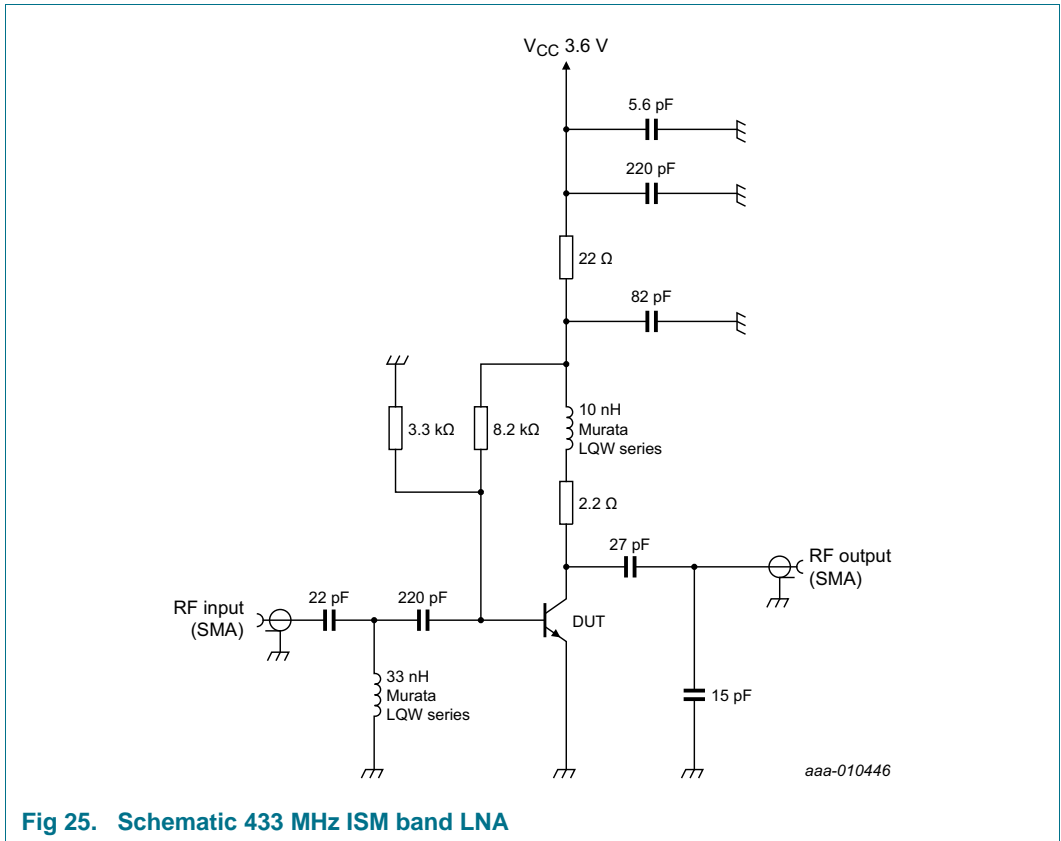
The following application example can be implemented using the evaluation kit. See [Section 3 “Ordering information”](#) for the order type number.

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: AN11433.



**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**

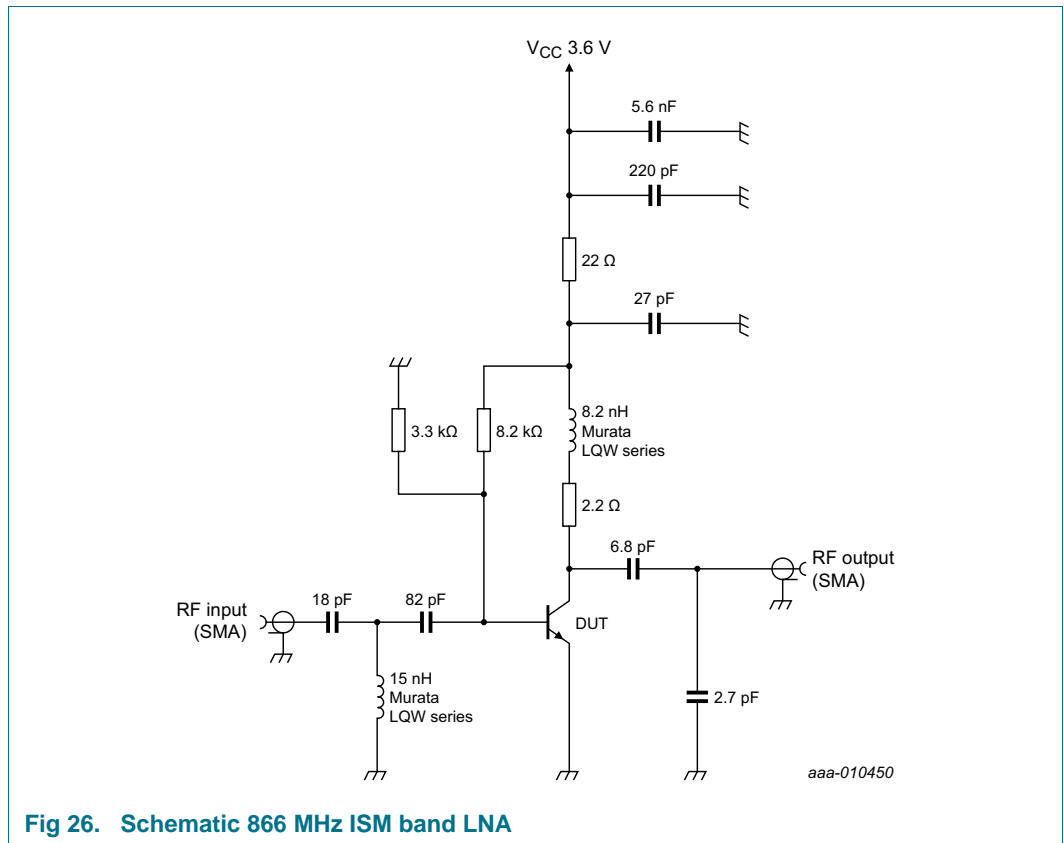
$I_{CC} = 7\text{ mA}$ ;  $V_{CC} = 3.6\text{ V}$

