

BGB741L7ESD

Internally matched general purpose LNA MMIC for 50 MHz- 3.5 GHz applications



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Technical documents



Simulation



Support

Product description

The BGB741L7ESD is a high performance broadband low noise amplifier (LNA) MMIC based on Infineon's silicon germanium carbon (SiGe:C) bipolar technology.



Feature list

- Minimum noise figure $NF_{min} = 1.05$ dB at 2.4 GHz, 3 V, 10 mA
- Supply voltage range $V_{CC} = 1.8$ to 4.0 V at $T_A = 25$ °C
- High RF input power robustness of 20 dBm
- Integrated ESD protection: 2 kV HBM at all pins

Product validation

Qualified for industrial applications according to the relevant tests of JEDEC47/20/22.

Potential applications

- Satellite navigation systems (e.g. GPS, GLONASS, BeiDou, Galileo)
- Wireless communications: WLAN 2.4 GHz and 5-6 GHz bands, broadband LTE or WiMAX LNA
- ISM applications like RKE and smart meter, as well as for emerging wireless applications such as DVB-Terrestrial

Device information

Table 1 Part information

| Product name / Ordering code | Package | Pin configuration | | | | Marking | Pieces / Reel |
|--|----------|-------------------|-----------------------|---------------|----------------|---------|------------------|
| BGB741L7ESD / BGB741L7ESDE6327XTSA1 | TSLP-7-1 | 1 = V_{CC} | 2 = V_{Bias} | 3 = RF_{in} | 4 = RF_{out} | AY | 7500 |
| | | 5 = V_{Ctrl} | 6 = Current adjust | 7 = Ground | | | |

Attention: ESD (Electrostatic discharge) sensitive device, observe handling precautions

Functional block diagram
Functional block diagram

This functional block diagram explains how the BGB707L7ESD is used. The RF power on/off function is controlled by applying V_{Ctrl} . By using an external resistor R_{ext} , the pre-set current of 5.5 mA (when R_{ext} is omitted) can be increased. Base V_B and collector V_C voltages are applied to the respective pins RF_{in} and RF_{out} by external inductors L_B and L_C .

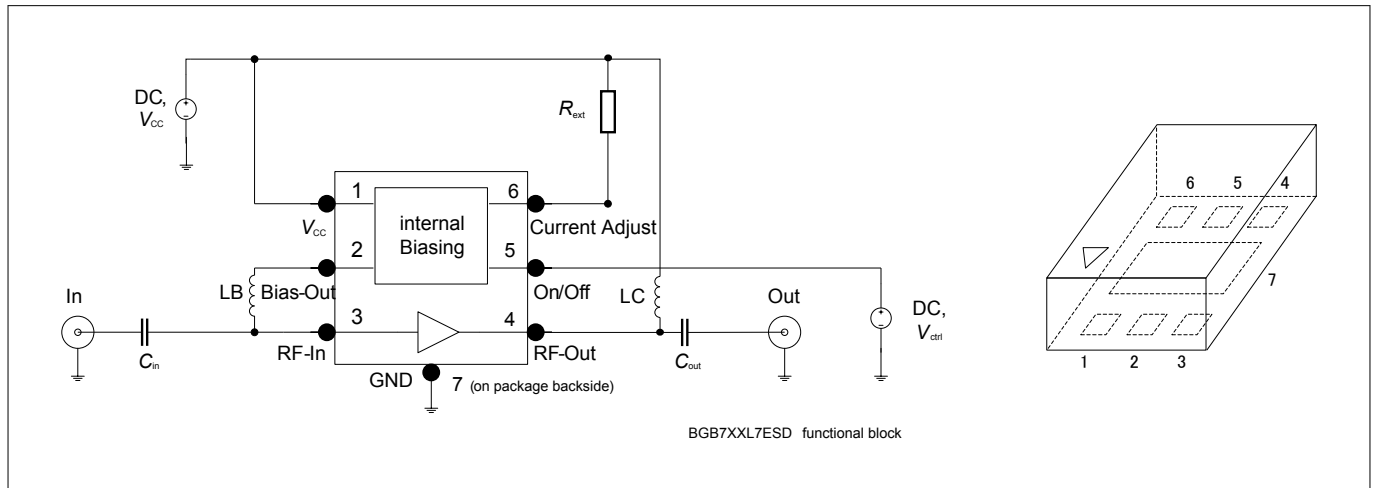


Figure 1 **Functional block diagram**

Table of contents

| | | |
|----------|---|----|
| | Product description | 1 |
| | Feature list | 1 |
| | Product validation | 1 |
| | Potential applications | 1 |
| | Device information | 1 |
| | Functional block diagram | 2 |
| | Table of contents | 3 |
| 1 | Operating conditions | 4 |
| 2 | Absolute maximum ratings | 5 |
| 3 | Thermal characteristics | 6 |
| 4 | Electrical characteristics | 7 |
| 4.1 | DC characteristics | 7 |
| 4.2 | Characteristic DC diagrams | 8 |
| 4.3 | AC characteristics | 10 |
| 5 | Package information TSLP-7-1 | 19 |
| | Revision history | 21 |
| | Disclaimer | 22 |

Operating conditions**1 Operating conditions****Table 2** **Operation conditions at $T_A = 25\text{ °C}$**

| Parameter | Symbol | Values | | | Unit | Note or test condition |
|-----------------------------|----------------|--------|------|----------|------|------------------------|
| | | Min. | Typ. | Max. | | |
| Supply voltage | V_{CC} | 1.8 | 3 | 4 | V | – |
| Control voltage in on-mode | $V_{Ctrl-on}$ | 1.2 | – | V_{CC} | | |
| Control voltage in off-mode | $V_{Ctrl-off}$ | -0.3 | | 0.3 | | |

Absolute maximum ratings

2 Absolute maximum ratings

Table 3 Absolute maximum ratings at $T_A = 25\text{ °C}$ (unless otherwise specified)

| Parameter | Symbol | Values | | Unit | Note or test condition |
|---------------------------------------|------------|--------|----------|------|--------------------------|
| | | Min. | Max. | | |
| Supply voltage | V_{CC} | – | 4 | V | $T_A = 25\text{ °C}$ |
| | | | 3.5 | | $T_A = -55\text{ °C}$ |
| Supply current | I_{CC} | | 30 | mA | – |
| DC current at RF_{in} | I_B | | 3 | | |
| Control voltage | V_{Ctrl} | | V_{CC} | V | |
| ESD stress pulse (HBM) | V_{ESD} | | +/- 2 | kV | |
| RF input power | P_{RFin} | | 20 | dBm | $T_S \leq 117\text{ °C}$ |
| Total power dissipation ¹⁾ | P_{tot} | – | 120 | mW | |
| Junction temperature | T_J | | 150 | °C | |
| Storage temperature | T_{Stg} | -55 | | | – |

Attention: Stresses above the max. values listed here may cause permanent damage to the device. Exposure to absolute maximum rating conditions for extended periods may affect device reliability. Exceeding only one of these values may cause irreversible damage to the integrated circuit.

