



# BFU730LX

NPN wideband silicon germanium RF transistor

Rev. 1 — 8 May 2013

Product data sheet

## 1. Product profile

### 1.1 General description

NPN silicon germanium microwave transistor for high speed, low noise applications in a SOT883C leadless ultra small plastic SMD 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

- Leadless ultra small plastic SMD package 1.0 mm × 0.6 mm × 0.34 mm
- Low noise high gain microwave transistor
- Noise figure (NF) = 0.75 dB at 6 GHz
- High maximum power gain ( $G_{p(max)}$ ) of 15.8 dB at 6 GHz
- Excellent linearity in WiFi LNA from 5 GHz to 5.9 GHz:
  - ◆ input third-order intercept point ( $IP_{3i}$ ) = 15 dBm
  - ◆ input power at 1 dB gain compression ( $P_{i(1dB)}$ ) = 0 dBmSee application note *AN11224: Low Noise Fast Turn ON/OFF 5-5.9GHz WiFi LNA with BFU730LX*.
- 110 GHz  $f_T$  silicon germanium technology

### 1.3 Applications

- Wi-Fi / WLAN
  - See application notes:
    - ◆ *AN11223: Low Noise Fast Turn ON/OFF 2.4-2.5GHz WiFi LNA with BFU730LX*
    - ◆ *AN11224: Low Noise Fast Turn ON/OFF 5-5.9GHz WiFi LNA with BFU730LX*
- WiMAX
- LNA for GPS, GLONASS, Galileo and Compass (BeiDou)
- DBS (2nd LNA stage, mixer stage, DRO), SDARS
- RKE, AMR / Zigbee
- LNA for microwave communications systems
- Low current battery equipped applications
- Microwave driver / buffer applications



## 1.4 Quick reference data

**Table 1. Quick reference data**

$T_j = 25\text{ °C}$  unless otherwise specified.

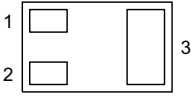
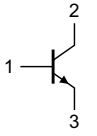
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{CB}$	collector-base voltage	open emitter	-	-	10.0	V
$V_{CE}$	collector-emitter voltage	open base	-	-	3.0	V
		shorted base	-	-	10.0	V
$V_{EB}$	emitter-base voltage	open collector	-	-	1.3	V
$I_C$	collector current		-	5	30	mA
$P_{tot}$	total power dissipation	$T_{sp} \leq 110\text{ °C}$	[1]	-	160	mW
$h_{FE}$	DC current gain	$I_C = 2\text{ mA}$ ; $V_{CE} = 2\text{ V}$ ; $T_j = 25\text{ °C}$	205	380	555	
$f_T$	transition frequency	$I_C = 25\text{ mA}$ ; $V_{CE} = 3\text{ V}$ ; $f = 2\text{ GHz}$ ; $T_{amb} = 25\text{ °C}$	-	53	-	GHz
$G_{p(max)}$	maximum power gain	$I_C = 25\text{ mA}$ ; $V_{CE} = 3\text{ V}$ ; $f = 6\text{ GHz}$ ; $T_{amb} = 25\text{ °C}$	[2]	15.8	-	dB
NF	noise figure	$I_C = 5\text{ mA}$ ; $V_{CE} = 3\text{ V}$ ; $f = 6\text{ GHz}$ ; $\Gamma_S = \Gamma_{opt}$	-	0.75	-	dB
$P_{L(1dB)}$	output power at 1 dB gain compression	$I_C = 25\text{ mA}$ ; $V_{CE} = 3\text{ V}$ ; $Z_S = Z_L = 50\text{ }\Omega$ ; $f = 1.8\text{ GHz}$ ; $T_{amb} = 25\text{ °C}$	-	11.7	-	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	base	 <p>Transparent top view</p>	 <p>aaa-006018</p>
2	collector		
3	emitter		

## 3. Ordering information

**Table 3. Ordering information**

Type number	Package		
	Name	Description	Version
BFU730LX	-	leadless ultra small plastic package; 3 terminals; body $1 \times 0.6 \times 0.34\text{ mm}$	SOT883C

## 4. Marking

Table 4. Marking

Type number	Marking
BFU730LX	ZD

## 5. Design support

Table 5. Available design support

Download from the BFU730LX product page on <http://www.nxp.com>.

