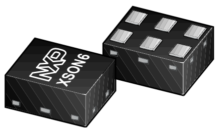


# BGU8009

## SiGe:C low-noise amplifier MMIC for GPS, GLONASS, Galileo and COMPASS and LTE B32

Rev. 7 — 20 July 2017 Product data sheet

## 1 General description

The BGU8009 is, also known as the GPS1201M, a Low-Noise Amplifier (LNA) for GNSS receiver and LTE Band 32 down link applications, available in a small plastic 6-pin extremely thin leadless package. The BGU8009 requires one external matching inductor and one external decoupling capacitor.

The BGU8009 adapts itself to the changing environment resulting from co-habitation of different radio systems in modern cellular handsets. It has been designed for low power consumption and optimal performance when jamming signals from co-existing cellular transmitters are present. At low jamming power levels, it delivers 18 dB gain at a noise figure of 0.65 dB. During high jamming power levels, resulting for example from a cellular transmit burst, it temporarily increases its bias current to improve sensitivity.

## 2 Features and benefits

- Covers full GNSS L1 band, from 1559 MHz to 1610 MHz and LTE band 32 from 1452 MHz to 1496 MHz
- GNSS:
  - Noise figure = 0.65 dB
  - Gain 18 dB
  - High input 1 dB compression point of -7 dBm
  - High out of band $IP3_i$ of 6 dBm
- LTE B32:
  - Noise figure = 0.65 dB
  - Gain 20 dB
  - High input 1 dB compression point of -8.5 dBm
- Supply voltage 1.5 V to 3.1 V
- Optimized performance at low supply current of 4.2 mA
- Power-down mode current consumption < 1 μA
- Integrated temperature stabilized bias for easy design
- Requires only one input matching inductor and one supply decoupling capacitor
- Input and output DC decoupled
- ESD protection on all pins (HBM > 2 kV)
- Integrated matching for the output
- Available in a 6-pins leadless package 1.1 mm × 0.9 mm × 0.47 mm; 0.4 mm pitch: SOT1230
- 180 GHz transit frequency - SiGe:C technology
- Moisture sensitivity level 1

## 3 Applications

- Smart phones
- Feature phones
- Tablets
- Digital still cameras
- Digital video cameras
- RF front-end modules
- Complete GNSS modules
- Personal health applications

## 4 Quick reference data

**Table 1. Quick reference data GNSS band L1**

*f = 1575 MHz; $V_{CC}$ = 2.85 V; $P_i$ < -40 dBm; $T_{amb}$ = 25 °C; input matched to 50 Ω using a 5.6 nH inductor, see Figure 34, unless otherwise specified.*

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{CC}$ | supply voltage | | 1.5 | - | 3.1 | V |
| $I_{CC}$ | supply current | $V_{I(ENABLE)}$ ≥ 0.8 V | | | | |
| | | • $P_i$ < -40 dBm | 2.6 | 4.4 | 6.5 | mA |
| | | • $P_i$ = -20 dBm | - | 9 | - | mA |
| $G_p$ | power gain | $P_i$ < -40 dBm | 16 | 17.8 | 20 | dB |
| | | $P_i$ = -20 dBm | - | 20.0 | - | dB |
| NF | noise figure | $P_i$ < -40 dBm [1] | - | 0.65 | 1.2 | dB |
| | | $P_i$ < -40 dBm [1] | - | 0.70 | 1.25 | dB |
| $P_{i(1dB)}$ | input power at 1 dB gain compression | $V_{CC}$ = 1.8 V | - | -10 | - | dBm |
| | | $V_{CC}$ = 2.85 V | -12.5 | -7 | - | dBm |
| $IP3_i$ | input third-order intercept point | $V_{CC}$ = 1.8 V [2] | - | 3 | - | dBm |
| | | $V_{CC}$ = 2.85 V [2] | - | 6 | - | dBm |

[1] PCB losses are subtracted.
[2] $f_1$ = 1713 MHz; $f_2$ = 1851 MHz; $P_i$ = -20 dBm per carrier.

**Table 2. Quick reference data LTE B32**

*f = 1474 MHz; $V_{CC}$ = 2.8 V; $P_i$ = -30 dBm; $T_{amb}$ = 25 °C; input matched to 50 Ω using a 9.1 nH inductor, see Figure 34, unless otherwise specified.*

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{CC}$ | supply voltage | | 1.5 | - | 3.1 | V |
| $I_{CC}$ | supply current | $V_{I(ENABLE)}$ ≥ 0.8 V | | 4.4 | | mA |
| $G_p$ | power gain | | | 20 | | dB |
| NF | noise figure | [1] | - | 0.65 | | dB |
| $P_{i(1dB)}$ | input power at 1 dB gain compression | $V_{CC}$ = 1.8 V | - | -11 | - | dBm |

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| | | $V_{CC}$ = 2.8 V | | -8.5 | - | dBm |
| $IP3_i$ | input third-order intercept point | $V_{CC}$ = 1.8 V [2] | - | -7 | - | dBm |
| | | $V_{CC}$ = 2.8 V [2] | - | -6 | - | dBm |

[1] PCB losses are subtracted.
[2] Δf = 1 MHz; $P_i$ = -30 dBm per carrier.

## 5 Ordering information

**Table 3. Ordering information**

| Type number | Package | | |
|---|---|---|---|
| | Name | Description | Version |
| BGU8009 | XSON6 | plastic very thin small outline package; no leads; 6 terminals;body 1.1 × 0.9 × 0.47 mm | SOT1230 |
| OM7820 | EVB | BGU8009 evaluation board, MMIC only | - |
| OM7824 | EVB | BGU8009 evaluation board, front-end EVB | - |
| OM17066 | EVB | BGU8009 evaluation board for LTE B32 | |

## 6 Marking

**Table 4. Marking codes**

| Type number | Marking code |
|---|---|
| BGU8009 | A |

### 6.1 Marking code description

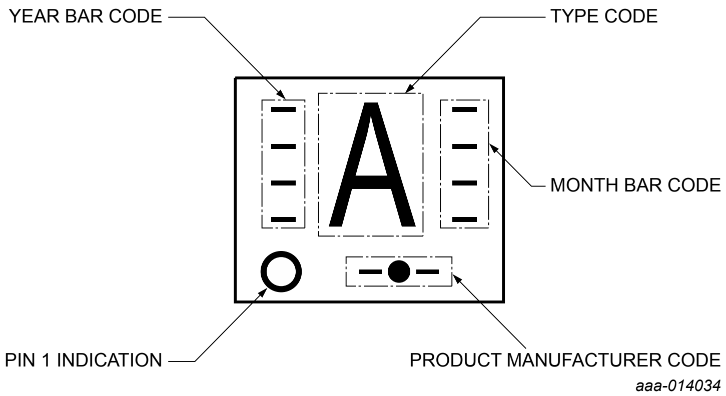



**Figure 1. SOT1230 marking code description example**

# 7 Block diagram

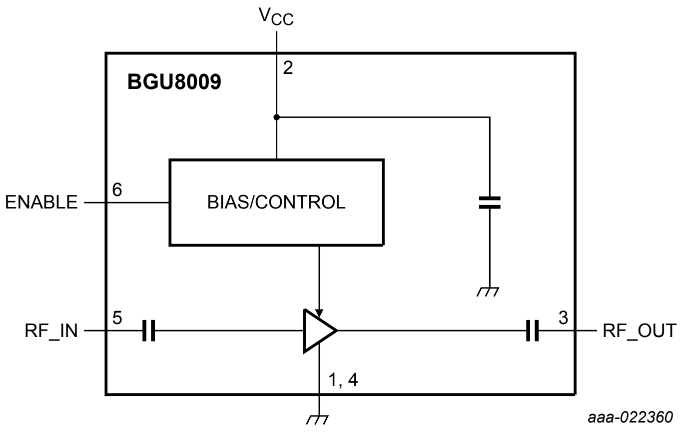



Figure 2. Block diagram

# 8 Pinning information

## 8.1 Pinning

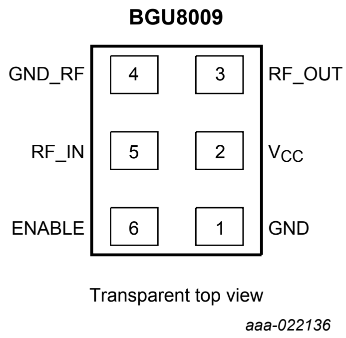



Figure 3. Pin configuration

## 8.2 Pin description

Table 5. Pin description

| Symbol | Pin | Description |
|---|---|---|
| GND | 1 | ground |
| $V_{CC}$ | 2 | supply voltage |
| RF_OUT | 3 | RF output |
| GND_RF | 4 | RF ground |
| RF_IN | 5 | RF input |
| ENABLE | 6 | enable |

