



# BGU8062

low-noise high-linearity amplifier

Rev. 2 — 24 January 2017

Product data sheet

## 1 General description

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The BGU8062 is, also known as the BTS3001M, a high linearity bypass amplifier for wireless infrastructure applications. The BGU8062 is equipped with fast shutdown to support TDD systems. The LNA has a high input and output return loss and is designed to operate between 1.5 GHz and 2.7 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

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- Low noise performance: NF = 1.3 dB
- High linearity performance: IP<sub>3O</sub> = 36 dBm
- High input return loss > 12 dB
- High output return loss > 15 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

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- 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**

$f = 1900 \text{ MHz}$ ;  $V_{CC} = 5 \text{ V}$ ;  $T_{amb} = 25 \text{ }^\circ\text{C}$ ; 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  $f = 1900 \text{ MHz}$ .

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I <sub>CC</sub>	supply current	LNA enable; bypass off	-	70	85	mA
		LNA disable; bypass on	-	3	5	mA
G <sub>ass</sub>	associated gain	LNA enable; bypass off	17	18.5	20	dB
		LNA disable; bypass on	-2.0	-1.6	-	dB
NF	noise figure	LNA enable; bypass off <sup>[1]</sup>	-	1.3	2.0	dB
P <sub>L(1dB)</sub>	output power at 1 dB gain compression	LNA enable; bypass off	18.5	20	-	dBm
IP <sub>3O</sub>	output third-order intercept point	2-tone; tone spacing = 1 MHz; P <sub>L</sub> = 5 dBm per tone				
		• LNA enable; bypass off	33.5	36	-	dBm
		• LNA disable; bypass on <sup>[2]</sup>	40	44	-	dBm

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

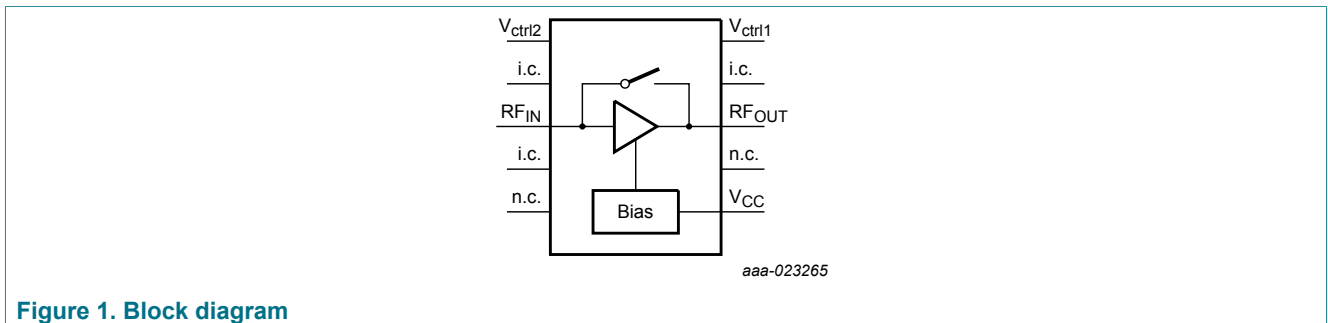
[2] Guaranteed by device design; not tested in production.

## 5 Ordering information

**Table 2. Ordering information**

Type number	Package		Version
	Name	Description	
BGU8062	HVSON10	plastic thermal enhanced very thin small outline package; no leads; 10 terminals; body 3 × 3 × 0.85 mm	SOT650-2

## 6 Block diagram



**Figure 1. Block diagram**

## 7 Pinning information

### 7.1 Pinning

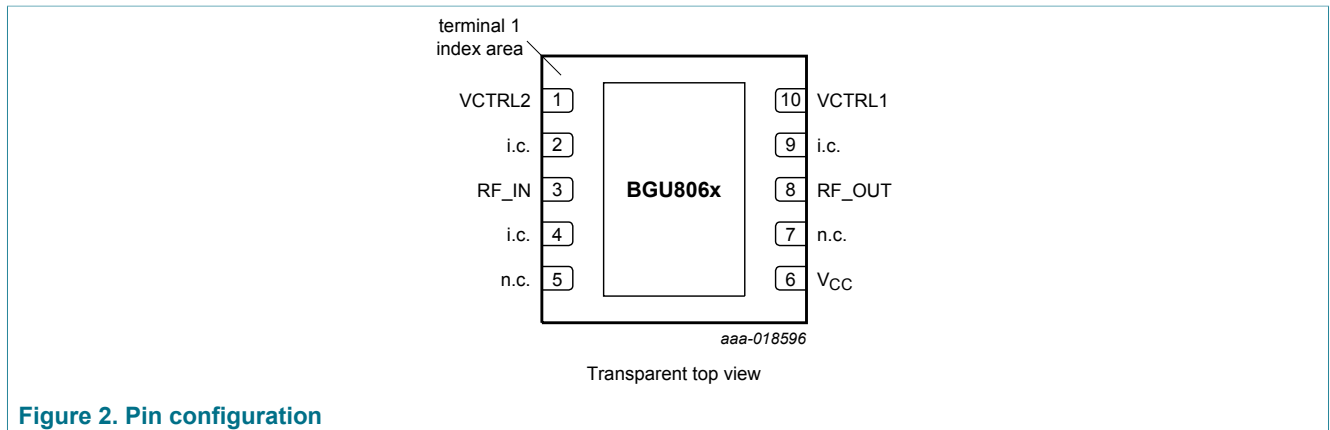


Figure 2. Pin configuration

### 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 <sub>CC</sub>	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). See Section 16.3 "Disclaimers", paragraph "Limiting values".

