



# 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  $\mu$ A
- 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  $\times$  1.45 mm  $\times$  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**

$f = 1559 \text{ MHz to } 1610 \text{ MHz}$ ;  $V_{CC} = 1.8 \text{ V}$ ;  $P_i < -40 \text{ dBm}$ ;  $T_{amb} = 25^\circ\text{C}$ ; input matched to  $50 \Omega$  using a  $5.6 \text{ nH}$  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                       | $V_{ENABLE} \geq 0.8 \text{ V}$             |     |      |      |      |
|                  |                                      | $P_i < -40 \text{ dBm}$                     | 3.2 | 4.5  | 5.7  | mA   |
|                  |                                      | $P_i = -20 \text{ dBm}$                     | 8.1 | 11.6 | 14.4 | mA   |
| $G_p$            | power gain                           | $P_i < -40 \text{ dBm}$ , no jammer         | 14  | 16.5 | 19   | dB   |
|                  |                                      | $P_i = -20 \text{ dBm}$ , no jammer         | 15  | 17.5 | 20   | dB   |
| NF               | noise figure                         | $P_i < -40 \text{ dBm}$ , no jammer [1]     | -   | 0.85 | 1.2  | dB   |
|                  |                                      | $P_i < -40 \text{ dBm}$ , no jammer [2]     | -   | 0.9  | 1.3  | dB   |
|                  |                                      | $P_i = -20 \text{ dBm}$ , no jammer         | -   | 1.2  | 1.6  | dB   |
| $P_{i(1dB)}$     | input power at 1 dB gain compression | $f = 1559 \text{ MHz to } 1610 \text{ MHz}$ |     |      |      |      |
|                  |                                      | $V_{CC} = 1.5 \text{ V}$                    | -15 | -12  | -    | dBm  |
|                  |                                      | $V_{CC} = 1.8 \text{ V}$                    | -14 | -11  | -    | dBm  |
|                  |                                      | $V_{CC} = 2.85 \text{ V}$                   | -11 | -8   | -    | dBm  |
| IP3 <sub>i</sub> | input third-order intercept point    | $f = 1.575 \text{ GHz}$                     |     |      |      |      |
|                  |                                      | $V_{CC} = 1.5 \text{ V}$ [3]                | 5   | 8    | -    | dBm  |
|                  |                                      | $V_{CC} = 1.8 \text{ V}$ [3]                | 5   | 9    | -    | dBm  |
|                  |                                      | $V_{CC} = 2.85 \text{ V}$ [3]               | 5   | 12   | -    | dBm  |

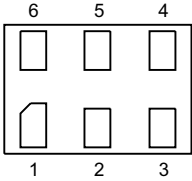
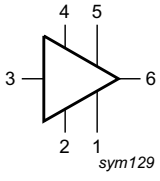
[1] PCB losses are subtracted.

[2] Including PCB losses.

[3]  $f_1 = 1713 \text{ MHz}$ ;  $f_2 = 1851 \text{ MHz}$ ;  $P_1 = P_2 = -30 \text{ dBm}$ .

## 2. Pinning information

**Table 2. Pinning**

| Pin | Description | Simplified outline                                                                                                | Graphic symbol                                                                                      |
|-----|-------------|-------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|
| 1   | GND         |  <p>Transparent top view</p> |  <p>sym129</p> |
| 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**

$f = 1559 \text{ MHz to } 1610 \text{ MHz}$ ;  $V_{CC} = 1.8 \text{ V}$ ;  $V_{ENABLE} \geq 0.8 \text{ V}$ ;  $P_i < -40 \text{ dBm}$ ;  $T_{amb} = 25 \text{ }^\circ\text{C}$ ; input matched to  $50 \text{ } \Omega$  using a  $5.6 \text{ nH}$  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      | $V_{ENABLE} \geq 0.8 \text{ V}$                                            |     |      |      |                  |
|            |                     | $P_i < -40 \text{ dBm}$                                                    | 3.2 | 4.5  | 5.7  | mA               |
|            |                     | $P_i = -20 \text{ dBm}$                                                    | 8.1 | 11.6 | 14.4 | mA               |
|            |                     | $V_{ENABLE} \leq 0.3 \text{ V}$                                            | -   | -    | 1    | $\mu\text{A}$    |
| $T_{amb}$  | ambient temperature |                                                                            | -40 | +25  | +125 | $^\circ\text{C}$ |
| $G_p$      | power gain          | $T_{amb} = 25 \text{ }^\circ\text{C}$                                      |     |      |      |                  |
|            |                     | $P_i < -40 \text{ dBm}$ , no jammer                                        | 14  | 16.5 | 19   | dB               |
|            |                     | $P_i = -20 \text{ dBm}$ , no jammer                                        | 15  | 17.5 | 20   | dB               |
|            |                     | $P_{jam} = -20 \text{ dBm}$ ; $f_{jam} = 850 \text{ MHz}$                  | 15  | 17.5 | 20   | dB               |
|            |                     | $P_{jam} = -20 \text{ dBm}$ ; $f_{jam} = 1850 \text{ MHz}$                 | 15  | 17.5 | 20   | dB               |
|            |                     | $-40 \text{ }^\circ\text{C} \leq T_{amb} \leq +125 \text{ }^\circ\text{C}$ |     |      |      |                  |
|            |                     | $P_i < -40 \text{ dBm}$ , no jammer                                        | 13  | -    | 20   | dB               |
|            |                     | $P_i = -20 \text{ dBm}$ , no jammer                                        | 14  | -    | 21   | dB               |
|            |                     | $P_{jam} = -20 \text{ dBm}$ ; $f_{jam} = 850 \text{ MHz}$                  | 14  | -    | 21   | dB               |
|            |                     | $P_{jam} = -20 \text{ dBm}$ ; $f_{jam} = 1850 \text{ MHz}$                 | 14  | -    | 21   | dB               |
| $RL_{in}$  | input return loss   | $P_i < -40 \text{ dBm}$                                                    | 5   | 8    | -    | dB               |
|            |                     | $P_i = -20 \text{ dBm}$                                                    | 6   | 10   | -    | dB               |
| $RL_{out}$ | output return loss  | $P_i < -40 \text{ dBm}$                                                    | 10  | 20   | -    | dB               |
|            |                     | $P_i = -20 \text{ dBm}$                                                    | 10  | 14   | -    | dB               |
| ISL        | isolation           |                                                                            | 20  | 23   | -    | dB               |
| NF         | noise figure        | $T_{amb} = 25 \text{ }^\circ\text{C}$                                      |     |      |      |                  |
|            |                     | $P_i < -40 \text{ dBm}$ , no jammer <a href="#">[1]</a>                    | -   | 0.85 | 1.2  | dB               |
|            |                     | $P_i < -40 \text{ dBm}$ , no jammer <a href="#">[2]</a>                    | -   | 0.9  | 1.3  | dB               |
|            |                     | $P_i = -20 \text{ dBm}$ , no jammer                                        | -   | 1.2  | 1.6  | dB               |
|            |                     | $P_{jam} = -20 \text{ dBm}$ ; $f_{jam} = 850 \text{ MHz}$                  | -   | 1.1  | 1.5  | dB               |
|            |                     | $P_{jam} = -20 \text{ dBm}$ ; $f_{jam} = 1850 \text{ MHz}$                 | -   | 1.3  | 1.7  | dB               |
|            |                     | $-40 \text{ }^\circ\text{C} \leq T_{amb} \leq +125 \text{ }^\circ\text{C}$ |     |      |      |                  |
|            |                     | $P_i < -40 \text{ dBm}$ , no jammer                                        | -   | -    | 1.8  | dB               |
|            |                     | $P_i = -20 \text{ dBm}$ , no jammer                                        | -   | -    | 2.0  | dB               |
|            |                     | $P_{jam} = -20 \text{ dBm}$ ; $f_{jam} = 850 \text{ MHz}$                  | -   | -    | 1.9  | dB               |
|            |                     | $P_{jam} = -20 \text{ dBm}$ ; $f_{jam} = 1850 \text{ MHz}$                 | -   | -    | 2.1  | dB               |