# 9 Limiting values

**Table 6. Limiting values**

*In accordance with the Absolute Maximum Rating System (IEC 60134). Absolute Maximum Ratings are given as Limiting Values of stress conditions during operation, that must not be exceeded under the worst probable conditions.*

| Symbol | Parameter | Conditions | Min | Max | Unit |
|---|---|---|---|---|---|
| $V_{CC}$ | supply voltage | [1] | -0.5 | +5.0 | V |
| $V_{I(ENABLE)}$ | input voltage on pin ENABLE | $V_{I(ENABLE)} < V_{CC} + 0.6$ V [1] [2] | -0.5 | +5.0 | V |
| $V_{I(RF\_IN)}$ | input voltage on pin RF_IN | DC, $V_{I(RF\_IN)} < V_{CC} + 0.6$ V [1] [2] [3] | -0.5 | +5.0 | V |
| $V_{I(RF\_OUT)}$ | input voltage on pin RF_OUT | DC, $V_{I(RF\_OUT)} < V_{CC} + 0.6$ V [1] [2] [3] | -0.5 | +5.0 | V |
| $P_i$ | input power | 1575 MHz [1] | - | 10 | dBm |
| | | 1474 MHz [1] | - | 10 | dBm |
| $P_{tot}$ | total power dissipation | $T_{sp} \leq 130$ °C | - | 55 | mW |
| $T_{stg}$ | storage temperature | | -65 | +150 | °C |
| $T_j$ | junction temperature | | - | 150 | °C |
| $V_{ESD}$ | electrostatic discharge voltage | Human Body Model (HBM) according to JEDEC standard JS-001-2010 | - | ±2 | kV |
| | | Charged Device Model (CDM) according to JEDEC standard JESD22-C101C | - | ±1 | kV |

[1] Stressed with pulses of 200 ms in duration, with application circuit as in Figure 34.

[2] Warning: due to internal ESD diode protection, the applied DC voltage shall not exceed $V_{CC}$ + 0.6 V and shall not exceed 5.0 V to avoid excess current.

[3] The RF input and RF output are AC coupled through internal DC blocking capacitors.

# 10 Recommended operating conditions

**Table 7. Operating conditions**

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{CC}$ | supply voltage | | 1.5 | - | 3.1 | V |
| $T_{amb}$ | ambient temperature | | -40 | +25 | +85 | °C |
| $V_{I(ENABLE)}$ | input voltage on pin ENABLE | OFF state | - | - | 0.3 | V |
| | | ON state | 0.8 | - | - | V |

# 11 Thermal characteristics

**Table 8. Thermal characteristics**

| Symbol | Parameter | Conditions | Typ | Unit |
|---|---|---|---|---|
| $R_{th(j-sp)}$ | thermal resistance from junction to solder point | | 225 | K/W |

# 12 Characteristics GNSS band L1

**Table 9. Characteristics at $V_{CC}$ = 1.8 V**

*f = 1575 MHz; $V_{CC}$ = 1.8 V; $V_{I(ENABLE)}$ >= 0.8 V; $P_i$ < -40 dBm; $T_{amb}$ = 25 °C; input matched to 50 Ω using a 5.6 nH inductor, see Figure 34, unless otherwise specified.*

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $I_{CC}$ | supply current | $V_{I(ENABLE)}$ ≥ 0.8 V | | | | |
| | | $P_i$ < -40 dBm | 2.3 | 4.2 | 6.2 | mA |
| | | $P_i$ = -20 dBm | - | 9 | - | mA |
| | | $V_{I(ENABLE)}$ ≤ 0.3 V | - | - | 1 | μA |
| $G_p$ | power gain | no jammer | 16 | 17.6 | 20 | dB |
| | | $P_{jam}$ = -20 dBm; $f_{jam}$ = 850 MHz | - | 19.8 | - | dB |
| | | $P_{jam}$ = -20 dBm; $f_{jam}$ = 1850 MHz | - | 20.0 | - | dB |
| $RL_{in}$ | input return loss | $P_i$ < -40 dBm | - | 9 | - | dB |
| | | $P_i$ = -20 dBm | - | 11 | - | dB |
| $RL_{out}$ | output return loss | $P_i$ < -40 dBm | - | 15 | - | dB |
| | | $P_i$ = -20 dBm | - | 15 | - | dB |
| ISL | isolation | | - | 37 | - | dB |
| NF | noise figure | $P_i$ = -40 dBm; no jammer [1] | - | 0.65 | 1.2 | dB |
| | | $P_i$ = -40 dBm; no jammer [2] [1] | - | 0.70 | 1.25 | dB |
| | | $P_{jam}$ = -20 dBm; $f_{jam}$ = 850 MHz [2] | - | 0.9 | - | dB |
| | | $P_{jam}$ = -20 dBm; $f_{jam}$ = 1850 MHz [2] | - | 1.2 | - | dB |
| $P_{i(1dB)}$ | input power at 1 dB gain compression | [1] | - | -10 | - | dBm |
| $IP3_i$ | input third-order intercept point | [1] [3] | - | 3 | - | dBm |
| | | [1] [4] | - | 3 | - | dBm |
| $t_{on}$ | turn-on time | time from $V_{I(ENABLE)}$ ON to 90 % of the gain | - | - | 2 | μs |
| $t_{off}$ | turn-off time | time from $V_{I(ENABLE)}$ OFF to 10 % of the gain | - | - | 1 | μs |

[1] Guaranteed by device design; not tested in production.
[2] Including PCB losses.
[3] $f_1$ = 1713 MHz; $f_2$ = 1851 MHz, $P_i$ = -20 dBm per carrier.
[4] $f_1$ = 1713 MHz; $f_2$ = 1851 MHz, $P_{i(1)}$ = -20 dBm, $P_{i(2)}$ = -65 dBm.

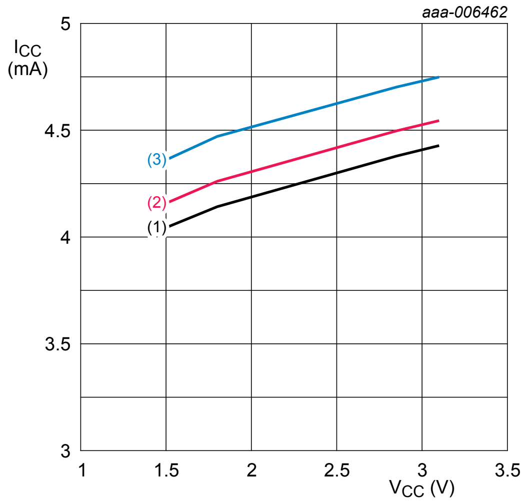
**Table 10. Characteristics at Vcc = 2.85 V**

*f = 1575 MHz; $V_{CC}$ = 2.85 V; $V_{I(ENABLE)}$ >= 0.8 V; $P_i$ < -40 dBm; $T_{amb}$ = 25 °C; input matched to 50 Ω using a 5.6 nH inductor,see Figure 34, unless otherwise specified.*

