Never stop thinkin

BGA231N7

Silicon Germanium GNSS Low Noise Amplifier

Data Sheet

Revision 1.0, 2013-01-30

RF & Protection Devices

Edition 2013-01-30

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Revision History	
Page or Item	**Subjects (major changes since previous revision)**
Revision 1.0, 2013-01-30	
all	Initial version for new packages TSNP-7-1 / TSNP-7-2

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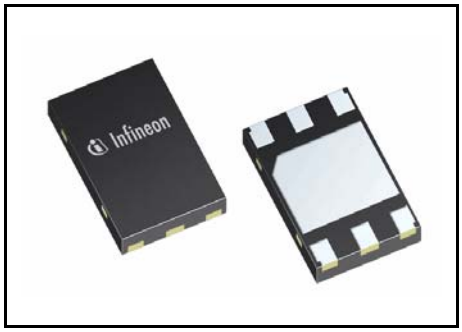
Features

- Insertion power gain: 16.0 dB
- High out of band input 3rd-order intercept point at input: +5 dBm
- High input 1 dB compression point: -5 dBm
- Low noise figure: 0.75 dB
- Low current consumption: 4.4 mA
- Operating frequencies: 1550 - 1615 MHz
- Supply voltage: 1.5 V to 3.6 V
- Digital on/off switch (1V logic high level)
- Tiny TSNP-7-1 / TSNP-7-2 leadless package
- B7HF Silicon Germanium technology
- RF output internally matched to 50 Ω
- Only 3 external SMD components necessary
- 2 kV HBM ESD protection (including AI-pin)
- Pb-free (RoHS compliant) package

RoHS



TSNP-7-1

TSNP-7-2

Application

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

Description

The BGA231N7 is a front-end low noise amplifier for Global Navigation Satellite Systems (GNSS) from 1550 MHz to 1615 MHz like GPS, Galileo, GLONASS, COMPASS and others. The LNA provides 16.0 dB gain and 0.75 dB noise figure at a current consumption of 4.4 mA in the application configuration described in **Chapter 3**. The BGA231N7 is based upon Infineon Technologies' B7HF Silicon Germanium technology. It operates from 1.5 V to 3.6 V supply voltage.

