BGU6009/N2

Low-noise amplifier MMIC for GPS, GLONASS, Galileo and COMPASS

Rev. 4 — 18 January 2017 Product data sheet

1. Product profile

1.1 General description

The BGU6009/N2 is, also known as the GPS1002M, a Low-Noise Amplifier (LNA) for GNSS receiver applications in a plastic leadless 6-pin, very thin small outline SOT1230 package. The BGU6009/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 = 0.9 dB
- Gain 17 dB
- High input 1 dB compression point $P_{i(1dB)}$ of −4 dBm
- High out of band $IP3_i$ of 7 dBm
- Supply voltage 1.5 V to 3.1 V
- Power-down mode current consumption < 2 μA
- Optimized performance at low supply current of 5.1 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 1.1 mm × 0.9 mm × 0.47 mm; 0.4 mm pitch: SOT1230

1.3 Applications

LNA for GPS, GLONASS, Gallileo and COMPASS (Beidou).

- Smart phones and feature phones
- Tablet PCs
- Personal Navigation Devices
- Digital Still Cameras
- Digital Video Cameras
- RF front-end modules
- Complete GPS chip set modules and theft protection (laptop, ATM)

1.4 Quick reference data

Table 1. Quick reference data

f = 1559 MHz to 1610 MHz; V_{CC} = 1.8 V; $V_{I(ENABLE)} \geq 0.9$ V; $P_i < -40$ dBm; T_{amb} = 25 °C; input matched to 50 Ω using a 6.8 nH inductor; unless otherwise specified.

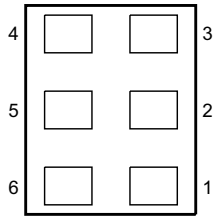
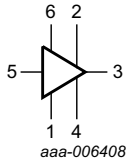
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{CC}	supply voltage	RF input AC coupled	1.5	1.8	3.1	V
I_{CC}	supply current		-	5.1	-	mA
G_p	power gain	no jammer	-	17	-	dB
NF	noise figure	no jammer [1]	-	0.9	-	dB
$P_{i(1dB)}$	input power at 1 dB gain compression	f = 1575 MHz				
		V_{CC} = 1.8 V	-	–7	-	dBm
		V_{CC} = 2.85 V	-	–4	-	dBm
$IP3_i$	input third-order intercept point	f = 1575 MHz				
		V_{CC} = 1.8 V [2]	-	5	-	dBm
		V_{CC} = 2.85 V [2]	-	7	-	dBm

[1] PCB losses are subtracted.

[2] f_1 = 1713 MHz; f_2 = 1851 MHz; P_i = –20 dBm at f_1; P_i = –65 dBm at f_2.

2. Pinning information

Table 2. Pinning

Pin	Description	Simplified outline	Graphic symbol
1	GND	 transparent top view	 aaa-006408
2	V_{CC}		
3	RF_OUT		
4	GND_RF		
5	RF_IN		
6	ENABLE		

3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
BGU6009/N2	XSON6	plastic very thin small outline package; no leads; 6 terminals; body 1.1 × 0.9 × 0.47 mm	SOT1230

4. Marking

Table 4. Marking codes

Type number	Marking code
BGU6009/N2	W

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	−0.5	+5.0	V
$V_{I(ENABLE)}$	input voltage on pin ENABLE	$V_{I(ENABLE)} < V_{CC} + 0.6$ V [1]	−0.5	+5.0	V
$V_{I(RF\_IN)}$	input voltage on pin RF_IN	DC; $V_{I(RF\_IN)} < V_{CC} + 0.6$ V [1][2]	−0.5	+5.0	V
$V_{I(RF\_OUT)}$	input voltage on pin RF_OUT	DC; $V_{I(RF\_OUT)} < V_{CC} + 0.6$ V [1][2]	−0.5	+5.0	V
P_i	input power		-	10	dBm
P_{tot}	total power dissipation	$T_{sp} \leq 130$ °C [3]	-	55	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		-	150	°C
V_{ESD}	electrostatic discharge voltage	Human Body Model (HBM) according to ANSI/ESDA/JEDEC standard JS-001	-	±2.5	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_{CC} + 0.6 V and shall not exceed 5.0 V to avoid excess current.

