

# BGB741L7ESD

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



### 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

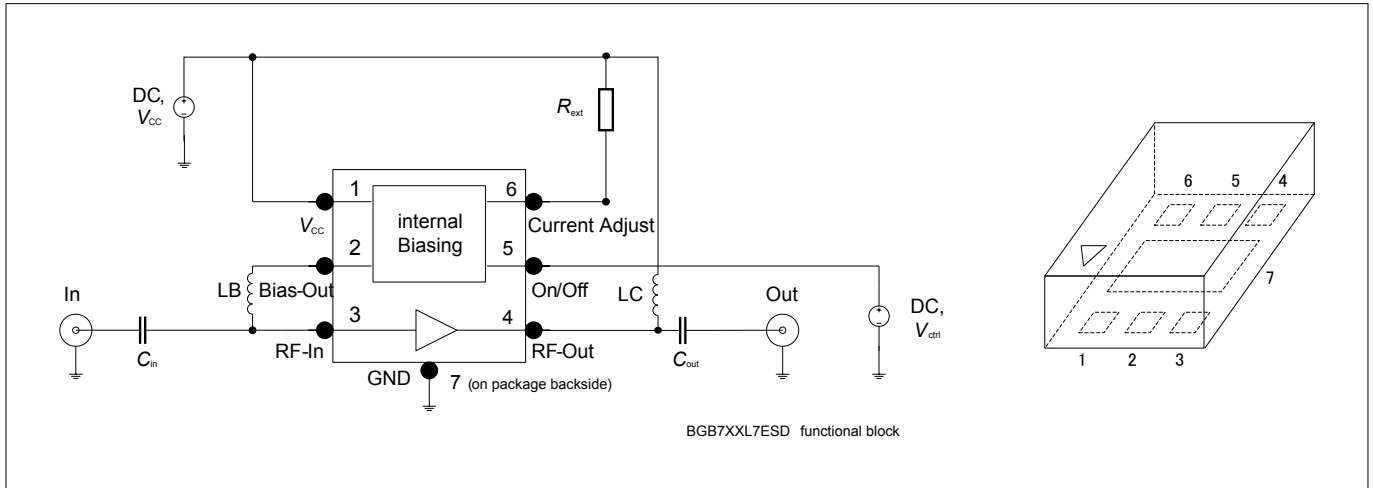
Product name / Ordering code	Package	Pin configuration				Marking	Pieces / Reel
BGB741L7ESD / BGB741L7ESDE6327XTSA1	TSLP-7-1	1 = $V_{CC}$	2 = $V_{Bias}$	3 = $RF_{in}$	4 = $RF_{out}$	AY	7500
		5 = $V_{Ctrl}$	6 = Current adjust	7 = Ground			

**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**



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**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	–	$V_{CC}$	V	–
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	$T_A = 25\text{ °C}$ $T_A = -55\text{ °C}$
			3.5		
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	$P_{RF_{in}}$		20	dBm	
Total power dissipation <sup>1)</sup>	$P_{tot}$		120	mW	$T_S \leq 117\text{ °C}$
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.*