**Table 7. Characteristics ...continued**

$f = 1559 \text{ MHz to } 1610 \text{ MHz}$ ;  $V_{CC} = 1.8 \text{ V}$ ;  $V_{ENABLE} \geq 0.8 \text{ V}$ ;  $P_i < -40 \text{ dBm}$ ;  $T_{amb} = 25 \text{ }^\circ\text{C}$ ; input matched to  $50 \text{ } \Omega$  using a  $5.6 \text{ nH}$  inductor; unless otherwise specified.

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

[1] PCB losses are subtracted.

[2] Including PCB losses.

[3] Out of band.

[4]  $f_1 = 1713 \text{ MHz}$ ;  $f_2 = 1851 \text{ MHz}$ ;  $P_1 = P_2 = -30 \text{ dBm}$ .

[5] Within 10 % of the final gain.

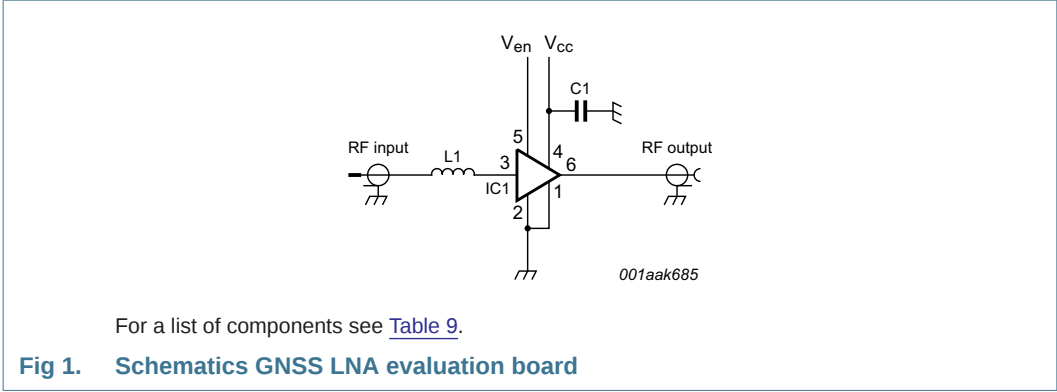
**Table 8. ENABLE (pin 5)**

$-40 \text{ }^\circ\text{C} \leq T_{amb} \leq +125 \text{ }^\circ\text{C}$ ;  $1.5 \text{ V} \leq V_{CC} \leq 2.85 \text{ V}$

| $V_{ENABLE} \text{ (V)}$ | State |
|--------------------------|-------|
| $\leq 0.3$               | OFF   |
| $\geq 0.8$               | ON    |

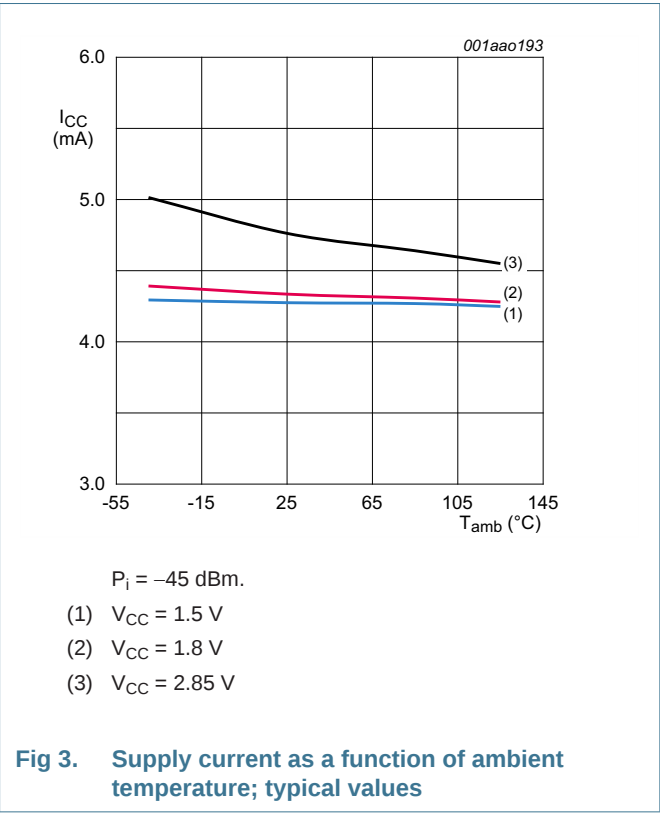
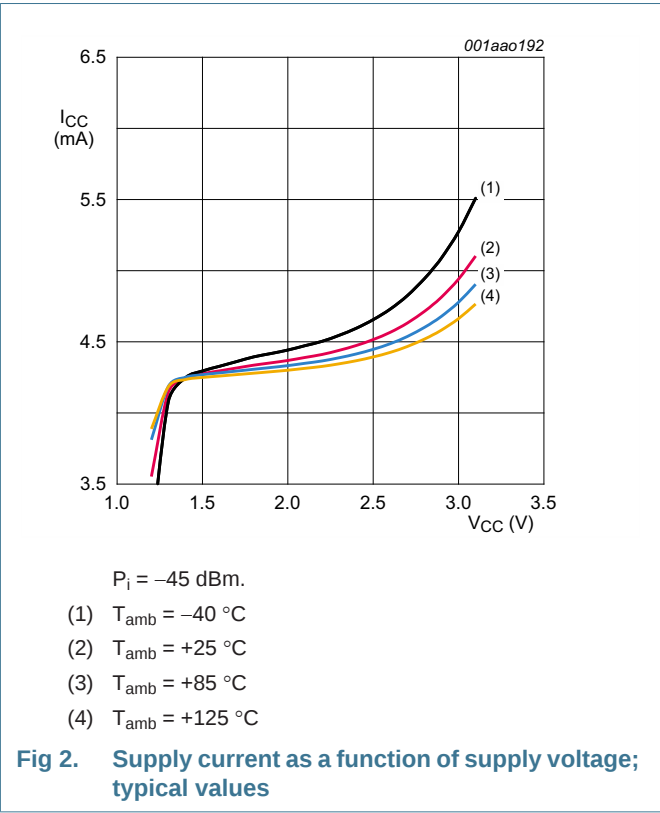
8. Application information

