

# BGA524N6

Silicon Germanium Low Noise Amplifier  
for Global Navigation Satellite Systems (GNSS)

## Data Sheet

Revision 3.5, 2021-08-31

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**Revision History**

Page or Item	Subjects (major changes since previous revision)
<b>Revision 3.5, 2021-08-31</b>	
17	Carrier Tape Drawing updated
<b>Revision 3.4, 2020-07-01</b>	
7	Type code information updated
15	Type code information updated
<b>Revision 3.3, 2018-04-10</b>	
3	Trademarks updated
7, 12	Package name TSNP-6-10 added
9	Maximum ratings comment updated
14	Package outline drawing for TSNP-6-10 added
15	Marking layout drawing for TSNP-6-10 added
16	Date code marking table added
17	Tape & reel dimensions for TSNP-6-10 added
<b>Revision 3.2, 2014-10-15</b>	
11-12	Footnotes 3 and 5 added

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## Silicon Germanium Low Noise Amplifier for Global Navigation Satellite Systems (GNSS)

BGA524N6

### Features

- High insertion power gain: 19.6 dB
- Out-of-band input 3rd order intercept point: -4dBm
- Input 1 dB compression point: -12 dBm
- Low noise figure: 0.55 dB
- Very low current consumption: 2.5 mA
- Operating frequencies: 1550 - 1615 MHz
- Supply voltage: 1.5 V to 3.3 V
- Digital on/off switch (1V logic high level)
- Ultra small TSNP-6-2 / TSNP-6-10 leadless package (footprint: 0.7 x 1.1 mm<sup>2</sup>)
- B7HF Silicon Germanium technology
- RF output internally matched to 50 Ω
- Only 1 external SMD component necessary
- 2kV HBM ESD protection (including AI-pin)
- Pb-free (RoHS compliant) package



### Application

- Ideal for all Global Navigation Satellite Systems (GNSS) like GPS, GLONASS, Beidou, Galileo and others

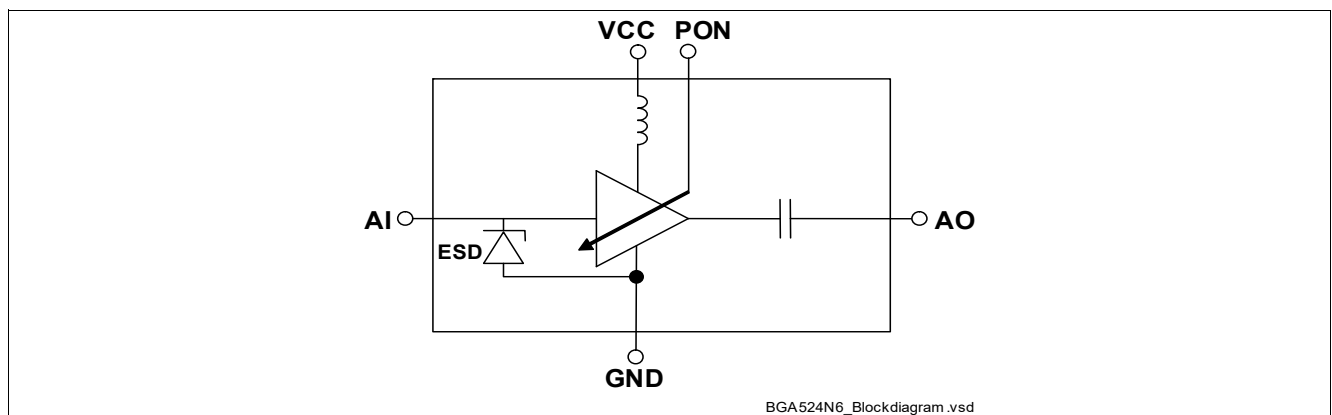


Figure 1 Block Diagram

Product Name	Marking / Type Code	Package
BGA524N6	H	TSNP-6-2 / TSNP-6-10

**Description**

The BGA524N6 is a front-end low noise amplifier for Global Navigation Satellite Systems (GNSS) from 1550 MHz to 1615 MHz like GPS, GLONASS, Beidou, Galileo and others. The LNA provides 19.6 dB gain and 0.55 dB noise figure at a current consumption of 2.5 mA in the application configuration described in [Chapter 3](#). The BGA524N6 is based upon Infineon Technologies' B7HF Silicon Germanium technology. It operates from 1.5 V to 3.3 V supply voltage.