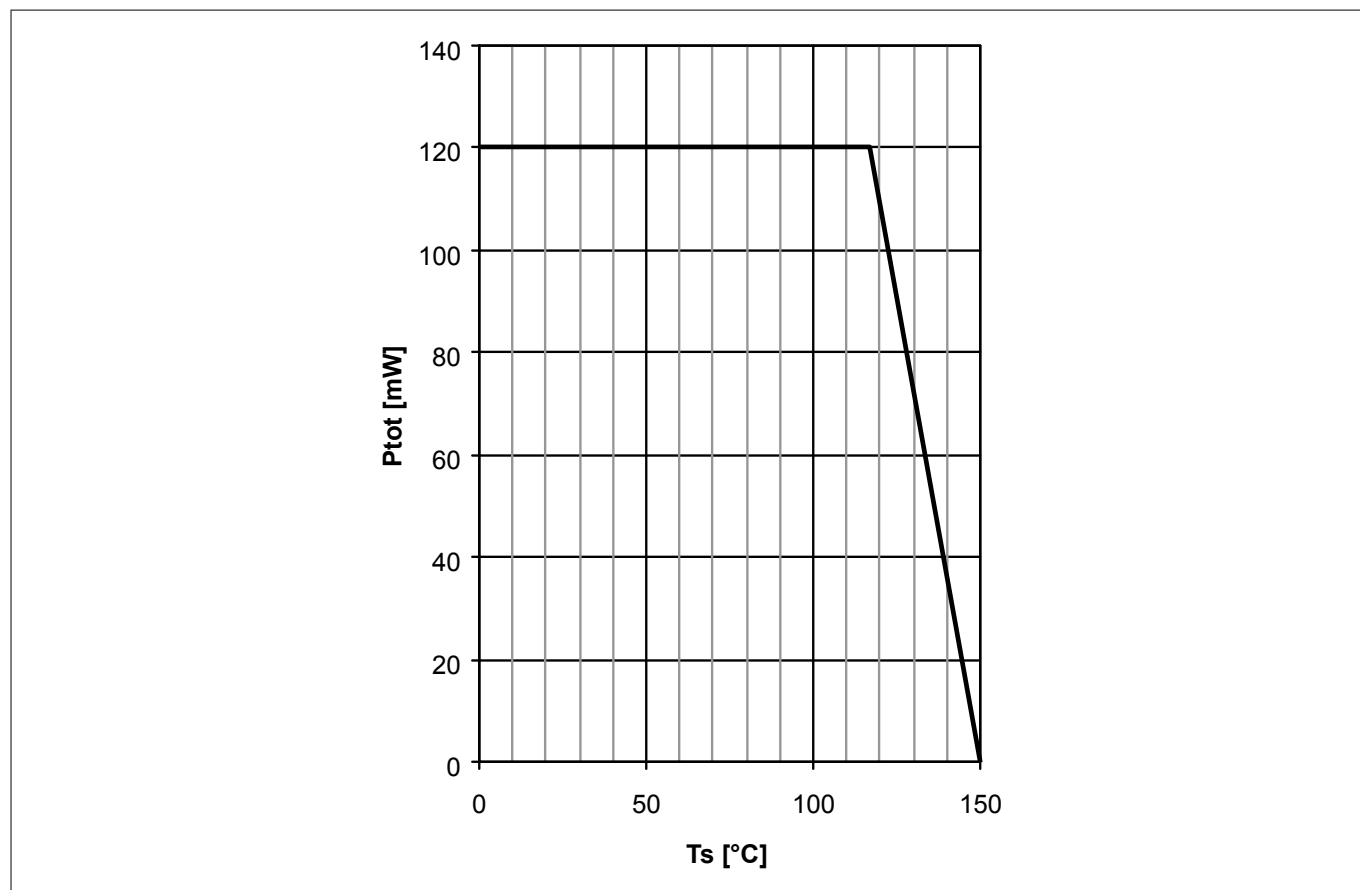
¹ T_S is the soldering point temperature. T_S is measured on the emitter lead at the soldering point of the PCB

Thermal characteristics

3 Thermal characteristics

Table 4 Thermal resistance

| Parameter | Symbol | Values | | | Unit | Note or test condition |
|----------------------------|------------|--------|------|------|------|------------------------|
| | | Min. | Typ. | Max. | | |
| Junction - soldering point | R_{thJS} | – | 275 | – | K/W | – |

Figure 2 Total power dissipation $P_{tot} = f(T_s)$

Electrical characteristics**4 Electrical characteristics****4.1 DC characteristics****Table 5 DC characteristics at $V_{CC} = 3\text{ V}$, $T_A = 25\text{ °C}$**

| Parameter | Symbol | Values | | | Unit | Note or test condition |
|-----------------------------|----------------|---------------|----------------|---------------|---------------|---|
| | | Min. | Typ. | Max. | | |
| Supply current in on-mode | I_{CC-on} | 5.0 – – | 5.5 6 10 | 6.5 – – | mA | $V_{Ctrl} = 3\text{ V}$ $R_{ext} = \text{open}$ $R_{ext} = 30\text{ k}\Omega$ $R_{ext} = 3\text{ k}\Omega$ |
| Supply current in off-mode | I_{CC-off} | – | – | 6 | μA | $V_{Ctrl} = 0\text{ V}$ |
| Control current in on-mode | $I_{Ctrl-on}$ | | 14 | 20 | | $V_{Ctrl} = 3\text{ V}$ |
| Control current in off-mode | $I_{Ctrl-off}$ | | – | 0.1 | | $V_{Ctrl} = 0\text{ V}$ |

Electrical characteristics

4.2 Characteristic DC diagrams

The measurement setup is an application circuit according to [Figure 1](#) on page 2, using the integrated biasing.
 $T_A = 25^\circ\text{C}$ (unless otherwise specified).

