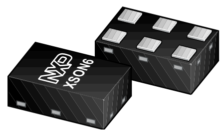


BGU8103

SiGe:C low-noise amplifier MMIC for GPS, GLONASS, Galileo and COMPASS

Rev. 3 — 18 January 2017 Product data sheet

1. General description

The BGU8103 is, also known as the GPS1301M, an ultra low current and Low-Noise Amplifier (LNA) for GNSS receiver applications. The BGU8103 is available in a small plastic 6-pin extremely thin leadless package. The BGU8103 requires only one external matching inductor.

The BGU8103 adapts itself to the changing environment resulting from co-habitation of different radio systems in modern cellular handsets. It has been designed for ultra low power consumption and optimal performance when jamming signals from co-existing cellular transmitters are present. At low jamming power levels, it delivers 17.5 dB gain at a noise figure of 0.80 dB and a supply current of 1.2 mA. During high jamming power levels, resulting for example from a cellular transmit burst, it temporarily increases its bias current to improve sensitivity.

2. Features and benefits

- Optimized performance at a low supply current of 1.2 mA
- Covers full GNSS L1 band, from 1559 MHz to 1610 MHz
- Noise figure = 0.80 dB
- Gain 17.5 dB
- Input 1 dB compression point of –16 dBm
- Out of band $IP3_i$ of –8 dBm
- Supply voltage 1.5 V to 3.1 V
- Self-shielding package concept
- Integrated supply decoupling capacitor
- Power-down mode current consumption < 1 μA
- Integrated temperature stabilized bias for easy design
- Requires only one input matching inductor
- Integrated DC blocking at both RF input and output
- ESD protection on all pins (HBM > 2 kV)
- Integrated matching for the output
- Available in a 6-pin leadless package 1.1 mm × 0.7 mm × 0.37 mm; 0.4 mm pitch: SOT1232
- 180 GHz transit frequency - SiGe:C technology
- Moisture sensitivity level 1

3. Applications

- Smart phones
- Feature phones
- Tablets
- Digital still cameras
- Digital video cameras
- RF front-end modules
- Complete GNSS modules
- Personal health applications

4. Quick reference data

Table 1. Quick reference data

f = 1575 MHz; V_{CC} = 1.8 V; $V_{I(ENABLE)} \geq 0.8$ V; $P_i < -40$ dBm; T_{amb} = 25 °C; input matched to 50 Ω using a 12 nH inductor; see Figure 3; unless otherwise specified.

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{CC}	supply voltage	RF input AC coupled		1.5	-	3.1	V
I_{CC}	supply current	$P_i < -40$ dBm		0.8	1.2	1.6	mA
G_p	power gain	no jammer		14.5	17.5	20.0	dB
NF	noise figure	$P_i = -40$ dBm; no jammer	[1][2]	-	0.8	1.4	dB
$P_{i(1dB)}$	input power at 1 dB gain compression		[2]	–19	–16	-	dBm
$IP3_i$	input third-order intercept point		[2][3]	–11	–8	-	dBm

[1] PCB losses are subtracted.

[2] Guaranteed by device design; not tested in production.

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

5. Ordering information

Table 2. Ordering information

Type number	Package		
	Name	Description	Version
BGU8103	XSON6	plastic extremely thin small outline package; no leads; 6 terminals; body 1.1 × 0.7 × 0.37 mm	SOT1232

