
# BGU7004

## SiGe:C Low Noise Amplifier MMIC for GPS, GLONASS, Galileo and Compass

Rev. 3 — 18 January 2017 Product data sheet

# 1. Product profile

## 1.1 General description

The BGU7004 is, also known as the GPS1103M, an AEC-Q100 qualified Low Noise Amplifier (LNA) for GNSS receiver applications in a plastic leadless 6-pin, extremely small SOT886 package. The BGU7004 requires only one external matching inductor and one external decoupling capacitor.

The BGU7004 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 16.5 dB gain at a noise figure of 0.85 dB. During high jamming power levels, resulting for example from a cellular transmit burst, it temporarily increases its bias current to improve sensitivity.

## 1.2 Features and benefits

- AEC-Q100 qualified (see Section 9.1)
- Covers full GNSS L1 band, from 1559 MHz to 1610 MHz
- Noise figure (NF) = 0.85 dB and gain ($G_p$) = 16.5 dB
- High input 1 dB compression point $P_i$ (1dB) of –11 dBm
- High out of band $IP3_i$ of 9 dBm
- Supply voltage 1.5 V to 2.85 V
- Power-down mode current consumption < 1 μA
- Optimized performance at low supply current of 4.5 mA
- Integrated matching for the output
- 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 temperature stabilized bias for easy design
- Small 6-pin leadless package 1 mm × 1.45 mm × 0.5 mm
- 110 GHz transit frequency - SiGe:C technology

## 1.3 Applications

- LNA for GPS, GLONASS, Galileo and Compass (BeiDou) in automotive applications like Toll Collection and Emergency Call.

- LNA for GPS, GLONASS, Galileo and Compass (BeiDou) in smart phones, feature phones, tablet PCs, Personal Navigation Devices, Digital Still Cameras, Digital Video Cameras, RF Front End modules, complete GPS chipset modules and theft protection (laptop, ATM).

### 1.4 Quick reference data

**Table 1. Quick reference data**

*f = 1559 MHz to 1610 MHz; $V_{CC}$ = 1.8 V; $P_i$ < –40 dBm; $T_{amb}$ = 25 °C; input matched to 50 Ω using a 5.6 nH inductor; unless otherwise specified.*

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{CC}$ | supply voltage | RF input AC coupled | 1.5 | - | 2.85 | V |
| $I_{CC}$ | supply current | $V_{ENABLE} \geq 0.8$ V | | | | |
| | | $P_i$ < –40 dBm | 3.2 | 4.5 | 5.7 | mA |
| | | $P_i$ = –20 dBm | 8.1 | 11.6 | 14.4 | mA |
| $G_p$ | power gain | $P_i$ < –40 dBm, no jammer | 14 | 16.5 | 19 | dB |
| | | $P_i$ = –20 dBm, no jammer | 15 | 17.5 | 20 | dB |
| NF | noise figure | $P_i$ < –40 dBm, no jammer [1] | - | 0.85 | 1.2 | dB |
| | | $P_i$ < –40 dBm, no jammer [2] | - | 0.9 | 1.3 | dB |
| | | $P_i$ = –20 dBm, no jammer | - | 1.2 | 1.6 | dB |
| $P_{i(1dB)}$ | input power at 1 dB gain compression | f = 1559 MHz to 1610 MHz | | | | |
| | | $V_{CC}$ = 1.5 V | –15 | –12 | - | dBm |
| | | $V_{CC}$ = 1.8 V | –14 | –11 | - | dBm |
| | | $V_{CC}$ = 2.85 V | –11 | –8 | - | dBm |
| $IP3_i$ | input third-order intercept point | f = 1.575 GHz | | | | |
| | | $V_{CC}$ = 1.5 V [3] | 5 | 8 | - | dBm |
| | | $V_{CC}$ = 1.8 V [3] | 5 | 9 | - | dBm |
| | | $V_{CC}$ = 2.85 V [3] | 5 | 12 | - | dBm |

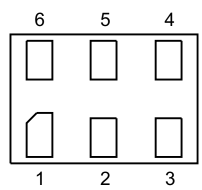
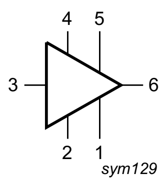
[1] PCB losses are substracted.

[2] Including PCB losses.

[3] $f_1$ = 1713 MHz; $f_2$ = 1851 MHz; $P_1 = P_2$ = –30 dBm.

## 2. Pinning information

**Table 2. Pinning**

| Pin | Description | Simplified outline | Graphic symbol |
|---|---|---|---|
| 1 | GND |   Transparent top view |   |
| 2 | GND | | |
| 3 | RF_IN | | |
| 4 | $V_{CC}$ | | |
| 5 | ENABLE | | |
| 6 | RF_OUT | | |

# 3. Ordering information

**Table 3. Ordering information**

| Type number | Package | | |
|---|---|---|---|
| | Name | Description | Version |
| BGU7004 | XSON6 | plastic extremely thin small outline package; no leads; 6 terminals; body 1 × 1.45 × 0.5 mm | SOT886 |

# 4. Marking

**Table 4. Marking codes**

| Type number | Marking code |
|---|---|
| BGU7004 | UY |

# 5. Limiting values

**Table 5. Limiting values**

*In accordance with the Absolute Maximum Rating System (IEC 60134).*

| Symbol | Parameter | Conditions | | Min | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{CC}$ | supply voltage | RF input AC coupled | | –0.5 | 3.1 | V |
| $V_{ENABLE}$ | voltage on pin ENABLE | $V_{CC} \geq 2.5$ V | | –0.5 | 3.1 | V |
| | | $V_{CC} < 2.5$ V | [2] | –0.5 | $V_{CC}$ + 0.6 | V |
| $V_{RF\_IN}$ | voltage on pin RF_IN | DC | | | | |
| | | $V_{CC} \geq 3.0$ V | [3] | –0.5 | 3.6 | V |
| | | $V_{CC} < 3.0$ V | [2][3] | –0.5 | $V_{CC}$ + 0.6 | V |
| $V_{RF\_OUT}$ | voltage on pin RF_OUT | DC | | | | |
| | | $V_{CC} \geq 1.8$ V | [3] | –0.5 | 3.6 | V |
| | | $V_{CC} < 1.8$ V | [2][3] | –0.5 | $V_{CC}$ + 1.8 | V |
| $P_i$ | input power | | | - | 0 | dBm |
| $P_{tot}$ | total power dissipation | $T_{sp} \leq 130$ °C | [1] | | 55 | mW |
| $T_{stg}$ | storage temperature | | | –65 | 150 | °C |
| $T_j$ | junction temperature | | | - | 150 | °C |

[1] $T_{sp}$ is the temperature at the soldering point of the emitter lead.

[2] Due to internal ESD diode protection, the applied voltage should not exceed the specified maximum in order to avoid excess current.

