



# BGU6005/N2

Low Noise Amplifier MMIC for GPS, GLONASS, Galileo and Compass

Rev. 2 — 31 January 2017

Preliminary data sheet

## 1. Product profile

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### 1.1 General description

The BGU6005/N2, also known as the GPS1001M, is a Low Noise Amplifier (LNA) for GNSS receiver applications in a plastic leadless 6-pin, extremely small SOT886 package. The BGU6005/N2 requires only one external matching inductor and one external decoupling capacitor.

### 1.2 Features and benefits

- Covers full GNSS L1 band, from 1559 MHz to 1610 MHz
- Noise figure (NF) = 0.85 dB
- Gain = 17.5 dB
- High input 1 dB compression point  $P_{i(1dB)}$  of -6 dBm
- High out of band  $IP3_i$  of 6 dBm
- Supply voltage from 1.5 V to 3.1 V
- Power-down mode current consumption < 2  $\mu$ A
- Optimized performance at low supply current of 5.2 mA
- Integrated matching for the output
- Requires only one input matching inductor and one supply decoupling capacitor
- Input and output DC decoupled
- ESD protection on all pins (HBM > 2 kV)
- Integrated temperature stabilized bias for easy design
- Small 6-pin leadless package 1 mm  $\times$  1.45 mm  $\times$  0.5 mm

### 1.3 Applications

- LNA for GPS, GLONASS, Galileo and Compass (BeiDou) in smart phones, feature phones, tablet PCs, personal navigation devices, digital still cameras, digital video cameras, RF front end modules, complete GPS chipset modules and theft protection (laptop, ATM).



### 1.4 Quick reference data

**Table 1. Quick reference data**

$f = 1559\text{ MHz to }1610\text{ MHz}$ ;  $V_{CC} = 1.8\text{ V}$ ;  $V_{I(ENABLE)} \geq 0.9\text{ V}$ ;  $P_i < -40\text{ dBm}$ ;  $T_{amb} = 25\text{ }^\circ\text{C}$ ; input matched to  $50\text{ }\Omega$  using a  $5.6\text{ nH}$  inductor; unless otherwise specified.

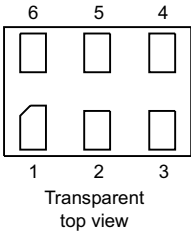
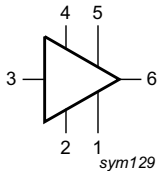
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{CC}$	supply voltage	RF input AC coupled	-	1.8	-	V
$I_{CC}$	supply current		-	5.2	-	mA
$G_p$	power gain	no jammer	-	17	-	dB
NF	noise figure	no jammer <a href="#">[1]</a>	-	0.85	-	dB
$P_{i(1dB)}$	input power at 1 dB gain compression	$f = 1575\text{ MHz}$				
		$V_{CC} = 1.8\text{ V}$	-	-9	-	dBm
		$V_{CC} = 2.85\text{ V}$	-	-6	-	dBm
IP3 <sub>i</sub>	input third-order intercept point	$f = 1575\text{ MHz}$				
		$V_{CC} = 1.8\text{ V}$ <a href="#">[2]</a>	-	3	-	dBm
		$V_{CC} = 2.85\text{ V}$ <a href="#">[2]</a>	-	6	-	dBm

[1] PCB losses are subtracted.

[2]  $f_1 = 1713\text{ MHz}$ ;  $f_2 = 1851\text{ MHz}$ ;  $P_1 = -20\text{ dBm}$  at  $f_1$ ;  $P_1 = -65\text{ dBm}$  at  $f_2$ .

## 2. Pinning information

**Table 2. Pinning**

Pin	Description	Simplified outline	Graphic symbol
1	GND		
2	GND		
3	RF_IN		
4	$V_{CC}$		
5	ENABLE		
6	RF_OUT		

## 3. Ordering information

**Table 3. Ordering information**

Type number	Package		Version
	Name	Description	
BGU6005/N2	XSON6	plastic extremely thin small outline package; no leads; 6 terminals; body $1 \times 1.45 \times 0.5\text{ mm}$	SOT886