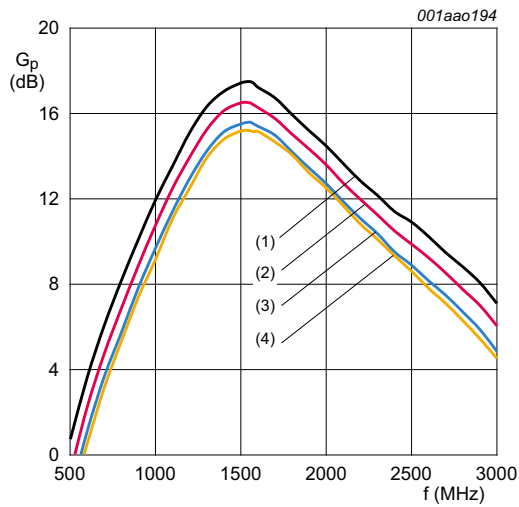
8.1 GNSS LNA



**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 |         |

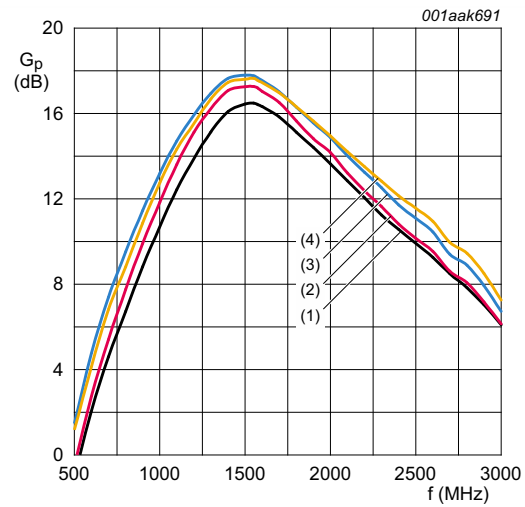




$V_{CC} = 1.8 \text{ V}$ ;  $P_i = -45 \text{ dBm}$ .

- (1)  $T_{amb} = -40 \text{ }^{\circ}\text{C}$
- (2)  $T_{amb} = +25 \text{ }^{\circ}\text{C}$
- (3)  $T_{amb} = +85 \text{ }^{\circ}\text{C}$
- (4)  $T_{amb} = +125 \text{ }^{\circ}\text{C}$

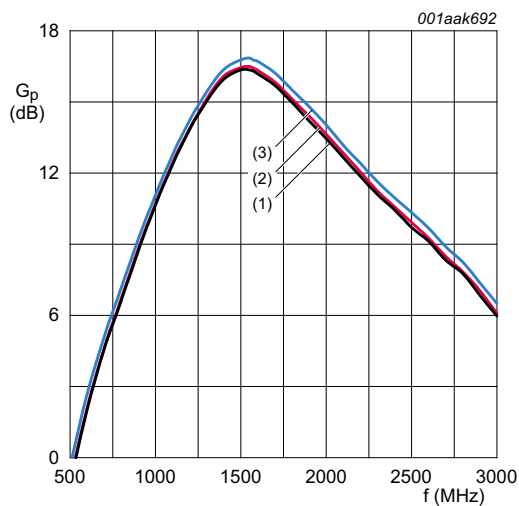
**Fig 4. Power gain as a function of frequency; typical values**



$V_{CC} = 1.8 \text{ V}$ ;  $T_{amb} = 25 \text{ }^{\circ}\text{C}$ .

- (1)  $P_i = -45 \text{ dBm}$
- (2)  $P_i = -30 \text{ dBm}$
- (3)  $P_i = -20 \text{ dBm}$
- (4)  $P_i = -15 \text{ dBm}$

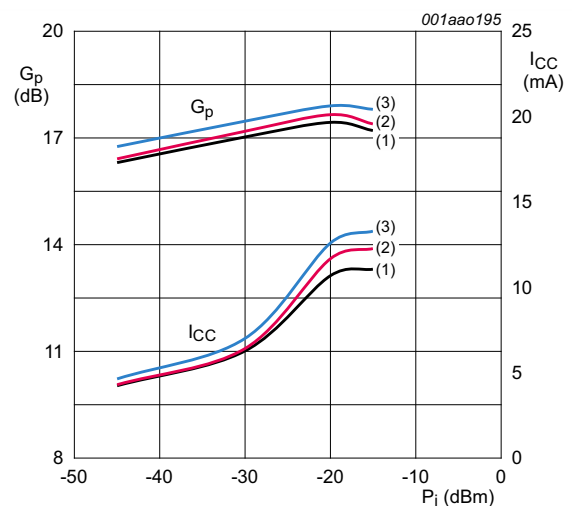
**Fig 5. Power gain as a function of frequency; typical values**



$P_i = -45 \text{ dBm}$ ;  $T_{amb} = 25 \text{ }^{\circ}\text{C}$ .

- (1)  $V_{CC} = 1.5 \text{ V}$
- (2)  $V_{CC} = 1.8 \text{ V}$
- (3)  $V_{CC} = 2.85 \text{ V}$

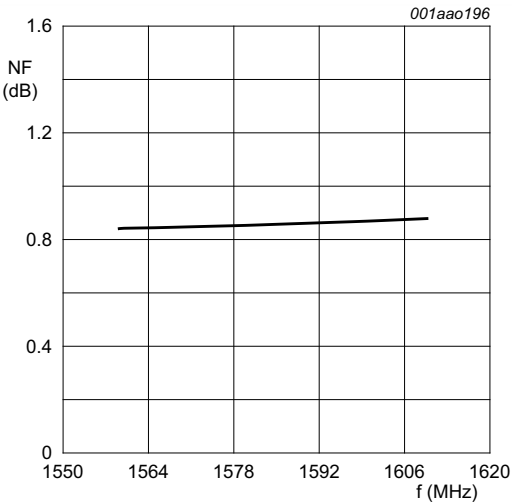
**Fig 6. Power gain as a function of frequency; typical values**



$T_{amb} = 25 \text{ }^{\circ}\text{C}$ ;  $f = 1575 \text{ MHz}$ .

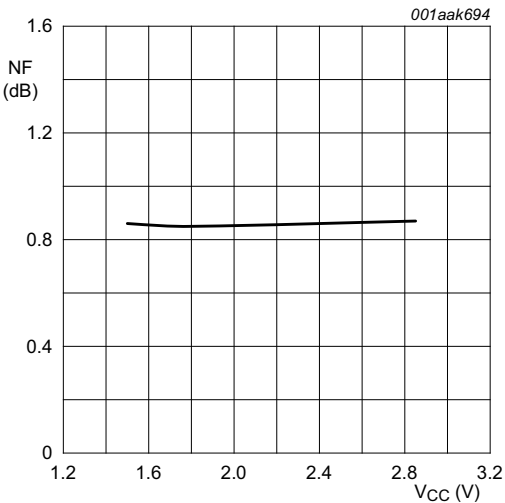
- (1)  $V_{CC} = 1.5 \text{ V}$
- (2)  $V_{CC} = 1.8 \text{ V}$
- (3)  $V_{CC} = 2.85 \text{ V}$

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



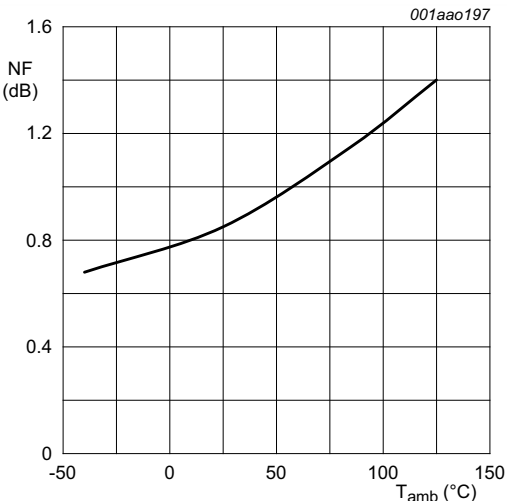
f = 1575 MHz; T<sub>amb</sub> = 25 °C; no jammer.

