

BGU7003W

Wideband silicon germanium low-noise amplifier MMIC

Rev. 2 — 11 April 2013

Product data sheet

1. Product profile

1.1 General description

The BGU7003W MMIC is a wideband amplifier in SiGe:C technology for high speed, low-noise applications in a plastic, leadless 6 pin, extremely thin small outline SOT886 package.

Table 1. Application information

$T_{amb} = 25\text{ }^{\circ}\text{C}$; $V_{CC} = 2.85\text{ V}$; $I_{CC(tot)} = 3.2\text{ mA}$ [1]; $V_{ENABLE} \geq 0.7\text{ V}$; $f = 100\text{ MHz}$; $Z_S = Z_L = 50\text{ }\Omega$ unless otherwise specified. All measurements are done with the SMA-connectors as reference plane.

Application	NF (dB)	$ S_{21} ^2$ (dB)	RL _{in} (dB)	RL _{out} (dB)	P _{i(1dB)} (dBm)	P _{L(1dB)} (dBm)	IP3 _i (dBm)	IP3 _o (dBm)
high-ohmic FM LNA	1.2	13	0.5	16.5	-23	-11	-15 [2]	-2 [2]

[1] $I_{CC(tot)} = I_{CC} + I_{RF_OUT} + I_{R_BIAS}$.

[2] The third order intercept point is measured at -30 dBm per tone at RF_IN ($f_1 = 100\text{ MHz}$; $f_2 = 100.2\text{ MHz}$)

1.2 Features and benefits

- Low noise high gain microwave MMIC
- Applicable between 40 MHz and 6 GHz
- Integrated temperature stabilized bias for easy design
- Bias current configurable with external resistor
- 110 GHz transit frequency - SiGe:C technology
- Power-down mode current consumption < 1 μA
- ESD protection > 1 kV Human Body Model (HBM) on all pins

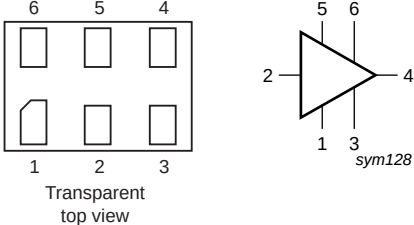
1.3 Applications

- GPS
- FM LNA
- Low-noise amplifiers for microwave communications systems
- WLAN and CDMA applications
- Analog / digital cordless applications



2. Pinning information

Table 2. Pinning

Pin	Description	Simplified outline	Graphic symbol
1	R_BIAS		
2	RF_IN		
3	GND		
4	RF_OUT		
5	ENABLE		
6	V _{CC}		

3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
BGU7003W	XSON6	plastic extremely thin small outline package; no leads; 6 terminals; body 1 × 1.45 × 0.5 mm	SOT886

4. Marking

Table 4. Marking codes

Type number	Marking code
BGU7003W	UW

5. Limiting values

Table 5. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
V _{CC}	supply voltage	RF input AC coupled	-	3.0	V
I _{CC(tot)}	total supply current	configurable with external resistor	-	25	mA
P _{tot}	total power dissipation	T _{sp} ≤ 103 °C	[1]	70	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 ground lead.

6. Thermal characteristics

Table 6. Thermal characteristics

Symbol	Parameter	Conditions	Typ	Unit
R _{th(j-sp)}	thermal resistance from junction to solder point		235	K/W

