

BGA715N7

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

Data Sheet

Revision 1.0, 2013-01-29
Preliminary

Edition 2013-01-29

**Published by
Infineon Technologies AG
81726 Munich, Germany**

**© 2013 Infineon Technologies AG
All Rights Reserved.**

Legal Disclaimer

The information given in this document shall in no event be regarded as a guarantee of conditions or characteristics. With respect to any examples or hints given herein, any typical values stated herein and/or any information regarding the application of the device, Infineon Technologies hereby disclaims any and all warranties and liabilities of any kind, including without limitation, warranties of non-infringement of intellectual property rights of any third party.

Information

For further information on technology, delivery terms and conditions and prices, please contact the nearest Infineon Technologies Office (www.infineon.com).

Warnings

Due to technical requirements, components may contain dangerous substances. For information on the types in question, please contact the nearest Infineon Technologies Office.

Infineon Technologies components may be used in life-support devices or systems only with the express written approval of Infineon Technologies, if a failure of such components can reasonably be expected to cause the failure of that life-support device or system or to affect the safety or effectiveness of that device or system. Life support devices or systems are intended to be implanted in the human body or to support and/or maintain and sustain and/or protect human life. If they fail, it is reasonable to assume that the health of the user or other persons may be endangered.

Revision History

Page or Item	Subjects (major changes since previous revision)
Revision 1.0, 2013-01-29	
all	Initial version for new packages TSNP-7-1 / TSNP-7-2

Trademarks of Infineon Technologies AG

AURIX™, C166™, CanPAK™, CIPOS™, CIPURSE™, EconoPACK™, CoolMOS™, CoolSET™, CORECONTROL™, CROSSAVE™, DAVE™, DI-POL™, EasyPIM™, EconoBRIDGE™, EconoDUAL™, EconoPIM™, EconoPACK™, EiceDRIVER™, eupec™, FCOS™, HITFET™, HybridPACK™, I²RF™, ISOFACE™, IsoPACK™, MIPAK™, ModSTACK™, my-d™, NovalithIC™, OptiMOS™, ORIGA™, POWERCODE™, PRIMARION™, PrimePACK™, PrimeSTACK™, PRO-SIL™, PROFET™, RASIC™, ReverSave™, SatRIC™, SIEGET™, SINDRION™, SIPMOS™, SmartLEWIS™, SOLID FLASH™, TEMPFET™, thinQ!™, TRENCHSTOP™, TriCore™.

Other Trademarks

Advance Design System™ (ADS) of Agilent Technologies, AMBA™, ARM™, MULTI-ICE™, KEIL™, PRIMECELL™, REALVIEW™, THUMB™, μVision™ of ARM Limited, UK. AUTOSAR™ is licensed by AUTOSAR development partnership. Bluetooth™ of Bluetooth SIG Inc. CAT-iq™ of DECT Forum. COLOSSUS™, FirstGPS™ of Trimble Navigation Ltd. EMV™ of EMVCo, LLC (Visa Holdings Inc.). EPCOS™ of Epcos AG. FLEXGO™ of Microsoft Corporation. FlexRay™ is licensed by FlexRay Consortium. HYPERTERMINAL™ of Hilgraeve Incorporated. IEC™ of Commission Electrotechnique Internationale. IrDA™ of Infrared Data Association Corporation. ISO™ of INTERNATIONAL ORGANIZATION FOR STANDARDIZATION. MATLAB™ of MathWorks, Inc. MAXIM™ of Maxim Integrated Products, Inc. MICROTEC™, NUCLEUS™ of Mentor Graphics Corporation. MIPI™ of MIPI Alliance, Inc. MIPS™ of MIPS Technologies, Inc., USA. muRata™ of MURATA MANUFACTURING CO., MICROWAVE OFFICE™ (MWO) of Applied Wave Research Inc., OmniVision™ of OmniVision Technologies, Inc. Openwave™ Openwave Systems Inc. RED HAT™ Red Hat, Inc. RFMD™ RF Micro Devices, Inc. SIRIUS™ of Sirius Satellite Radio Inc. SOLARIS™ of Sun Microsystems, Inc. SPANSION™ of Spansion LLC Ltd. Symbian™ of Symbian Software Limited. TAIYO YUDEN™ of Taiyo Yuden Co. TEAKLITE™ of CEVA, Inc. TEKTRONIX™ of Tektronix Inc. TOKO™ of TOKO KABUSHIKI KAISHA TA. UNIX™ of X/Open Company Limited. VERILOG™, PALLADIUM™ of Cadence Design Systems, Inc. VLYNQ™ of Texas Instruments Incorporated. VXWORKS™, WIND RIVER™ of WIND RIVER SYSTEMS, INC. ZETEX™ of Diodes Zetex Limited.