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



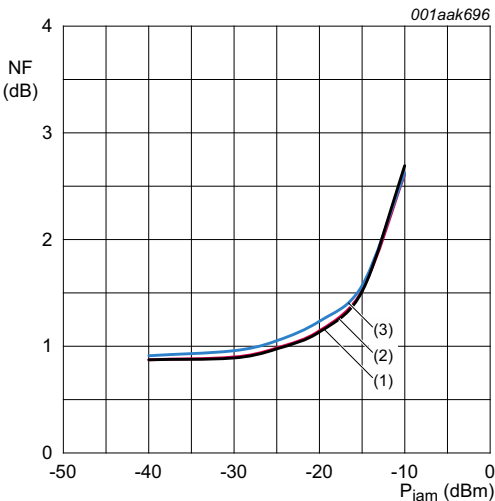
f = 1575 MHz; T<sub>amb</sub> = 25 °C; no jammer.

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



f = 1575 MHz; V<sub>CC</sub> = 1.8 V; no jammer.

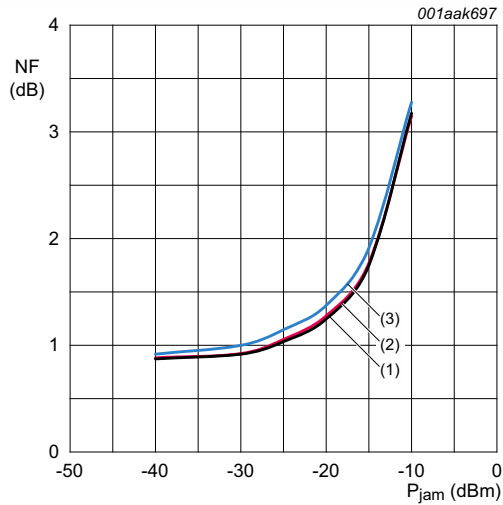
Fig 10. Noise figure as a function of ambient temperature; typical values



f<sub>jam</sub> = 850 MHz; T<sub>amb</sub> = 25 °C; f = 1575 MHz.

- (1) V<sub>CC</sub> = 1.5 V
- (2) V<sub>CC</sub> = 1.8 V
- (3) V<sub>CC</sub> = 2.85 V

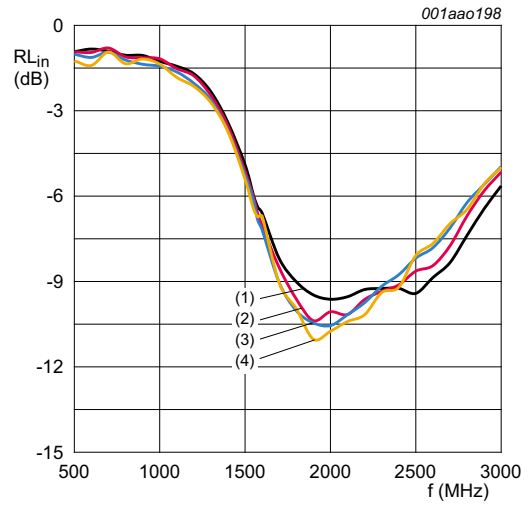
Fig 11. Noise figure as a function of jamming power; typical values



$f_{jam} = 1850 \text{ MHz}$ ;  $T_{amb} = 25 \text{ }^{\circ}\text{C}$ ;  $f = 1575 \text{ MHz}$ .

- (1)  $V_{CC} = 1.5 \text{ V}$
- (2)  $V_{CC} = 1.8 \text{ V}$
- (3)  $V_{CC} = 2.85 \text{ V}$

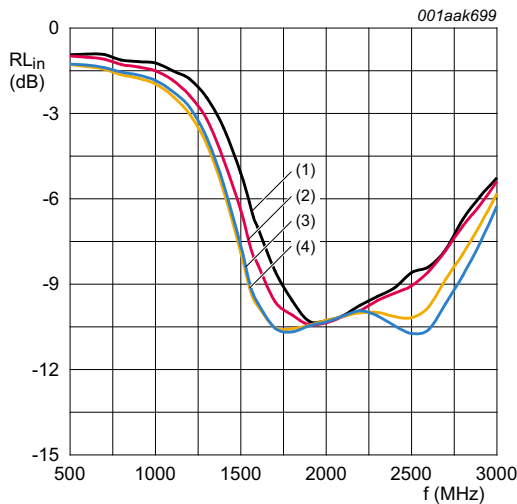
**Fig 12.** Noise figure as a function of jamming power; typical values



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

- (1)  $T_{amb} = -40 \text{ }^{\circ}\text{C}$
- (2)  $T_{amb} = +25 \text{ }^{\circ}\text{C}$
- (3)  $T_{amb} = +85 \text{ }^{\circ}\text{C}$
- (4)  $T_{amb} = +125 \text{ }^{\circ}\text{C}$

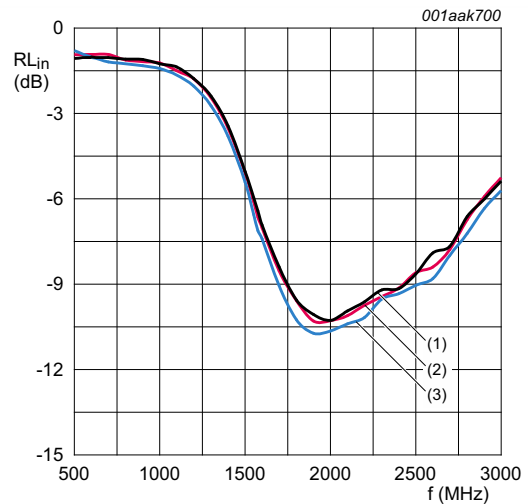
**Fig 13.** Input return loss as a function of frequency; typical values



$V_{CC} = 1.8 \text{ V}$ ;  $T_{amb} = 25 \text{ }^{\circ}\text{C}$ .

- (1)  $P_i = -45 \text{ dBm}$
- (2)  $P_i = -30 \text{ dBm}$
- (3)  $P_i = -20 \text{ dBm}$
- (4)  $P_i = -15 \text{ dBm}$

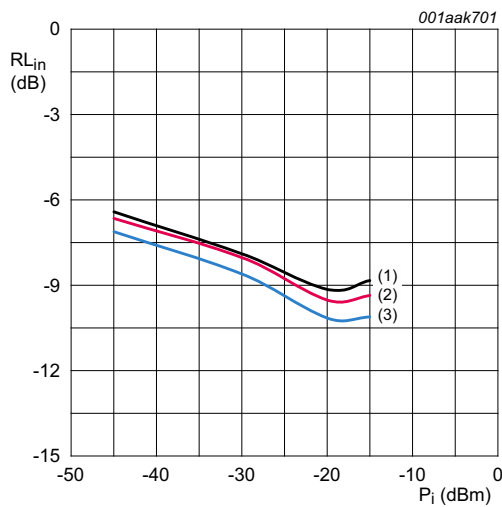
**Fig 14.** Input return loss as a function of frequency; typical values



$P_i = -45 \text{ dBm}$ ;  $T_{amb} = 25 \text{ }^{\circ}\text{C}$ .

