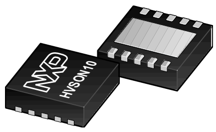


BGU8061

low-noise high-linearity amplifier

Rev. 2 — 27 January 2017 **Product data sheet**

1 General description

The BGU8061 is, also known as the BTS3001L, a high-linearity bypass amplifier for wireless infrastructure applications, equipped with fast shutdown to support TDD systems. The LNA has a high input and output return loss and is designed to operate between 0.7 GHz and 1.5 GHz. It is housed in a 3 mm × 3 mm × 0.85 mm 10-terminal plastic thin small outline package. The LNA is ESD protected on all terminals.

2 Features and benefits

- Low-noise performance: NF = 1.1 dB
- High-linearity performance: $IP3_O$ = 36.5 dBm
- High-input return loss > 10 dB
- High-output return loss > 10 dB
- Unconditionally stable up to 20 GHz
- Small 10-terminal leadless package 3 mm × 3 mm × 0.85 mm
- ESD protection on all terminals
- Moisture sensitivity level 1
- Fast shut down to support TDD systems
- +5 V single supply

3 Applications

- Wireless infrastructure
- Low noise and high-linearity applications
- LTE, W-CDMA, CDMA, GSM
- General-purpose wireless applications
- TDD or FDD systems
- Suitable for small cells

4 Quick reference data

Table 1. Quick reference data

f = 900 MHz; V_{CC} = 5 V; T_{amb} = 25 °C; input and output 50 Ω; unless otherwise specified. All RF parameters are measured on an application board with the circuit as shown in Figure 29 and components listed in Table 9 implemented. This board is optimized for f = 900 MHz.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I_{CC}	supply current	LNA enable; bypass off	-	70	85	mA
		LNA disable; bypass on	-	3	5	mA
G_{ass}	associated gain	LNA enable; bypass off	19	20.5	22	dB
		LNA disable; bypass on	−1.6	−1.0	-	dB
NF	noise figure	LNA enable; bypass off [1]	-	1.1	1.8	dB
$P_{L(1dB)}$	output power at 1 dB gain compression	LNA enable; bypass off	19	20.5	-	dBm
$IP3_O$	output third-order intercept point	2-tone; tone spacing = 1 MHz; PL = 5 dBm per tone				
		LNA enable; bypass off	33.5	36.5	-	dBm
		LNA disable; bypass on	-	44	-	dBm

[1] Connector and Printed-Circuit Board (PCB) losses have been de-embedded.

5 Ordering information

Table 2. Ordering information

Type number	Package		
	Name	Description	Version
BGU8061	HVSON10	plastic thermal enhanced very thin small outline package; no leads; 10 terminals; body 3 mm × 3 mm × 0.85 mm	SOT650-2

6 Block diagram

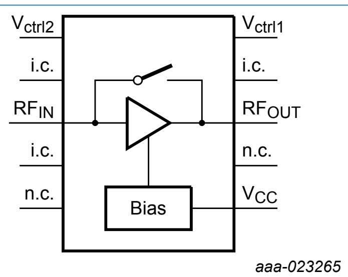


Figure 1. Block diagram

7 Pinning information

7.1 Pinning

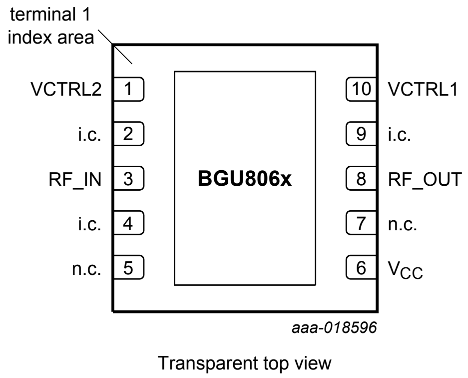


Figure 2. Pin configuration

7.2 Pin description

Table 3. Pin description

Symbol	Pin	Description
VCTRL2	1	voltage control 2
i.c.	2, 4, 9	internally connected, can be grounded or left open in the application
RF_IN	3	RF input
n.c.	5	not connected
V_{CC}	6	supply voltage
n.c.	7	not connected
RF_OUT	8	RF output
VCTRL1	10	voltage control 1
GND	exposed die pad	ground

8 Limiting values

Table 4. Limiting values

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

Symbol	Parameter	Conditions	Min	Max	Unit
V_{CC}	supply voltage		-	6	V
$V_{i(CTRL1)}$	input voltage on pin CTRL1		-	3.6	V
$V_{i(CTRL2)}$	input voltage on pin CTRL2		-	3.6	V
$P_{i(RF)CW}$	continuous waveform RF input power		-	20	dBm
T_{amb}	ambient temperature		−40	+85	°C
T_{stg}	storage temperature		−40	+150	°C
T_j	junction temperature		-	150	°C
P	power dissipation	$T_{case} \leq 125$ °C [1]	-	510	mW
V_{ESD}	electrostatic discharge voltage	Human Body Model (HBM) according to ANSI/ESDA/JEDEC standard JS-001-2010	-	2.0	kV
		Charged Device Model (CDM) according to JEDEC standard 22-C101B	-	1.0	kV

[1] Case is ground solder pad.

9 Recommended operating conditions

Table 5. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{CC}	supply voltage		4.75	5	5.25	V
Z_0	characteristic impedance		-	50	-	Ω

10 Thermal characteristics

Table 6. Thermal characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-case)}$	thermal resistance from junction to case	[1] [2]	-	55	-	K/W

[1] Case is ground solder pad.

