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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: IP_{3O} = 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

$f = 900\text{ MHz}$; $V_{CC} = 5\text{ V}$; $T_{amb} = 25\text{ }^{\circ}\text{C}$; input and output $50\text{ }\Omega$; 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 $f = 900\text{ MHz}$.

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
IP _{3O}	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

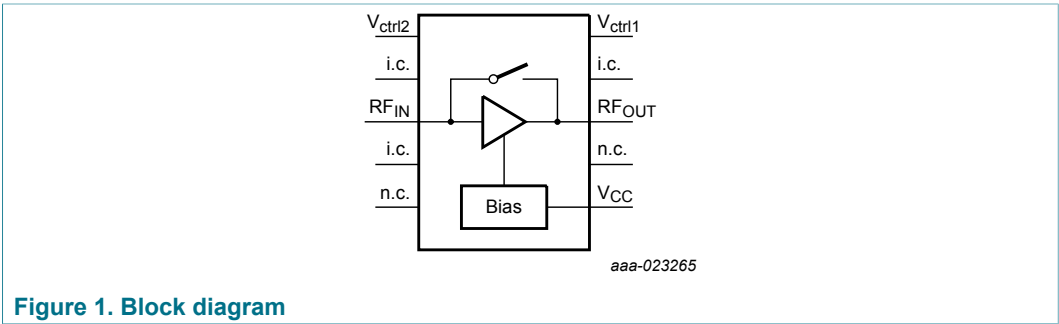
[1] Connector and Printed-Circuit Board (PCB) losses have been de-embedded.

5 Ordering information

Table 2. Ordering information

Type number	Package		Version
	Name	Description	
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



7 Pinning information

7.1 Pinning

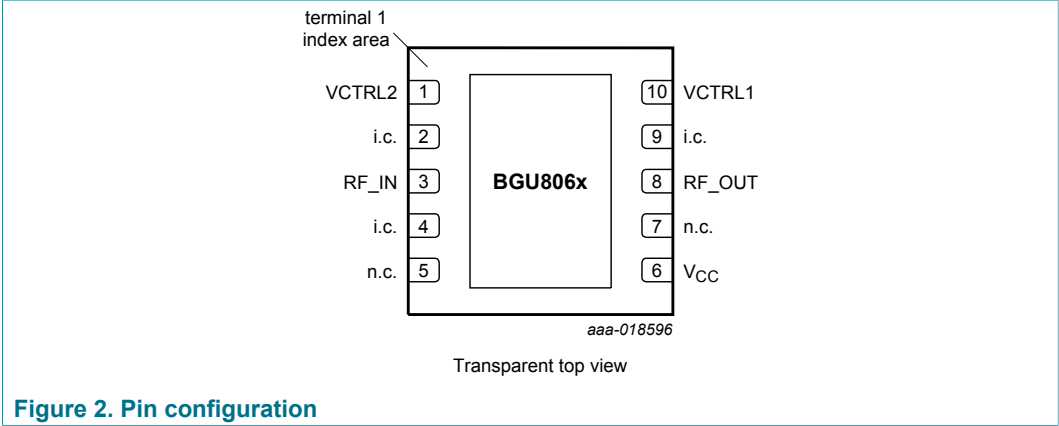


Figure 2. Pin configuration

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} ≤ 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

$f = 900\text{ MHz}$; $V_{CC} = 5\text{ V}$; $T_{amb} = 25\text{ °C}$; input and output $50\text{ }\Omega$; 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 $f = 900\text{ MHz}$.

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				
		$700\text{ MHz} \leq f \leq 1500\text{ MHz}$	-	0.9	-	dB
		$1000\text{ MHz} \leq f \leq 1500\text{ MHz}$	-	0.8	-	dB
NF	noise figure	LNA enable; bypass off ^[1]	-	1.1	1.8	dB
ΔG	gain variation	$700\text{ MHz} \leq f \leq 1500\text{ MHz}$	-	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; $P_L = 5\text{ dBm}$ 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	$P_i = -20\text{ dBm}$	-	0.5	-	μs
$t_{s(poff)}$	power-off settling time	$P_i = -20\text{ dBm}$	-	0.1	-	μs
K	Rollett stability factor	both on-state and off-state up to $f = 20\text{ GHz}$	1	-	-	-

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

Table 8. Control truth table

 $V_{CC} = 5\text{ V}$; $T_{amb} = 25\text{ }^{\circ}\text{C}$.

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 $+0.7\text{ V}$.
A logic HIGH is the result of an input voltage on that specific pin between 1.2 V and 3.6 V .