[2] The RF input and RF output are AC coupled through internal DC blocking capacitor.

[3] T_{sp} is the temperature at the soldering point of GND_RF (pin 4).

6. Thermal characteristics

Table 6. Thermal characteristics

Symbol	Parameter	Conditions	Typ	Unit
$R_{th(j-sp)}$	thermal resistance from junction to solder point		225	K/W

7. Characteristics

Table 7. Characteristics at V_{CC} = 1.8 V

f = 1559 MHz to 1610 MHz; V_{CC} = 1.8 V; $V_{I(ENABLE)} \geq 0.9$ V; $P_i < -40$ dBm; T_{amb} = 25 °C; input matched to 50 Ω using a 6.8 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	$V_{I(ENABLE)} \geq 0.9$ V	-	5.1	-	mA
		$V_{I(ENABLE)} \leq 0.3$ V	-	-	2	µA
G_p	power gain	no jammer	-	17	-	dB
RL_{in}	input return loss		-	12	-	dB
RL_{out}	output return loss		-	11	-	dB
ISL	isolation		-	25	-	dB
NF	noise figure	no jammer [1]	-	0.9	-	dB
$P_{i(1dB)}$	input power at 1 dB gain compression	f = 1575 MHz	-	−7	-	dBm
$IP3_i$	input third-order intercept point	f = 1575 MHz [2]	-	5	-	dBm

Table 7. Characteristics at V_{CC} = 1.8 V *…continued*

f = 1559 MHz to 1610 MHz; V_{CC} = 1.8 V; $V_{I(ENABLE)} \geq 0.9$ V; $P_i < -40$ dBm; T_{amb} = 25 °C; input matched to 50 Ω using a 6.8 nH inductor; unless otherwise specified.

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

[1] PCB losses are subtracted.

[2] f_1 = 1713 MHz; f_2 = 1851 MHz; P_i = –20 dBm at f_1; P_i = –65 dBm at f_2.

[3] Within 10 % of the final gain.

Table 8. Characteristics at V_{CC} = 2.85 V

f = 1559 MHz to 1610 MHz; V_{CC} = 2.85 V; $V_{I(ENABLE)} \geq 0.9$ V; $P_i < -40$ dBm; T_{amb} = 25 °C; input matched to 50 Ω using a 6.8 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	$V_{I(ENABLE)} \geq 0.9$ V	-	5.5	-	mA
		$V_{I(ENABLE)} \leq 0.3$ V	-	-	2	µA
G_p	power gain	no jammer	-	17.5	-	dB
RL_{in}	input return loss		-	13	-	dB
RL_{out}	output return loss		-	11	-	dB
ISL	isolation		-	25	-	dB
NF	noise figure	no jammer [1]	-	0.95	-	dB
$P_{i(1dB)}$	input power at 1 dB gain compression	f = 1575 MHz	-	–4	-	dBm
$IP3_i$	input third-order intercept point	f = 1575 MHz [2]	-	7	-	dBm
t_{on}	turn-on time	[3]	-	-	2	µs
t_{off}	turn-off time	[3]	-	-	1	µs
K	Rollett stability factor		1	-	-	-

[1] PCB losses are subtracted.

[2] f_1 = 1713 MHz; f_2 = 1851 MHz; P_i = –20 dBm at f_1; P_i = –65 dBm at f_2.

[3] Within 10 % of the final gain.

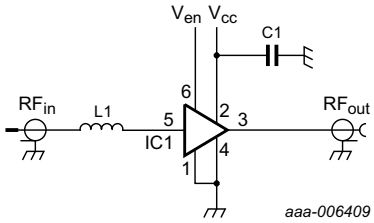
Table 9. ENABLE (pin 6)

–40 °C ≤ T_{amb} ≤ +85 °C; 1.5 V ≤ V_{CC} ≤ 3.1 V.

$V_{I(ENABLE)}$ (V)	State
≤ 0.3	OFF
≥ 0.9	ON

8. Application information

8.1 GNSS LNA



For a list of components, see Table 10.

