



BGU8063

low-noise high-linearity amplifier

Rev. 2 — 27 January 2017

Product data sheet

1 General description

The BGU8063 is, also known as the BTS3001H, 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 2.5 GHz and 4.0 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 = 1.4 dB
- High-linearity performance: IP_{3O} = 34 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

$f = 2500 \text{ MHz}$; $V_{CC} = 5 \text{ V}$; $T_{amb} = 25 \text{ }^\circ\text{C}$; 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 $f = 2500 \text{ MHz}$.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I _{CC}	supply current	LNA enable; bypass off	-	75	90	mA
		LNA disable; bypass on	-	3	5	mA
G _{ass}	associated gain	LNA enable; bypass off	17.0	18.5	20	dB
		LNA disable; bypass on	-2.2	-1.8	-	dB
NF	noise figure	LNA enable; bypass off ^[1]	-	1.4	2.2	dB
P _{L(1dB)}	output power at 1 dB gain compression	LNA enable; bypass off	17.5	19.0	-	dBm
IP _{3O}	output third-order intercept point	2-tone; tone spacing = 1 MHz; P _L = 5 dBm per tone				
		LNA enable; bypass off	31.0	34.0	-	dBm
		LNA disable; bypass on	-	43.0	-	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	
BGU8063	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

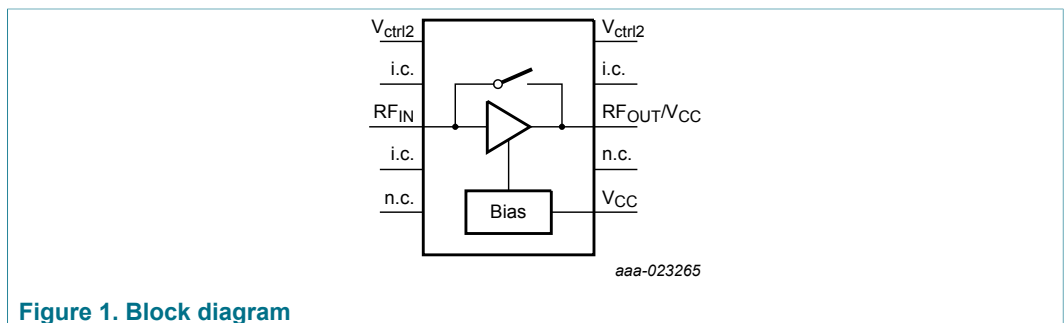
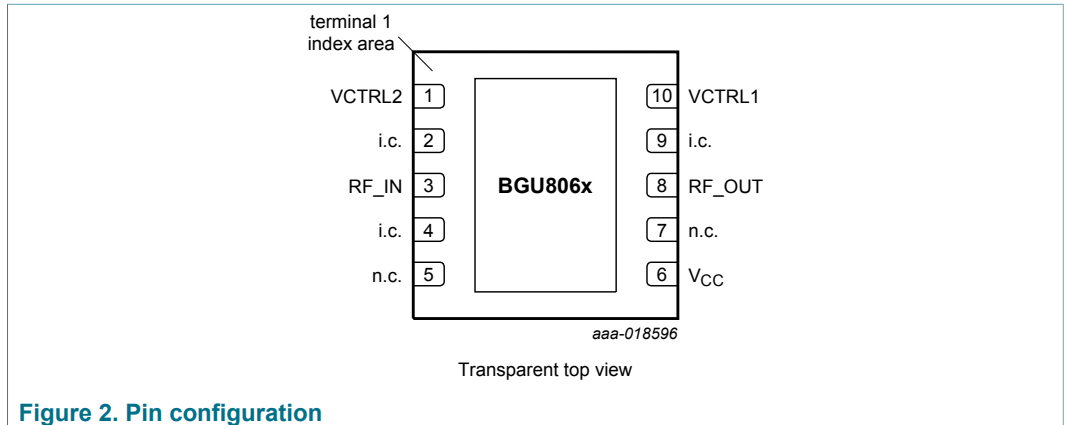


Figure 1. Block diagram

7 Pinning information

7.1 Pinning



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 _{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. 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

$f = 2500$ MHz; $V_{CC} = 5$ V; $T_{amb} = 25$ °C; input and output 50Ω ; 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 $f = 2500$ MHz.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I _{CC}	supply current	LNA enable; bypass off	-	75	90	mA
		LNA disable; bypass on	-	3	5	mA
G _{ass}	associated gain	LNA enable; bypass off	17.0	18.5	20	dB
		LNA disable; bypass on	-2.2	-1.8	-	dB
G _{flat}	gain flatness	within 100 MHz bandwidth; LNA enable; bypass off				
		2500 MHz ≤ f ≤ 4000 MHz	-	0.4	-	dB
		3000 MHz ≤ f ≤ 3500 MHz	-	0.3	-	dB
NF	noise figure	LNA enable; bypass off ^[1]	-	1.4	2.2	dB
ΔG	gain variation	2500 MHz ≤ f ≤ 4000 MHz	-	4.9	-	dB
P _{L(1dB)}	output power at 1 dB gain compression	LNA enable; bypass off	17.5	19.0	-	dBm
IP _{3O}	output third-order intercept point	2-tone; tone spacing = 1 MHz; P _L = 5 dBm per tone				
		LNA enable; bypass off	31.0	34.0	-	dBm
		LNA disable; bypass on	-	43.0	-	dBm
RL _{in}	input return loss	LNA enable; bypass off	-	-10	-	dB
		LNA disable; bypass on	-	-20	-	dB
RL _{out}	output return loss	LNA enable; bypass off	-	-10	-	dB
		LNA disable; bypass on	-	-20	-	dB
ISL	isolation	LNA disable; bypass off	-	30	-	dB
		LNA enable; bypass off	-	25	-	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.