12 Graphics

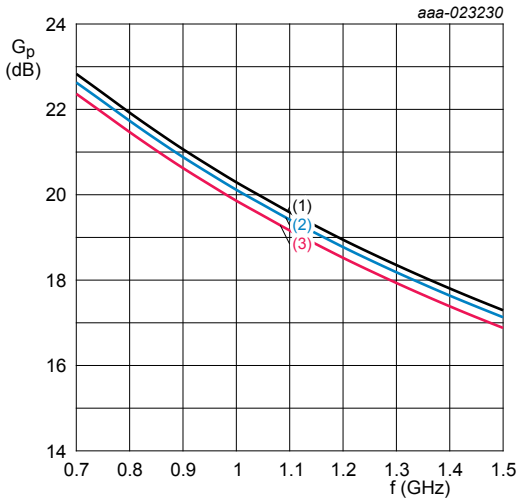


Figure 3. Power gain as a function of frequency
Gain mode; typical values

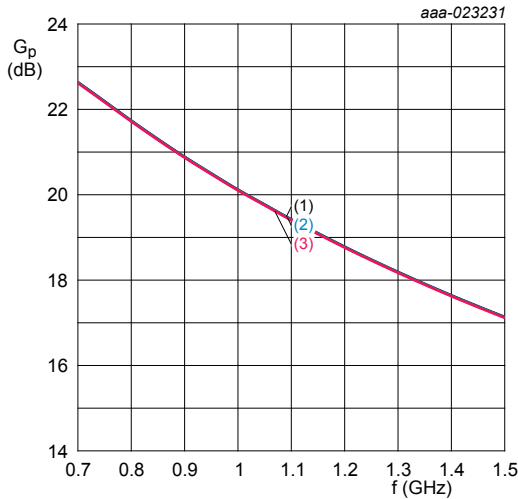


Figure 4. Power gain as a function of frequency
Gain mode; typical values

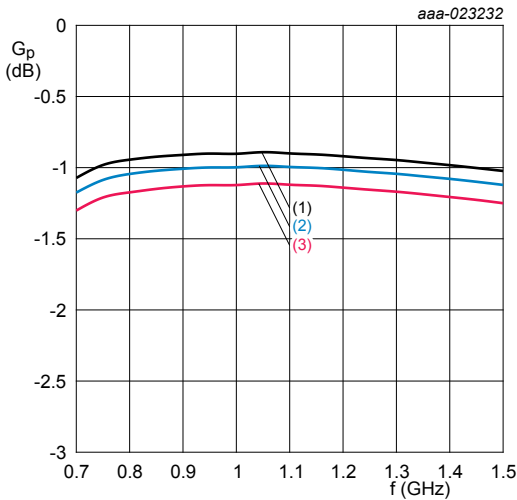


Figure 5. Power gain as a function of frequency
Bypass mode; typical values

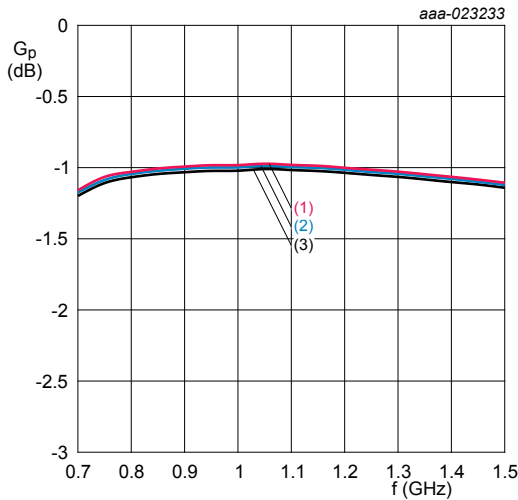
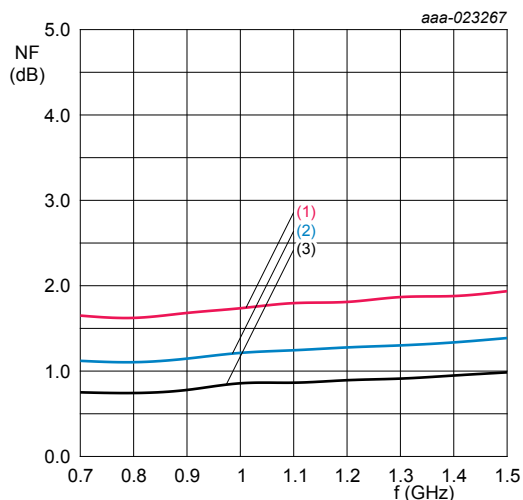