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $I_{CC}$ | supply current | $V_{I(ENABLE)} \geq 0.8$ V | | | | |
| | | • $P_i$ < -40 dBm | 2.6 | 4.4 | 6.5 | mA |
| | | • $P_i$ = -20 dBm | - | 9 | - | mA |
| | | $V_{I(ENABLE)} \leq 0.3$ V | - | - | 1 | μA |
| $G_p$ | power gain | no jammer | 16 | 17.8 | 20 | dB |
| | | • $P_{jam}$ = -20 dBm; $f_{jam}$ = 850 MHz | - | 20.0 | - | dB |
| | | • $P_{jam}$ = -20 dBm; $f_{jam}$ = 1850 MHz | - | 20.2 | - | dB |
| $RL_{in}$ | input return loss | $P_i$ < -40 dBm | - | 9 | - | dB |
| | | $P_i$ = -20 dBm | - | 11 | - | dB |
| $RL_{out}$ | output return loss | $P_i$ < -40 dBm | - | 15 | - | dB |
| | | $P_i$ = -20 dBm | - | 15 | - | dB |
| ISL | isolation | | - | 37 | - | dB |
| NF | noise figure | $P_i$ = -40 dBm; no jammer [1] | - | 0.65 | 1.2 | dB |
| | | $P_i$ = -40 dBm; no jammer [2] [1] | - | 0.70 | 1.25 | dB |
| | | $P_{jam}$ = -20 dBm; $f_{jam}$ = 850 MHz [2] | - | 0.9 | - | dB |
| | | $P_{jam}$ = -20 dBm; $f_{jam}$ = 1850 MHz [2] | - | 1.2 | - | dB |
| $P_{i(1dB)}$ | input power at 1 dB gain compression | [1] | -12.5 | -7 | - | dBm |
| $IP3_i$ | input third-order intercept point | [1] [3] | 0 | 6 | - | dBm |
| | | [1] [4] | 0 | 6 | - | dBm |
| $t_{on}$ | turn-on time | time from $V_{I(ENABLE)}$ ON to 90 % of the gain | - | - | 2 | μs |
| $t_{off}$ | turn-off time | time from $V_{I(ENABLE)}$ OFF to 10 % of the gain | - | - | 1 | μs |

[1] Guaranteed by device design; not tested in production.
[2] Including PCB losses.
[3] $f_1$ = 1713 MHz; $f_2$ = 1851 MHz, $P_i$ = -20 dBm per carrier.
[4] $f_1$ = 1713 MHz; $f_2$ = 1851 MHz, $P_{i(1)}$ = -20 dBm, $P_{i(2)}$ = -65 dBm.

## 13 Graphs GNSS band L1



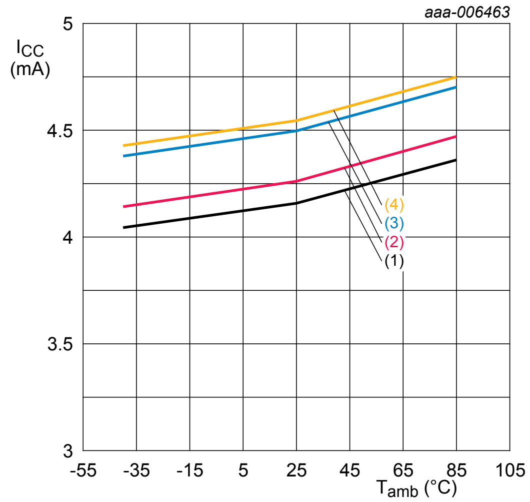

$P_i$ = -45 dBm.

(1) $T_{amb}$ = -40°C

(2) $T_{amb}$ = +25°C

(3) $T_{amb}$ = +85°C

**Figure 4. Supply current as a function of supply voltage; typical values**




$P_i$ = -45 dBm.

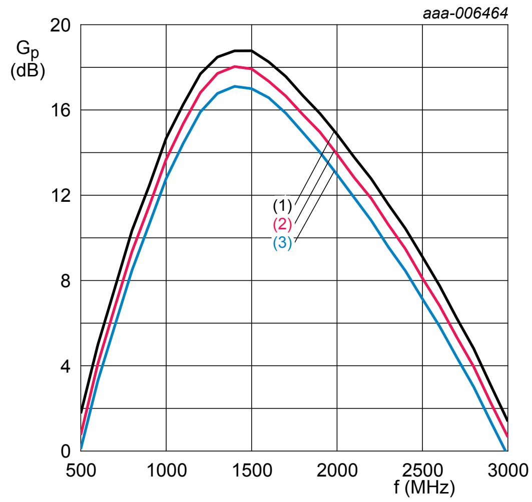
(1) $V_{CC}$ = 1.5 V

(2) $V_{CC}$ = 1.8 V

(3) $V_{CC}$ = 2.85 V

(4) $V_{CC}$ = 3.1 V

**Figure 5. Supply current as a function of ambient temperature; typical values**



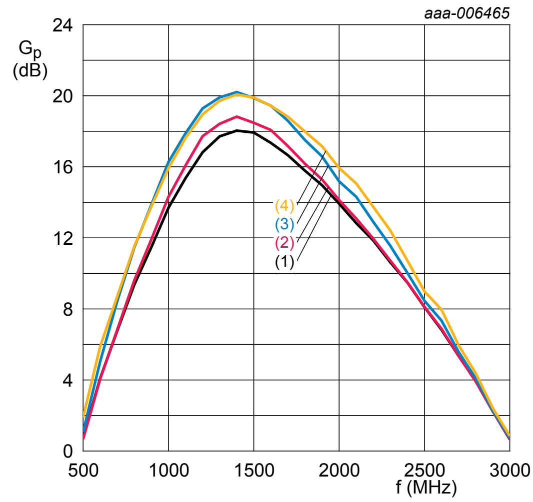

$P_i$ = -45 dBm; $V_{CC}$ = 1.8 V.

(1) $T_{amb}$ = -40°C

(2) $T_{amb}$ = +25°C

(3) $T_{amb}$ = +85°C

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




$T_{amb}$ = 25°C; $V_{CC}$ = 1.8 V.

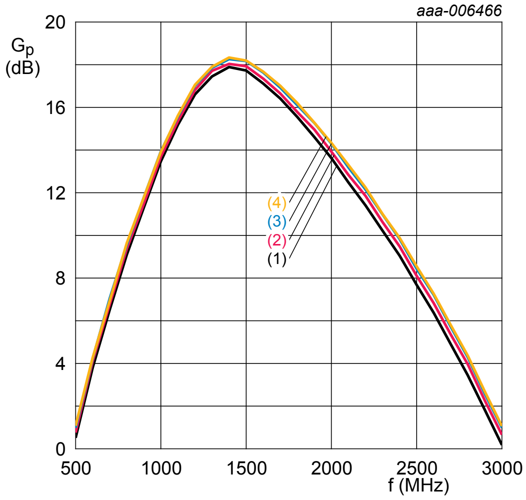
(1) $P_i$ = -45 dBm

(2) $P_i$ = -30 dBm

(3) $P_i$ =- 20 dBm

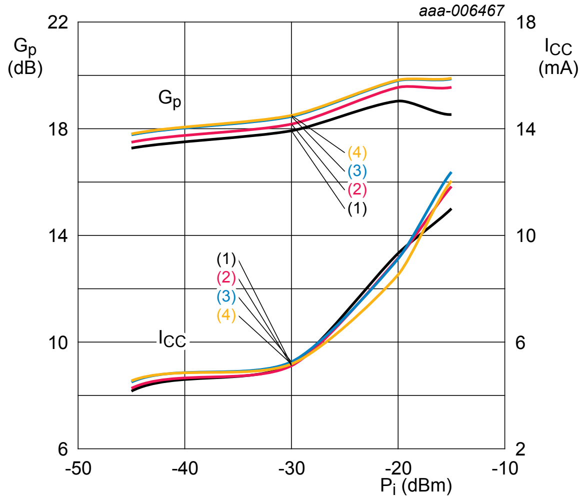
(4) $P_i$ = -15 dBm

**Figure 7. Power gain as a function of frequency; typical values**



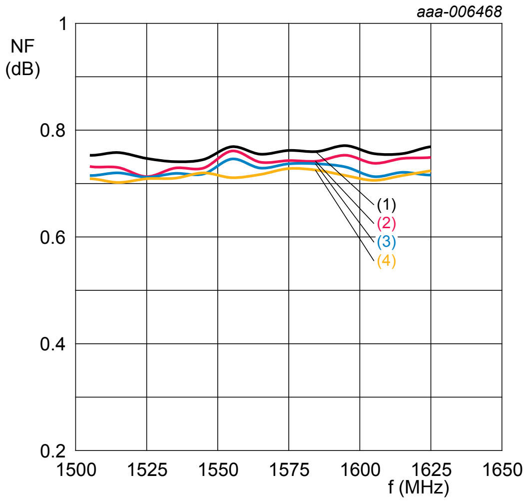

$P_i$ = -45 dBm; $T_{amb}$ = 25°C.
(1) $V_{CC}$ = 1.5 V
(2) $V_{CC}$ = 1.8 V
(3) $V_{CC}$ = 2.85 V
(4) $V_{CC}$ = 3.1 V