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

# 6. Thermal characteristics

**Table 6. Thermal characteristics**

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

## 7. Characteristics

**Table 7. Characteristics**
*f = 1559 MHz to 1610 MHz; $V_{CC}$ = 1.8 V; $V_{ENABLE}$ ≥ 0.8 V; $P_i$ < –40 dBm; $T_{amb}$ = 25 °C; input matched to 50 Ω using a 5.6 nH inductor; unless otherwise specified.*

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{CC}$ | supply voltage | RF input AC coupled | 1.5 | - | 2.85 | V |
| $I_{CC}$ | supply current | $V_{ENABLE}$ ≥ 0.8 V | | | | |
| | | $P_i$ < –40 dBm | 3.2 | 4.5 | 5.7 | mA |
| | | $P_i$ = –20 dBm | 8.1 | 11.6 | 14.4 | mA |
| | | $V_{ENABLE}$ ≤ 0.3 V | - | - | 1 | μA |
| $T_{amb}$ | ambient temperature | | –40 | +25 | +125 | °C |
| $G_p$ | power gain | $T_{amb}$ = 25 °C | | | | |
| | | $P_i$ < –40 dBm, no jammer | 14 | 16.5 | 19 | dB |
| | | $P_i$ = –20 dBm, no jammer | 15 | 17.5 | 20 | dB |
| | | $P_{jam}$ = –20 dBm; $f_{jam}$ = 850 MHz | 15 | 17.5 | 20 | dB |
| | | $P_{jam}$ = –20 dBm; $f_{jam}$ = 1850 MHz | 15 | 17.5 | 20 | dB |
| | | –40 °C ≤ $T_{amb}$ ≤ +125 °C | | | | |
| | | $P_i$ < –40 dBm, no jammer | 13 | - | 20 | dB |
| | | $P_i$ = –20 dBm, no jammer | 14 | - | 21 | dB |
| | | $P_{jam}$ = –20 dBm; $f_{jam}$ = 850 MHz | 14 | - | 21 | dB |
| | | $P_{jam}$ = –20 dBm; $f_{jam}$ = 1850 MHz | 14 | - | 21 | dB |
| $RL_{in}$ | input return loss | $P_i$ < –40 dBm | 5 | 8 | - | dB |
| | | $P_i$ = –20 dBm | 6 | 10 | - | dB |
| $RL_{out}$ | output return loss | $P_i$ < –40 dBm | 10 | 20 | - | dB |
| | | $P_i$ = –20 dBm | 10 | 14 | - | dB |
| ISL | isolation | | 20 | 23 | - | dB |
| NF | noise figure | $T_{amb}$ = 25 °C | | | | |
| | | $P_i$ < –40 dBm, no jammer [1] | - | 0.85 | 1.2 | dB |
| | | $P_i$ < –40 dBm, no jammer [2] | - | 0.9 | 1.3 | dB |
| | | $P_i$ = –20 dBm, no jammer | - | 1.2 | 1.6 | dB |
| | | $P_{jam}$ = –20 dBm; $f_{jam}$ = 850 MHz | - | 1.1 | 1.5 | dB |
| | | $P_{jam}$ = –20 dBm; $f_{jam}$ = 1850 MHz | - | 1.3 | 1.7 | dB |
| | | –40 °C ≤ $T_{amb}$ ≤ +125 °C | | | | |
| | | $P_i$ < –40 dBm, no jammer | - | - | 1.8 | dB |
| | | $P_i$ = –20 dBm, no jammer | - | - | 2.0 | dB |
| | | $P_{jam}$ = –20 dBm; $f_{jam}$ = 850 MHz | - | - | 1.9 | dB |
| | | $P_{jam}$ = –20 dBm; $f_{jam}$ = 1850 MHz | - | - | 2.1 | dB |

**Table 7. Characteristics** *…continued*
*f = 1559 MHz to 1610 MHz; $V_{CC}$ = 1.8 V; $V_{ENABLE} \geq$ 0.8 V; $P_i$ < –40 dBm; $T_{amb}$ = 25 °C; input matched to 50 Ω using a 5.6 nH inductor; unless otherwise specified.*

| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| $P_{i(1dB)}$ | input power at 1 dB gain compression | f = 1559 MHz to 1610 MHz | | | | | |
| | | $V_{CC}$ = 1.5 V | | –15 | –12 | - | dBm |
| | | $V_{CC}$ = 1.8 V | | –14 | –11 | - | dBm |
| | | $V_{CC}$ = 2.85 V | | –11 | –8 | - | dBm |
| | | f = 806 MHz to 928 MHz | | | | | |
| | | $V_{CC}$ = 1.5 V | [3] | –15 | –12 | - | dBm |
| | | $V_{CC}$ = 1.8 V | [3] | –14 | –11 | - | dBm |
| | | $V_{CC}$ = 2.85 V | [3] | –14 | –11 | - | dBm |
| | | f = 1612 MHz to 1909 MHz | | | | | |
| | | $V_{CC}$ = 1.5 V | [3] | –13 | –10 | - | dBm |
| | | $V_{CC}$ = 1.8 V | [3] | –12 | –9 | - | dBm |
| | | $V_{CC}$ = 2.85 V | [3] | –10 | –7 | - | dBm |
| $IP3_i$ | input third-order intercept point | f = 1.575 GHz | | | | | |
| | | $V_{CC}$ = 1.5 V | [4] | 5 | 8 | - | dBm |
| | | $V_{CC}$ = 1.8 V | [4] | 5 | 9 | - | dBm |
| | | $V_{CC}$ = 2.85 V | [4] | 5 | 12 | - | dBm |
| $t_{on}$ | turn-on time | | [5] | - | - | 2 | µs |
| $t_{off}$ | turn-off time | | [5] | - | - | 1 | µs |
| K | Rollett stability factor | | | 1 | - | - | |

[1] PCB losses are subtracted.

[2] Including PCB losses.

[3] Out of band.

[4] $f_1$ = 1713 MHz; $f_2$ = 1851 MHz; $P_1 = P_2$ = –30 dBm.

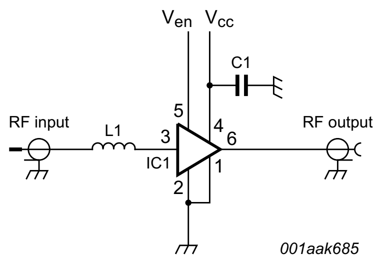
[5] Within 10 % of the final gain.

**Table 8. ENABLE (pin 5)**
*–40 °C ≤ $T_{amb}$ ≤ +125 °C; 1.5 V ≤ $V_{CC}$ ≤ 2.85 V*

| $V_{ENABLE}$ (V) | State |
|---|---|
| ≤ 0.3 | OFF |
| ≥ 0.8 | ON |

# 8. Application information

## 8.1 GNSS LNA



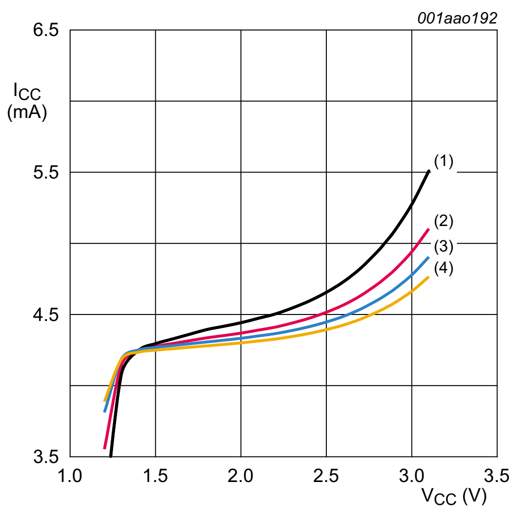

For a list of components see Table 9.