Figure 6. Power gain as a function of frequency
Bypass mode; typical values



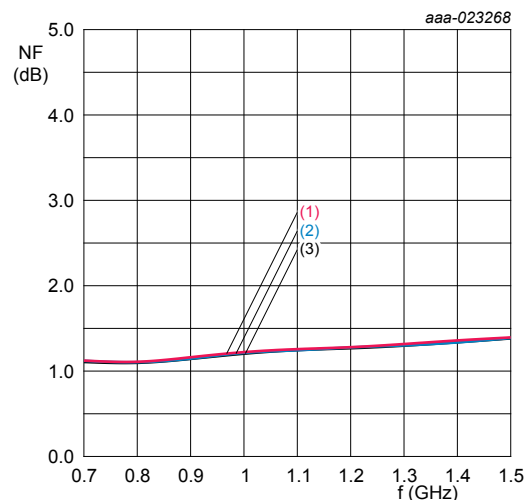
$V_{CC} = 5\text{ V}$

(1) $T_{amb} = -40\text{ °C}$

(2) $T_{amb} = +25\text{ °C}$

(3) $T_{amb} = +95\text{ °C}$

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



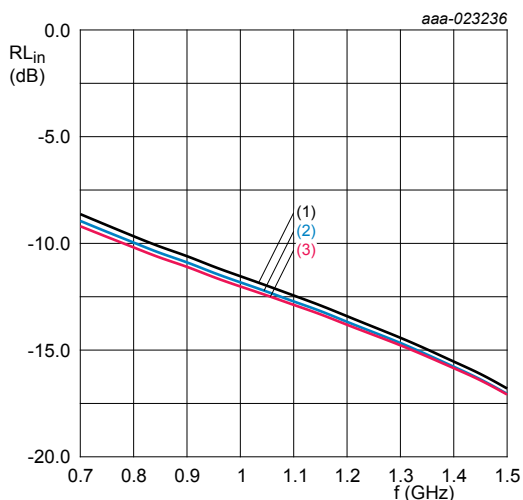
$T_{amb} = +25\text{ °C}$

(1) $V_{CC} = 4.75\text{ V}$

(2) $V_{CC} = 5\text{ V}$

(3) $V_{CC} = 5.25\text{ V}$

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



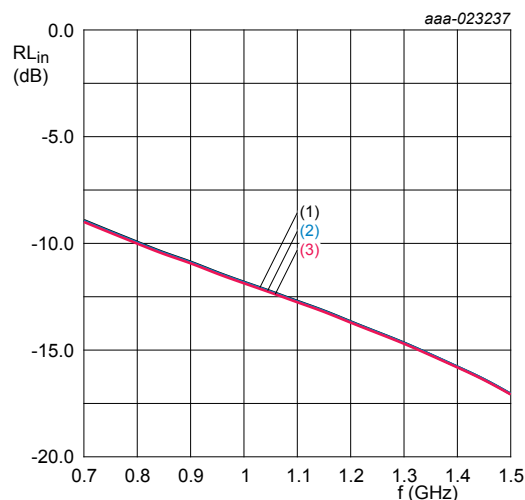
$V_{CC} = 5\text{ V}$

(1) $T_{amb} = -40\text{ °C}$

(2) $T_{amb} = +25\text{ °C}$

(3) $T_{amb} = +95\text{ °C}$

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



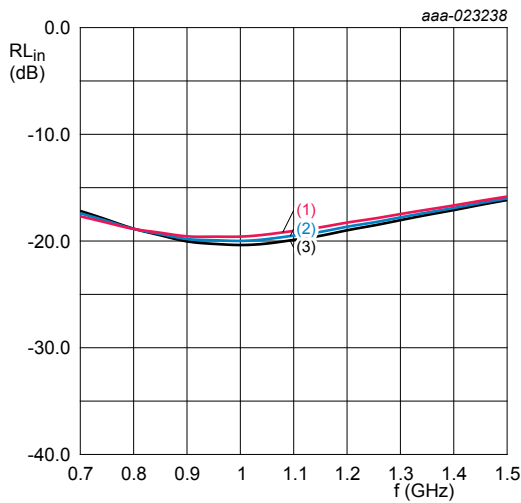
$T_{amb} = +25\text{ °C}$

(1) $V_{CC} = 4.75\text{ V}$