**Pin Definition and Function****Table 1 Pin Definition and Function**

Pin No.	Name	Function
1	GND	Ground
2	VCC	DC supply
3	AO	LNA output
4	GND	Ground
5	AI	LNA input
6	PON	Power on control



## 1 Maximum Ratings

**Table 2 Maximum Ratings**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Voltage at pin VCC	$V_{CC}$	-0.3	–	3.6	V	1)
Voltage at pin AI	$V_{AI}$	-0.3	–	0.9	V	–
Voltage at pin AO	$V_{AO}$	-0.3	–	$V_{CC} + 0.3$	V	–
Voltage at pin PON	$V_{PON}$	-0.3	–	$V_{CC} + 0.3$	V	–
Voltage at pin GNDRF	$V_{GNDRF}$	-0.3	–	0.3	V	–
Current into pin VCC	$I_{CC}$	–	–	16	mA	–
RF input power	$P_{IN}$	–	–	0	dBm	–
Total power dissipation, $T_S < 148\text{ °C}^2)$	$P_{tot}$	–	–	60	mW	–
Junction temperature	$T_J$	–	–	150	°C	–
Ambient temperature range	$T_A$	-40	–	85	°C	–
Storage temperature range	$T_{STG}$	-65	–	150	°C	–
ESD capability all pins	$V_{ESD\_HBM}$	–	–	2000	V	according to JESD22A-114

1) All voltages refer to GND-Node unless otherwise noted

2)  $T_S$  is measured on the ground lead at the soldering point

**Attention: Stresses above the max. values listed here may cause permanent damage to the device. Maximum ratings are absolute ratings; exceeding only one of these values may cause irreversible damage to the integrated circuit. Exposure to conditions at or below absolute maximum rating but above the specified maximum operation conditions may affect device reliability and life time. Functionality of the device might not be given under these conditions.**

### Thermal Resistance

**Table 3 Thermal Resistance**

Parameter	Symbol	Value	Unit
Junction - soldering point <sup>1)</sup>	$R_{thJS}$	25	K/W

1) For calculation of  $R_{thJA}$  please refer to Application Note Thermal Resistance

## 2 Electrical Characteristics

**Table 4** Electrical Characteristics:<sup>1)</sup>  $T_A = 25\text{ °C}$ ,  $V_{CC} = 1.8\text{ V}$ ,  $V_{PON,ON} = 1.8\text{ V}$ ,  $V_{PON,OFF} = 0\text{ V}$ ,  
 $f = 1550 - 1615\text{ MHz}$  (GPS / Glonass / Beidou / Galileo)

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Supply voltage	$V_{CC}$	1.5	–	3.3	V	–
Supply current	$I_{CC}$	–	2.5	3.2	mA	ON-mode
		–	2.5	3.5 <sup>5)</sup>	mA	ON-mode, $f_{IN} = 1575\text{ MHz}$ , $P_{IN} \leq -40\text{ dBm}$
		–	0.2	3	$\mu\text{A}$	OFF-mode
Power On voltage	$V_{pon}$	1.0	–	$V_{CC}$	V	ON-mode
		0	–	0.4	V	OFF-mode
Power On current	$I_{pon}$	–	5	10	$\mu\text{A}$	ON-mode
		–	–	1	$\mu\text{A}$	OFF-mode
Insertion power gain	$ S_{21} ^2$	18.4	19.6	20.8	dB	–
Noise figure <sup>2)</sup>	$NF$	–	0.55	1.0	dB	$Z_S = 50\ \Omega$
Input return loss <sup>3)</sup>	$RL_{in}$	8	11	–	dB	–
Output return loss <sup>3)</sup>	$RL_{out}$	12	20	–	dB	–
Reverse isolation <sup>3)</sup>	$1/ S_{12} ^2$	32	37	–	dB	–
Power gain settling time <sup>4),5)</sup>	$t_S$	–	5	8	$\mu\text{s}$	OFF- to ON-mode
		–	5	8	$\mu\text{s}$	ON- to OFF-mode
Inband input 1dB-compression point <sup>3)</sup>	$IP_{1dB}$	-19	-16	–	dBm	–
Inband input 3 <sup>rd</sup> -order intercept point <sup>6),3)</sup>	$IIP_3$	-12	-9	–	dBm	$f_1 = 1575\text{ MHz}$ $f_2 = f_1 \pm 1\text{ MHz}$
Out-of-band input 3 <sup>rd</sup> -order intercept point <sup>7),5)</sup>	$IIP_{3oob}$	-8	-5	–	dBm	$f_1 = 1712.7\text{ MHz}$ $f_2 = 1850\text{ MHz}$
Stability <sup>5)</sup>	$k$	> 2	> 3	–		$f = 20\text{ MHz} \dots 10\text{ GHz}$

1) Based on the application described in chapter 3

2) PCB losses are subtracted

3) Verification based on AQL; not 100% tested in production

4) To be within 1 dB of the final gain OFF- to ON-mode; to be within 3 dB of the final gain ON- to OFF-mode

5) Guaranteed by device design; not tested in production

6) Input power = -30 dBm for each tone

7) Input power = -20 dBm for each tone

**Electrical Characteristics**
**Table 5 Electrical Characteristics:**<sup>1)</sup>  $T_A = 25\text{ °C}$ ,  $V_{CC} = 2.8\text{ V}$ ,  $V_{PON,ON} = 2.8\text{ V}$ ,  $V_{PON,OFF} = 0\text{ V}$ ,  
 $f = 1550 - 1615\text{ MHz}$  (GPS / Glonass / Beidou / Galileo)