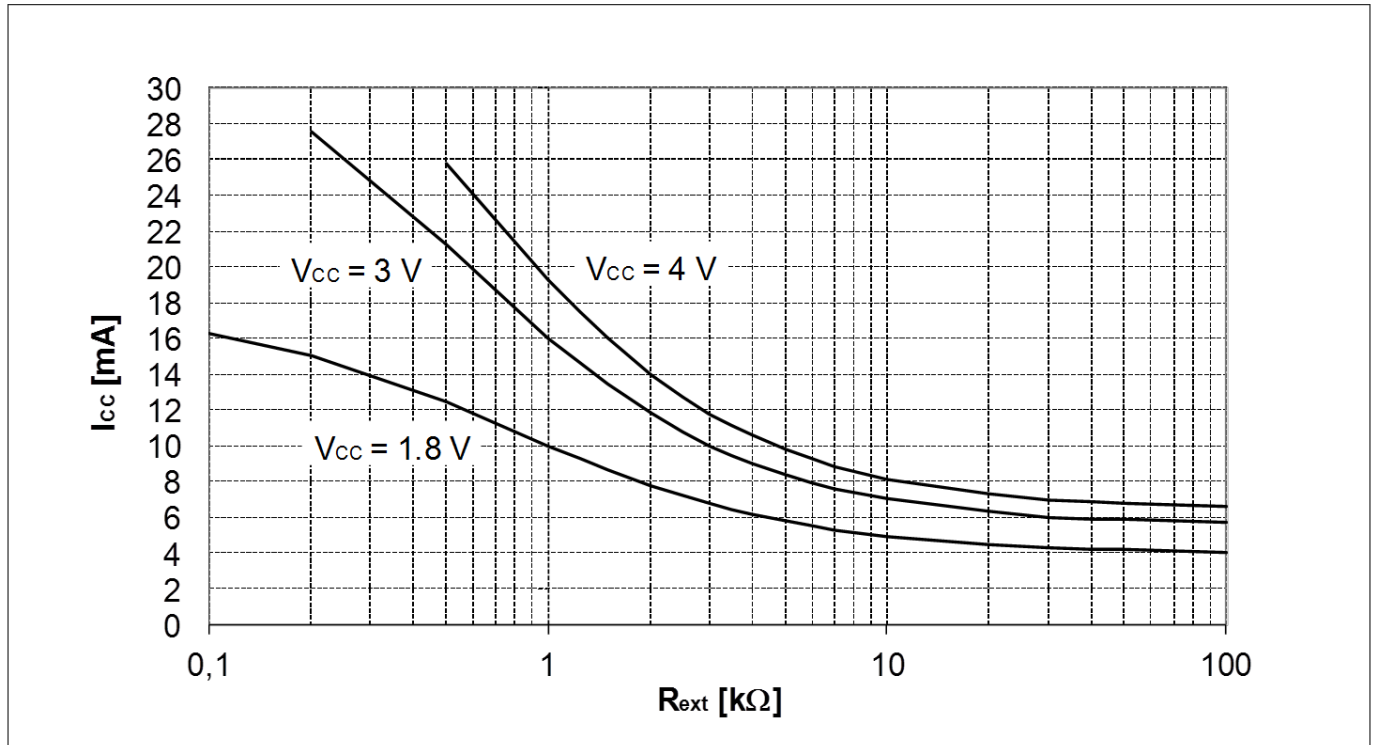


Figure 3 Supply current vs external resistance $I_{CC} = f(R_{ext})$, $V_{Ctrl} = 3\text{ V}$, $V_{CC} = \text{parameter}$

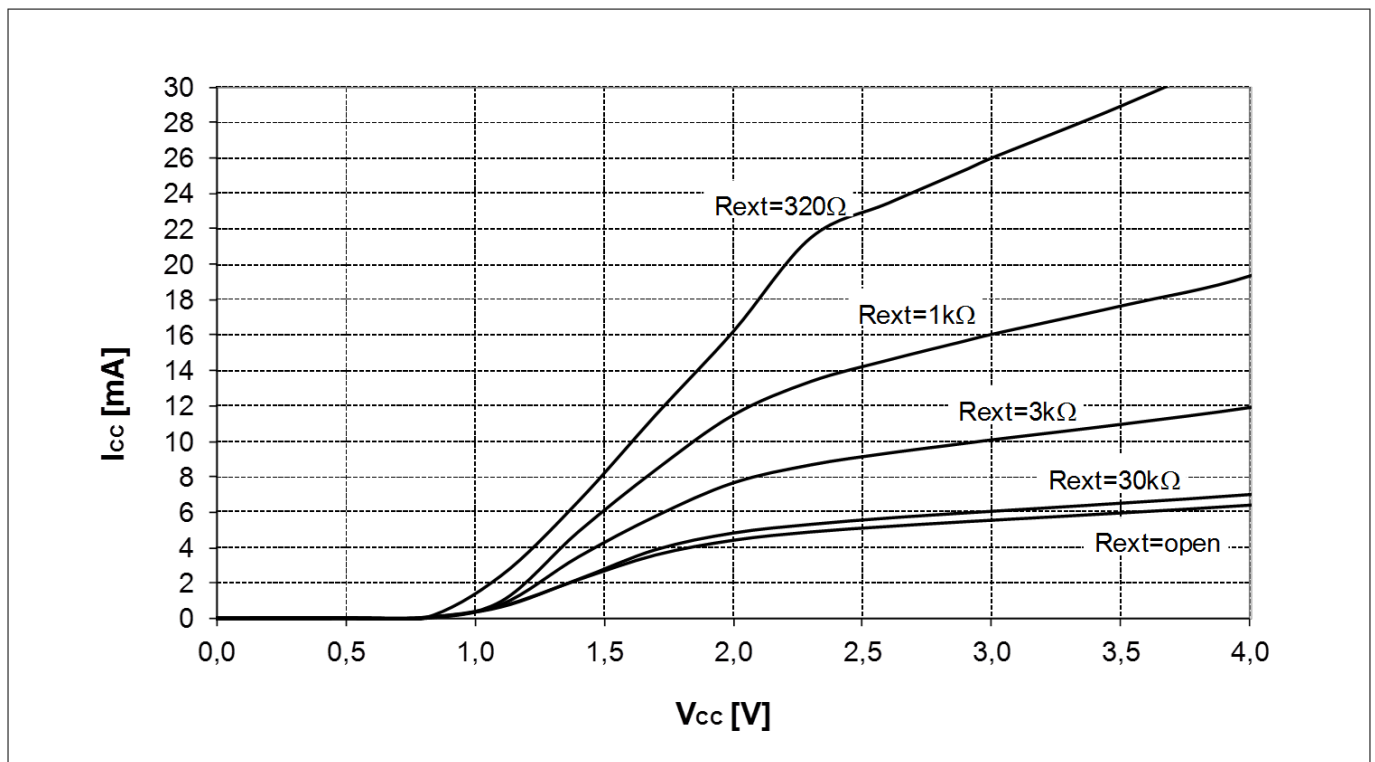


Figure 4 Supply current vs supply voltage $I_{CC} = f(V_{CC})$, $V_{Ctrl} = 3\text{ V}$, $R_{ext} = \text{parameter}$

