

# BFU790F

NPN wideband silicon germanium RF transistor

Rev. 1 — 22 April 2011

Product data sheet

## 1. Product profile

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### 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 microwave transistor
- 110 GHz  $f_T$  silicon germanium technology
- High maximum output power at 1 dB compression 20 dBm at 1.8 GHz

### 1.3 Applications

- High linearity applications
- Medium output power applications
- Wi-Fi / WLAN / WiMAX
- ZigBee
- LTE, cellular, UMTS



### 1.4 Quick reference data

**Table 1. Quick reference data**

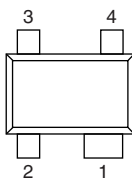
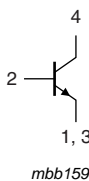
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{CBO}$	collector-base voltage	open emitter	-	-	10	V
$V_{CEO}$	collector-emitter voltage	open base	-	-	2.8	V
$V_{EBO}$	emitter-base voltage	open collector	-	-	1.0	V
$I_C$	collector current		-	50	100	mA
$P_{tot}$	total power dissipation	$T_{sp} \leq 90\text{ °C}$	[1]	-	234	mW
$h_{FE}$	DC current gain	$I_C = 10\text{ mA}; V_{CE} = 2\text{ V}; T_j = 25\text{ °C}$	235	410	585	
$C_{CBS}$	collector-base capacitance	$V_{CB} = 2\text{ V}; f = 1\text{ MHz}$	-	514	-	fF
$f_T$	transition frequency	$I_C = 100\text{ mA}; V_{CE} = 1\text{ V}; f = 2\text{ GHz}; T_{amb} = 25\text{ °C}$	-	25	-	GHz
$IP3O$	output third-order intercept point	$I_C = 30\text{ mA}; V_{CE} = 2.5\text{ V}; f = 1.8\text{ GHz}; T_{amb} = 25\text{ °C}$	-	33	-	dBm
$G_{p(max)}$	maximum power gain	$I_C = 85\text{ mA}; V_{CE} = 1\text{ V}; f = 1.8\text{ GHz}; T_{amb} = 25\text{ °C}$	[2]	-	19.5	dB
NF	noise figure	$I_C = 20\text{ mA}; V_{CE} = 2\text{ V}; \Gamma_S = \Gamma_{opt}; f = 1.8\text{ GHz}; T_{amb} = 25\text{ °C}$	-	0.40	-	dB
$P_{L(1dB)}$	output power at 1 dB gain compression	$I_C = 60\text{ mA}; V_{CE} = 2.5\text{ V}; Z_S = Z_L = 50\text{ }\Omega; f = 1.8\text{ GHz}; T_{amb} = 25\text{ °C}$	-	20	-	dBm

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

[2]  $G_{p(max)}$  is the maximum power gain, if  $K > 1$ . If  $K < 1$  then  $G_{p(max)}$  = Maximum Stable Gain (MSG).

## 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		Version
	Name	Description	
BFU790F	-	plastic surface-mounted flat pack package; reverse pinning; 4 leads	SOT343F

## 4. Marking

**Table 4. Marking**

Type number	Marking	Description
BFU790F	D8*	* = 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).*

