



BGU8062

low-noise high-linearity amplifier

Rev. 2 — 24 January 2017

Product data sheet

1 General description

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

- Low noise performance: $NF = 1.3 \text{ dB}$
- High linearity performance: $IP3_O = 36 \text{ dBm}$
- High input return loss $> 12 \text{ dB}$
- High output return loss $> 15 \text{ dB}$
- 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

$f = 1900\text{ MHz}$; $V_{CC} = 5\text{ V}$; $T_{amb} = 25\text{ }^{\circ}\text{C}$; 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 _{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 | 17 | 18.5 | 20 | dB |
| | | LNA disable; bypass on | -2.0 | -1.6 | - | dB |
| NF | noise figure | LNA enable; bypass off ^[1] | - | 1.3 | 2.0 | dB |
| P _{L(1dB)} | output power at 1 dB gain compression | LNA enable; bypass off | 18.5 | 20 | - | dBm |
| IP _{3O} | output third-order intercept point | 2-tone; tone spacing = 1 MHz; P _L = 5 dBm per tone | | | | |
| | | • LNA enable; bypass off | 33.5 | 36 | - | dBm |
| | | • LNA disable; bypass on ^[2] | 40 | 44 | - | dBm |

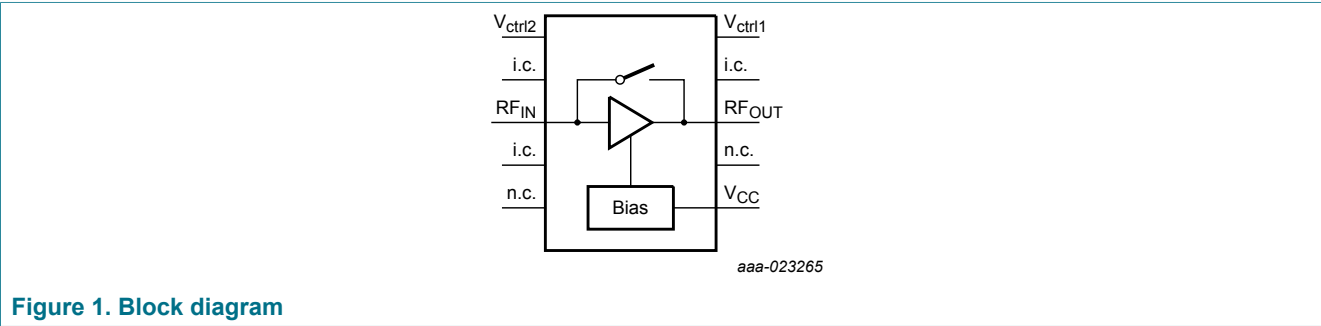
[1] Connector and Printed-Circuit Board (PCB) losses have been de-embedded.
[2] Guaranteed by device design; not tested in production.

5 Ordering information

Table 2. Ordering information

| Type number | Package | | |
|-------------|---------|---|----------|
| | Name | Description | Version |
| 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



7 Pinning information

7.1 Pinning

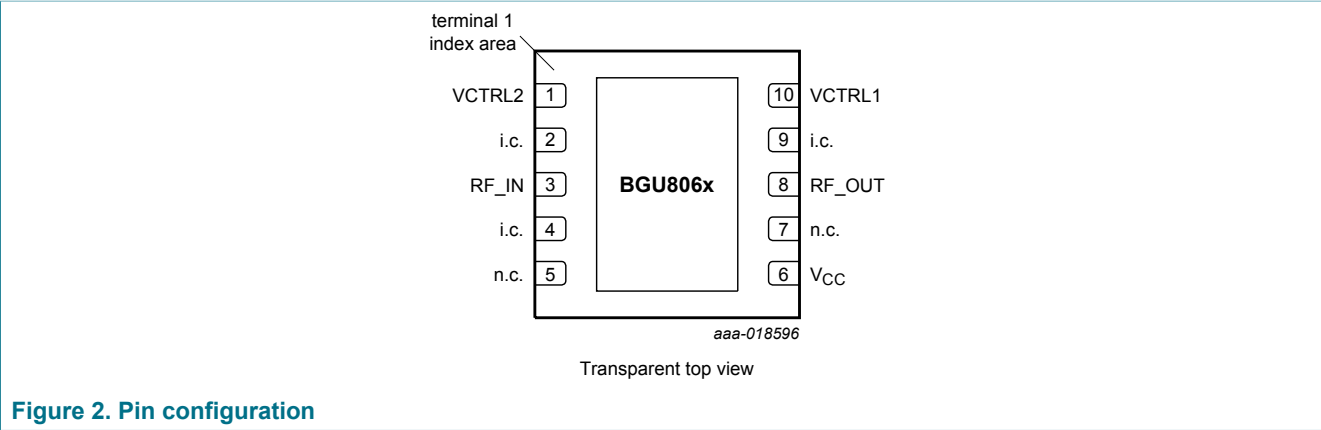


Figure 2. Pin configuration

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). 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 | $T_{case} \leq 125\text{ °C}$ [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 | 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