[2] Thermal resistance measured using infrared measurement technique, device mounted on application board and placed in still air.

11 Characteristics

Table 7. Characteristics

f = 900 MHz; V_{CC} = 5 V; T_{amb} = 25 °C; input and output 50 Ω; unless otherwise specified. All RF parameters are measured on an application board with the circuit as shown in Figure 29 and components listed in Table 9 implemented. This board is optimized for f = 900 MHz.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I_{CC}	supply current	LNA enable; bypass off	-	70	85	mA
		LNA disable; bypass on	-	3	5	mA
G_{ass}	associated gain	LNA enable; bypass off	19	20.5	22	dB
		LNA disable; bypass on	−1.6	−1.0	-	dB
G_{flat}	gain flatness	within 100 MHz bandwidth; LNA enable; bypass off				
		700 MHz ≤ f ≤ 1500 MHz	-	0.9	-	dB
		1000 MHz ≤ f ≤ 1500 MHz	-	0.8	-	dB
NF	noise figure	LNA enable; bypass off [1]	-	1.1	1.8	dB
ΔG	gain variation	700 MHz ≤ f ≤ 1500 MHz	-	5.5	-	dB
$P_{L(1dB)}$	output power at 1 dB gain compression	LNA enable; bypass off	19	20.5	-	dBm
$IP3_O$	output third-order intercept point	2-tone; tone spacing = 1 MHz; P_L = 5 dBm per tone				
		LNA enable; bypass off	33.5	36.5	-	dBm
		LNA disable; bypass on	-	44	-	dBm
RL_{in}	input return loss	LNA enable; bypass off	-	10	-	dB
		LNA disable; bypass on	-	15	-	dB
RL_{out}	output return loss	LNA enable; bypass off	-	10	-	dB
		LNA disable; bypass on	-	15	-	dB
ISL	isolation	LNA disable; bypass off	-	30	-	dB
		LNA enable; bypass off	-	20	-	dB
$t_{s(pon)}$	power-on settling time	P_i = −20 dBm	-	0.5	-	μs
$t_{s(poff)}$	power-off settling time	P_i = −20 dBm	-	0.1	-	μs
K	Rollett stability factor	both on-state and off-state up to f = 20 GHz	1	-	-	-

[1] Connector and Printed-Circuit Board (PCB) losses have been de-embedded.

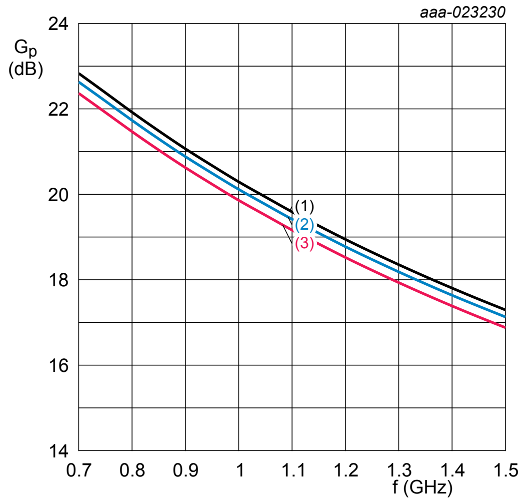
Table 8. Control truth table

V_{CC} = 5 V; T_{amb} = 25 °C.

Control signal setting[1]		Mode of operation	
CTRL2 (pin 1)	CTRL1 (pin 10)	LNA	bypass
HIGH	LOW	disable	on
HIGH	HIGH	disable	on
LOW	LOW	enable	off
LOW	HIGH	disable	off

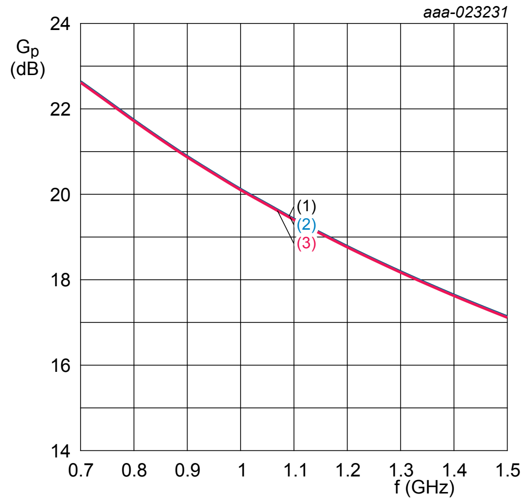
[1] A logic LOW is the result of an input voltage on that specific pin between −0.3 V and +0.7 V.
A logic HIGH is the result of an input voltage on that specific pin between 1.2 V and 3.6 V.