Support item	Available	Remarks
Device models for Agilent EEsof EDA ADS	yes	<a href="#">[1]</a> Based on Mextram device model
Device models for Agilent EEsof EDA Genesys	yes	Based on Mextram device model
Device models for AWR Microwave Office	planned	Based on Mextram device model
Device models for ANSYS Ansoft designer	planned	Based on Mextram device model
SPICE model	planned	Based on Gummel-Poon device model
S-parameters	yes	
Noise parameters	yes	
Customer evaluation kit	yes	
Gerber files evaluation board	yes	
Reflow soldering footprint	yes	
AN11223: Low Noise Fast Turn ON/OFF 2.4-2.5GHz WiFi LNA with BFU730LX	yes	Application note
AN11224: Low Noise Fast Turn ON/OFF 5-5.9GHz WiFi LNA with BFU730LX	yes	Application note

[1] See <http://www.nxp.com/models.html>.

## 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	-	10.0	V
$V_{CE}$	collector-emitter voltage	open base	-	3.0	V
		shorted base	-	10.0	V
$V_{EB}$	emitter-base voltage	open collector	-	1.3	V
$P_{tot}$	total power dissipation	$T_{sp} \leq 110\text{ °C}$	<a href="#">[1]</a> -	160	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.

## 7. Recommended operating conditions

Table 7. Recommended operating conditions

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$T_j$	junction temperature		-40	-	+125	°C
$I_C$	collector current		-	-	30	mA

## 8. Thermal characteristics

Table 8. Thermal characteristics

Symbol	Parameter	Conditions	Typ	Unit
$R_{th(j-sp)}$	thermal resistance from junction to solder point		250	K/W

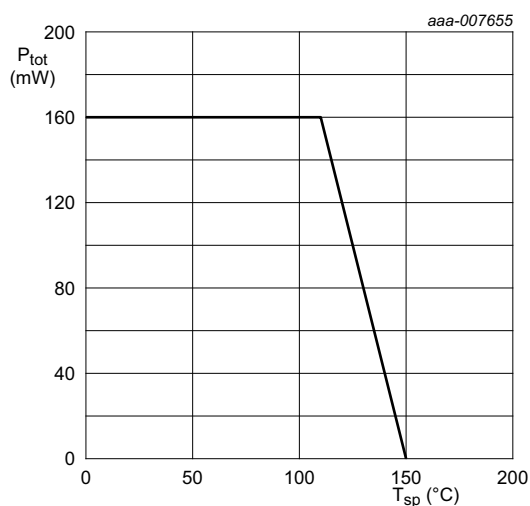


Fig 1. Total supply current as a function of solder point temperature

## 9. Characteristics

Table 9. Characteristics

$T_j = 25\text{ °C}$  unless otherwise specified; measurements done on characterization boards.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{(BR)CBO}$	collector-base breakdown voltage	$I_C = 2.5\text{ }\mu\text{A}$ ; $I_E = 0\text{ mA}$	10	-	-	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	$I_C = 1\text{ mA}$ ; $I_B = 0\text{ mA}$	3.0	-	-	V
$I_C$	collector current		-	5	30	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	$I_C = 2\text{ mA}$ ; $V_{CE} = 2\text{ V}$	205	380	555	
$C_{CE}$	collector-emitter capacitance	$V_{CE} = 2\text{ V}$ ; $f = 1\text{ MHz}$	-	145	-	fF
$C_{EB}$	emitter-base capacitance	$V_{EB} = 0.5\text{ V}$ ; $f = 1\text{ MHz}$	-	310	-	fF
$C_{CB}$	collector-base capacitance	$V_{CB} = 2\text{ V}$ ; $f = 1\text{ MHz}$	-	84	-	fF
$f_T$	transition frequency	$I_C = 25\text{ mA}$ ; $V_{CE} = 3\text{ V}$ ; $f = 2\text{ GHz}$ ; $T_{amb} = 25\text{ °C}$	-	53	-	GHz