7. Characteristics

Table 7. Characteristics

$T_{amb} = 25\text{ }^{\circ}\text{C}$; $V_{CC} = 2.5\text{ V}$; $I_{CC(tot)} = 5.0\text{ mA}$; $V_{ENABLE} \geq 0.7\text{ V}$ unless otherwise specified. All measurements done on characterization board without matching, de-embedded up to the pins.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{CC}	supply voltage	RF input AC coupled	2.2	-	2.85	V
$I_{CC(tot)}$	total supply current	configurable with external resistor	[1] 3	-	15	mA
		$V_{ENABLE} \leq 0.4\text{ V}$	[1] -	-	0.001	mA
T_{amb}	ambient temperature		-40	+25	+85	$^{\circ}\text{C}$
$ S_{21} ^2$	insertion power gain	$T_{amb} = 25\text{ }^{\circ}\text{C}$				
		f = 100 MHz	[2] 21.0	22.5	-	dB
		f = 900 MHz	[2] 18.5	20.0	-	dB
		f = 1.575 GHz	16.0	17.5	-	dB
		f = 2.4 GHz	[2] 14.0	15.2	-	dB
		f = 5.8 GHz	[2] 10.0	11.4	-	dB
		$-40\text{ }^{\circ}\text{C} \leq T_{amb} \leq +85\text{ }^{\circ}\text{C}$				
		f = 100 MHz	[2] 20.0	22.5	-	dB
		f = 900 MHz	[2] 17.5	20.0	-	dB
		f = 1.575 GHz	[2] 15.0	17.5	-	dB
		f = 2.4 GHz	[2] 13.0	15.2	-	dB
		f = 5.8 GHz	[2] 9.0	11.4	-	dB
MSG	maximum stable gain	f = 100 MHz	-	33.8	-	dB
		f = 900 MHz	-	23.8	-	dB
		f = 1.575 GHz	-	20.5	-	dB
		f = 2.4 GHz	-	17.8	-	dB
		f = 5.8 GHz	-	15.4	-	dB
NF _{min}	minimum noise figure	f = 100 MHz	-	0.6	-	dB
		f = 900 MHz	-	0.6	-	dB
		f = 1.575 GHz	-	0.7	-	dB
		f = 2.4 GHz	-	0.8	-	dB
		f = 5.8 GHz	-	1.5	-	dB

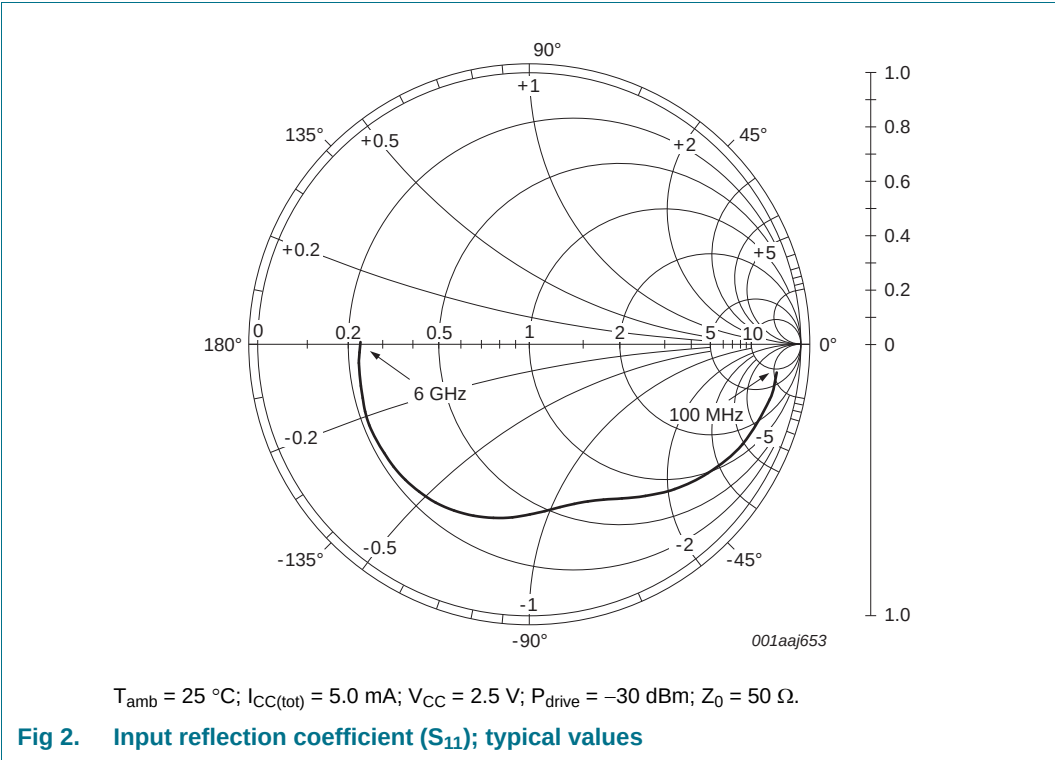
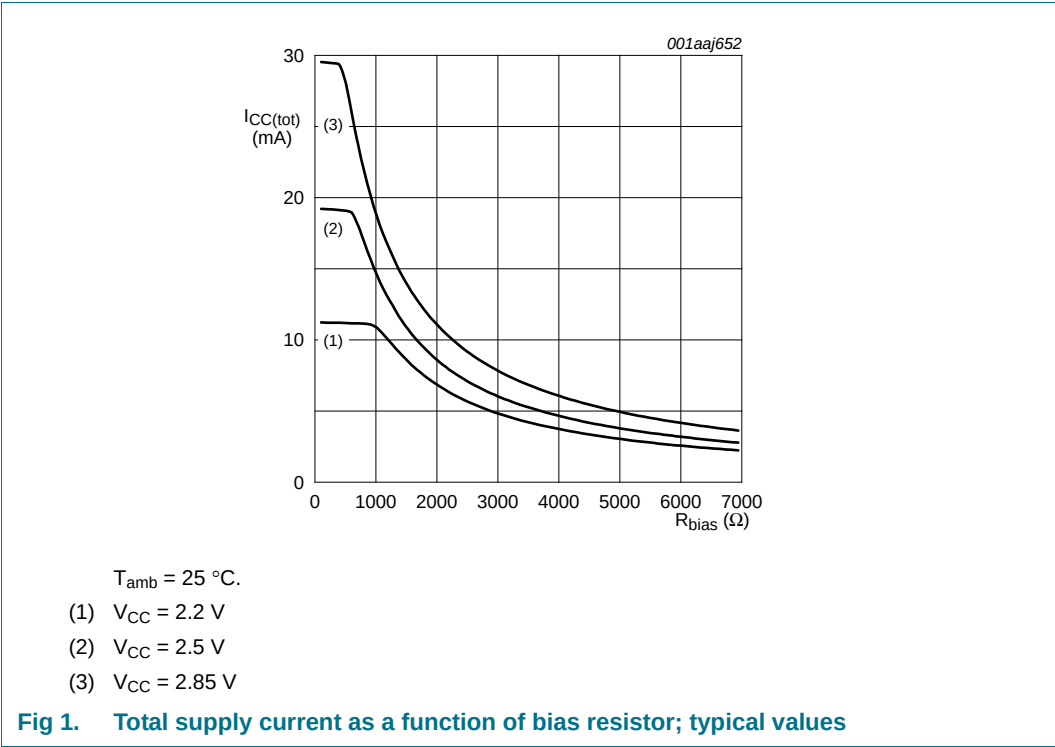
[1] $I_{CC(tot)} = I_{CC} + I_{RF_OUT} + I_{R_BIAS}$.