<sup>1</sup>  $T_S$  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	-

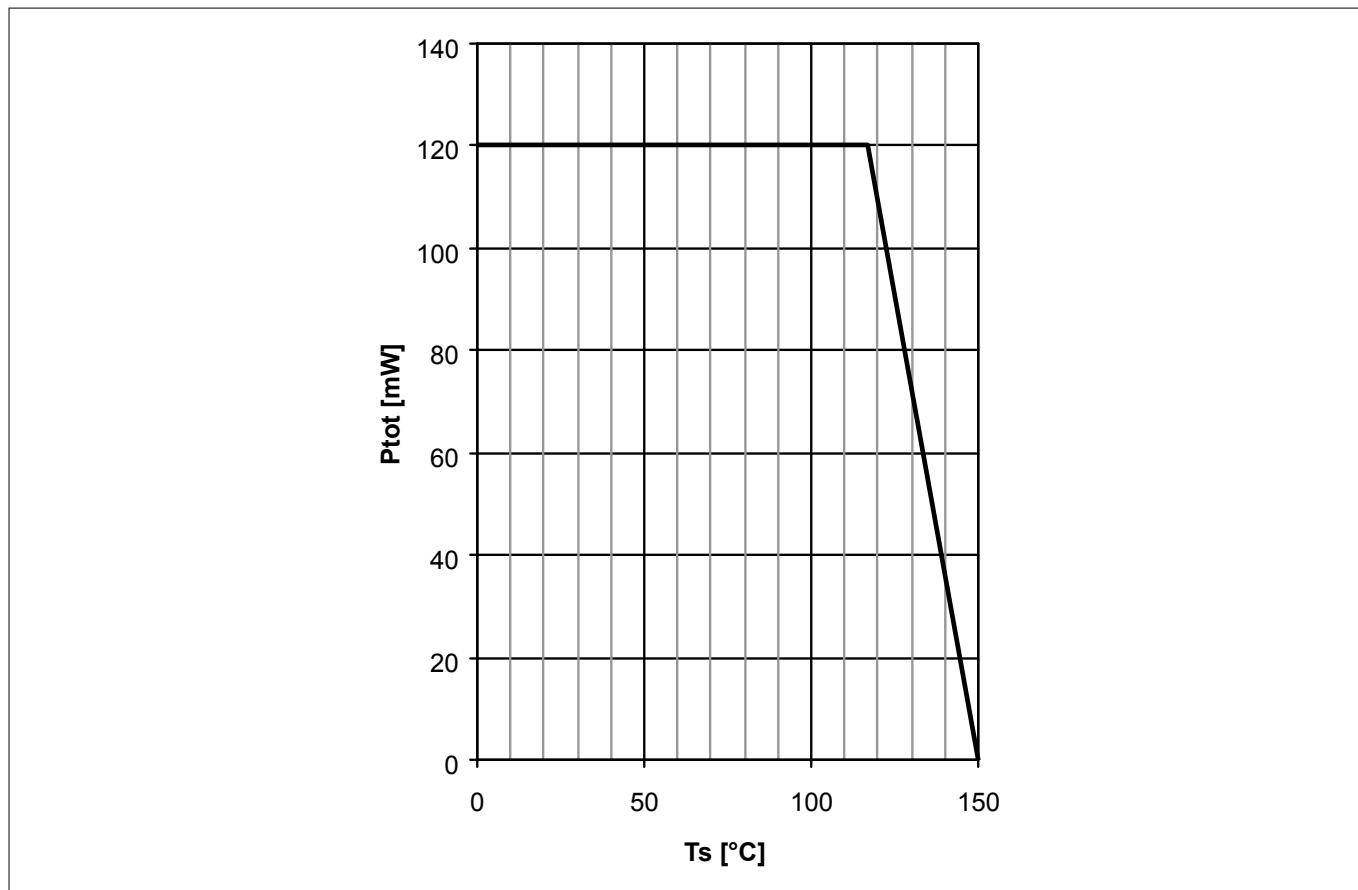


Figure 2 Total power dissipation  $P_{tot} = f(T_s)$

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**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	6.5	mA	$V_{Ctrl} = 3\text{ V}$ $R_{ext} = \text{open}$ $R_{ext} = 30\text{ k}\Omega$ $R_{ext} = 3\text{ k}\Omega$
		–	6	–		
		–	10	–		
Supply current in off-mode	$I_{CC-off}$	–	–	6	$\mu\text{A}$	$V_{Ctrl} = 0\text{ V}$
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.  $T_A = 25\text{ }^\circ\text{C}$  (unless otherwise specified).

