

# BFU910F

NPN wideband silicon germanium RF transistor

Rev. 2 — 16 January 2015

Product data sheet

## 1. Product profile

### 1.1 General description

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

The BFU910F is suitable for small signal applications up to 20 GHz.

### 1.2 Features and benefits

- Low noise high gain microwave transistor
- Minimum noise figure ( $NF_{min}$ ) = 0.65 dB at 12 GHz
- Maximum stable gain 14.2 dB at 12 GHz
- 90 GHz  $f_T$  SiGe technology

### 1.3 Applications

- $K_u$  band DBS Low-Noise blocks

### 1.4 Quick reference data

**Table 1. Quick reference data**

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

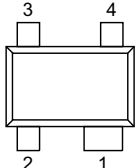
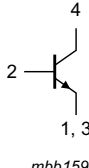
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{CE}$	collector-emitter voltage	$R_{BE} \leq 1\text{ M}\Omega$	-	2.0	3.0	V
$I_C$	collector current		-	10	15	mA
$P_{tot}$	total power dissipation	$T_{sp} \leq 90\text{ °C}$ [1]	-	-	300	mW
$h_{FE}$	DC current gain	$I_C = 6\text{ mA}$ ; $V_{CE} = 2\text{ V}$	-	1900	-	
$C_{CBS}$	collector-base capacitance	$V_{CB} = 2\text{ V}$ ; $f = 1\text{ MHz}$	-	35	-	fF
$f_T$	transition frequency	$I_C = 6\text{ mA}$ ; $V_{CE} = 2\text{ V}$	-	90	-	GHz
MSG	maximum stable gain	$I_C = 6\text{ mA}$ ; $V_{CE} = 2\text{ V}$ ; $f = 12\text{ GHz}$	-	14.2	-	dB
$NF_{min}$	minimum noise figure	$I_C = 6\text{ mA}$ ; $V_{CE} = 2\text{ V}$ ; $f = 12\text{ GHz}$ ; $\Gamma_S = \Gamma_{opt}$	-	0.65	-	dB
$G_{ass}$	associated gain	$I_C = 6\text{ mA}$ ; $V_{CE} = 2\text{ V}$ ; $f = 12\text{ GHz}$ ; $\Gamma_S = \Gamma_{opt}$	-	13.0	-	dB
$P_{L(1dB)}$	output power at 1 dB gain compression	$I_C = 10\text{ mA}$ ; $V_{CE} = 2\text{ V}$ ; $f = 12\text{ GHz}$ ; $Z_S = Z_L = 50\text{ }\Omega$	-	2	-	dBm

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



## 2. Pinning information

Table 2. Discrete pinning

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

## 3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
BFU910F	-	plastic surface-mounted flat pack package; reverse pinning; 4 leads	SOT343F

## 4. Marking

Table 4. Marking

Type number	Marking	Description
BFU910F	F1*	* = t : made in Malaysia
		* = w : made in China

## 5. Design support

Table 5. Available design support

Download from the BFU910F product information page on <http://www.nxp.com>.

Support item	Available	Remarks
Device models for Agilent EEsof EDA ADS	Q1 2015	Based on Mextram device model.
SPICE model	Q1 2015	Based on Gummel-Poon device model.
S-parameters	yes	
Noise parameters	yes	
Solder pattern	yes	
Application notes	yes	

## 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	-	9.5	V
$V_{CE}$	collector-emitter voltage	open base	-	2.0	V
		shorted base	-	9.5	V
$V_{EB}$	emitter-base voltage	open collector	-	1.5	V
$T_{stg}$	storage temperature		-65	+150	°C

## 7. Recommended operating conditions

**Table 7. Characteristics**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{CE}$	collector-emitter voltage	$R_{BE} \leq 1 \text{ M}\Omega$	-	2.0	3.0	V
$V_{EB}$	emitter-base voltage	open collector	-	-	1.0	V
$I_C$	collector current		-	-	15	mA
$P_i$	input power	$Z_S = 50 \Omega$	-	-	0	dBm
$T_j$	junction temperature		-40	-	+150	°C
$P_{tot}$	total power dissipation	$T_{sp} \leq 90 \text{ °C}$ [1]	-	-	300	mW