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

| 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 |

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|----------------------|---------------------------------------|--|------|------|-----|---------------|
| G_{ass} | associated gain | LNA enable; bypass off | 17 | 18.5 | 20 | dB |
| | | LNA disable; bypass on | -2.0 | -1.6 | - | dB |
| | | $f = 2600 \text{ MHz}$; LNA enable; bypass off | 14 | 15.5 | 17 | dB |
| G_{flat} | gain flatness | within 100 MHz bandwidth; LNA enable; bypass off | | | | |
| | | • $1500 \text{ MHz} \leq f \leq 2700 \text{ MHz}$ | - | 0.6 | - | dB |
| | | • $1900 \text{ MHz} \leq f \leq 2700 \text{ MHz}$ | - | 0.5 | - | dB |
| NF | noise figure | LNA enable; bypass off ^[1] | - | 1.3 | 2.0 | dB |
| ΔG | gain variation | $1900 \text{ MHz} \leq f \leq 2700 \text{ MHz}$ | - | 3.1 | - | dB |
| $P_{L(1\text{dB})}$ | output power at 1 dB gain compression | LNA enable; bypass off | 18.5 | 20 | - | 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 | - | dBm |
| | | • LNA disable; bypass on ^[2] | 40 | 44 | - | dBm |
| RL _{in} | input return loss | LNA enable; bypass off | - | 12 | - | dB |
| | | LNA disable; bypass on | - | 15 | - | dB |
| RL _{out} | output return loss | | - | 15 | - | dB |
| ISL | isolation | LNA disable; bypass off | 20 | 30 | - | dB |
| | | LNA enable; bypass off | 15 | 20 | - | dB |
| $t_{s(\text{pon})}$ | power-on settling time | $P_i = -20 \text{ dBm}$ | - | 0.8 | 1.0 | μs |
| $t_{s(\text{poff})}$ | power-off settling time | $P_i = -20 \text{ dBm}$ | - | 0.8 | 1.0 | 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.

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

Table 8. Control truth table

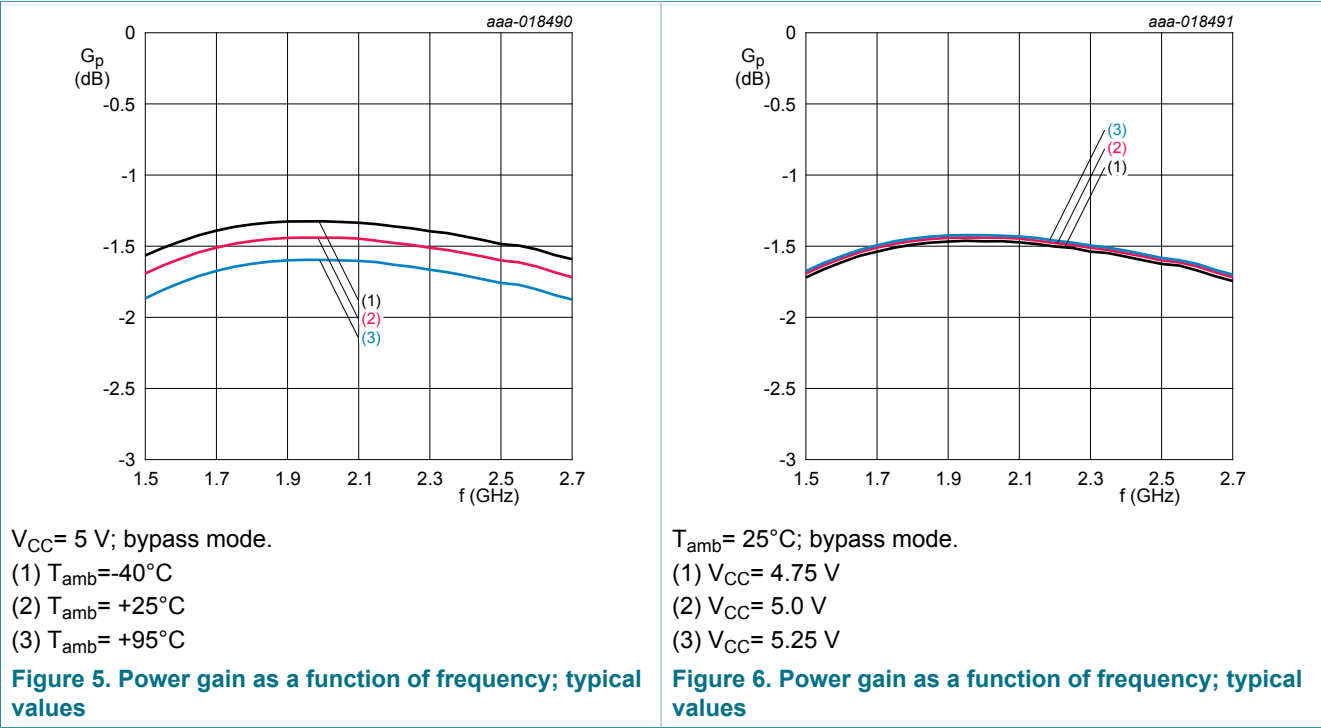
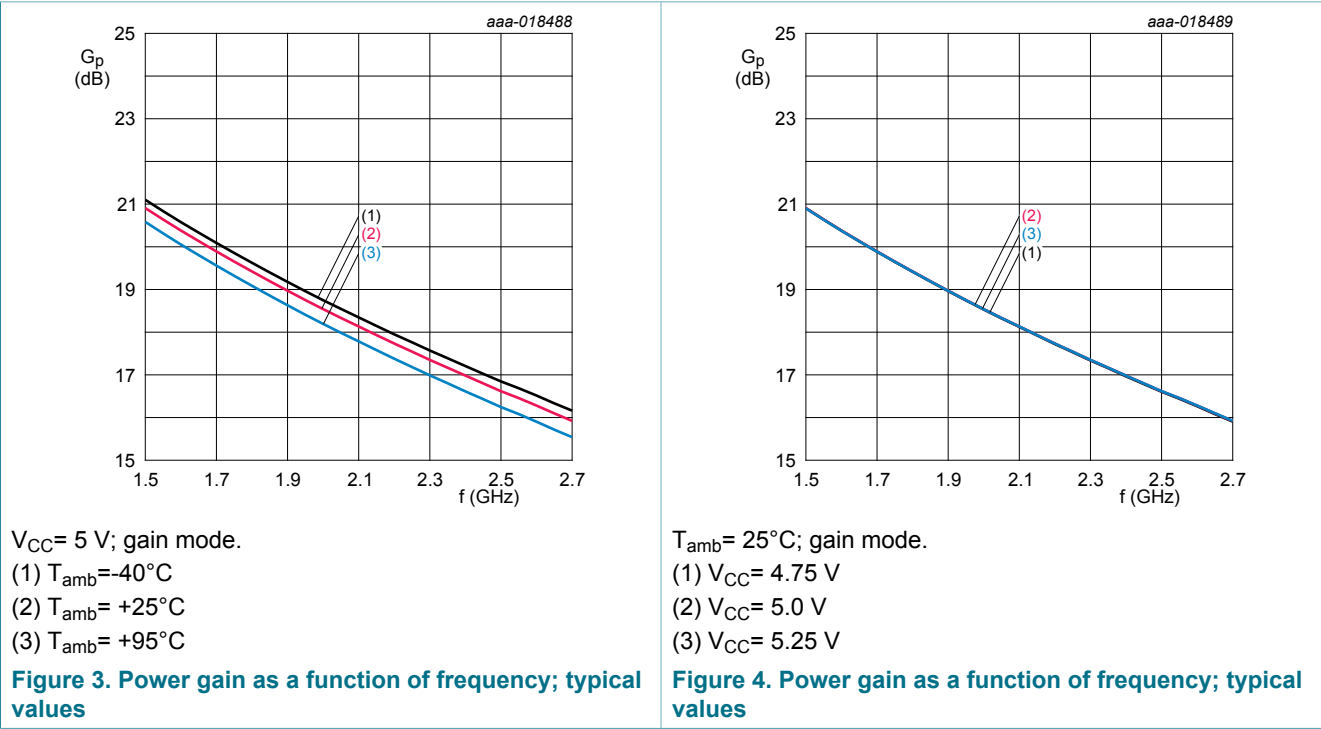
$V_{CC} = 5 \text{ V}$; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$.