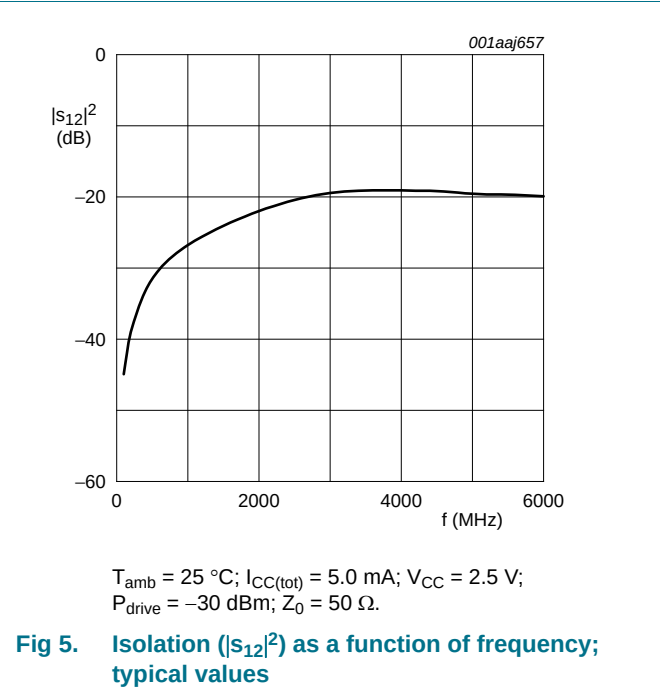
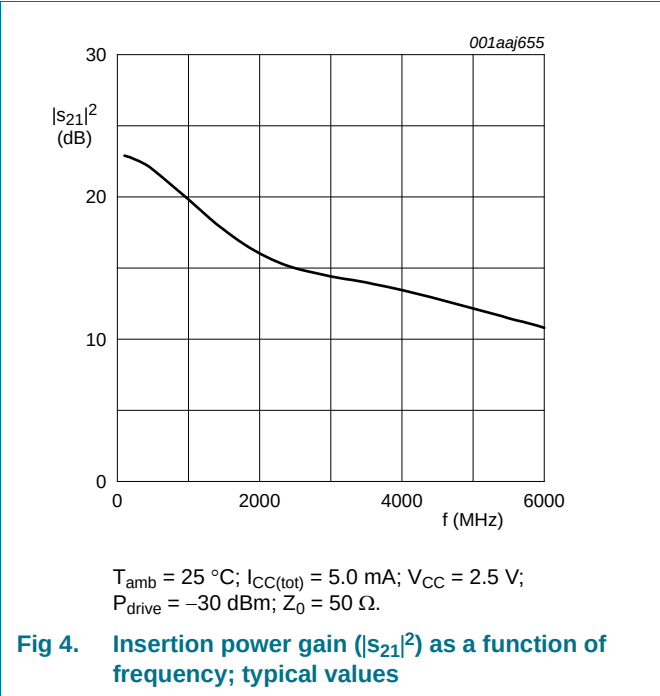
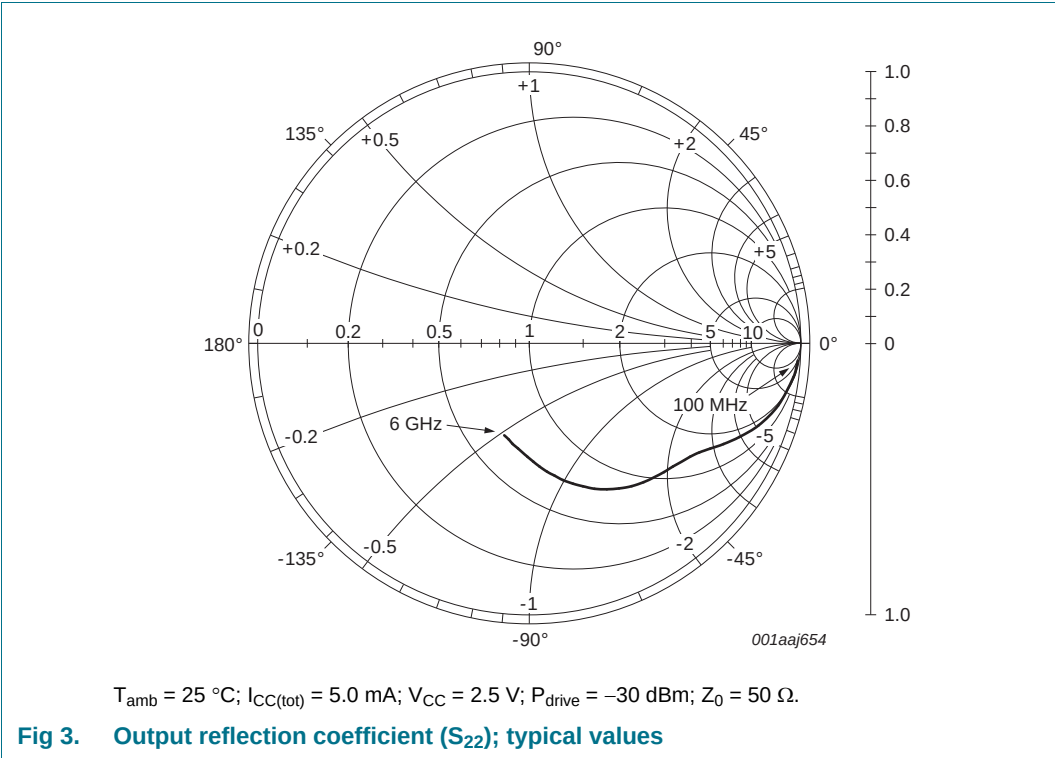
[2] Guaranteed by design and characterization.