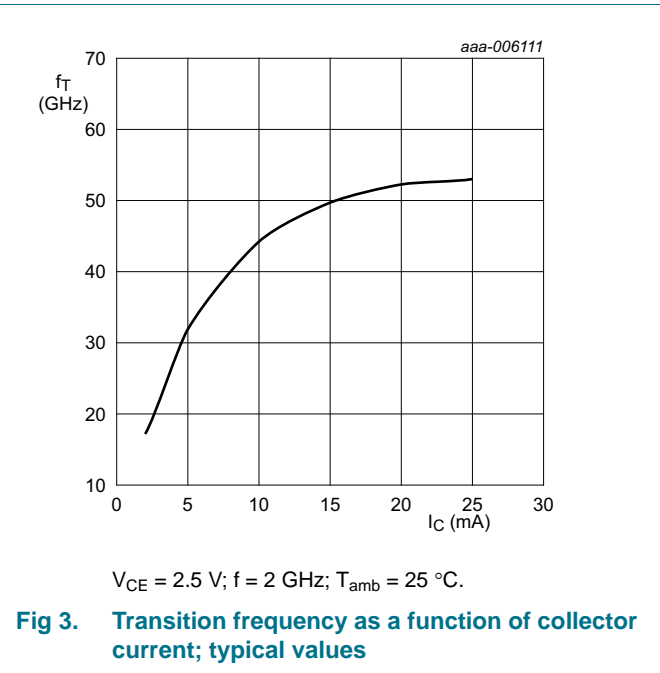
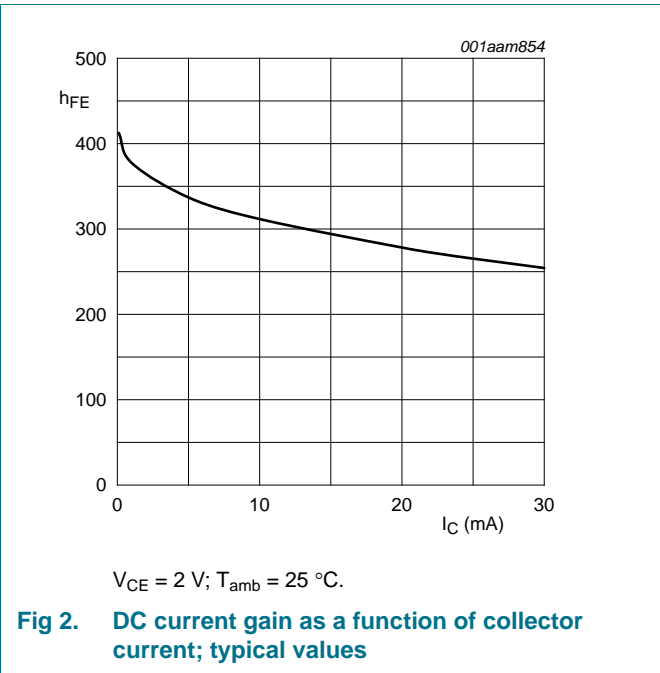
**Table 9. Characteristics ...continued** $T_j = 25\text{ °C}$  unless otherwise specified; measurements done on characterization boards.