Fig 1. Schematics GNSS LNA evaluation board

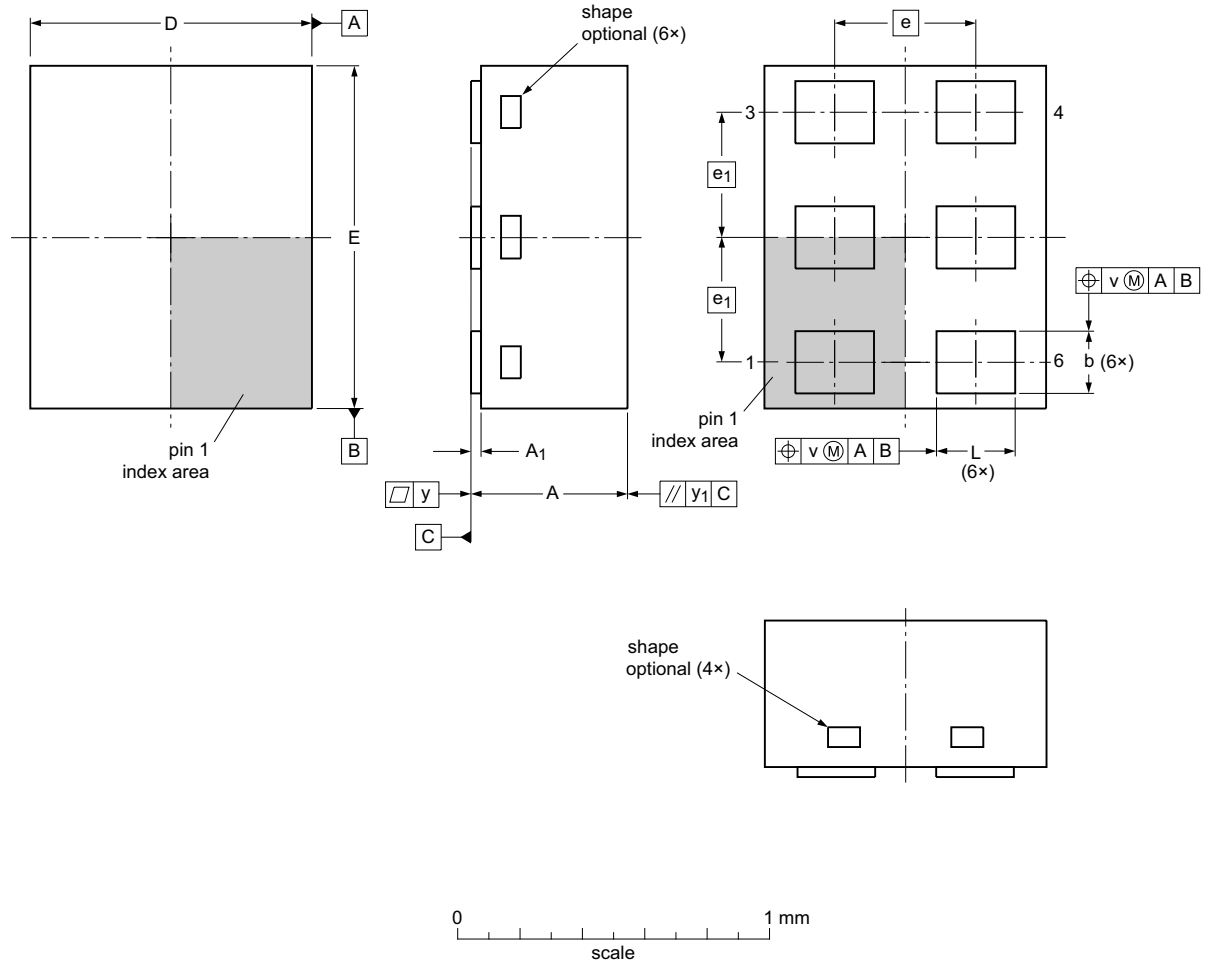
Table 10. List of components

For schematics, see Figure 1.

