

# 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**

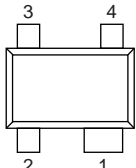
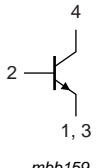
**Table 1. Quick reference data**

Wi-Fi LNA applications circuits;  $I_C = 10.8 \text{ mA}$ ;  $V_{CE} = 2.1 \text{ V}$ ;  $T_{amb} = 25 \text{ }^\circ\text{C}$ ; 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	$I_C = 10 \text{ mA}$ ; $V_{CE} = 2 \text{ V}$ ; $T_j = 25 \text{ }^\circ\text{C}$	155	330	505	
$ S_{21} ^2$	insertion power gain	$f = 2.4 \text{ GHz}$	-	13.1	-	dB
		$f = 5.0 \text{ GHz}$	-	12.2	-	dB
		$f = 5.9 \text{ GHz}$	-	11.1	-	dB
NF	noise figure	$f = 2.4 \text{ GHz}$	-	1.1	-	dB
		$f = 5.0 \text{ GHz}$	-	1.1	-	dB
		$f = 5.9 \text{ GHz}$	-	1.2	-	dB
IP3	third-order intercept point	$f = 2.4 \text{ GHz}$	-	15.7	-	dBm
		$f = 5.0 \text{ GHz}$	-	18.8	-	dBm
		$f = 5.9 \text{ GHz}$	-	18.8	-	dBm

**2. Pinning information**

**Table 2. Discrete pinning**

Pin	Description	Simplified outline	Graphic symbol
1	emitter		 <p style="text-align: right; margin-right: 20px;"><i>mbb159</i></p>
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).*

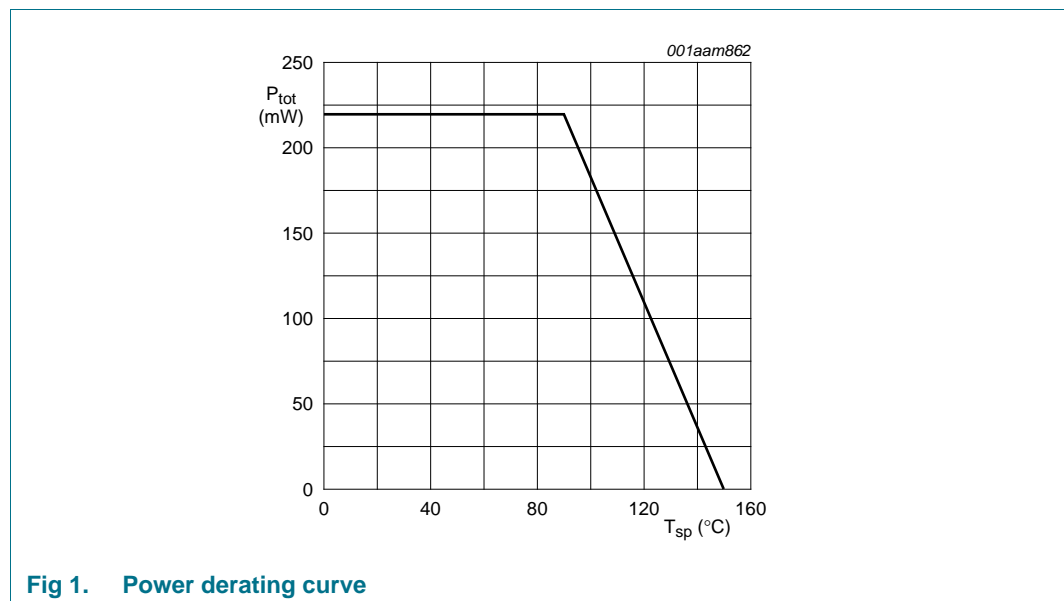
Symbol	Parameter	Conditions	Min	Max	Unit
$V_{CBO}$	collector-base voltage	open emitter	-	10	V
$V_{CEO}$	collector-emitter voltage	open base	-	2.8	V
$V_{EBO}$	emitter-base voltage	open collector	-	1.0	V
$I_C$	collector current		-	70	mA
$P_{tot}$	total power dissipation	$T_{sp} \leq 90\text{ °C}$	[1]	220	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