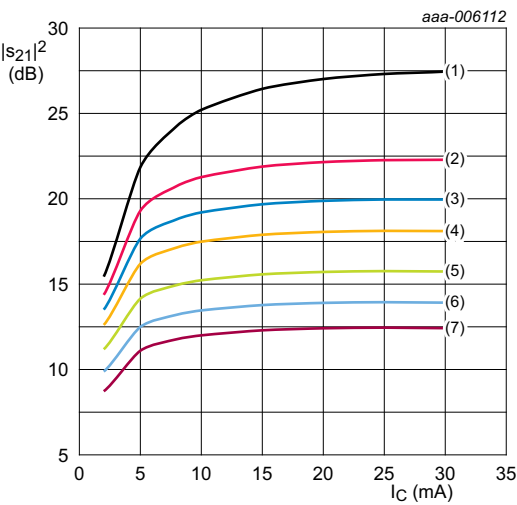
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$G_{p(max)}$	maximum power gain	$I_C = 5\text{ mA}; V_{CE} = 3\text{ V}; T_{amb} = 25\text{ °C}$	[1]			
		$f = 1.8\text{ GHz}$	-	22.0	-	dB
		$f = 6\text{ GHz}$	-	15.0	-	dB
		$I_C = 10\text{ mA}; V_{CE} = 3\text{ V}; T_{amb} = 25\text{ °C}$	[1]			
		$f = 1.8\text{ GHz}$	-	23.6	-	dB
		$f = 6\text{ GHz}$	-	15.7	-	dB
		$I_C = 25\text{ mA}; V_{CE} = 3\text{ V}; T_{amb} = 25\text{ °C}$	[1]			
		$f = 1.8\text{ GHz}$	-	24.5	-	dB
		$f = 6\text{ GHz}$	-	15.8	-	dB
$ s_{21} ^2$	insertion power gain	$I_C = 5\text{ mA}; V_{CE} = 3\text{ V}; T_{amb} = 25\text{ °C}$				
		$f = 1.8\text{ GHz}$	-	19.3	-	dB
		$f = 6\text{ GHz}$	-	11.1	-	dB
		$I_C = 10\text{ mA}; V_{CE} = 3\text{ V}; T_{amb} = 25\text{ °C}$				
		$f = 1.8\text{ GHz}$	-	21.3	-	dB
		$f = 6\text{ GHz}$	-	12.0	-	dB
		$I_C = 25\text{ mA}; V_{CE} = 3\text{ V}; T_{amb} = 25\text{ °C}$				
		$f = 1.8\text{ GHz}$	-	22.3	-	dB
		$f = 6\text{ GHz}$	-	12.5	-	dB
$NF_{min}$	minimum noise figure	$I_C = 5\text{ mA}; V_{CE} = 3\text{ V}; \Gamma_S = \Gamma_{opt}; T_{amb} = 25\text{ °C}$				
		$f = 1.8\text{ GHz}$	-	0.55	-	dB
		$f = 6\text{ GHz}$	-	0.75	-	dB
		$I_C = 10\text{ mA}; V_{CE} = 3\text{ V}; \Gamma_S = \Gamma_{opt}; T_{amb} = 25\text{ °C}$				
		$f = 1.8\text{ GHz}$	-	0.7	-	dB
		$f = 6\text{ GHz}$	-	0.9	-	dB
		$I_C = 25\text{ mA}; V_{CE} = 3\text{ V}; \Gamma_S = \Gamma_{opt}; T_{amb} = 25\text{ °C}$				
		$f = 1.8\text{ GHz}$	-	1.1	-	dB
		$f = 6\text{ GHz}$	-	1.2	-	dB
$P_{L(1dB)}$	output power at 1 dB gain compression	$I_C = 5\text{ mA}; V_{CE} = 3\text{ V}; Z_S = Z_L = 50\text{ }\Omega; T_{amb} = 25\text{ °C}$				
		$f = 1.8\text{ GHz}$	-	-3.7	-	dBm
		$f = 6\text{ GHz}$	-	-1.6	-	dBm
		$I_C = 10\text{ mA}; V_{CE} = 3\text{ V}; Z_S = Z_L = 50\text{ }\Omega; T_{amb} = 25\text{ °C}$				
		$f = 1.8\text{ GHz}$	-	3.5	-	dBm
		$f = 6\text{ GHz}$	-	5.4	-	dBm
		$I_C = 25\text{ mA}; V_{CE} = 3\text{ V}; Z_S = Z_L = 50\text{ }\Omega; T_{amb} = 25\text{ °C}$				
		$f = 1.8\text{ GHz}$	-	11.7	-	dBm
		$f = 6\text{ GHz}$	-	12.7	-	dBm

Table 9. Characteristics ...continued  
*T<sub>j</sub> = 25 °C unless otherwise specified; measurements done on characterization boards.*