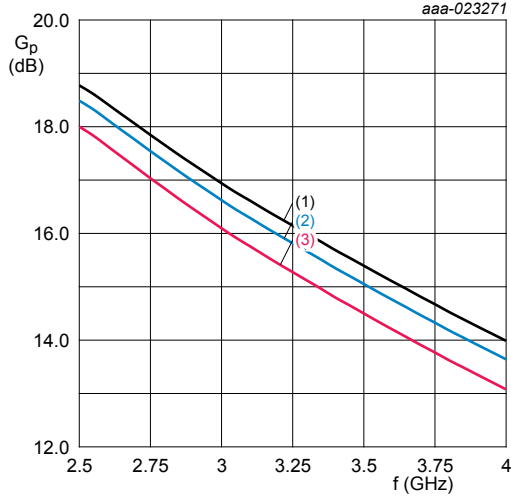
Table 8. Control truth table

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

Control signal setting ^[1]		Mode of operation	
CTRL1	CTRL2	LNA	bypass
LOW	HIGH	disable	on
HIGH	HIGH	disable	on
LOW	LOW	enable	off
HIGH	LOW	disable	off

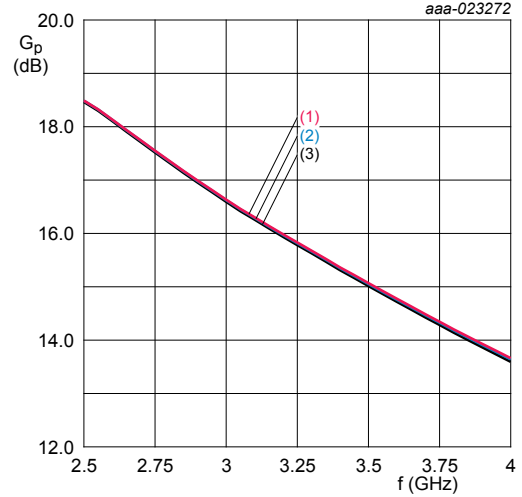
- [1] A logic LOW is the result of an input voltage on that specific pin between -0.3 V and $+0.7\text{ V}$.
A logic HIGH is the result of an input voltage on that specific pin between 1.2 V and 3.6 V .

12 Graphics



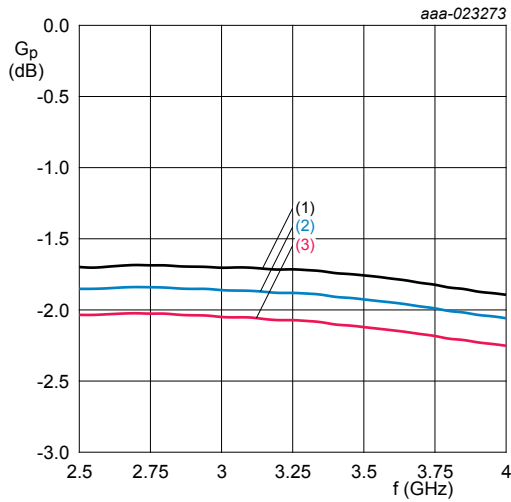
$V_{CC} = 5\text{ V}$
 (1) $T_{amb} = -40\text{ °C}$
 (2) $T_{amb} = +25\text{ °C}$
 (3) $T_{amb} = +95\text{ °C}$

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



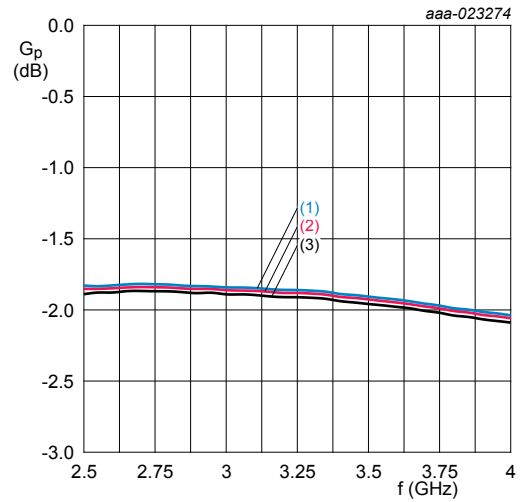
$T_{amb} = +25\text{ °C}$
 (1) $V_{CC} = 4.75\text{ V}$
 (2) $V_{CC} = 5\text{ V}$
 (3) $V_{CC} = 5.25\text{ V}$