Product Name	Marking	Package
BGA231N7	BD	TSNP-7-1 / TSNP-7-2

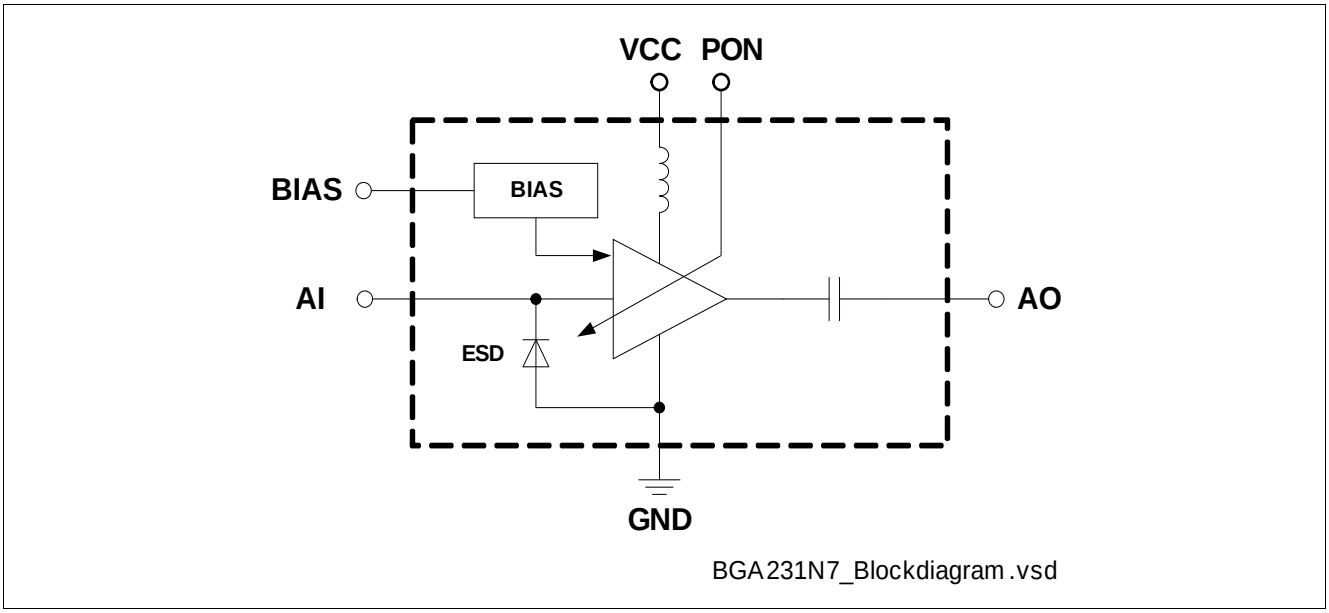


Figure 1 Block Diagram

Table 1 Pin Definition and Function

Pin No.	Name	Function
1	PON	Power on control
2	AI	LNA input
3	BIAS	DC bias
4	n.c.	not connected
5	AO	LNA output
6	VCC	DC Supply
7	GND	RF and DC ground

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 BIAS	V_{BIAS}	-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 VSS	V_{SS}	-0.3	–	0.3	V	–
Current into pin VCC	I_{CC}	–	–	20	mA	–
RF input power	P_{IN}	–	–	0	dBm	–
Total power dissipation, T_S < 129 °C 2)	T_J	–	–	72	mW	–
Junction temperature	P_{tot}	–	–	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 VSS-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. Exposure to absolute maximum rating conditions for extended periods may affect device reliability. Maximum ratings are absolute ratings; exceeding only one of these values may cause irreversible damage to the integrated circuit.

Thermal Resistance

Table 3 Thermal Resistance

Parameter	Symbol	Value	Unit
Junction - soldering point1)	R_{thJS}	291	K/W

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

2 Electrical Characteristics

Table 4 Electrical Characteristics:[1] T_A = 25 °C, V_{CC} = 2.8 V, $V_{PON,ON}$ = 2.8 V, $V_{PON,OFF}$ = 0 V, f = 1550 - 1615 MHz (GPS / Glonass / Beidou / Galileo)

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Supply voltage	V_{CC}	1.5	–	3.6	V	–
Supply current	I_{CC}	–	4.4	–	mA	ON-mode
		–	0.2	3	µA	OFF-mode
Power On voltage	V_{pon}	1.0	–	Vcc	V	ON-mode
		0	–	0.4	V	OFF-mode
Power On current	I_{pon}	–	5	–	µA	ON-mode
		–	–	1	µA	OFF-mode
Insertion power gain	$\|S_{21}\|^2$	–	16.0	–	dB	
Noise figure[2]	NF	–	0.75	1.3	dB	Z_S = 50 Ω
Input return loss	RL_{in}	–	10	–	dB	
Output return loss	RL_{out}	–	16	–	dB	
Reverse isolation	$1/\|S_{12}\|^2$	–	23	–	dB	
Power gain settling time[3]	t_S	–	5	–	µs	OFF- to ON-mode
		–	5	–	µs	ON- to OFF-mode
Inband input 1 dB-compression point	IP_{1dB}	–	-5	–	dBm	
Inband input 3rd-order intercept point[4]	IIP_3	–	0	–	dBm	f_1 = 1575 MHz f_2 = f_1 +/-1 MHz
Out of band input 3rd order intercept point[5]	IIP_{3oob}	–	+5	–	dBm	f_1 = 1712.7 MHz f_2 = 1850 MHz
Stability	k	–	> 1	–		f = 20 MHz ... 10 GHz

1) Based on the application described in chapter 3
2) PCB losses are subtracted
3) 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
4) Input Power = -30 dBm for each tone
5) Input Power = -20 dBm for each tone

Table 5 Electrical Characteristics:[1] T_A = 25 °C, V_{CC} = 1.8 V, $V_{PON,ON}$ = 1.8 V, $V_{PON,OFF}$ = 0 V, f = 1550 - 1615 MHz (GPS / Glonass / Beidou / Galileo)