**Fig 1. Schematics GNSS LNA evaluation board**

**Table 9. List of components**

*For schematics see Figure 1.*

| Component | Description | Value | Supplier | Remarks |
|---|---|---|---|---|
| C1 | decoupling capacitor | 1 nF | various | |
| IC1 | BGU7004 | - | NXP | |
| L1 | high quality matching inductor | 5.6 nH | Murata LQW15A | |




$P_i$ = –45 dBm.

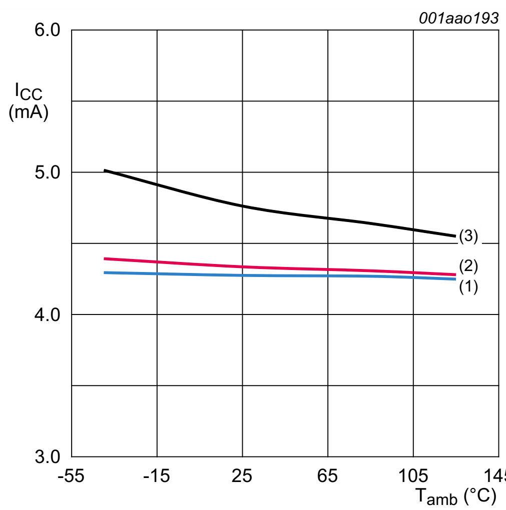
(1) $T_{amb}$ = –40 °C

(2) $T_{amb}$ = +25 °C

(3) $T_{amb}$ = +85 °C

(4) $T_{amb}$ = +125 °C

**Fig 2. Supply current as a function of supply voltage; typical values**



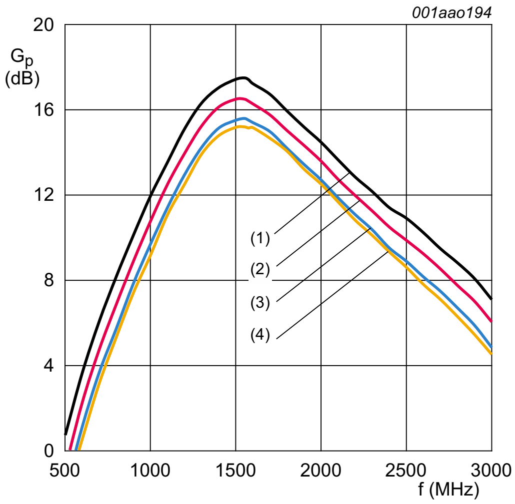

$P_i$ = –45 dBm.

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

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

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

**Fig 3. Supply current as a function of ambient temperature; typical values**




$V_{CC}$ = 1.8 V; $P_i$ = –45 dBm.

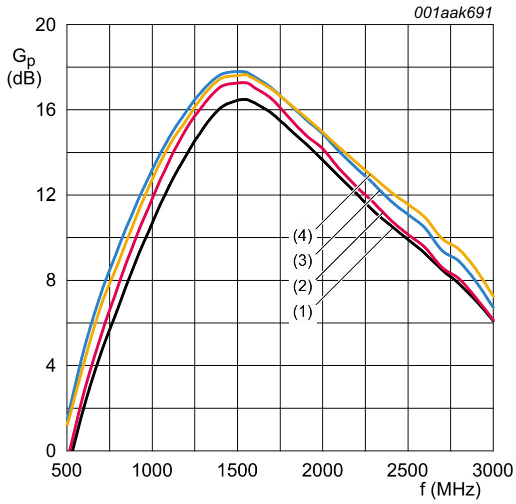
(1) $T_{amb}$ = –40 °C

(2) $T_{amb}$ = +25 °C

(3) $T_{amb}$ = +85 °C

(4) $T_{amb}$ = +125 °C

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




$V_{CC}$ = 1.8 V; $T_{amb}$ = 25 °C.

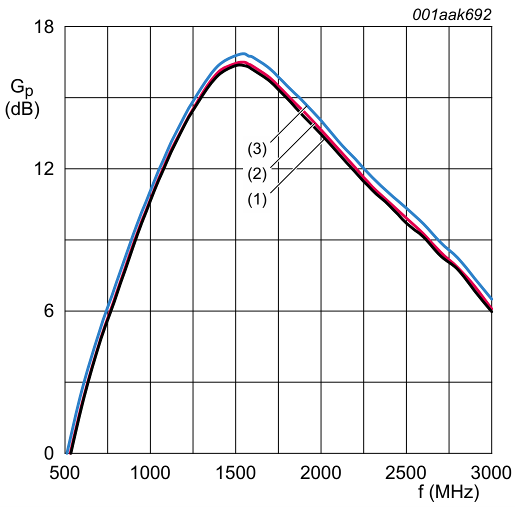
(1) $P_i$ = –45 dBm

(2) $P_i$ = –30 dBm

(3) $P_i$ = –20 dBm

(4) $P_i$ = –15 dBm

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



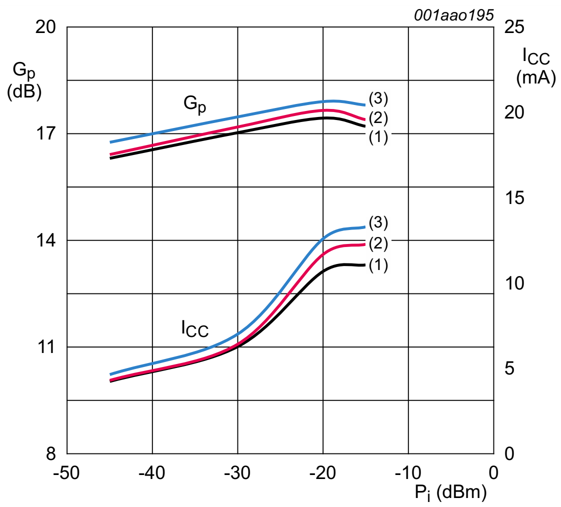

$P_i$ = –45 dBm; $T_{amb}$ = 25 °C.

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

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

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

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



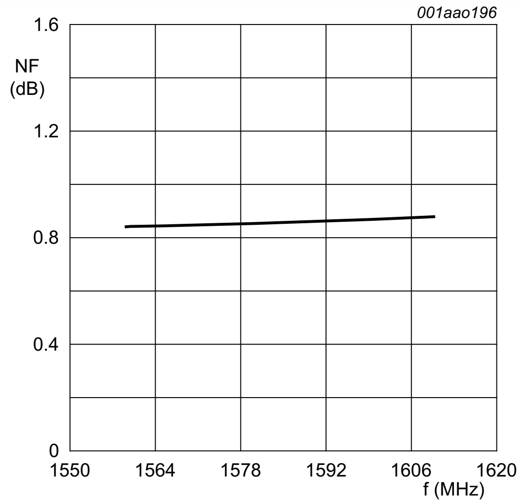

$T_{amb}$ = 25 °C; f = 1575 MHz.