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



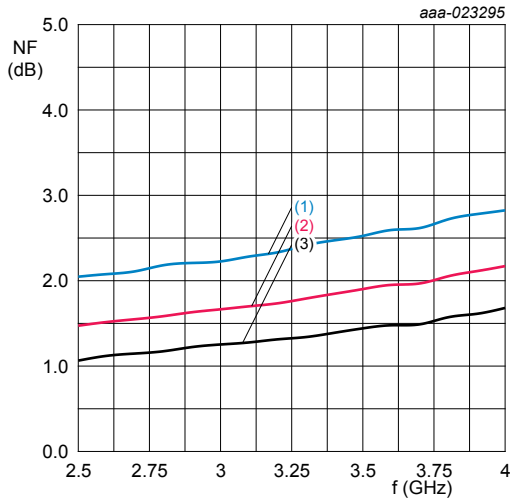
$V_{CC} = 5\text{ V}$
 (1) $T_{amb} = -40\text{ °C}$
 (2) $T_{amb} = +25\text{ °C}$
 (3) $T_{amb} = +95\text{ °C}$

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



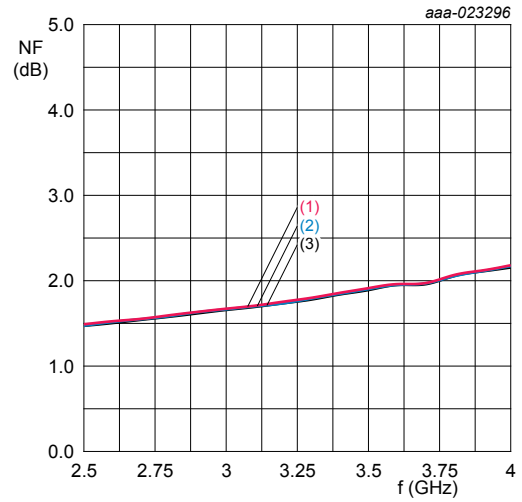
$T_{amb} = +25\text{ °C}$
 (1) $V_{CC} = 4.75\text{ V}$
 (2) $V_{CC} = 5\text{ V}$
 (3) $V_{CC} = 5.25\text{ V}$

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



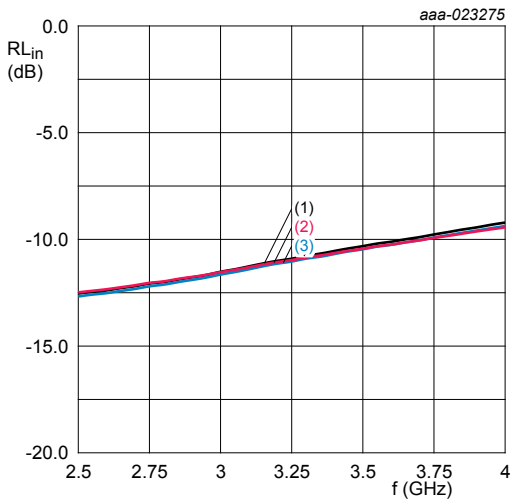
$V_{CC} = 5\text{ V}$
 (1) $T_{amb} = -40\text{ °C}$
 (2) $T_{amb} = +25\text{ °C}$
 (3) $T_{amb} = +95\text{ °C}$

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



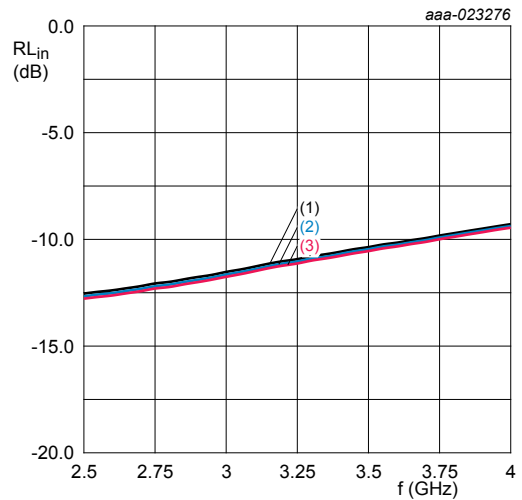
$T_{amb} = +25\text{ °C}$
 (1) $V_{CC} = 4.75\text{ V}$
 (2) $V_{CC} = 5\text{ V}$
 (3) $V_{CC} = 5.25\text{ V}$

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



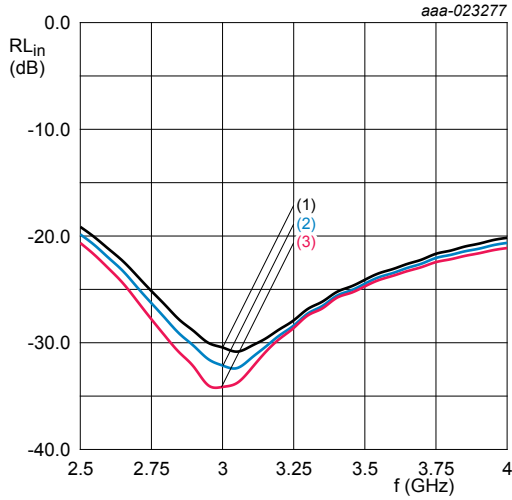
$V_{CC} = 5\text{ V}$
 (1) $T_{amb} = -40\text{ °C}$
 (2) $T_{amb} = +25\text{ °C}$
 (3) $T_{amb} = +95\text{ °C}$

