BFU768F

NPN wideband silicon germanium RF transistor

Rev. 1.2 — 24 December 2012 Product data sheet

1. Product profile

1.1 General description

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

CAUTION

This device is sensitive to ElectroStatic Discharge (ESD). Observe precautions for handling electrostatic sensitive devices.

Such precautions are described in the *ANSI/ESD S20.20*, *IEC/ST 61340-5*, *JESD625-A* or equivalent standards.

1.2 Features and benefits

- Low noise high linearity RF transistor
- 110 GHz f_T silicon germanium technology
- Optimal linearity for low current and high gain
- Low minimum noise figure of 0.50 dB at 2.4 GHz and 0.74 dB at 5.8 GHz
- Low component count Wi-Fi LNA application circuits available for 2.4 GHz ISM band and 4.9 GHz to 5.9 GHz U-NII band, with optimized RF performance:
  - Low current: 10.8 mA
  - Noise figure < 1.2 dB
  - Gain: 13.1 dB at 2.4 GHz, 12.2 dB at 5 GHz
  - High IP3: 15.7 dBm at 2.4 GHz, 18.8 dBm at 5 GHz
  - Very fast on/off times
  - Unconditionally stable
- Higher IP3, higher gain or lower noise figure possible with different application circuits

1.3 Applications

- High linearity applications
- Medium output power applications
- Wi-Fi / WLAN / WiMAX
- ZigBee

1.4 Quick reference data

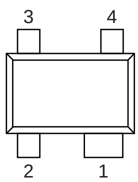
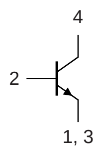
Table 1. Quick reference data

Wi-Fi LNA applications circuits; I_C = 10.8 mA; V_{CE} = 2.1 V; T_{amb} = 25 °C; unless otherwise specified

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{CBO}	collector-base voltage	open emitter	-	-	10	V
V_{CEO}	collector-emitter voltage	open base	-	-	2.8	V
V_{EBO}	emitter-base voltage	open collector	-	-	1.0	V
I_C	collector current		-	-	70	mA
h_{FE}	DC current gain	I_C = 10 mA; V_{CE} = 2 V; T_j = 25 °C	155	330	505	
$\lvert s_{21}\rvert^2$	insertion power gain	f = 2.4 GHz	-	13.1	-	dB
		f = 5.0 GHz	-	12.2	-	dB
		f = 5.9 GHz	-	11.1	-	dB
NF	noise figure	f = 2.4 GHz	-	1.1	-	dB
		f = 5.0 GHz	-	1.1	-	dB
		f = 5.9 GHz	-	1.2	-	dB
IP3	third-order intercept point	f = 2.4 GHz	-	15.7	-	dBm
		f = 5.0 GHz	-	18.8	-	dBm
		f = 5.9 GHz	-	18.8	-	dBm

2. Pinning information

Table 2. Discrete pinning

Pin	Description	Simplified outline	Graphic symbol
1	emitter		 mbb159
2	base		
3	emitter		
4	collector		

3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
BFU768F	-	plastic surface-mounted flat pack package; reverse pinning; 4 leads	SOT343F

4. Marking

Table 4. Marking

Type number	Marking	Description
BFU768F	ZB*	* = p : made in Hong Kong
		* = t : made in Malaysia
		* = w : made in China

5. Limiting values

Table 5. Limiting values
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions		Min	Max	Unit
V_{CBO}	collector-base voltage	open emitter		-	10	V
V_{CEO}	collector-emitter voltage	open base		-	2.8	V
V_{EBO}	emitter-base voltage	open collector		-	1.0	V
I_C	collector current			-	70	mA
P_{tot}	total power dissipation	$T_{sp} \leq 90$ °C	[1]	-	220	mW
T_{stg}	storage temperature			–65	+150	°C
T_j	junction temperature			-	150	°C

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

6. Thermal characteristics

Table 6. Thermal characteristics

Symbol	Parameter	Conditions	Typ	Unit
$R_{th(j-sp)}$	thermal resistance from junction to solder point		270	K/W