- (1)  $V_{CC} = 1.5 \text{ V}$
- (2)  $V_{CC} = 1.8 \text{ V}$
- (3)  $V_{CC} = 2.85 \text{ V}$

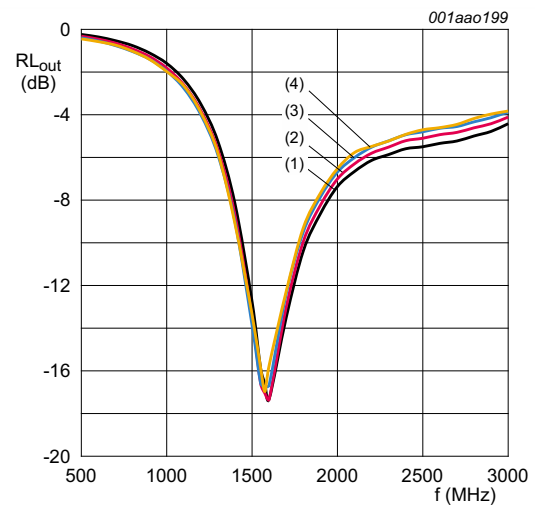
**Fig 15.** Input return loss as a function of frequency; typical values



$T_{amb} = 25\text{ °C}$ ;  $f = 1575\text{ MHz}$ .

- (1)  $V_{CC} = 1.5\text{ V}$
- (2)  $V_{CC} = 1.8\text{ V}$
- (3)  $V_{CC} = 2.85\text{ V}$

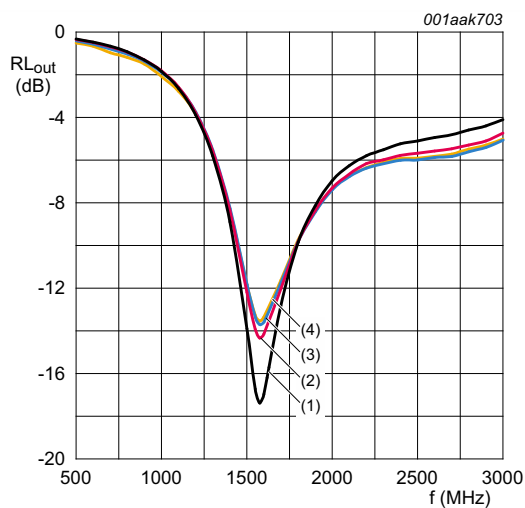
**Fig 16. Input return loss as a function of input power; typical values**



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

- (1)  $T_{amb} = -40\text{ °C}$
- (2)  $T_{amb} = +25\text{ °C}$
- (3)  $T_{amb} = +85\text{ °C}$
- (4)  $T_{amb} = +125\text{ °C}$

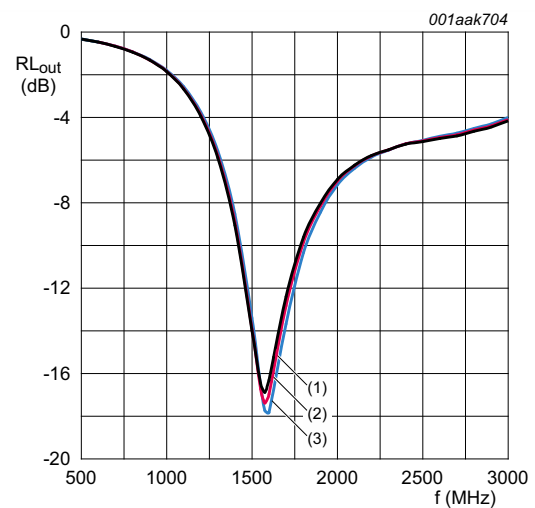
**Fig 17. Output return loss as a function of frequency; typical values**



$V_{CC} = 1.8\text{ V}$ ;  $T_{amb} = 25\text{ °C}$ .

- (1)  $P_i = -45\text{ dBm}$
- (2)  $P_i = -30\text{ dBm}$
- (3)  $P_i = -20\text{ dBm}$
- (4)  $P_i = -15\text{ dBm}$

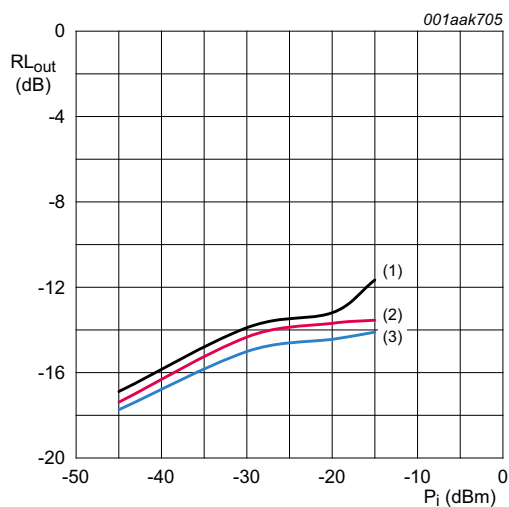
**Fig 18. Output return loss as a function of frequency; typical values**



$P_i = -45\text{ dBm}$ ;  $T_{amb} = 25\text{ °C}$ .

- (1)  $V_{CC} = 1.5\text{ V}$
- (2)  $V_{CC} = 1.8\text{ V}$
- (3)  $V_{CC} = 2.85\text{ V}$

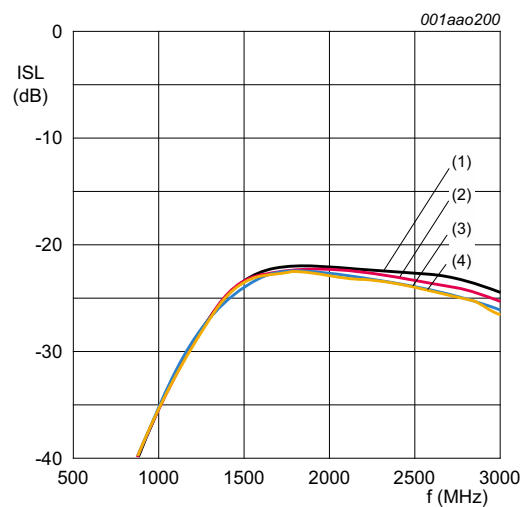
**Fig 19. Output return loss as a function of frequency; typical values**



$T_{amb} = 25\text{ }^{\circ}\text{C}$ ;  $f = 1575\text{ MHz}$ .