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

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

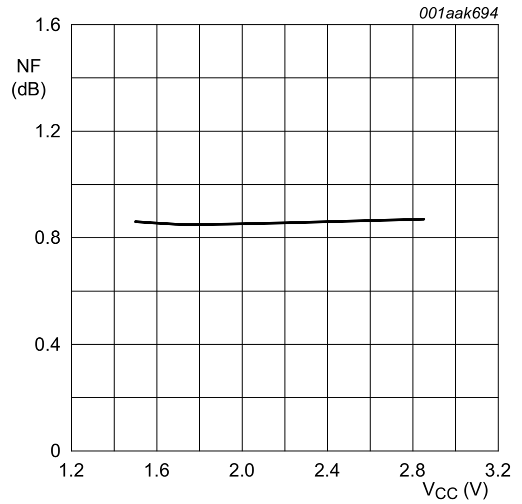
(3) $V_{CC}$ = 2.85 V

**Fig 7. Power gain and supply current as function of input power; typical values**



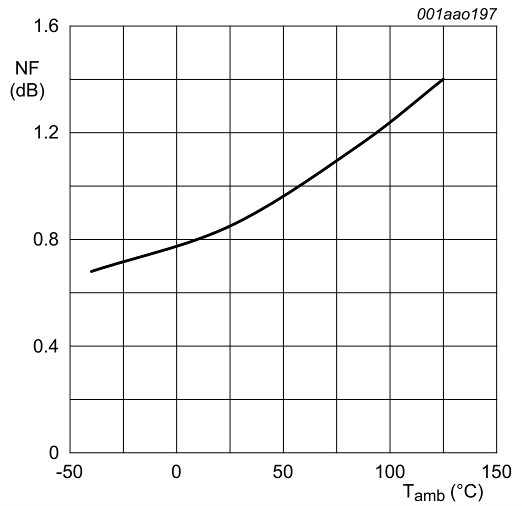

f = 1575 MHz; $T_{amb}$ = 25 °C; no jammer.

**Fig 8. Noise figure as a function of supply voltage; typical values**



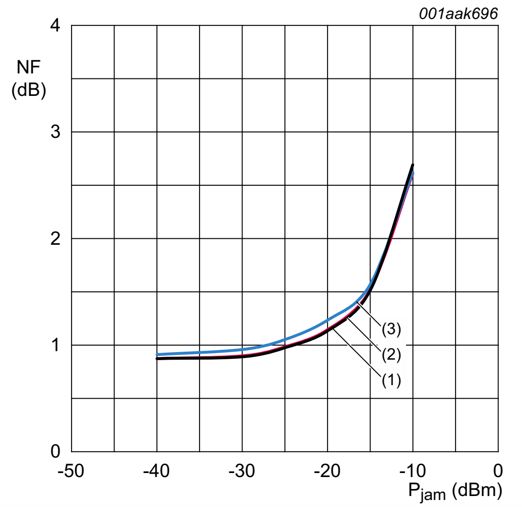

f = 1575 MHz; $T_{amb}$ = 25 °C; no jammer.

**Fig 9. Noise figure as a function of supply voltage; typical values**




f = 1575 MHz; $V_{CC}$ = 1.8 V; no jammer.

**Fig 10. Noise figure as a function of ambient temperature; typical values**



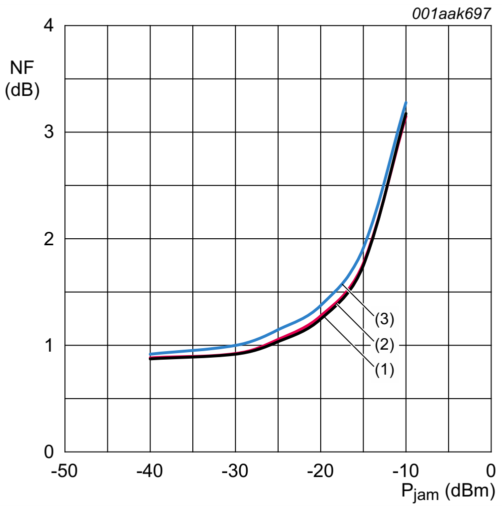

$f_{jam}$= 850 MHz; $T_{amb}$ = 25 °C; f = 1575 MHz.

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

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

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

**Fig 11. Noise figure as a function of jamming power; typical values**



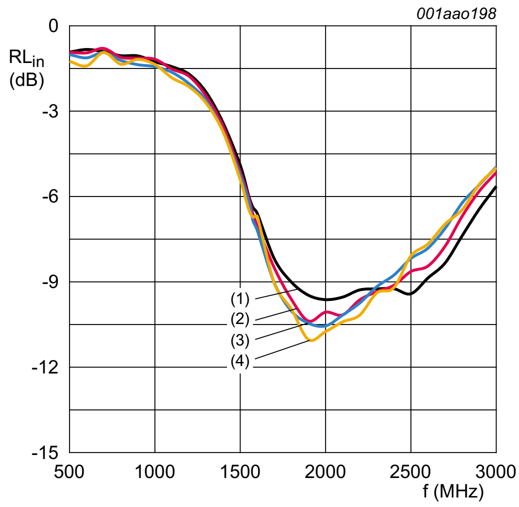

$f_{jam}$ = 1850 MHz; $T_{amb}$ = 25 °C; f = 1575 MHz.

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

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

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

**Fig 12. Noise figure as a function of jamming power; typical values**




$V_{CC}$ = 1.8 V; $P_i$ = –45 dBm.

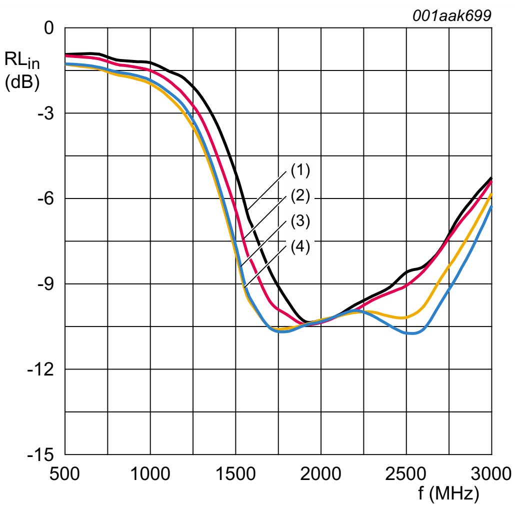
(1) $T_{amb}$ = –40 °C

(2) $T_{amb}$ = +25 °C

(3) $T_{amb}$ = +85 °C

(4) $T_{amb}$ = +125 °C

**Fig 13. Input return loss as a function of frequency; typical values**




$V_{CC}$ = 1.8 V; $T_{amb}$ = 25 °C.

