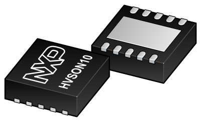


BGU8063

low-noise high-linearity amplifier

Rev. 3.1 — 10 February 2021 Product data sheet

1 General description

The BGU8063 also known as the BTS3001H, is 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 5 GHz. It is housed in a 3 mm x 3 mm x 0.85 mm with 10 terminals, in a 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: $IP3_o$ = 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 x 3 mm x 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 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 = 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	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	-	dBm
$IP3_O$	output third-order intercept point	2-tone; tone spacing = 1 MHz; P_L = 5 dBm per tone					
		LNA enable; bypass off		31	34	-	dBm
		LNA disable; bypass on		-	43	-	dBm

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

5 Ordering information

Table 2. Ordering information

Type number	orderable part number	Package		
		Name	Description	Version
BGU8063	BGU8063J	HVSON10	plastic thermal enhanced very thin small outline package; no leads; 10 terminals; body 3 mm x 3 mm x 0.85 mm	SOT650-1

6 Block diagram

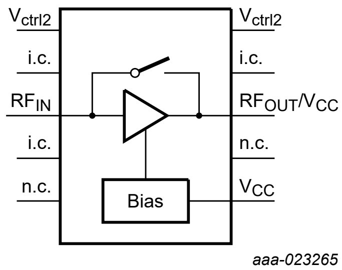
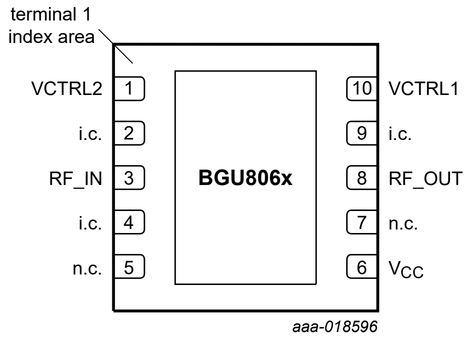


Figure 1. Block diagram BGU8063

7 Pinning information

7.1 Pinning



Transparent top view

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_{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	kV
		Charged Device Model (CDM); according to JEDEC standard 22-C101B		-	1	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	Typ	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 Functional description

Table 7. Control truth table

V_{CC} = 5 V; T_{amb} = 25 °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 V
A logic HIGH is the result of an input voltage on the specific pin between 1.2 V and 3.6 V

12 Characteristics

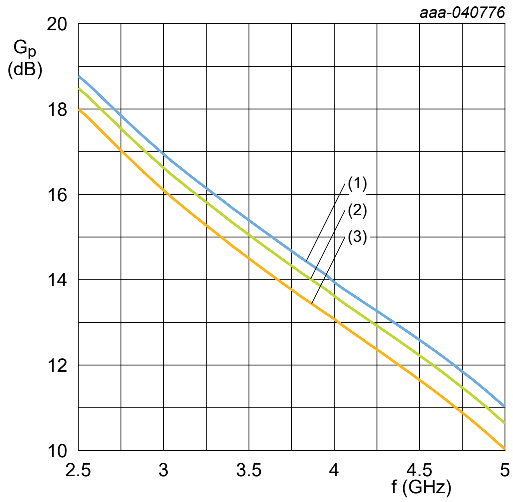
Table 8. Characteristics

f = 2500 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 = 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	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	-	dBm
$IP3_O$	output third-order intercept point	2-tone; tone spacing = 1 MHz; P_L = 5 dBm per tone					
		LNA enable; bypass off		31	34	-	dBm
		LNA disable; bypass on		-	43	-	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	-	-	-

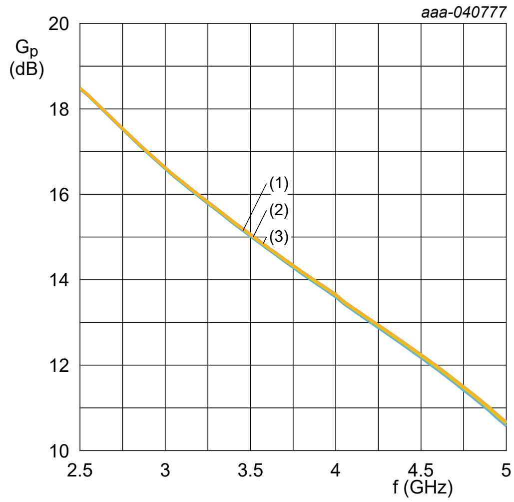
[1] Connector and Printed-Circuit Board (PCB) losses have been de-embedded.