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Supply voltage	V_{CC}	1.5	–	3.6	V	–
Supply current	I_{CC}	–	4.4	–	mA	ON-mode
		–	0.2	3	µA	OFF-mode
Gain switch control voltage	V_{pon}	1.0	–	Vcc	V	ON-mode
		0	–	0.4	V	OFF-mode
Gain switch control current	I_{pon}	–	5	–	µA	ON-mode
		–	–	1	µA	OFF-mode
Insertion power gain	$\|S_{21}\|^2$	–	16.0	–	dB	
Noise figure[2]	NF	–	0.75	1.3	dB	Z_S = 50 Ω
Input return loss	RL_{in}	–	10	–	dB	
Output return loss	RL_{out}	–	16	–	dB	
Reverse isolation	$1/\|S_{12}\|^2$	–	23	–	dB	
Power gain settling time[3]	t_S	–	5	–	µs	OFF- to ON-mode
		–	5	–	µs	ON- to OFF-mode
Inband input 1 dB-compression point	IP_{1dB}	–	-8	–	dBm	
Inband input 3rd-order intercept point[4]	IIP_3	–	0	–	dBm	f_1 = 1575 MHz f_2 = f_1 +/-1 MHz
Out of band input 3rd order intercept point[5]	IIP_{3oob}	–	+5	–	dBm	f_1 = 1712.7 MHz f_2 = 1850 MHz
Stability	k	–	> 1	–		f = 20 MHz ... 10 GHz

1) Based on the application described in chapter 3
2) PCB losses are subtracted
3) 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
4) Input Power = -30 dBm for each tone
5) Input Power = -20 dBm for each tone

3 Application Information

Application Board Configuration

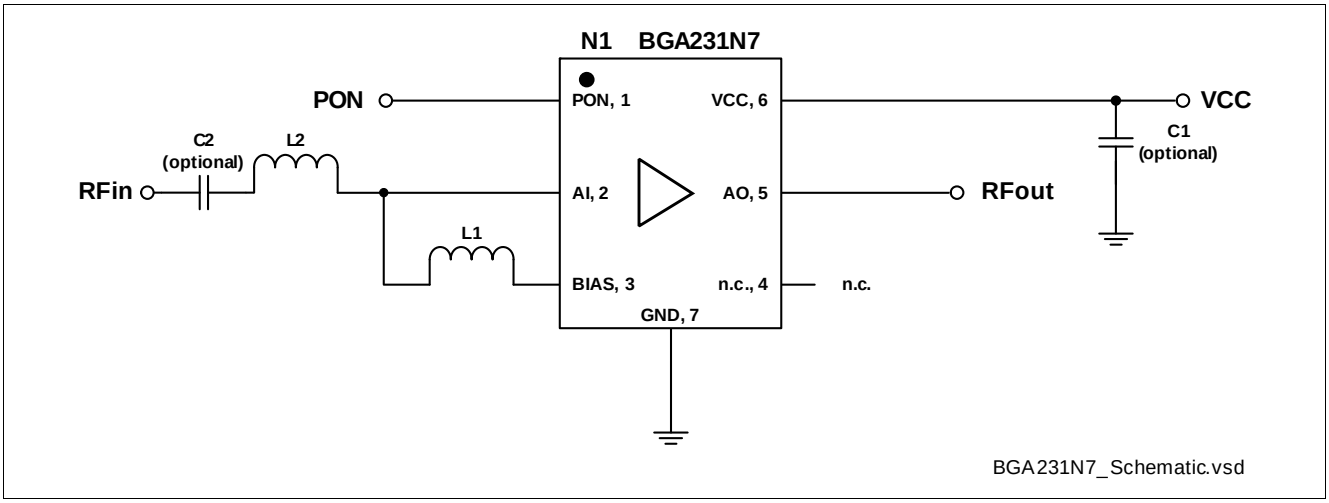


Figure 2 Application Schematic BGA231N7

Table 6 Bill of Materials

Name	Value	Package	Manufacturer	Function
C1 (optional)	100 nF	0201	Various	RF block [1)]
C2 (optional)	33 pF	0201	Various	DC block [2)]
L1	39 nH	0201	Murata LQP03T	Bias feed and RF choke
L2	6.8 nH	0201	Murata LQP03T	Input matching
N1	BGA231N7	TSNP-7-1 / TSNP-7-2	Infineon	SiGe LNA

1) RF bypass recommended to mitigate power supply noise

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

A list of all application notes is available at **http://www.infineon.com/gpslna.appnotes**.