12 Graphics



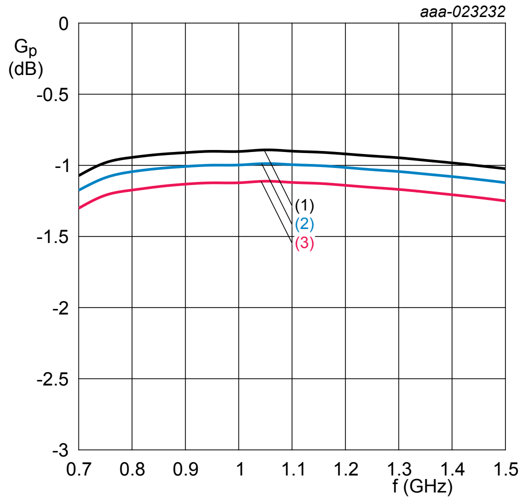
V_{CC} = 5 V
(1) T_{amb} = −40 °C
(2) T_{amb} = +25 °C
(3) T_{amb} = +95 °C

Figure 3. Power gain as a function of frequency Gain mode; typical values



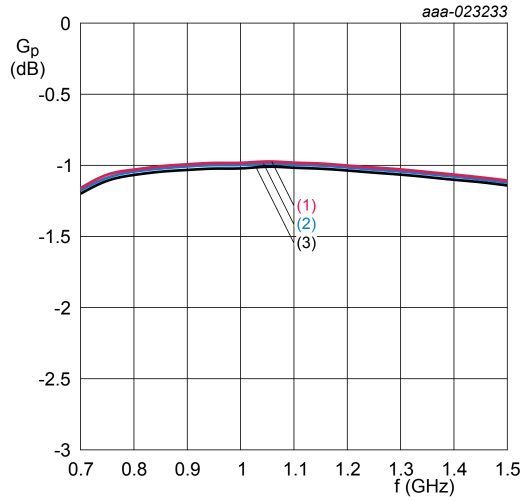
T_{amb} = +25 °C
(1) V_{CC} = 4.75 V
(2) V_{CC} = 5 V
(3) V_{CC} = 5.25 V

Figure 4. Power gain as a function of frequency Gain mode; typical values



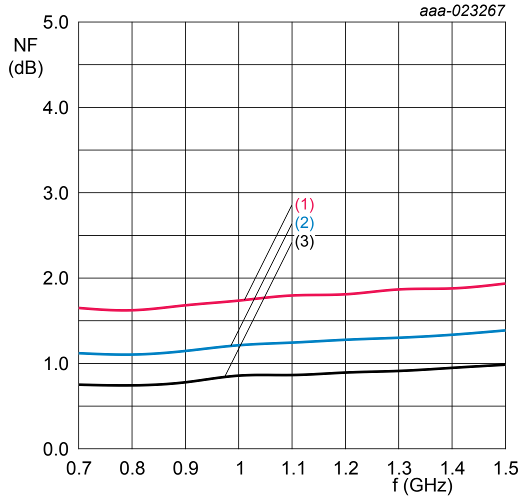
V_{CC} = 5 V
(1) T_{amb} = −40 °C
(2) T_{amb} = +25 °C
(3) T_{amb} = +95 °C