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Supply voltage	$V_{CC}$	1.5	–	3.3	V	–
Supply current	$I_{CC}$	–	2.6	3.3	mA	ON-mode
		–	2.6	3.6 <sup>5)</sup>	mA	ON-mode, $f_{IN} = 1575\text{ MHz}$ , $P_{IN} \leq -40\text{ dBm}$
		–	0.2	3	$\mu\text{A}$	OFF-mode
Power On voltage	$V_{pon}$	1.0	–	$V_{cc}$	V	ON-mode
		0	–	0.4	V	OFF-mode
Power On current	$I_{pon}$	–	10	15	$\mu\text{A}$	ON-mode
		–	–	1	$\mu\text{A}$	OFF-mode
Insertion power gain	$ S_{21} ^2$	18.4	19.6	20.8	dB	–
Noise figure <sup>2)</sup>	$NF$	–	0.55	1.0	dB	$Z_S = 50\ \Omega$
Input return loss <sup>3)</sup>	$RL_{in}$	8	11	–	dB	–
Output return loss <sup>3)</sup>	$RL_{out}$	12	18	–	dB	–
Reverse isolation <sup>3)</sup>	$1/ S_{12} ^2$	32	37	–	dB	–
Power gain settling time <sup>4),5)</sup>	$t_S$	–	5	8	$\mu\text{s}$	OFF- to ON-mode
		–	5	8	$\mu\text{s}$	ON- to OFF-mode
Inband input 1dB-compression point <sup>3)</sup>	$IP_{1dB}$	-15	-12	–	dBm	–
Inband input 3 <sup>rd</sup> -order intercept point <sup>6),3)</sup>	$IIP_3$	-11	-8	–	dBm	$f_1 = 1575\text{ MHz}$ $f_2 = f_1 \pm 1\text{ MHz}$
Out-of-band input 3 <sup>rd</sup> -order intercept point <sup>7),5)</sup>	$IIP_{3oob}$	-7	-4	–	dBm	$f_1 = 1712.7\text{ MHz}$ $f_2 = 1850\text{ MHz}$
Stability <sup>5)</sup>	$k$	> 2	> 3	–		$f = 20\text{ MHz} \dots 10\text{ GHz}$

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3) Verification based on AQL; not 100% tested in production

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5) Guaranteed by device design; not tested in production

6) Input power = -30 dBm for each tone

7) Input power = -20 dBm for each tone

### 3 Application Information

#### Application Board Configuration

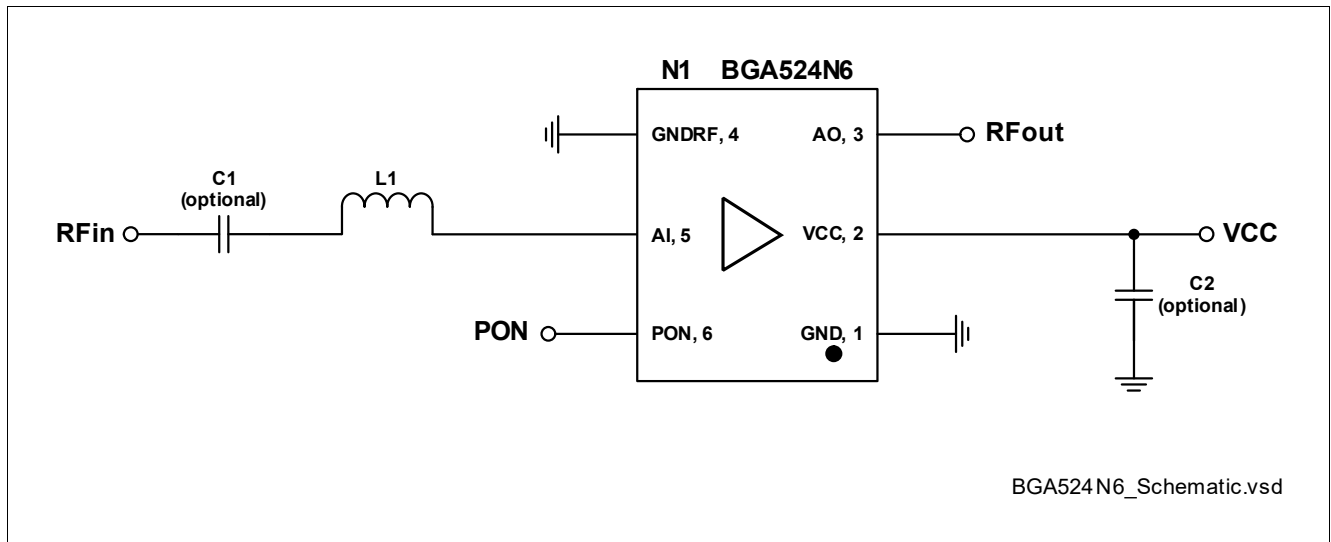


Figure 2 Application Schematic BGA524N6

Table 6 Bill of Materials

Name	Value	Package	Manufacturer	Function
C1 (optional)	1nF	0402	Various	DC block <sup>1)</sup>
C2 (optional)	> 10nF <sup>2)</sup>	0402	Various	RF bypass <sup>3)</sup>
L1	8.2nH	0402	Murata LQW type	Input matching
N1	BGA524N6	TSNP-6-2 / TSNP-6-10	Infineon	SiGe LNA

1) DC block might be realized with pre-filter in GNSS applications

2) For data sheet characteristics 1 $\mu$ F used

3) RF bypass recommended to mitigate power supply noise

A list of all application notes is available at <http://www.infineon.com/gpsIna.appnotes>.