**Figure 8. Power gain as a function of frequency; typical values**



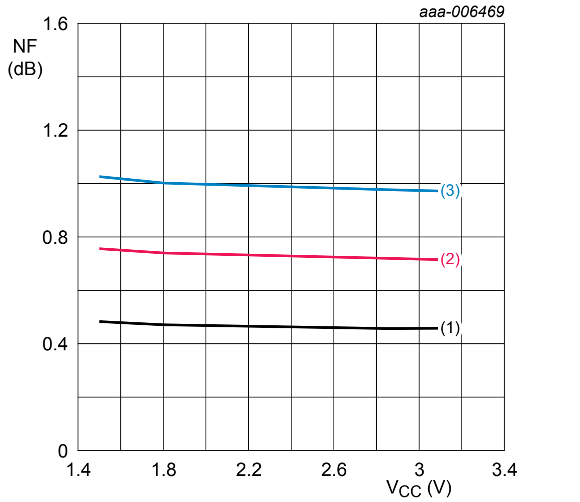

f = 1575 MHz; $T_{amb}$= 25°C.
(1) $V_{CC}$ = 1.5 V
(2) $V_{CC}$ = 1.8 V
(3) $V_{CC}$ = 2.85 V
(4) $V_{CC}$ = 3.1 V

**Figure 9. Power gain and supply current as function of input power; typical values**



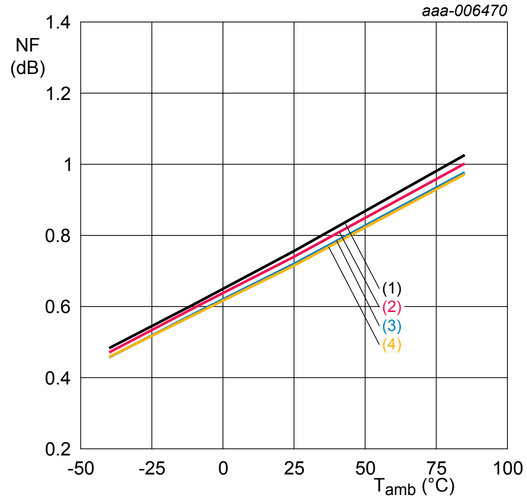

$T_{amb}$ = 25°C; no jammer, including PCB losses.
(1) $V_{CC}$ = 1.5 V
(2) $V_{CC}$ = 1.8 V
(3) $V_{CC}$ = 2.85 V
(4) $V_{CC}$ = 3.1 V

**Figure 10. Noise figure as a function of frequency; typical values**




f = 1575 MHz; no jammer, including PCB losses.
(1) $T_{amb}$ = -40°C
(2) $T_{amb}$ = +25°C
(3) $T_{amb}$ = +85°C

**Figure 11. Noise figure as a function of supply voltage; typical values**




f = 1575 MHz; no jammer, including PCB losses.

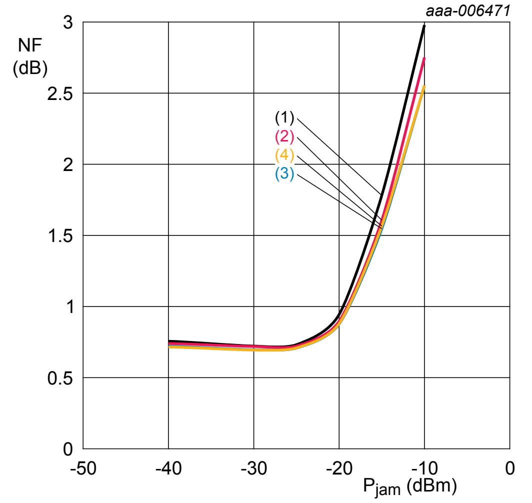
(1) $V_{CC}$ = 1.5 V

(2) $V_{CC}$ = 1.8 V

(3) $V_{CC}$ = 2.85 V

(4) $V_{CC}$ = 3.1 V

**Figure 12. Noise figure as a function of ambient temperature; typical values**




$f_{jam}$ = 850 MHz; $T_{amb}$= 25°C; f = 1575 MHz; including PCB losses.

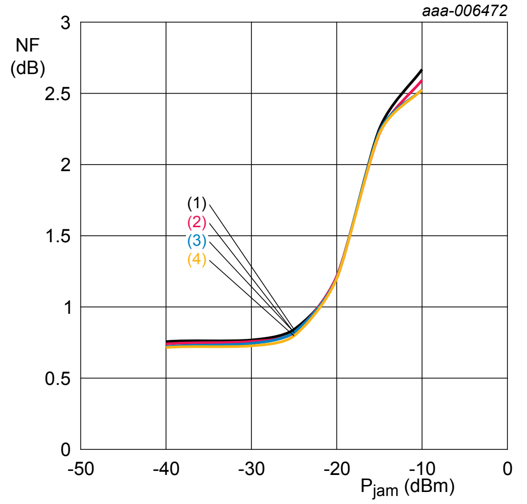
(1) $V_{CC}$ = 1.5 V

(2) $V_{CC}$ = 1.8 V

(3) $V_{CC}$ = 2.85 V

(4) $V_{CC}$ = 3.1 V

**Figure 13. Noise figure as a function of jamming power; typical values**




$f_{jam}$ = 1850 MHz; $T_{amb}$= 25°C; f = 1575 MHz; including PCB losses.

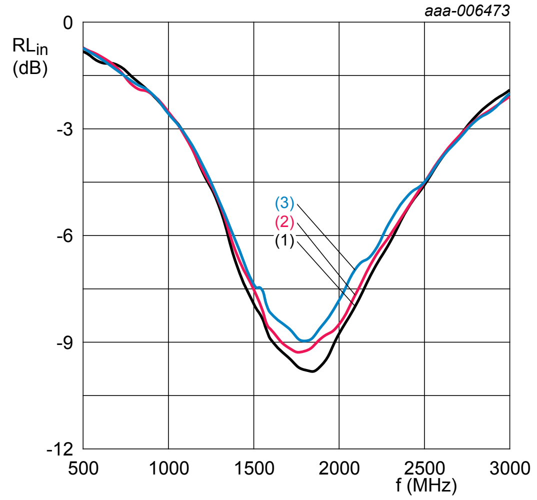
(1) $V_{CC}$ = 1.5 V

(2) $V_{CC}$ = 1.8 V

(3) $V_{CC}$ = 2.85 V

(4) $V_{CC}$ = 3.1 V

**Figure 14. Noise figure as a function of jamming power; typical values**



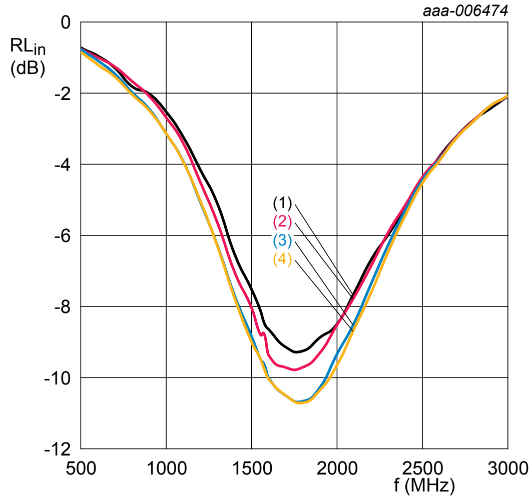

$P_i$ = -45 dBm; $V_{CC}$= 1.8 V.

(1) $T_{amb}$ = -40°C

(2) $T_{amb}$ = +25°C

(3) $T_{amb}$ = +85°C

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




$T_{amb}$ = 25°C; $V_{CC}$= 1.8 V.