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



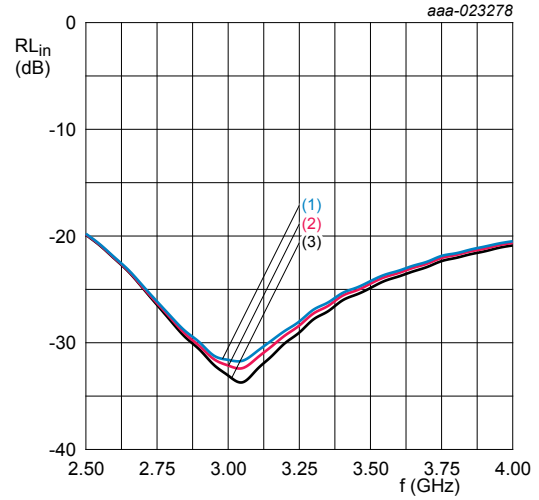
$T_{amb} = +25\text{ °C}$
 (1) $V_{CC} = 4.75\text{ V}$
 (2) $V_{CC} = 5\text{ V}$
 (3) $V_{CC} = 5.25\text{ V}$

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



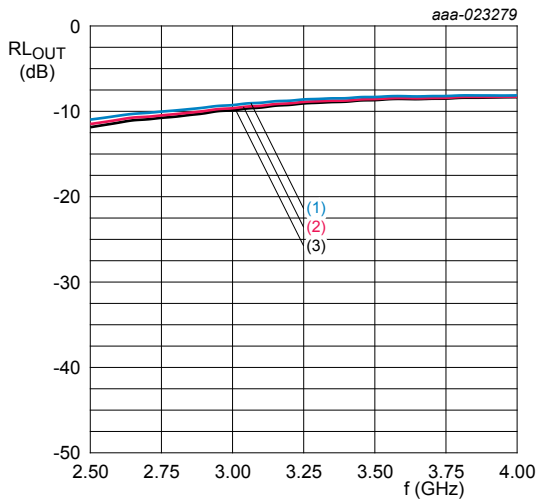
$V_{CC} = 5\text{ V}$
 (1) $T_{amb} = -40\text{ °C}$
 (2) $T_{amb} = +25\text{ °C}$
 (3) $T_{amb} = +95\text{ °C}$

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



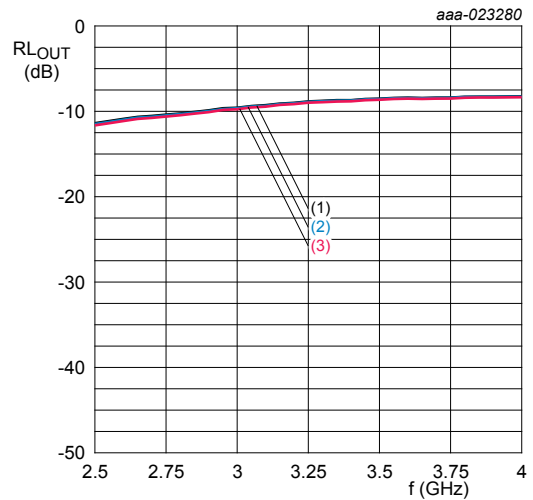
$T_{amb} = +25\text{ °C}$
 (1) $V_{CC} = 4.75\text{ V}$
 (2) $V_{CC} = 5\text{ V}$
 (3) $V_{CC} = 5.25\text{ V}$

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



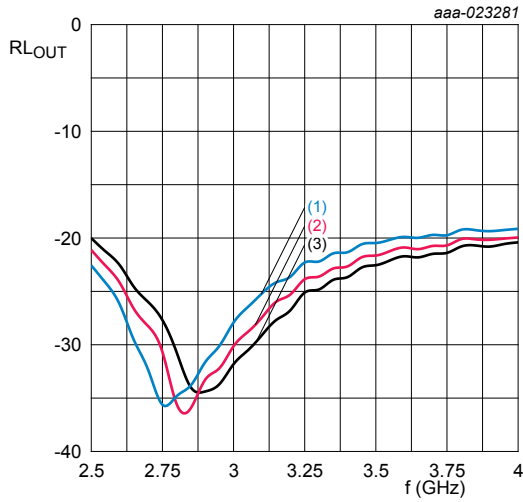
$V_{CC} = 5\text{ V}$
 (1) $T_{amb} = -40\text{ °C}$
 (2) $T_{amb} = +25\text{ °C}$
 (3) $T_{amb} = +95\text{ °C}$