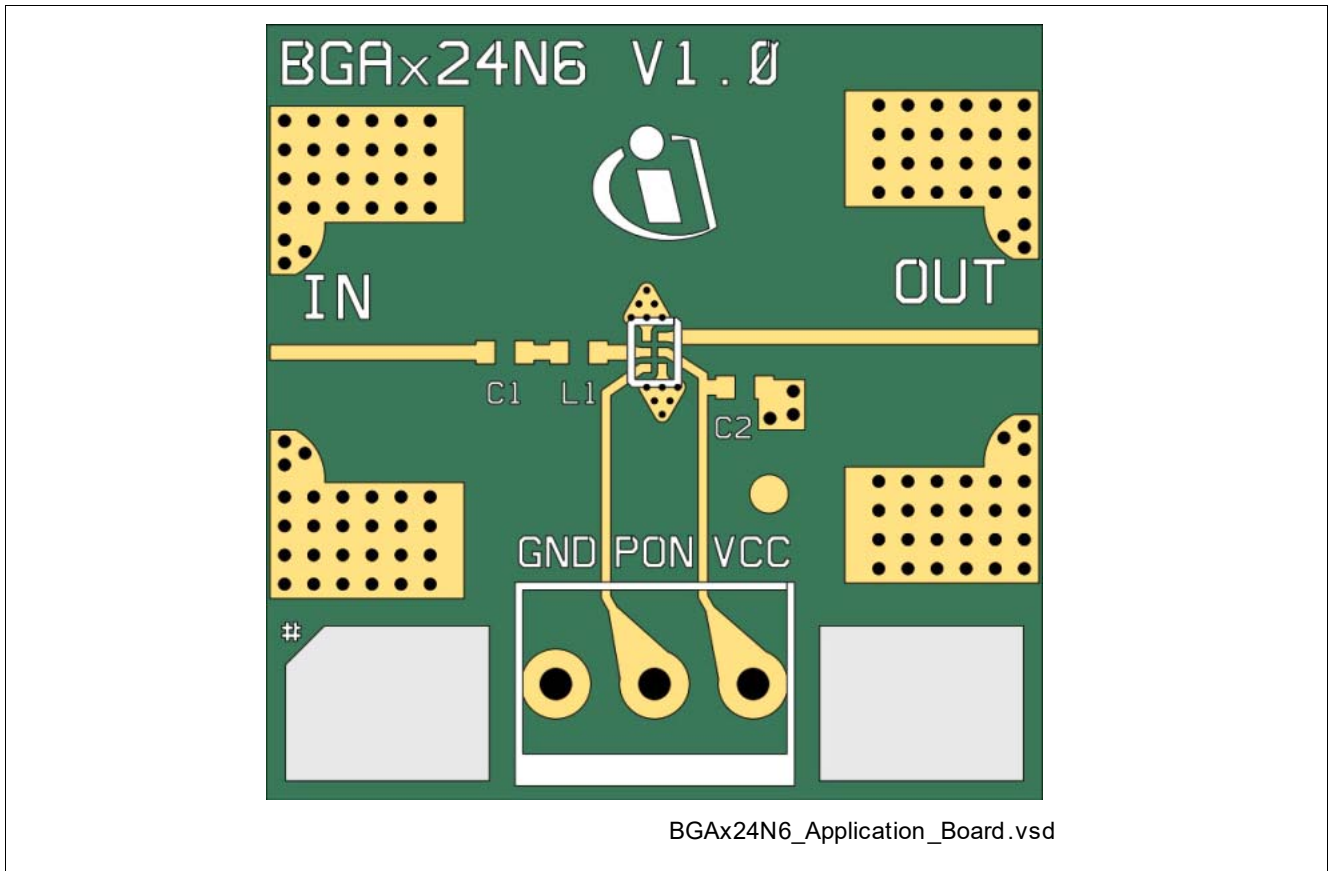


Figure 3 Drawing of Application Board

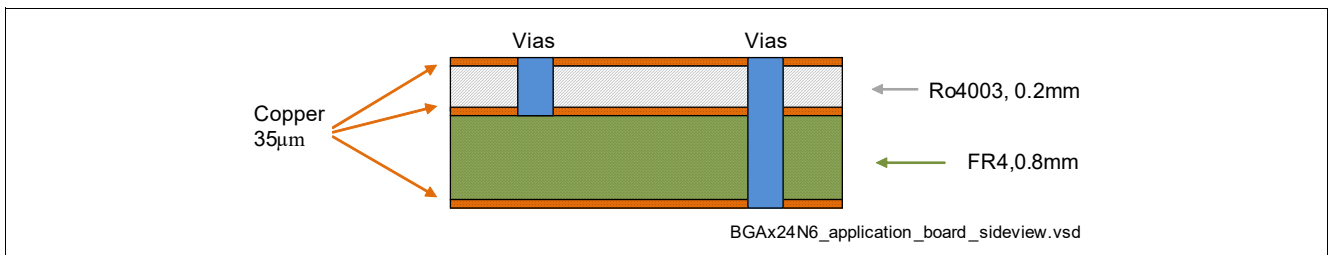


Figure 4 Application Board Cross-Section