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
IP3 <sub>o</sub>	output third-order intercept point	I <sub>C</sub> = 5 mA; V <sub>CE</sub> = 3 V; Z <sub>S</sub> = Z <sub>L</sub> = 50 Ω; T <sub>amb</sub> = 25 °C				
		f = 1.8 GHz	-	14.7	-	dBm
		f = 6 GHz	-	19.0	-	dBm
		I <sub>C</sub> = 10 mA; V <sub>CE</sub> = 3 V; Z <sub>S</sub> = Z <sub>L</sub> = 50 Ω; T <sub>amb</sub> = 25 °C				
		f = 1.8 GHz	-	23.8	-	dBm
		f = 6 GHz	-	25.3	-	dBm
		I <sub>C</sub> = 25 mA; V <sub>CE</sub> = 3 V; Z <sub>S</sub> = Z <sub>L</sub> = 50 Ω; T <sub>amb</sub> = 25 °C				
		f = 1.8 GHz	-	25.5	-	dBm
		f = 6 GHz	-	26.9	-	dBm

[1] G<sub>p(max)</sub> is the maximum power gain, if K > 1. If K < 1 then G<sub>p(max)</sub> = MSG.

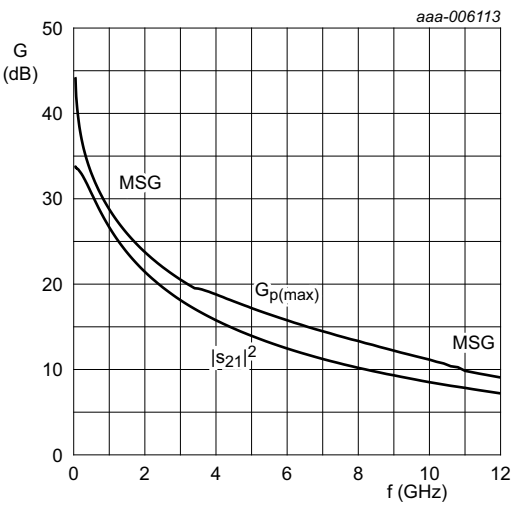




$V_{CE} = 3\text{ V}$ ;  $T_{amb} = 25\text{ }^{\circ}\text{C}$ .

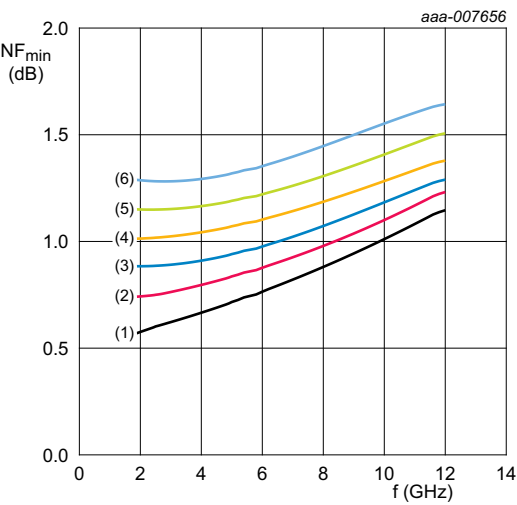
- (1)  $f = 0.9\text{ GHz}$
- (2)  $f = 1.8\text{ GHz}$
- (3)  $f = 2.4\text{ GHz}$
- (4)  $f = 3.0\text{ GHz}$
- (5)  $f = 4.0\text{ GHz}$
- (6)  $f = 5.0\text{ GHz}$
- (7)  $f = 6.0\text{ GHz}$

Fig 4. Insertion power gain as a function of collector current; typical value



$I_C = 25\text{ mA}$ ;  $V_{CE} = 3\text{ V}$ ;  $T_{amb} = 25\text{ }^{\circ}\text{C}$ .