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



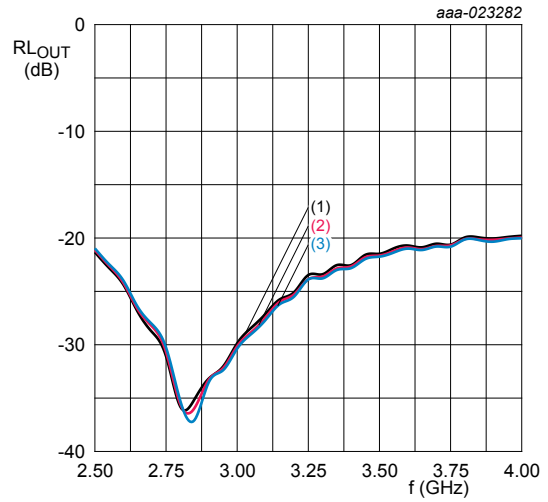
$T_{amb} = +25\text{ °C}$
 (1) $V_{CC} = 4.75\text{ V}$
 (2) $V_{CC} = 5\text{ V}$
 (3) $V_{CC} = 5.25\text{ V}$

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



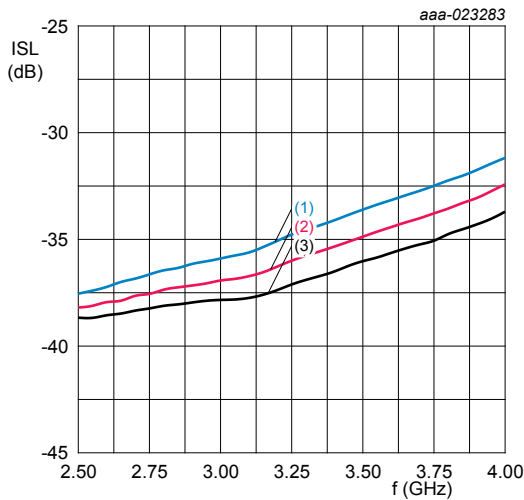
$V_{CC} = 5\text{ V}$
 (1) $T_{amb} = -40\text{ }^{\circ}\text{C}$
 (2) $T_{amb} = +25\text{ }^{\circ}\text{C}$
 (3) $T_{amb} = +95\text{ }^{\circ}\text{C}$

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



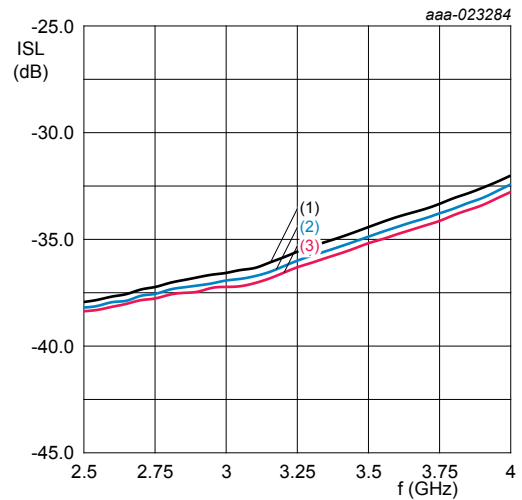
$T_{amb} = +25\text{ }^{\circ}\text{C}$
 (1) $V_{CC} = 4.75\text{ V}$
 (2) $V_{CC} = 5\text{ V}$
 (3) $V_{CC} = 5.25\text{ V}$

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



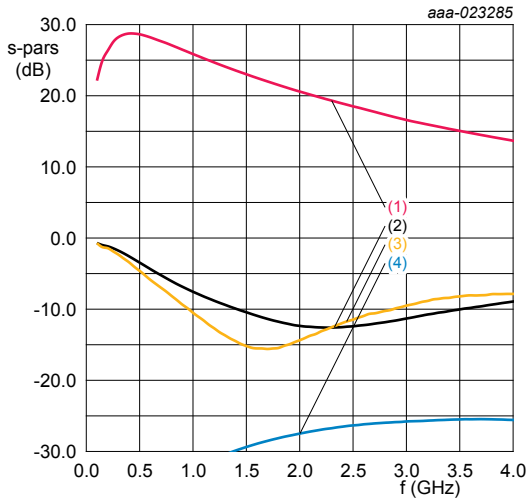
$V_{CC} = 5\text{ V}$
 (1) $T_{amb} = -40\text{ }^{\circ}\text{C}$
 (2) $T_{amb} = +25\text{ }^{\circ}\text{C}$
 (3) $T_{amb} = +95\text{ }^{\circ}\text{C}$

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

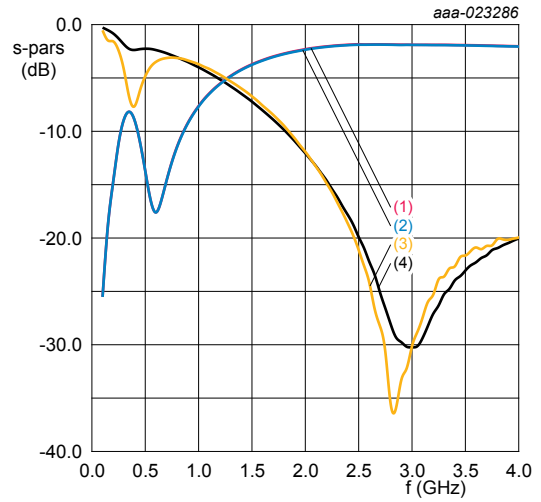
Figure 18. Isolation as a function of frequency - Isolation mode; typical values