[1]  $T_{sp}$  is the temperature at the solder point of the emitter 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][2] 202	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  $T_{amb}$ :  $T_{sp} = T_{amb} + P \times R_{th(sp-amb)}$   
 with  $P$  the power dissipation and  $R_{th(sp-amb)}$  the thermal resistance between the solder point and ambient.  
 $R_{th(sp-amb)}$  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.

[2] Based on simulation.

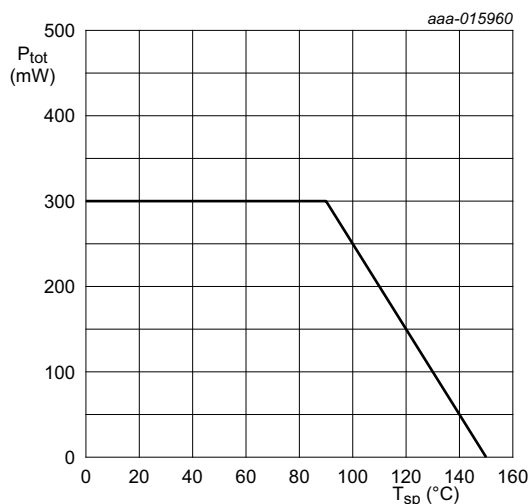


Fig 1. Power derating curve

## 9. Characteristics

Table 9. Characteristics

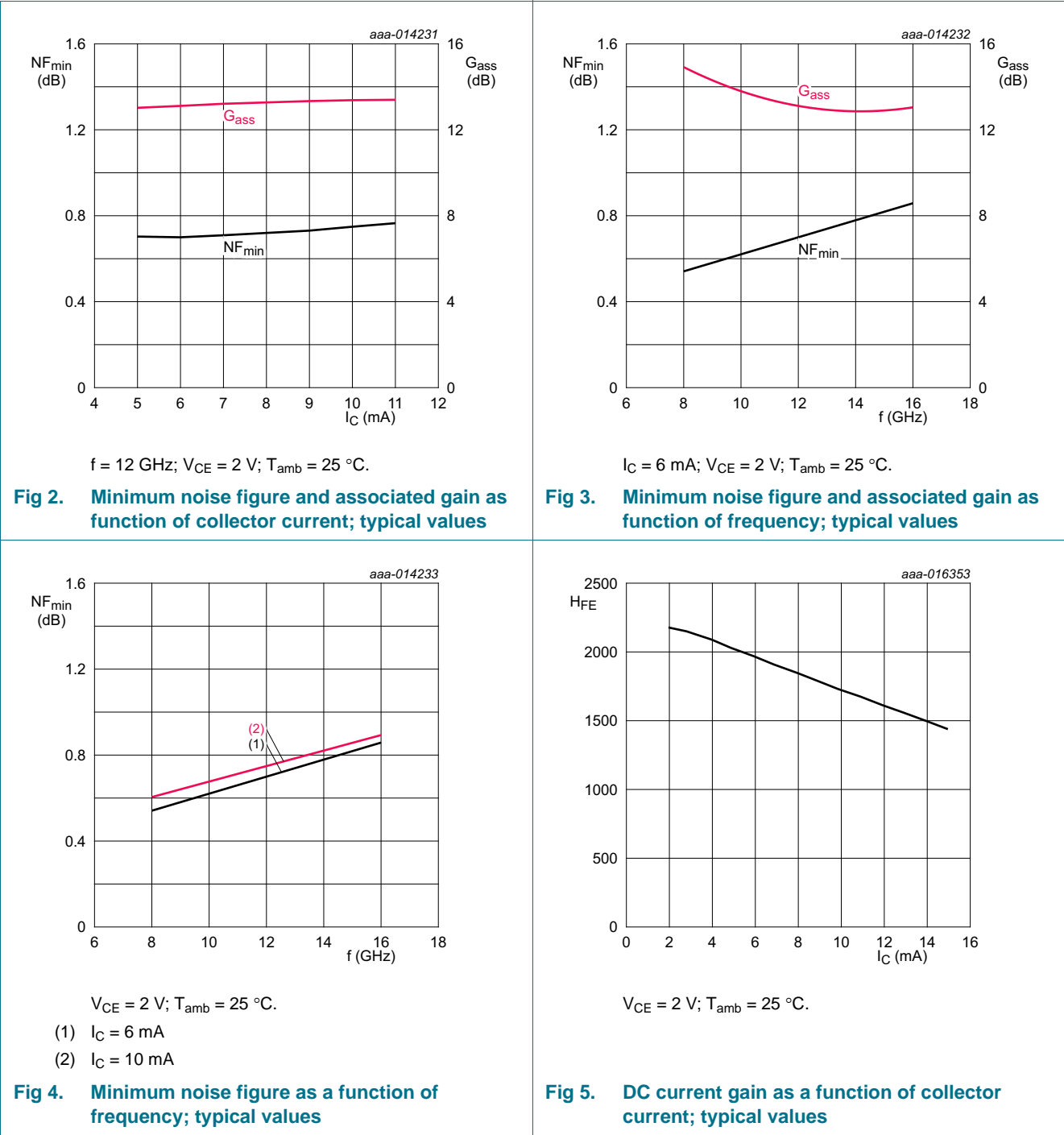
$T_{amb} = 25\text{ °C}$  unless otherwise specified