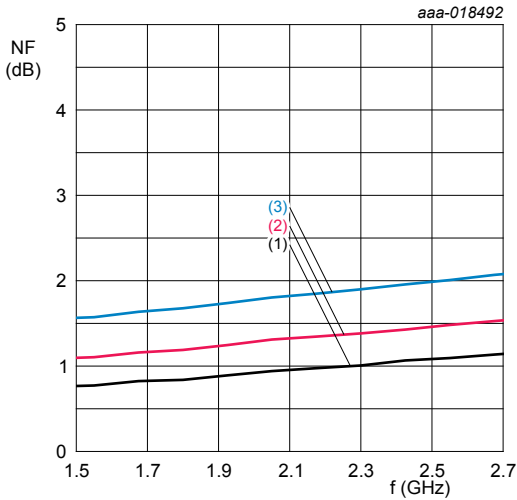
| Control signal setting ^[1] | | Mode of operation | |
|---------------------------------------|----------------|-------------------|--------|
| CTRL2 (pin 1) | CTRL1 (pin 10) | LNA | bypass |
| HIGH | LOW | disable | on |
| HIGH | HIGH | disable | on |
| LOW | LOW | enable | off |
| LOW | HIGH | disable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

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

A logic HIGH is the result of an input voltage on that specific pin between 1.2 V and 3.6 V.