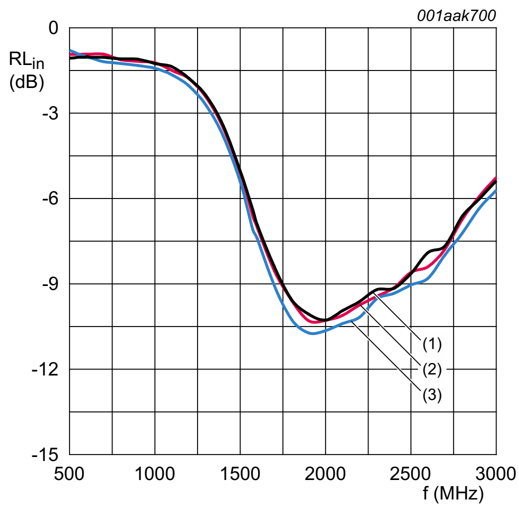
(1) $P_i$ = –45 dBm

(2) $P_i$ = –30 dBm

(3) $P_i$ = –20 dBm

(4) $P_i$ = –15 dBm

**Fig 14. Input return loss as a function of frequency; typical values**



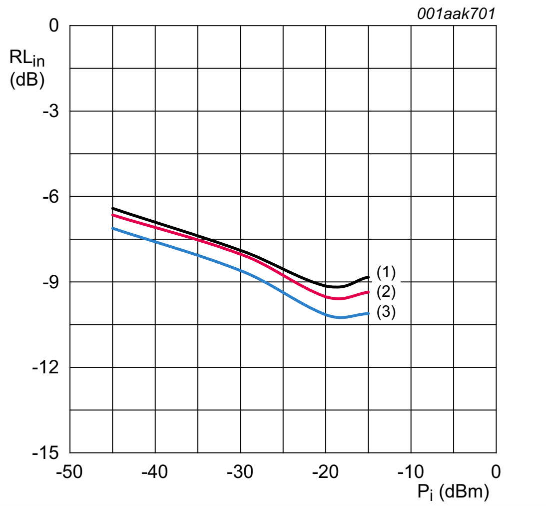

$P_i$ = –45 dBm; $T_{amb}$ = 25 °C.

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

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

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

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



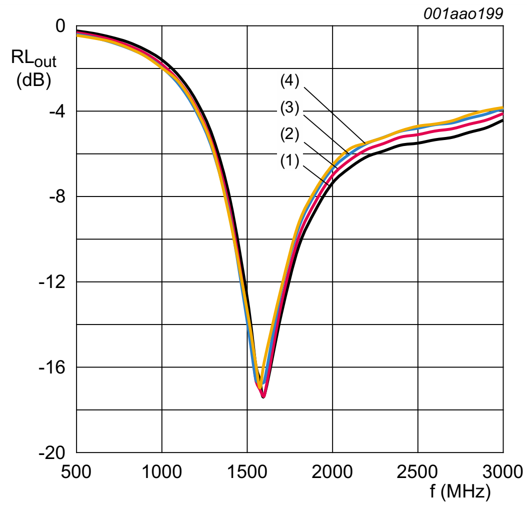

$T_{amb}$ = 25 °C; f = 1575 MHz.

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

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

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

**Fig 16. Input return loss as a function of input power; typical values**




$V_{CC}$ = 1.8 V; $P_i$ = –45 dBm.

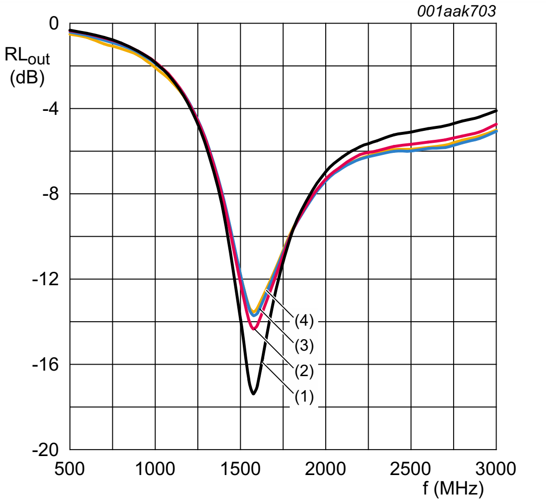
(1) $T_{amb}$ = –40 °C

(2) $T_{amb}$ = +25 °C

(3) $T_{amb}$ = +85 °C

(4) $T_{amb}$ = +125 °C

**Fig 17. Output return loss as a function of frequency; typical values**




$V_{CC}$ = 1.8 V; $T_{amb}$ = 25 °C.

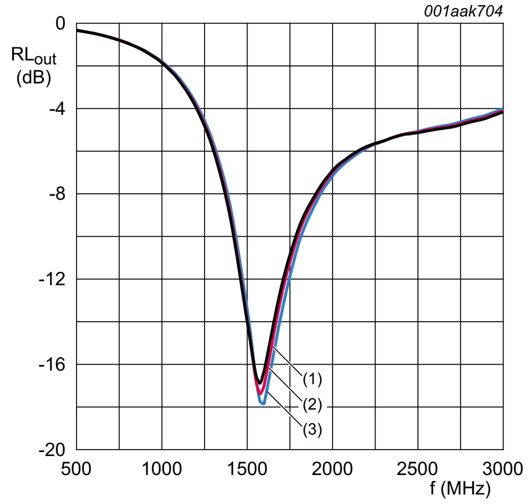
(1) $P_i$ = –45 dBm

(2) $P_i$ = –30 dBm

(3) $P_i$ = –20 dBm

(4) $P_i$ = –15 dBm

**Fig 18. Output return loss as a function of frequency; typical values**



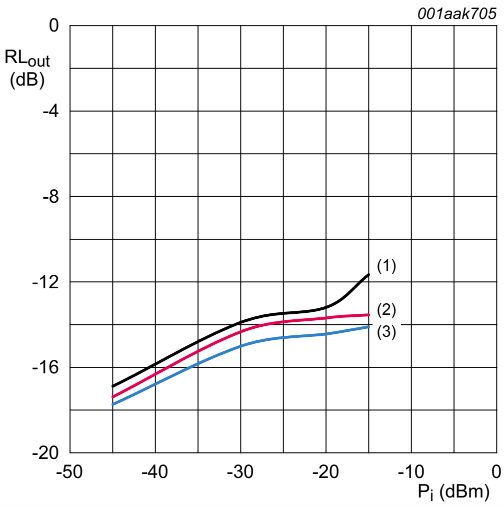

$P_i$ = –45 dBm; $T_{amb}$ = 25 °C.

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

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

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

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



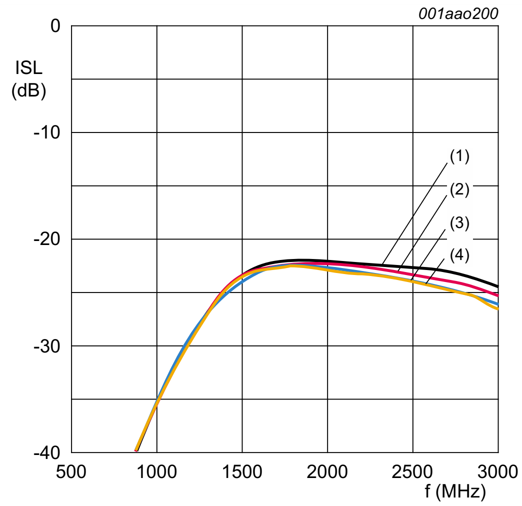

$T_{amb}$ = 25 °C; f = 1575 MHz.

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

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

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

**Fig 20. Output return loss as a function of input power; typical values**




$V_{CC}$ = 1.8 V; $P_i$ = –45 dBm.