Figure 5. Power gain as a function of frequency Bypass mode; typical values



T_{amb} = +25 °C
(1) V_{CC} = 4.75 V
(2) V_{CC} = 5 V
(3) V_{CC} = 5.25 V

Figure 6. Power gain as a function of frequency Bypass mode; typical values



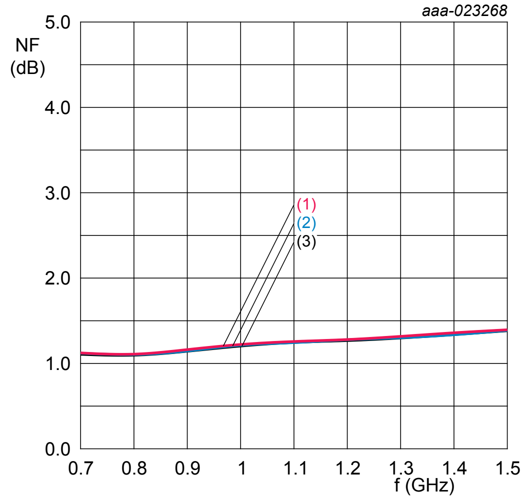
V_{CC} = 5 V

(1) T_{amb} = −40 °C

(2) T_{amb} = +25 °C

(3) T_{amb} = +95 °C

Figure 7. Noise figure as a function of frequency
Gain mode; typical values



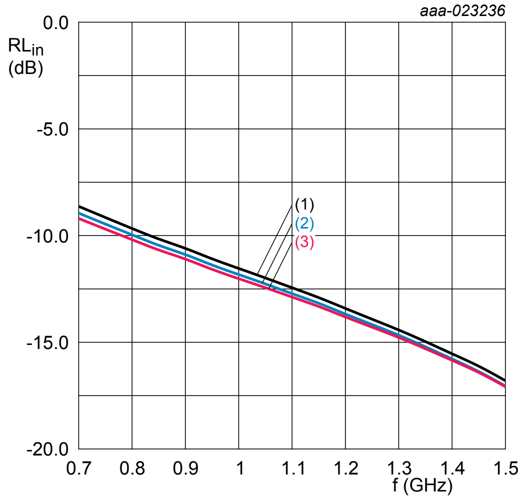
T_{amb} = +25 °C

(1) V_{CC} = 4.75 V

(2) V_{CC} = 5 V

(3) V_{CC} = 5.25 V

Figure 8. Noise figure as a function of frequency
Gain mode; typical values



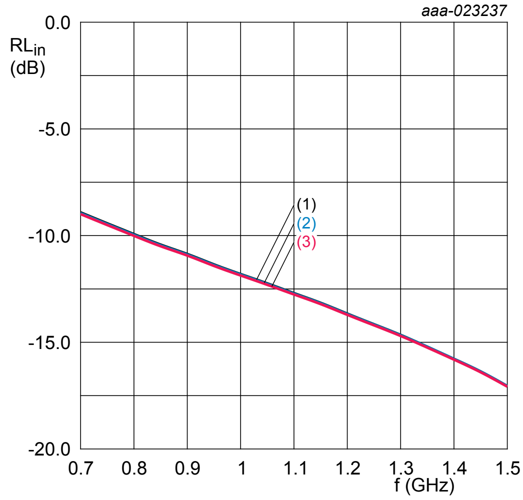
V_{CC} = 5 V

(1) T_{amb} = −40 °C

(2) T_{amb} = +25 °C

(3) T_{amb} = +95 °C

Figure 9. Input return loss as a function of frequency
Gain mode; typical values



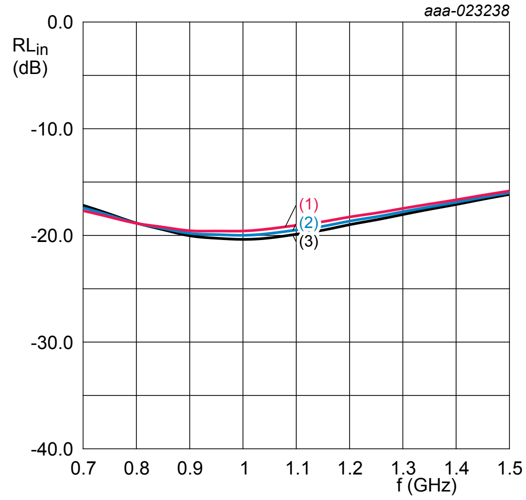
T_{amb} = +25 °C

(1) V_{CC} = 4.75 V

(2) V_{CC} = 5 V

(3) V_{CC} = 5.25 V

Figure 10. Input return loss as a function of frequency
Gain mode; typical values



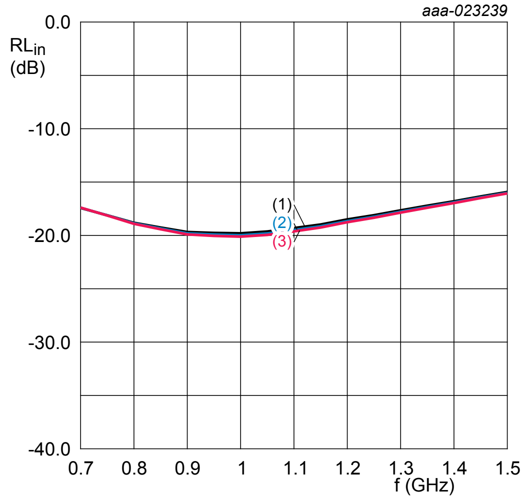
V_{CC} = 5 V

(1) T_{amb} = −40 °C

(2) T_{amb} = +25 °C

(3) T_{amb} = +95 °C

Figure 11. Input return loss as a function of frequency Bypass mode; typical values



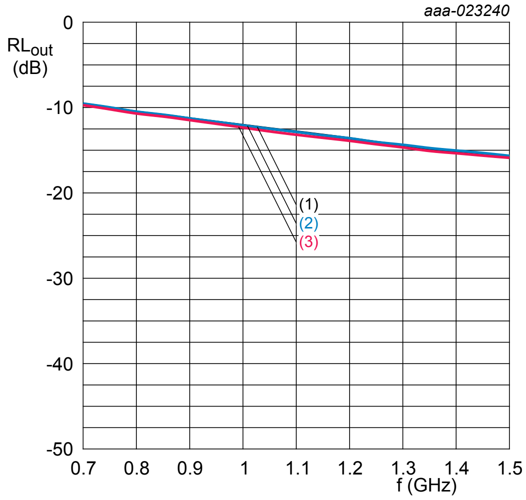
T_{amb} = +25 °C

(1) V_{CC} = 4.75 V

(2) V_{CC} = 5 V

(3) V_{CC} = 5.25 V

Figure 12. Input return loss as a function of frequency Bypass mode; typical values



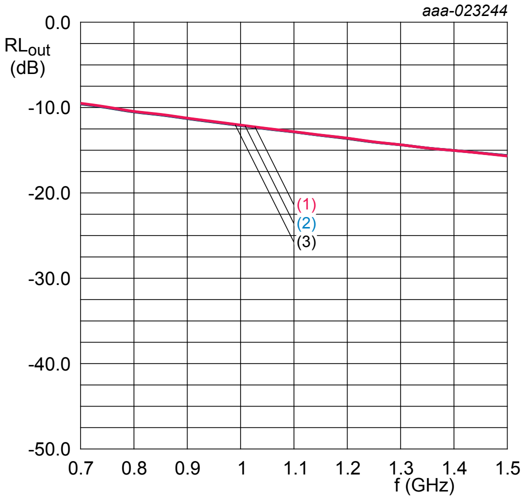
V_{CC} = 5 V

(1) T_{amb} = −40 °C

(2) T_{amb} = +25 °C

(3) T_{amb} = +95 °C

Figure 13. Output return loss as a function of frequency Gain mode; typical values



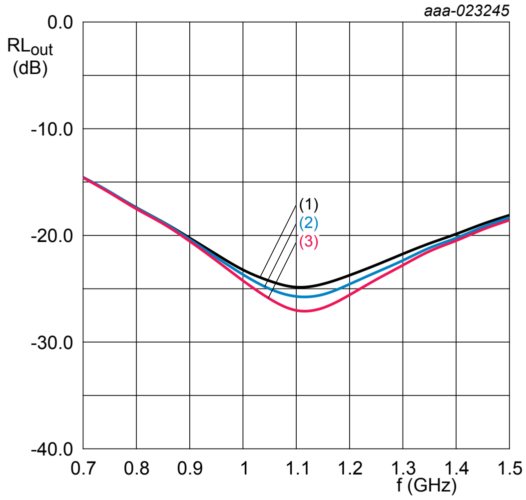
T_{amb} = +25 °C

(1) V_{CC} = 4.75 V

(2) V_{CC} = 5 V

(3) V_{CC} = 5.25 V

Figure 14. Output return loss as a function of frequency Gain mode; typical values