(2) $V_{CC} = 5\text{ V}$

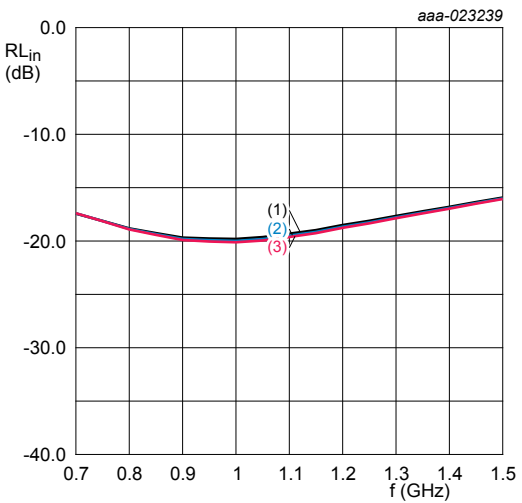
(3) $V_{CC} = 5.25\text{ V}$

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



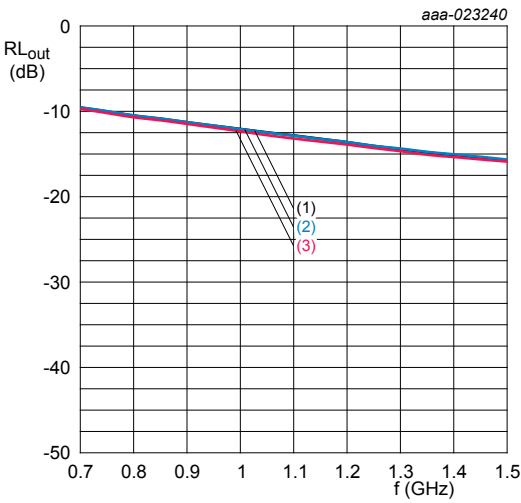
V_{CC} = 5 V
(1) T_{amb} = -40 °C
(2) T_{amb} = +25 °C
(3) T_{amb} = +95 °C

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



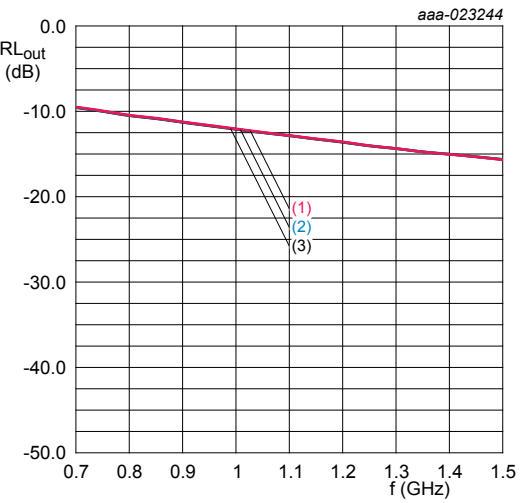
T_{amb} = +25 °C
(1) V_{CC} = 4.75 V
(2) V_{CC} = 5 V
(3) V_{CC} = 5.25 V

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



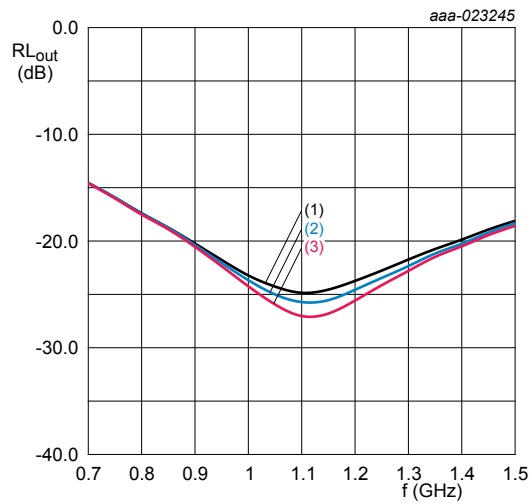
V_{CC} = 5 V
(1) T_{amb} = -40 °C
(2) T_{amb} = +25 °C
(3) T_{amb} = +95 °C

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



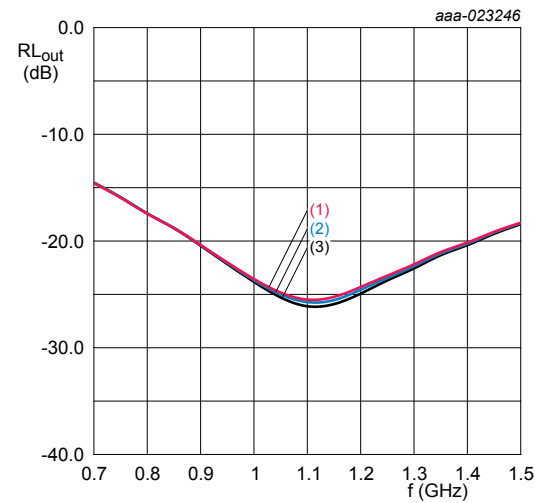
T_{amb} = +25 °C
(1) V_{CC} = 4.75 V
(2) V_{CC} = 5 V
(3) V_{CC} = 5.25 V