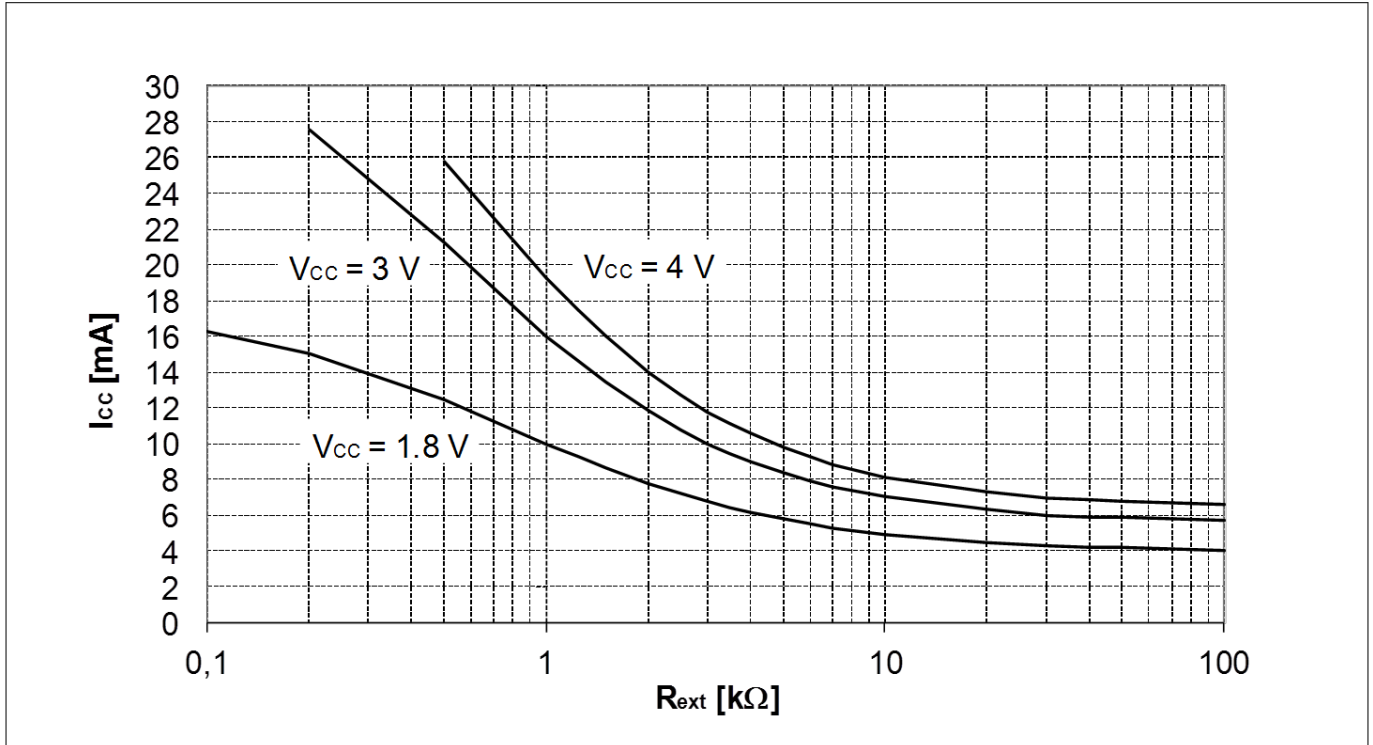


Figure 3 Supply current vs external resistance  $I_{CC} = f(R_{ext}), V_{Ctrl} = 3\text{ V}, V_{CC} = \text{parameter}$