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	-	2.0	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	-	$\Omega$

## 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 Characteristics

**Table 7. Characteristics**

$f = 1900$  MHz;  $V_{CC} = 5$  V;  $T_{amb} = 25$  °C; input and output 50  $\Omega$ ; 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  $f = 1900$  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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
G <sub>ass</sub>	associated gain	LNA enable; bypass off	17	18.5	20	dB
		LNA disable; bypass on	-2.0	-1.6	-	dB
		f = 2600 MHz; LNA enable; bypass off	14	15.5	17	dB
G <sub>flat</sub>	gain flatness	within 100 MHz bandwidth; LNA enable; bypass off				
		• 1500 MHz ≤ f ≤ 2700 MHz	-	0.6	-	dB
		• 1900 MHz ≤ f ≤ 2700 MHz	-	0.5	-	dB
NF	noise figure	LNA enable; bypass off <sup>[1]</sup>	-	1.3	2.0	dB
ΔG	gain variation	1900 MHz ≤ f ≤ 2700 MHz	-	3.1	-	dB
P <sub>L(1dB)</sub>	output power at 1 dB gain compression	LNA enable; bypass off	18.5	20	-	dBm
IP <sub>3O</sub>	output third-order intercept point	2-tone; tone spacing = 1 MHz; P <sub>L</sub> = 5 dBm per tone				
		• LNA enable; bypass off	33.5	36	-	dBm
		• LNA disable; bypass on <sup>[2]</sup>	40	44	-	dBm
RL <sub>in</sub>	input return loss	LNA enable; bypass off	-	12	-	dB
		LNA disable; bypass on	-	15	-	dB
RL <sub>out</sub>	output return loss		-	15	-	dB
ISL	isolation	LNA disable; bypass off	20	30	-	dB
		LNA enable; bypass off	15	20	-	dB
t <sub>s(pon)</sub>	power-on settling time	P <sub>i</sub> = -20 dBm	-	0.8	1.0	μs
t <sub>s(poff)</sub>	power-off settling time	P <sub>i</sub> = -20 dBm	-	0.8	1.0	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.

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

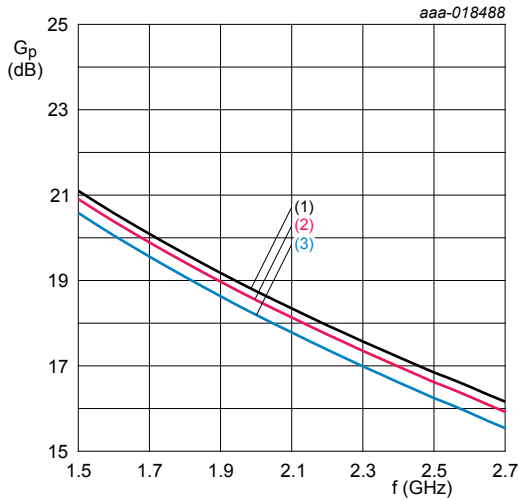
**Table 8. Control truth table**

V<sub>CC</sub> = 5 V; T<sub>amb</sub> = 25 °C.

Control signal setting <sup>[1]</sup>		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

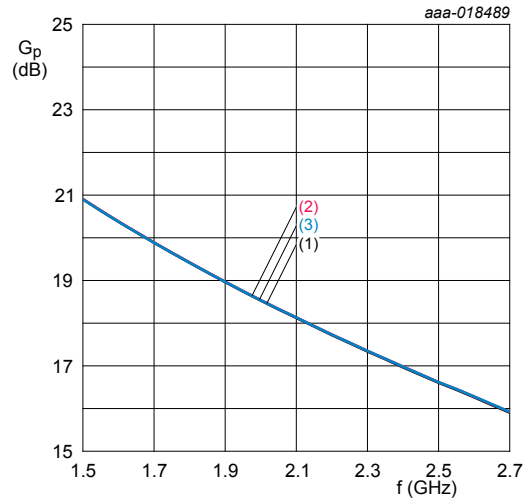
[1] A logic LOW is the result of an input voltage on that specific pin between -0.3 V and +0.7 V.  
A logic HIGH is the result of an input voltage on that specific pin between 1.2 V and 3.6 V.

11.1 Graphs



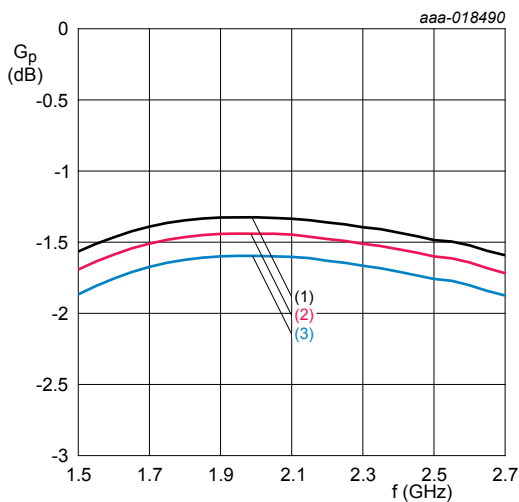
$V_{CC} = 5\text{ V}$ ; gain mode.  
 (1)  $T_{amb} = -40^\circ\text{C}$   
 (2)  $T_{amb} = +25^\circ\text{C}$   
 (3)  $T_{amb} = +95^\circ\text{C}$

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



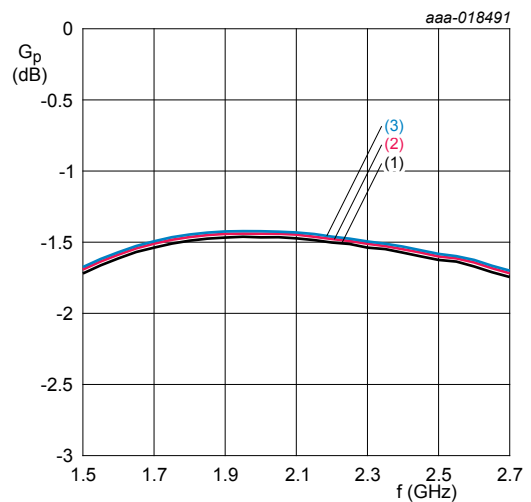
$T_{amb} = 25^\circ\text{C}$ ; gain mode.  
 (1)  $V_{CC} = 4.75\text{ V}$   
 (2)  $V_{CC} = 5.0\text{ V}$   
 (3)  $V_{CC} = 5.25\text{ V}$