13 Graphics



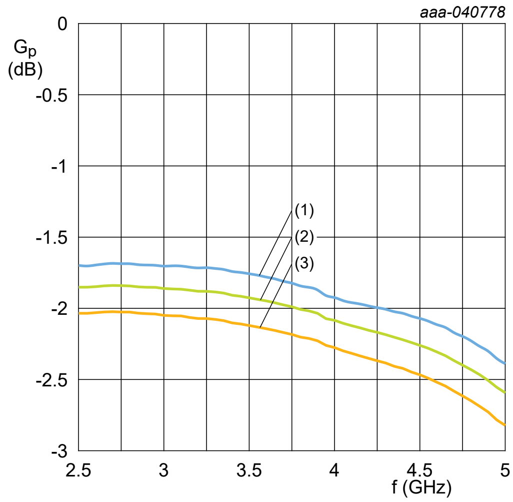
V_{CC} = 5 V
1. T_{amb} = -40 °C
2. T_{amb} = 25 °C
3. T_{amb} = 95 °C

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



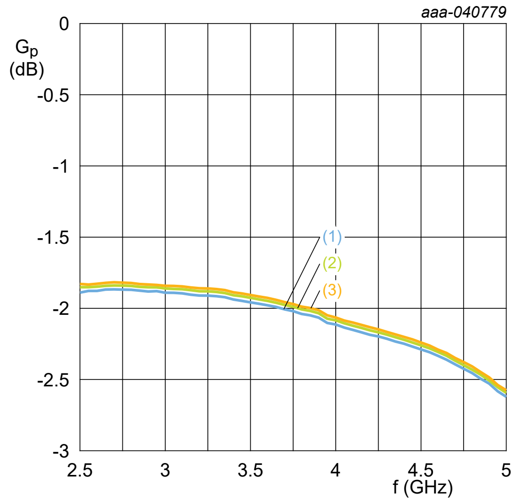
T_{amb} = 25 °C
1. V_{CC} = 4.75 V
2. V_{CC} = 5 V
3. V_{CC} = 5.25 V

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



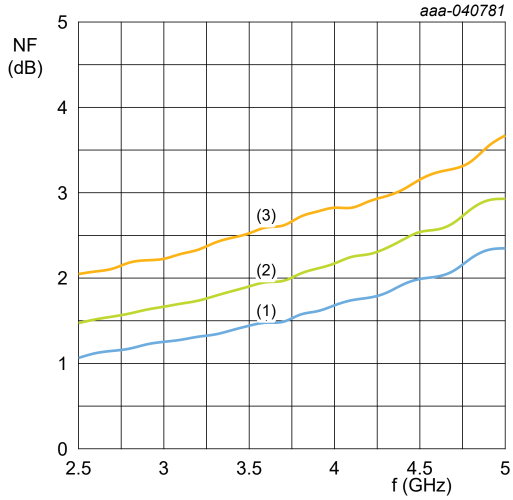
V_{CC} = 5 V
1. T_{amb} = -40 °C
2. T_{amb} = 25 °C
3. T_{amb} = 95 °C

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

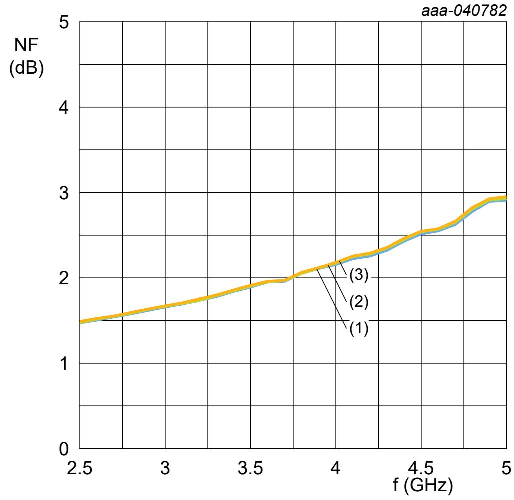
Figure 6. Power gain as a function of frequency - Bypass mode; typical values



V_{CC} = 5 V

1. T_{amb} = -40 °C
2. T_{amb} = 25 °C
3. T_{amb} = 95 °C

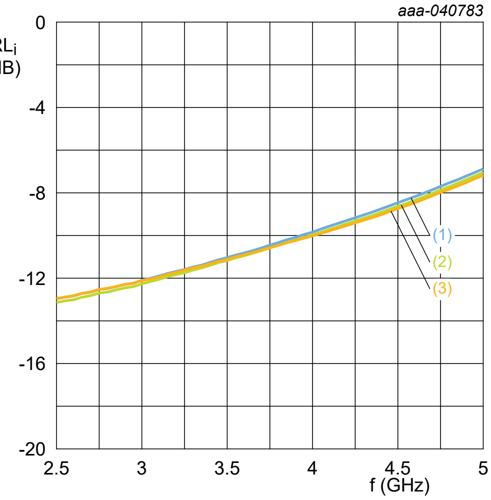
Figure 7. Noise figure as a function of frequency - Gain mode; typical values



T_{amb} = 25 °C

1. V_{CC} = 4.75 V
2. V_{CC} = 5 V
3. V_{CC} = 5.25 V

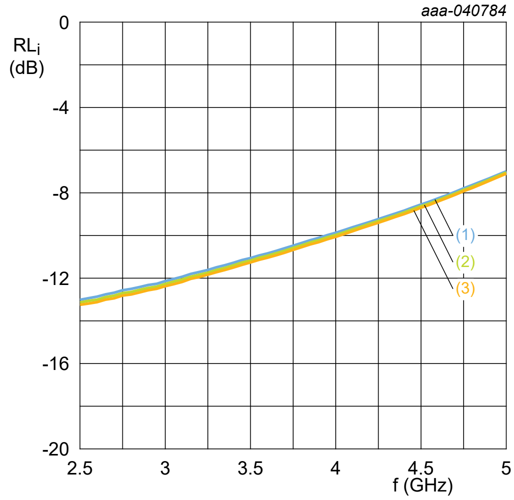
Figure 8. Noise figure as a function of frequency - Gain mode; typical values