6. Marking

Table 3. Marking codes

Type number	Marking code
BGU8103	G

7. Block diagram

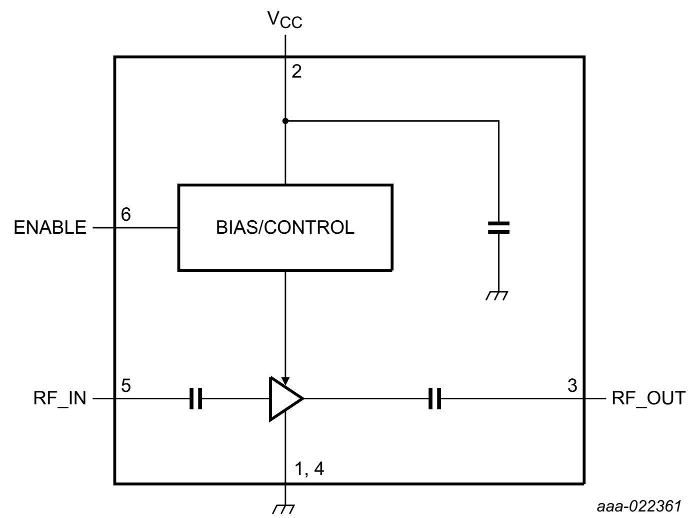


Fig 1. Block diagram

8. Pinning information

8.1 Pinning

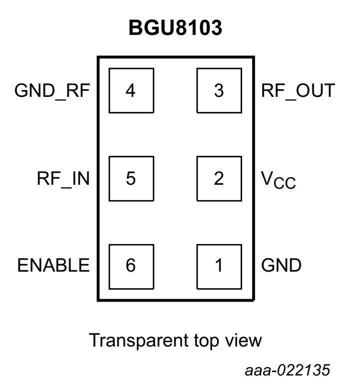


Fig 2. Pin configuration

8.2 Pin description

Table 4. Pin description

Symbol	Pin	Description
GND	1	ground
V_{CC}	2	supply voltage
RF_OUT	3	RF output
GND_RF	4	ground RF
RF_IN	5	RF input
ENABLE	6	enable

9. Limiting values

Table 5. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134).
See Section 18.3 "Disclaimers", paragraph "Limiting values".

Symbol	Parameter	Conditions	Min	Max	Unit
V_{CC}	supply voltage	RF input AC coupled [1]	–0.5	+5.0	V
$V_{I(ENABLE)}$	input voltage on pin ENABLE	$V_{I(ENABLE)} < V_{CC} + 0.6$ V [1][2]	–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][3]	–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][3]	–0.5	+5.0	V
P_i	input power	[1]	-	10	dBm
P_{tot}	total power dissipation	$T_{sp} \leq 130$ °C	-	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 JEDEC standard JS-001-2010	-	±2	kV
		Charged Device Model (CDM) according to JEDEC standard JESD22-C101C	-	±2	kV

[1] Stressed with pulses of 200 ms in duration, with application circuit as in Figure 3.

[2] Warning: Due to internal ESD diode protection, to avoid excess current, the applied DC voltage must not exceed V_{CC} + 0.6 V or 5.0 V.

[3] The RF input and RF output are AC coupled through internal DC blocking capacitors.

10. Recommended operating conditions

Table 6. Operating conditions

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{CC}	supply voltage		1.5	-	3.1	V
T_{amb}	ambient temperature		–40	+25	+85	°C
$V_{I(ENABLE)}$	input voltage on pin ENABLE	OFF state	-	-	0.3	V
		ON state	0.8	-	-	V

11. Thermal characteristics

Table 7. Thermal characteristics

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

12. Characteristics

Table 8. Characteristics at V_{CC} = 1.8 V

f = 1575 MHz; V_{CC} = 1.8 V; $V_{I(ENABLE)} \geq$ 0.8 V; P_i < –40 dBm; T_{amb} = 25 °C; input matched to 50 Ω using a 12 nH inductor; see Figure 3; unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I_{CC}	supply current	$V_{I(ENABLE)} \geq$ 0.8 V				
		P_i < –40 dBm	0.8	1.2	1.6	mA
		P_i = –20 dBm	-	2.5	-	mA
		$V_{I(ENABLE)} \leq$ 0.3 V	-	-	1	μA
G_p	power gain	no jammer	14.5	17.5	20.0	dB
		P_{jam} = –20 dBm; f_{jam} = 850 MHz	-	18.5	-	dB
		P_{jam} = –20 dBm; f_{jam} = 1850 MHz	-	18.0	-	dB
RL_{in}	input return loss	P_i < –40 dBm	-	8	-	dB
		P_i = –20 dBm	-	9	-	dB
RL_{out}	output return loss	P_i < –40 dBm	-	11	-	dB
		P_i = –20 dBm	-	11	-	dB
ISL	isolation		-	35	-	dB
NF	noise figure	P_i = –40 dBm; no jammer [1][2]	-	0.8	1.4	dB
		P_i = –40 dBm; no jammer [2][3]	-	0.9	1.5	dB
		P_{jam} = –20 dBm; f_{jam} = 850 MHz [3]	-	1.1	-	dB
		P_{jam} = –20 dBm; f_{jam} = 1850 MHz [3]	-	1.4	-	dB
$P_{i(1dB)}$	input power at 1 dB gain compression	[2]	–19	–16	-	dBm
$IP3_i$	input third-order intercept point	[2][4]	–11	–8	-	dBm
IMD3	third-order intermodulation distortion	output referred [4]	-	–72	-	dBm
t_{on}	turn-on time	time from $V_{I(ENABLE)}$ ON to 90 % of the gain	-	-	2	μs
t_{off}	turn-off time	time from $V_{I(ENABLE)}$ OFF to 10 % of the gain	-	-	1	μs

[1] PCB losses are subtracted.