## 4 Package Information

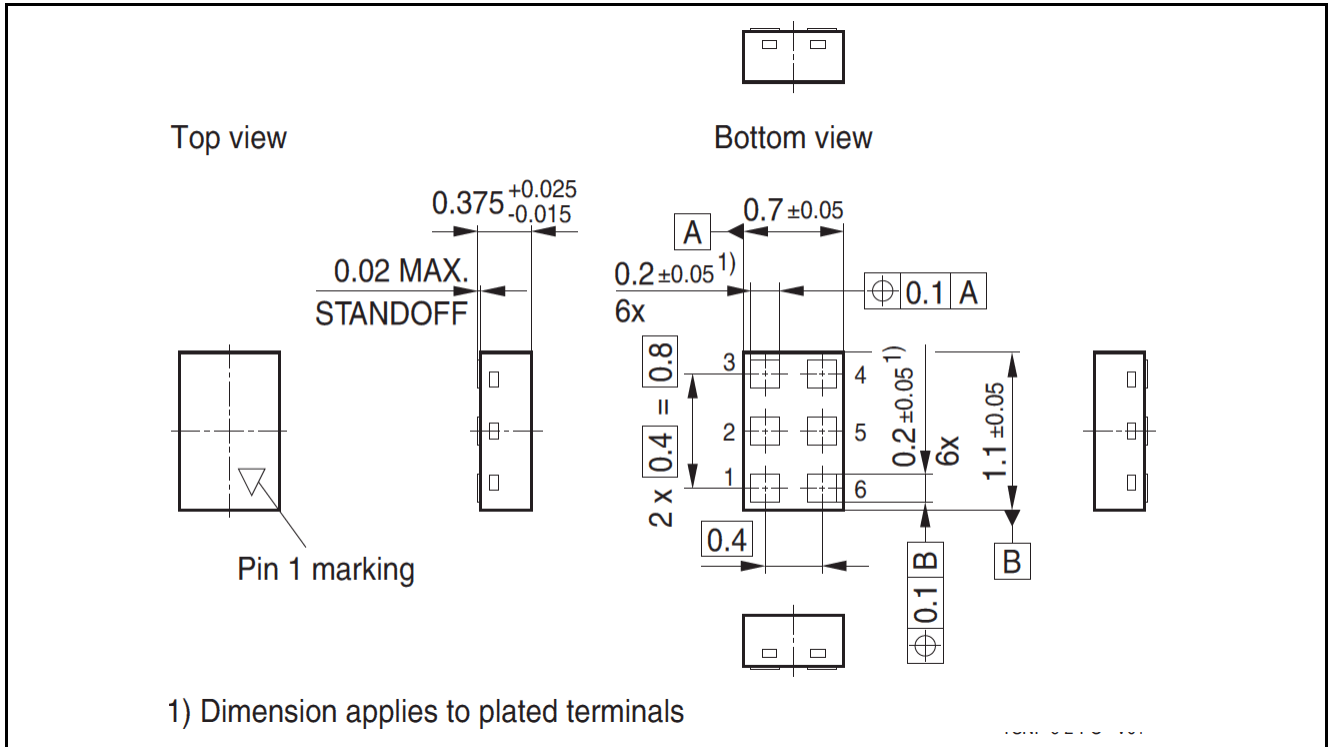


Figure 5 TSNP-6-2 Package Outline (top, side and bottom views)