Last Trademarks Update 2011-11-11

Table of Contents

	Table of Contents	4
	List of Figures	5
	List of Tables	6
	Features	7
1	Maximum Ratings	9
1.1	Thermal Resistance	9
2	Electrical Characteristics	10
3	Application Information	11
4	Package Information	12
4.1	TSNP-7-1	12
4.2	TSNP-7-2	13
4.3	Footprint Recommendation	14

List of Figures

Figure 1	Block Diagram	8
Figure 2	Application Schematic BGA715N7	11
Figure 3	Application Board Drawing BGA715N7	11
Figure 4	Package Dimensions for TSNP-7-1	12
Figure 5	Marking Layout TSNP-7-1 (top view)	12
Figure 6	Tape & Reel Dimensions TSNP-7-1 (Ø reel 180, pieces/reel 7500)	12
Figure 7	Package Dimensions for TSNP-7-2	13
Figure 8	Marking Layout TSNP-7-2 (top view)	13
Figure 9	Tape & Reel Dimensions TSNP-7-2 (Ø reel 180, pieces/reel 6000)	13
Figure 10	Footprint Recommendation 1 for TSNP-7-1 / TSNP-7-2	14
Figure 11	Footprint Recommendation 2 for TSNP-7-1 / TSNP-7-2	14

List of Tables

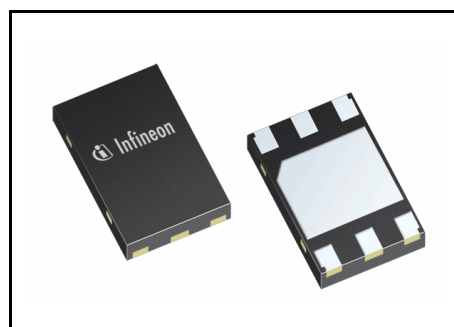
Table 1	Pin Definition and Function	8
Table 2	Maximum Ratings	9
Table 3	Thermal resistance	9
Table 4	Electrical Characteristics	10
Table 5	Bill of Materials	11

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

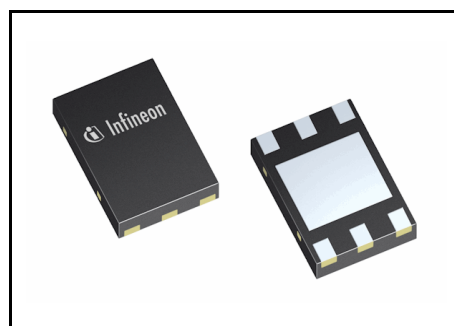
BGA715N7

Features

- High gain: 20 dB
- Low noise figure: 0.7 dB
- Low current consumption: 3.3 mA
- Supply voltage: 1.5 V to 3.3 V
- High input 1dB-compression point -15.5 dBm at 1.8 V supply
- High input 3rd-order intercept point -7 dBm at 1.8 V supply
- B7HFM Silicon Germanium technology
- RF output internally matched to 50 Ω
- Low external part count
- 2kV HBM ESD protection (including AI-pin)
- Tiny TSNP-7-1 / TSNP-7-2 leadless packages
- Moisture sensitivity level: MSL 1
- Pb-free (RoHS compliant) packages



TSNP-7-1



TSNP-7-2

Application

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

Description

The BGA715N7 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 20 dB gain, 0.7 dB noise figure and high linearity performance in the application configuration described in [Chapter 3](#). Current consumption is as low as 3.3 mA. The BGA715N7 is based upon Infineon Technologies' B7HFM Silicon Germanium technology. It operates over a 1.5 V to 3.3 V supply range.

If an ultra low noise figure of 0.6 dB is required, please refer to Infineon Application Note AN161.