V_{CC} = 5 V

1. T_{amb} = -40 °C
2. T_{amb} = 25 °C
3. T_{amb} = 95 °C

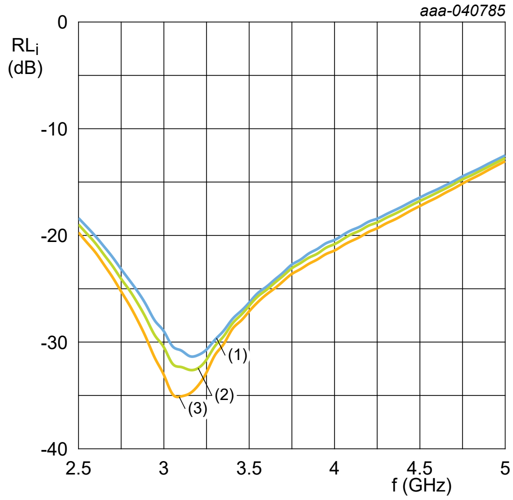
Figure 9. Input return loss as a function of frequency - Gain mode; typical values



T_{amb} = 25 °C

1. V_{CC} = 4.75 V
2. V_{CC} = 5 V
3. V_{CC} = 5.25 V

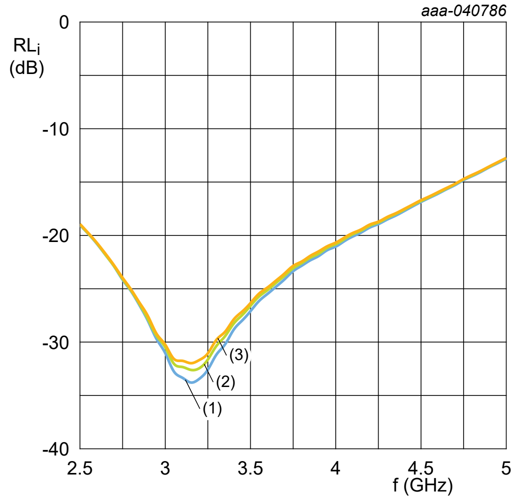
Figure 10. Input return loss as a function of frequency - Gain mode; typical values



V_{CC} = 5 V

1. T_{amb} = -40 °C
2. T_{amb} = 25 °C
3. T_{amb} = 95 °C

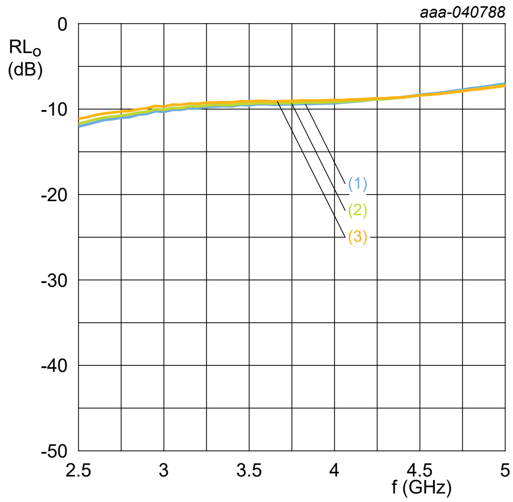
Figure 11. Input return loss as a function of frequency - Bypass mode; typical values



T_{amb} = 25 °C

1. V_{CC} = 4.75 V
2. V_{CC} = 5 V
3. V_{CC} = 5.25 V

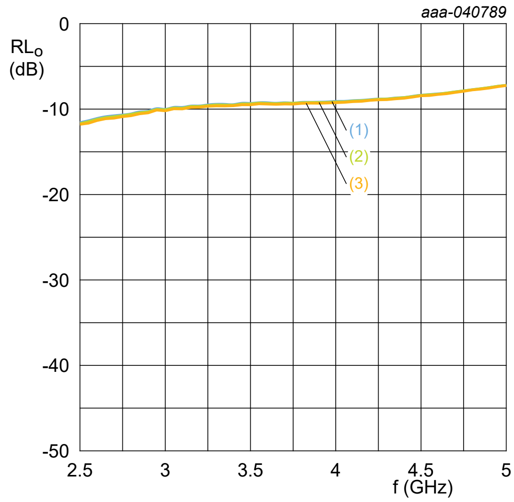
Figure 12. Input return loss as a function of frequency - Bypass mode; typical values