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{(BR)CBO}$	collector-base breakdown voltage	$I_C = 10\text{ }\mu\text{A}$ ; $I_E = 0\text{ }\mu\text{A}$	9.5	-	-	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	$I_C = 10\text{ }\mu\text{A}$ ; $I_B = 0\text{ }\mu\text{A}$	2.0	-	-	V
$I_C$	collector current		-	6	15	mA
$h_{FE}$	DC current gain	$I_C = 1.5\text{ mA}$ ; $V_{CE} = 1.5\text{ V}$	1200	2200	3300	
		$I_C = 6\text{ mA}$ ; $V_{CE} = 2\text{ V}$	-	1900	-	
$C_{CES}$	collector-emitter capacitance	$V_{CE} = 2\text{ V}$ ; $f = 1\text{ MHz}$	-	215	-	fF
$C_{EBS}$	emitter-base capacitance	$V_{EB} = 0.5\text{ V}$ ; $f = 1\text{ MHz}$	-	300	-	fF
$C_{CBS}$	collector-base capacitance	$V_{CB} = 2\text{ V}$ ; $f = 1\text{ MHz}$	-	35	-	fF
$f_T$	transition frequency	$I_C = 5\text{ mA}$ ; $V_{CE} = 2\text{ V}$	-	90	-	GHz
MSG	maximum stable gain	$f = 10.7\text{ GHz}$ ; $V_{CE} = 2\text{ V}$				
		$I_C = 6\text{ mA}$	-	15.2	-	dB
		$I_C = 10\text{ mA}$	-	15.5	-	dB
		$f = 12\text{ GHz}$ ; $V_{CE} = 2\text{ V}$				
		$I_C = 6\text{ mA}$	-	14.2	-	dB
		$I_C = 10\text{ mA}$	-	14.5	-	dB
		$f = 12.75\text{ GHz}$ ; $V_{CE} = 2\text{ V}$				
		$I_C = 6\text{ mA}$	-	14.2	-	dB
		$I_C = 10\text{ mA}$	-	14.5	-	dB