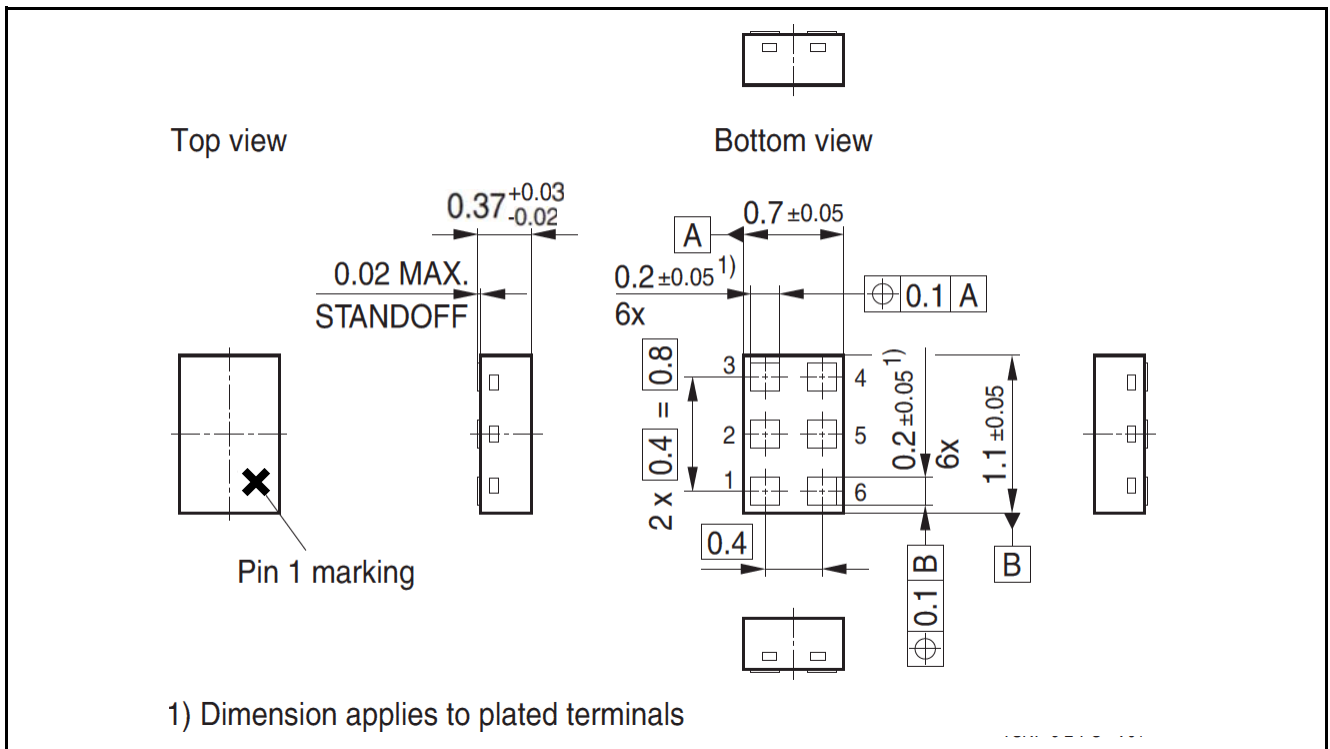
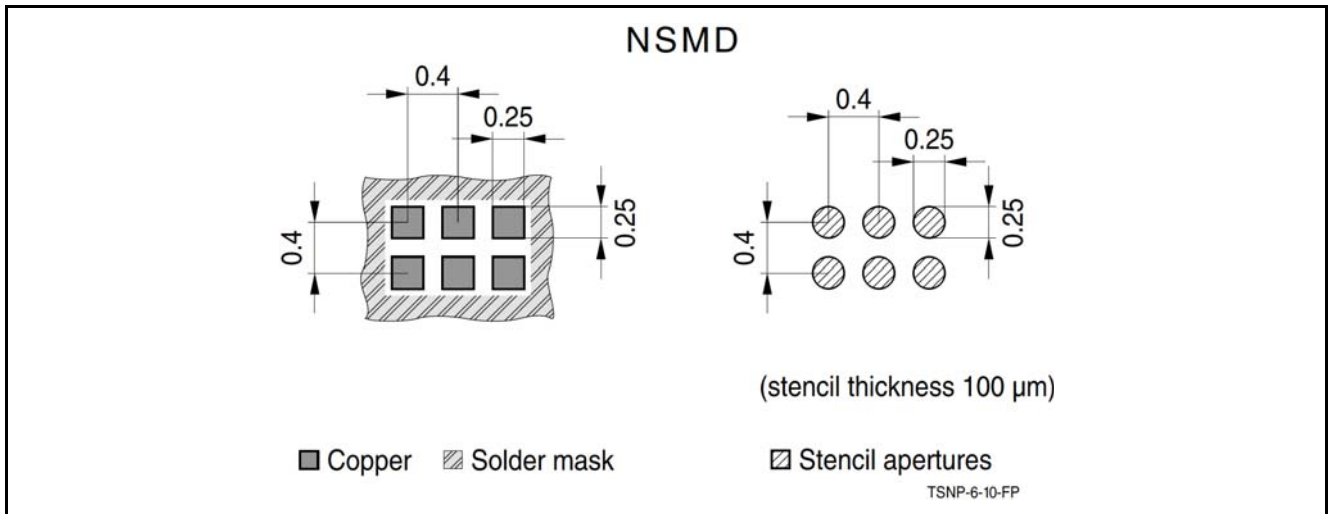
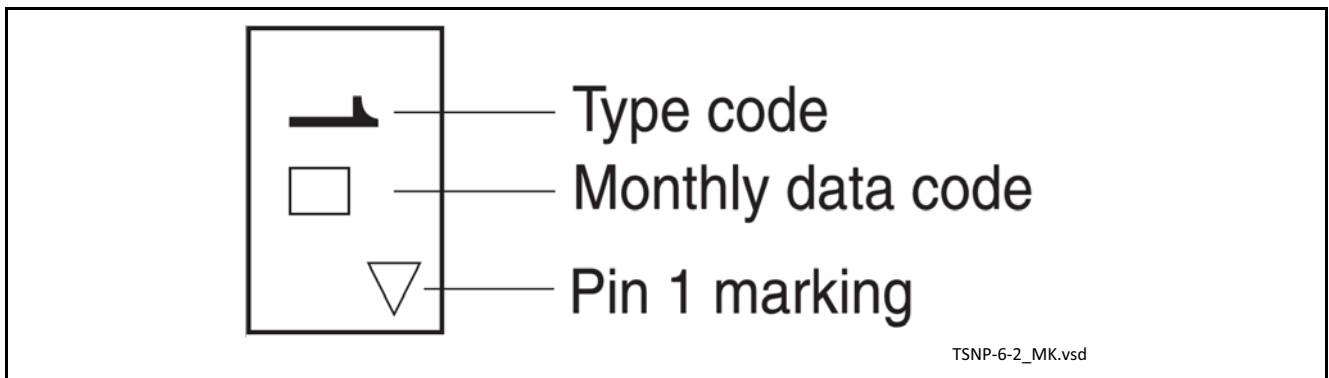