V_{CC} = 5 V

1. T_{amb} = -40 °C
2. T_{amb} = 25 °C
3. T_{amb} = 95 °C

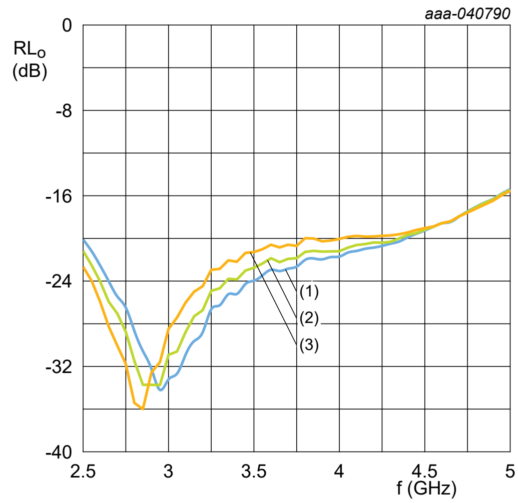
Figure 13. Output return loss as a function of frequency - Gain mode; typical values



T_{amb} = 25 °C

1. V_{CC} = 4.75 V
2. V_{CC} = 5 V
3. V_{CC} = 5.25 V

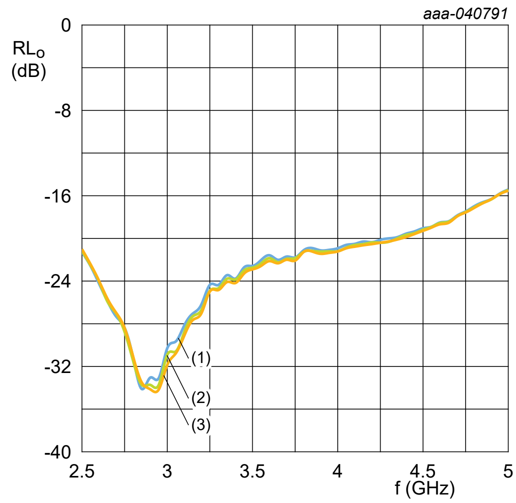
Figure 14. Output return loss as a function of frequency - Gain mode; typical values



V_{CC} = 5 V

1. T_{amb} = -40 °C
2. T_{amb} = 25 °C
3. T_{amb} = 95 °C

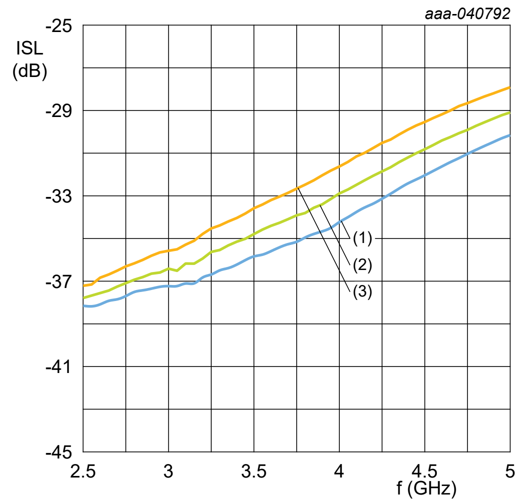
Figure 15. Output return loss as a function of frequency - Bypass mode; typical values



T_{amb} = 25 °C

1. V_{CC} = 4.75 V
2. V_{CC} = 5 V
3. V_{CC} = 5.25 V

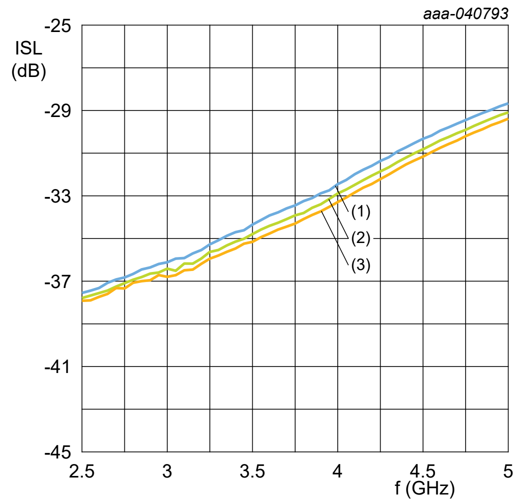
Figure 16. Output return loss as a function of frequency - Bypass mode; typical values



V_{CC} = 5 V

1. T_{amb} = -40 °C
2. T_{amb} = 25 °C
3. T_{amb} = 95 °C

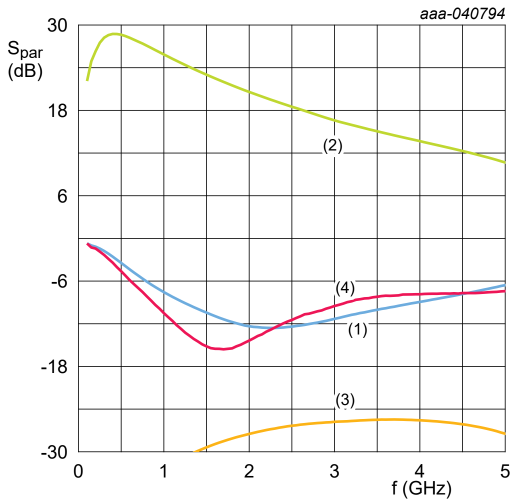
Figure 17. Isolation as a function of frequency - Isolation mode; typical values