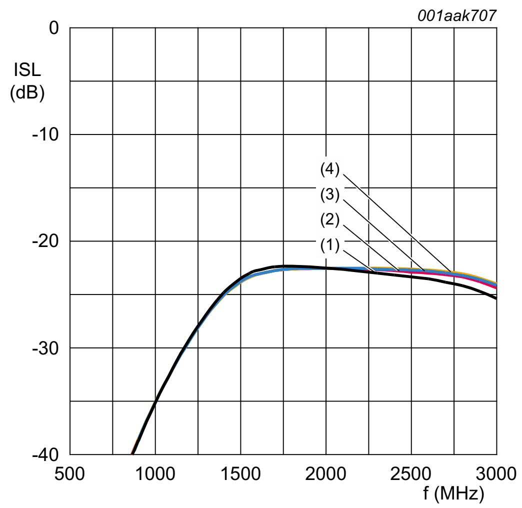
(1) $T_{amb}$ = –40 °C

(2) $T_{amb}$ = +25 °C

(3) $T_{amb}$ = +85 °C

(4) $T_{amb}$ = +125 °C

**Fig 21. Isolation as a function of frequency; typical values**




$V_{CC}$ = 1.8 V; $T_{amb}$ = 25 °C.

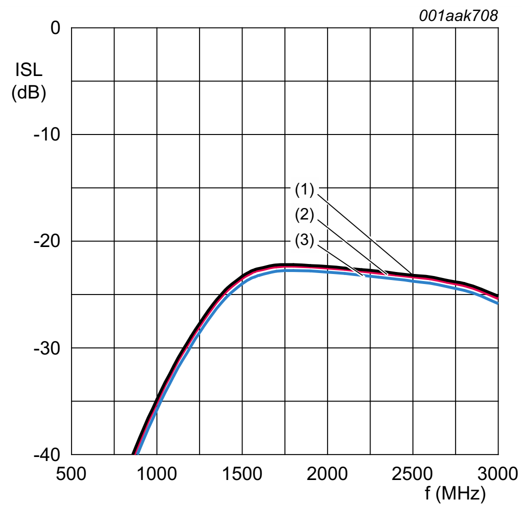
(1) $P_i$ = –45 dBm

(2) $P_i$ = –30 dBm

(3) $P_i$ = –20 dBm

(4) $P_i$ = –15 dBm

**Fig 22. Isolation as a function of frequency; typical values**



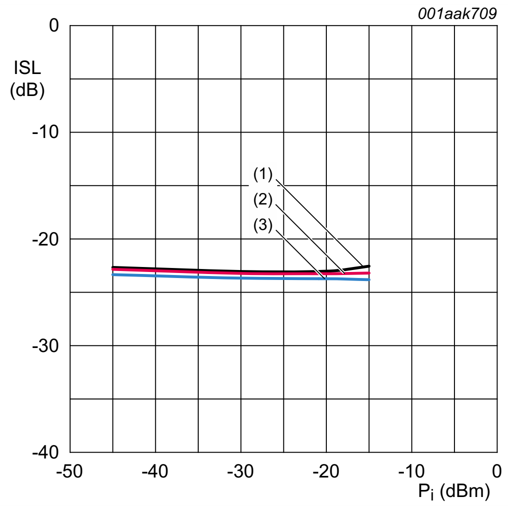

$P_i$ = –45 dBm; $T_{amb}$ = 25 °C.

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

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

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

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



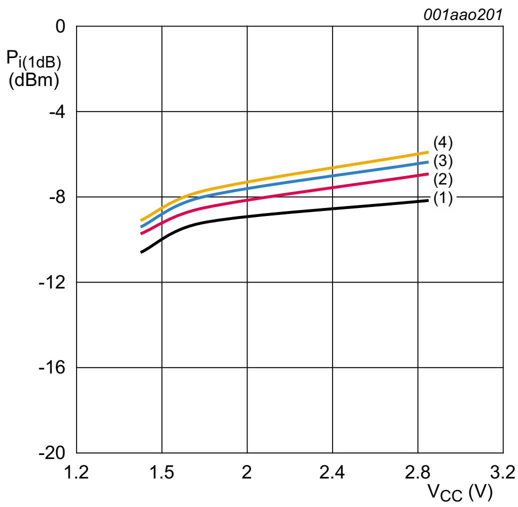

$T_{amb}$ = 25 °C; f = 1575 MHz.

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

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

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

**Fig 24. Isolation as a function of input power; typical values**




f = 850 MHz.

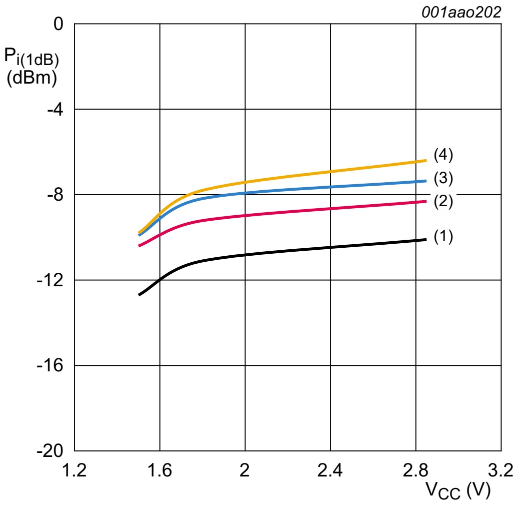
(1) $T_{amb}$ = −40 °C

(2) $T_{amb}$ = +25 °C

(3) $T_{amb}$ = +85 °C

(4) $T_{amb}$ = +125 °C

**Fig 25. Input power at 1 dB gain compression as a function of supply voltage; typical values**




f = 1850 MHz.

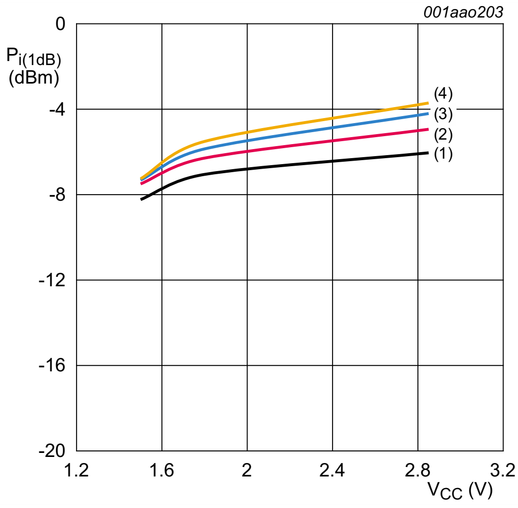
(1) $T_{amb}$ = −40 °C

(2) $T_{amb}$ = +25 °C

(3) $T_{amb}$ = +85 °C

(4) $T_{amb}$ = +125 °C

**Fig 26. Input power at 1 dB gain compression as a function of supply voltage; typical values**




f = 1575 MHz.