Product Name	Marking	Package
BGA715N7	UG	TSNP-7-1 / TSNP-7-2

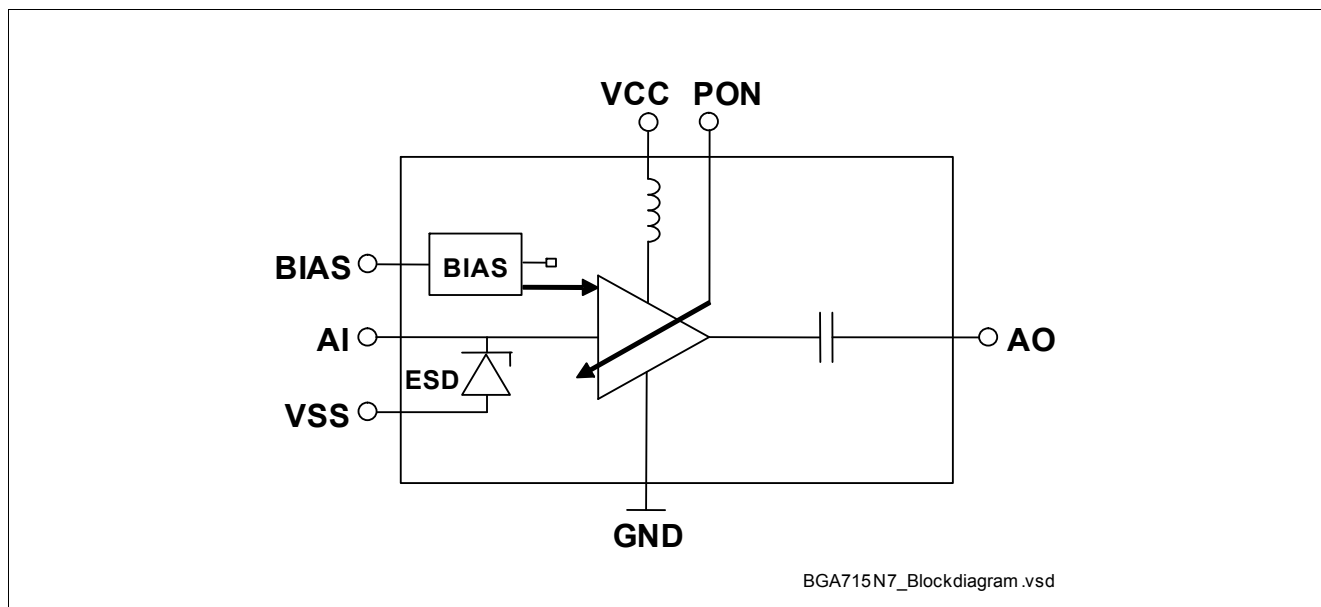


Figure 1 Block Diagram

Table 1 Pin Definition and Function

Pin No.	Symbol	Function
1	AI	LNA input
2	BIAS	DC bias
3	GND	RF ground
4	PON	Power on control
5	VCC	DC supply
6	AO	LNA output
7	VSS	DC ground

1 Maximum Ratings

Table 2 Maximum Ratings

Parameter ¹⁾	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Voltage at pin VCC	V_{CC}	-0.3	—	3.6	V	—
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 GND	V_{GND}	-0.3	—	0.3	V	—
Current into pin VCC	I_{CC}	—	—	10	mA	—
RF input power	P_{IN}	—	—	10	dBm	—
Total power dissipation	P_{tot}	—	—	36	mW	—
Junction temperature	T_J	—	—	150	°C	—
Ambient temperature range	T_A	-40	—	85	°C	—
Storage temperature range	T_{STG}	-65	—	150	°C	—
Human Body Model ESD capability, all pin to all pin ²⁾	V_{ESD_HBM}	—	—	2000	V	—
Machine Model ESD capability, all pin to all pin ³⁾	V_{ESD_MM}	—	—	100	V	—

1) All voltages refer to VSS-Node.

2) According to JEDEC22A-114

3) According to JEDEC22A-115

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.

1.1 Thermal Resistance

Table 3 Thermal resistance

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Junction - soldering point ¹⁾	R_{thJS}	—	159	—	K/W	—

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

2 Electrical Characteristics

$T_A = 25\text{ °C}$, $V_{CC} = 1.8\text{ V}$, $V_{PON,ON} = 1.8\text{ V}$, $V_{PON,OFF} = 0\text{ V}$, $f = 1550 - 1615\text{ MHz}$ (GPS / Glonass / Beidou / Galileo)