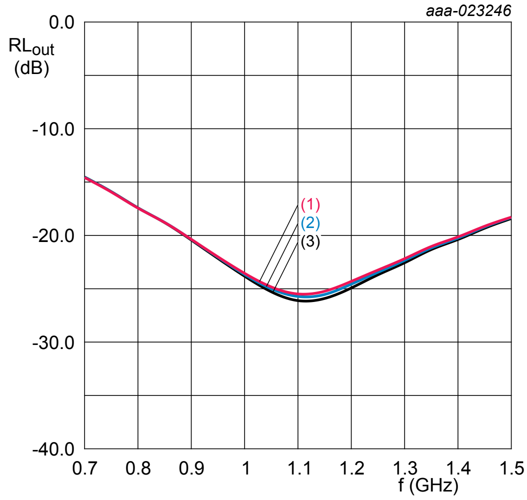
V_{CC} = 5 V

(1) T_{amb} = −40 °C

(2) T_{amb} = +25 °C

(3) T_{amb} = +95 °C

Figure 15. Output return loss as a function of frequency Bypass mode; typical values



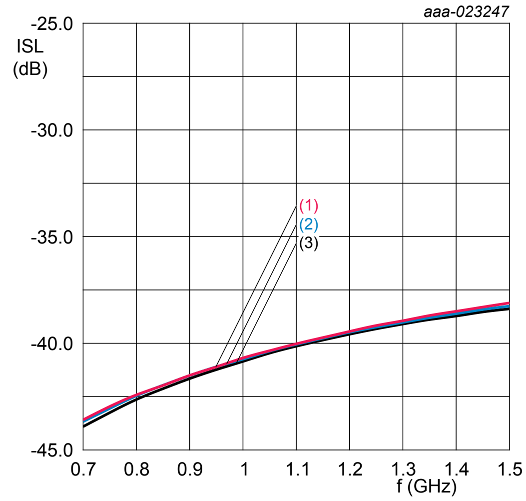
T_{amb} = +25 °C

(1) V_{CC} = 4.75 V

(2) V_{CC} = 5 V

(3) V_{CC} = 5.25 V

Figure 16. Output return loss as a function of frequency Bypass mode; typical values