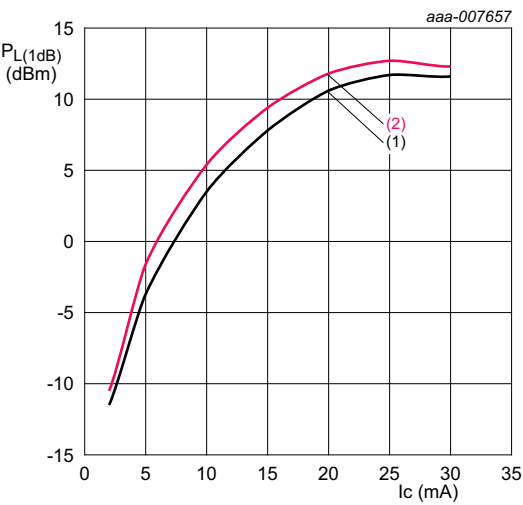
Fig 5. Gain as a function of frequency; typical values



$V_{CE} = 3$  V;  $T_{amb} = 25$  °C.

- (1)  $I_C = 5$  mA
- (2)  $I_C = 10$  mA
- (3)  $I_C = 15$  mA
- (4)  $I_C = 20$  mA
- (5)  $I_C = 25$  mA
- (6)  $I_C = 30$  mA

Fig 6. Minimum noise figure as a function of frequency; typical values



$V_{CE} = 3$  V;  $T_{amb} = 25$  °C.

- (1)  $f = 1.8$  GHz
- (2)  $f = 6$  GHz

Fig 7. Output power at 1 dB gain compression as a function of collector current; typical values