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



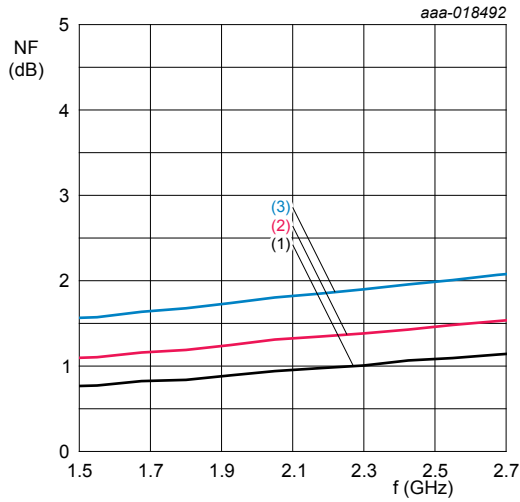
$V_{CC} = 5\text{ V}$ ; bypass mode.  
 (1)  $T_{amb} = -40^\circ\text{C}$   
 (2)  $T_{amb} = +25^\circ\text{C}$   
 (3)  $T_{amb} = +95^\circ\text{C}$

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



$T_{amb} = 25^\circ\text{C}$ ; bypass mode.  
 (1)  $V_{CC} = 4.75\text{ V}$   
 (2)  $V_{CC} = 5.0\text{ V}$   
 (3)  $V_{CC} = 5.25\text{ V}$

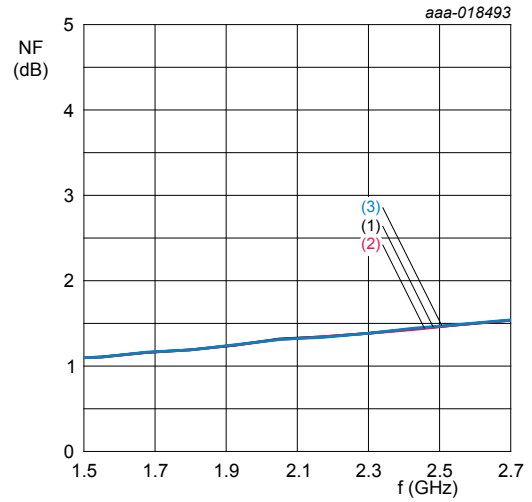
**Figure 6. Power gain as a function of frequency; typical values**



$V_{CC} = 5\text{ V}$ ; gain mode.

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

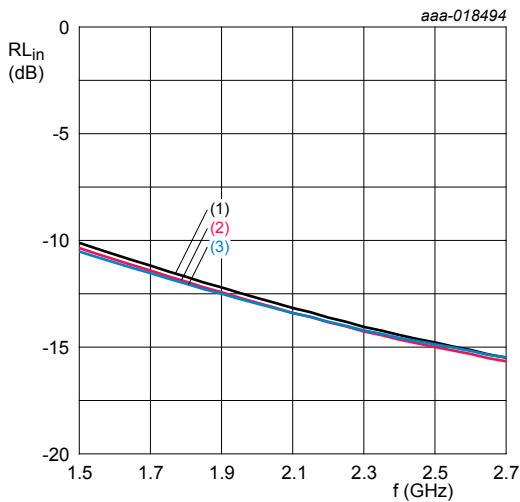
**Figure 7. Noise figure as a function of frequency; typical values**



$T_{amb} = 25^\circ\text{C}$ ; gain mode.

- (1)  $V_{CC} = 4.75\text{ V}$
- (2)  $V_{CC} = 5.0\text{ V}$
- (3)  $V_{CC} = 5.25\text{ V}$

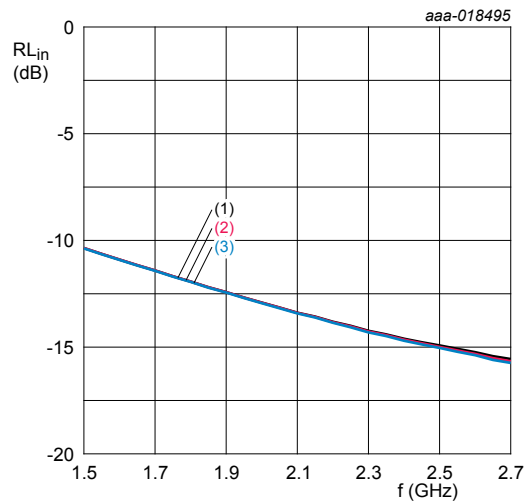
**Figure 8. Noise figure as a function of frequency; typical values**



$V_{CC} = 5\text{ V}$ ; gain mode.

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

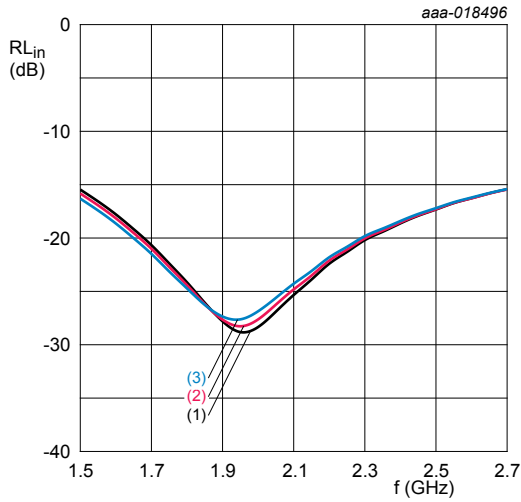
**Figure 9. Input return loss as a function of frequency; typical values**



$T_{amb} = 25^\circ\text{C}$ ; gain mode.