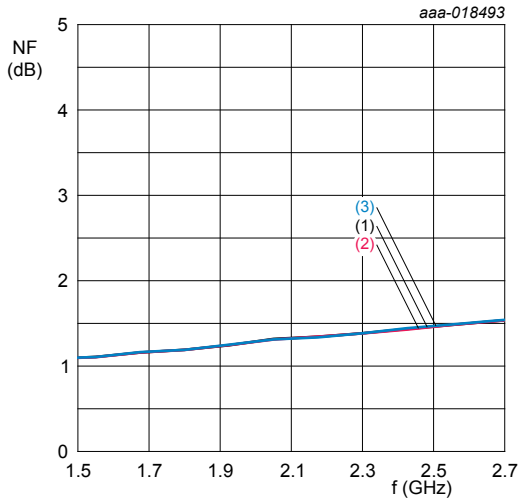
11.1 Graphs





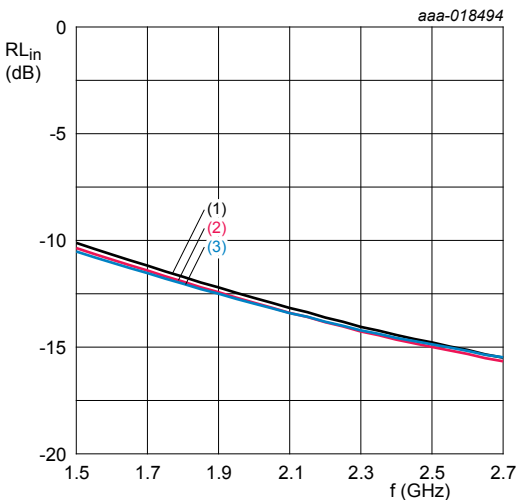
$V_{CC} = 5\text{ V}$; gain mode.
(1) $T_{amb} = -40^{\circ}\text{C}$
(2) $T_{amb} = +25^{\circ}\text{C}$
(3) $T_{amb} = +95^{\circ}\text{C}$

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



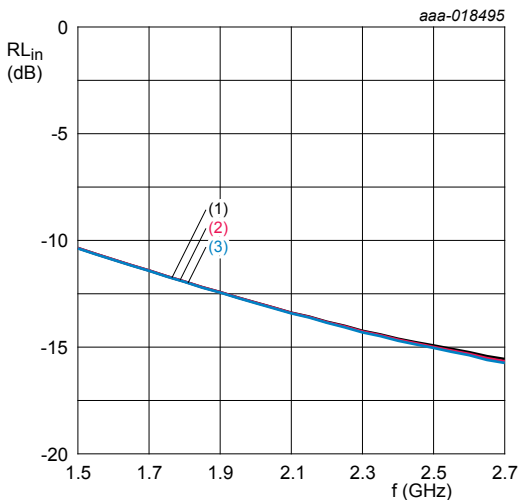
$T_{amb} = 25^{\circ}\text{C}$; gain mode.
(1) $V_{CC} = 4.75\text{ V}$
(2) $V_{CC} = 5.0\text{ V}$
(3) $V_{CC} = 5.25\text{ V}$

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



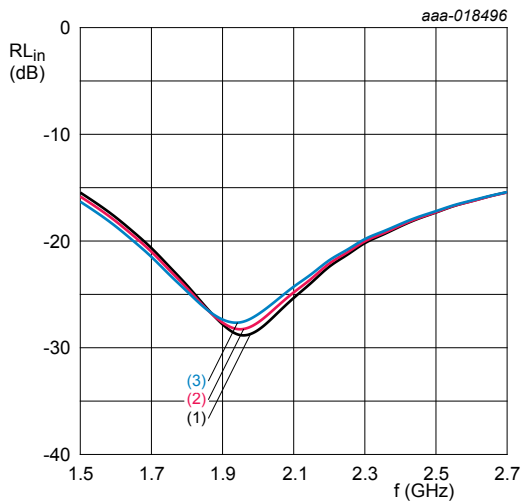
$V_{CC} = 5\text{ V}$; gain mode.
(1) $T_{amb} = -40^{\circ}\text{C}$
(2) $T_{amb} = +25^{\circ}\text{C}$
(3) $T_{amb} = +95^{\circ}\text{C}$

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

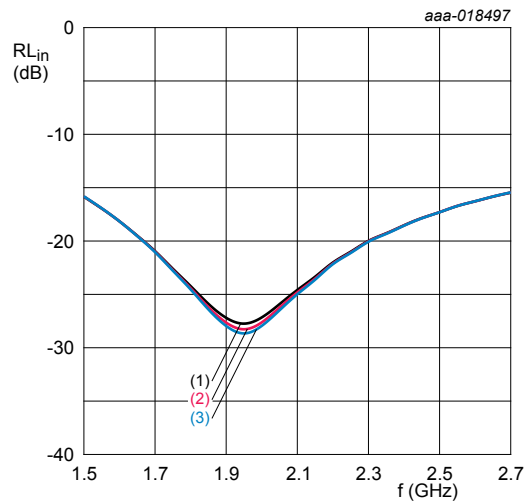
Figure 10. Input return loss as a function of frequency; typical values



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

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

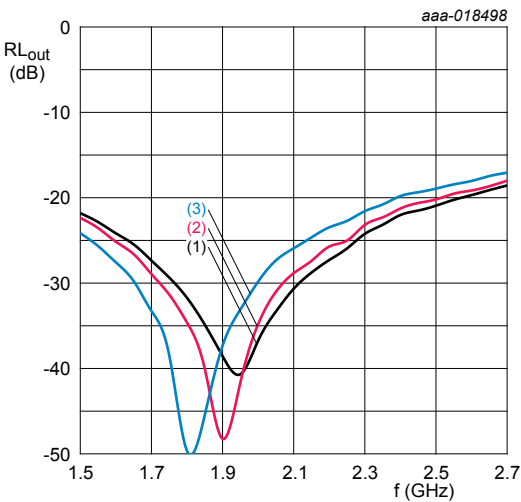
Figure 11. Input return loss as a function of frequency; typical values