## 4. Marking

**Table 4. Marking codes**

Type number	Marking code
BGU6005/N2	D1

## 5. Limiting values

**Table 5. Limiting values**

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

Symbol	Parameter	Conditions	Min	Max	Unit
V <sub>CC</sub>	supply voltage	RF input AC coupled	-0.5	+5.0	V
V <sub>I(ENABLE)</sub>	input voltage on pin ENABLE	V <sub>I(ENABLE)</sub> < V <sub>CC</sub> + 0.6 [1]	-0.5	+5.0	V
V <sub>I(RF_IN)</sub>	input voltage on pin RF_IN	DC; V <sub>I(RF_IN)</sub> < V <sub>CC</sub> + 0.6 [1][2]	-0.5	+5.0	V
V <sub>I(RF_OUT)</sub>	input voltage on pin RF_OUT	DC; V <sub>I(RF_OUT)</sub> < V <sub>CC</sub> + 0.6 [1][2]	-0.5	+5.0	V
P <sub>i</sub>	input power		-	10	dBm
P <sub>tot</sub>	total power dissipation	T <sub>sp</sub> ≤ 130 °C [3]	-	55	mW
T <sub>stg</sub>	storage temperature		-65	+150	°C
T <sub>j</sub>	junction temperature		-	150	°C
V <sub>ESD</sub>	electrostatic discharge voltage	Human Body Model (HBM) According to ANSI/ESDA/JEDEC standard JS-001	-	±4	kV
		Charged Device Model (CDM) According to JEDEC standard JESD22-C101	-	±1	kV

- [1] Warning: due to internal ESD diode protection, the applied DC voltage should not exceed V<sub>CC</sub> + 0.6 and shall not exceed 5.0 V in order to avoid excess current.
- [2] The RF input and RF output are AC coupled through internal DC blocking capacitor.
- [3] T<sub>sp</sub> is the temperature at the soldering point of the emitter lead.

## 6. Thermal characteristics

**Table 6. Thermal characteristics**

Symbol	Parameter	Conditions	Typ	Unit
R <sub>th(j-sp)</sub>	thermal resistance from junction to solder point		225	K/W

## 7. Characteristics

**Table 7. Characteristics at V<sub>CC</sub> = 1.8 V**

f = 1559 MHz to 1610 MHz; V<sub>CC</sub> = 1.8 V; V<sub>I(ENABLE)</sub> ≥ 0.9 V; P<sub>i</sub> < -40 dBm; T<sub>amb</sub> = 25 °C; input matched to 50 Ω using a 5.6 nH inductor; unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V <sub>CC</sub>	supply voltage	RF input AC coupled	-	1.8	-	V
I <sub>CC</sub>	supply current	V <sub>I(ENABLE)</sub> ≥ 0.9 V	-	5.2	-	mA
		V <sub>I(ENABLE)</sub> ≤ 0.3 V	-	-	2	μA
G <sub>p</sub>	power gain	no jammer	-	17	-	dB
RL <sub>in</sub>	input return loss		-	8	-	dB
RL <sub>out</sub>	output return loss		-	14	-	dB
ISL	isolation		-	24	-	dB
NF	noise figure	no jammer [1]	-	0.85	-	dB
P <sub>i(1dB)</sub>	input power at 1 dB gain compression	f = 1575 MHz	-	-9	-	dBm
IP3 <sub>i</sub>	input third-order intercept point	f = 1575 MHz [2]	-	3	-	dBm

**Table 7. Characteristics at  $V_{CC} = 1.8\text{ V}$  ...continued**

$f = 1559\text{ MHz to }1610\text{ MHz}$ ;  $V_{CC} = 1.8\text{ V}$ ;  $V_{I(ENABLE)} \geq 0.9\text{ V}$ ;  $P_i < -40\text{ dBm}$ ;  $T_{amb} = 25\text{ }^\circ\text{C}$ ; input matched to  $50\ \Omega$  using a  $5.6\text{ nH}$  inductor; unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$t_{on}$	turn-on time	[3]	-	-	2	$\mu\text{s}$
$t_{off}$	turn-off time	[3]	-	-	1	$\mu\text{s}$
K	Rollett stability factor		1	-	-	

[1] PCB losses are subtracted.

[2]  $f_1 = 1713\text{ MHz}$ ;  $f_2 = 1851\text{ MHz}$ ;  $P_1 = -20\text{ dBm}$  at  $f_1$ ;  $P_1 = -65\text{ dBm}$  at  $f_2$ .

[3] Within 10 % of the final gain.