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$ S_{21} ^2$	insertion power gain		-	19	-	dB
NF	noise figure		-	1.0	-	dB
IP3 <sub>o</sub>	output third-order intercept point	$f_1 = 433.1\text{ MHz}$ ; $f_2 = 433.2\text{ MHz}$ ; $P_i = -30\text{ dBm}$ per carrier	-	11	-	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: AN11434.



**Fig 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**

$I_{CC} = 7\text{ mA}$ ;  $V_{CC} = 3.6\text{ V}$

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$ S_{21} ^2$	insertion power gain		-	16	-	dB
NF	noise figure		-	1.1	-	dB
IP3 <sub>o</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	-	14	-	dBm

## 11. Package outline

Plastic surface-mounted package; 4 leads

SOT143B

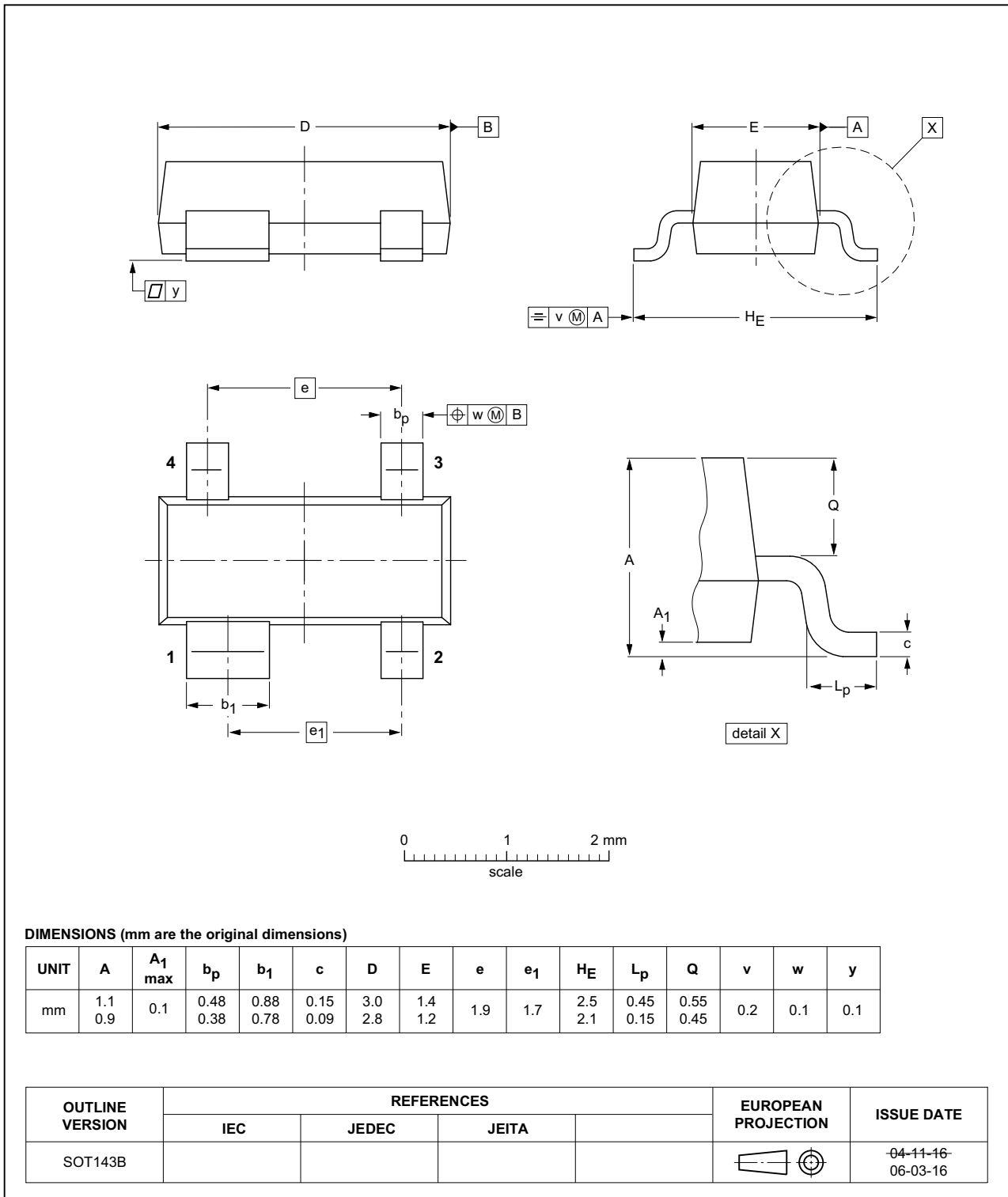


Fig 27. Package outline SOT143B

## 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
BFU520X v.2	20140305	Product data sheet	-	BFU520X v.1
Modifications:	<ul style="list-style-type: none"> <li>• <a href="#">Section 10.1 on page 16</a>: a remarks has been added below <a href="#">Figure 25</a>.</li> <li>• <a href="#">Section 10.2 on page 17</a>: a remarks has been added below <a href="#">Figure 26</a>.</li> </ul>			
BFU520X v.1	20140220	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".

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