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



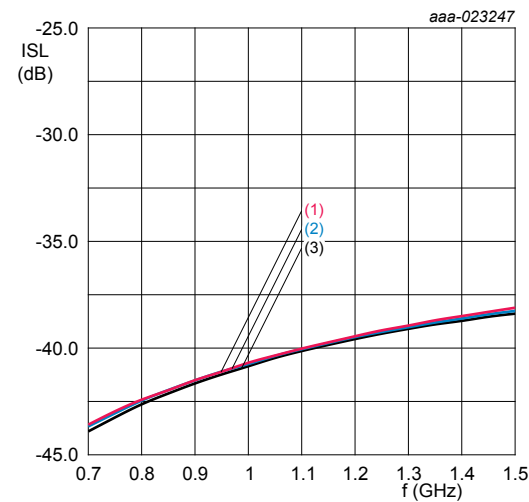
$V_{CC} = 5\text{ V}$
(1) $T_{amb} = -40\text{ }^{\circ}\text{C}$
(2) $T_{amb} = +25\text{ }^{\circ}\text{C}$
(3) $T_{amb} = +95\text{ }^{\circ}\text{C}$

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



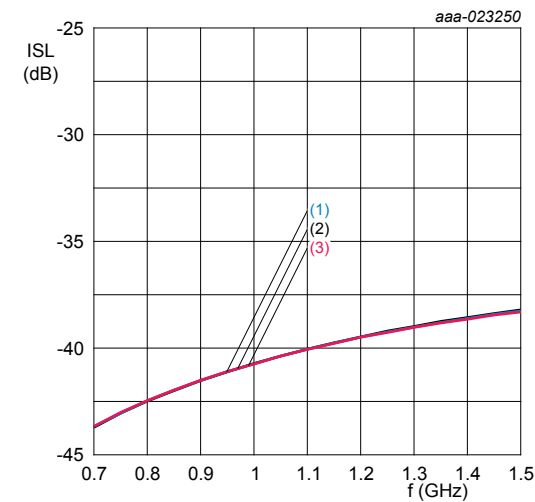
$T_{amb} = +25\text{ }^{\circ}\text{C}$
(1) $V_{CC} = 4.75\text{ V}$
(2) $V_{CC} = 5\text{ V}$
(3) $V_{CC} = 5.25\text{ V}$

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



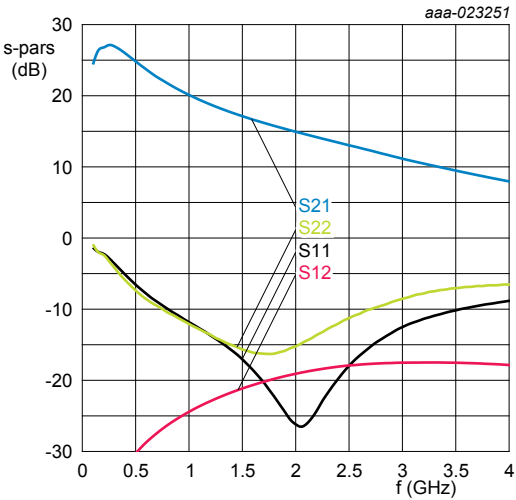
$V_{CC} = 5\text{ V}$
(1) $T_{amb} = -40\text{ }^{\circ}\text{C}$
(2) $T_{amb} = +25\text{ }^{\circ}\text{C}$
(3) $T_{amb} = +95\text{ }^{\circ}\text{C}$

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



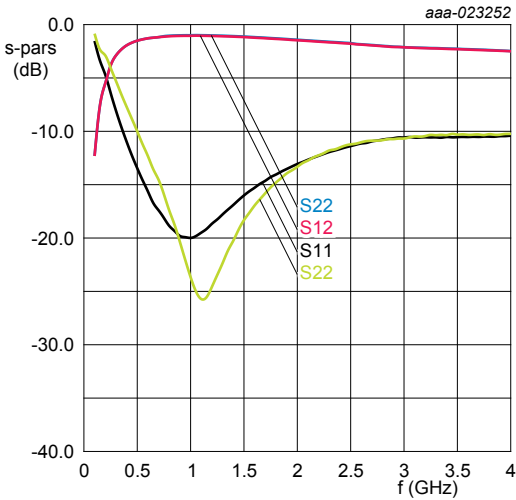
$T_{amb} = +25\text{ }^{\circ}\text{C}$
(1) $V_{CC} = 4.75\text{ V}$
(2) $V_{CC} = 5\text{ V}$
(3) $V_{CC} = 5.25\text{ V}$

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



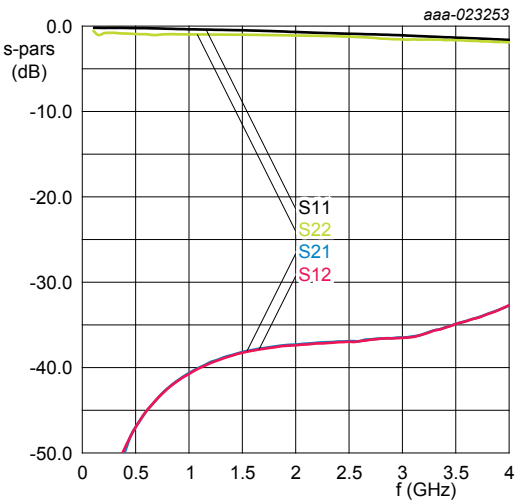
$V_{CC} = 5\text{ V}; T_{amb} = +25\text{ }^{\circ}\text{C}$