4 Package Information

4.1 TSNP-7-1

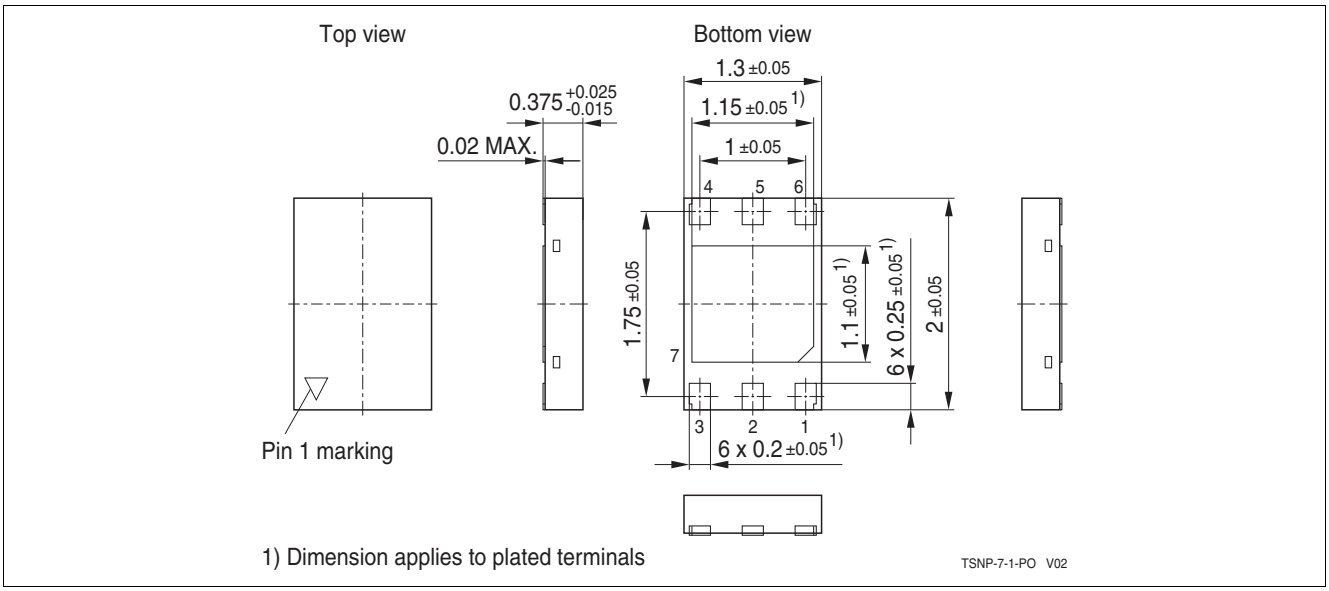


Figure 3 Package Dimensions for TSNP-7-1

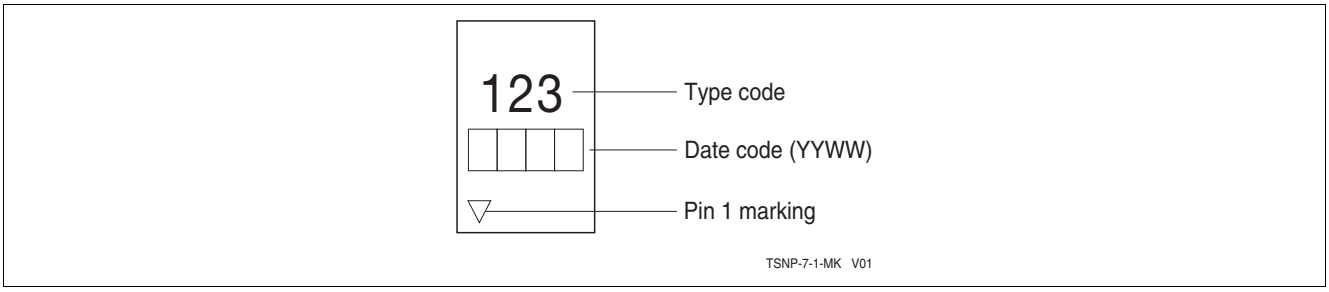


Figure 4 Marking Layout TSNP-7-1 (top view)