- (1)  $V_{CC} = 1.5\text{ V}$
- (2)  $V_{CC} = 1.8\text{ V}$
- (3)  $V_{CC} = 2.85\text{ V}$

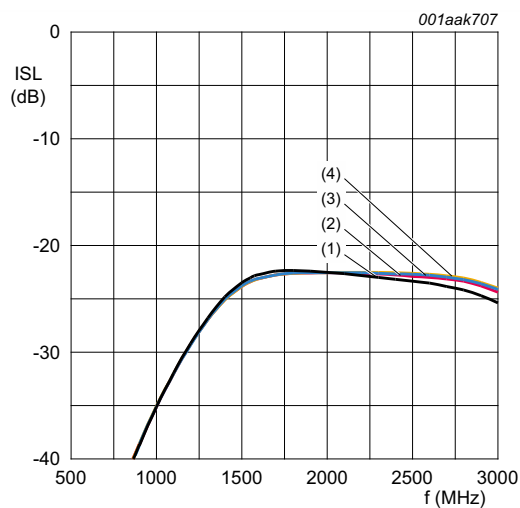
**Fig 20. Output return loss as a function of input power; typical values**



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

- (1)  $T_{amb} = -40\text{ }^{\circ}\text{C}$
- (2)  $T_{amb} = +25\text{ }^{\circ}\text{C}$
- (3)  $T_{amb} = +85\text{ }^{\circ}\text{C}$
- (4)  $T_{amb} = +125\text{ }^{\circ}\text{C}$

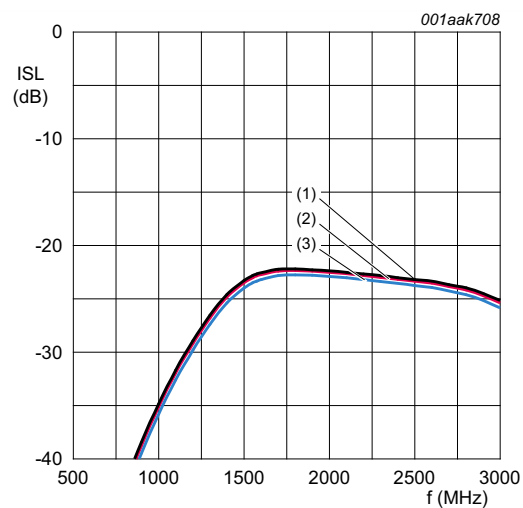
**Fig 21. Isolation as a function of frequency; typical values**



$V_{CC} = 1.8\text{ V}$ ;  $T_{amb} = 25\text{ }^{\circ}\text{C}$ .

- (1)  $P_i = -45\text{ dBm}$
- (2)  $P_i = -30\text{ dBm}$
- (3)  $P_i = -20\text{ dBm}$
- (4)  $P_i = -15\text{ dBm}$

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



$P_i = -45\text{ dBm}$ ;  $T_{amb} = 25\text{ }^{\circ}\text{C}$ .

- (1)  $V_{CC} = 1.5\text{ V}$
- (2)  $V_{CC} = 1.8\text{ V}$
- (3)  $V_{CC} = 2.85\text{ V}$

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

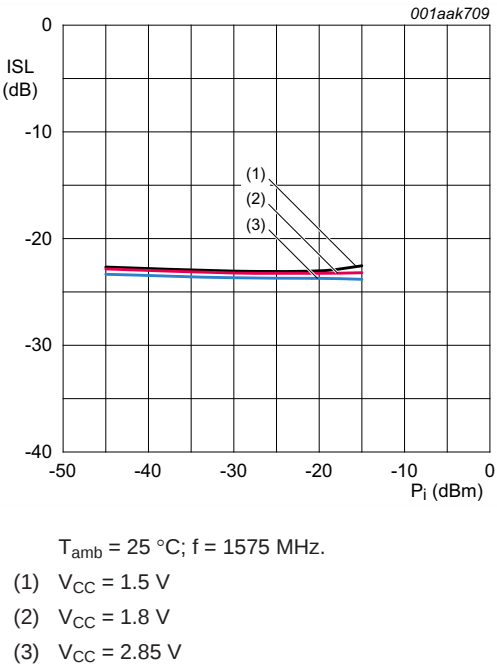


Fig 24. Isolation as a function of input power; typical values

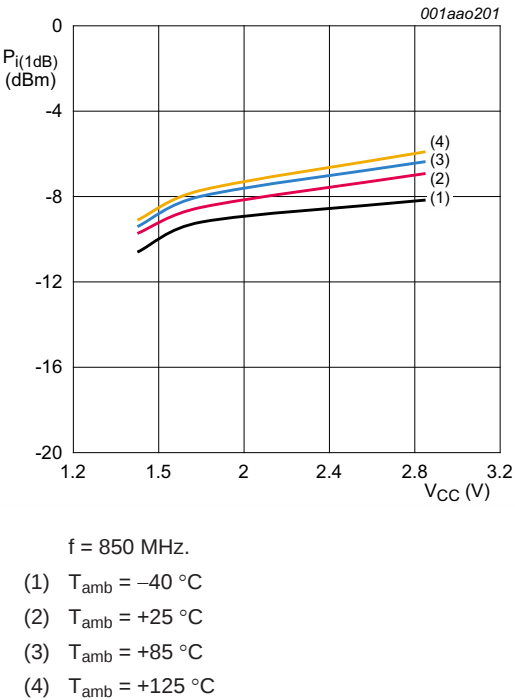


Fig 25. Input power at 1 dB gain compression as a function of supply voltage; typical values

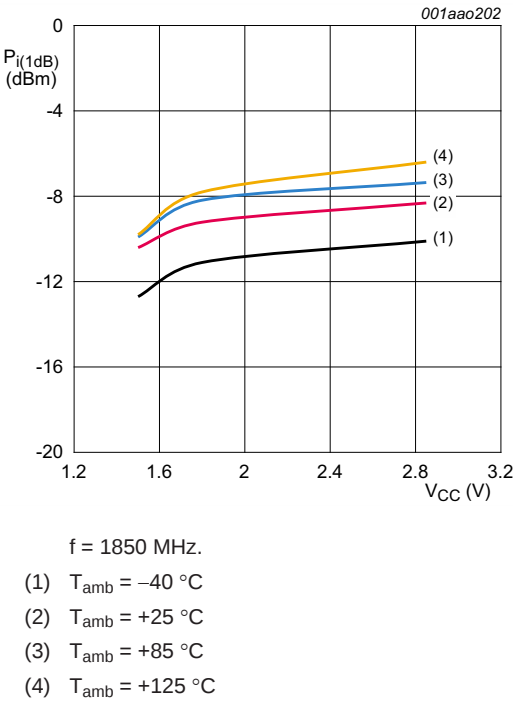


Fig 26. Input power at 1 dB gain compression as a function of supply voltage; typical values