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

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

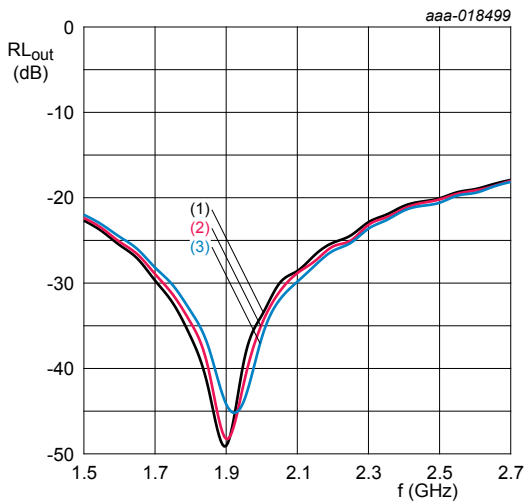
Figure 12. Input return loss as a function of frequency; typical values



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

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

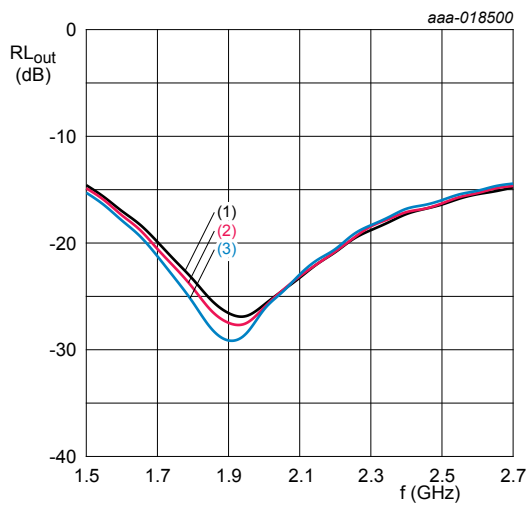
Figure 13. Output return loss as a function of frequency; typical values



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

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

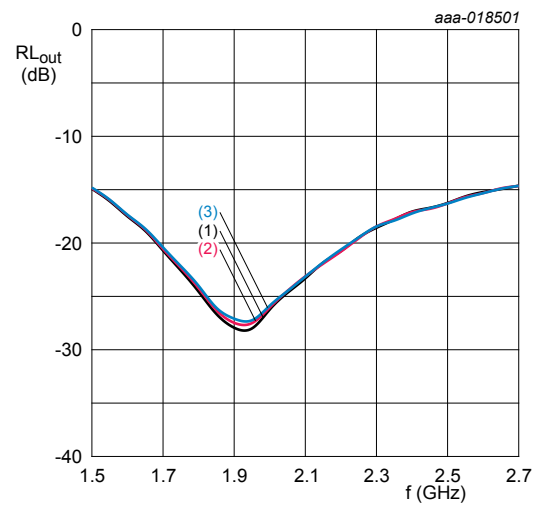
Figure 14. Output return loss as a function of frequency; typical values



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

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

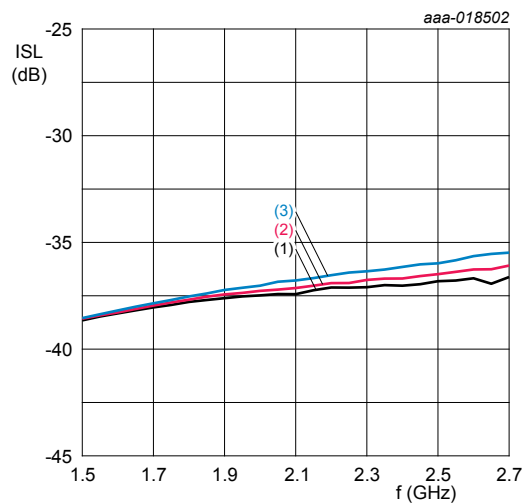
Figure 15. Output return loss as a function of frequency; typical values



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

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

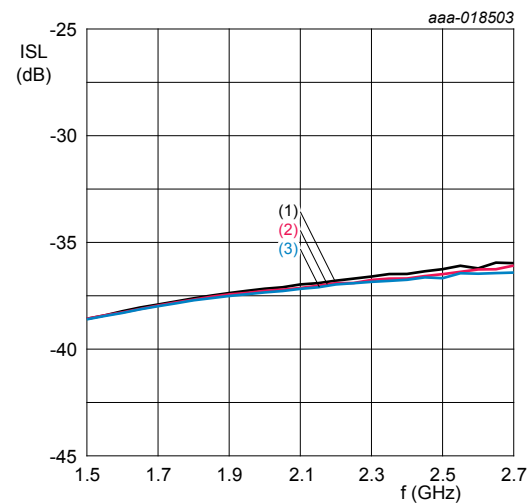
Figure 16. Output return loss as a function of frequency; typical values



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

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

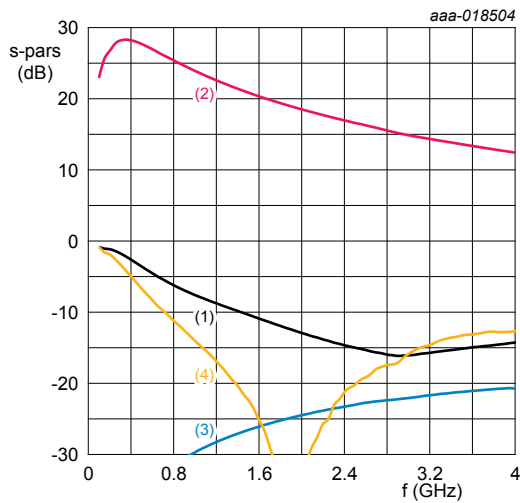
Figure 17. Isolation as a function of frequency; typical values