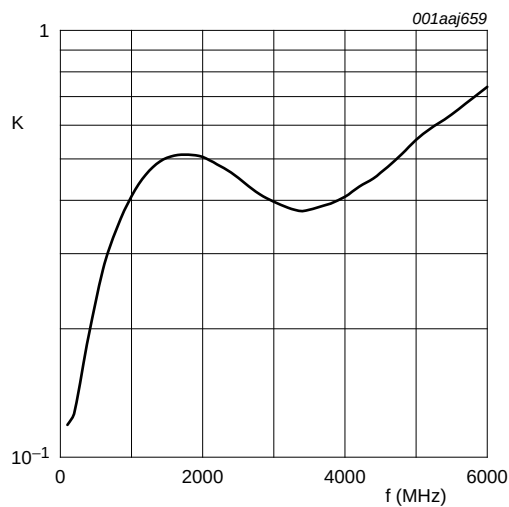
Table 8. ENABLE (pin 5)

$-40\text{ }^{\circ}\text{C} \leq T_{amb} \leq +85\text{ }^{\circ}\text{C}$

$V_{ENABLE}\text{ (V)}$	State
≤ 0.4	OFF
≥ 0.7	ON

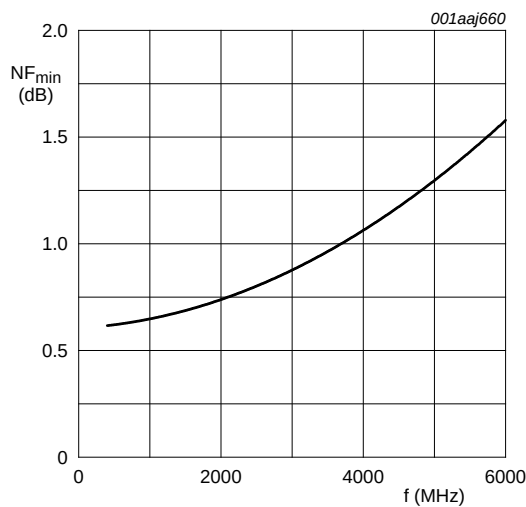






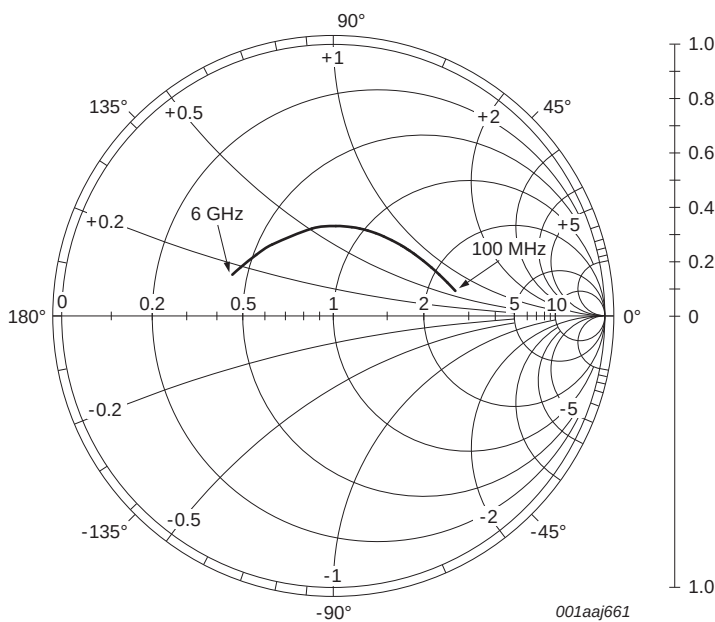
$T_{amb} = 25\text{ }^{\circ}\text{C}$; $I_{CC(tot)} = 5.0\text{ mA}$; $V_{CC} = 2.5\text{ V}$;
 $P_{drive} = -30\text{ dBm}$; $Z_0 = 50\text{ }\Omega$.