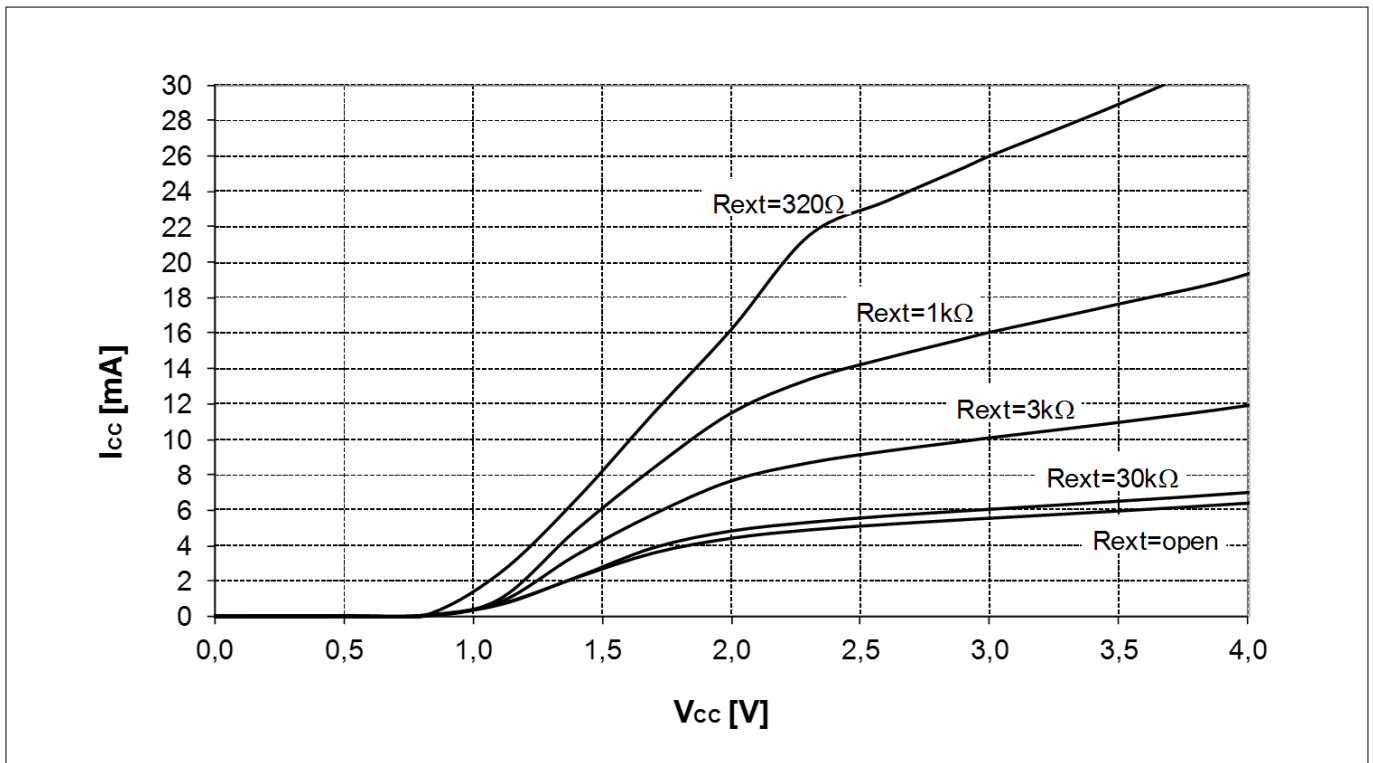


Figure 4 Supply current vs supply voltage  $I_{CC} = f(V_{CC}), V_{Ctrl} = 3\text{ V}, R_{ext} = \text{parameter}$