Electrical characteristics

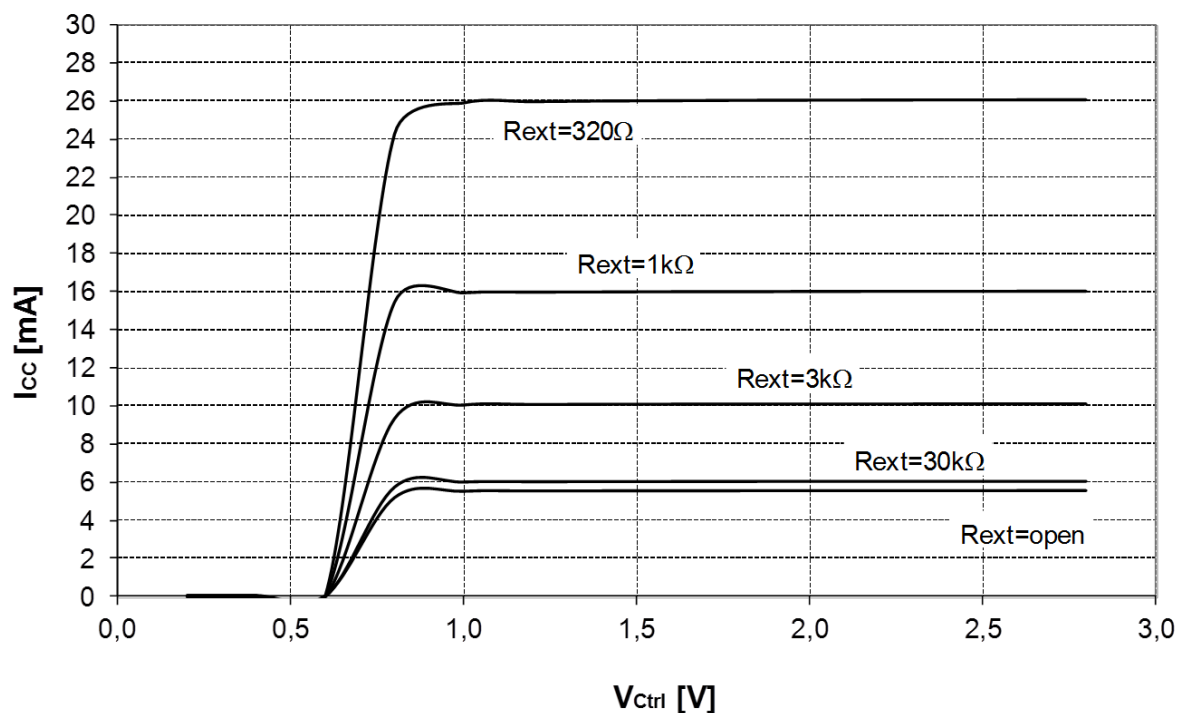


Figure 5 Supply current vs control voltage $I_{CC} = f(V_{ctrl})$, $V_{CC} = 3\text{ V}$, $R_{ext} = \text{parameter}$

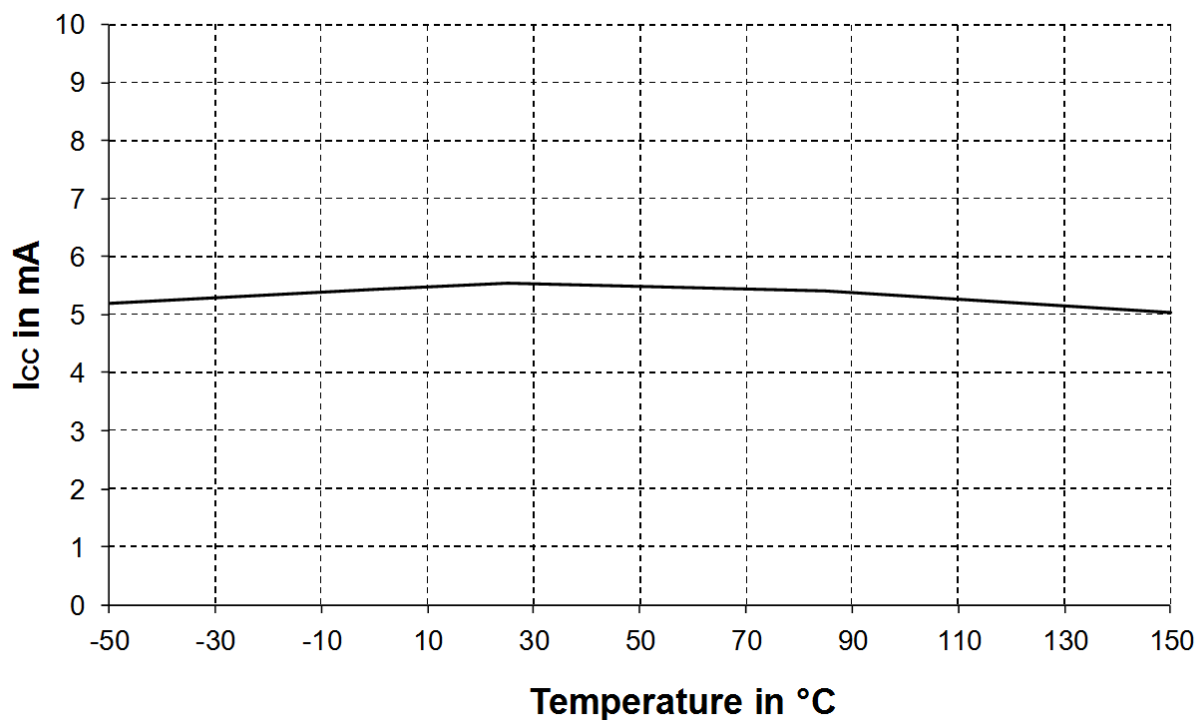


Figure 6 Supply current vs temperature $I_{CC} = f(T_A)$, $V_{ctrl} = V_{CC} = 3\text{ V}$, $R_{ext} = \text{open}$

Electrical characteristics

4.3 AC characteristics

The measurement setup is a test fixture with Bias-T's in a 50 Ω system, $T_A = 25^\circ\text{C}$.