T_{amb} = 25 °C

1. V_{CC} = 4.75 V
2. V_{CC} = 5 V
3. V_{CC} = 5.25 V

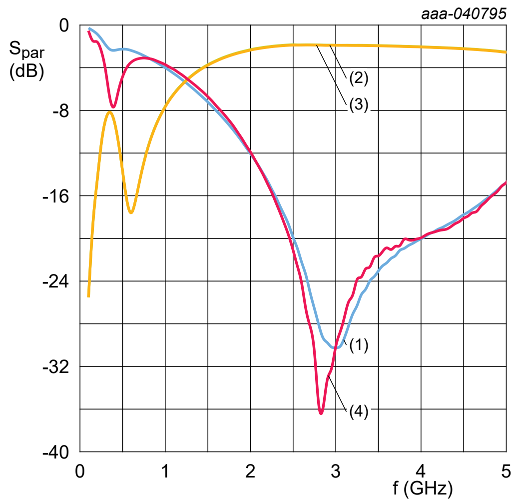
Figure 18. Isolation as a function of frequency - Isolation mode; typical values



V_{CC} = 5 V; T_{amb} = 25 °C

1. S11
2. S21
3. S12
4. S22

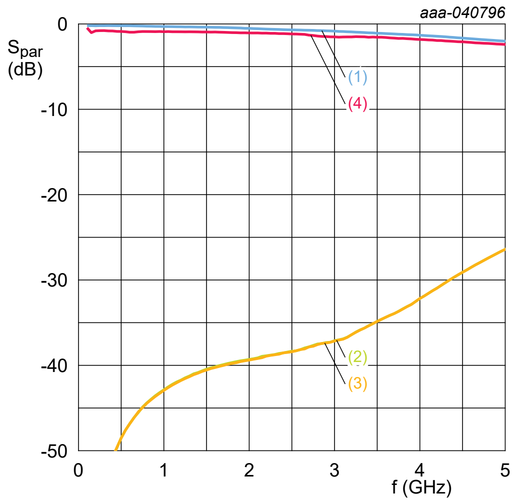
Figure 19. Wideband S-parameters as function of frequency - Gain mode; typical values



V_{CC} = 5 V; T_{amb} = 25 °C

1. S11
2. S21
3. S12
4. S22

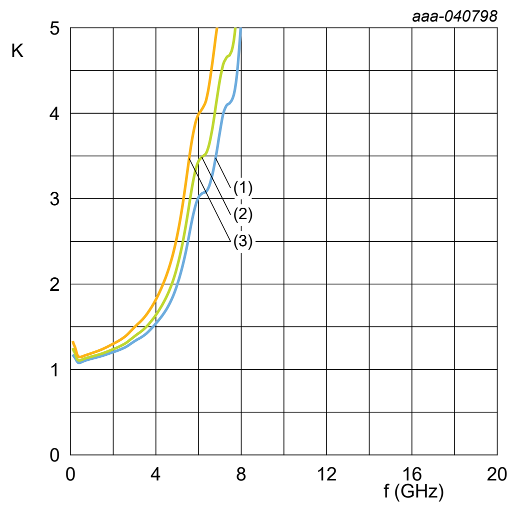
Figure 20. Wideband S-parameters as function of frequency - Bypass mode; typical values



V_{CC} = 5 V; T_{amb} = 25 °C

1. S11
2. S21
3. S12
4. S22

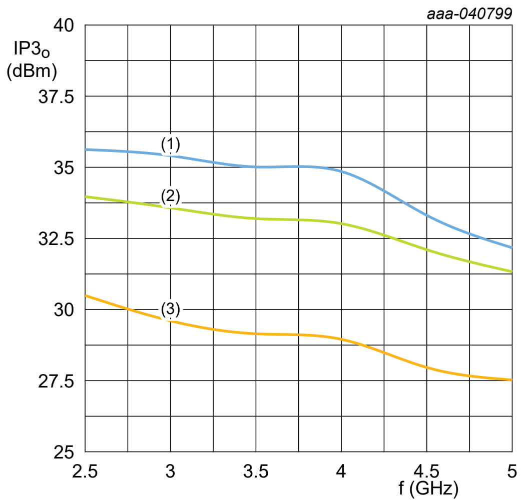
Figure 21. Wideband S-parameters as function of frequency - Isolation mode; typical values



V_{CC} = 5 V

1. T_{amb} = -40 °C
2. T_{amb} = 25 °C
3. T_{amb} = 95 °C

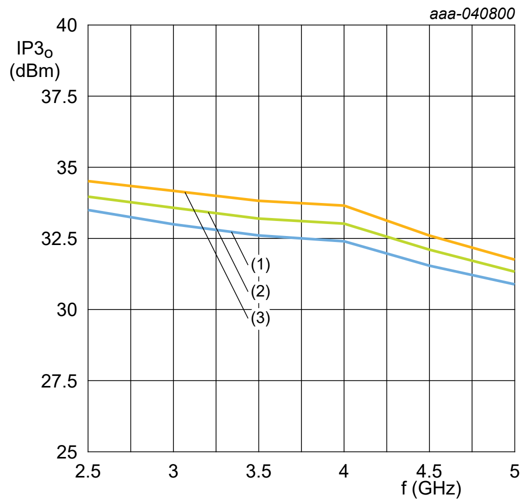
Figure 22. Rollett stability factor as function of frequency - Gain mode; typical values