Electrical characteristics

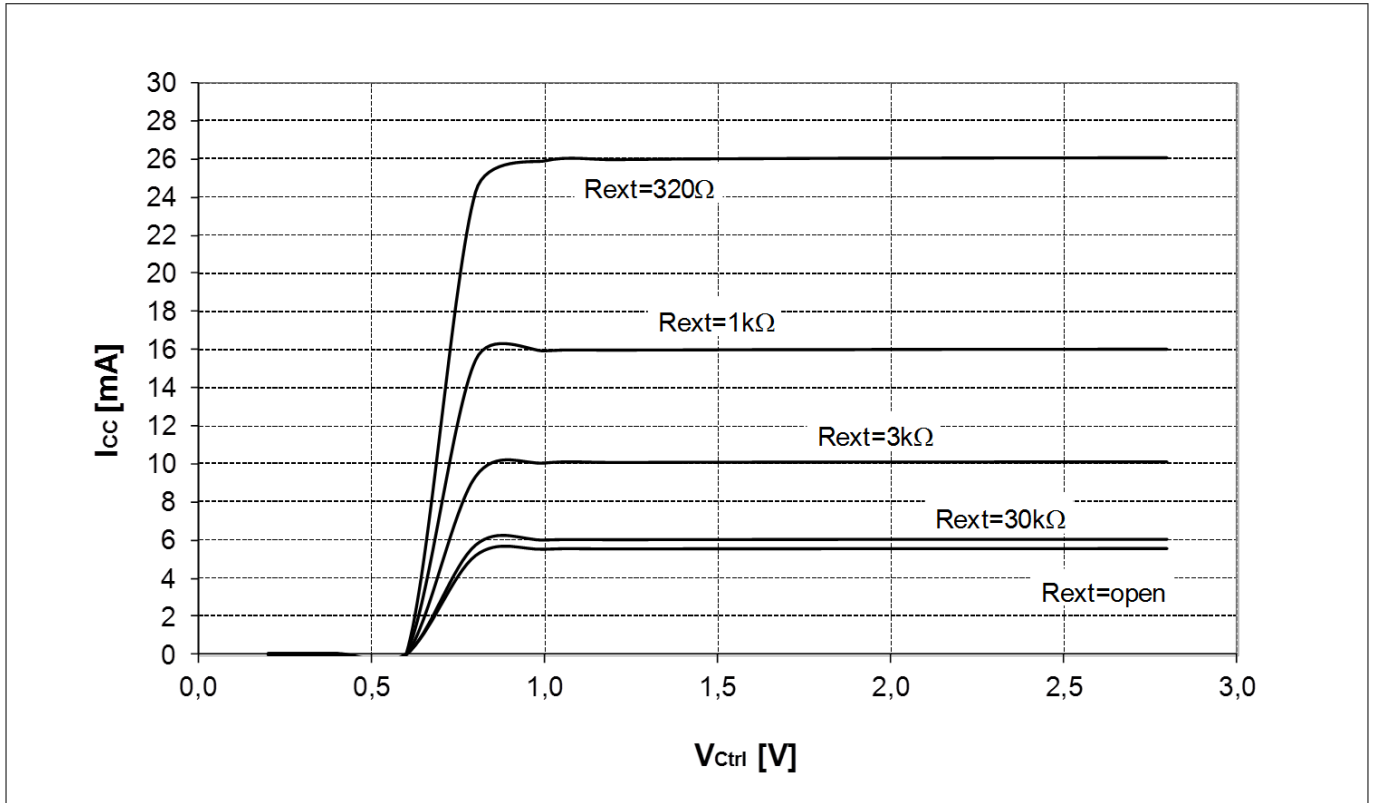


Figure 5 Supply current vs control voltage  $I_{CC} = f(V_{Ctrl})$ ,  $V_{CC} = 3 V$ ,  $R_{ext} = \text{parameter}$

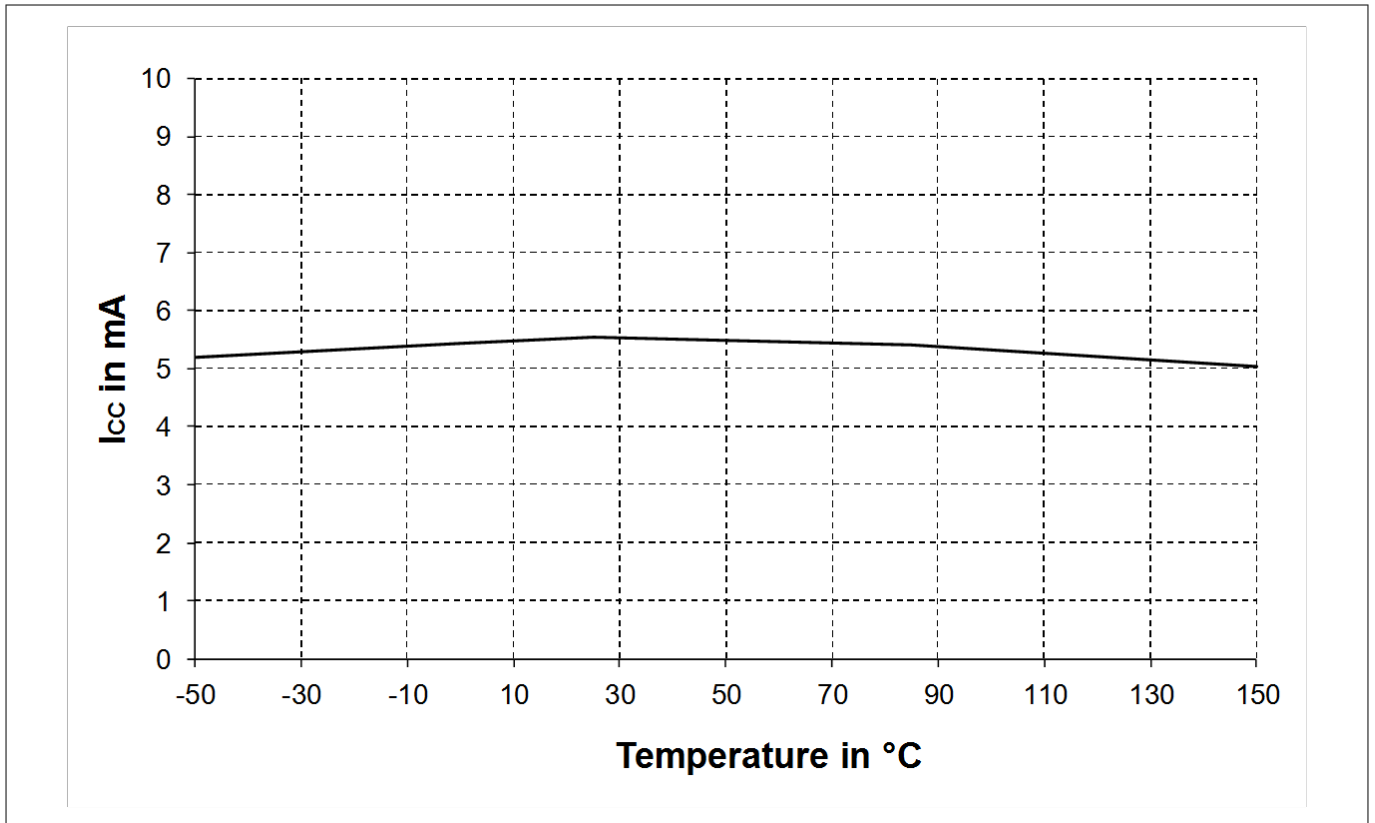
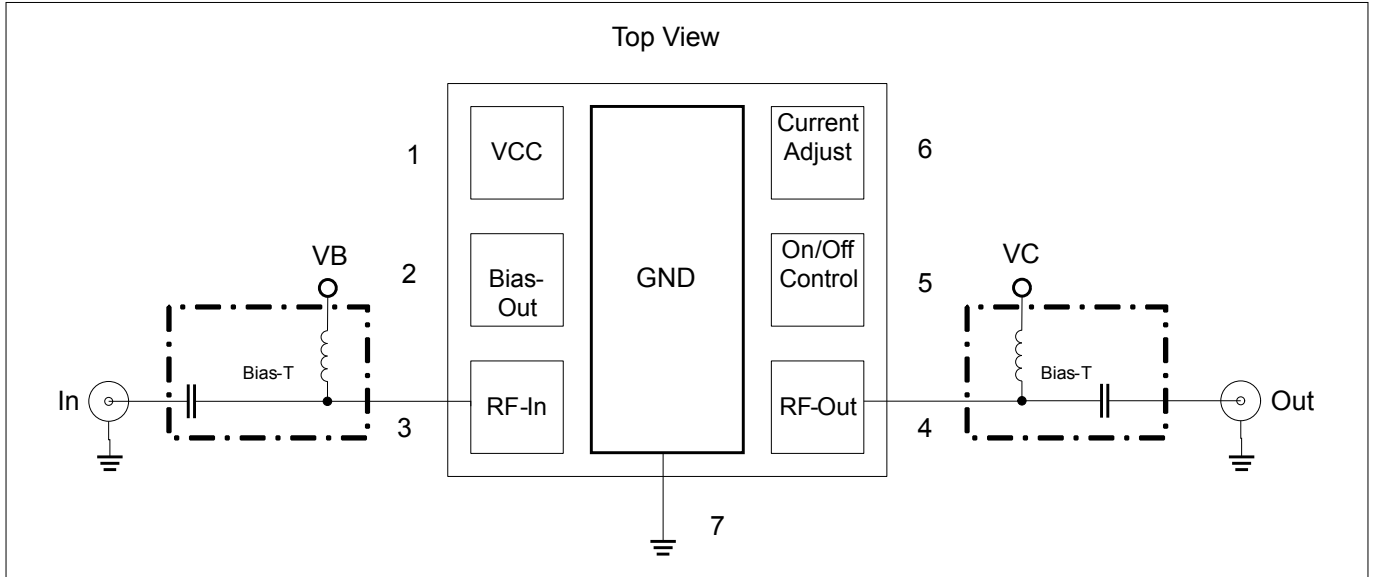