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

- (1) S11
- (2) S21
- (3) S12
- (4) S22

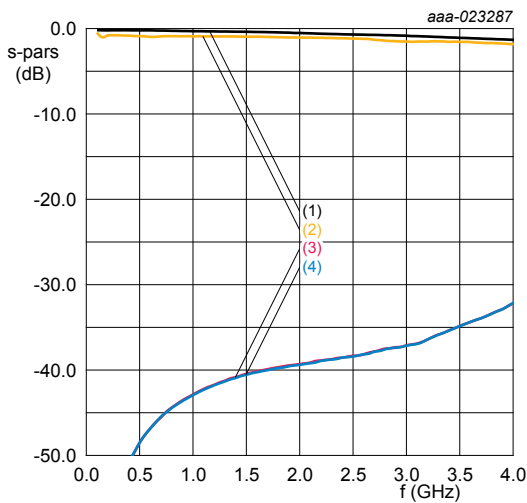
Figure 19. Wideband S-parameters as function of frequency - Gain mode; typical values



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

- (1) S11
- (2) S21
- (3) S12
- (4) S22

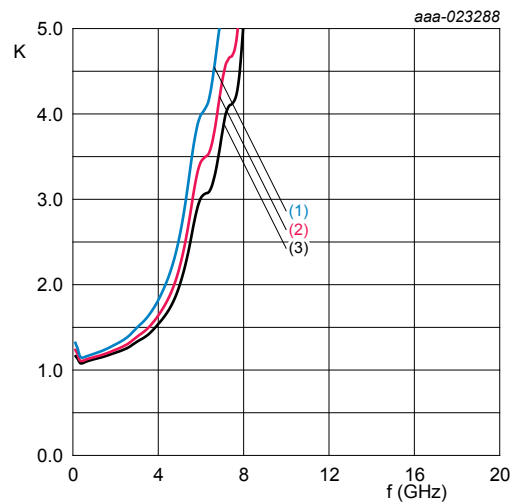
Figure 20. Wideband S-parameters as function of frequency - Bypass mode; typical values



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

- (1) S11
- (2) S21
- (3) S12
- (4) S22

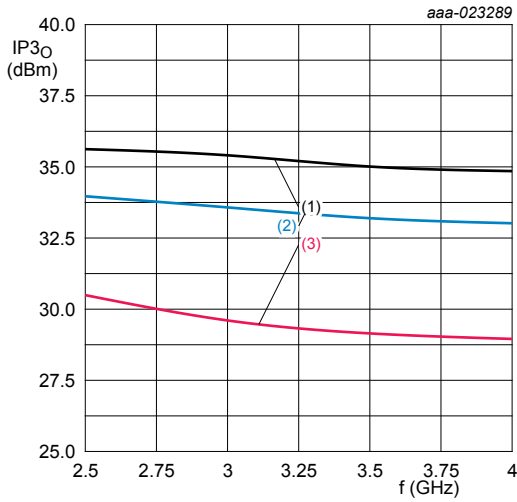
Figure 21. Wideband S-parameters as function of frequency - Isolation mode; typical values



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

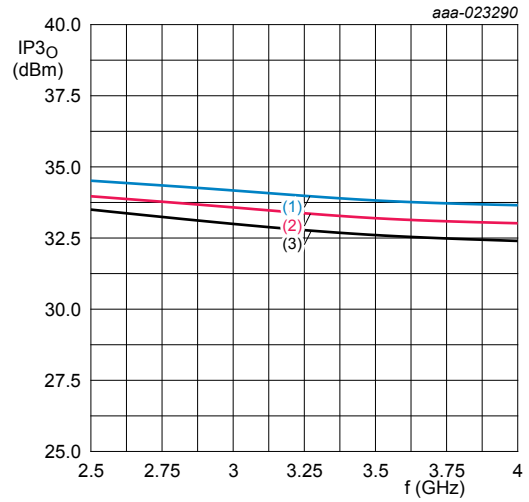
- (1) $T_{amb} = -40\text{ }^{\circ}\text{C}$
- (2) $T_{amb} = +25\text{ }^{\circ}\text{C}$
- (3) $T_{amb} = +95\text{ }^{\circ}\text{C}$

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



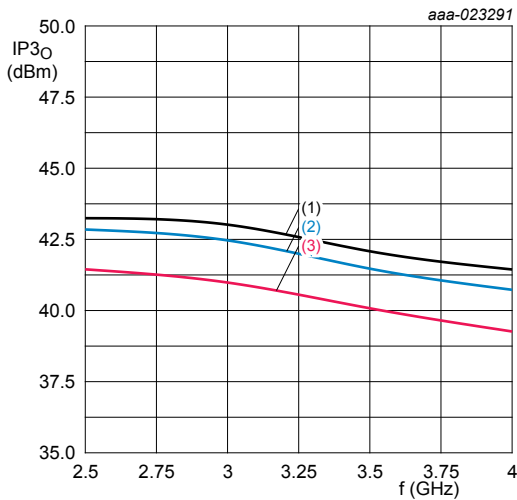
$V_{CC} = 5\text{ V}$
 (1) $T_{amb} = -40\text{ °C}$
 (2) $T_{amb} = +25\text{ °C}$
 (3) $T_{amb} = +95\text{ °C}$