**Table 8. Characteristics at  $V_{CC} = 2.85\text{ V}$** 

$f = 1559\text{ MHz to }1610\text{ MHz}$ ;  $V_{CC} = 2.85\text{ V}$ ;  $V_{I(ENABLE)} \geq 0.9\text{ V}$ ;  $P_i < -40\text{ dBm}$ ;  $T_{amb} = 25\text{ }^\circ\text{C}$ ; input matched to  $50\ \Omega$  using a  $5.6\text{ nH}$  inductor; unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{CC}$	supply voltage	RF input AC coupled	-	2.85	-	V
$I_{CC}$	supply current	$V_{I(ENABLE)} \geq 0.9\text{ V}$	-	5.7	-	mA
		$V_{I(ENABLE)} \leq 0.3\text{ V}$	-	-	2	$\mu\text{A}$
$G_p$	power gain	no jammer	-	17.5	-	dB
$RL_{in}$	input return loss		-	8	-	dB
$RL_{out}$	output return loss		-	15	-	dB
ISL	isolation		-	25	-	dB
NF	noise figure	no jammer [1]	-	0.85	-	dB
$P_{i(1dB)}$	input power at 1 dB gain compression	$f = 1575\text{ MHz}$	-	-6	-	dBm
$IP3_i$	input third-order intercept point	$f = 1575\text{ MHz}$ [2]	-	6	-	dBm
$t_{on}$	turn-on time	[3]	-	-	2	$\mu\text{s}$
$t_{off}$	turn-off time	[3]	-	-	1	$\mu\text{s}$
K	Rollett stability factor		1	-	-	

[1] PCB losses are subtracted.

[2]  $f_1 = 1713\text{ MHz}$ ;  $f_2 = 1851\text{ MHz}$ ;  $P_1 = -20\text{ dBm}$  at  $f_1$ ;  $P_1 = -65\text{ dBm}$  at  $f_2$ .

[3] Within 10 % of the final gain.

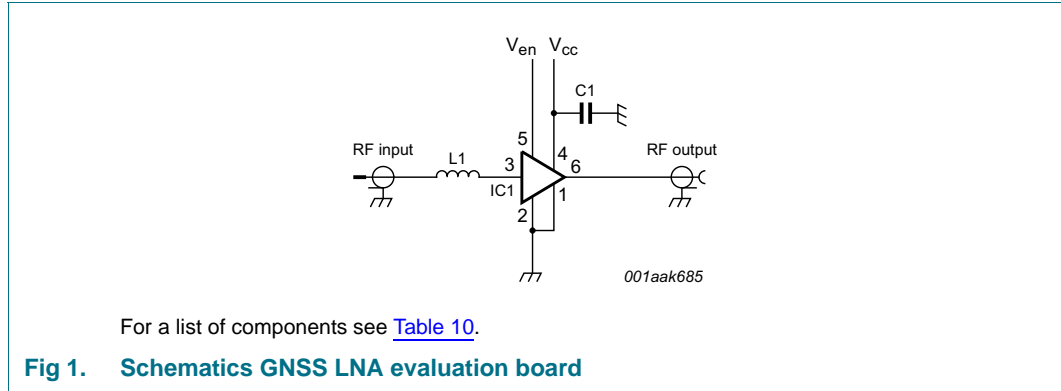
**Table 9. ENABLE (pin 5)**

$-40\text{ }^\circ\text{C} \leq T_{amb} \leq +85\text{ }^\circ\text{C}$ ;  $1.5\text{ V} \leq V_{CC} \leq 3.1\text{ V}$

$V_{I(ENABLE)}\text{ (V)}$	State
$\leq 0.3$	OFF
$\geq 0.9$	ON

## 8. Application information

### 8.1 GNSS LNA



**Table 10. List of components**

For schematics see [Figure 1](#).