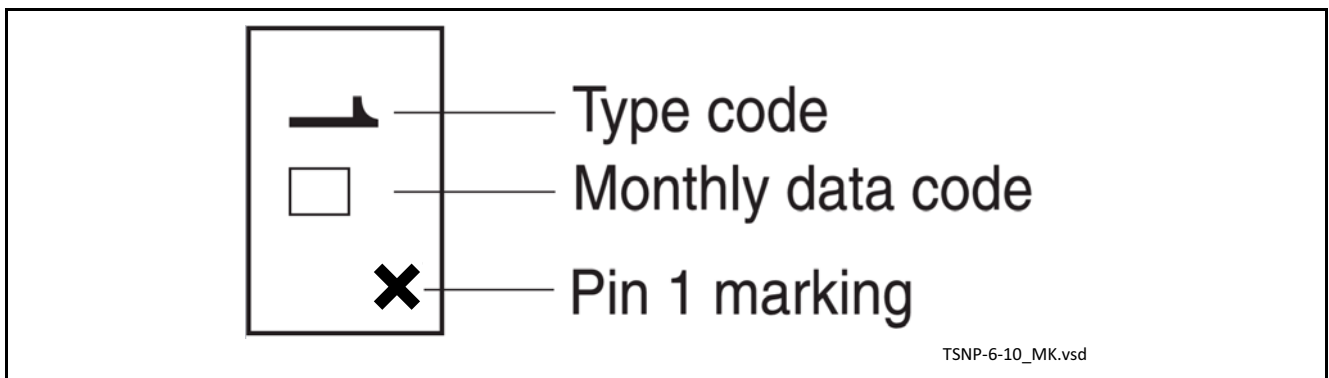
Figure 6 TSNP-6-10 Package Outline (top, side and bottom views)



**Figure 7** Footprint Recommendation TSNP-6-2 and TSNP-6-10



**Figure 8** Marking Layout TSNP-6-2 (top view, product type code see [Page 7](#))



**Figure 9** Marking Layout TSNP-6-10 (top view, product type code see [Page 7](#))

Month	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
01	a	p	A	P	a	p	A	P	a	p	A	P
02	b	q	B	Q	b	q	B	Q	b	q	B	Q
03	c	r	C	R	c	r	C	R	c	r	C	R
04	d	s	D	S	d	s	D	S	d	s	D	S
05	e	t	E	T	e	t	E	T	e	t	E	T
06	f	u	F	U	f	u	F	U	f	u	F	U
07	g	v	G	V	g	v	G	V	g	v	G	V
08	h	x	H	X	h	x	H	X	h	x	H	X
09	j	y	J	Y	j	y	J	Y	j	y	J	Y
10	k	z	K	Z	k	z	K	Z	k	z	K	Z
11	l	2	L	4	l	2	L	4	l	2	L	4
12	n	3	N	5	n	3	N	5	n	3	N	5