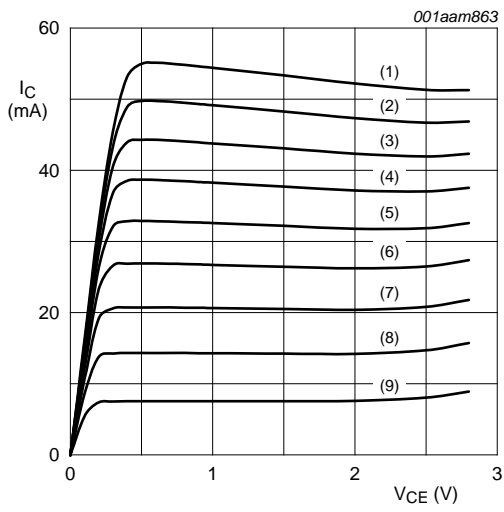
**Fig 1. Power derating curve**

## 7. Characteristics

**Table 7. Characteristics**

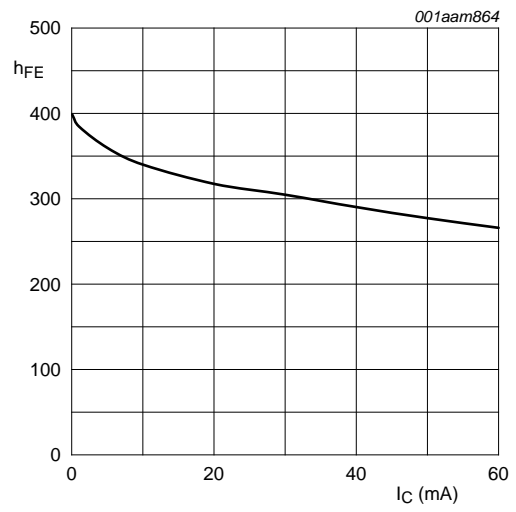
Wi-Fi LNA applications circuits;  $I_C = 10.8$  mA;  $V_{CE} = 2.1$  V;  $T_{amb} = 25$  °C; unless otherwise specified

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{(BR)CBO}$	collector-base breakdown voltage	$I_C = 2.5$ $\mu$ A; $I_E = 0$ 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



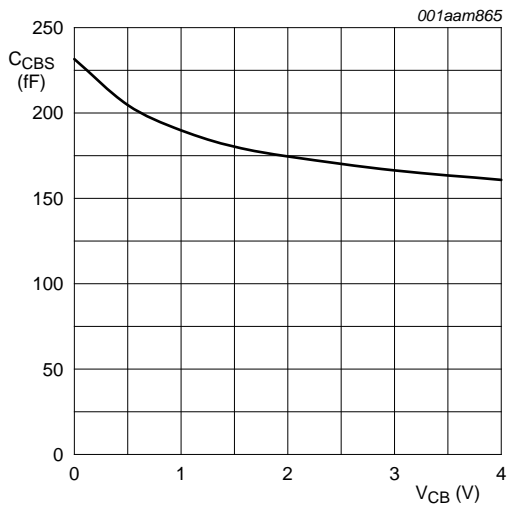
- $T_{amb} = 25\text{ }^\circ\text{C}.$
- (1)  $I_B = 180\text{ }\mu\text{A}$
  - (2)  $I_B = 160\text{ }\mu\text{A}$
  - (3)  $I_B = 140\text{ }\mu\text{A}$
  - (4)  $I_B = 120\text{ }\mu\text{A}$
  - (5)  $I_B = 100\text{ }\mu\text{A}$
  - (6)  $I_B = 80\text{ }\mu\text{A}$
  - (7)  $I_B = 60\text{ }\mu\text{A}$
  - (8)  $I_B = 40\text{ }\mu\text{A}$
  - (9)  $I_B = 20\text{ }\mu\text{A}$

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



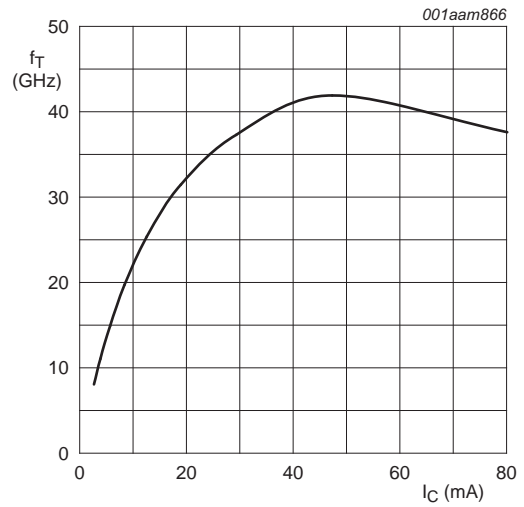
$V_{CE} = 2\text{ V}; T_{amb} = 25\text{ }^\circ\text{C}.$