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

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

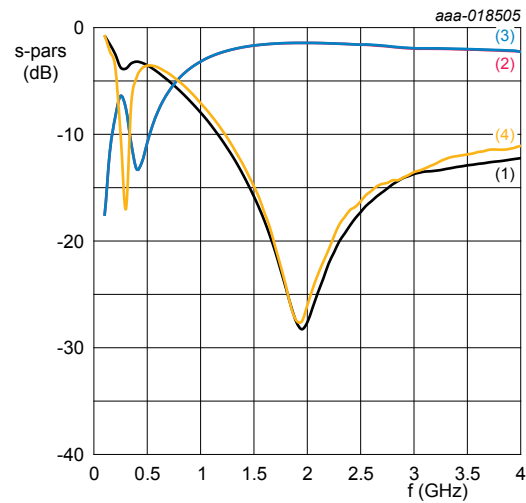
Figure 18. Isolation as a function of frequency; typical values



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

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

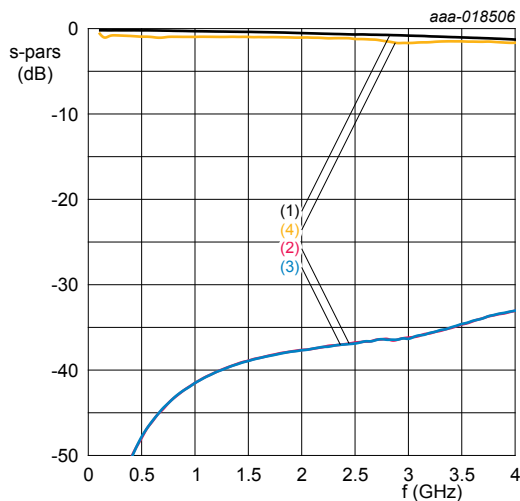
Figure 19. Wideband S-parameters as a function of frequency; typical values



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

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

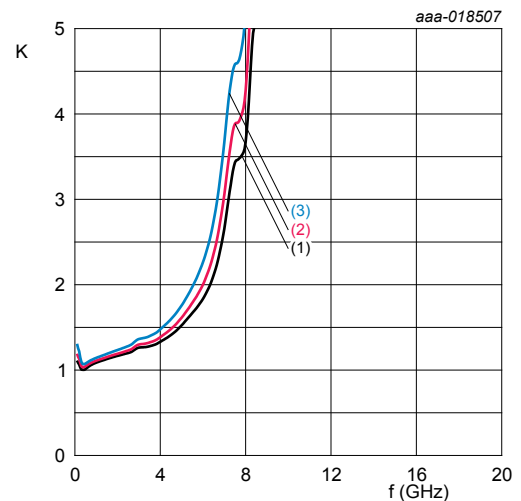
Figure 20. Wideband S-parameters as a function of frequency; typical values



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

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

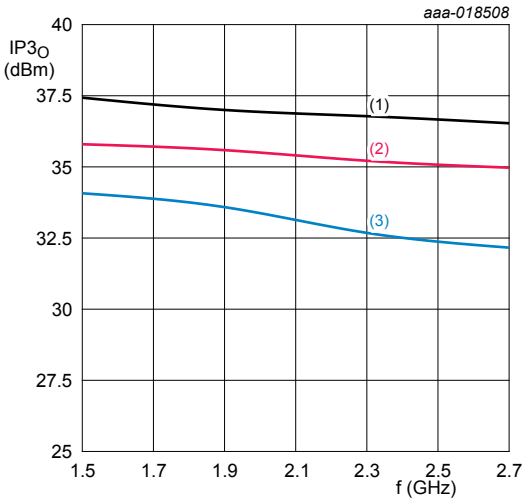
Figure 21. Wideband S-parameters as a function of frequency; typical values



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

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

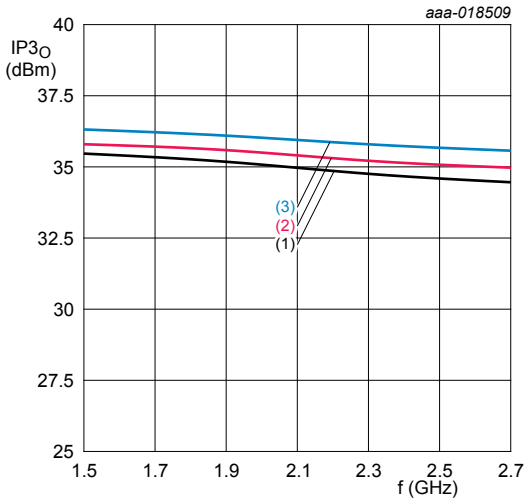
Figure 22. Rollett stability factor as a function of frequency; typical values