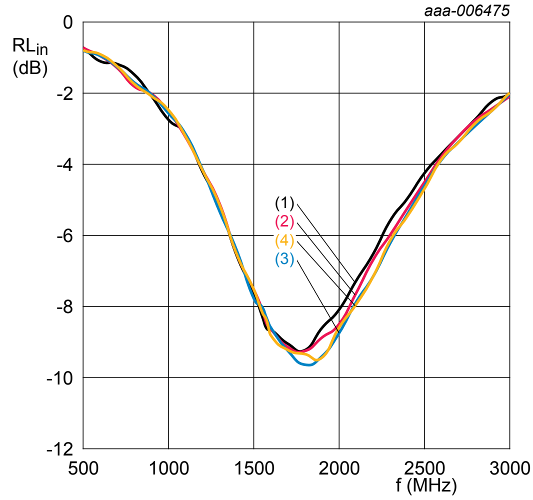
(1) $P_i$ = -45 dBm

(2) $P_i$ = -30 dBm

(3) $P_i$ = -20 dBm

(4) $P_i$ = -15 dBm

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




$P_i$ = -45 dBm; $T_{amb}$= 25°C.

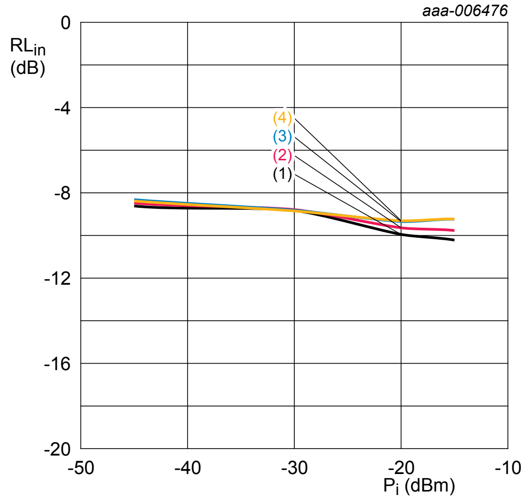
(1) $V_{CC}$ = 1.5 V

(2) $V_{CC}$ = 1.8 V

(3) $V_{CC}$ = 2.85 V

(4) $V_{CC}$ = 3.1 V

**Figure 17. Input return loss as a function of frequency; typical values**




f = 1575 MHz; $T_{amb}$ = 25°C.

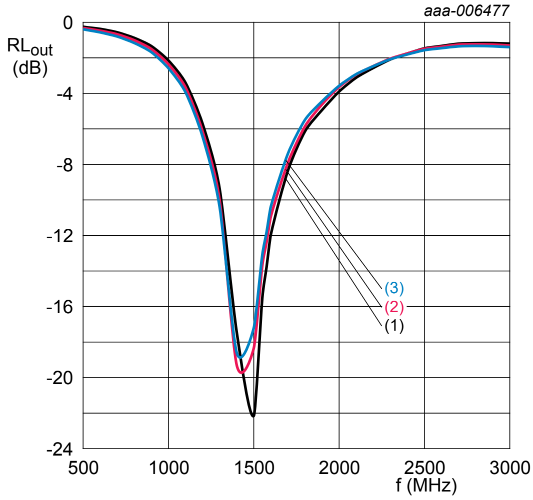
(1) $V_{CC}$ = 1.5 V

(2) $V_{CC}$ = 1.8 V

(3) $V_{CC}$ = 2.85 V

(4) $V_{CC}$ = 3.1 V

**Figure 18. Input return loss as a function of input power; typical values**



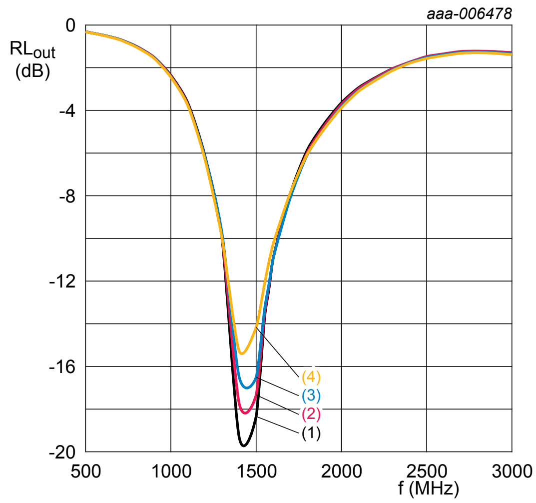

$P_i$ = -45 dBm; $V_{CC}$ = 1.8 V.

(1) $T_{amb}$ = -40°C

(2) $T_{amb}$ = +25°C

(3) $T_{amb}$ = +85°C

**Figure 19. Output return loss as a function of frequency; typical values**




$T_{amb}$ = 25°C; $V_{CC}$ = 1.8 V.

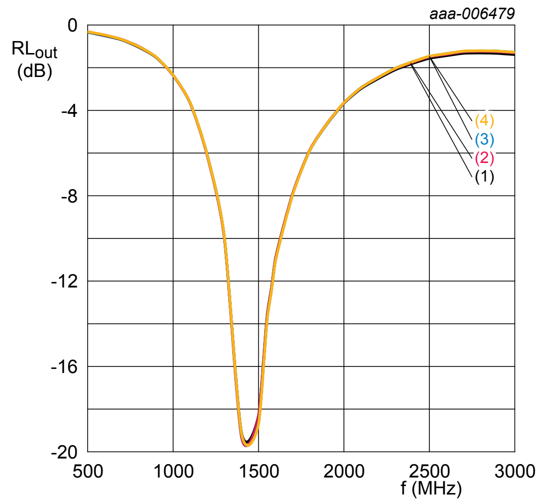
(1) $P_i$ = -45 dBm

(2) $P_i$ = -30 dBm

(3) $P_i$ = -20 dBm

(4) $P_i$ = -15 dBm

**Figure 20. Output return loss as a function of frequency; typical values**




$P_i$= -45 dBm; $T_{amb}$ = 25°C.

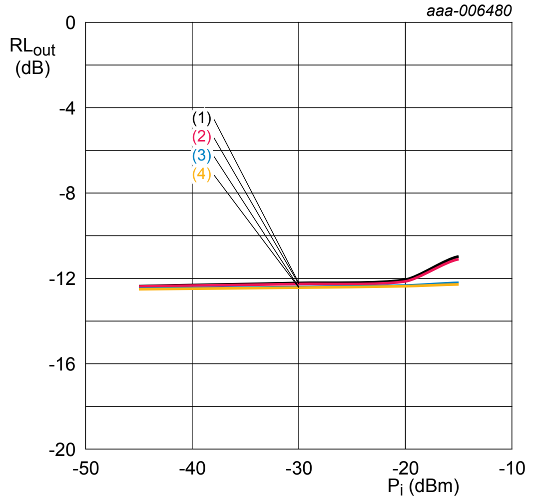
(1) $V_{CC}$ = 1.5 V

(2) $V_{CC}$ = 1.8 V

(3) $V_{CC}$ = 2.85 V

(4) $V_{CC}$ = 3.1 V

**Figure 21. Output return loss as a function of frequency; typical values**




f = 1575 MHz; $T_{amb}$ = 25°C.