Figure 6 Supply current vs temperature  $I_{CC} = f(T_A)$ ,  $V_{Ctrl} = V_{CC} = 3 V$ ,  $R_{ext} = open$

**Electrical characteristics**

**4.3 AC characteristics**

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



**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 <sup>1)</sup>	$NF_{min}$	–	1.05 0.95	–	dB	$I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$ $Z_S = Z_{S,opt}$
Noise figure in 50 $\Omega$ system <sup>2)</sup>	$NF_{50}$		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$		19 21		dB	$I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$
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	$IP_{1dB}$		-5.5 -8		dBm	$I_{Cq} = 6\text{ mA}$ $I_{Cq} = 10\text{ mA}$
Input 3 <sup>rd</sup> 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			$I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$

<sup>1</sup> Test fixture losses are extracted

<sup>2</sup> Parameter measured on an application board according to **Figure 1** on page 2 presenting a 50  $\Omega$  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  $IP_{1dB}$ .

**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 <sup>1)</sup>	$NF_{min}$	–	1.05 0.95	–	dB	$I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$ $Z_S = Z_{S,opt}$
Noise figure in 50 $\Omega$ system <sup>2)</sup>	$NF_{50}$		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		dB	$I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$
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	$IP_{1dB}$		-5 -7.5		dBm	$I_{Cq} = 6\text{ mA}$ $I_{Cq} = 10\text{ mA}$
Input 3 <sup>rd</sup> 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			$I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$

<sup>1</sup> Test fixture losses are extracted

<sup>2</sup> Parameter measured on an application board according to **Figure 1** on page 2 presenting a 50  $\Omega$  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  $IP_{1dB}$ .