Fig 6. Rollet's stability factor as a function of frequency; typical values



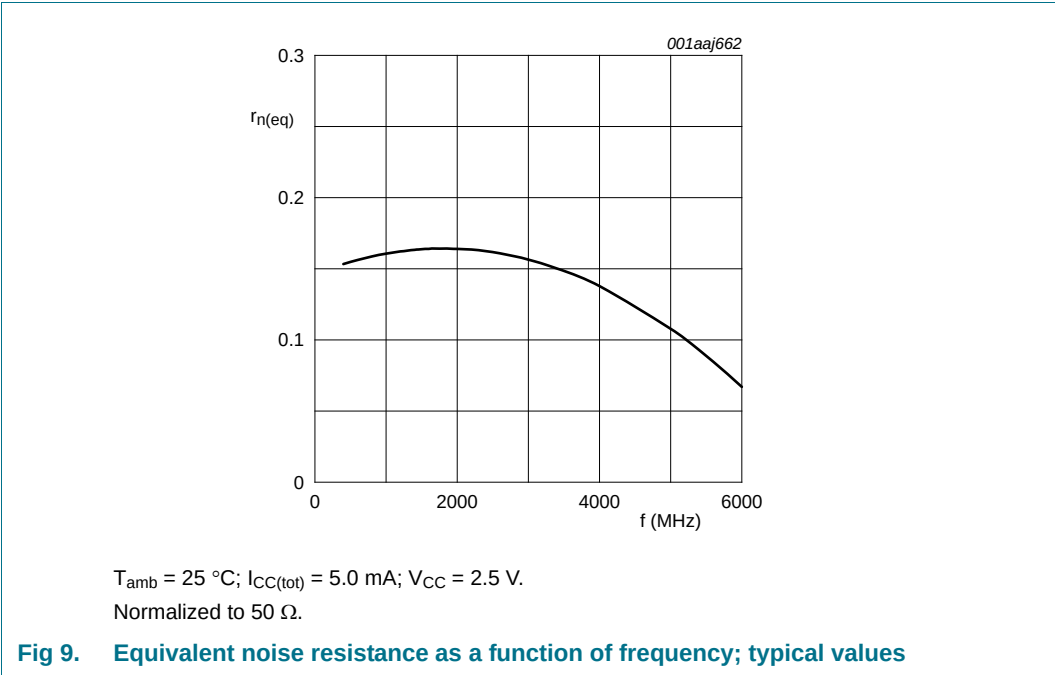
$T_{amb} = 25\text{ }^{\circ}\text{C}$; $I_{CC(tot)} = 5.0\text{ mA}$; $V_{CC} = 2.5\text{ V}$;
 $P_{drive} = -30\text{ dBm}$; $Z_0 = 50\text{ }\Omega$.

Fig 7. Minimum noise figure as a function of frequency; typical values



$T_{amb} = 25\text{ }^{\circ}\text{C}$; $I_{CC(tot)} = 5.0\text{ mA}$; $V_{CC} = 2.5\text{ V}$.

Fig 8. Optimum source reflection coefficient for minimum noise figure; typical values



8. Application information

8.1 High-ohmic FM LNA

Table 9. Characteristics [1]
 $T_{amb} = 25\text{ }^{\circ}\text{C}$; $V_{CC} = 2.85\text{ V}$; $I_{CC(tot)} = 3.2\text{ mA}$ [2]; $V_{ENABLE} \geq 0.7\text{ V}$; $f = 100\text{ MHz}$; $Z_S = Z_L = 50\text{ }\Omega$ unless otherwise specified. All measurements are done with the SMA-connectors as reference plane.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
NF	noise figure		-	1.2	-	dB
$ S_{21} ^2$	Insertion power gain		-	13	-	dB
RL_{in}	input return loss		-	0.5	-	dB
RL_{out}	output return loss		-	16.5	-	dB
$P_{i(1dB)}$	input power at 1 dB gain compression		-	-23	-	dBm
$P_{L(1dB)}$	output power at 1 dB gain compression		-	-11	-	dBm
$IP3_i$	input third-order intercept point	[3]	-	-15	-	dBm
$IP3_o$	output third-order intercept point	[3]	-	-2	-	dBm

[1] See application note: AN11034 for details.
[2] $I_{CC(tot)} = I_{CC} + I_{RF_OUT} + I_{R_BIAS}$.
[3] The third order intercept point is measured at -30 dBm per tone at RF_IN ($f_1 = 100\text{ MHz}$; $f_2 = 100.2\text{ MHz}$)

8.2 50 ohm FM LNA

Table 10. Characteristics^[1]