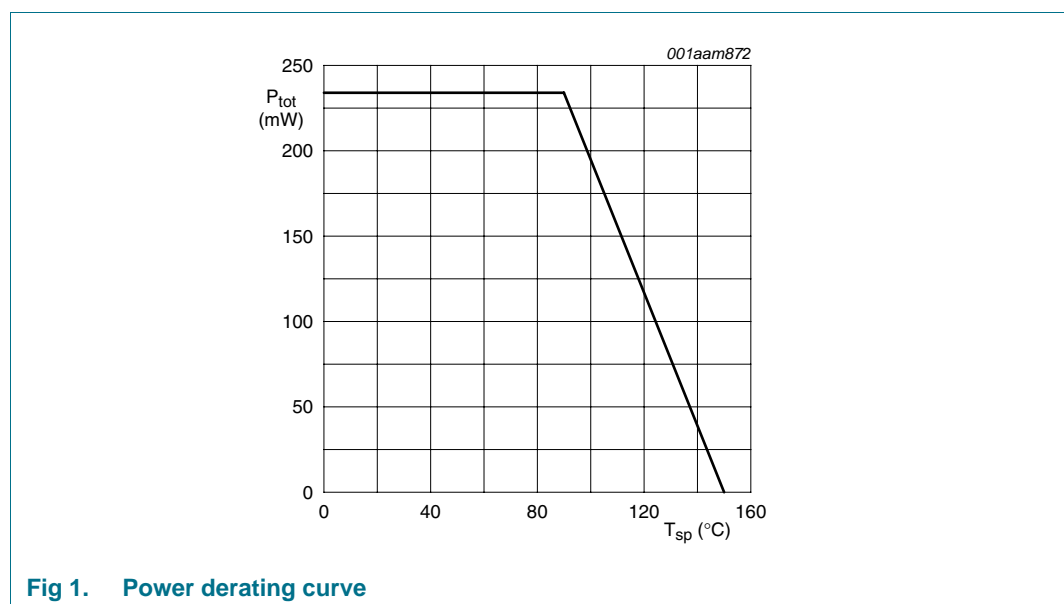
Symbol	Parameter	Conditions	Min	Max	Unit
$V_{CBO}$	collector-base voltage	open emitter	-	10	V
$V_{CEO}$	collector-emitter voltage	open base	-	2.8	V
$V_{EBO}$	emitter-base voltage	open collector	-	1.0	V
$I_C$	collector current		-	100	mA
$P_{tot}$	total power dissipation	$T_{sp} \leq 90\text{ °C}$	[1]	234	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		256	K/W