**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 <sup>1)</sup>	$NF_{min}$	–	1.05 0.95	–	dB	$I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$ $Z_S = Z_{S,opt}$
Noise figure in 50 $\Omega$ system <sup>2)</sup>	$NF_{50}$		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		dB	$I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$
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	$IP_{1dB}$		-5 -7		dBm	$I_{Cq} = 6\text{ mA}$ $I_{Cq} = 10\text{ mA}$
Input 3 <sup>rd</sup> 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			$I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$

<sup>1</sup> Test fixture losses are extracted

<sup>2</sup> Parameter measured on an application board according to **Figure 1** on page 2 presenting a 50  $\Omega$  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  $IP_{1dB}$ .

## 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 <sup>1)</sup>	$NF_{\min}$	–	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 $\Omega$ system <sup>2)</sup>	$NF_{50}$		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		dB	$I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$
Maximum available power gain	$G_{\text{ma}}$		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 <sup>rd</sup> order intercept point	$IIP_3$		2.5 1			$I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$
Input return loss	$RL_{\text{in}}$		14.5 16		dB	$I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$
Output return loss	$RL_{\text{out}}$		14 23			$I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$

<sup>1</sup> Test fixture losses are extracted

<sup>2</sup> Parameter measured on an application board according to [Figure 1](#) on page 2 presenting a 50  $\Omega$  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 <sup>1)</sup>	$NF_{min}$	–	1.05 1.05	–	dB	$I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$ $Z_S = Z_{S,opt}$
Noise figure in 50 $\Omega$ system <sup>2)</sup>	$NF_{50}$		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	$IP_{1dB}$		-4 -6		dBm	$I_{Cq} = 6\text{ mA}$ $I_{Cq} = 10\text{ mA}$
Input 3 <sup>rd</sup> 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			$I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$

<sup>1</sup> Test fixture losses are extracted

<sup>2</sup> Parameter measured on an application board according to **Figure 1** on page 2 presenting a 50  $\Omega$  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  $IP_{1dB}$ .

## 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 <sup>1)</sup>	$NF_{\min}$	–	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 $\Omega$ system <sup>2)</sup>	$NF_{50}$		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		dB	$I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$
Maximum available power gain	$G_{\text{ma}}$		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 <sup>rd</sup> order intercept point	$IIP_3$		3 1			$I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$
Input return loss	$RL_{\text{in}}$		12.5 13.5		dB	$I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$
Output return loss	$RL_{\text{out}}$		12.5 18			$I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$

<sup>1</sup> Test fixture losses are extracted

<sup>2</sup> Parameter measured on an application board according to [Figure 1](#) on page 2 presenting a 50  $\Omega$  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 <sup>1)</sup>	$NF_{min}$	–	1.25 1.2	–	dB	$I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$ $Z_S = Z_{S,opt}$
Noise figure in 50 $\Omega$ system <sup>2)</sup>	$NF_{50}$		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		dB	$I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$
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	$IP_{1dB}$		-2.5 -4.5		dBm	$I_{Cq} = 6\text{ mA}$ $I_{Cq} = 10\text{ mA}$
Input 3 <sup>rd</sup> 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			$I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$

<sup>1</sup> Test fixture losses are extracted

<sup>2</sup> Parameter measured on an application board according to **Figure 1** on page 2 presenting a 50  $\Omega$  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  $IP_{1dB}$ .

**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 <sup>1)</sup>	$NF_{min}$	–	1.8 1.75	–	dB	$I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$ $Z_S = Z_{S,opt}$
Noise figure in 50 $\Omega$ system <sup>2)</sup>	$NF_{50}$		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		dB	$I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$
Maximum available power gain	$G_{ma}$		14 15			$I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$
Input 1 dB gain compression point	$IP_{1dB}$		-1 -3		dBm	$I_{Cq} = 6\text{ mA}$ $I_{Cq} = 10\text{ mA}$
Input 3 <sup>rd</sup> 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			$I_C = 6\text{ mA}$ $I_C = 10\text{ mA}$

<sup>1</sup> Test fixture losses are extracted

<sup>2</sup> Parameter measured on an application board according to **Figure 1** on page 2 presenting a 50  $\Omega$  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  $IP_{1dB}$ .