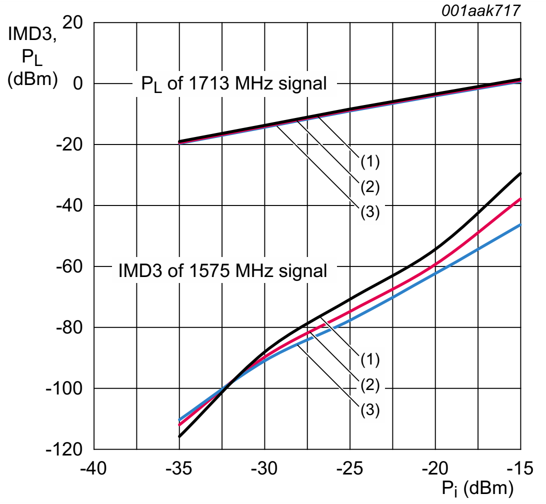
(1) $T_{amb}$ = −40 °C

(2) $T_{amb}$ = +25 °C

(3) $T_{amb}$ = +85 °C

(4) $T_{amb}$ = +125 °C

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



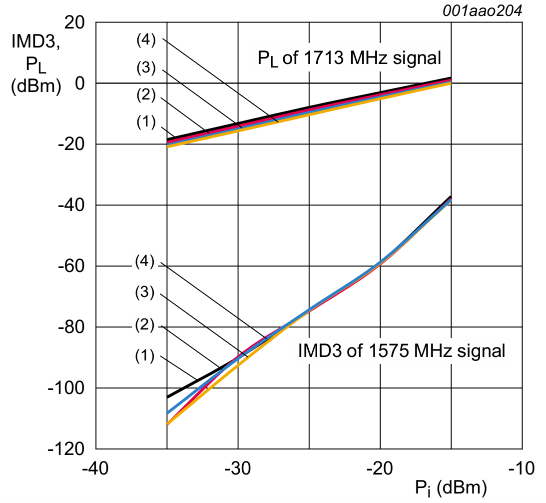

f = 1575 MHz; $f_1$ = 1713 MHz; $f_2$ = 1851 MHz;
$T_{amb}$ = 25 °C.

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

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

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

**Fig 28. Third order intermodulation distortion and output power as function of input power; typical values**




f = 1575 MHz; $f_1$ = 1713 MHz; $f_2$ = 1851 MHz;
$V_{CC}$ = 1.8 V.

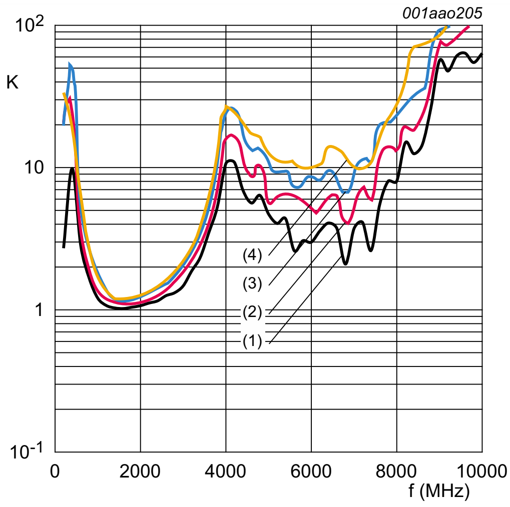
(1) $T_{amb}$ = –40 °C

(2) $T_{amb}$ = +25 °C

(3) $T_{amb}$ = +85 °C

(4) $T_{amb}$ = +125 °C

**Fig 29. Third order intermodulation distortion and output power as function of input power; typical values**




$V_{CC}$ = 1.8 V; $P_i$ = –45 dBm.

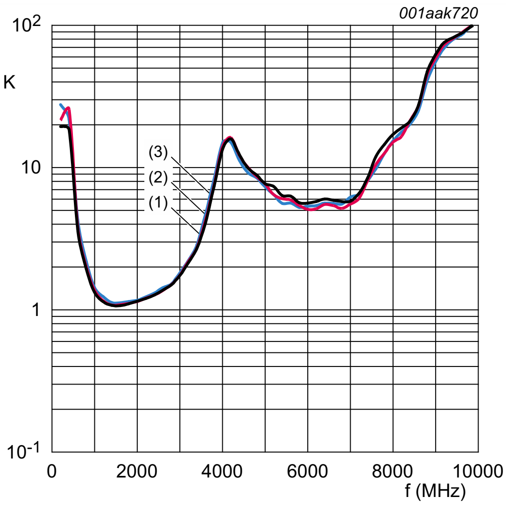
(1) $T_{amb}$ = –40 °C

(2) $T_{amb}$ = +25 °C

(3) $T_{amb}$ = +85 °C

(4) $T_{amb}$ = +125 °C

**Fig 30. Rollett stability factor as a function of frequency; typical values**




$T_{amb}$ = 25 °C; $P_i$ = –45 dBm.

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

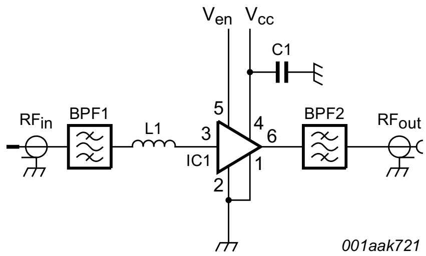
(2) $V_{CC}$ = 1.8 V

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

**Fig 31. Rollett stability factor as a function of frequency; typical values**

## 8.2 GPS front-end

The GPS LNA is typically used in a GPS front-end. A GPS front-end application circuit and its characteristics is provided here.




For a list of components see Table 10.

**Fig 32. Schematics GPS front-end evaluation board**

**Table 10. List of components**

*For schematics see Figure 32.*

| Component | Description | Value | Supplier | Remarks |
|---|---|---|---|---|
| BPF1, BPF2 | GPS SAW filter | - | Murata SAFEA1G57KE0F00 | Alternatives from Epcos:<br>• B9444<br>Alternatives from Murata:<br>• SAFEA1G57KH0F00<br>• SAFEA1G57KB0F00<br>Alternatives from Fujitsu:<br>• FAR-F6KA-1G5754-L4AA<br>• FAR-F6KA-1G5754-L4AJ |
| C1 | decoupling capacitor | 1 nF | Various | |
| IC1 | BGU7004 | - | NXP | |
| L1 | high quality matching inductor | 5.6 nH | Murata LQW15A | |

### 8.3 Characteristics GPS front-end

**Table 11. Characteristics GPS front-end**

*f = 1575 MHz; $V_{CC}$ = 1.8 V; $V_{ENABLE}$ ≥ 0.8 V; power at LNA input $P_i$ < –40 dBm; $T_{amb}$ = 25 °C; input and output matched to 50 Ω; unless otherwise specified.*

| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| $V_{CC}$ | supply voltage | RF input AC coupled | | 1.5 | - | 2.85 | V |
| $I_{CC}$ | supply current | | | - | 4.5 | - | mA |
| $G_p$ | power gain | power at LNA input $P_i$ < –40 dBm | [1] | - | 14.5 | - | dB |
| | | power at LNA input $P_i$ = –20 dBm | [1] | - | 15.5 | - | dB |
| $RL_{in}$ | input return loss | power at LNA input $P_i$ < –40 dBm | [1] | - | 8.5 | - | dB |
| | | power at LNA input $P_i$ = –20 dBm | [1] | - | 10.5 | - | dB |
| $RL_{out}$ | output return loss | power at LNA input $P_i$ < –40 dBm | [1] | - | 14.5 | - | dB |
| | | power at LNA input $P_i$ = –20 dBm | [1] | - | 12.5 | - | dB |
| NF | noise figure | power at LNA input $P_i$ < –40 dBm | [1] | - | 1.8 | - | dB |
| | | power at LNA input $P_i$ = –20 dBm | [1] | - | 1.9 | - | dB |
| $P_{i(1dB)}$ | input power at 1 dB gain compression | f = 1575 MHz | | | –8.2 | | dBm |
| | | f = 806 MHz to 928 MHz | [2] | | 31 | | dBm |
| | | f = 1612 MHz to 1909 MHz | [2] | | 40 | | dBm |
| $IP3_i$ | input third-order intercept point | | [3] | | 64 | | dBm |
| α | attenuation | f = 850 MHz | [4] | 95 | - | - | dBc |
| | | f = 1850 MHz | [4] | 90 | - | - | dBc |
| $t_{on}$ | turn-on time | | [5] | - | - | 2 | μs |
| $t_{off}$ | turn-off time | | [5] | - | - | 1 | μs |

[1] Power at GPS front-end input = power at LNA input + attenuation BPF1.