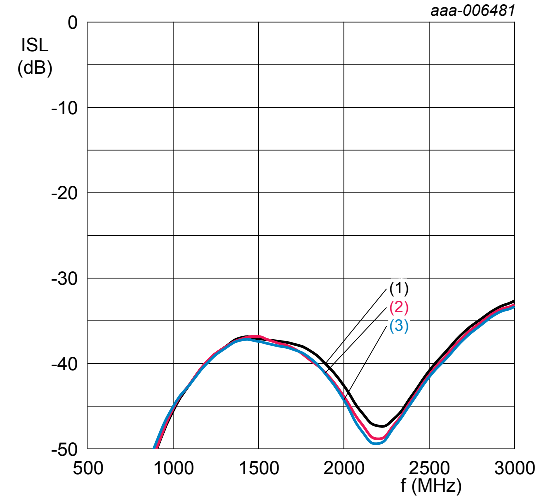
(1) $V_{CC}$ = 1.5 V

(2) $V_{CC}$ = 1.8 V

(3) $V_{CC}$ = 2.85 V

(4) $V_{CC}$ = 3.1 V

**Figure 22. Output return loss as a function of input power; typical values**



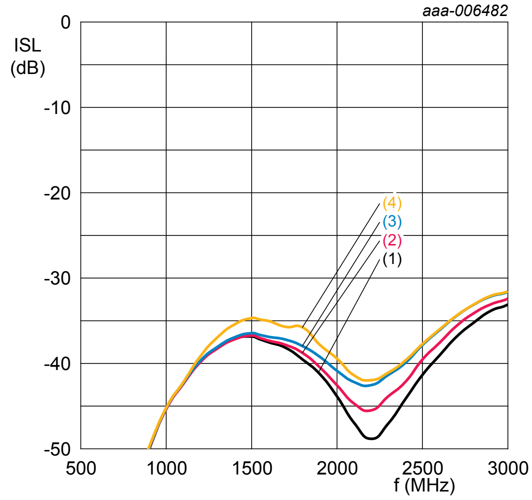

$P_i$ = -45 dBm; $V_{CC}$ = 1.8 V.

(1) $T_{amb}$ = -40°C

(2) $T_{amb}$ = +25°C

(3) $T_{amb}$ = +85°C

**Figure 23. Isolation as a function of frequency; typical values**




$T_{amb}$ = 25°C; $V_{CC}$ = 1.8 V.

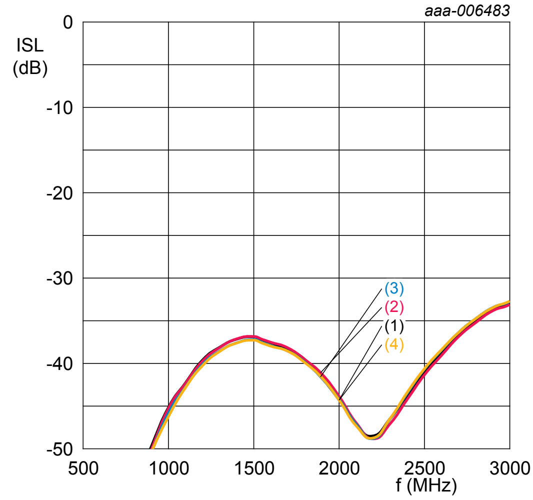
(1) $P_i$ = -45 dBm

(2) $P_i$ = -30 dBm

(3) $P_i$ = -20 dBm

(4) $P_i$ = -15 dBm

**Figure 24. Isolation as a function of frequency; typical values**




$P_i$ = -45 dBm; $T_{amb}$ = 25°C.

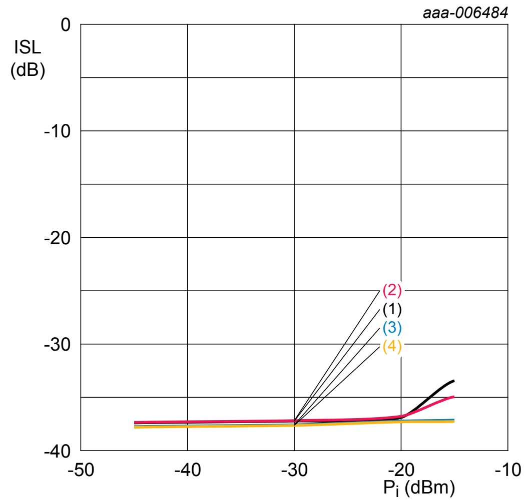
(1) $V_{CC}$ = 1.5 V

(2) $V_{CC}$ = 1.8 V

(3) $V_{CC}$ = 2.85 V

(4) $V_{CC}$ = 3.1 V

**Figure 25. Isolation as a function of frequency; typical values**




f = 1575 MHz; $T_{amb}$ = 25°C.

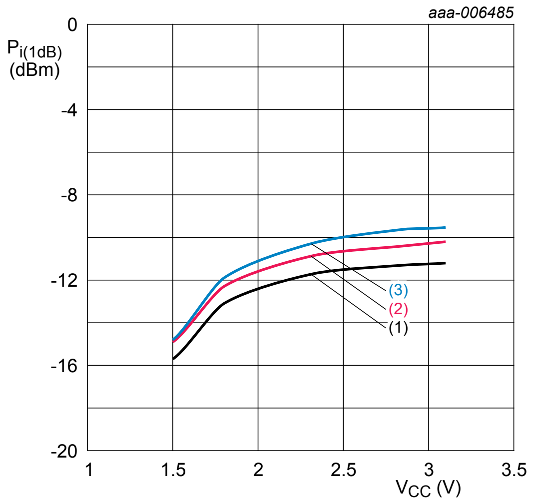
(1) $V_{CC}$ = 1.5 V

(2) $V_{CC}$ = 1.8 V

(3 )$V_{CC}$ = 2.85 V

(4 )$V_{CC}$ = 3.1 V

**Figure 26. Isolation as a function of input power; typical values**



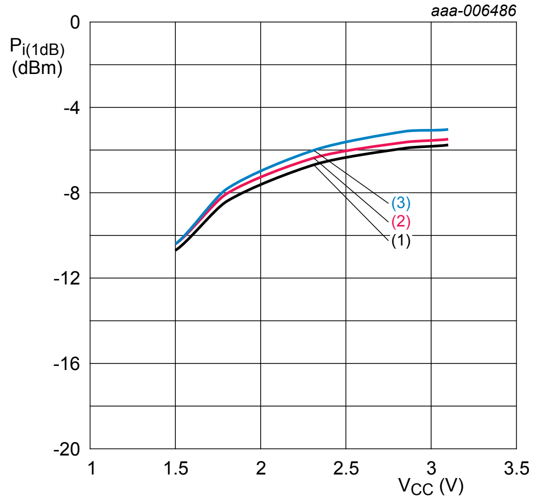

f = 850 MHz.

(1) $T_{amb}$ = -40°C

(2) $T_{amb}$ = +25°C

(3) $T_{amb}$ = +85°C

**Figure 27. Input power at 1 dB gain compression as a function of supply voltage; typical values**



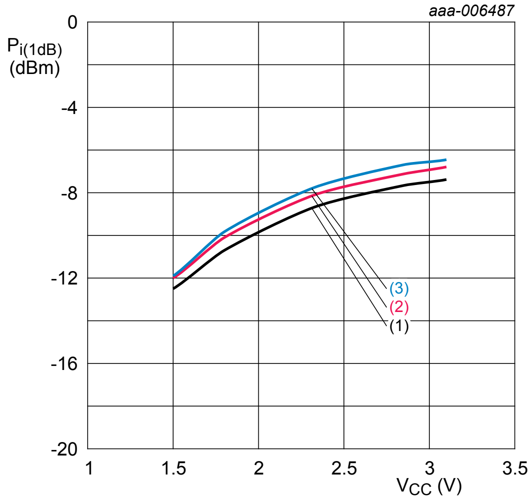

f = 1850 MHz.

(1) $T_{amb}$ = -40°C

(2) $T_{amb}$ = +25°C

(3) $T_{amb}$= +85°C

**Figure 28. Input power at 1 dB gain compression as a function of supply voltage; typical values**



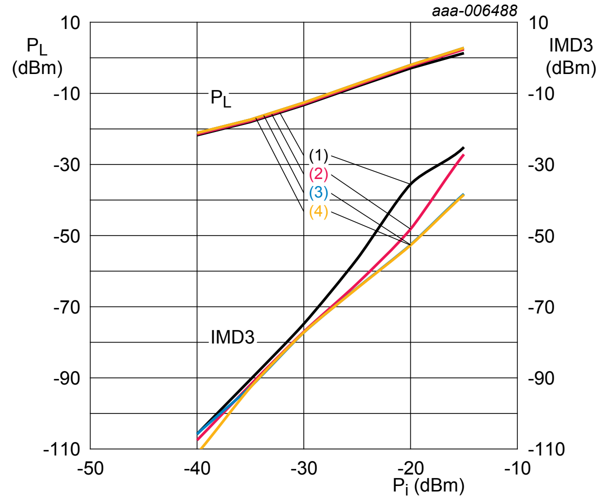

f = 1575 MHz.