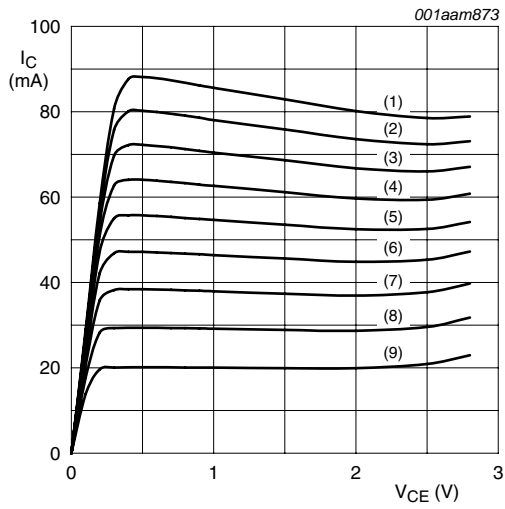
**Fig 1. Power derating curve**

## 7. Characteristics

**Table 7. Characteristics**
 $T_j = 25\text{ °C}$  unless otherwise specified

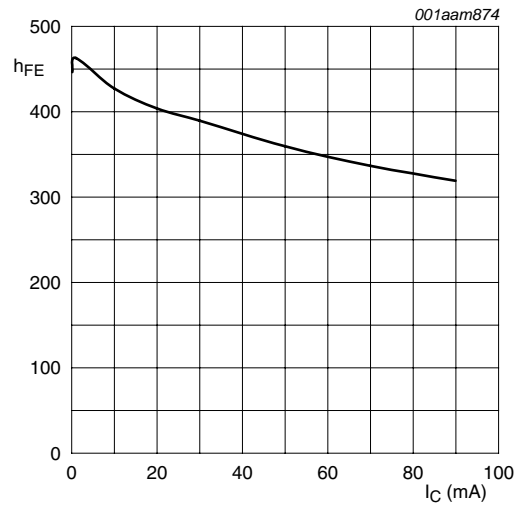
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{(BR)CBO}$	collector-base breakdown voltage	$I_C = 2.5\ \mu\text{A}; I_E = 0\ \text{mA}$	10	-	-	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	$I_C = 1\ \text{mA}; I_B = 0\ \text{mA}$	2.8	-	-	V
$I_C$	collector current		-	50	100	mA
$I_{CBO}$	collector-base cut-off current	$I_E = 0\ \text{mA}; V_{CB} = 4.5\ \text{V}$	-	-	100	nA
$h_{FE}$	DC current gain	$I_C = 10\ \text{mA}; V_{CE} = 2\ \text{V}$	235	410	585	
$C_{CES}$	collector-emitter capacitance	$V_{CB} = 2\ \text{V}; f = 1\ \text{MHz}$	-	527	-	fF
$C_{EBS}$	emitter-base capacitance	$V_{EB} = 0.5\ \text{V}; f = 1\ \text{MHz}$	-	2817	-	fF
$C_{CBS}$	collector-base capacitance	$V_{CB} = 2\ \text{V}; f = 1\ \text{MHz}$	-	514	-	fF
$f_T$	transition frequency	$I_C = 100\ \text{mA}; V_{CE} = 1\ \text{V}; f = 2\ \text{GHz}; T_{amb} = 25\text{ °C}$	-	25	-	GHz
$G_{p(max)}$	maximum power gain	$I_C = 85\ \text{mA}; V_{CE} = 1\ \text{V}; T_{amb} = 25\text{ °C}$	[1]			
		$f = 1.5\ \text{GHz}$	-	21	-	dB
		$f = 1.8\ \text{GHz}$	-	19.5	-	dB
		$f = 2.4\ \text{GHz}$	-	16.5	-	dB
$ s_{21} ^2$	insertion power gain	$I_C = 85\ \text{mA}; V_{CE} = 1\ \text{V}; T_{amb} = 25\text{ °C}$				
		$f = 1.5\ \text{GHz}$	-	14.5	-	dB
		$f = 1.8\ \text{GHz}$	-	13	-	dB
		$f = 2.4\ \text{GHz}$	-	10.5	-	dB
NF	noise figure	$I_C = 20\ \text{mA}; V_{CE} = 2\ \text{V}; \Gamma_S = \Gamma_{opt}; T_{amb} = 25\text{ °C}$				
		$f = 1.5\ \text{GHz}$	-	0.40	-	dB
		$f = 1.8\ \text{GHz}$	-	0.40	-	dB
		$f = 2.4\ \text{GHz}$	-	0.50	-	dB
$G_{ass}$	associated gain	$I_C = 20\ \text{mA}; V_{CE} = 2\ \text{V}; \Gamma_S = \Gamma_{opt}; T_{amb} = 25\text{ °C}$				
		$f = 1.5\ \text{GHz}$	-	19	-	dB
		$f = 1.8\ \text{GHz}$	-	17.5	-	dB
		$f = 2.4\ \text{GHz}$	-	15.7	-	dB
$P_{L(1dB)}$	output power at 1 dB gain compression	$I_C = 60\ \text{mA}; V_{CE} = 2.5\ \text{V}; Z_S = Z_L = 50\ \Omega; T_{amb} = 25\text{ °C}$				
		$f = 1.5\ \text{GHz}$	-	20	-	dBm
		$f = 1.8\ \text{GHz}$	-	20	-	dBm
		$f = 2.4\ \text{GHz}$	-	19	-	dBm
IP3	third-order intercept point	$I_C = 30\ \text{mA}; V_{CE} = 2.5\ \text{V}; Z_S = Z_L = 50\ \Omega; T_{amb} = 25\text{ °C}$				
		$f = 1.5\ \text{GHz}$	-	33	-	dBm
		$f = 1.8\ \text{GHz}$	-	33	-	dBm
		$f = 2.4\ \text{GHz}$	-	34	-	dBm
		$f = 5.8\ \text{GHz}$	-	33	-	dBm

[1]  $G_{p(max)}$  is the maximum power gain, if  $K > 1$ . If  $K < 1$  then  $G_{p(max)} = \text{MSG}$ .