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



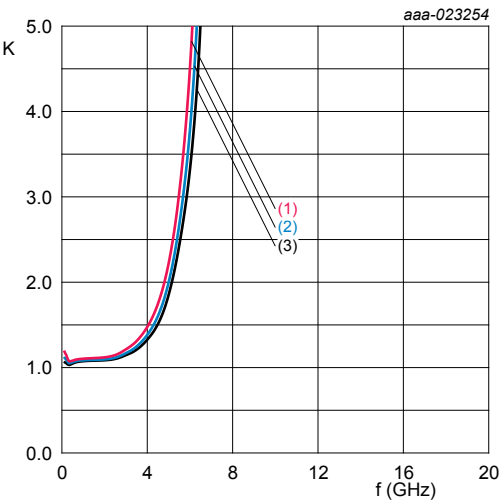
$V_{CC} = 5\text{ V}; T_{amb} = +25\text{ }^{\circ}\text{C}$

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



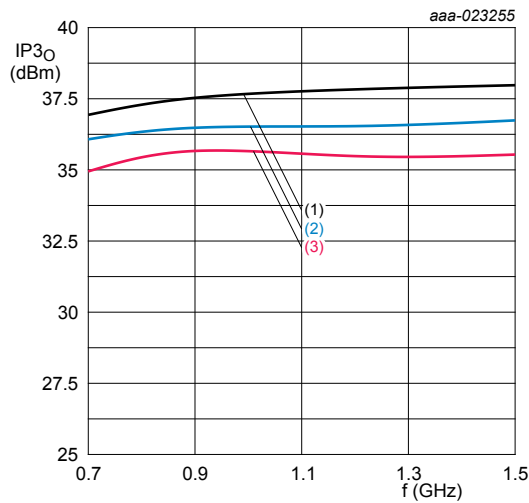
$V_{CC} = 5\text{ V}; T_{amb} = +25\text{ }^{\circ}\text{C}$

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



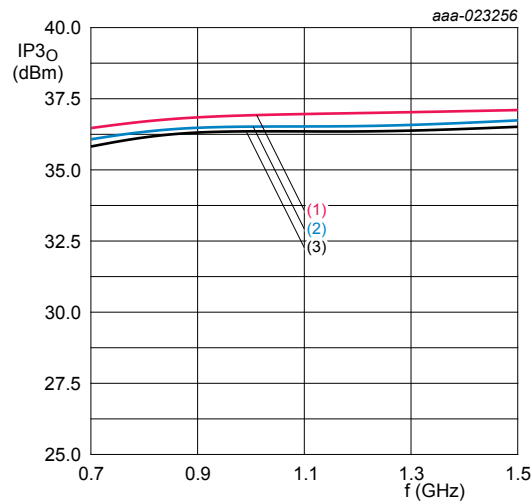
$V_{CC} = 5\text{ V}$
(1) $T_{amb} = -40\text{ }^{\circ}\text{C}$
(2) $T_{amb} = +25\text{ }^{\circ}\text{C}$
(3) $T_{amb} = +95\text{ }^{\circ}\text{C}$

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



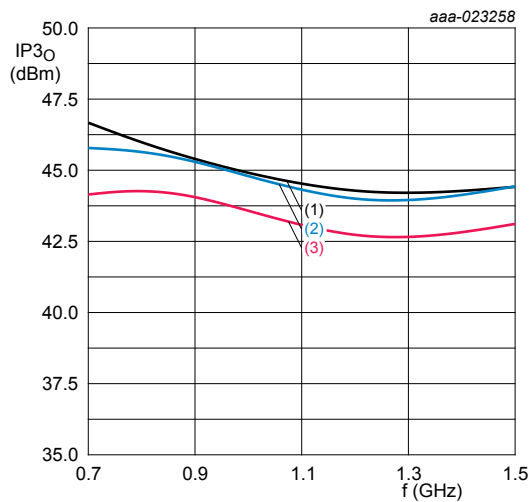
V_{CC} = 5 V
(1) T_{amb} = -40 °C
(2) T_{amb} = +25 °C
(3) T_{amb} = +95 °C