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

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

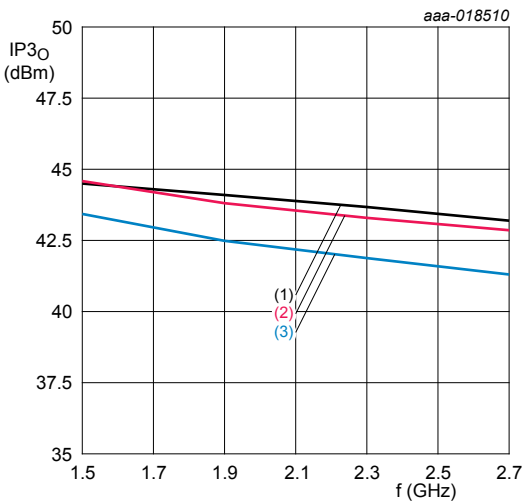
Figure 23. Output third-order intercept point as a function of frequency; typical values



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

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

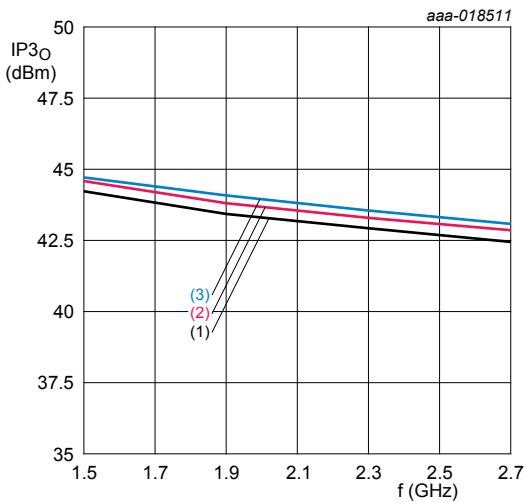
Figure 24. Output third-order intercept point as a function of frequency; typical values



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

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

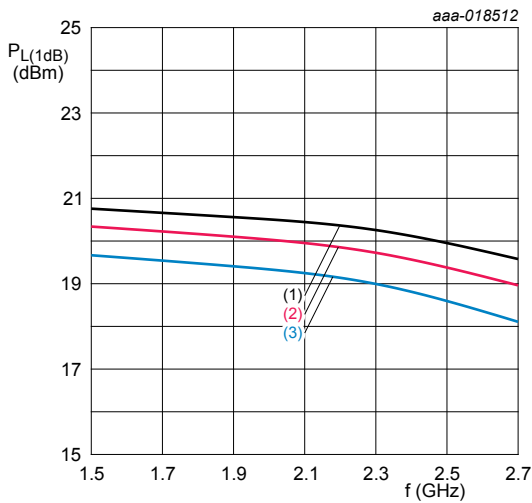
Figure 25. Output third-order intercept point as a function of frequency; typical values



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

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

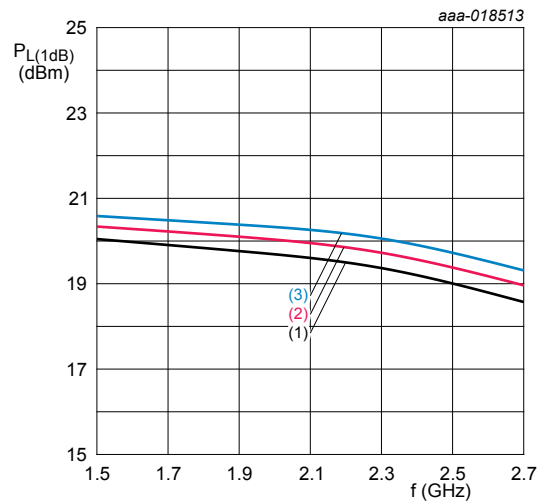
Figure 26. Output third-order intercept point as a function of frequency; typical values