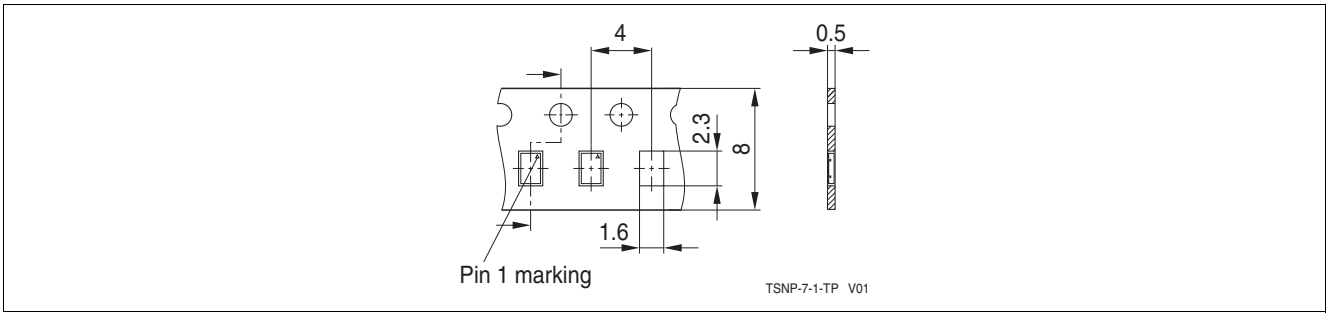


Figure 5 Tape & Reel Dimensions TSNP-7-1 (Ø reel 180, pieces/reel 7500)