- (1)  $V_{CC} = 4.75\text{ V}$
- (2)  $V_{CC} = 5.0\text{ V}$
- (3)  $V_{CC} = 5.25\text{ V}$

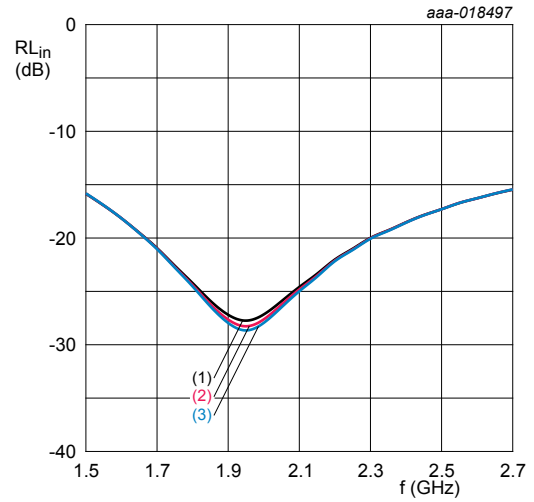
**Figure 10. Input return loss as a function of frequency; typical values**



V<sub>CC</sub> = 5 V; bypass mode.

- (1) T<sub>amb</sub> = -40°C
- (2) T<sub>amb</sub> = +25°C
- (3) T<sub>amb</sub> = +95°C

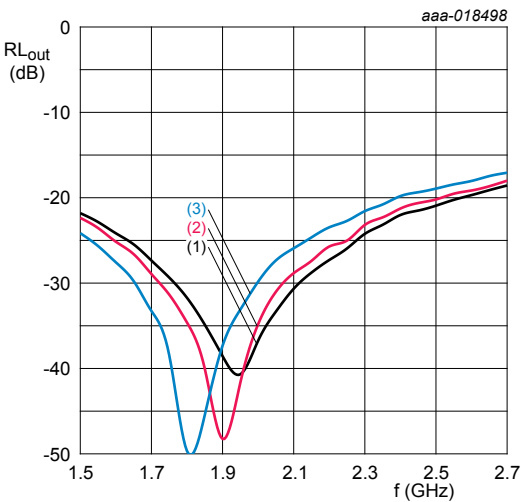
Figure 11. Input return loss as a function of frequency; typical values



T<sub>amb</sub> = 25°C; bypass mode.

- (1) V<sub>CC</sub> = 4.75 V
- (2) V<sub>CC</sub> = 5.0 V
- (3) V<sub>CC</sub> = 5.25 V

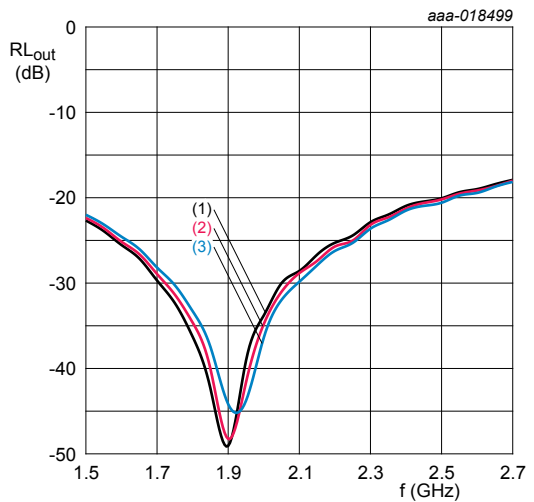
Figure 12. Input return loss as a function of frequency; typical values



V<sub>CC</sub> = 5 V; gain mode.

- (1) T<sub>amb</sub> = -40°C
- (2) T<sub>amb</sub> = +25°C
- (3) T<sub>amb</sub> = +95°C