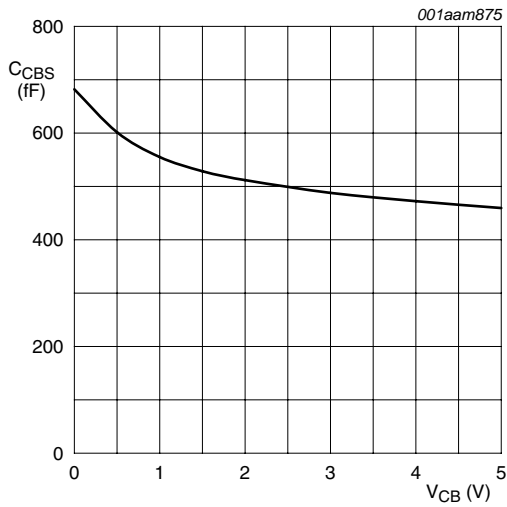
- $T_{amb} = 25\text{ }^{\circ}\text{C}.$
- (1)  $I_B = 250\text{ }\mu\text{A}$
  - (2)  $I_B = 225\text{ }\mu\text{A}$
  - (3)  $I_B = 200\text{ }\mu\text{A}$
  - (4)  $I_B = 175\text{ }\mu\text{A}$
  - (5)  $I_B = 150\text{ }\mu\text{A}$
  - (6)  $I_B = 125\text{ }\mu\text{A}$
  - (7)  $I_B = 100\text{ }\mu\text{A}$
  - (8)  $I_B = 75\text{ }\mu\text{A}$
  - (9)  $I_B = 50\text{ }\mu\text{A}$

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



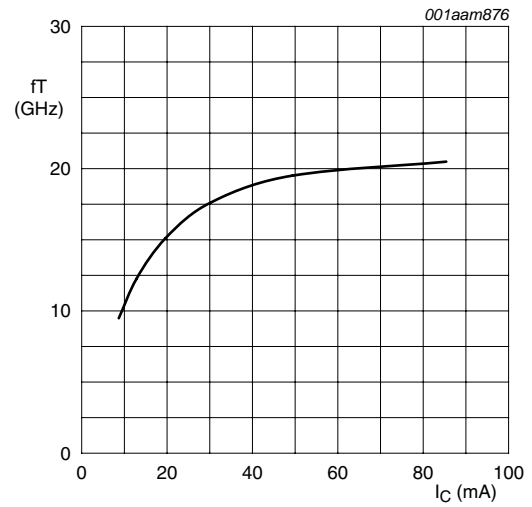
$V_{CE} = 2\text{ V}; T_{amb} = 25\text{ }^{\circ}\text{C}.$

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



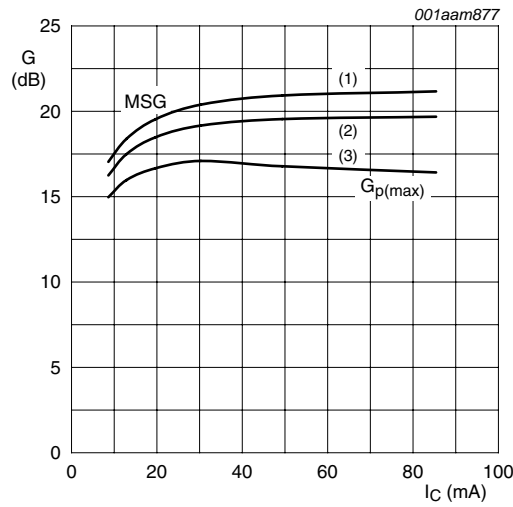
$f = 1 \text{ MHz}$ ,  $T_{amb} = 25 \text{ }^\circ\text{C}$ .

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



$V_{CE} = 1 \text{ V}$ ;  $f = 2 \text{ GHz}$ ;  $T_{amb} = 25 \text{ }^\circ\text{C}$ .

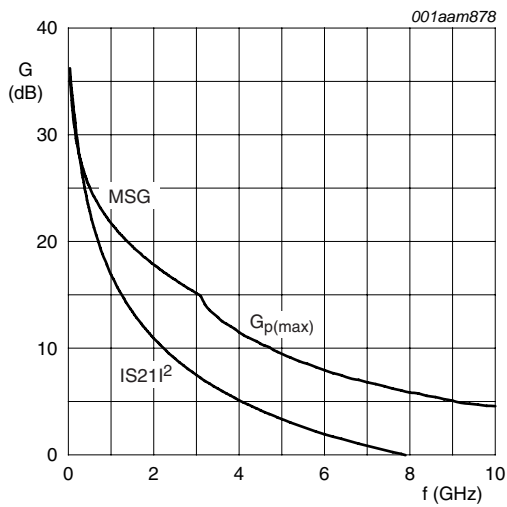
**Fig 5. Transition frequency as a function of collector current; typical values**