Component	Description	Value	Supplier	Remarks
C1	decoupling capacitor	1 nF	various	
IC1	BGU6005/N2	-	NXP	
L1	high quality matching inductor	5.6 nH	Murata LQW15A	

## 9. Package outline

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

SOT886

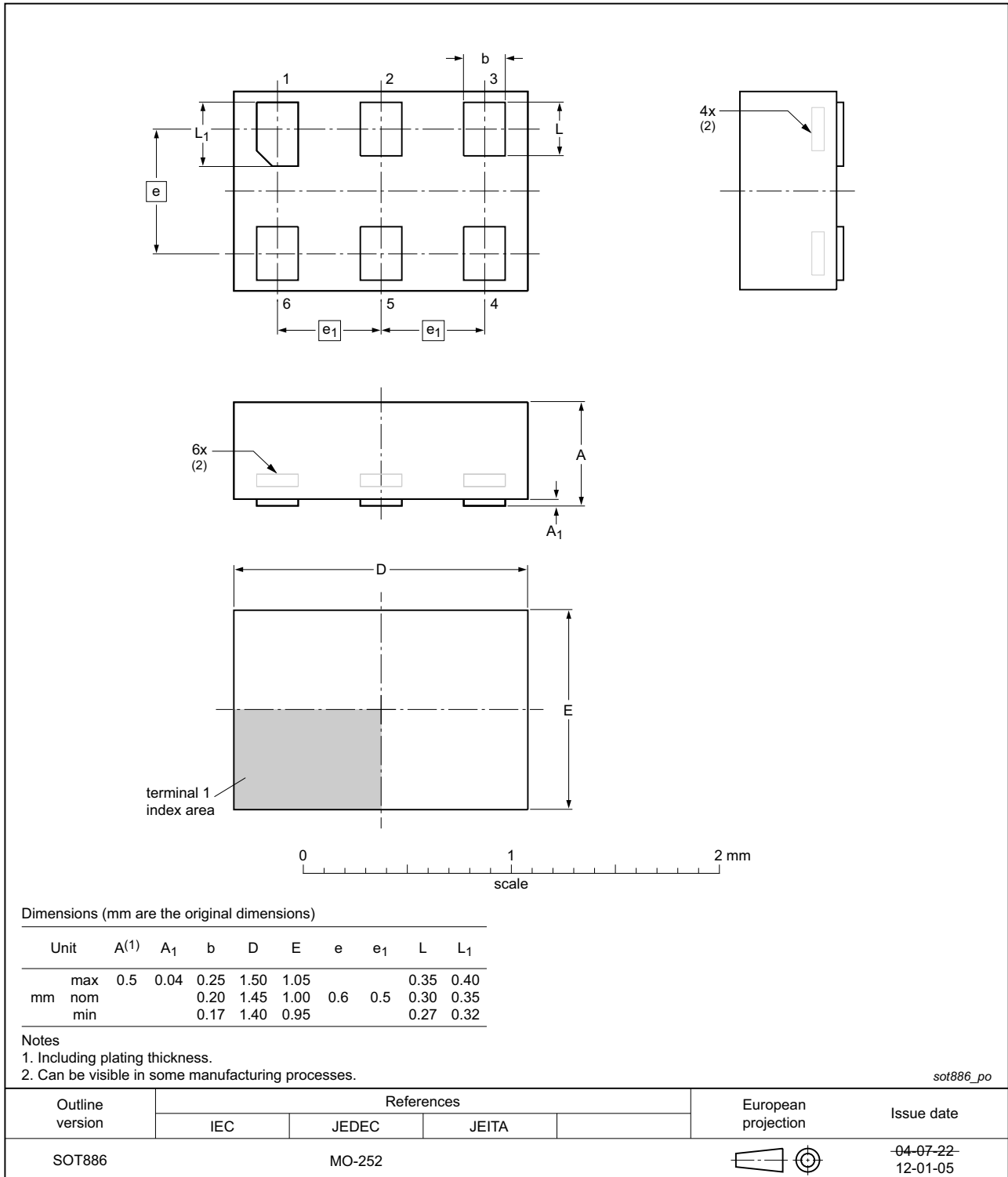


Fig 2. Package outline SOT886 (XSON6)

## 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. Abbreviations

Table 11. Abbreviations

Acronym	Description
ATM	Automated Teller Machine (cash dispenser)
ESD	ElectroStatic Discharge
GLONASS	GLObal NAVigation Satellite System
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
HBM	Human Body Model
MMIC	Monolithic Microwave Integrated Circuit
PCB	Printed Circuit Board

## 12. Revision history

Table 12. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BGU6005_N2 v.2	20170131	Preliminary data sheet	-	BGU6005_N2 v.1
Modifications:	<ul style="list-style-type: none"> <li><a href="#">Section 1</a>: added GPS1001M according to our new naming convention</li> </ul>			
BGU6005_N2 v.1	20140324	Preliminary data sheet	-	-

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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.
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