Figure 10 Date Code Marking TSNP-6-2 and TSNP-6-10

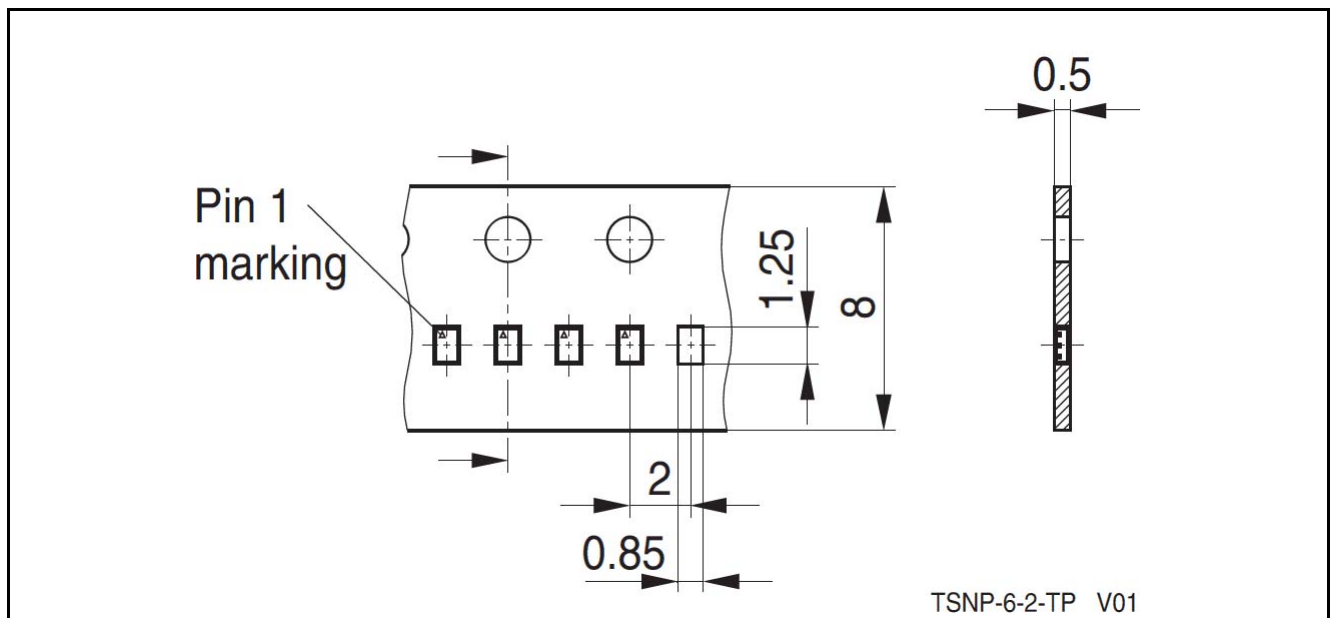


Figure 11 Tape & Reel Dimensions TSNP-6-2 (reel diameter 180 mm, pieces/reel 15000)



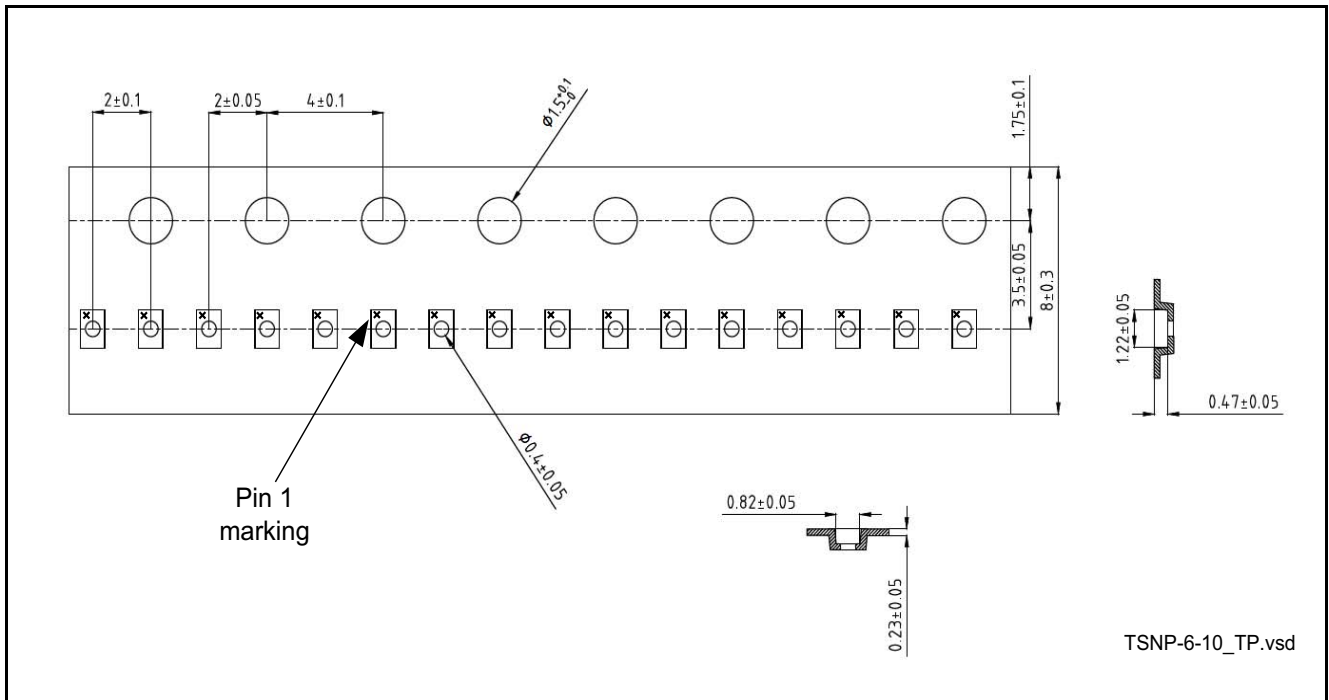


Figure 12 Tape & Reel Dimensions TSNP-6-10 (reel diameter 180 mm, pieces/reel 12000)

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