$T_{amb} = 25\text{ }^{\circ}\text{C}$; $V_{CC} = 2.8\text{ V}$; $I_{CC(tot)} = 4.3\text{ mA}$ ^[2]; $V_{ENABLE} \geq 0.7\text{ V}$; $f = 100\text{ MHz}$; $Z_S = Z_L = 50\text{ }\Omega$ (input and output matched to $50\text{ }\Omega$) unless otherwise specified. All measurements are done with the SMA-connectors as reference plane.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
NF	noise figure		-	1.5	-	dB
$ S_{21} ^2$	Insertion power gain		-	15	-	dB
RL_{in}	input return loss		-	9	-	dB
RL_{out}	output return loss		-	14	-	dB
$P_{i(1dB)}$	input power at 1 dB gain compression		-	-20	-	dBm
$P_{L(1dB)}$	output power at 1 dB gain compression		-	-6	-	dBm
$IP3_i$	input third-order intercept point	^[3]	-	-12.5	-	dBm
$IP3_o$	output third-order intercept point	^[3]	-	2.5	-	dBm

[1] See application note AN11035 for details.

[2] $I_{CC(tot)} = I_{CC} + I_{RF_OUT} + I_{R_BIAS}$.

[3] The third order intercept point is measured at -30 dBm per tone at RF_IN ($f_1 = 100\text{ MHz}$; $f_2 = 100.2\text{ MHz}$)

9. Package outline

XSON6: plastic extremely thin small outline package; no leads; 6 terminals; body 1 x 1.45 x 0.5 mm