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



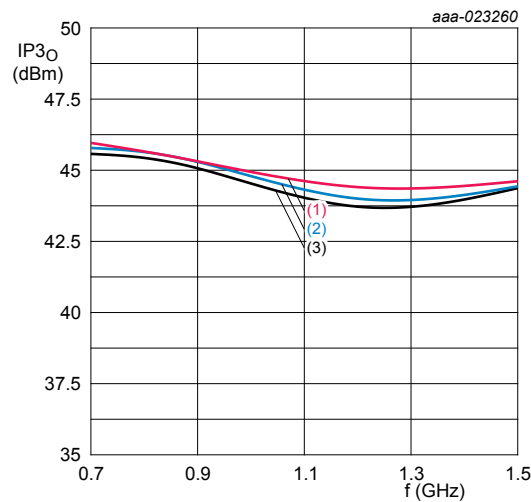
T_{amb} = +25 °C
(1) V_{CC} = 4.75 V
(2) V_{CC} = 5 V
(3) V_{CC} = 5.25 V

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



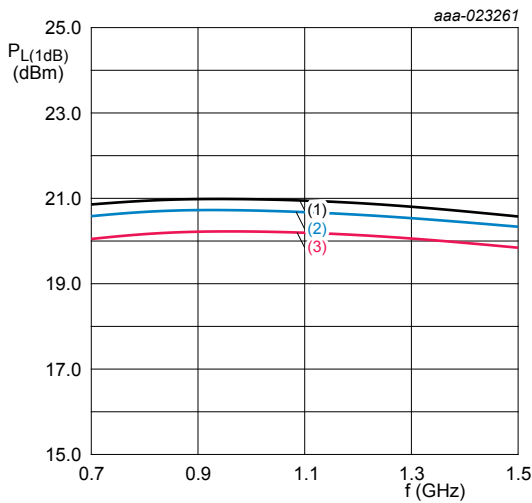
V_{CC} = 5 V
(1) T_{amb} = -40 °C
(2) T_{amb} = +25 °C
(3) T_{amb} = +95 °C

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



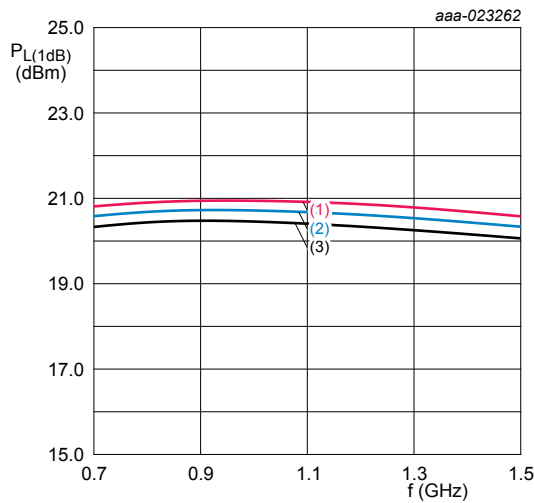
T_{amb} = +25 °C
(1) V_{CC} = 4.75 V
(2) V_{CC} = 5 V
(3) V_{CC} = 5.25 V

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



$V_{CC} = 5\text{ V}$
(1) $T_{amb} = -40\text{ }^{\circ}\text{C}$
(2) $T_{amb} = +25\text{ }^{\circ}\text{C}$
(3) $T_{amb} = +95\text{ }^{\circ}\text{C}$

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



$T_{amb} = +25\text{ }^{\circ}\text{C}$
(1) $V_{CC} = 4.75\text{ V}$
(2) $V_{CC} = 5\text{ V}$
(3) $V_{CC} = 5.25\text{ V}$