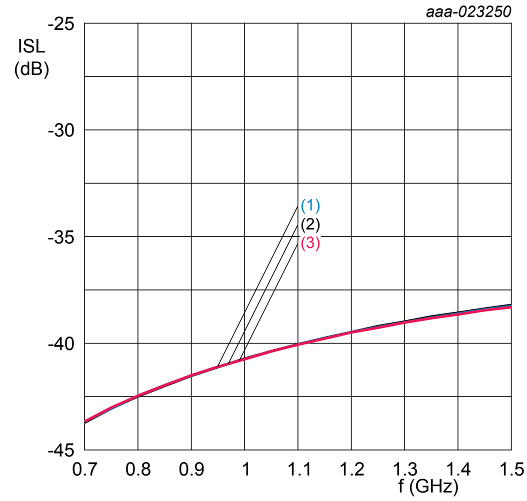
V_{CC} = 5 V

(1) T_{amb} = −40 °C

(2) T_{amb} = +25 °C

(3) T_{amb} = +95 °C

Figure 17. Isolation as a function of frequency Isolation mode; typical values



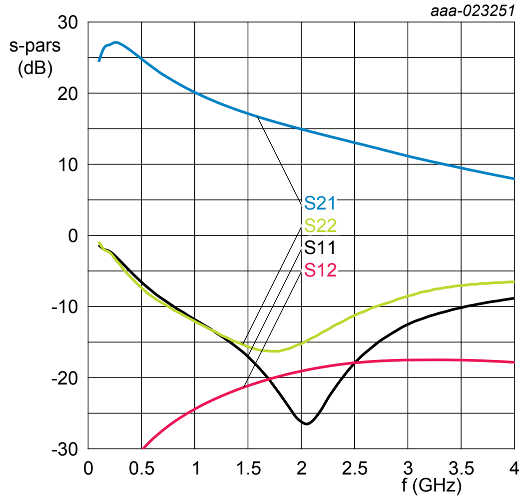
T_{amb} = +25 °C

(1) V_{CC} = 4.75 V

(2) V_{CC} = 5 V

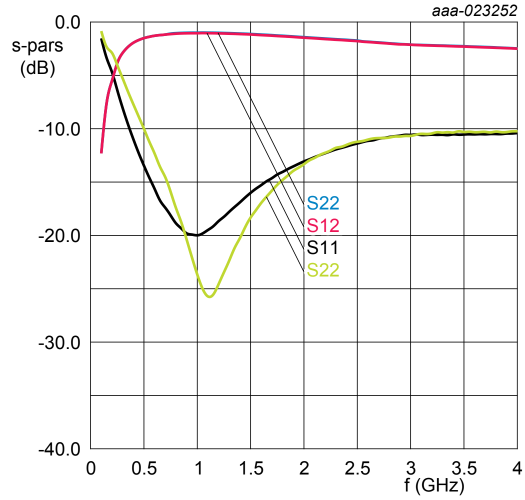
(3) V_{CC} = 5.25 V

Figure 18. Isolation as a function of frequency Isolation mode; typical values



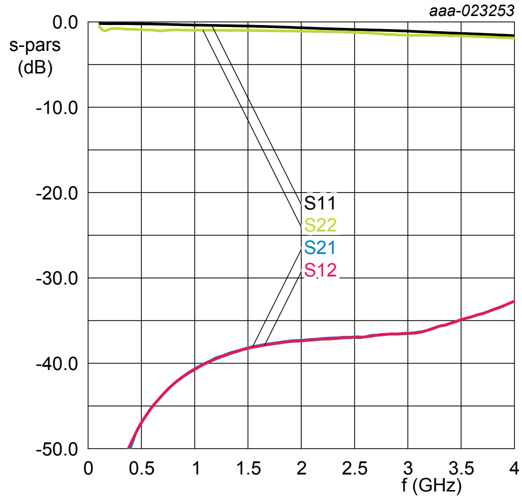
V_{CC} = 5 V; T_{amb} = +25 °C

Figure 19. Wideband S-parameters as function of frequency Gain mode; typical values



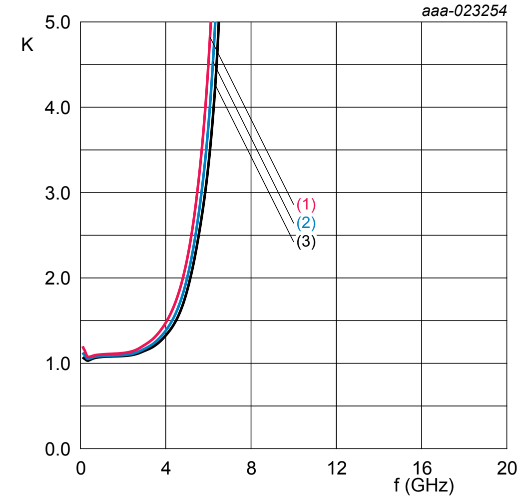
V_{CC} = 5 V; T_{amb} = +25 °C

Figure 20. Wideband S-parameters as function of frequency Bypass mode; typical values



V_{CC} = 5 V; T_{amb} = +25 °C

Figure 21. Wideband S-parameters as function of frequency Isolation mode; typical values



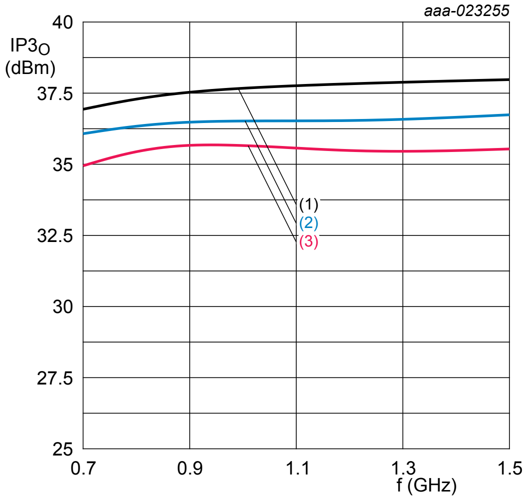
V_{CC} = 5 V

(1) T_{amb} = −40 °C

(2) T_{amb} = +25 °C

(3) T_{amb} = +95 °C

Figure 22. Rollett Stability factor as function of frequency Gain mode; typical values



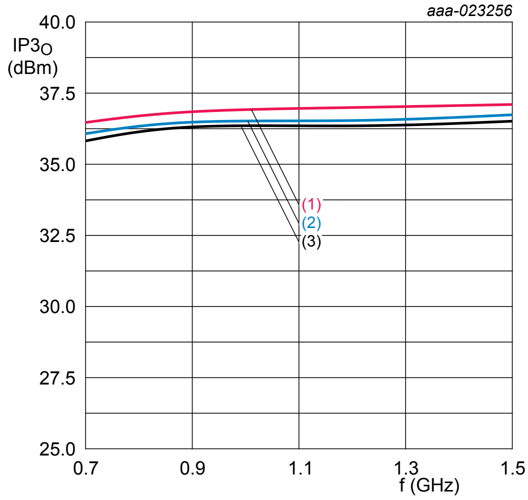
V_{CC} = 5 V

(1) T_{amb} = −40 °C

(2) T_{amb} = +25 °C

(3) T_{amb} = +95 °C

Figure 23. Output third-order intercept point as a function of frequency Gain mode; typical values



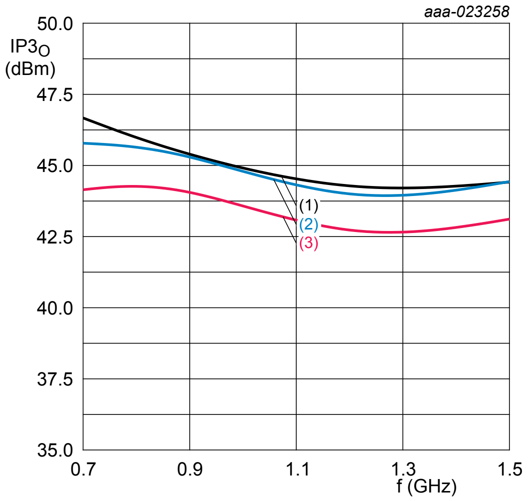
T_{amb} = +25 °C

(1) V_{CC} = 4.75 V

(2) V_{CC} = 5 V

(3) V_{CC} = 5.25 V

Figure 24. Output third-order intercept point as a function of frequency Gain mode; typical values