Table 4 Electrical Characteristics¹⁾

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Supply voltage	V_{CC}	1.5	1.8	3.6	V	–
Supply current	I_{CC}	–	3.3	–	mA	ON-mode
		–	0.2	3	μA	OFF-mode
Gain switch control voltage	V_{pon}	1.0	–	V_{CC}	V	ON-mode
		0	–	0.4	V	OFF-mode
Gain switch control current	I_{pon}	–	5	–	μA	ON-mode
		–	–	1	μA	OFF-mode
Power gain	$ S_{21} ^2$	–	20	–	dB	High-gain Mode
Noise figure ²⁾	NF	–	0.7	–	dB	$Z_S = 50\text{ }\Omega$
Input return loss	RL_{in}	–	14	–	dB	–
Output return loss	RL_{out}	–	13	–	dB	–
Reverse isolation	$1/ S_{12} ^2$	–	43	–	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}	–	-15.5	–	dBm	–
Inband input 3 rd -order intercept point ⁴⁾	IIP_3	–	-7	–	dBm	$f_1 = 1575\text{ MHz}$ $f_2 = f_1 \pm 1\text{ MHz}$
Stability	k	–	> 1	–		$f = 20\text{ MHz} \dots 20\text{ GHz}$

1) Measured on BGA715N7 application board according to application schematic on page 7, including PCB losses (unless noted otherwise)

2) PCB transmission line- and connector losses of 0.05 dB 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