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

13 Application information

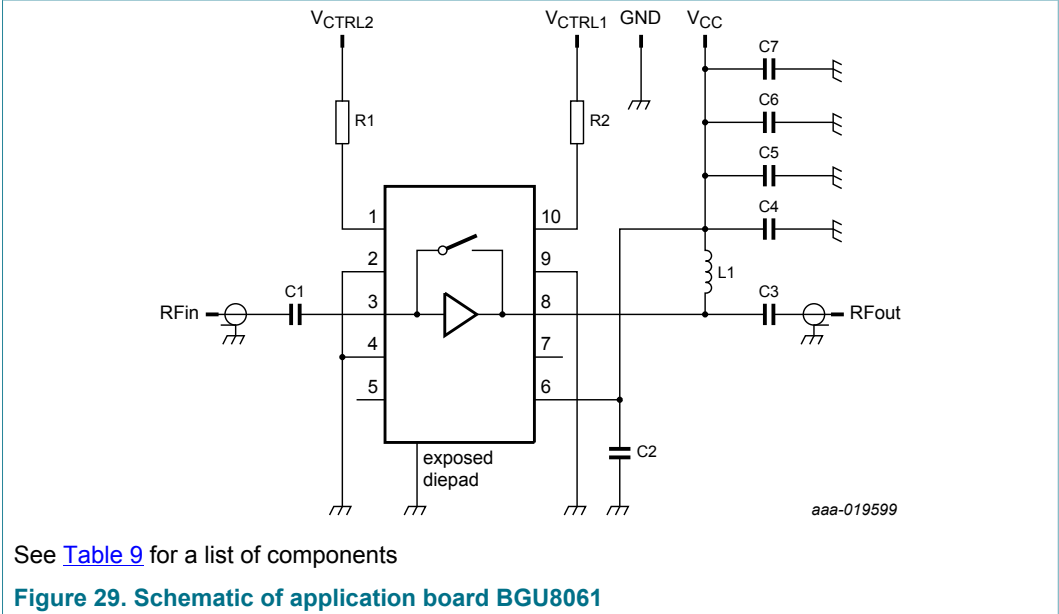


Table 9. List of components

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 μ F	
L1	inductor	15 nH	
R1, R2	resistor	1 k Ω	

14 Package outline

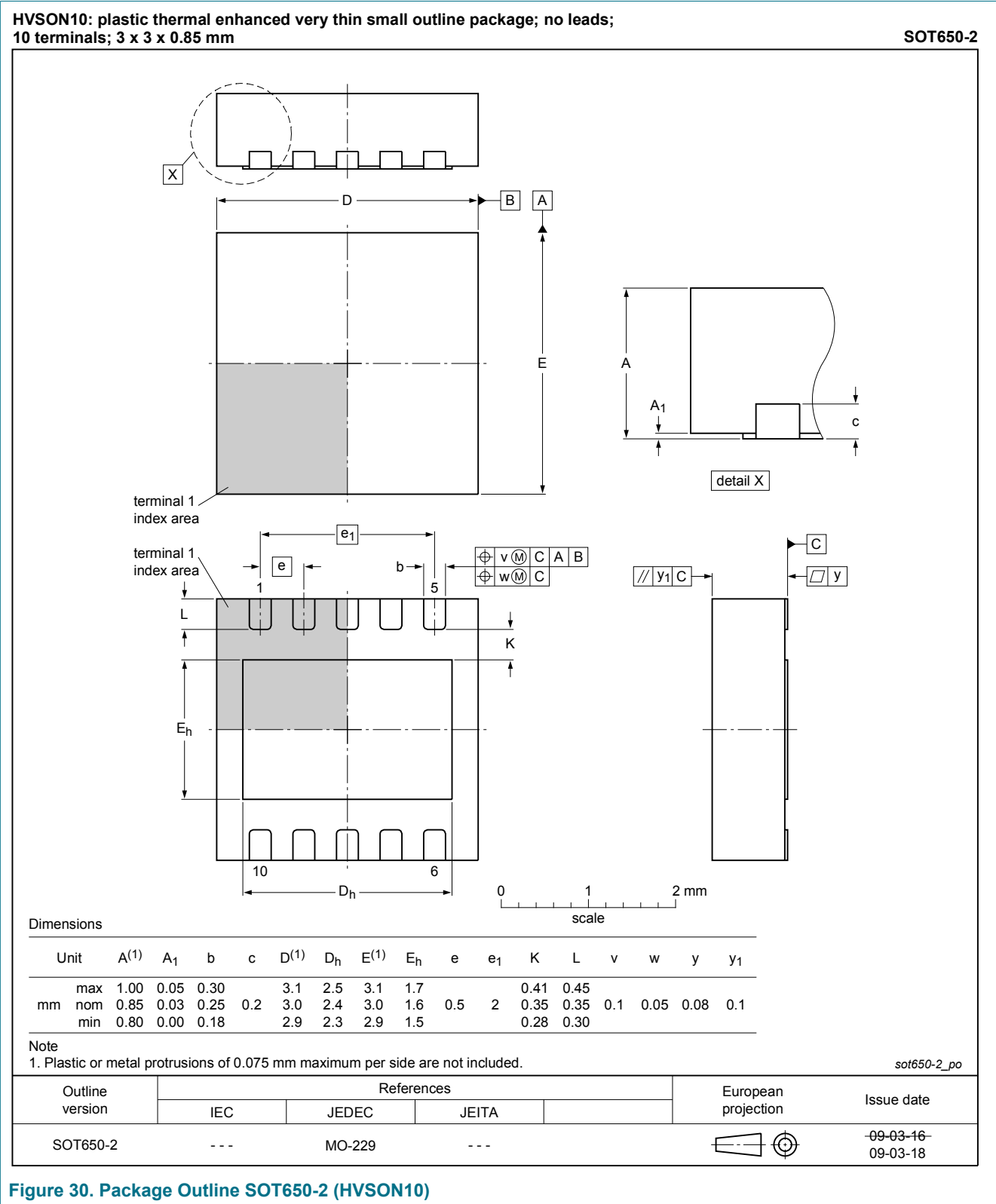


Figure 30. Package Outline SOT650-2 (HVSON10)

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	<td>	product data sheet	-	-

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