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

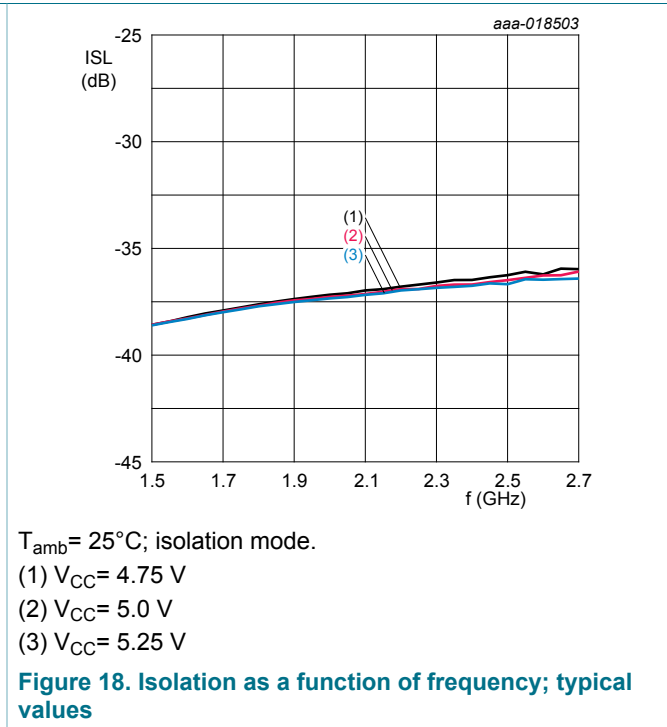
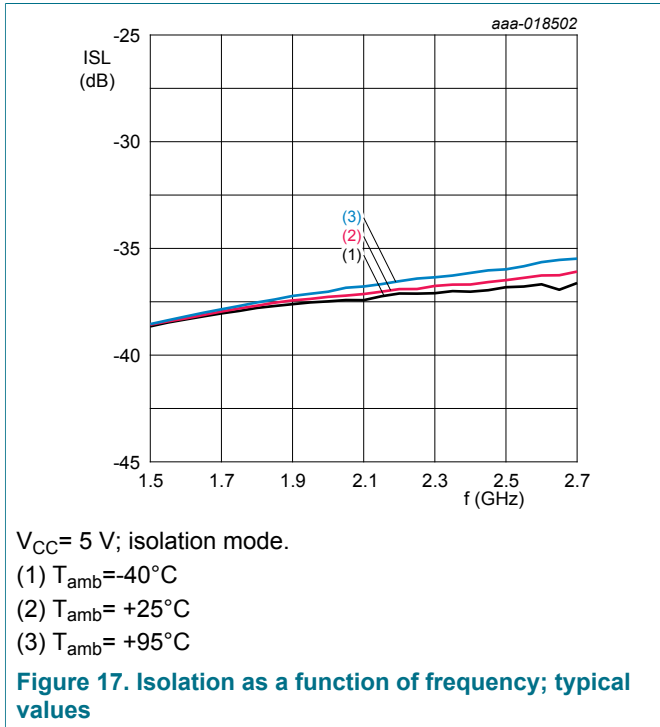
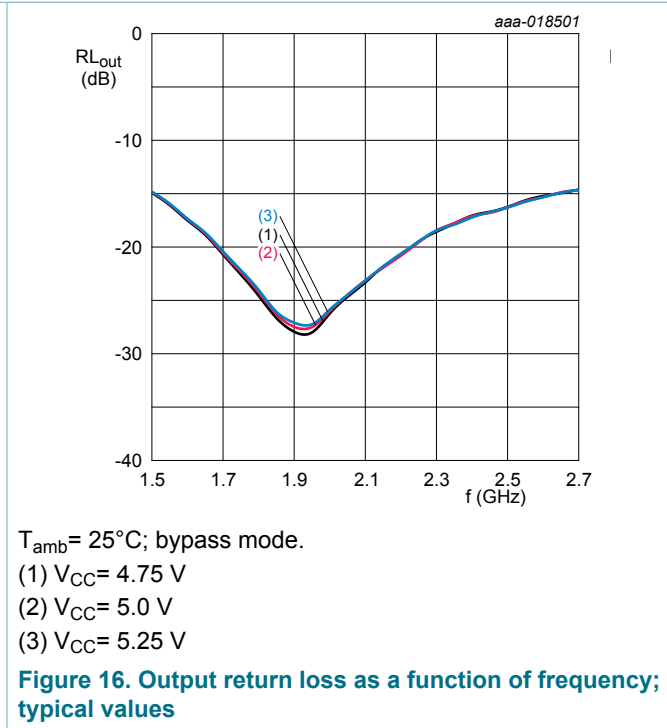
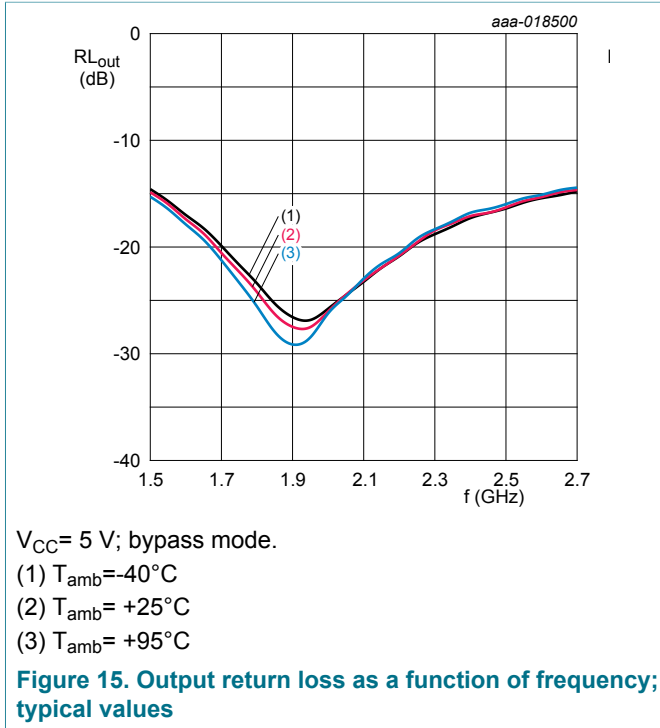


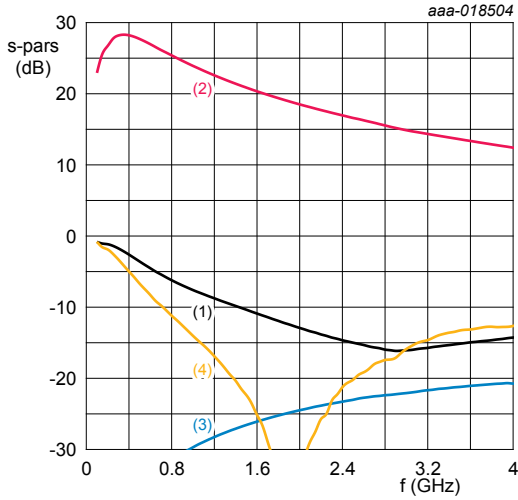
T<sub>amb</sub> = 25°C; gain mode.

- (1) V<sub>CC</sub> = 4.75 V
- (2) V<sub>CC</sub> = 5.0 V
- (3) V<sub>CC</sub> = 5.25 V

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



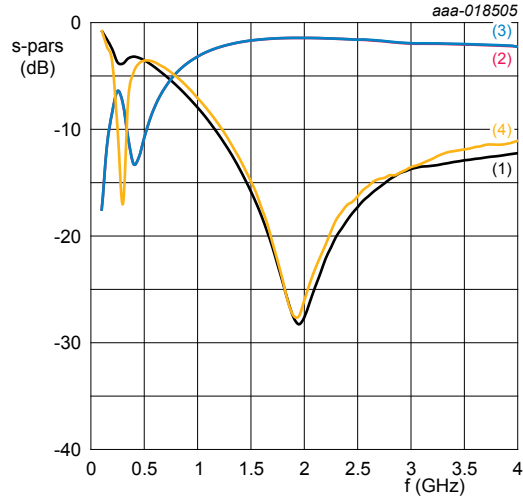




$V_{CC} = 5\text{ V}$ ;  $T_{amb} = 25^\circ\text{C}$ ; gain mode.