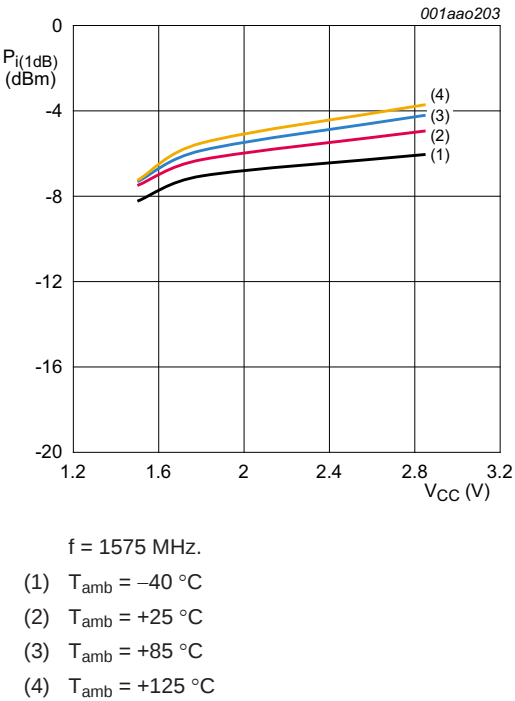
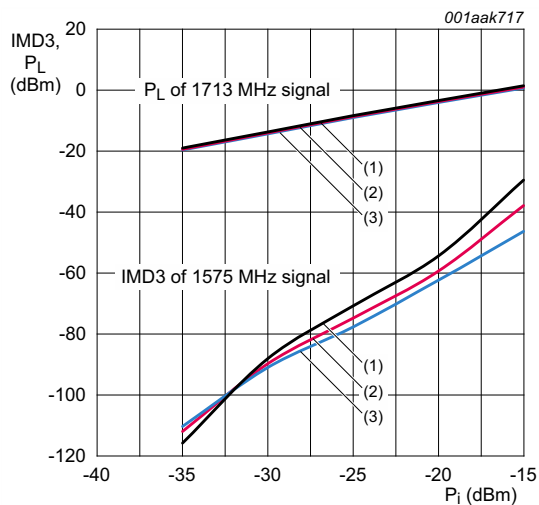
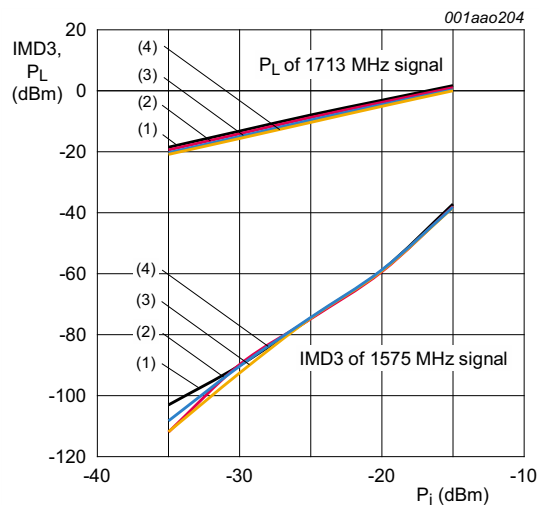


Fig 27. Input power at 1 dB gain compression as a function of supply voltage; typical values



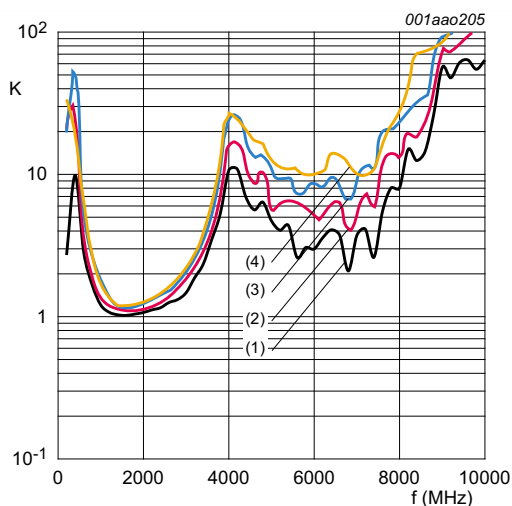
- $f = 1575 \text{ MHz}; f_1 = 1713 \text{ MHz}; f_2 = 1851 \text{ MHz};$   
 $T_{\text{amb}} = 25 \text{ }^{\circ}\text{C}.$
- (1)  $V_{\text{CC}} = 1.5 \text{ V}$
  - (2)  $V_{\text{CC}} = 1.8 \text{ V}$
  - (3)  $V_{\text{CC}} = 2.85 \text{ V}$

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



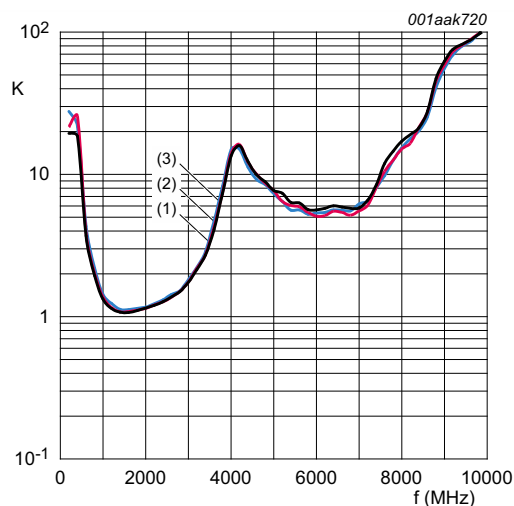
- $f = 1575 \text{ MHz}; f_1 = 1713 \text{ MHz}; f_2 = 1851 \text{ MHz};$   
 $V_{\text{CC}} = 1.8 \text{ V}.$
- (1)  $T_{\text{amb}} = -40 \text{ }^{\circ}\text{C}$
  - (2)  $T_{\text{amb}} = +25 \text{ }^{\circ}\text{C}$
  - (3)  $T_{\text{amb}} = +85 \text{ }^{\circ}\text{C}$
  - (4)  $T_{\text{amb}} = +125 \text{ }^{\circ}\text{C}$

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



- $V_{\text{CC}} = 1.8 \text{ V}; P_i = -45 \text{ dBm}.$
- (1)  $T_{\text{amb}} = -40 \text{ }^{\circ}\text{C}$
  - (2)  $T_{\text{amb}} = +25 \text{ }^{\circ}\text{C}$
  - (3)  $T_{\text{amb}} = +85 \text{ }^{\circ}\text{C}$
  - (4)  $T_{\text{amb}} = +125 \text{ }^{\circ}\text{C}$

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

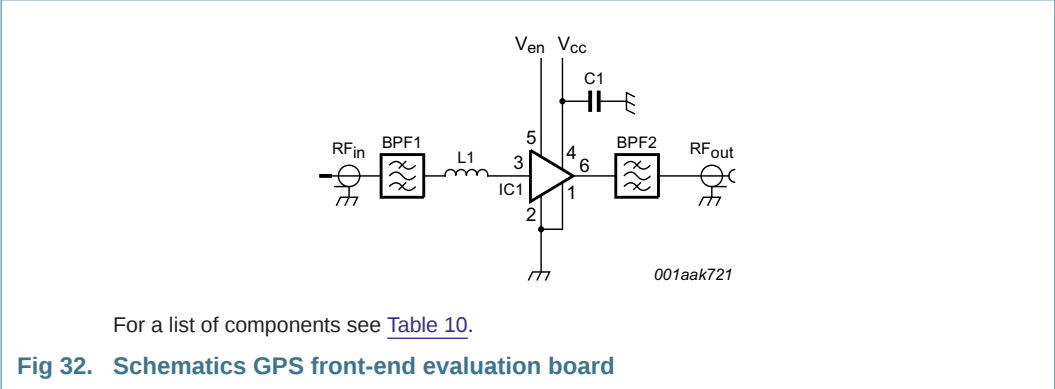


- $T_{\text{amb}} = 25 \text{ }^{\circ}\text{C}; P_i = -45 \text{ dBm}.$
- (1)  $V_{\text{CC}} = 1.5 \text{ V}$
  - (2)  $V_{\text{CC}} = 1.8 \text{ V}$
  - (3)  $V_{\text{CC}} = 2.85 \text{ V}$