10. Package outline

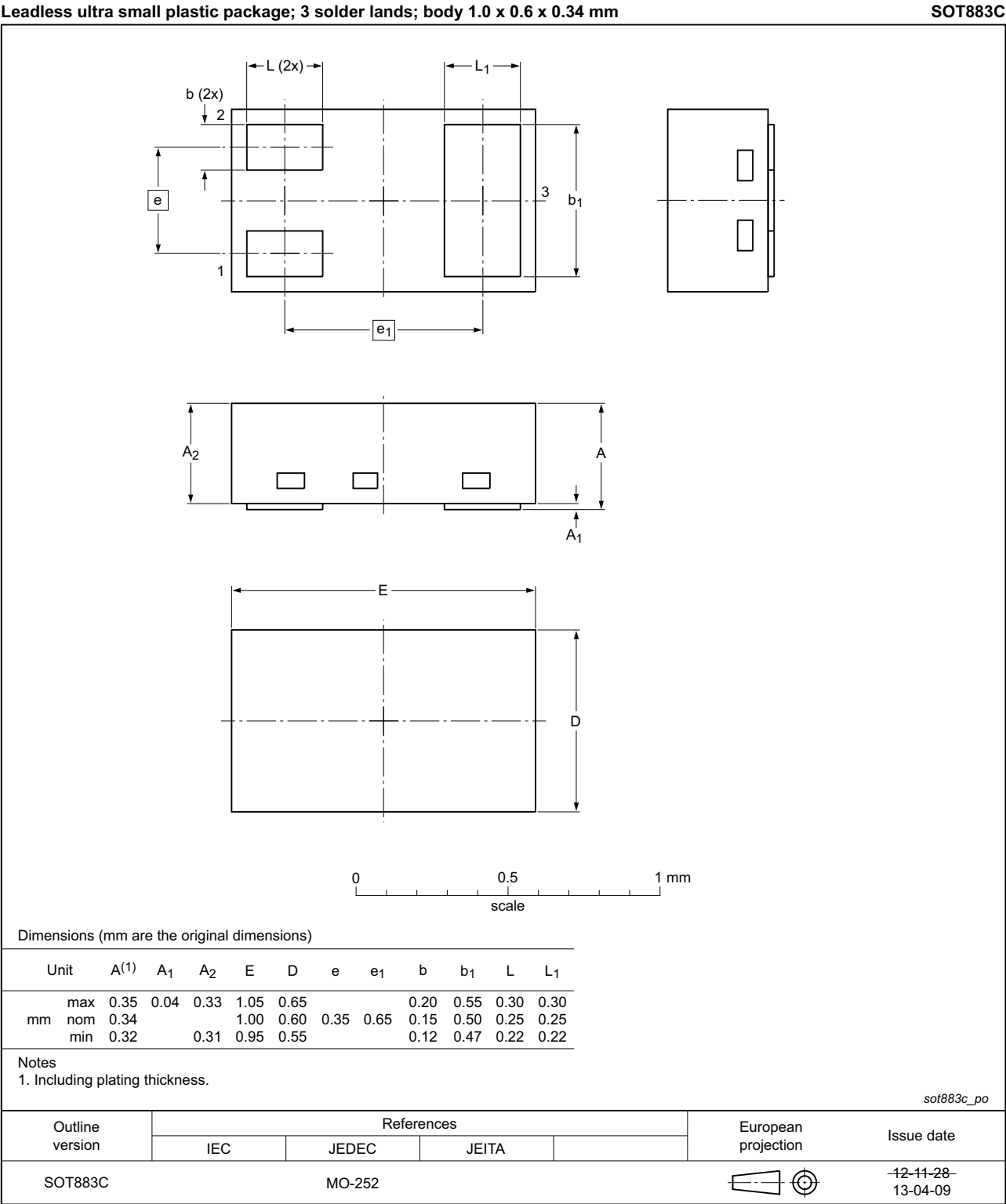


Fig 8. Package outline SOT883C

## 11. Abbreviations

Table 10. Abbreviations

Acronym	Description
AMR	Automatic Meter Reading
DBS	Direct Broadcast Satellite
DRO	Dielectric Resonator Oscillator
GLONASS	GLObal NAVigation Satellite System
GPS	Global Positioning System
LNA	Low Noise Amplifier
LNB	Low Noise Block
NPN	Negative-Positive-Negative
RKE	Remote Keyless Entry
SDARS	Satellite Digital Audio Radio Service
SMD	Surface-Mounted Device
WiMAX	Worldwide Interoperability for Microwave Access
WLAN	Wireless Local Area Network

## 12. Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BFU730LX v.1	20130508	Product data sheet	-	-

## 13. Legal information

### 13.1 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".

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL <http://www.nxp.com>.

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**Quick reference data** — The Quick reference data is an extract of the product data given in the Limiting values and Characteristics sections of this document, and as such is not complete, exhaustive or legally binding.

## 13.4 Trademarks

Notice: All referenced brands, product names, service names and trademarks are the property of their respective owners.

## 14. Contact information

For more information, please visit: <http://www.nxp.com>

For sales office addresses, please send an email to: [salesaddresses@nxp.com](mailto:salesaddresses@nxp.com)

## 15. Contents

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<b>1</b>	<b>Product profile</b> . . . . .	<b>1</b>
1.1	General description . . . . .	1
1.2	Features and benefits . . . . .	1
1.3	Applications . . . . .	1
1.4	Quick reference data . . . . .	2
<b>2</b>	<b>Pinning information</b> . . . . .	<b>2</b>
<b>3</b>	<b>Ordering information</b> . . . . .	<b>2</b>
<b>4</b>	<b>Marking</b> . . . . .	<b>3</b>
<b>5</b>	<b>Design support</b> . . . . .	<b>3</b>
<b>6</b>	<b>Limiting values</b> . . . . .	<b>3</b>
<b>7</b>	<b>Recommended operating conditions</b> . . . . .	<b>4</b>
<b>8</b>	<b>Thermal characteristics</b> . . . . .	<b>4</b>
<b>9</b>	<b>Characteristics</b> . . . . .	<b>4</b>
<b>10</b>	<b>Package outline</b> . . . . .	<b>9</b>
<b>11</b>	<b>Abbreviations</b> . . . . .	<b>10</b>
<b>12</b>	<b>Revision history</b> . . . . .	<b>10</b>
<b>13</b>	<b>Legal information</b> . . . . .	<b>11</b>
13.1	Data sheet status . . . . .	11
13.2	Definitions . . . . .	11
13.3	Disclaimers . . . . .	11
13.4	Trademarks . . . . .	12
<b>14</b>	<b>Contact information</b> . . . . .	<b>12</b>
<b>15</b>	<b>Contents</b> . . . . .	<b>13</b>

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Please be aware that important notices concerning this document and the product(s) described herein, have been included in section 'Legal information'.

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