- (1)  $S_{11}$
- (2)  $S_{21}$
- (3)  $S_{12}$
- (4)  $S_{22}$

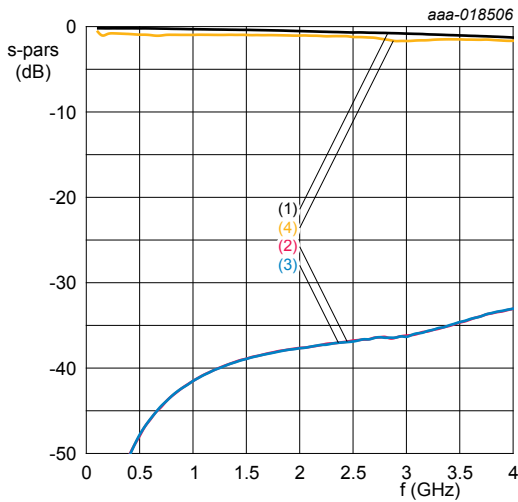
Figure 19. Wideband S-parameters as a function of frequency; typical values



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

- (1)  $S_{11}$
- (2)  $S_{21}$
- (3)  $S_{12}$
- (4)  $S_{22}$

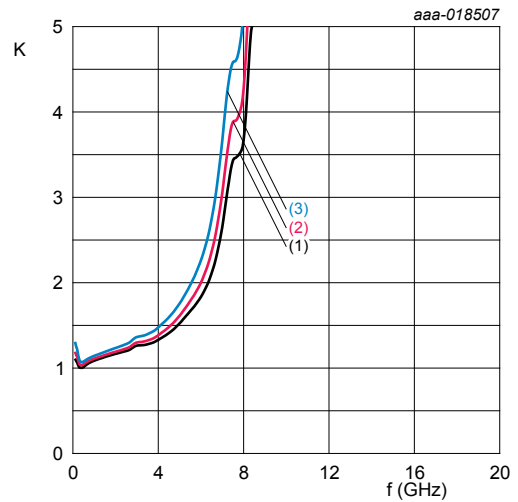
Figure 20. Wideband S-parameters as a function of frequency; typical values



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

- (1)  $S_{11}$
- (2)  $S_{21}$
- (3)  $S_{12}$
- (4)  $S_{22}$

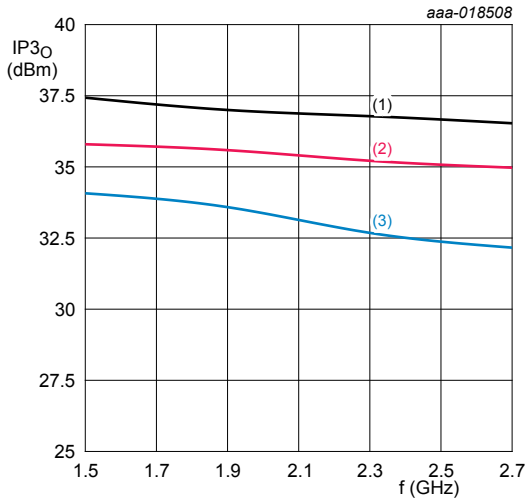
Figure 21. Wideband S-parameters as a function of frequency; typical values



$V_{CC} = 5\text{ V}$ ; gain mode.

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

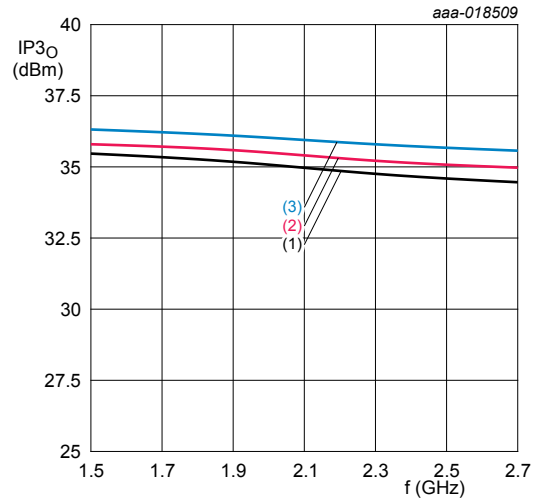
Figure 22. Rollett stability factor as a function of frequency; typical values



V<sub>CC</sub> = 5 V; gain mode.

- (1) T<sub>amb</sub> = -40°C
- (2) T<sub>amb</sub> = +25°C
- (3) T<sub>amb</sub> = +95°C

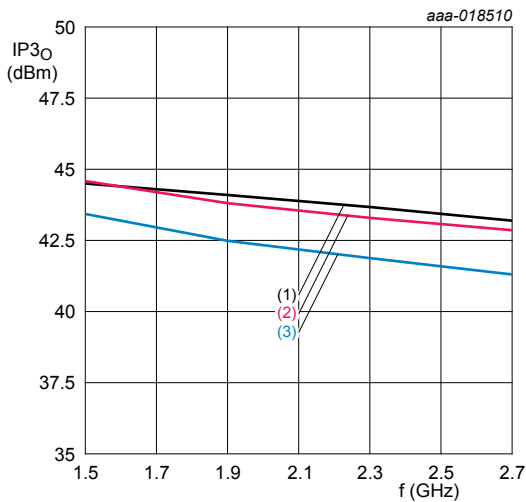
Figure 23. Output third-order intercept point as a function of frequency; typical values



T<sub>amb</sub> = 25°C; gain mode.