**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.



**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: <ul style="list-style-type: none"><li>• B9444</li></ul> Alternatives from Murata: <ul style="list-style-type: none"><li>• SAFEA1G57KH0F00</li><li>• SAFEA1G57KB0F00</li></ul> Alternatives from Fujitsu: <ul style="list-style-type: none"><li>• FAR-F6KA-1G5754-L4AA</li><li>• FAR-F6KA-1G5754-L4AJ</li></ul> |
| 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;  $V_{ENABLE} \geq 0.8$  V; power at LNA input  $P_i < -40$  dBm;  $T_{amb} = 25$  °C; input and output matched to  $50 \Omega$ ; 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     |
| $\alpha$     | attenuation                          | $f = 850$ MHz [4]                      | 95  | -    | -    | dBc     |
|              |                                      | $f = 1850$ MHz [4]                     | 90  | -    | -    | dBc     |
| $t_{on}$     | turn-on time                         | [5]                                    | -   | -    | 2    | $\mu$ s |
| $t_{off}$    | turn-off time                        | [5]                                    | -   | -    | 1    | $\mu$ s |

[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

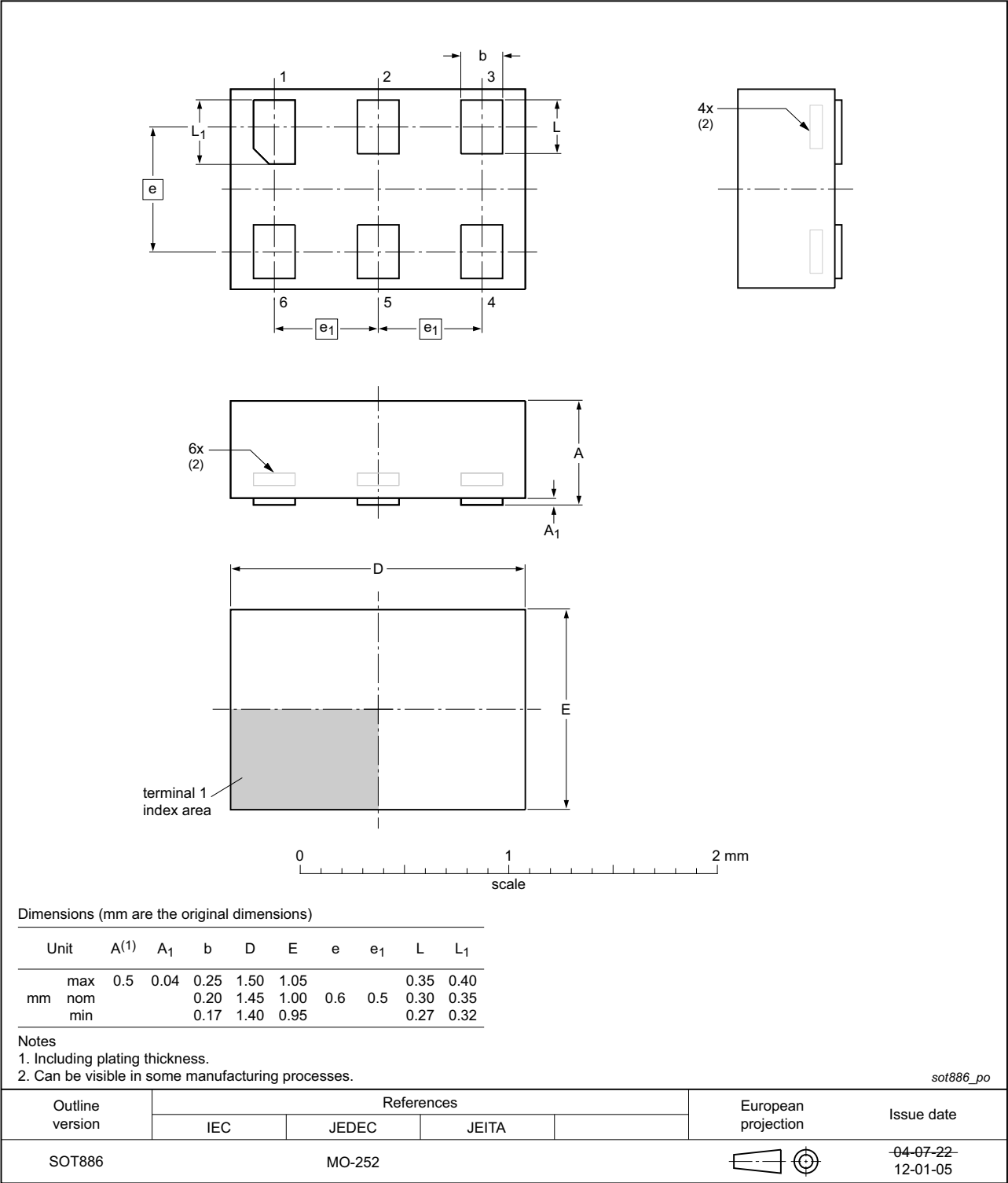


Fig 33. Package outline SOT886 (XSON6)

## 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: | <ul style="list-style-type: none"> <li><a href="#">Section 1</a>: added GPS1103M according to our new naming convention</li> </ul>                                                                                                                                                                                                                                                                                                                                                                    |                    |               |             |
| BGU7004 v.2    | 20150220                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Product data sheet | -             | BGU7004 v.1 |
| Modifications: | <ul style="list-style-type: none"> <li>The title of this data sheet has been changed.</li> <li><a href="#">Section 1.3 on page 1</a>: Added GLONASS, Galileo and Compass (BeiDou) to the possible applications.</li> <li><a href="#">Section 11 on page 17</a>: ESD information has moved from Section 1.1 to this section.</li> <li><a href="#">Section 14.3 on page 18</a>: Adjusted the disclaimers with respect to "suitability to use in automotive applications" and "Translations".</li> </ul> |                    |               |             |
| BGU7004 v.1    | 20110705                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Product data sheet | -             | -           |

## 14. Legal information

### 14.1 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>.

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Компания «Океан Электроники» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

Наши преимущества:

- Поставка оригинальных импортных электронных компонентов напрямую с производств Америки, Европы и Азии, а так же с крупнейших складов мира;
- Широкая линейка поставок активных и пассивных импортных электронных компонентов (более 30 млн. наименований);
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Помощь Конструкторского Отдела и консультации квалифицированных инженеров;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Поставка электронных компонентов под контролем ВП;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- При необходимости вся продукция военного и аэрокосмического назначения проходит испытания и сертификацию в лаборатории (по согласованию с заказчиком);
- Поставка специализированных компонентов военного и аэрокосмического уровня качества (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Actel, Aeroflex, Peregrine, VPT, Syfer, Eurofarad, Texas Instruments, MS Kennedy, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Компания «Океан Электроники» является официальным дистрибьютором и эксклюзивным представителем в России одного из крупнейших производителей разъемов военного и аэрокосмического назначения «JONHON», а так же официальным дистрибьютором и эксклюзивным представителем в России производителя высокотехнологичных и надежных решений для передачи СВЧ сигналов «FORSTAR».



## JONHON

«JONHON» (основан в 1970 г.)

Разъемы специального, военного и аэрокосмического назначения:

(Применяются в военной, авиационной, аэрокосмической, морской, железнодорожной, горно- и нефтедобывающей отраслях промышленности)

«FORSTAR» (основан в 1998 г.)

ВЧ соединители, коаксиальные кабели,  
кабельные сборки и микроволновые компоненты:

(Применяются в телекоммуникациях гражданского и специального назначения, в средствах связи, РЛС, а так же военной, авиационной и аэрокосмической отраслях промышленности).



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