V_{CC} = 5 V

1. T_{amb} = -40 °C
2. T_{amb} = 25 °C
3. T_{amb} = 95 °C

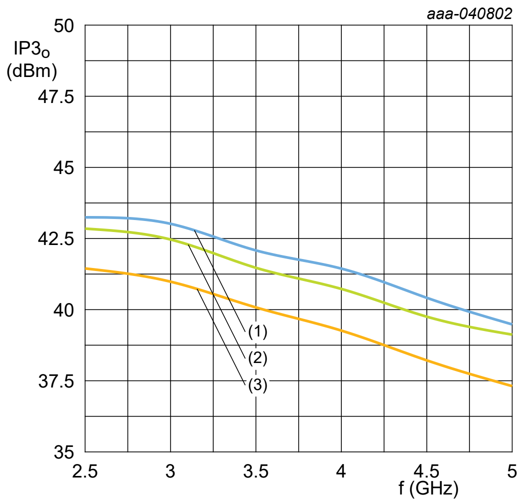
Figure 23. Output third-order intercept point as a function of frequency - Gain mode; typical values



T_{amb} = 25 °C

1. V_{CC} = 4.75 V
2. V_{CC} = 5 V
3. V_{CC} = 5.25 V

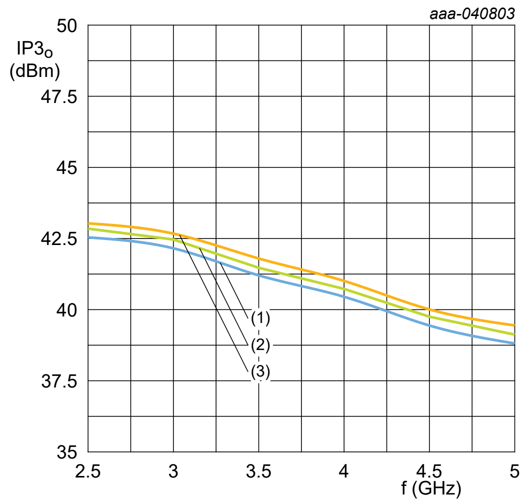
Figure 24. Output third-order intercept point as a function of frequency - Gain mode; typical values



V_{CC} = 5 V

1. T_{amb} = -40 °C
2. T_{amb} = 25 °C
3. T_{amb} = 95 °C

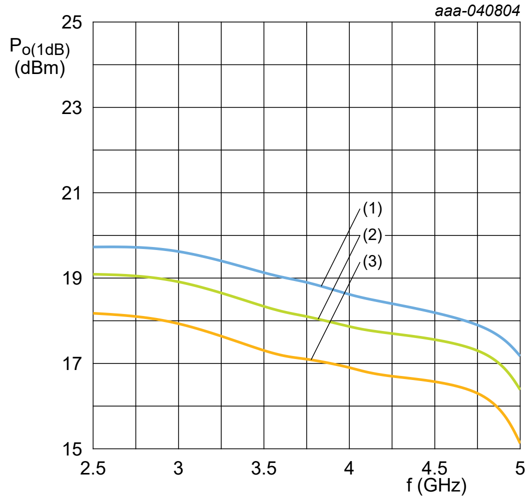
Figure 25. Output third-order intercept point as a function of frequency - Bypass mode; typical values



T_{amb} = 25 °C

1. V_{CC} = 4.75 V
2. V_{CC} = 5 V
3. V_{CC} = 5.25 V

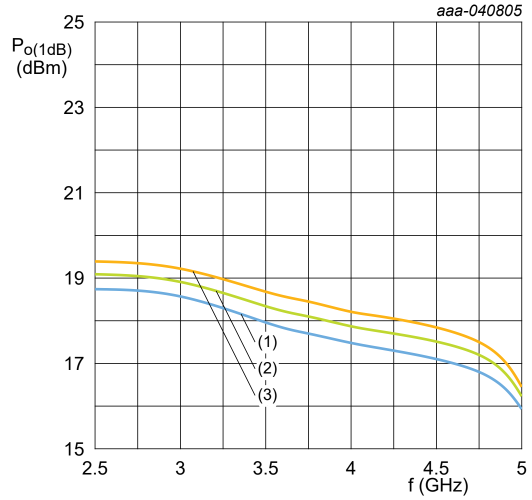
Figure 26. Output third-order intercept point as a function of frequency - Bypass mode; typical values



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 functional of frequency - Gain mode; typical values

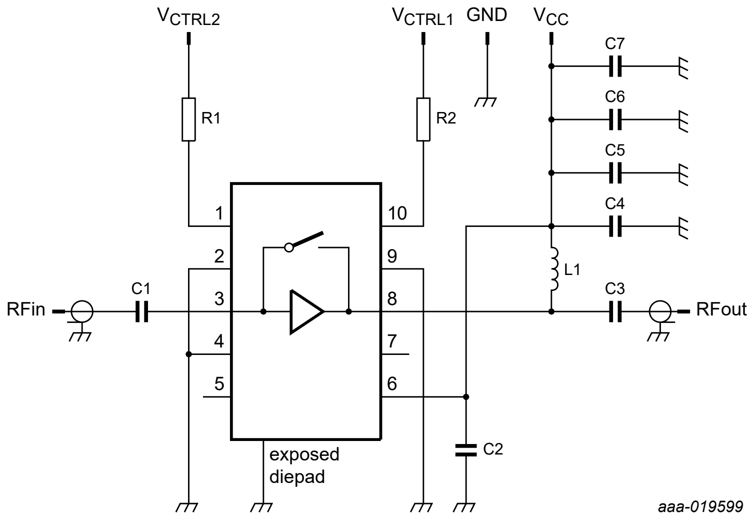


T_{amb} = 25 °C

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 functional of frequency - Gain mode; typical values

14 Application information



See Table 9 for a list of components.