[2] Guaranteed by device design; not tested in production.

[3] Including PCB losses.

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

Table 9. Characteristics at V_{CC} = 2.85 V

f = 1575 MHz; V_{CC} = 2.85 V; $V_{I(ENABLE)} \geq 0.8$ V; $P_i < -40$ dBm; T_{amb} = 25 °C; input matched to 50 Ω using a 12 nH inductor; see Figure 3; unless otherwise specified.

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
I_{CC}	supply current	$V_{I(ENABLE)} \geq 0.8$ V					
		$P_i < -40$ dBm		0.8	1.2	1.6	mA
		$P_i = -20$ dBm		-	2.5	-	mA
		$V_{I(ENABLE)} \leq 0.3$ V		-	-	1	μA
G_p	power gain	no jammer		15.0	17.5	20.0	dB
		$P_{jam} = -20$ dBm; f_{jam} = 850 MHz		-	18.5	-	dB
		$P_{jam} = -20$ dBm; f_{jam} = 1850 MHz		-	18.5	-	dB
RL_{in}	input return loss	$P_i < -40$ dBm		-	8	-	dB
		$P_i = -20$ dBm		-	9	-	dB
RL_{out}	output return loss	$P_i < -40$ dBm		-	11	-	dB
		$P_i = -20$ dBm		-	11	-	dB
ISL	isolation			-	35	-	dB
NF	noise figure	$P_i = -40$ dBm; no jammer	[1][2]	-	1.0	1.4	dB
		$P_i = -40$ dBm; no jammer	[2][3]	-	1.1	1.5	dB
		$P_{jam} = -20$ dBm; f_{jam} = 850 MHz	[3]	-	1.1	-	dB
		$P_{jam} = -20$ dBm; f_{jam} = 1850 MHz	[3]	-	1.4	-	dB
$P_{i(1dB)}$	input power at 1 dB gain compression		[2]	–16	–13	-	dBm
$IP3_i$	input third-order intercept point		[2][4]	–10	–7	-	dBm
IMD3	third-order intermodulation distortion	output referred	[4]	-	–72	-	dBm
t_{on}	turn-on time	time from $V_{I(ENABLE)}$ ON to 90 % of the gain		-	-	2	μs
t_{off}	turn-off time	time from $V_{I(ENABLE)}$ OFF to 10 % of the gain		-	-	1	μs

[1] PCB losses are subtracted.

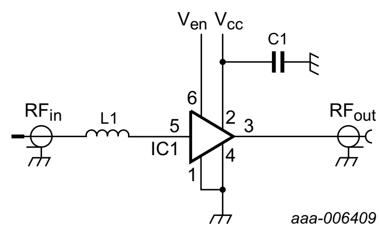
[2] Guaranteed by device design; not tested in production.

[3] Including PCB losses.

[4] f_1 = 1713 MHz; f_2 = 1851 MHz; $P_i = -20$ dBm at f_1; $P_i = -65$ dBm at f_2.

13. Application information

13.1 GNSS LNA



For a list of components, see Table 10.