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



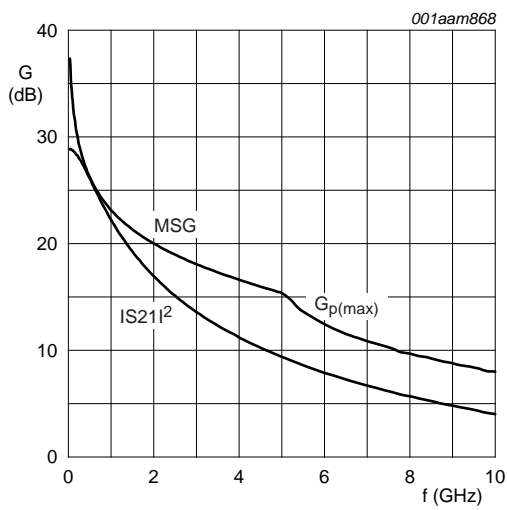
$f = 1 \text{ MHz}$ ,  $T_{amb} = 25 \text{ }^\circ\text{C}$ .

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



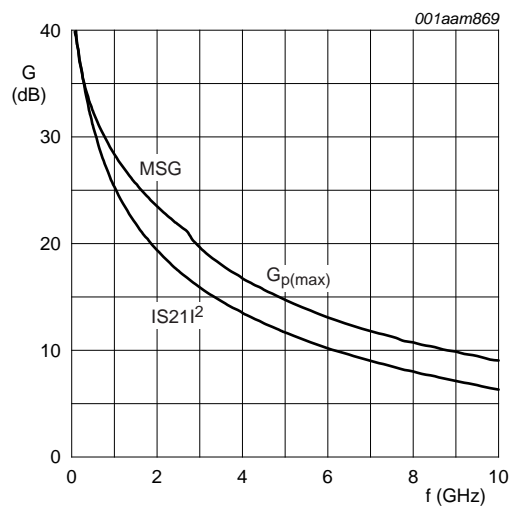
$V_{CE} = 1 \text{ V}$ ;  $f = 2 \text{ GHz}$ ;  $T_{amb} = 25 \text{ }^\circ\text{C}$ .

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



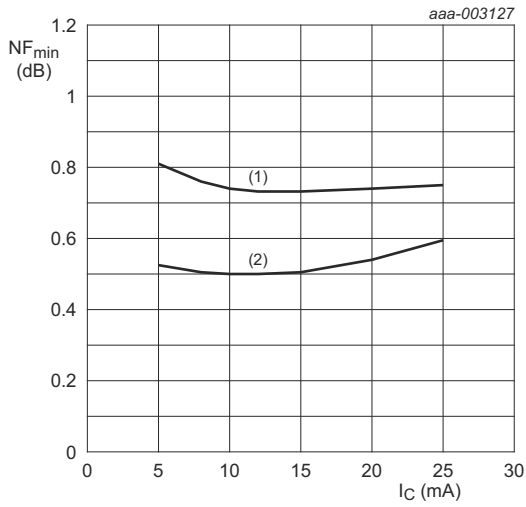
$V_{CE} = 1 \text{ V}$ ;  $I_C = 8 \text{ mA}$ ;  $T_{amb} = 25 \text{ }^\circ\text{C}$ .

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



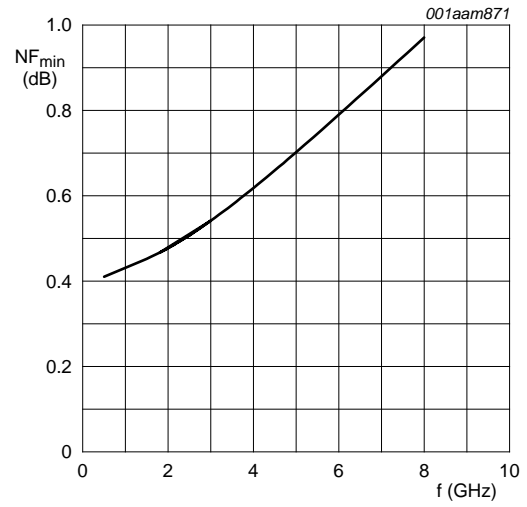
$V_{CE} = 1 \text{ V}$ ;  $I_C = 50 \text{ mA}$ ;  $T_{amb} = 25 \text{ }^\circ\text{C}$ .