(1) $T_{amb}$ = -40°C

(2) $T_{amb}$ = +25°C

(3) $T_{amb}$ = +85°C

**Figure 29. Input power at 1 dB gain compression as a function of supply voltage; typical values**




$T_{amb}$ = 25°C; f = 1575 MHz; $f_1$ = 1713 MHz; $f_2$ = 1851 MHz; $P_i$ per carrier.

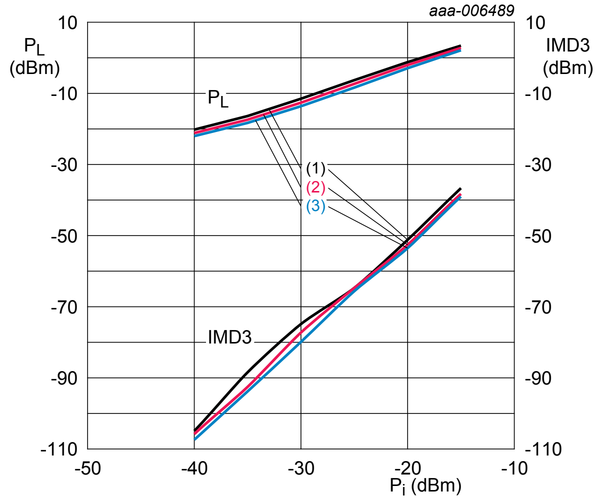
(1) $V_{CC}$ = 1.5 V

(2) $V_{CC}$ = 1.8 V

(3) $V_{CC}$ = 2.85 V

(4) $V_{CC}$ = 3.1 V

**Figure 30. Output power and third order intermodulation distortion as function of input power; typical values**



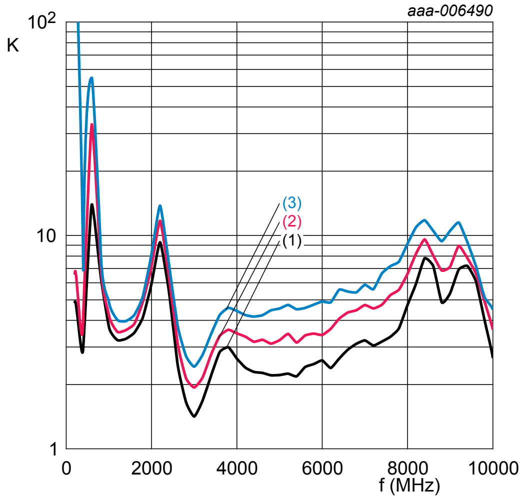

$V_{CC}$ = 2.85 V; f = 1575 MHz; $f_1$ = 1713 MHz; $f_2$ = 1851 MHz; $P_i$ per carrier.

(1) $T_{amb}$ = - 40°C

(2) $T_{amb}$ = +25°C

(3) $T_{amb}$ = +85°C

**Figure 31. Output power and third order intermodulation distortion as function of input power; typical values**



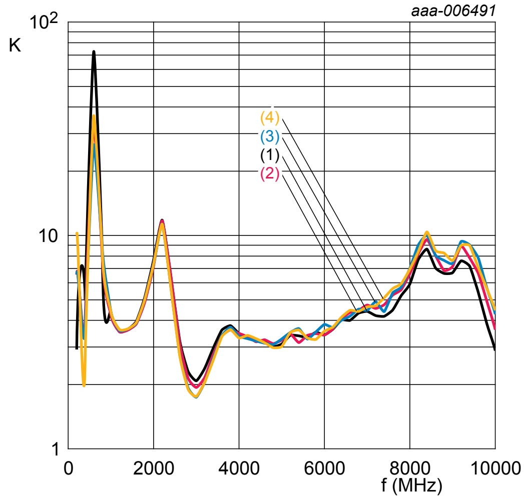

$V_{CC}$ = 1.8 V; $P_i$ = -45 dBm.

(1) $T_{amb}$ = -40°C

(2) $T_{amb}$ = +25°C

(3) $T_{amb}$ = +85°C

**Figure 32. Rollett stability factor as a function of frequency; typical values**




$T_{amb}$ = 25°C; $P_i$ = -45 dBm.

(1) $V_{CC}$ = 1.5 V

(2) $V_{CC}$ = 1.8 V

(3) $V_{CC}$ = 2.85 V

(4) $V_{CC}$ = 3.1 V

**Figure 33. Rollett stability factor as a function of frequency; typical values**

## 14 Characteristics LTE B32

**Table 11. Characteristics**

*1474 MHz; $V_{CC}$ = 1.8 V; $P_i$ = -30 dBm; $T_{amb}$ = 25 °C; input matched 50 Ω using application diagram from Table 13 and component values as in Figure 34. Unless otherwise specified.*

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Gain Mode | | | | | | |
| $I_{CC}$ | supply current | $V_{I(ENABLE)}$ ≥ 0.8 V | - | 4.4 | | mA |
| $G_p$ | power gain | | - | 20 | - | dB |
| $RL_{in}$ | input return loss | | - | 17.5 | - | dB |
| $RL_{out}$ | output return loss | | - | 23.5 | - | dB |
| ISL | isolation | | - | 36 | - | dB |
| NF | noise figure | [1] [2] | - | 0.65 | - | dBm |
| $P_{i(1dB)}$ | input power at 1 dB gain compression | [2] | - | -11 | - | dBm |
| $IP3_i$ | input third-order intercept point | Δf = 1 MHz, $P_i$ = -30 dBm [2] [3] | - | -7 | - | dBm |
| $t_{on}$ | turn-on time | Time from $V_{I(CTRL)}$ ON to 90 % of the gain | - | - | 2 | μs |
| $t_{off}$ | turn-off time | Time from $V_{I(CTRL)}$ OFF to 10 % of the gain | - | - | 1 | μs |
| K | Rollett stability factor | | 1 | - | - | - |

[1] PCB losses are subtracted.
[2] Guaranteed by device design; not tested in production.
[3] $f_1$= 1474 MHz, $f_2$ = 1475 MHz

**Table 12. Characteristics**

*1474 MHz; $V_{CC}$ =2.8 V; $P_i$ = -30 dBm; $T_{amb}$ = 25 °C; input matched 50 Ω using application diagram from Table 13 and component values as in Figure 34. Unless otherwise specified.*

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Gain Mode | | | | | | |
| $I_{CC}$ | supply current | $V_{I(ENABLE)}$ ≥ 0.8 V | - | 4.6 | | mA |
| $G_p$ | power gain | | - | 20 | - | dB |
| $RL_{in}$ | input return loss | | - | 17.5 | - | dB |
| $RL_{out}$ | output return loss | | - | 23.5 | - | dB |
| ISL | isolation | | - | 36 | - | dB |
| NF | noise figure | [1] [2] | - | 0.65 | - | dB |
| $P_{i(1dB)}$ | input power at 1 dB gain compression | [2] | - | -8.5 | - | dBm |
| $IP3_i$ | input third-order intercept point | Δf = 1 MHz, $P_i$ = - 30 dBm [2] [3] | | -6 | | dBm |

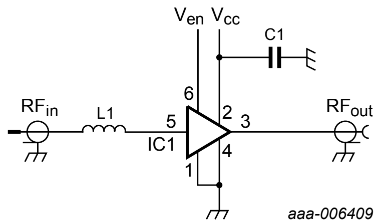
 

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $t_{on}$ | turn-on time | Time from $V_{I(CTRL)}$ ON to 90 % of the gain | - | - | 2 | μs |
| $t_{off}$ | turn-off time | Time from $V_{I(CTRL)}$ OFF to 10 % of the gain | - | - | 1 | μs |
| K | Rollett stability factor | | 1 | - | - | - |

[1] PCB losses are subtracted.
[2] Guaranteed by device design; not tested in production.
[3] $f_1$= 1474 MHz, $f_2$ = 1475 MHz

## 15 Application information

### 15.1 GNSS and LTE B32 LNA




For a list of components, see Table 13 (GNSS) and Table 14 (LTE B32).