Component	Description	Value	Remarks
C1	decoupling capacitor	1 nF	
IC1	BGU6009/N2	-	NXP Semiconductors
L1	high-quality matching inductor	6.8 nH	Murata LQW15A

9. Package outline

XSON6: plastic very thin small outline package; no leads; 6 terminals; body 1.1 x 0.9 x 0.47 mm **SOT1230**



Dimensions (mm are the original dimensions)

Unit		A	A_1	D	E	e_1	e	b	L	V	Y	Y_1
mm	min	0.44		0.85	1.05			0.17	0.22			
	nom	0.47		0.90	1.10	0.4	0.45	0.20	0.25	0.1	0.05	0.1
	max	0.50	0.04	0.95	1.15			0.25	0.30			

Note
1. Dimension A is including plating thickness.

sot1230_po

Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
SOT1230						~~13-01-02~~ 13-01-08

Fig 2. Package outline SOT1230 (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
LNA	Low-Noise Amplifier
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
BGU6009_N2 v.4	20170118	Product data sheet	-	BGU6009_N2 v.3
Modifications:	• Section 1: added GPS1002M according to our new naming convention			
BGU6009_N2 v.3	20160315	Product data sheet	-	BGU6009_N2 v.2
Modifications:	• Marking code F changed into W			
BGU6009_N2 v.2	20141106	Product data sheet	-	BGU6009_N2 v.1
Modifications:	• Table 1 on page 2: The value of the inductor has been corrected.			
BGU6009_N2 v.1	20141001	Product data sheet	-	-

13. Legal information

13.1 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".

[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.

13.2 Definitions

Draft — The document is a draft version only. The content is still under internal review and subject to formal approval, which may result in modifications or additions. NXP Semiconductors does not give any representations or warranties as to the accuracy or completeness of information included herein and shall have no liability for the consequences of use of such information.

Short data sheet — A short data sheet is an extract from a full data sheet with the same product type number(s) and title. A short data sheet is intended for quick reference only and should not be relied upon to contain detailed and full information. For detailed and full information see the relevant full data sheet, which is available on request via the local NXP Semiconductors sales office. In case of any inconsistency or conflict with the short data sheet, the full data sheet shall prevail.

Product specification — The information and data provided in a Product data sheet shall define the specification of the product as agreed between NXP Semiconductors and its customer, unless NXP Semiconductors and customer have explicitly agreed otherwise in writing. In no event however, shall an agreement be valid in which the NXP Semiconductors product is deemed to offer functions and qualities beyond those described in the Product data sheet.

13.3 Disclaimers

Limited warranty and liability — Information in this document is believed to be accurate and reliable. However, NXP Semiconductors does not give any representations or warranties, expressed or implied, as to the accuracy or completeness of such information and shall have no liability for the consequences of use of such information. NXP Semiconductors takes no responsibility for the content in this document if provided by an information source outside of NXP Semiconductors.

In no event shall NXP Semiconductors be liable for any indirect, incidental, punitive, special or consequential damages (including - without limitation - lost profits, lost savings, business interruption, costs related to the removal or replacement of any products or rework charges) whether or not such damages are based on tort (including negligence), warranty, breach of contract or any other legal theory.

Notwithstanding any damages that customer might incur for any reason whatsoever, NXP Semiconductors' aggregate and cumulative liability towards customer for the products described herein shall be limited in accordance with the *Terms and conditions of commercial sale* of NXP Semiconductors.

Right to make changes — NXP Semiconductors reserves the right to make changes to information published in this document, including without limitation specifications and product descriptions, at any time and without notice. This document supersedes and replaces all information supplied prior to the publication hereof.

Suitability for use — NXP Semiconductors products are not designed, authorized or warranted to be suitable for use in life support, life-critical or safety-critical systems or equipment, nor in applications where failure or malfunction of an NXP Semiconductors product can reasonably be expected to result in personal injury, death or severe property or environmental damage. NXP Semiconductors and its suppliers accept no liability for inclusion and/or use of NXP Semiconductors products in such equipment or applications and therefore such inclusion and/or use is at the customer's own risk.

Applications — Applications that are described herein for any of these products are for illustrative purposes only. NXP Semiconductors makes no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

Customers are responsible for the design and operation of their applications and products using NXP Semiconductors products, and NXP Semiconductors accepts no liability for any assistance with applications or customer product design. It is customer's sole responsibility to determine whether the NXP Semiconductors product is suitable and fit for the customer's applications and products planned, as well as for the planned application and use of customer's third party customer(s). Customers should provide appropriate design and operating safeguards to minimize the risks associated with their applications and products.

NXP Semiconductors does not accept any liability related to any default, damage, costs or problem which is based on any weakness or default in the customer's applications or products, or the application or use by customer's third party customer(s). Customer is responsible for doing all necessary testing for the customer's applications and products using NXP Semiconductors products in order to avoid a default of the applications and the products or of the application or use by customer's third party customer(s). NXP does not accept any liability in this respect.