3 Application Information

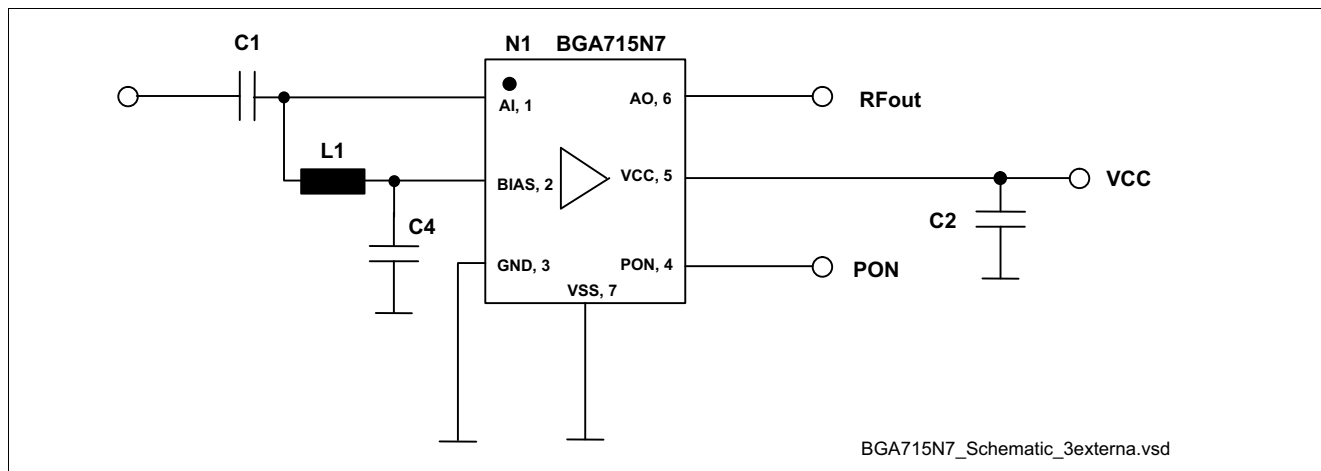


Figure 2 Application Schematic BGA715N7

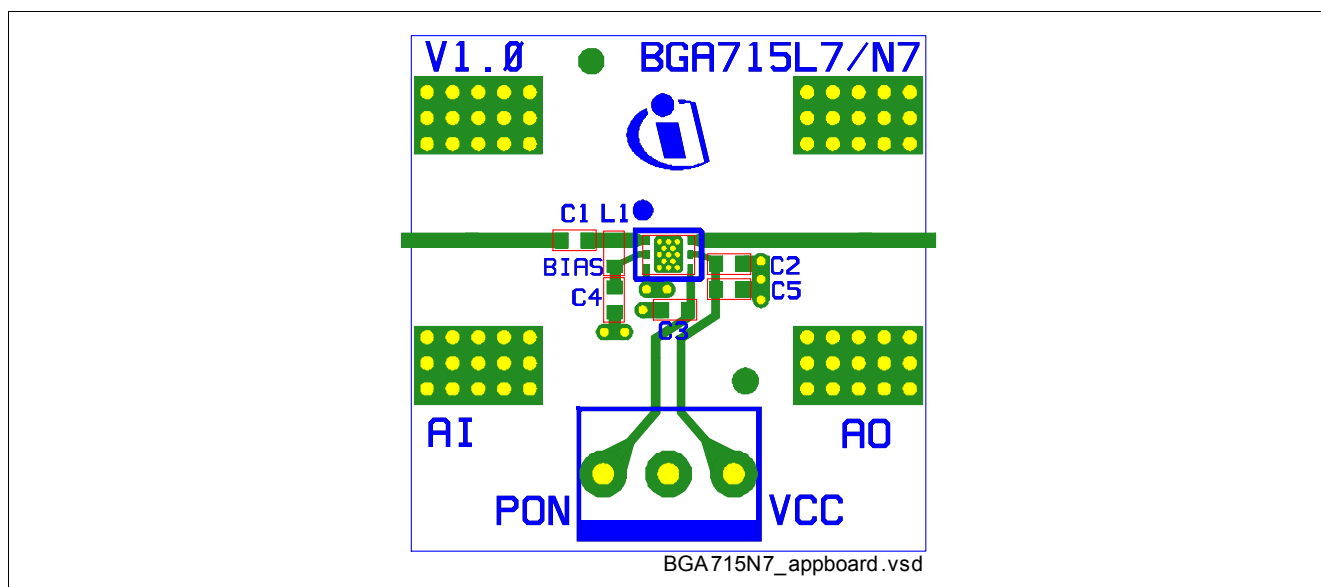


Figure 3 Application Board Drawing BGA715N7

Table 5 Bill of Materials

Name	Value	Package	Manufacturer	Function
C1	1.8 pF	0402	Various	DC blocking and input matching
C2	1 μ F	0402	Various	RF block
C4	15 pF	0402	Various	RF block
L1	4.7 nH LQW15A series	0402	Murata	Bias feed and input matching
N1	BGA715N7	TSNP-7-1 / TSNP-7-2	Infineon	SiGe LNA