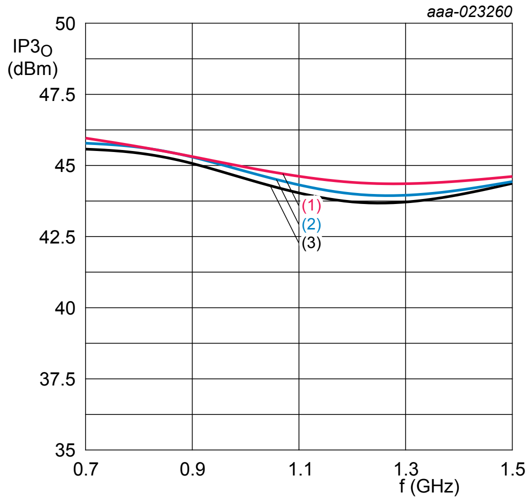
V_{CC} = 5 V

(1) T_{amb} = −40 °C

(2) T_{amb} = +25 °C

(3) T_{amb} = +95 °C

Figure 25. Output third-order intercept point as a function of frequency Bypass mode; typical values



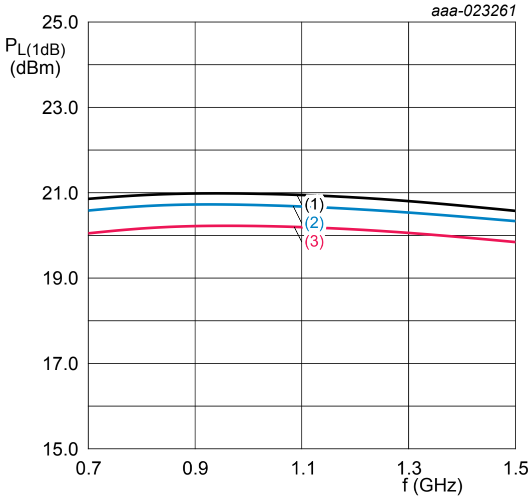
T_{amb} = +25 °C

(1) V_{CC} = 4.75 V

(2) V_{CC} = 5 V

(3) V_{CC} = 5.25 V

Figure 26. Output third-order intercept point as a function of frequency Bypass mode; typical values



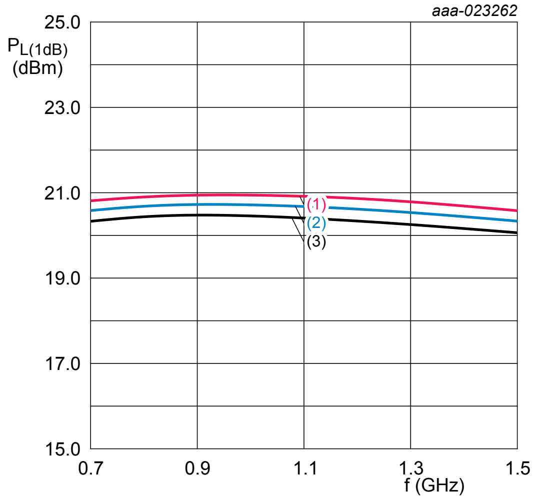
V_{CC} = 5 V

(1) T_{amb} = −40 °C

(2) T_{amb} = +25 °C

(3) T_{amb} = +95 °C

Figure 27. Output power at 1 dB gain compression as a function of frequency Gain mode; typical values



T_{amb} = +25 °C

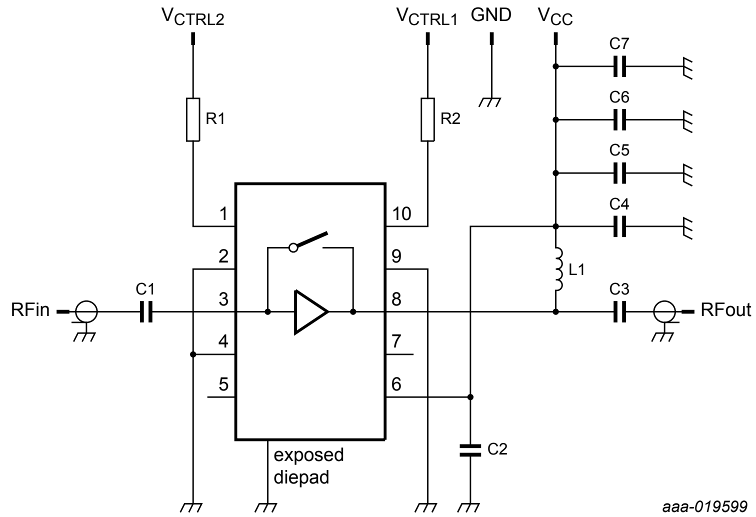
(1) V_{CC} = 4.75 V

(2) V_{CC} = 5 V

(3) V_{CC} = 5.25 V

Figure 28. Output power at 1 dB gain compression as a function of frequency Gain mode; typical values