Package information TSLP-7-1

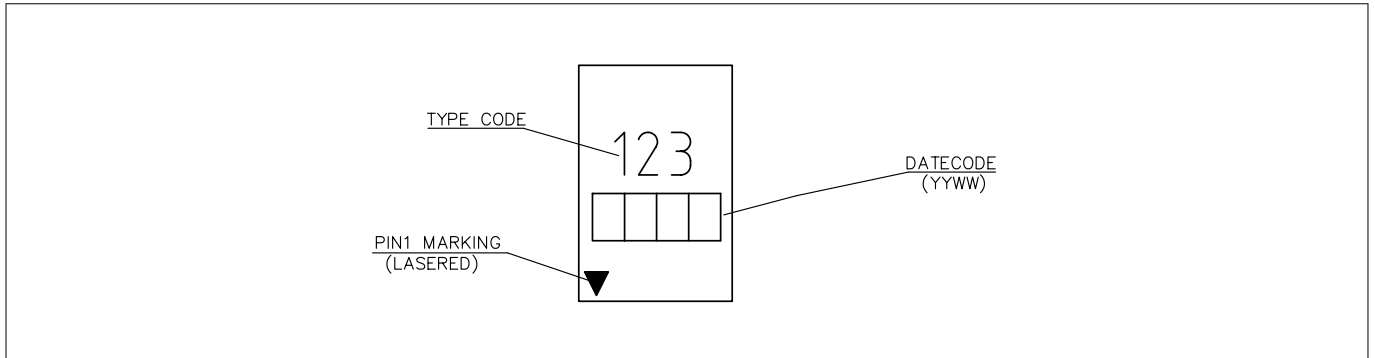


Figure 10 Marking layout example

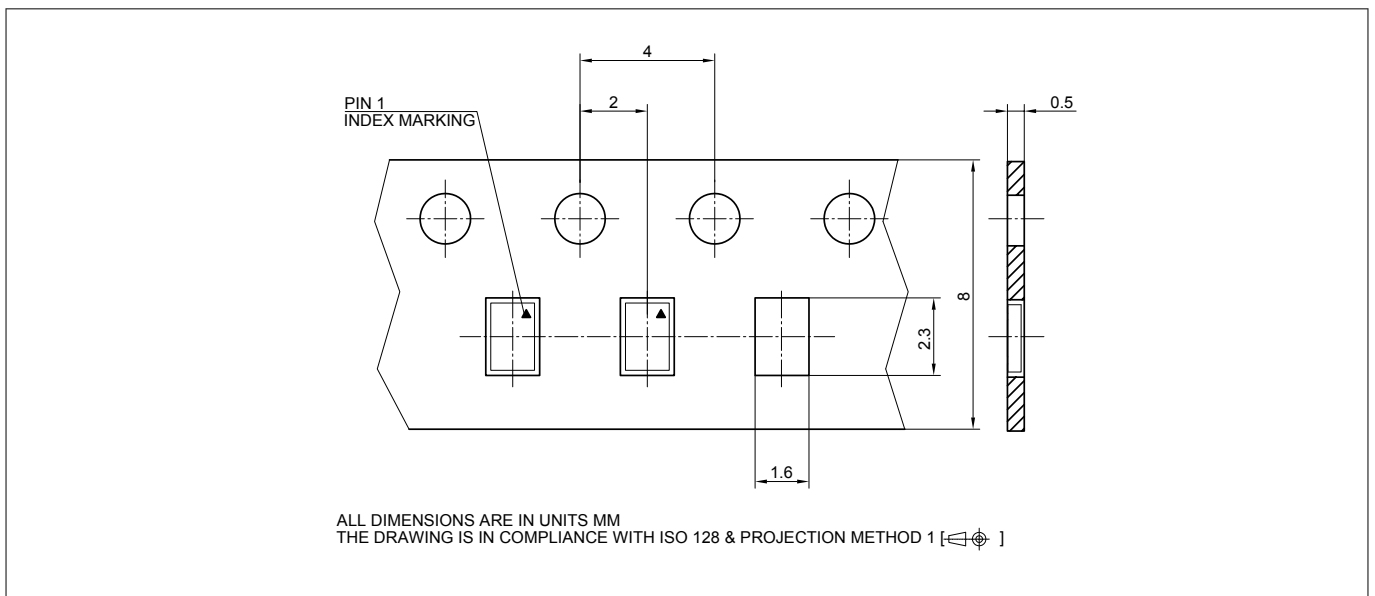


Figure 11 Tape information

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.

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**Revision history****Revision history**

<b>Document version</b>	<b>Date of release</b>	<b>Description of changes</b>
3.0	2018-09-26	New datasheet layout.

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