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

4 Package Information

4.1 TSNP-7-1

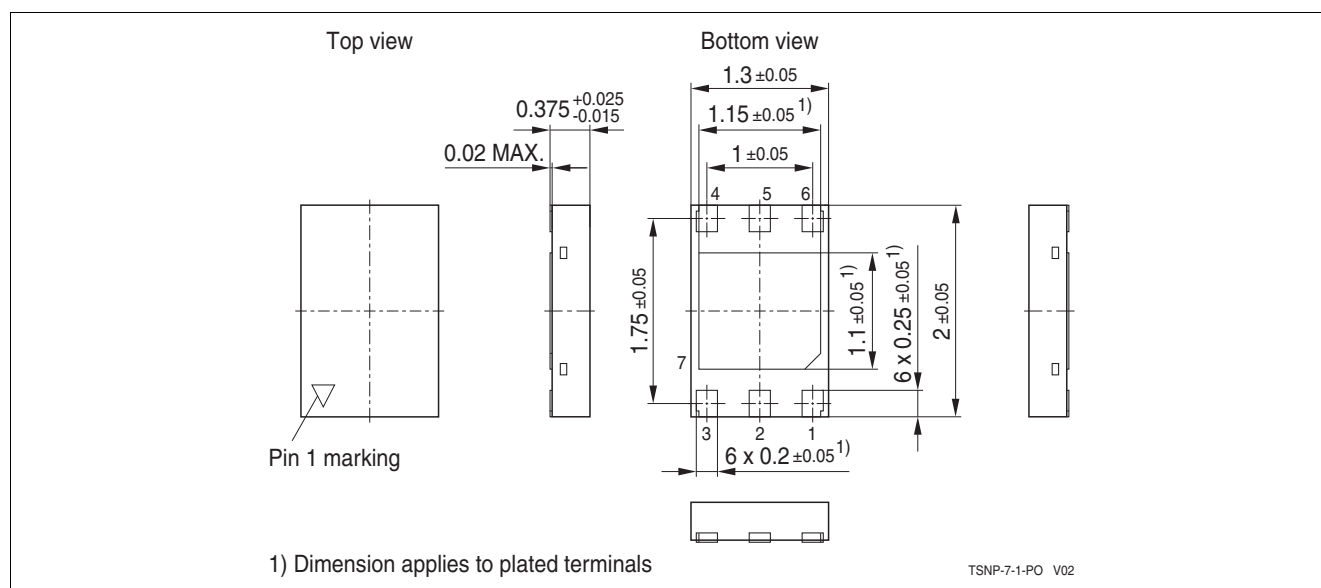


Figure 4 Package Dimensions for TSNP-7-1

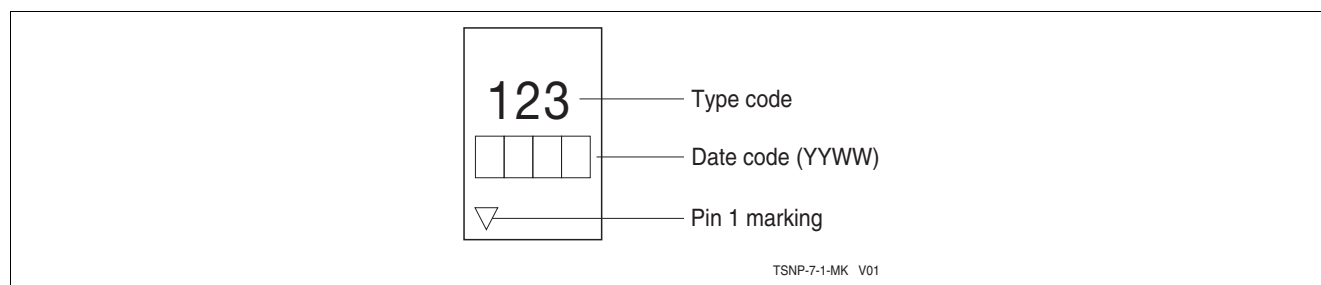


Figure 5 Marking Layout TSNP-7-1 (top view)

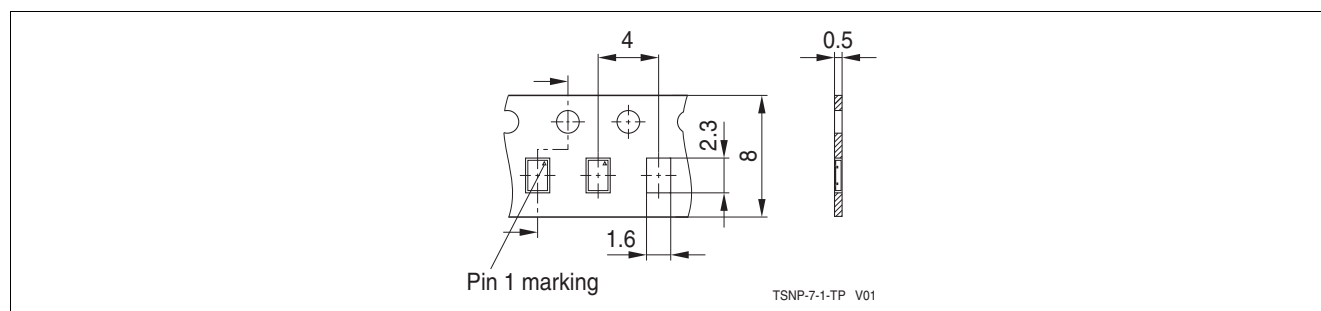


Figure 6 Tape & Reel Dimensions TSNP-7-1 (Ø reel 180, pieces/reel 7500)