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



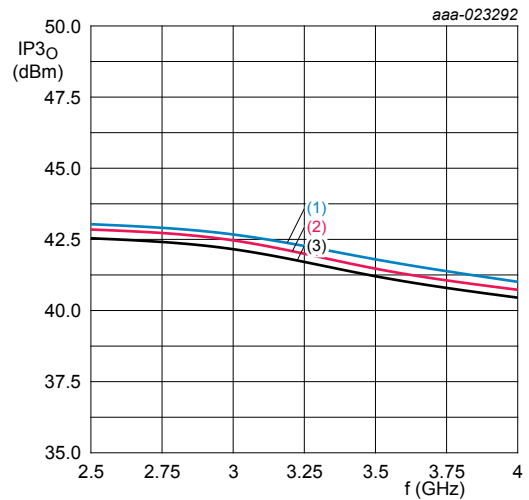
$T_{amb} = +25\text{ °C}$
 (1) $V_{CC} = 4.75\text{ V}$
 (2) $V_{CC} = 5\text{ V}$
 (3) $V_{CC} = 5.25\text{ V}$

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



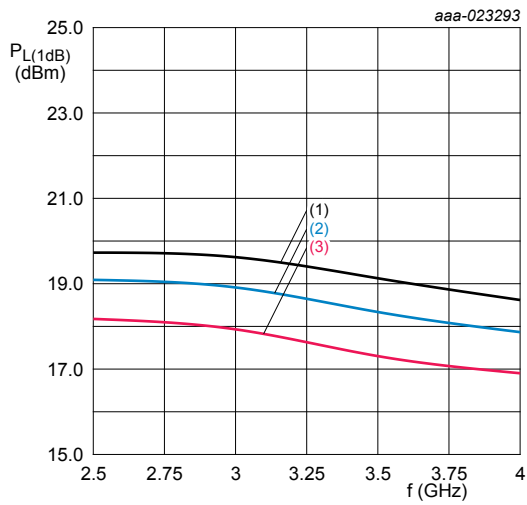
$V_{CC} = 5\text{ V}$
 (1) $T_{amb} = -40\text{ °C}$
 (2) $T_{amb} = +25\text{ °C}$
 (3) $T_{amb} = +95\text{ °C}$

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



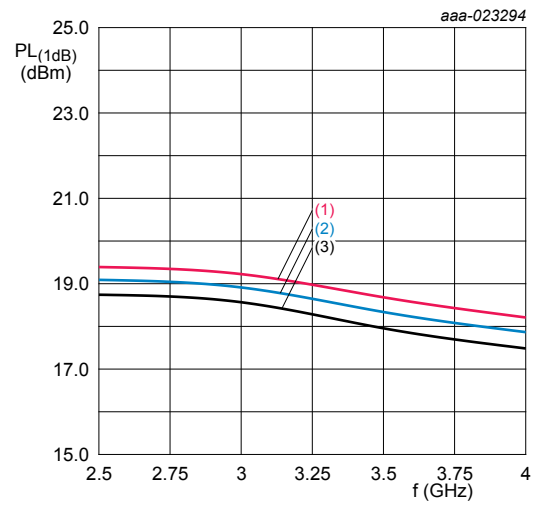
$T_{amb} = +25\text{ °C}$
 (1) $V_{CC} = 4.75\text{ V}$
 (2) $V_{CC} = 5\text{ V}$
 (3) $V_{CC} = 5.25\text{ V}$

Figure 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

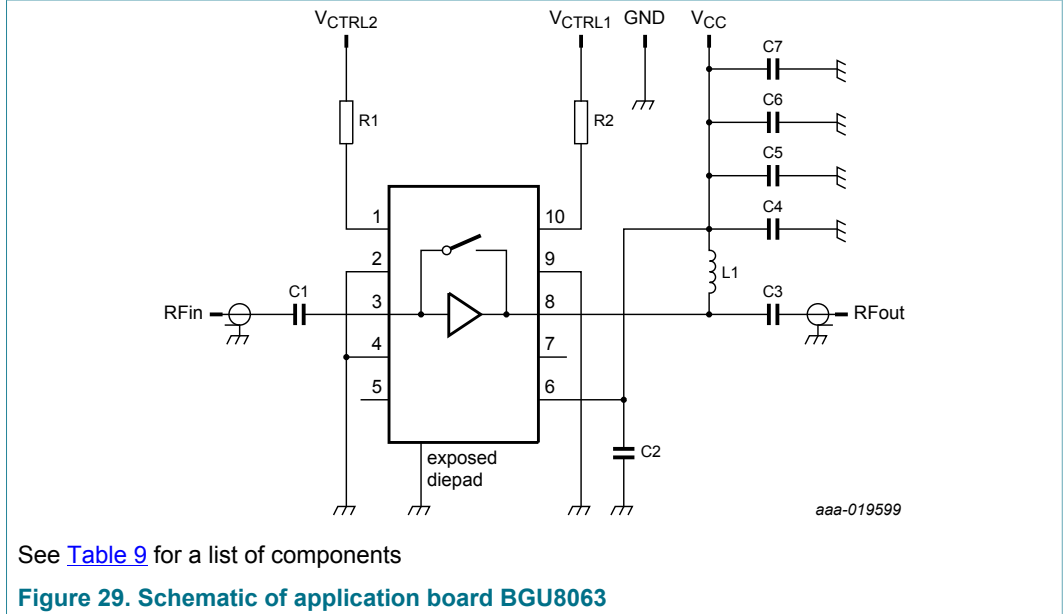
Figure 27. Output power at 1 dB gain compression as a function of frequency - Gain mode; typical values