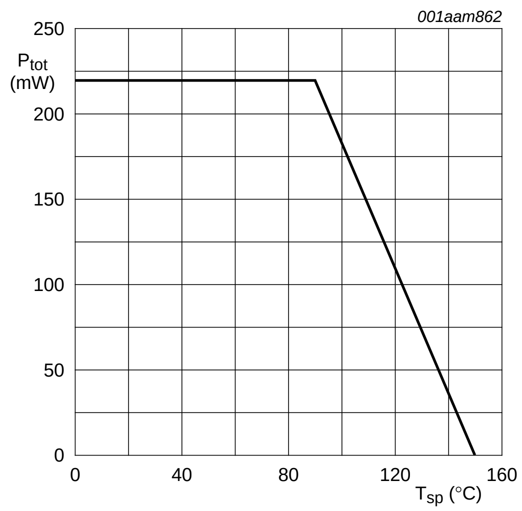


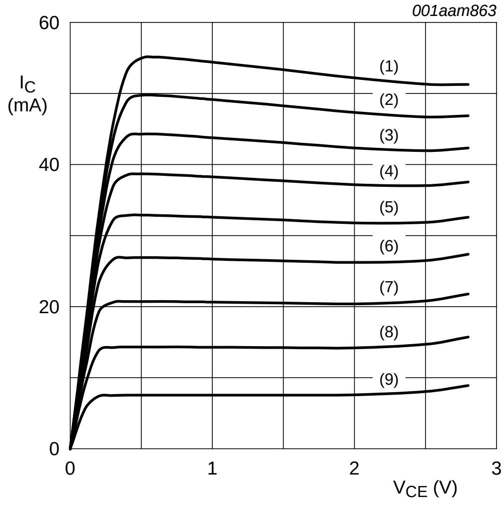
Fig 1. Power derating curve

7. Characteristics

Table 7. Characteristics

Wi-Fi LNA applications circuits; I_C = 10.8 mA; V_{CE} = 2.1 V; T_{amb} = 25 °C; unless otherwise specified

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{(BR)CBO}$	collector-base breakdown voltage	I_C = 2.5 μA; I_E = 0 mA	10	-	-	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	I_C = 1 mA; I_B = 0 mA	2.8	-	-	V
I_C	collector current		-	-	70	mA
I_{CBO}	collector-base cut-off current	I_E = 0 mA; V_{CB} = 4.5 V	-	-	100	nA
h_{FE}	DC current gain	I_C = 10 mA; V_{CE} = 2 V	155	330	505	
$\|s_{21}\|^2$	insertion power gain	f = 2.4 GHz	-	13.1	-	dB
		f = 5.0 GHz	-	12.2	-	dB
		f = 5.9 GHz	-	11.1	-	dB
NF_{min}	minimum noise figure	f = 2.4 GHz, measured on the pins	-	0.50	-	dB
		f = 5.8 GHz, measured on the pins	-	0.74	-	dB
NF	noise figure	f = 2.4 GHz	-	1.1	-	dB
		f = 5.0 GHz	-	1.1	-	dB
		f = 5.9 GHz	-	1.2	-	dB
RL_{in}	input return loss	f = 2.4 GHz	-	10.2	-	dB
		f = 5.0 GHz	-	10.5	-	dB
		f = 5.9 GHz	-	11.3	-	dB
RL_{out}	output return loss	f = 2.4 GHz	-	11.7	-	dB
		f = 5.0 GHz	-	13.7	-	dB
		f = 5.9 GHz	-	19.3	-	dB
$P_{L(1dB)}$	output power at 1 dB gain compression	f = 2.4 GHz	-	3.9	-	dBm
		f = 5.0 GHz	-	5.9	-	dBm
		f = 5.9 GHz	-	4.9	-	dBm
IP3	third-order intercept point	f = 2.4 GHz	-	15.7	-	dBm
		f = 5.0 GHz	-	18.8	-	dBm
		f = 5.9 GHz	-	18.8	-	dBm
t_{on}	turn-on time	2.4 GHz Wi-Fi LNA application	-	170	-	ns
		4.9 GHz to 5.9 GHz Wi-Fi LNA application	-	300	-	ns
t_{off}	turn-off time	2.4 GHz Wi-Fi LNA application	-	40	-	ns
		4.9 GHz to 5.9 GHz Wi-Fi LNA application	-	12	-	ns



T_{amb} = 25 °C.