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$ S_{21} ^2$	insertion power gain	$f = 10.7\text{ GHz}; V_{CE} = 2\text{ V}$				
		$I_C = 6\text{ mA}$	-	13.0	-	dB
		$I_C = 10\text{ mA}$	-	13.5	-	dB
		$f = 12\text{ GHz}; V_{CE} = 2\text{ V}$				
		$I_C = 6\text{ mA}$	-	12.0	-	dB
		$I_C = 10\text{ mA}$	-	12.5	-	dB
		$f = 12.75\text{ GHz}; V_{CE} = 2\text{ V}$				
		$I_C = 6\text{ mA}$	-	12.0	-	dB
		$I_C = 10\text{ mA}$	-	12.5	-	dB
$NF_{min}$	minimum noise figure	$f = 10.7\text{ GHz}; V_{CE} = 2\text{ V}; \Gamma_S = \Gamma_{opt}$				
		$I_C = 6\text{ mA}$	-	0.6	-	dB
		$I_C = 10\text{ mA}$	-	0.65	-	dB
		$f = 12\text{ GHz}; V_{CE} = 2\text{ V}; \Gamma_S = \Gamma_{opt}$				
		$I_C = 6\text{ mA}$	-	0.65	0.85	dB
		$I_C = 10\text{ mA}$	-	0.7	-	dB
		$f = 12.75\text{ GHz}; V_{CE} = 2\text{ V}; \Gamma_S = \Gamma_{opt}$				
		$I_C = 6\text{ mA}$	-	0.65	-	dB
		$I_C = 10\text{ mA}$	-	0.7	-	dB
$G_{ass}$	associated gain	$f = 10.7\text{ GHz}; V_{CE} = 2\text{ V}; \Gamma_S = \Gamma_{opt}$				
		$I_C = 6\text{ mA}$	-	13.5	-	dB
		$I_C = 10\text{ mA}$	-	14.0	-	dB
		$f = 12\text{ GHz}; V_{CE} = 2\text{ V}; \Gamma_S = \Gamma_{opt}$				
		$I_C = 6\text{ mA}$	-	13.0	-	dB
		$I_C = 10\text{ mA}$	-	13.5	-	dB
		$f = 12.75\text{ GHz}; V_{CE} = 2\text{ V}; \Gamma_S = \Gamma_{opt}$				
		$I_C = 6\text{ mA}$	-	13.0	-	dB
		$I_C = 10\text{ mA}$	-	13.5	-	dB
$P_{L(1dB)}$	output power at 1 dB gain compression	$f = 12\text{ GHz}; V_{CE} = 2\text{ V}; Z_S = Z_L = 50\text{ }\Omega; I_C = 10\text{ mA}$	-	2	-	dBm
$IP3_o$	output third-order intercept point	$f_1 = 12.000\text{ GHz}; f_2 = 12.025\text{ GHz}; V_{CE} = 2\text{ V}; Z_S = Z_L = 50\text{ }\Omega; I_C = 10\text{ mA}$	-	12.5	-	dBm