**Figure 34. Schematics GNSS LNA and LTE B32 evaluation board**

**Table 13. List of components for GNSS applications**

*See Figure 34 for schematics.*

| Component | Description | Value | Remarks |
|---|---|---|---|
| EVB | Evaluation Board | SOT1230 - EVB | EVB for GNSS application, NXP Semiconductors |
| C1 | decoupling capacitor | 1 nF | |
| IC1 | BGU8009 | - | NXP Semiconductors |
| L1 | high-quality matching inductor | 5.6 nH | GNSS band L1: 1559 < f < 1610 MHz Murata LQW15A |

**Table 14. List of components for LTE B32 applications**

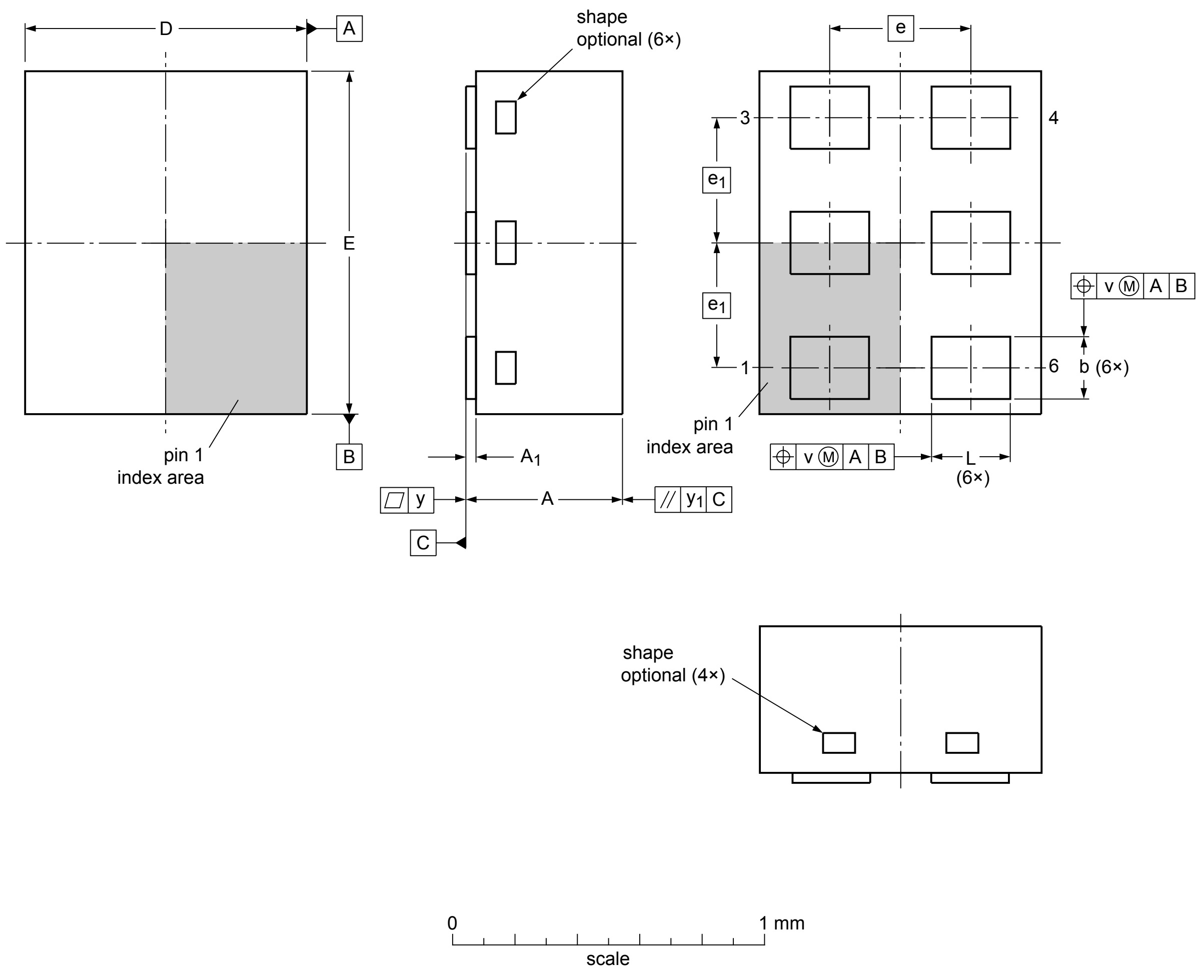
*See Figure 34 for schematics.*

| Component | Description | Value | Remarks |
|---|---|---|---|
| EVB | Evaluation Board | OM17025 (SOT1230, SOT1232) | EVB for LTE application, NXP Semiconductors |
| C1 | decoupling capacitor | 1 nF | |
| IC1 | BGU8009 | - | NXP Semiconductors |
| L1 | high-quality matching inductor | 9.1 nH | LTE band 32 L1: 1452 < f < 1496 MHz Murata LQW15A |

GNSS: See application note AN11288 for details. LTE B32: See application note AN11986.

# 16 Package outline

**XSON6: plastic very thin small outline package; no leads; 6 terminals; body 1.1 x 0.9 x 0.47 mm** **SOT1230**




Dimensions (mm are the original dimensions)

| Unit | | A | $A_1$ | D | E | $e_1$ | e | b | L | v | Y | $Y_1$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | min | 0.44 | | 0.85 | 1.05 | | | 0.17 | 0.22 | | | |
| mm | nom | 0.47 | | 0.90 | 1.10 | 0.4 | 0.45 | 0.20 | 0.25 | 0.1 | 0.05 | 0.1 |
| | max | 0.50 | 0.04 | 0.95 | 1.15 | | | 0.25 | 0.30 | | | |

Note

1. Dimension A is including plating thickness.

*sot1230_po*

| Outline version | References: IEC | References: JEDEC | References: JEITA | | European projection | Issue date |
|---|---|---|---|---|---|---|
| SOT1230 | | | | | | ~~13-01-02~~<br>13-01-08 |

**Figure 35. Package outline SOT1230 (XSON6)**

## 17 Handling information


Figure 36. CAUTION

This device is sensitive to ElectroStatic Discharge (ESD). Observe precautions for handling electrostatic sensitive devices. Such precautions are described in the ANSI/ ESD S20.20, IEC/ST 61340-5, JESD625-A or equivalent standards.

## 18 Abbreviations

Table 15. Abbreviations

| Acronym | Description |
|---|---|
| GLONASS | Global Navigation Satellite System |
| GNSS | Global Navigation Satellite System |
| GPS | Global Positioning System |
| HBM | Human Body Model |
| MMIC | Monolithic Microwave Integrated Circuit |
| PCB | Printed-Circuit Board |
| SiGe:C | Silicon Germanium Carbon |

## 19 Revision history

Table 16. Revision history

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|---|---|---|---|---|
| BGU8009 v.7 | 20170720 | Product data sheet | - | BGU8009 v.6 |
| Modifications: | • Section 1 "General description" on page 1: added GPS1201M according to our new naming convention<br>• Section 2 "Features and benefits" on page 1: added LTE B32 characteristics<br>• Section 14 "Characteristics LTE B32" on page 16 added<br>• Table 13 added EVB | | | |
| BGU8009 v.6 | 20170118 | Product data sheet | - | BGU8009 v.5 |
| Modifications: | • Section 1: added GPS1201M according to our new naming convention | | | |
| BGU8009 v.5 | 20160405 | Product data sheet | - | BGU8009 v.4 |
| Modifications: | • updated Figure 2 "Block diagram" on page 3 | | | |
| BGU8009 v.4 | 20160316 | Product data sheet | - | BGU8009 v.3 |
| Modifications: | • updated Table 8 on page 5 and Table 9 on page 6 | | | |
| BGU8009 v.3 | 20141001 | Product data sheet | - | BGU8009 v.2 |
| Modifications: | • Section 6.1 on page 3: Section has been added. | | | |
| BGU8009 v.2 | 20130619 | Product data sheet | - | BGU8009 v.1 |
| BGU8009 v.1 | 20130201 | Product data sheet | - | - |

# 20 Legal information

## 20.1 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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