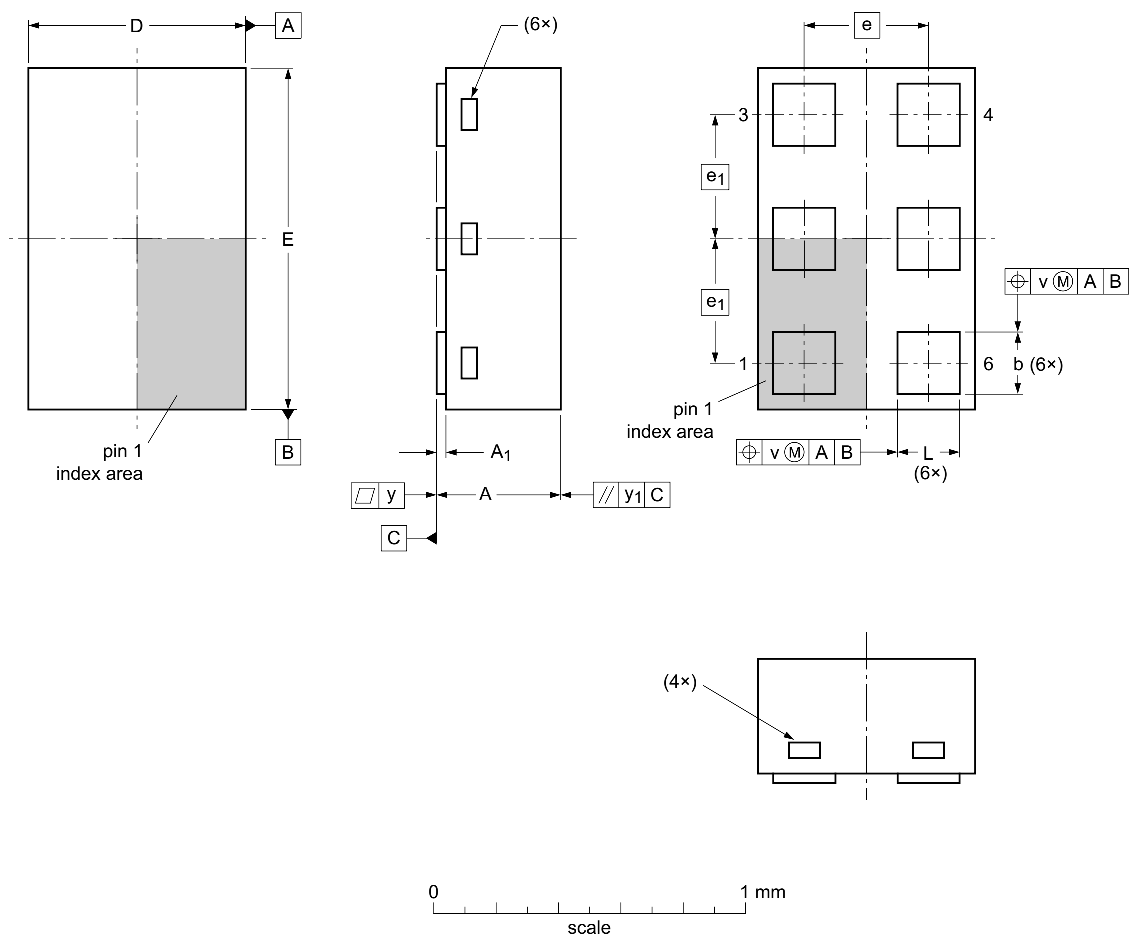
Fig 3. Schematics GNSS LNA evaluation board

Table 10. List of components
For schematics, see Figure 3.

Component	Description	Value	Remarks
C1	decoupling capacitor	1 nF	to suppress power supply noise
IC1	BGU8103	-	NXP Semiconductors
L1	high-quality matching inductor	12 nH	Murata LQW15A

14. Package outline

XSON6: plastic extremely thin small outline package; no leads; 6 terminals; body 1.1 x 0.7 x 0.37 mm **SOT1232**



Dimensions (mm are the original dimensions)

Unit		A	A_1	D	E	e_1	e	b	L	V	Y	Y_1
mm	min	0.34		0.65	1.05			0.17	0.17			
	nom	0.37		0.70	1.10	0.4	0.4	0.20	0.20	0.1	0.05	0.1
	max	0.40	0.04	0.75	1.15			0.25	0.25			

Note
1. Dimension A is including plating thickness.

sot1232_po

Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
SOT1232						~~13-04-12~~ 13-11-08

Fig 4. Package outline SOT1232 (XSON6)

15. 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.

16. Abbreviations

Table 11. Abbreviations

Acronym	Description
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
SiGe:C	Silicon Germanium Carbon

17. Revision history

Table 12. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BGU8103 v.3	20170118	Product data sheet	-	BGU8103 v.2
Modifications:	• Section 1: added GPS1301M according to our new naming convention			
BGU8103 v.2	20160325	Product data sheet	-	BGU8103 v.1
Modifications:	• Data sheet status changed from Preliminary data sheet to Product data sheet			
BGU8103 v.1	20151221	Preliminary data sheet	-	-

18. Legal information

18.1 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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20. Contents

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