(1) I_B = 180 μA

(2) I_B = 160 μA

(3) I_B = 140 μA

(4) I_B = 120 μA

(5) I_B = 100 μA

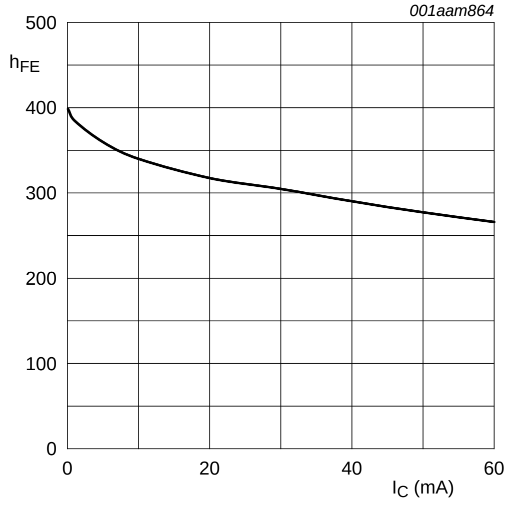
(6) I_B = 80 μA

(7) I_B = 60 μA

(8) I_B = 40 μA

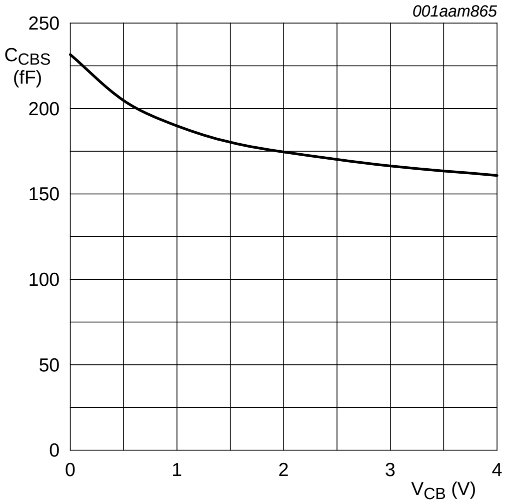
(9) I_B = 20 μA

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



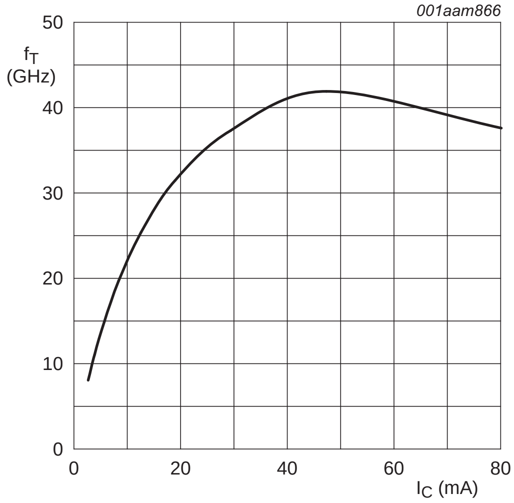
V_{CE} = 2 V; T_{amb} = 25 °C.

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



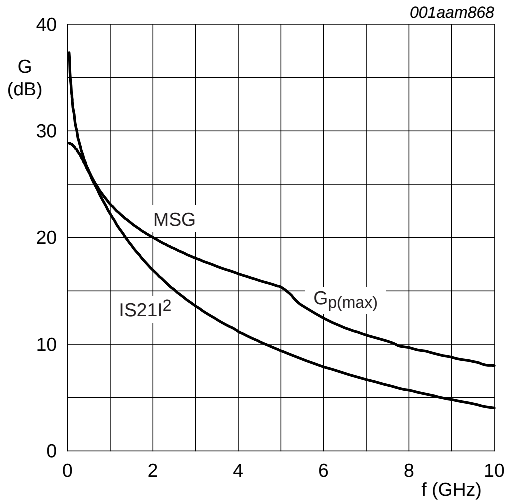
f = 1 MHz, T_{amb} = 25 °C.