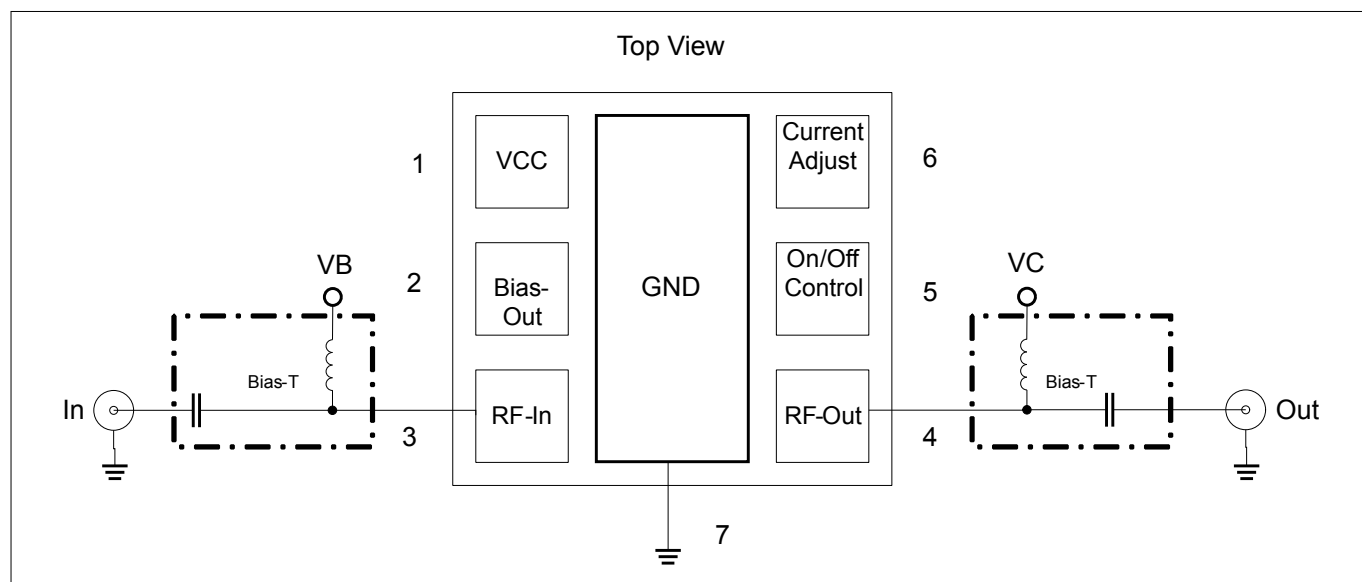


Figure 7 **Testing setup**

Electrical characteristics

Table 6 AC characteristics, $V_C = 3\text{ V}$, $f = 150\text{ MHz}$

| Parameter | Symbol | Values | | | Unit | Note or test condition |
|--|-------------------|--------|--------------|------|------|---|
| | | Min. | Typ. | Max. | | |
| Minimum noise figure ¹⁾ | NF_{\min} | – | 1.05 0.95 | – | dB | $I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$ $Z_S = Z_{S,\text{opt}}$ |
| Noise figure in 50 Ω system ²⁾ | NF_{50} | | 1.1 1.05 | | | $I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$ $Z_S = Z_L = 50\text{ }\Omega$ |
| Transducer gain | $ S_{21} ^2$ | | 19 21 | | | $I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$ |
| Maximum stable power gain | G_{ms} | | 20 21.5 | | | $I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$ |
| Input 1 dB gain compression point | $IP_{1\text{dB}}$ | | -5.5 -8 | | dBm | $I_{Cq} = 6\text{ mA}$ $I_{Cq} = 10\text{ mA}$ |
| Input 3 rd order intercept point | IIP_3 | | 5.5 3.5 | | | $I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$ |
| Input return loss | RL_{in} | | 14 18 | | dB | $I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$ |
| Output return loss | RL_{out} | | 12.5 18.5 | | | $I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$ |

¹⁾ Test fixture losses are extracted

²⁾ Parameter measured on an application board according to [Figure 1](#) on page 2 presenting a 50 Ω system to the device. I_{Cq} is the quiescent current, that is at small RF input power level. I_C increases as RF input power level approaches $IP_{1\text{dB}}$.

Electrical characteristics

Table 7 AC characteristics, $V_C = 3\text{ V}$, $f = 450\text{ MHz}$

| Parameter | Symbol | Values | | | Unit | Note or test condition |
|--|-------------------|--------|--------------|------|------|---|
| | | Min. | Typ. | Max. | | |
| Minimum noise figure ¹⁾ | NF_{\min} | – | 1.05 0.95 | – | dB | $I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$ $Z_S = Z_{S,\text{opt}}$ |
| Noise figure in 50 Ω system ²⁾ | NF_{50} | | 1.1 1.05 | | | $I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$ $Z_S = Z_L = 50\ \Omega$ |
| Transducer gain | $ S_{21} ^2$ | | 18.5 20.5 | | | $I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$ |
| Maximum available power gain | G_{ma} | | 19 20.5 | | | $I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$ |
| Input 1 dB gain compression point | $IP_{1\text{dB}}$ | | -5 -7.5 | | dBm | $I_{Cq} = 6\text{ mA}$ $I_{Cq} = 10\text{ mA}$ |
| Input 3 rd order intercept point | IIP_3 | | 4 2.5 | | | $I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$ |
| Input return loss | RL_{in} | | 15.5 21 | | dB | $I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$ |
| Output return loss | RL_{out} | | 14.5 28 | | | $I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$ |

¹⁾ Test fixture losses are extracted

²⁾ Parameter measured on an application board according to [Figure 1](#) on page 2 presenting a 50 Ω system to the device. I_{Cq} is the quiescent current, that is at small RF input power level. I_C increases as RF input power level approaches $IP_{1\text{dB}}$.

Electrical characteristics

Table 8 AC characteristics, $V_C = 3\text{ V}$, $f = 900\text{ MHz}$

| Parameter | Symbol | Values | | | Unit | Note or test condition |
|--|-------------------|--------|--------------|------|------|---|
| | | Min. | Typ. | Max. | | |
| Minimum noise figure ¹⁾ | NF_{\min} | – | 1.05 0.95 | – | dB | $I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$ $Z_S = Z_{S,\text{opt}}$ |
| Noise figure in 50 Ω system ²⁾ | NF_{50} | | 1.1 1.05 | | | $I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$ $Z_S = Z_L = 50\text{ }\Omega$ |
| Transducer gain | $ S_{21} ^2$ | | 18.5 20 | | | $I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$ |
| Maximum available power gain | G_{ma} | | 19 20.5 | | | $I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$ |
| Input 1 dB gain compression point | $IP_{1\text{dB}}$ | | -5 -7 | | dBm | $I_{Cq} = 6\text{ mA}$ $I_{Cq} = 10\text{ mA}$ |
| Input 3 rd order intercept point | IIP_3 | | 3 1.5 | | | $I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$ |
| Input return loss | RL_{in} | | 15.5 19 | | dB | $I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$ |
| Output return loss | RL_{out} | | 14.5 28.5 | | | $I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$ |

¹⁾ Test fixture losses are extracted

²⁾ Parameter measured on an application board according to [Figure 1](#) on page 2 presenting a 50 Ω system to the device. I_{Cq} is the quiescent current, that is at small RF input power level. I_C increases as RF input power level approaches $IP_{1\text{dB}}$.