4.2 TSNP-7-2

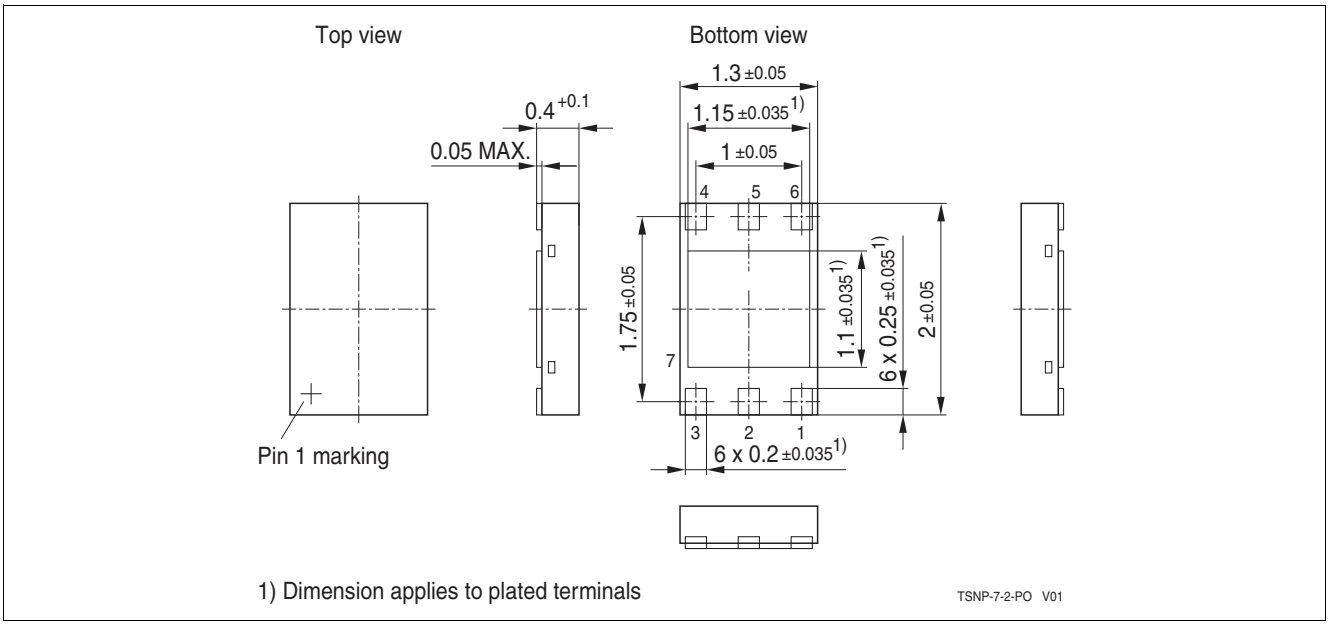


Figure 6 Package Dimensions for TSNP-7-2

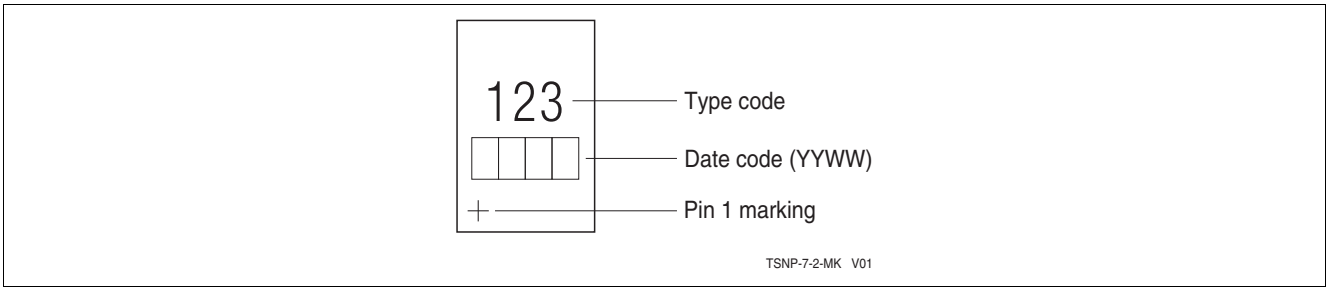


Figure 7 Marking Layout TSNP-7-2 (top view)

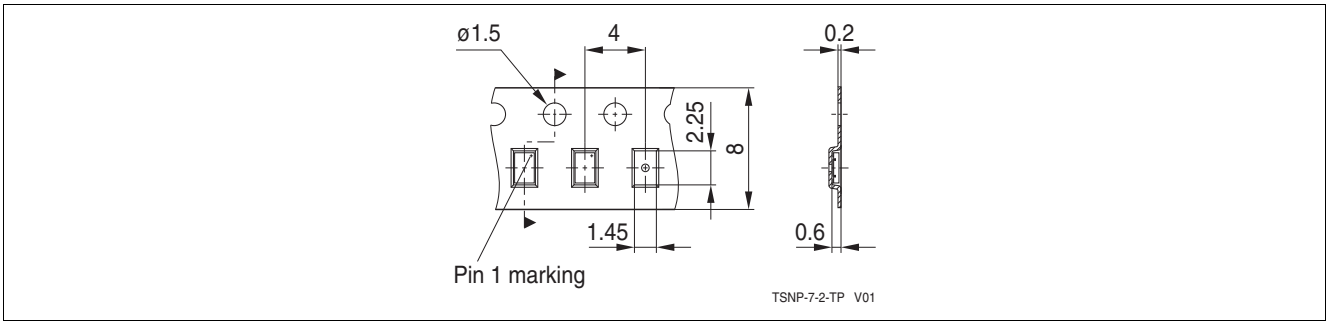


Figure 8 Tape & Reel Dimensions TSNP-7-2 (Ø reel 180, pieces/reel 6000)