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



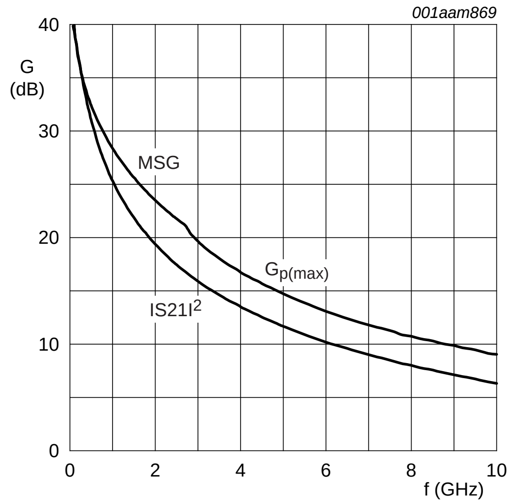
V_{CE} = 1 V; f = 2 GHz; T_{amb} = 25 °C.

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



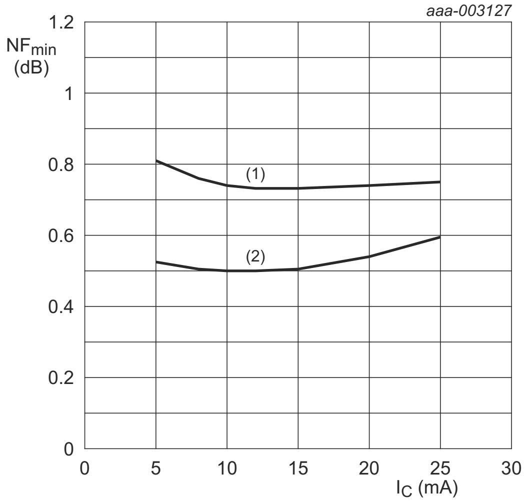
V_{CE} = 1 V; I_C = 8 mA; T_{amb} = 25 °C.

Fig 6. Gain as a function of frequency; typical values



V_{CE} = 1 V; I_C = 50 mA; T_{amb} = 25 °C.

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

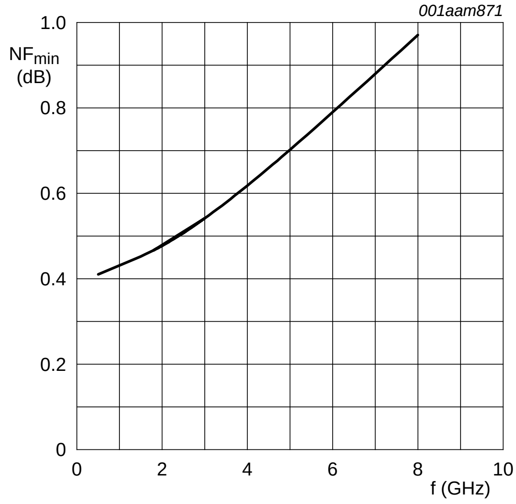


V_{CE} = 2 V; T_{amb} = 25 °C.