- (1) V<sub>CC</sub> = 4.75 V
- (2) V<sub>CC</sub> = 5.0 V
- (3) V<sub>CC</sub> = 5.25 V

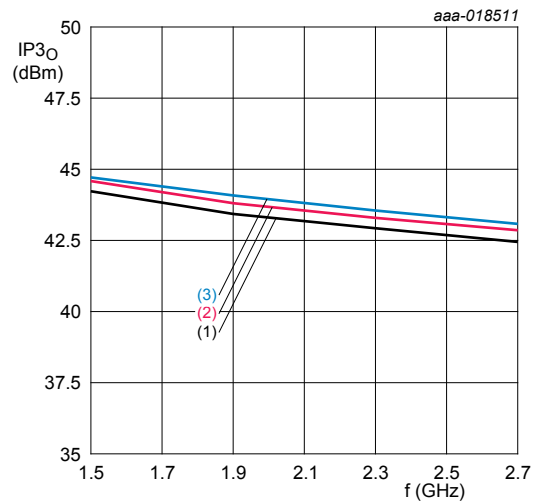
Figure 24. Output third-order intercept point as a function of frequency; typical values



V<sub>CC</sub> = 5 V; bypass mode.

- (1) T<sub>amb</sub> = -40°C
- (2) T<sub>amb</sub> = +25°C
- (3) T<sub>amb</sub> = +95°C

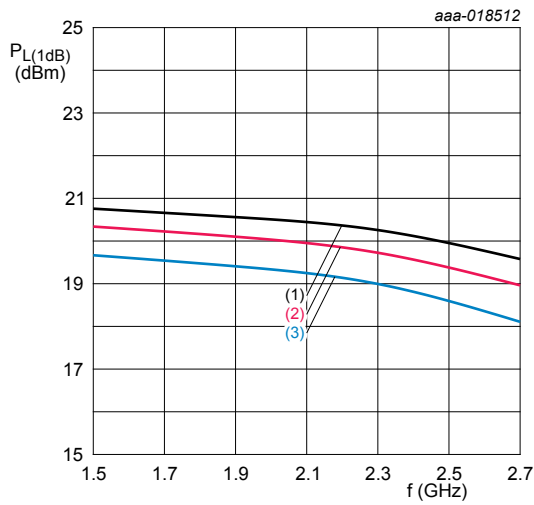
Figure 25. Output third-order intercept point as a function of frequency; typical values



T<sub>amb</sub> = 25°C; bypass mode.

- (1) V<sub>CC</sub> = 4.75 V
- (2) V<sub>CC</sub> = 5.0 V
- (3) V<sub>CC</sub> = 5.25 V

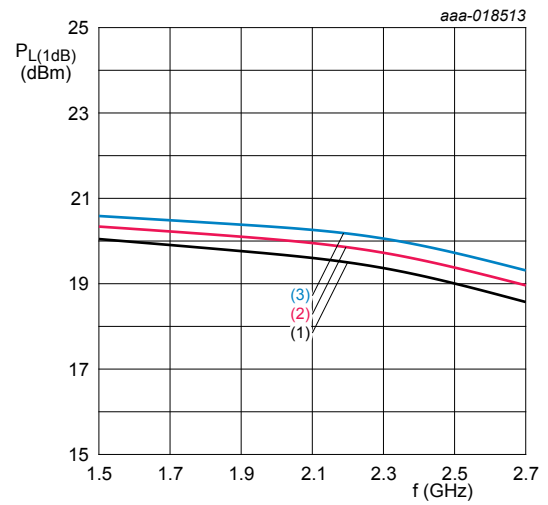
Figure 26. Output third-order intercept point as a function of frequency; typical values



$V_{CC} = 5$  V; gain mode.

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

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

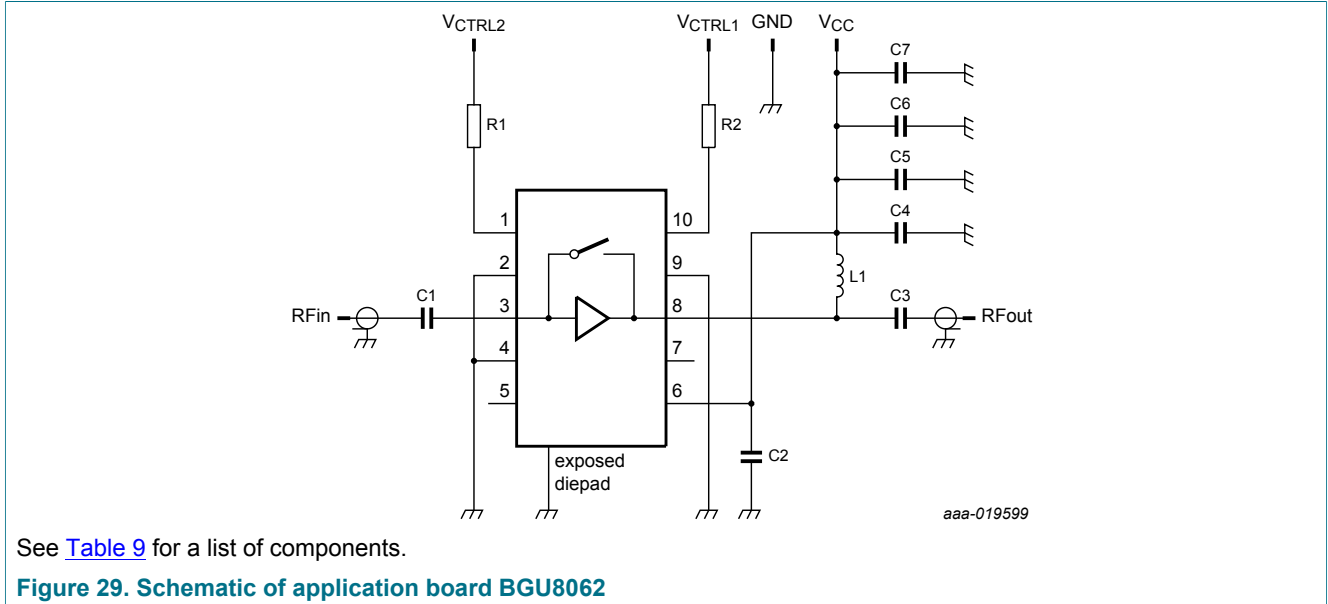


$T_{amb} = 25^\circ\text{C}$ ; gain mode.