4.3 Footprint Recommendation

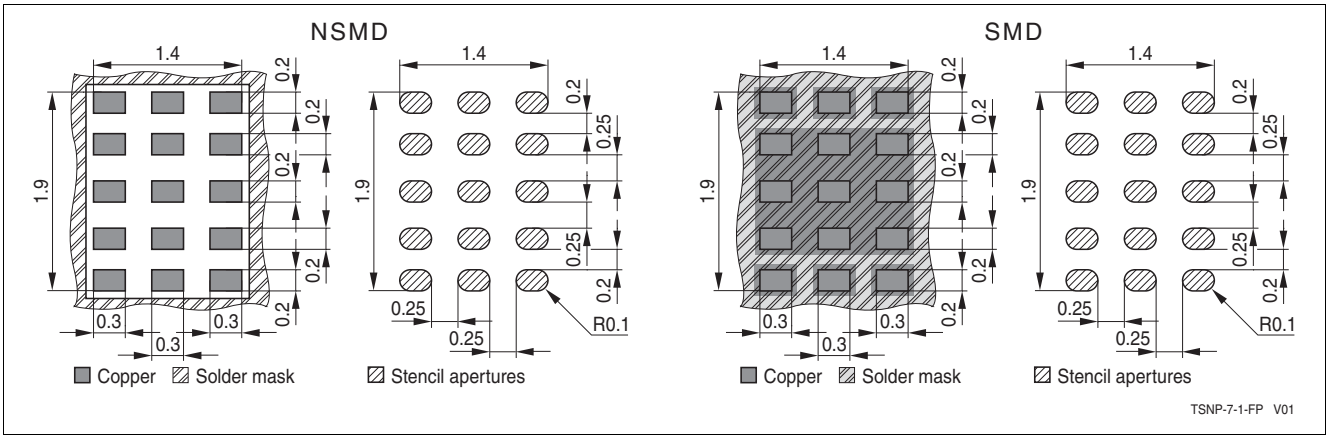


Figure 9 Footprint Recommendation 1 for TSNP-7-1 / TSNP-7-2

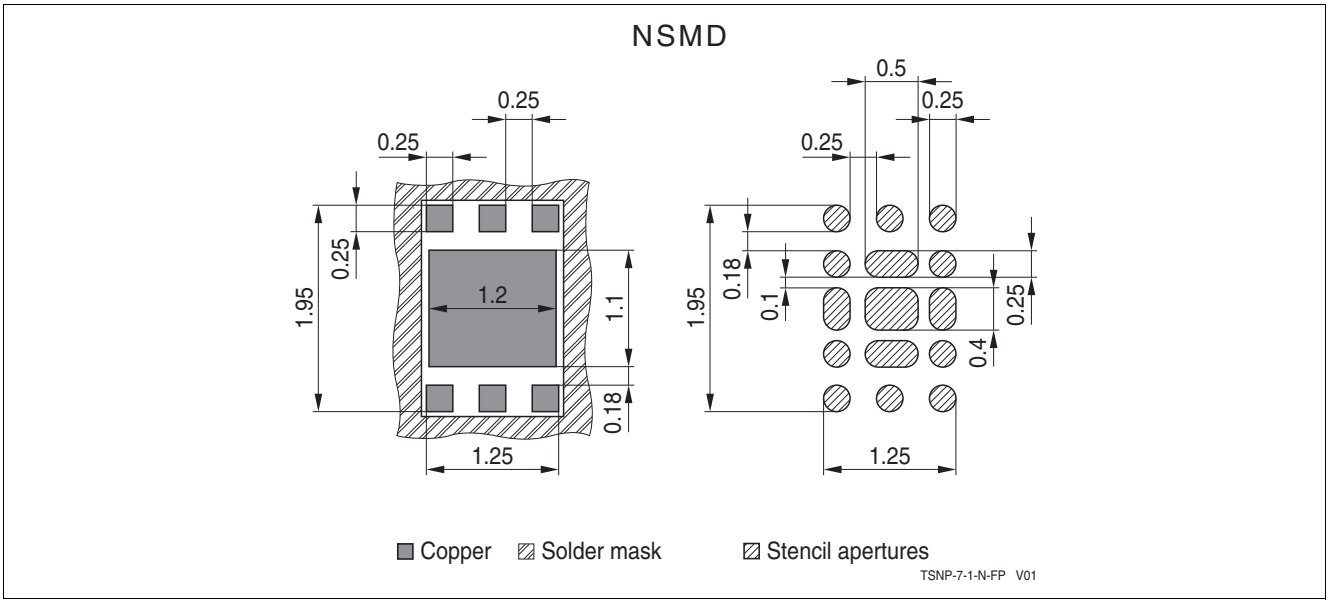


Figure 10 Footprint Recommendation 2 for TSNP-7-1 / TSNP-7-2

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