**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

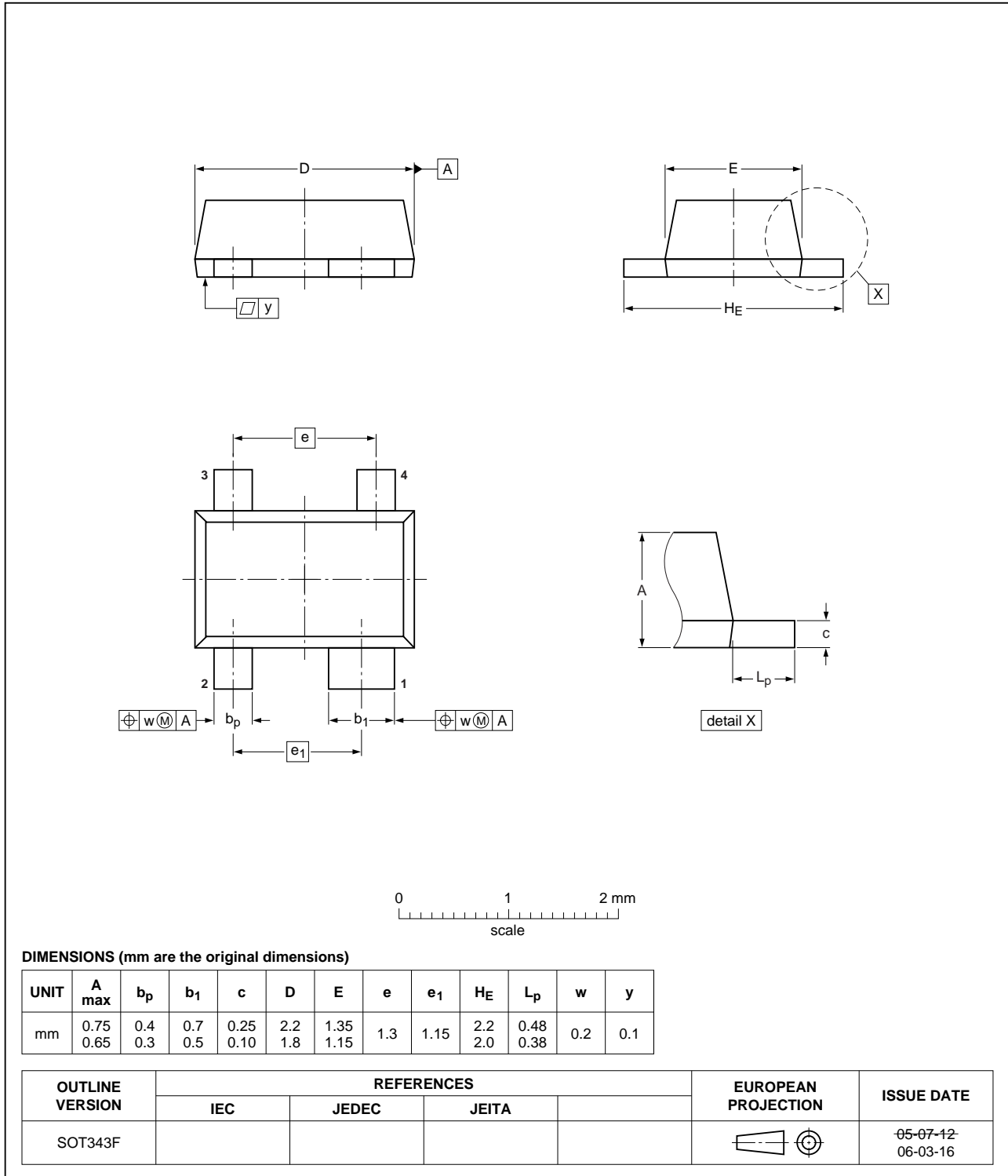


Fig 10. Package outline SOT343F

## 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:	<ul style="list-style-type: none"> <li>• <a href="#">Table 7</a> row <math>P_{L(1dB)}</math> output power at 1 dB gain compression: replaced dB by dBm</li> </ul>			
BFU768F v.1.1	20121116	Product data sheet	-	BFU768F v.1
Modification:	<ul style="list-style-type: none"> <li>• Status distribution changed.</li> </ul>			
BFU768F v.1	20120510	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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