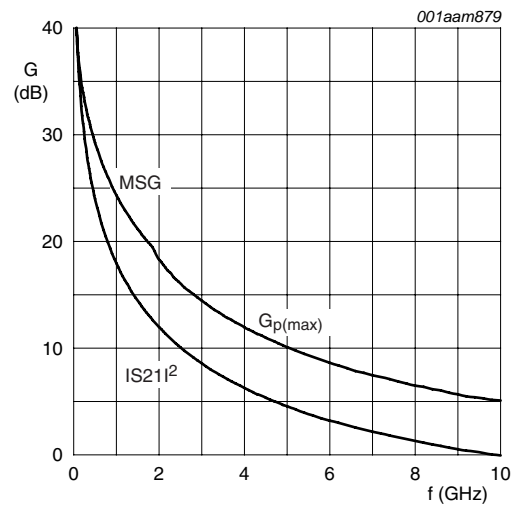
$V_{CE} = 1 \text{ V}$ ;  $T_{amb} = 25 \text{ }^\circ\text{C}$ .

- (1)  $f = 1.5 \text{ GHz}$
- (2)  $f = 1.8 \text{ GHz}$
- (3)  $f = 2.4 \text{ GHz}$

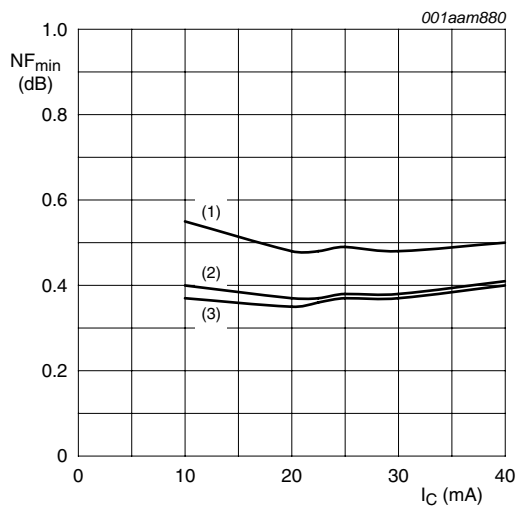
**Fig 6. Gain as a function of collector current; typical value**



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

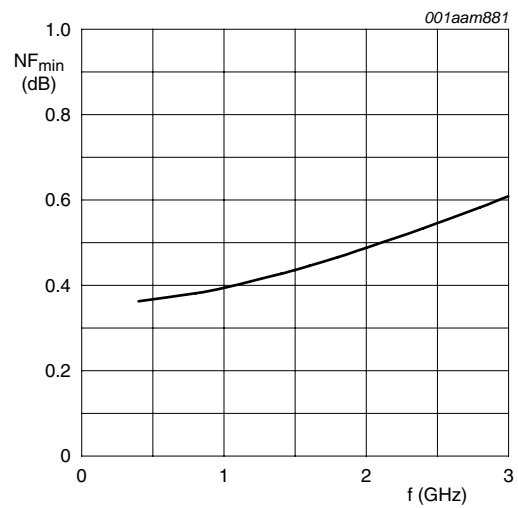


**Fig 8. Gain as a function of frequency; typical values**



- $V_{CE} = 2\text{ V}$ ;  $T_{amb} = 25\text{ }^\circ\text{C}$ .
- (1)  $f = 2.4\text{ GHz}$
  - (2)  $f = 1.8\text{ GHz}$
  - (3)  $f = 1.5\text{ GHz}$