[2] Out of band.

[3] $f_1$ = 1713 MHz; $f_2$ = 1851 MHz; $P_1 = P_2$ = +10 dBm.

[4] Relative to f = 1575 MHz.

[5] Within 10 % of the final gain.

## 9. Test information

### 9.1 Quality information

All qualification tests are performed according AEC-Q100 except for read point testing (final test of qualification sample). Which is done only at room temperature.

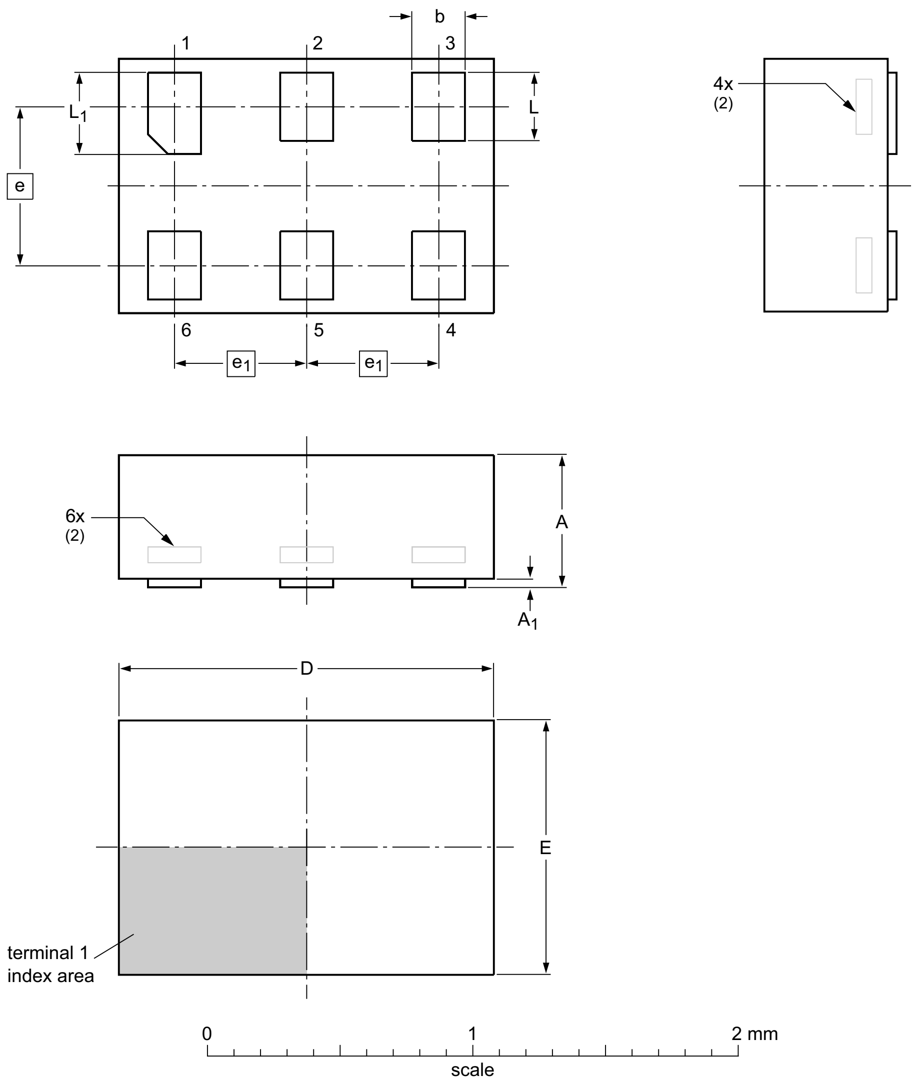
As part of the zero defect program, the following is part of the industrial test flow:

- Part Average Testing
- Maverick Lot Handling at assembly factory

# 10. Package outline

XSON6: plastic extremely thin small outline package; no leads; 6 terminals; body 1 x 1.45 x 0.5 mm

SOT886




Dimensions (mm are the original dimensions)

| Unit | | A(1) | $A_1$ | b | D | E | e | $e_1$ | L | $L_1$ |
|---|---|---|---|---|---|---|---|---|---|---|
| | max | 0.5 | 0.04 | 0.25 | 1.50 | 1.05 | | | 0.35 | 0.40 |
| mm | nom | | | 0.20 | 1.45 | 1.00 | 0.6 | 0.5 | 0.30 | 0.35 |
| | min | | | 0.17 | 1.40 | 0.95 | | | 0.27 | 0.32 |

Notes

1. Including plating thickness.
2. Can be visible in some manufacturing processes.

*sot886_po*

| Outline version | References | | | | European projection | Issue date |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | JEITA | | | |
| SOT886 | | MO-252 | | | | ~~04-07-22~~<br>12-01-05 |

Fig 33. Package outline SOT886 (XSON6)

## 11. Handling information

**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.

## 12. Abbreviations

**Table 12. Abbreviations**

| Acronym | Description |
|---|---|
| AEC | Automotive Electronics Council |
| ATM | Automated Teller Machine (cash dispenser) |
| BPF | Band-Pass Filter |
| ESD | ElectroStatic Discharge |
| 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 |
| SAW | Surface Acoustic Wave |
| SiGe:C | Silicon Germanium Carbon |

## 13. Revision history

**Table 13. Revision history**

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|---|---|---|---|---|
| BGU7004 v.3 | 20170118 | Product data sheet | - | BGU7004 v.2 |
| Modifications: | • Section 1: added GPS1103M according to our new naming convention | | | |
| BGU7004 v.2 | 20150220 | Product data sheet | - | BGU7004 v.1 |
| Modifications: | • The title of this data sheet has been changed.<br>• Section 1.3 on page 1: Added GLONASS, Galileo and Compass (BeiDou) to the possible applications.<br>• Section 11 on page 17: ESD information has moved from Section 1.1 to this section.<br>• Section 14.3 on page 18: Adjusted the disclaimers with respect to “suitability to use in automotive applications” and “Translations”. | | | |
| BGU7004 v.1 | 20110705 | Product data sheet | - | - |

# 14. Legal information

## 14.1 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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## 16. Contents





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**Date of release: 18 January 2017**
**Document identifier: BGU7004**