- (1)  $V_{CC} = 4.75$  V
- (2)  $V_{CC} = 5.0$  V
- (3)  $V_{CC} = 5.25$  V

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

## 12 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 $\mu$ F	
L1	inductor	15 nH	
R1, R2	resistor	1 k $\Omega$	

13 Package outline

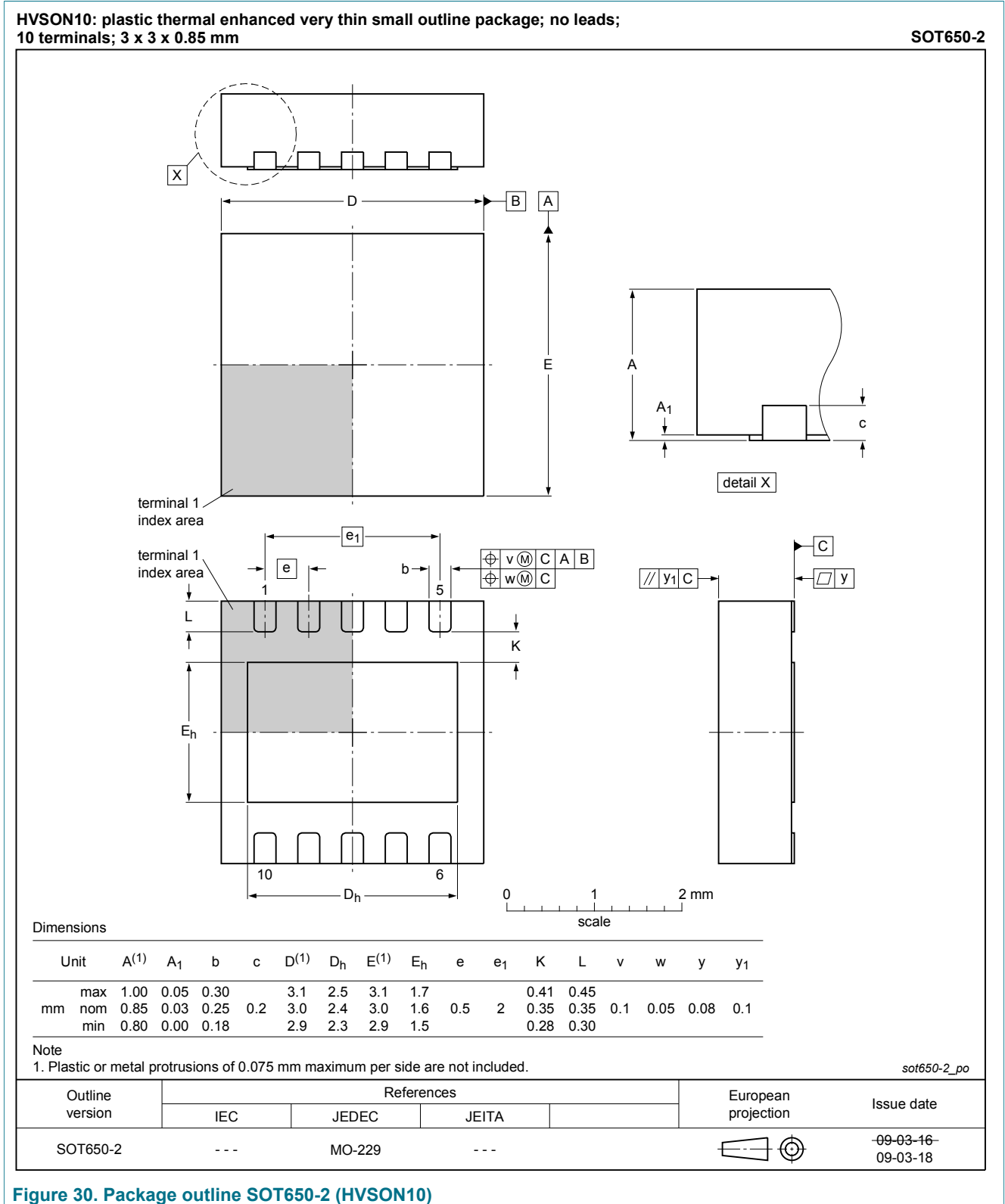


Figure 30. Package outline SOT650-2 (HVSON10)

## 14 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

## 15 Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BGU8062 v.2	20170124	Product data sheet	-	BGU8062 v.1
Modifications:	<ul style="list-style-type: none"> <li>• Table 1 added: Min value to <math>IP3_O</math></li> <li>• added BTS3001M according to our new naming convention</li> </ul>			
BGU8062 v.1	20150909	Product data sheet	-	-

## 16 Legal information

### 16.1 Data sheet status

Document status <sup>[1][2]</sup>	Product status <sup>[3]</sup>	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>.

### 16.2 Definitions

**Draft** — The document is a draft version only. The content is still under internal review and subject to formal approval, which may result in modifications or additions. NXP Semiconductors does not give any representations or warranties as to the accuracy or completeness of information included herein and shall have no liability for the consequences of use of such information.

**Short data sheet** — A short data sheet is an extract from a full data sheet with the same product type number(s) and title. A short data sheet is intended for quick reference only and should not be relied upon to contain detailed and full information. For detailed and full information see the relevant full data sheet, which is available on request via the local NXP Semiconductors sales office. In case of any inconsistency or conflict with the short data sheet, the full data sheet shall prevail.

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## Contents

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

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