Electrical characteristics

Table 9 AC characteristics, $V_C = 3\text{ V}$, $f = 1.5\text{ GHz}$

| Parameter | Symbol | Values | | | Unit | Note or test condition |
|--|-------------------|--------|--------------|------|------|---|
| | | Min. | Typ. | Max. | | |
| Minimum noise figure ¹⁾ | NF_{\min} | – | 1.05 1.0 | – | dB | $I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$ $Z_S = Z_{S,\text{opt}}$ |
| Noise figure in 50 Ω system ²⁾ | NF_{50} | | 1.1 1.05 | | | $I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$ $Z_S = Z_L = 50\ \Omega$ |
| Transducer gain | $ S_{21} ^2$ | | 18 19.5 | | | $I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$ |
| Maximum available power gain | G_{ma} | | 18.5 20 | | | $I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$ |
| Input 1 dB gain compression point | $IP_{1\text{dB}}$ | | -4.5 -6.5 | | dBm | $I_{Cq} = 6\text{ mA}$ $I_{Cq} = 10\text{ mA}$ |
| Input 3 rd order intercept point | IIP_3 | | 2.5 1 | | | $I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$ |
| Input return loss | RL_{in} | | 14.5 16 | | dB | $I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$ |
| Output return loss | RL_{out} | | 14 23 | | | $I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$ |

¹⁾ Test fixture losses are extracted

²⁾ Parameter measured on an application board according to [Figure 1](#) on page 2 presenting a 50 Ω system to the device. I_{Cq} is the quiescent current, that is at small RF input power level. I_C increases as RF input power level approaches $IP_{1\text{dB}}$.

Electrical characteristics

Table 10 AC characteristics, $V_C = 3\text{ V}$, $f = 1.9\text{ GHz}$

| Parameter | Symbol | Values | | | Unit | Note or test condition |
|--|-------------------|--------|--------------|------|------|---|
| | | Min. | Typ. | Max. | | |
| Minimum noise figure ¹⁾ | NF_{\min} | – | 1.05 1.05 | – | dB | $I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$ $Z_S = Z_{S,\text{opt}}$ |
| Noise figure in 50 Ω system ²⁾ | NF_{50} | | 1.15 1.1 | | | $I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$ $Z_S = Z_L = 50\ \Omega$ |
| Transducer gain | $ S_{21} ^2$ | | 17.5 19 | | | $I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$ |
| Maximum available power gain | G_{ma} | | 18 19.5 | | | $I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$ |
| Input 1 dB gain compression point | $IP_{1\text{dB}}$ | | -4 -6 | | dBm | $I_{Cq} = 6\text{ mA}$ $I_{Cq} = 10\text{ mA}$ |
| Input 3 rd order intercept point | IIP_3 | | 2.5 1 | | | $I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$ |
| Input return loss | RL_{in} | | 13.5 15 | | dB | $I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$ |
| Output return loss | RL_{out} | | 13.5 21 | | | $I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$ |

¹⁾ Test fixture losses are extracted

²⁾ Parameter measured on an application board according to [Figure 1](#) on page 2 presenting a 50 Ω system to the device. I_{Cq} is the quiescent current, that is at small RF input power level. I_C increases as RF input power level approaches $IP_{1\text{dB}}$.

Electrical characteristics

Table 11 AC characteristics, $V_C = 3\text{ V}$, $f = 2.4\text{ GHz}$

| Parameter | Symbol | Values | | | Unit | Note or test condition |
|--|-------------------|--------|--------------|------|------|---|
| | | Min. | Typ. | Max. | | |
| Minimum noise figure ¹⁾ | NF_{\min} | – | 1.1 1.05 | – | dB | $I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$ $Z_S = Z_{S,\text{opt}}$ |
| Noise figure in 50 Ω system ²⁾ | NF_{50} | | 1.15 1.1 | | | $I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$ $Z_S = Z_L = 50\ \Omega$ |
| Transducer gain | $ S_{21} ^2$ | | 17 18.5 | | | $I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$ |
| Maximum available power gain | G_{ma} | | 17.5 19 | | | $I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$ |
| Input 1 dB gain compression point | $IP_{1\text{dB}}$ | | -3.5 -5.5 | | dBm | $I_{Cq} = 6\text{ mA}$ $I_{Cq} = 10\text{ mA}$ |
| Input 3 rd order intercept point | IIP_3 | | 3 1 | | | $I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$ |
| Input return loss | RL_{in} | | 12.5 13.5 | | dB | $I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$ |
| Output return loss | RL_{out} | | 12.5 18 | | | $I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$ |

¹⁾ Test fixture losses are extracted

²⁾ Parameter measured on an application board according to [Figure 1](#) on page 2 presenting a 50 Ω system to the device. I_{Cq} is the quiescent current, that is at small RF input power level. I_C increases as RF input power level approaches $IP_{1\text{dB}}$.

Electrical characteristics

Table 12 AC characteristics, $V_C = 3\text{ V}$, $f = 3.5\text{ GHz}$

| Parameter | Symbol | Values | | | Unit | Note or test condition |
|--|-------------------|--------|--------------|------|------|---|
| | | Min. | Typ. | Max. | | |
| Minimum noise figure ¹⁾ | NF_{\min} | – | 1.25 1.2 | – | dB | $I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$ $Z_S = Z_{S,\text{opt}}$ |
| Noise figure in 50 Ω system ²⁾ | NF_{50} | | 1.35 1.25 | | | $I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$ $Z_S = Z_L = 50\ \Omega$ |
| Transducer gain | $ S_{21} ^2$ | | 15 16.5 | | | $I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$ |
| Maximum available power gain | G_{ma} | | 16 17.5 | | | $I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$ |
| Input 1 dB gain compression point | $IP_{1\text{dB}}$ | | -2.5 -4.5 | | dBm | $I_{Cq} = 6\text{ mA}$ $I_{Cq} = 10\text{ mA}$ |
| Input 3 rd order intercept point | IIP_3 | | 3.5 1.5 | | | $I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$ |
| Input return loss | RL_{in} | | 10 10.5 | | dB | $I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$ |
| Output return loss | RL_{out} | | 10 13.5 | | | $I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$ |

¹⁾ Test fixture losses are extracted

²⁾ Parameter measured on an application board according to [Figure 1](#) on page 2 presenting a 50 Ω system to the device. I_{Cq} is the quiescent current, that is at small RF input power level. I_C increases as RF input power level approaches $IP_{1\text{dB}}$.