4.2 TSNP-7-2

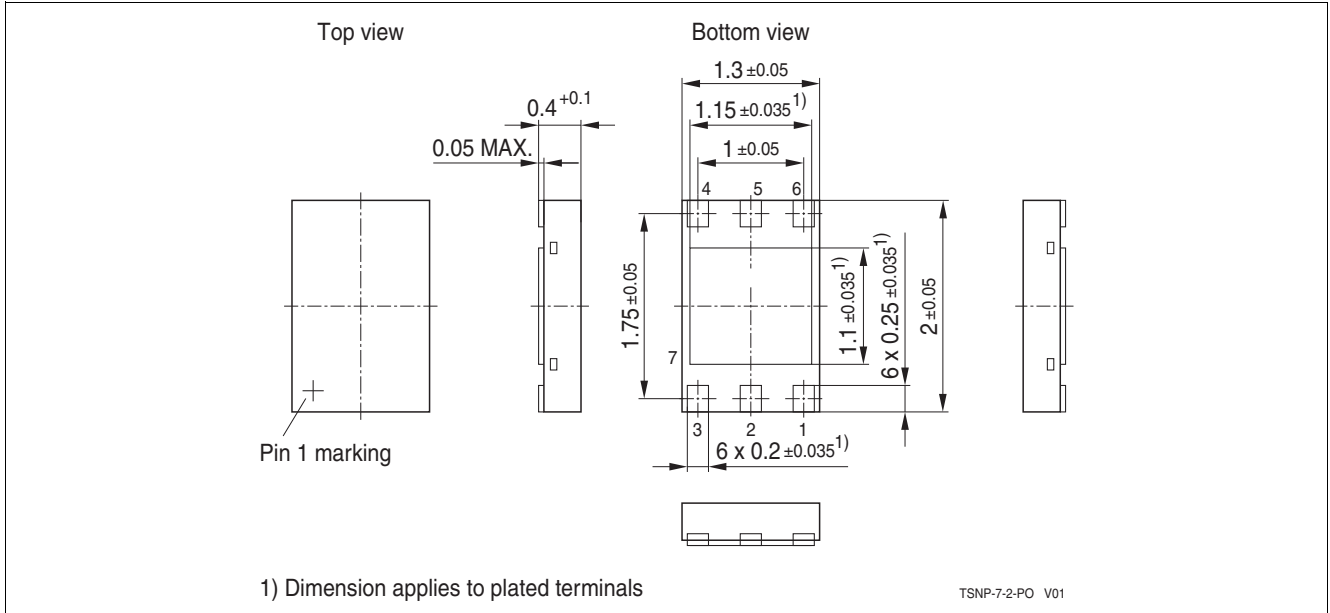


Figure 7 Package Dimensions for TSNP-7-2

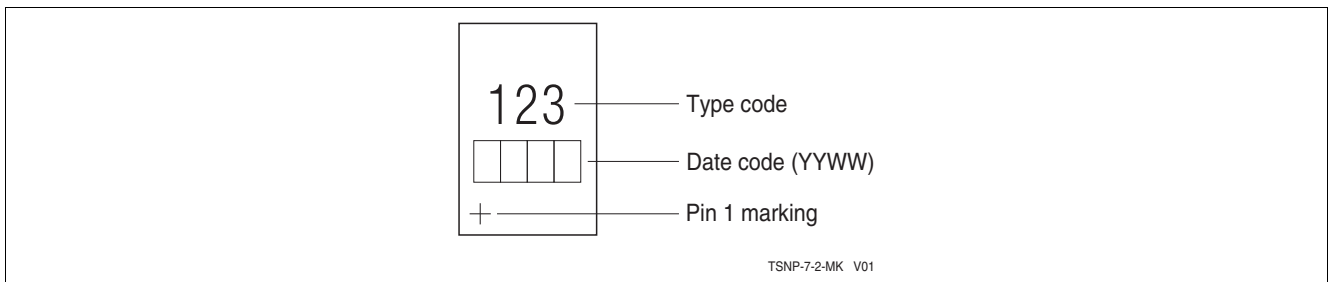


Figure 8 Marking Layout TSNP-7-2 (top view)

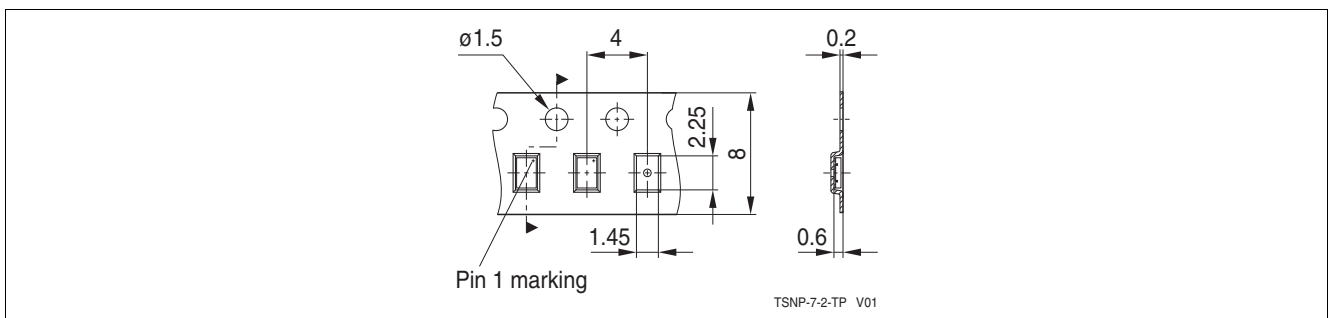


Figure 9 Tape & Reel Dimensions TSNP-7-2 (Ø reel 180, pieces/reel 6000)