**Fig 9. Minimum noise figure as a function of collector current; typical values**

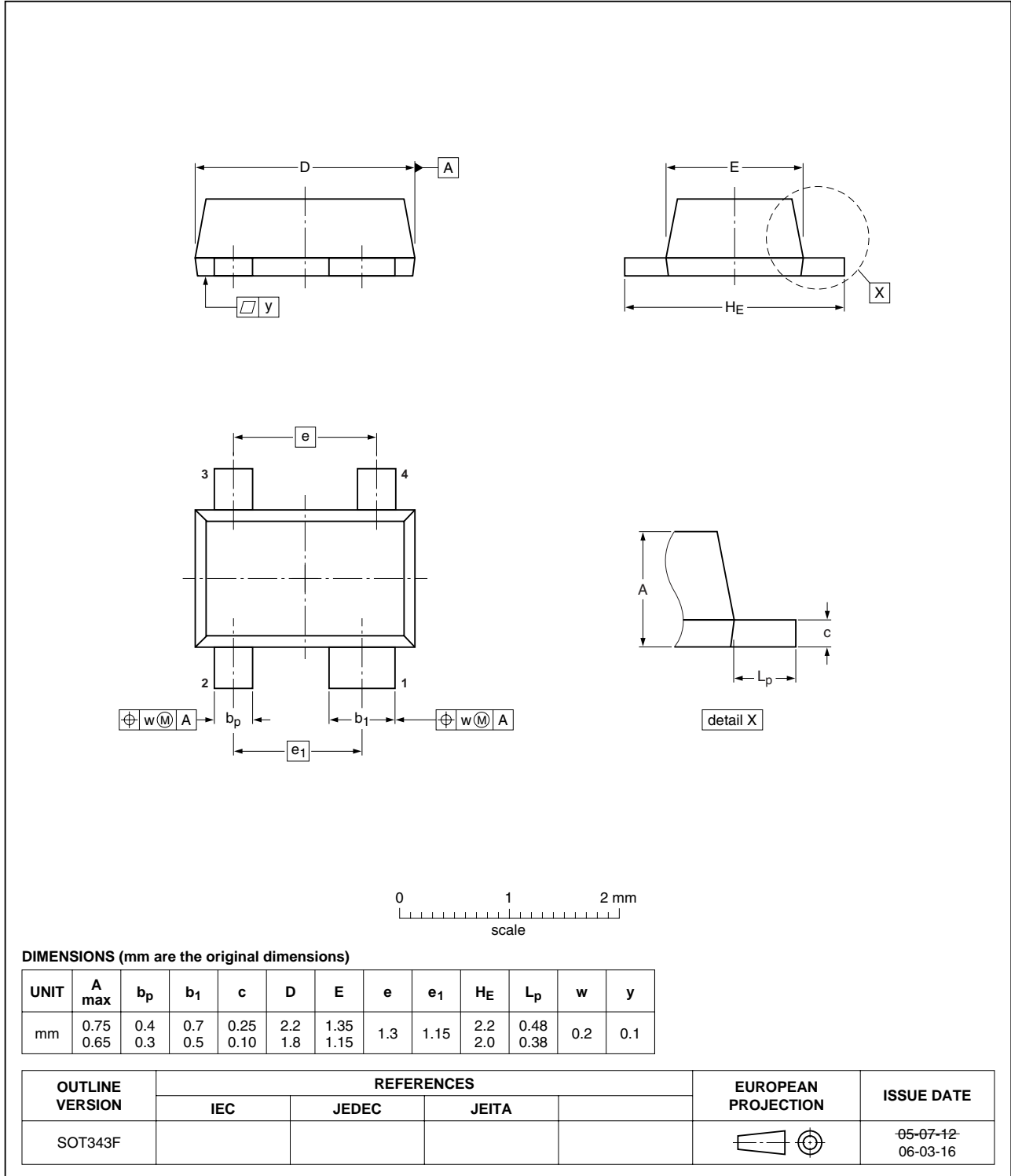


**Fig 10. Minimum noise figure as a function of frequency; typical values**

**8. Package outline**

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

SOT343F



**Fig 11. Package outline SOT343F**



## 9. Abbreviations

**Table 8. Abbreviations**

Acronym	Description
DC	Direct Current
LTE	Long Term Evolution
NPN	Negative-Positive-Negative
RF	Radio Frequency
UMTS	Universal Mobile Telecommunications System
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
BFU790F v.1	20110422	Product data sheet	-	-

## 11. Legal information

### 11.1 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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