SOT886

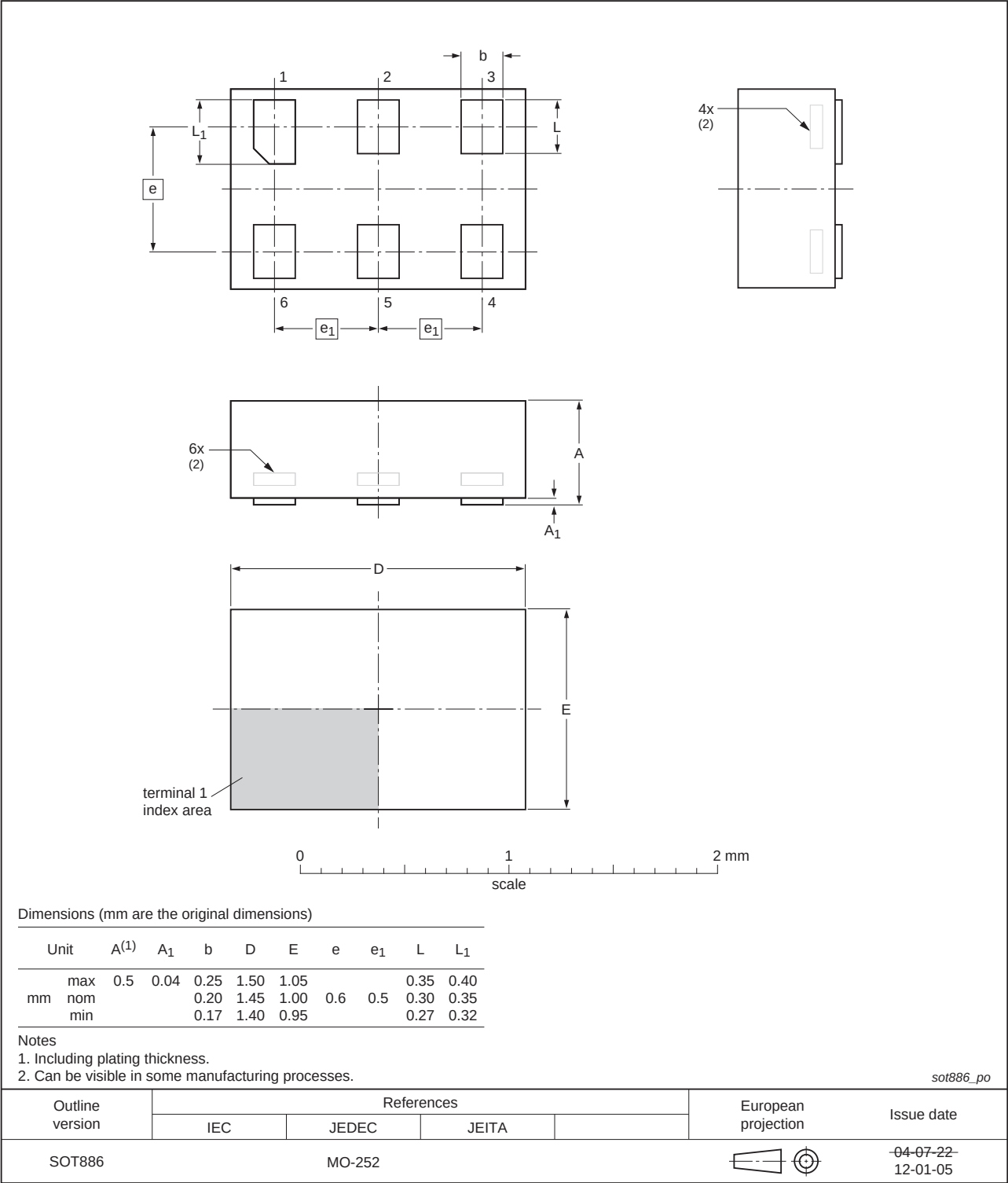


Fig 10. Package outline SOT886 (XSON6)

10. Handling information

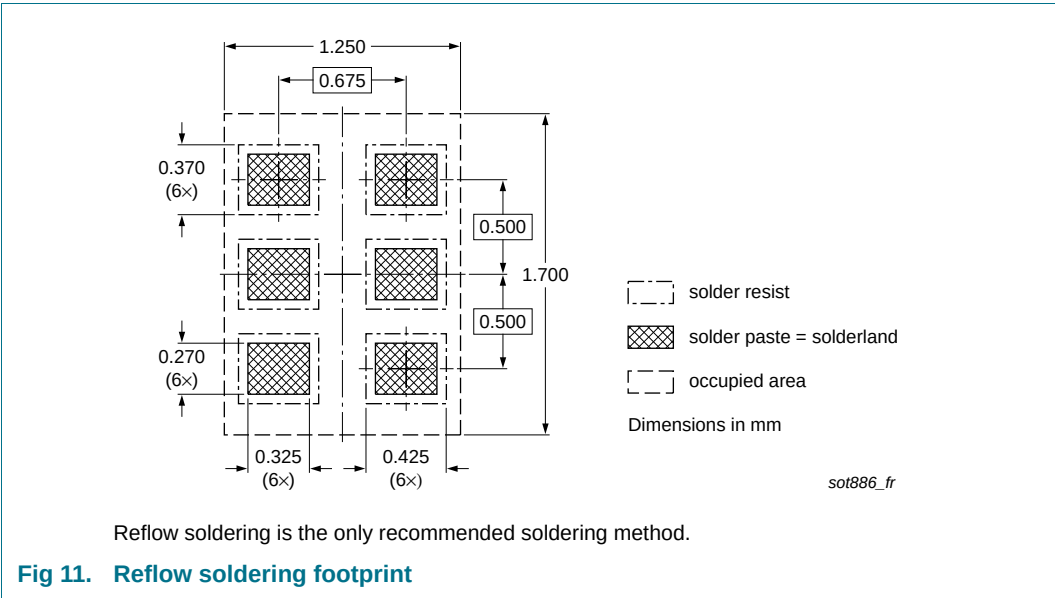
CAUTION



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.

11. Soldering



12. Abbreviations

Table 11. Abbreviations	
Acronym	Description
AC	Alternating Current
CDMA	Code Division Multiple Access
DC	Direct Current
FM	Frequency Modulation
FR4	Flame Retardant 4
GPS	Global Positioning System
LNA	Low-Noise Amplifier
MMIC	Monolithic Microwave Integrated Circuit
RF	Radio Frequency
SiGe:C	Silicon Germanium Carbon
SMA	SubMiniature version A
WLAN	Wireless Local Area Network

13. Revision history

Table 12. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BGU7003W v.2	20130411	Product data sheet	-	BGU7003W v.1
Modifications:	• Figure 10 on page 9: figure has been updated.			
BGU7003W v.1	20110830	Product data sheet	-	-

14. Legal information

14.1 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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