Electrical characteristics

Table 13 AC characteristics, $V_C = 3\text{ V}$, $f = 5.5\text{ GHz}$

| Parameter | Symbol | Values | | | Unit | Note or test condition |
|--|-------------------|--------|--------------|------|------|---|
| | | Min. | Typ. | Max. | | |
| Minimum noise figure ¹⁾ | NF_{\min} | – | 1.8 1.75 | – | dB | $I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$ $Z_S = Z_{S,\text{opt}}$ |
| Noise figure in 50 Ω system ²⁾ | NF_{50} | | 1.95 1.85 | | | $I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$ $Z_S = Z_L = 50\ \Omega$ |
| Transducer gain | $ S_{21} ^2$ | | 12 13 | | | $I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$ |
| Maximum available power gain | G_{ma} | | 14 15 | | | $I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$ |
| Input 1 dB gain compression point | $IP_{1\text{dB}}$ | | -1 -3 | | dBm | $I_{Cq} = 6\text{ mA}$ $I_{Cq} = 10\text{ mA}$ |
| Input 3 rd order intercept point | IIP_3 | | 8.5 4 | | | $I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$ |
| Input return loss | RL_{in} | | 7 8 | | dB | $I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$ |
| Output return loss | RL_{out} | | 7 8.5 | | | $I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$ |

¹⁾ Test fixture losses are extracted

²⁾ Parameter measured on an application board according to [Figure 1](#) on page 2 presenting a 50 Ω system to the device. I_{Cq} is the quiescent current, that is at small RF input power level. I_C increases as RF input power level approaches $IP_{1\text{dB}}$.