13 Application information



See Table 9 for a list of components

Figure 29. Schematic of application board BGU8061

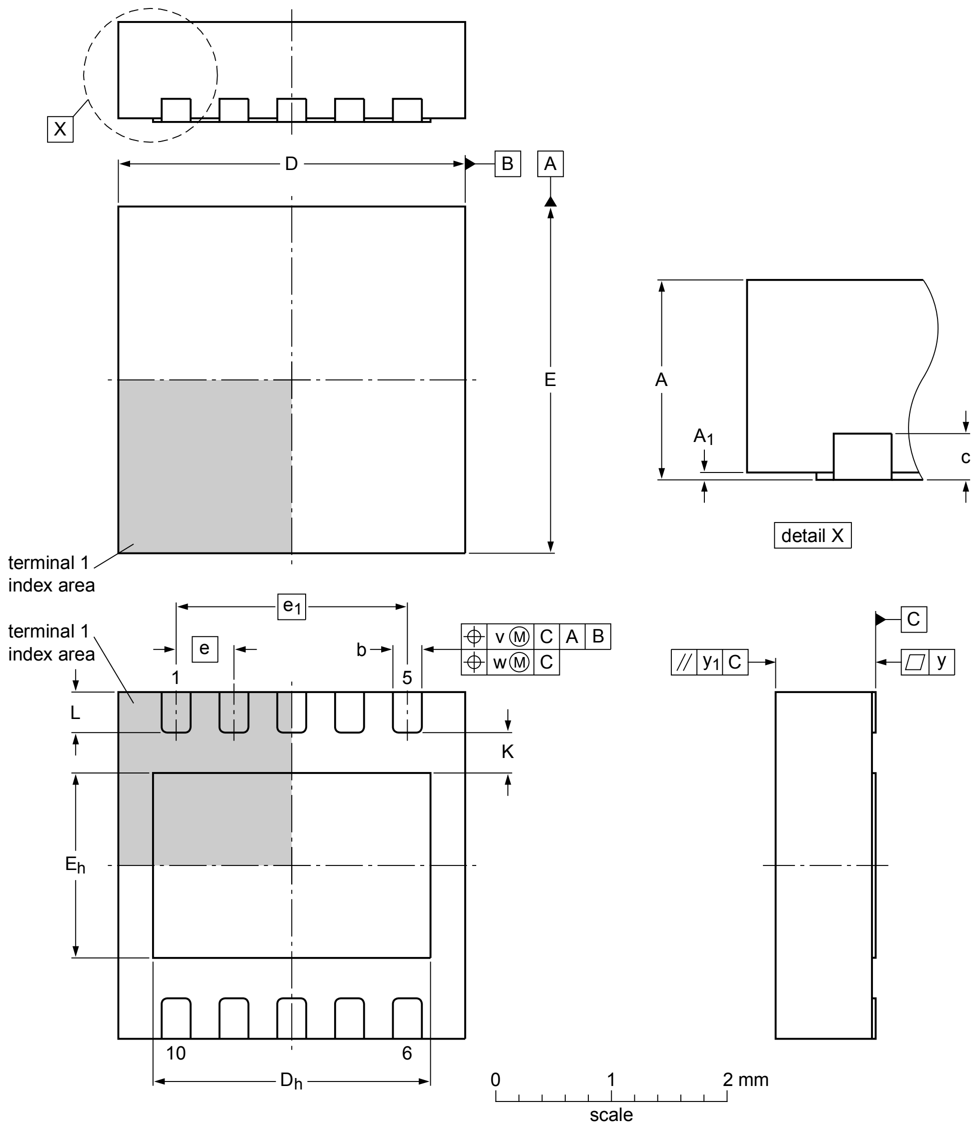
Table 9. List of components

See Figure 29 for schematics.

Component	Description	Value	Remarks
C1	capacitor	100 nF	
C2, C3	capacitor	100 pF	
C4	capacitor	1 nF	
C5	capacitor	-	optional
C6	capacitor	10 nF	
C7	capacitor	1 μF	
L1	inductor	15 nH	
R1, R2	resistor	1 kΩ	

14 Package outline

HVSON10: plastic thermal enhanced very thin small outline package; no leads; 10 terminals; 3 x 3 x 0.85 mm **SOT650-2**



Dimensions

Unit		$A^{(1)}$	A_1	b	c	$D^{(1)}$	D_h	$E^{(1)}$	E_h	e	e_1	K	L	v	w	y	y_1
mm	max	1.00	0.05	0.30		3.1	2.5	3.1	1.7			0.41	0.45				
	nom	0.85	0.03	0.25	0.2	3.0	2.4	3.0	1.6	0.5	2	0.35	0.35	0.1	0.05	0.08	0.1
	min	0.80	0.00	0.18		2.9	2.3	2.9	1.5			0.28	0.30				

Note
1. Plastic or metal protrusions of 0.075 mm maximum per side are not included.

sot650-2_po

Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
SOT650-2	- - -	MO-229	- - -			~~09-03-16~~ 09-03-18

Figure 30. Package Outline SOT650-2 (HVSON10)

15 Abbreviations

Table 10. Abbreviations

Acronym	Description
CDMA	Code Division Multiple Access
ESD	ElectroStatic Discharge
FDD	Frequency-Division Duplexing
GSM	Global System for Mobile communication
LNA	Low Noise Amplifier
LTE	Long Term Evolution
TDD	Time-Division Duplexing
W-CDMA	Wideband Code Division Multiple Access

16 Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BGU8061 v.2	20170127	product data sheet	-	BGU8061 v.1
Modifications	• Section 1: added BTS3001L according to our new naming convention			
BGU8061 v.1	<tbd>	product data sheet	-	-

Contents

Date of release: 27 January 2017
Document identifier: BGU8061