4.3 Footprint Recommendation

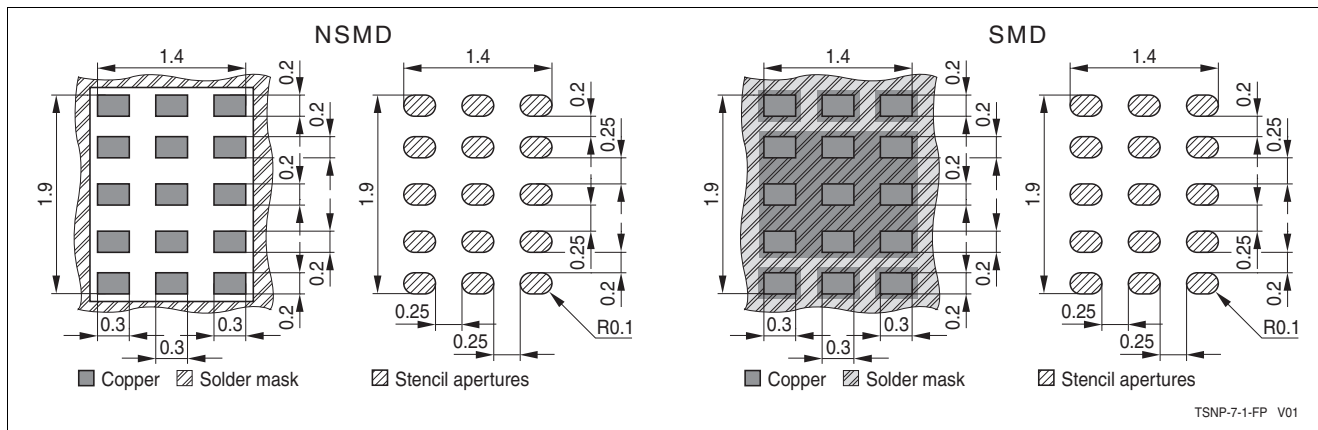


Figure 10 Footprint Recommendation 1 for TSNP-7-1 / TSNP-7-2

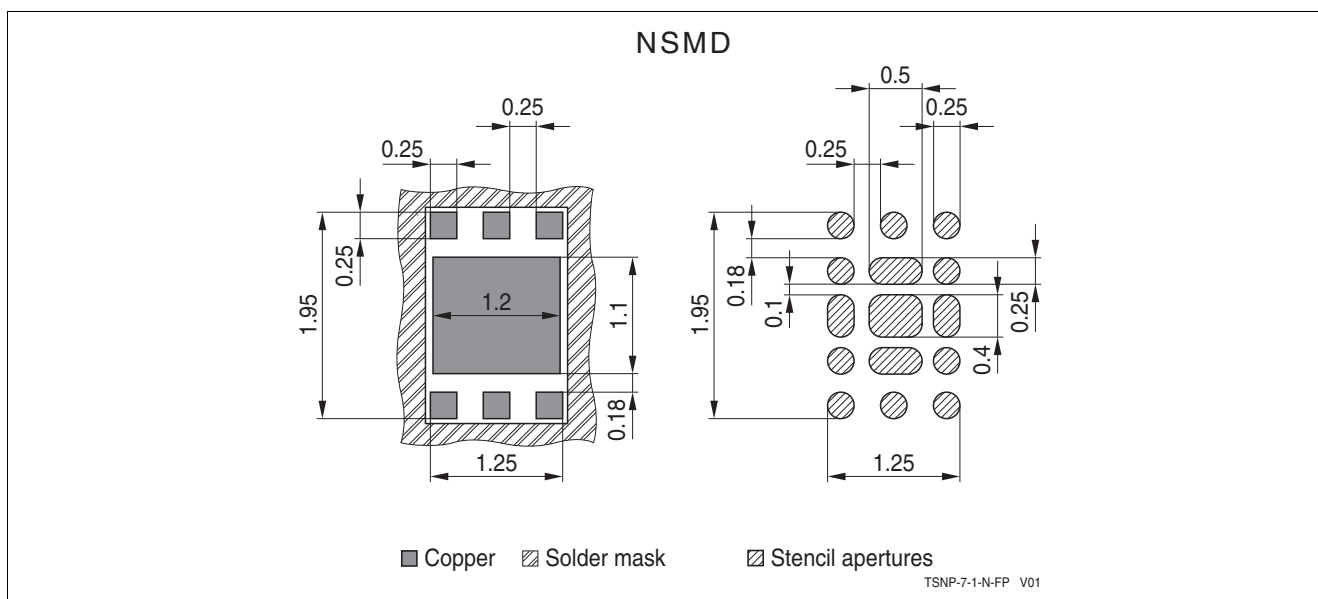


Figure 11 Footprint Recommendation 2 for TSNP-7-1 / TSNP-7-2

www.infineon.com