Limiting values — Stress above one or more limiting values (as defined in the Absolute Maximum Ratings System of IEC 60134) will cause permanent damage to the device. Limiting values are stress ratings only and (proper) operation of the device at these or any other conditions above those given in the Recommended operating conditions section (if present) or the Characteristics sections of this document is not warranted. Constant or repeated exposure to limiting values will permanently and irreversibly affect the quality and reliability of the device.

Terms and conditions of commercial sale — NXP Semiconductors products are sold subject to the general terms and conditions of commercial sale, as published at http://www.nxp.com/profile/terms, unless otherwise agreed in a valid written individual agreement. In case an individual agreement is concluded only the terms and conditions of the respective agreement shall apply. NXP Semiconductors hereby expressly objects to applying the customer's general terms and conditions with regard to the purchase of NXP Semiconductors products by customer.

No offer to sell or license — Nothing in this document may be interpreted or construed as an offer to sell products that is open for acceptance or the grant, conveyance or implication of any license under any copyrights, patents or other industrial or intellectual property rights.

Export control — This document as well as the item(s) described herein may be subject to export control regulations. Export might require a prior authorization from competent authorities.

Non-automotive qualified products — Unless this data sheet expressly states that this specific NXP Semiconductors product is automotive qualified, the product is not suitable for automotive use. It is neither qualified nor tested in accordance with automotive testing or application requirements. NXP Semiconductors accepts no liability for inclusion and/or use of non-automotive qualified products in automotive equipment or applications.

In the event that customer uses the product for design-in and use in automotive applications to automotive specifications and standards, customer (a) shall use the product without NXP Semiconductors' warranty of the product for such automotive applications, use and specifications, and (b) whenever customer uses the product for automotive applications beyond NXP Semiconductors' specifications such use shall be solely at customer's own risk, and (c) customer fully indemnifies NXP Semiconductors for any liability, damages or failed product claims resulting from customer design and use of the product for automotive applications beyond NXP Semiconductors' standard warranty and NXP Semiconductors' product specifications.

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.

Translations — A non-English (translated) version of a document is for reference only. The English version shall prevail in case of any discrepancy between the translated and English versions.

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**

15. Contents

For more information, please visit: http://www.nxp.com
For sales office addresses, please send an email to: salesaddresses@nxp.com

Date of release: 18 January 2017
Document identifier: BGU6009_N2

Общество с ограниченной ответственностью «МосЧип» ИНН 7719860671 / КПП 771901001
Адрес: 105318, г.Москва, ул.Щербаковская д.3, офис 1107

Данный компонент на территории Российской Федерации

Вы можете приобрести в компании MosChip.

Для оперативного оформления запроса Вам необходимо перейти по данной ссылке:

http://moschip.ru/get-element

Вы можете разместить у нас заказ для любого Вашего проекта, будь то серийное производство или разработка единичного прибора.

В нашем ассортименте представлены ведущие мировые производители активных и пассивных электронных компонентов.

Нашей специализацией является поставка электронной компонентной базы двойного назначения, продукции таких производителей как XILINX, Intel (ex.ALTERA), Vicor, Microchip, Texas Instruments, Analog Devices, Mini-Circuits, Amphenol, Glenair.

Сотрудничество с глобальными дистрибьюторами электронных компонентов, предоставляет возможность заказывать и получать с международных складов практически любой перечень компонентов в оптимальные для Вас сроки.

На всех этапах разработки и производства наши партнеры могут получить квалифицированную поддержку опытных инженеров.

Система менеджмента качества компании отвечает требованиям в соответствии с ГОСТ Р ИСО 9001, ГОСТ РВ 0015-002 и ЭС РД 009

Офис по работе с юридическими лицами:

105318, г.Москва, ул.Щербаковская д.3, офис 1107, 1118, ДЦ «Щербаковский»

Телефон: +7 495 668-12-70 (многоканальный)

Факс: +7 495 668-12-70 (доб.304)

E-mail: info@moschip.ru

Skype отдела продаж:
moschip.ru
moschip.ru_4
moschip.ru_6
moschip.ru_9