5 Package information TSLP-7-1

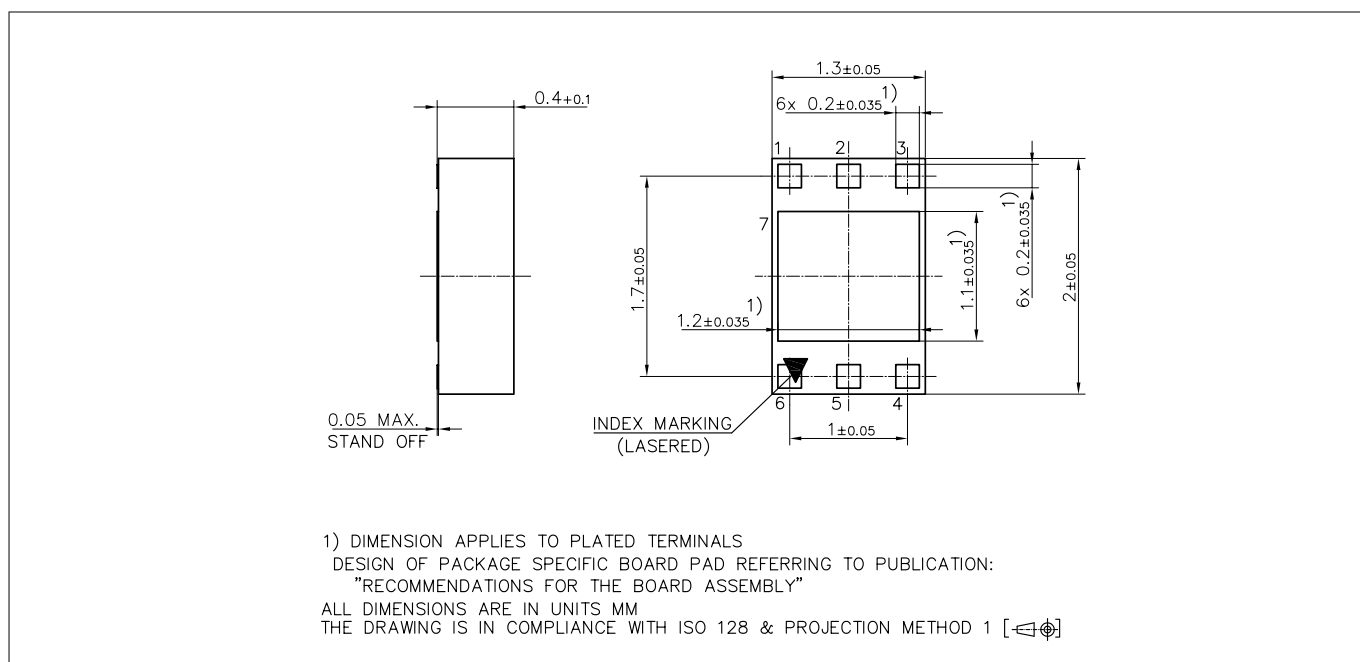


Figure 8 Package outline

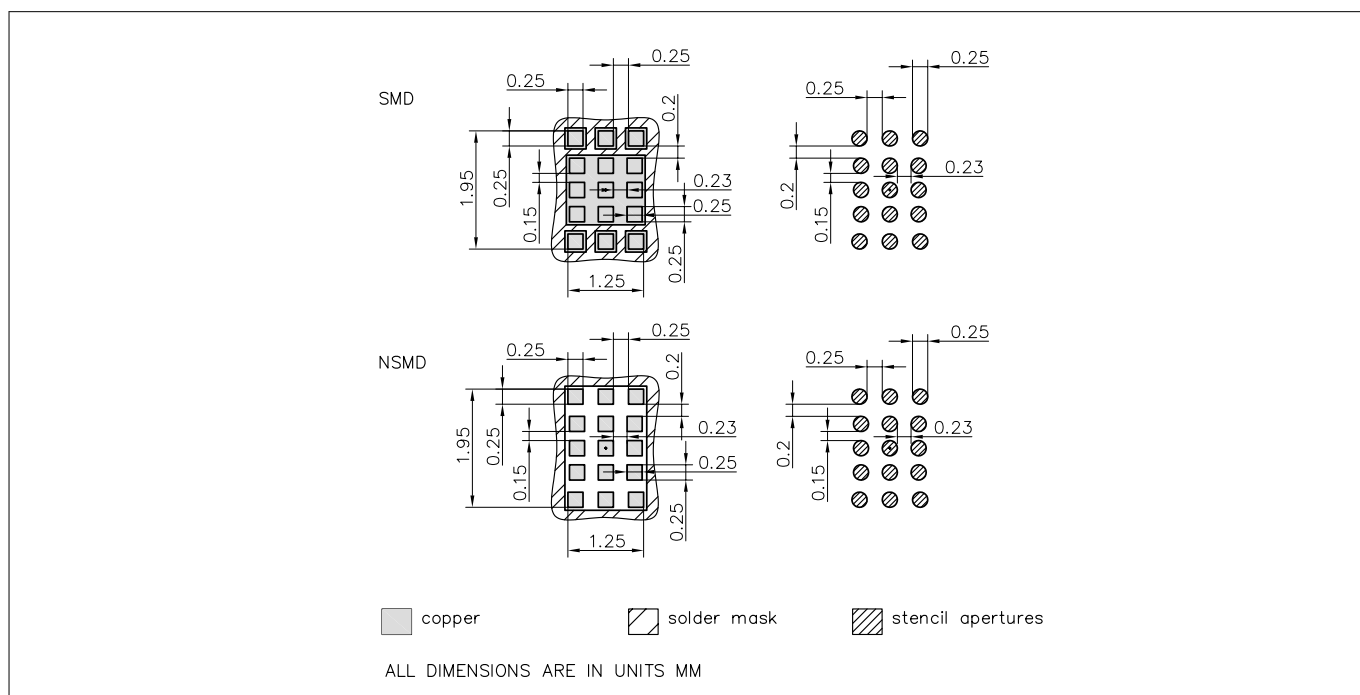
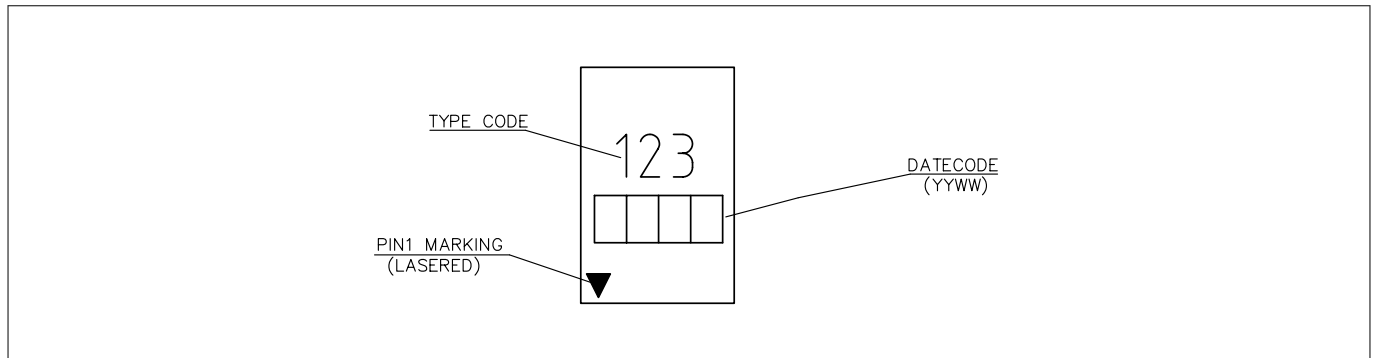
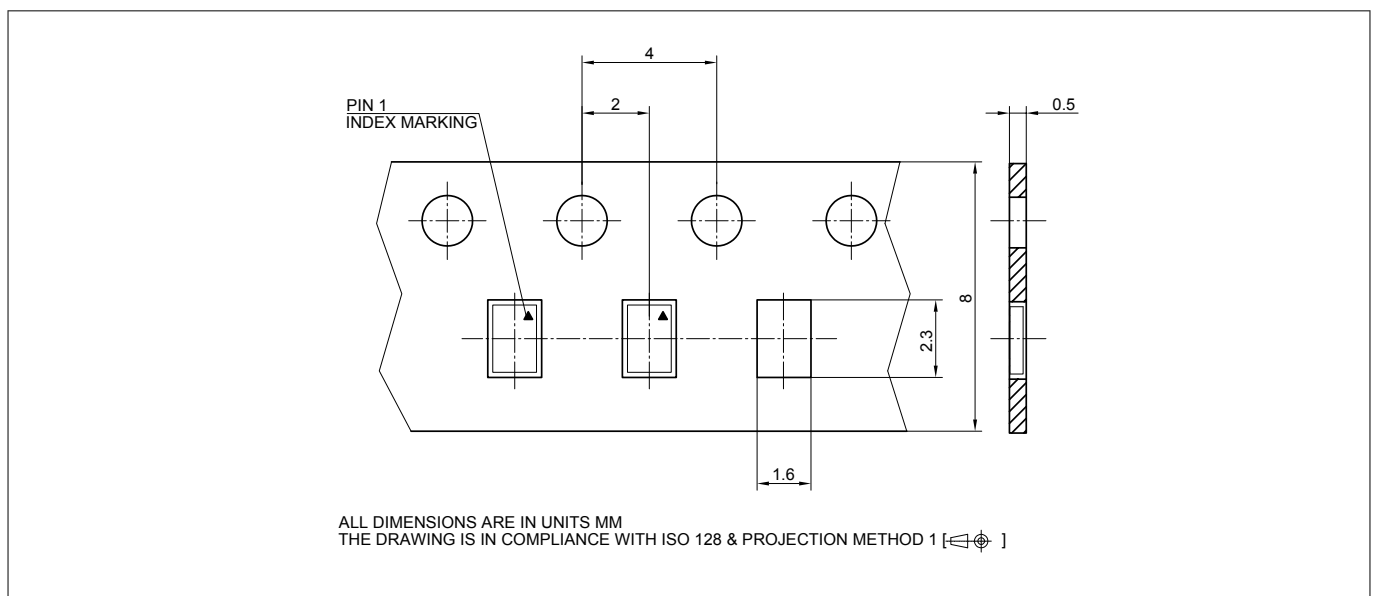


Figure 9 Foot print

Package information TSLP-7-1

Figure 10 Marking layout example

Figure 11 Tape information

Note: See our [Recommendations for Printed Circuit Board Assembly of TSLP/TSSLP/TSNP Packages](#). The marking layout is an example. For the real marking code refer to the device information on the first page. The number of characters shown in the layout example is not necessarily the real one. The marking layout can consist of less characters.

Revision history**Revision history**

| Document version | Date of release | Description of changes |
|------------------|-----------------|------------------------|
| 3.0 | 2018-09-26 | New datasheet layout. |

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