(1) f = 5.8 GHz

(2) f = 2.4 GHz

Fig 8. Minimum noise figure as a function of collector current; typical values

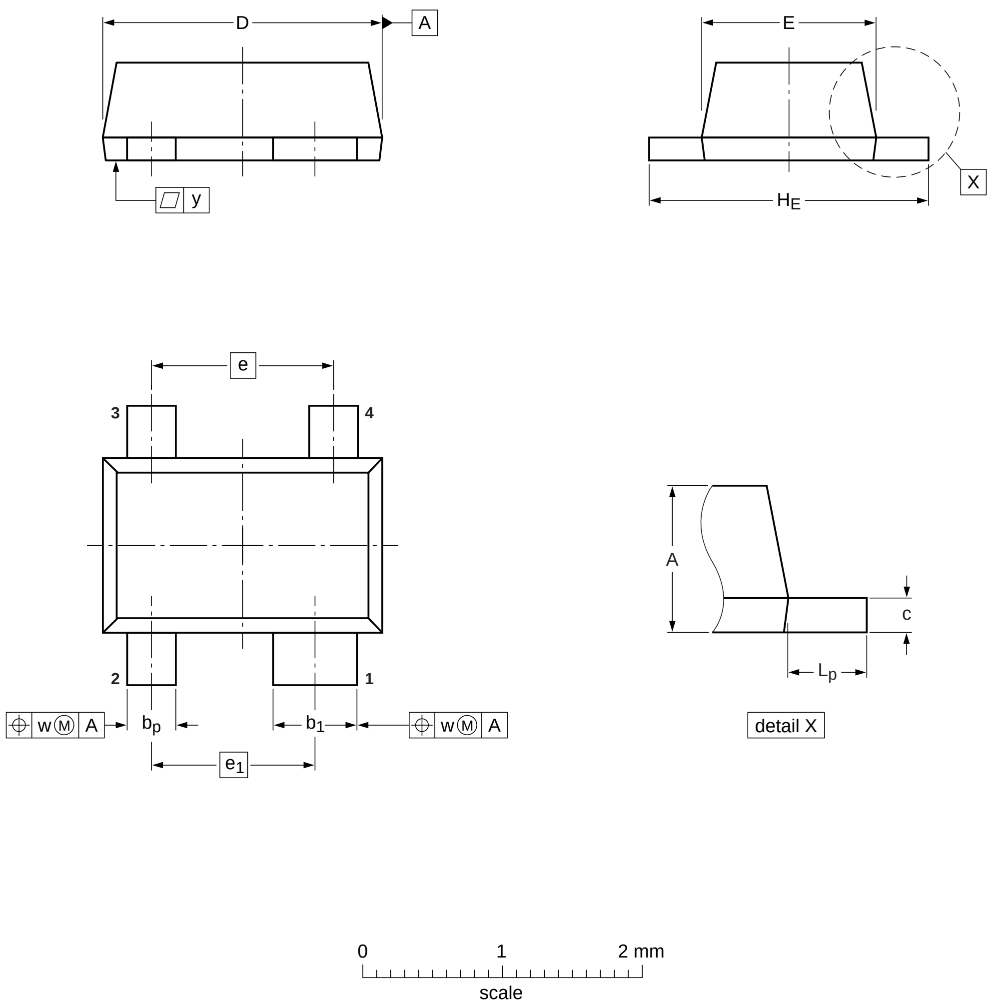


I_C = 12 mA; V_{CE} = 2 V; T_{amb} = 25 °C.

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

8. Package outline

Plastic surface-mounted flat pack package; reverse pinning; 4 leads **SOT343F**



DIMENSIONS (mm are the original dimensions)

UNIT	A max	b_p	b_1	c	D	E	e	e_1	H_E	L_p	w	y
mm	0.75 0.65	0.4 0.3	0.7 0.5	0.25 0.10	2.2 1.8	1.35 1.15	1.3	1.15	2.2 2.0	0.48 0.38	0.2	0.1

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT343F						~~05-07-12~~ 06-03-16

Fig 10. Package outline SOT343F

9. Abbreviations

Table 8. Abbreviations

Acronym	Description
DC	Direct Current
ISM	Industrial, Scientific and Medical
LNA	Low Noise Amplifier
NPN	Negative-Positive-Negative
RF	Radio Frequency
U-NII	Unlicensed National Information Infrastructure
WiMAX	Worldwide Interoperability for Microwave Access
WLAN	Wireless Local Area Network

10. Revision history

Table 9. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BFU768F v.1.2	20121224	Product data sheet	-	BFU768F v.1.1
Modification:	• Table 7 row $P_{L(1dB)}$ output power at 1 dB gain compression: replaced dB by dBm			
BFU768F v.1.1	20121116	Product data sheet	-	BFU768F v.1
Modification:	• Status distribution changed.			
BFU768F v.1	20120510	Product data sheet	-	-

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11.1 Data sheet status

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

[1] Please consult the most recently issued document before initiating or completing a design.

[2] The term 'short data sheet' is explained in section "Definitions".

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13. Contents

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