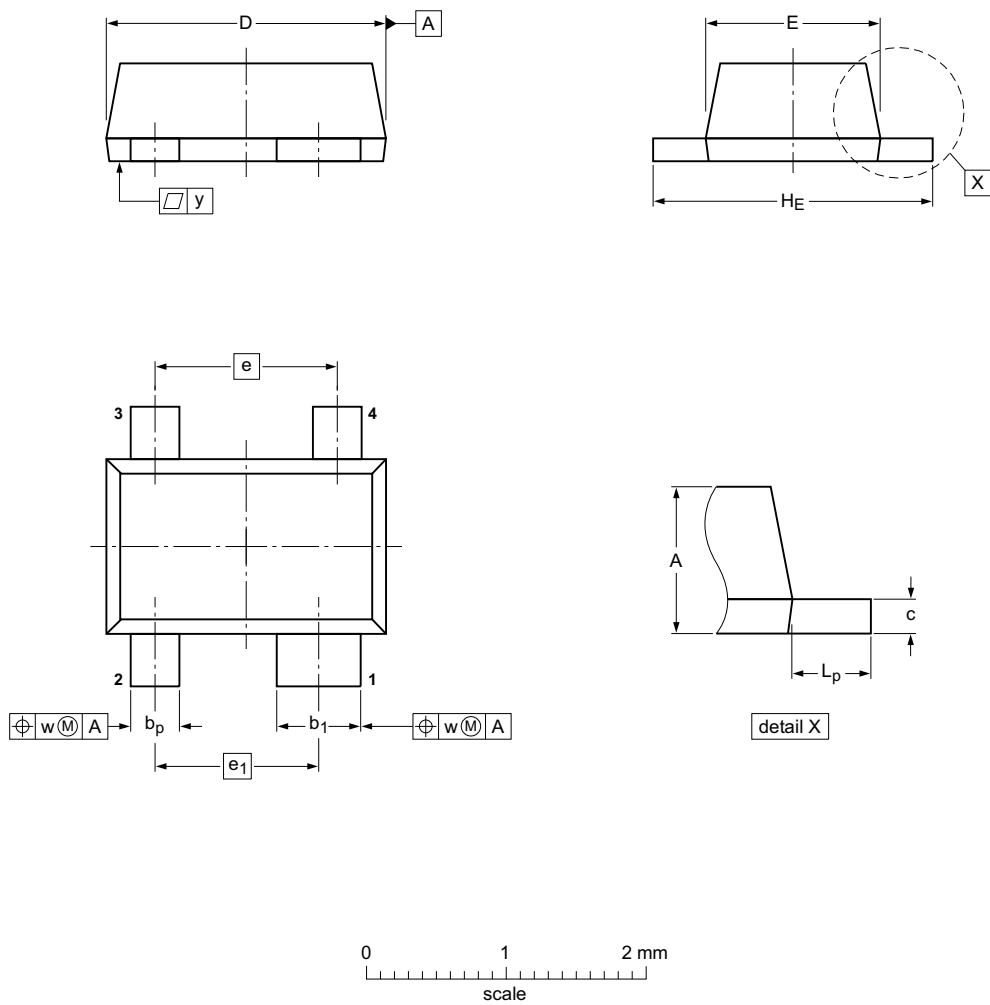
9.1 Graphs



10. Package outline

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

SOT343F



DIMENSIONS (mm are the original dimensions)

UNIT	A <sub>max</sub>	b <sub>p</sub>	b <sub>1</sub>	c	D	E	e	e <sub>1</sub>	H <sub>E</sub>	L <sub>p</sub>	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 6. Package outline SOT343F

## 11. 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.

## 12. Abbreviations

Table 10. Abbreviations

Acronym	Description
DBS	Direct Broadcast Satellite
K <sub>u</sub> band	K-under band
NPN	Negative-Positive-Negative
SiGe	Silicon Germanium

## 13. Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BFU910F v.2	20150116	Product data sheet	-	BFU910F v.1
Modifications	<ul style="list-style-type: none"> <li>The status of this document has been changed to "Product data sheet".</li> <li>The title has been changed to "NPN wideband silicon germanium RF transistor".</li> <li><a href="#">Section 1.1 on page 1</a>: the wording of this section has been changed.</li> <li><a href="#">Table 1 on page 1</a>: Some changes have been made.</li> <li><a href="#">Table 6 on page 3</a>: The maximum value for <math>V_{CE,open\ base}</math> has been changed.</li> <li><a href="#">Table 7 on page 3</a>: The typical value for <math>V_{CE}</math> has been changed.</li> <li><a href="#">Table 9 on page 4</a>: the conditions for <math>V_{(BR)CBO}</math> and <math>V_{(BR)CEO}</math> have been changed.</li> <li><a href="#">Figure 5 on page 6</a>: the figure has been added.</li> </ul>			
BFU910F v.1	20141128	Preliminary data sheet	-	-



## 14. Legal information

### 14.1 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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