Figure 29. Schematic of application board BGU8063

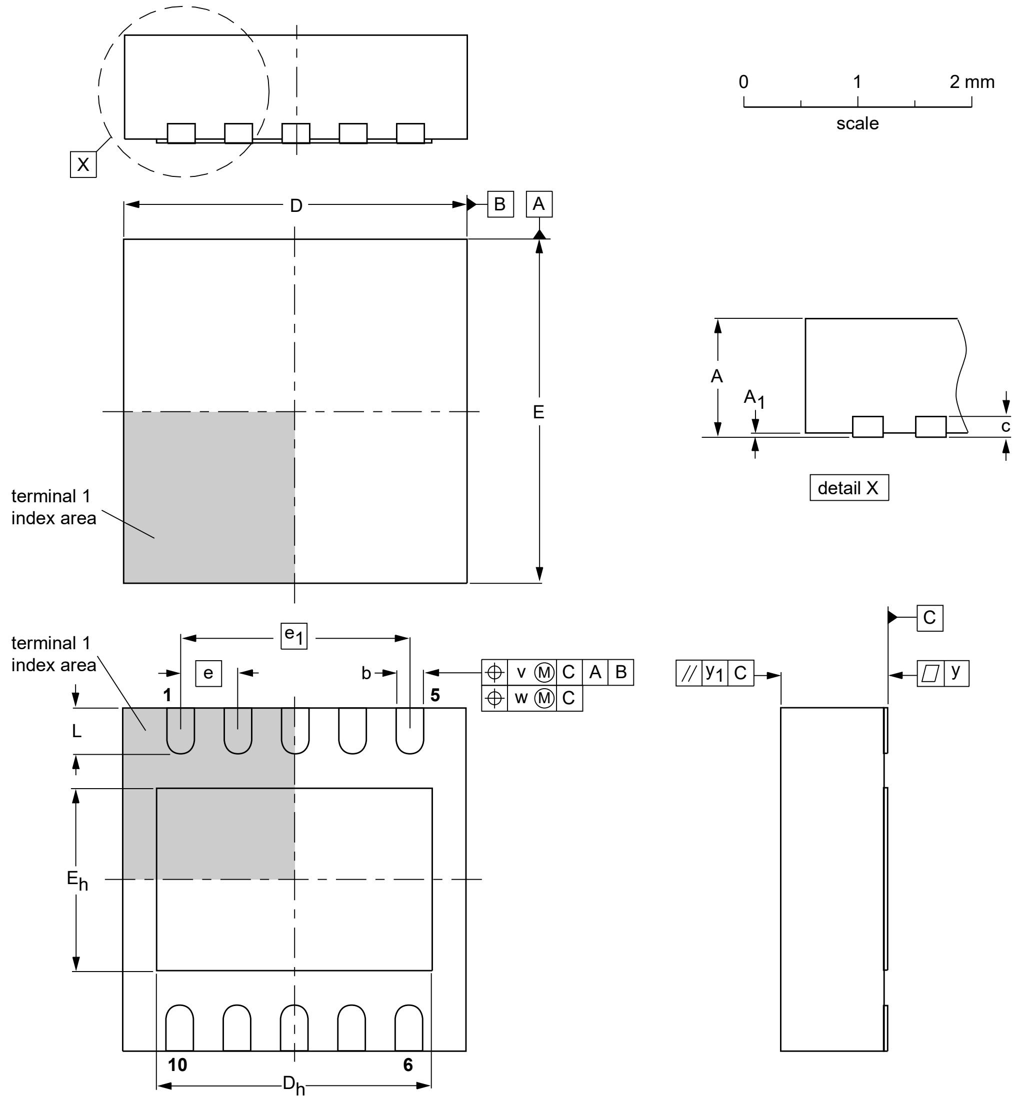
Table 9. List of components

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	

15 Package outline

HVSON10: plastic thermal enhanced very thin small outline package; no leads; 10 terminals; body 3 x 3 x 0.85 mm **SOT650-1**



DIMENSIONS (mm are the original dimensions)

UNIT	A(1) max.	A_1	b	c	D(1)	D_h	E(1)	E_h	e	e_1	L	v	w	y	y_1
mm	1	0.05 0.00	0.30 0.18	0.2	3.1 2.9	2.55 2.15	3.1 2.9	1.75 1.45	0.5	2	0.55 0.30	0.1	0.05	0.05	0.1