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

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

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



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

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

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

12 Application information

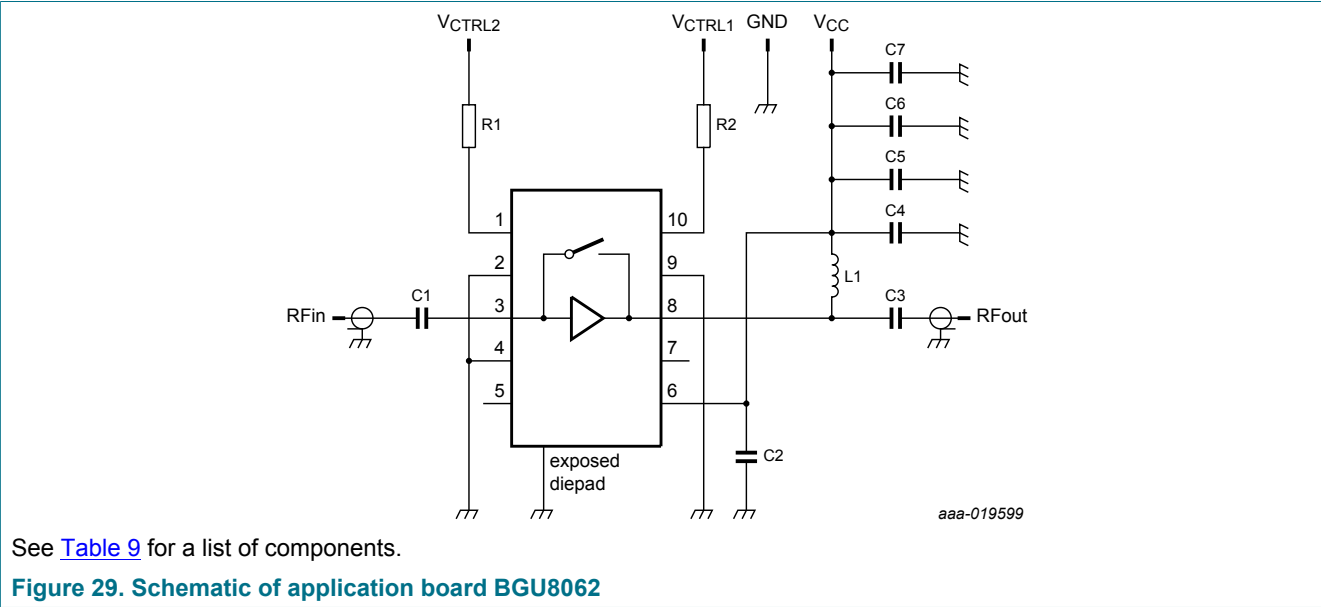


Table 9. List of components

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 µF | |
| L1 | inductor | 15 nH | |
| R1, R2 | resistor | 1 kΩ | |

13 Package outline

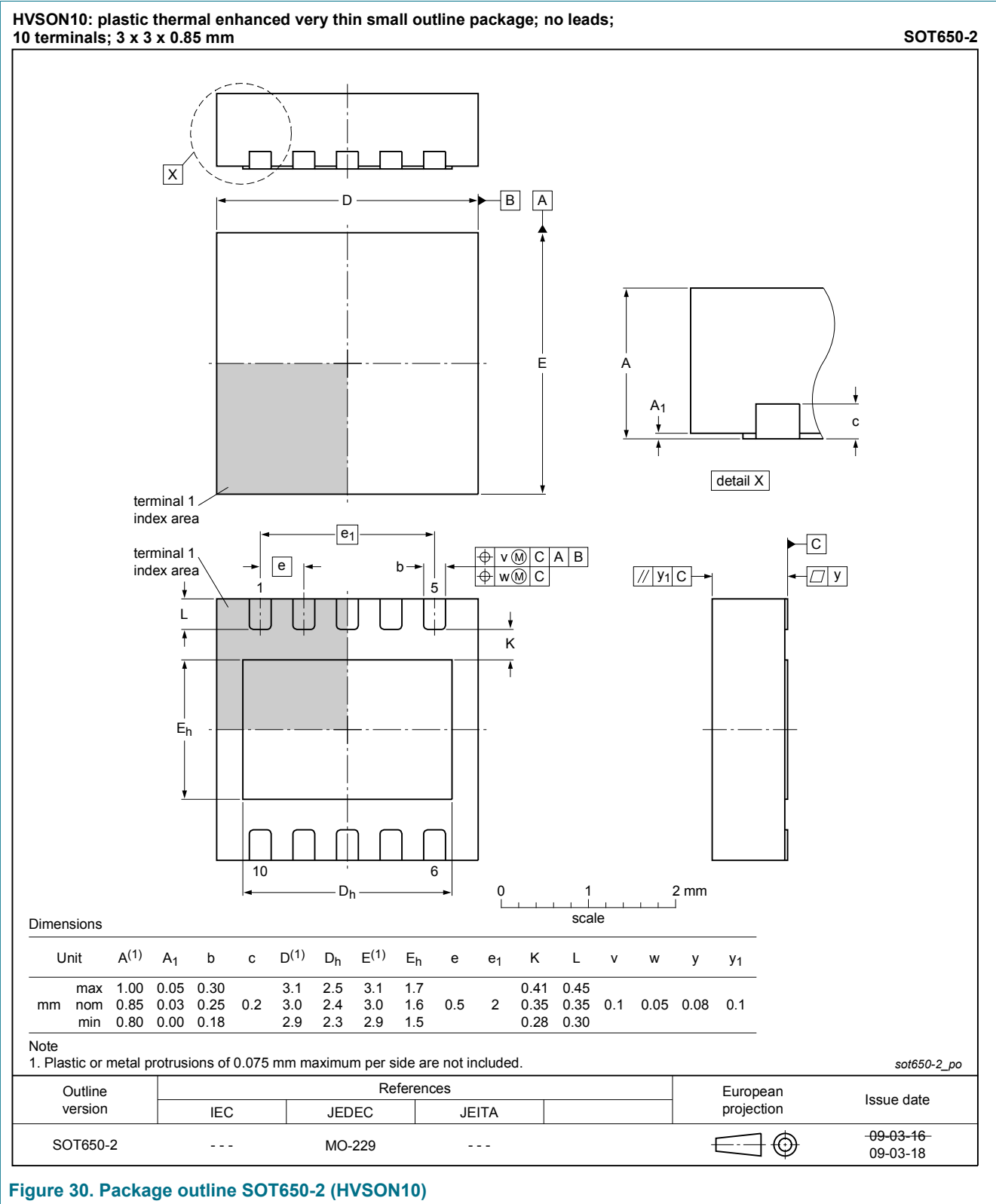


Figure 30. Package outline SOT650-2 (HVSON10)

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">Table 1 added: Min value to $IP3_o$added BTS3001M according to our new naming convention | | | |
| BGU8062 v.1 | 20150909 | Product data sheet | - | - |

16 Legal information

16.1 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>.

16.2 Definitions

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