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 BGU8063

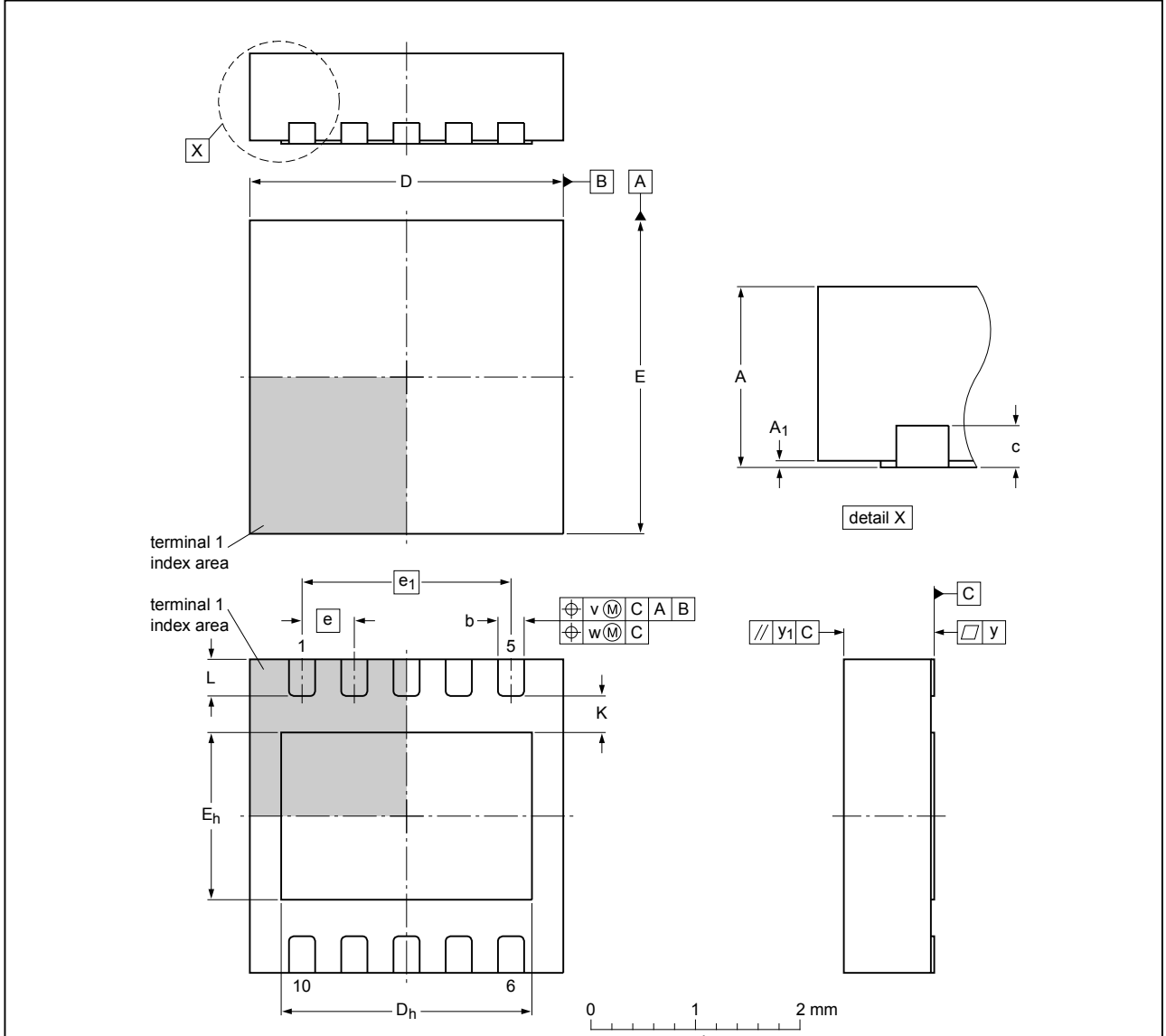
Table 9. List of components

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
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
BGU8063 v.2	20170127	product data sheet	-	BGU8063 v.1
Modifications:	<ul style="list-style-type: none"> • Section 1: added BTS3001H according to our new naming convention 			
BGU8063 v.1	20170118	product data sheet	-	-

Contents

1	General description	1
2	Features and benefits	1
3	Applications	1
4	Quick reference data	2
5	Ordering information	2
6	Block diagram	2
7	Pinning information	3
7.1	Pinning	3
7.2	Pin description	3
8	Limiting values	4
9	Recommended operating conditions	4
10	Thermal characteristics	4
11	Characteristics	5
12	Graphics	7
13	Application information	14
14	Package outline	15
15	Abbreviations	16
16	Revision history	16

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Date of release: 27 January 2017

Document identifier: BGU8063