Note

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

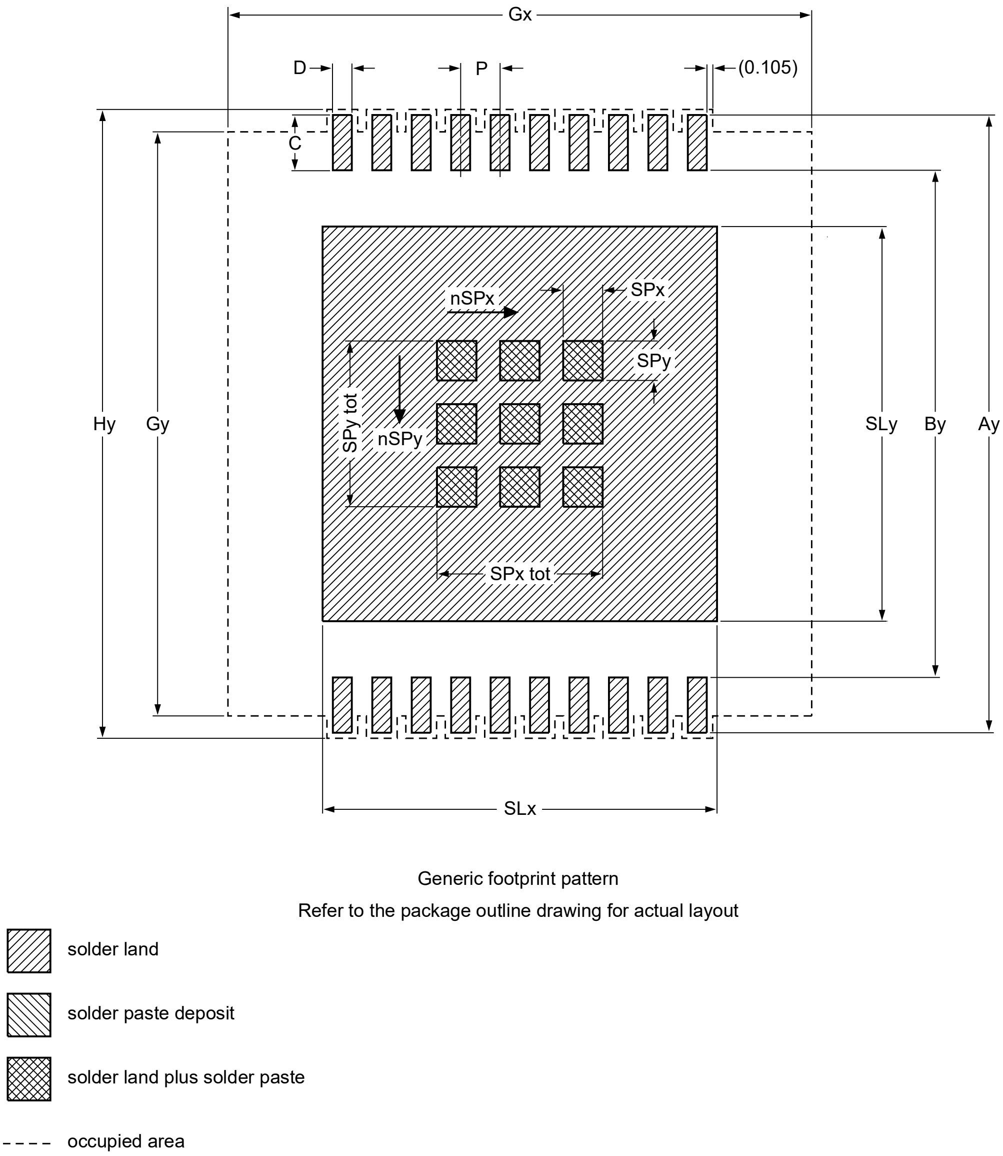
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT650-1	- - -	MO-229	- - -			~~01-01-22~~ 02-02-08

Figure 30. Package outline SOT650-1 (HVSON10)

15.1 Footprint and solder information

NXP recommends by default to apply the soldering and footprint guidelines as are released in POD SOT650-1

Footprint information for reflow soldering of HVSON10 package **SOT650-1**



DIMENSIONS in mm

P	Ay	By	C	D	SLx	SLy	SPx tot	SPy tot	SPx	SPy	Gx	Gy	Hy	nSPx	nSPy
0.500	4.000	2.200	0.900	0.240	2.400	1.500	1.400	0.650	0.550	0.650	3.300	3.300	4.250	2	1

Issue date ~~09-12-29~~ 09-12-29

sot650-1_fr

Figure 31. Footprint information

16 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

17 Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BGU8063 v.3.1	20210210	Product data sheet	CIN	BGU8063 v.3
modification	• corrected typo wrong product name was mentioned BGU3063 instead of BGU8063			
BGU8063 v.3	20210127	Product data sheet	CIN	BGU8063 v.2
modification	• changed frequency range in all graphics from 4 GHz to 5 GHz • changed location of truth table from the Characteristics topic to the Functional description topic • added solder footprint information • added orderable part number to the Ordering information			
BGU8063 v.2	20170127	Product data sheet	-	BGU8063 v.1
modification	• changed status to Product data sheet			
BGU8063v.1	20170112	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".
[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.

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