

BGA7H1BN6

Silicon Germanium Low Noise Amplifier for LTE

Data Sheet

Revision 3.5, 2020-09-16

Edition 2020-09-16

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

**© 2020 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 3.5, 2020-09-16	
3	Trademarks updated
11	Frequencies updated in Table 4

Other Trademarks

All referenced product or service names and trademarks are the property of their respective owners.

Table of Contents

	Table of Contents	4
	List of Figures	5
	List of Tables	6
	Features	7
1	Maximum Ratings	9
2	Electrical Characteristics	10
2.1	Measured RF Characteristics Highband	10
2.2	Measured RF Characteristics Midband	11
3	Application Information	12
3.1	Application Circuit Schematic Highband	12
3.2	Application Circuit Schematic Midband	13
4	Package Information	14

List of Figures

Figure 1	Block Diagram	7
Figure 2	Application Schematic BGA7H1BN6	12
Figure 3	Application Schematic BGA7H1BN6	13
Figure 4	TSNP-6-2 Package Outline (top, side and bottom views)	14
Figure 5	Footprint Recommendation TSNP-6-2	14
Figure 6	Marking Layout (top view)	14
Figure 7	Tape & Reel Dimensions (reel diameter 180 mm, pieces/reel 15000)	15

List of Tables

Table 1	Pin Definition and Function	8
Table 2	Maximum Ratings	9
Table 3	Electrical Characteristics: $T_A = 25\text{ °C}$, $V_{CC} = 2.8\text{ V}$, $V_{C,ON} = 2.8\text{ V}$, $V_{C,BYP} = 0\text{ V}$, $f = 2300 - 2690\text{ MHz}$	10
Table 4	Electrical Characteristics: $T_A = 25\text{ °C}$, $V_{CC} = 2.8\text{ V}$, $V_{C,ON} = 2.8\text{ V}$, $V_{C,BYP} = 0\text{ V}$, $f = 1805 - 2200\text{ MHz}$	11
Table 5	Bill of Materials	12
Table 6	Bill of Materials	13

Features

- Insertion power gain: 12.3 dB
- Low noise figure: 0.85 dB
- Low current consumption: 4.3 mA
- Insertion Loss in bypass mode: -3.1 dB
- Operating frequencies: 1805 - 2690 MHz
- Two-state control: Bypass- and High gain-Mode
- Supply voltage: 1.5 V to 3.6 V
- Digital on/off switch (1V logic high level)
- Ultra small TSNP-6-2 leadless package (footprint: 0.7 x 1.1 mm²)
- B7HF Silicon Germanium technology
- RF output internally matched to 50 Ω
- Only 1 external SMD component necessary
- Pb-free (RoHS compliant) package



Product Validation

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

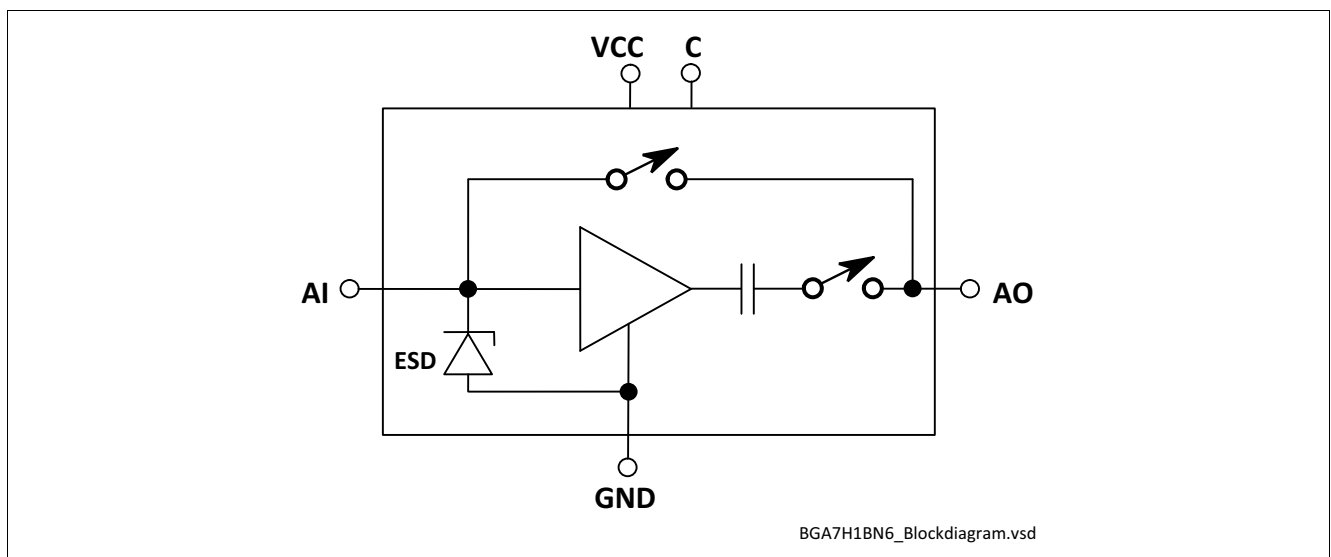


Figure 1 Block Diagram

Product Name	Marking	Package
BGA7H1BN6	L	TSNP-6-2

Description

The BGA7H1BN6 is a front-end low noise amplifier for LTE which covers a wide frequency range from 1805 MHz to 2690 MHz. The LNA provides 12.3 dB gain and 0.85 dB noise figure at a current consumption of 4.3 mA in the application configuration described in [Chapter 3](#). In bypass mode the LNA provides an insertion loss of -3.1dB. The BGA7H1BN6 is based upon Infineon Technologies' B7HF Silicon Germanium technology. It operates from 1.5 V to 3.6 V supply voltage. The device features a single-line two-state control (Bypass- and High gain-Mode). OFF-state can be enabled by powering down Vcc.

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	C	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	–	5.0	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 C	V_C	-0.3	–	$V_{CC} + 0.3$	V	–
Voltage at GND pins	V_{GND}	-0.3	–	0.3	V	–
Current into pin VCC	I_{CC}	–	–	50	mA	–
RF input power	P_{IN}	–	–	+25	dBm	–
Total power dissipation, $T_S < 148\text{ °C}^2)$	P_{tot}	–	–	250	mW	–
Junction temperature	T_J	–	–	150	°C	–
Ambient temperature range	T_A	-40	–	85	°C	–
Storage temperature range	T_{STG}	-65	–	150	°C	–

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.

2 Electrical Characteristics

2.1 Measured RF Characteristics Highband

Table 3 Electrical Characteristics:¹⁾ $T_A = 25\text{ °C}$, $V_{CC} = 2.8\text{ V}$, $V_{C,ON} = 2.8\text{ V}$, $V_{C,BYP} = 0\text{ V}$, $f = 2300 - 2690\text{ MHz}$

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Supply voltage	V_{CC}	1.5	–	3.6	V	–
Supply current	I_{CC}	–	4.3	5.3	mA	High gain mode
		–	87	120	μA	Bypass mode
		–	110	150	μA	Bypass mode / $V_{CC} = 5.0\text{ V}$
Control voltage	V_C	1.0	–	V_{CC}	V	High gain mode
		0	–	0.4	V	Bypass mode
Insertion power gain $f = 2500\text{ MHz}$	$ S_{21} ^2$	9.5	11.0	12.5	dB	High gain mode
		-4.5	-3.5	-2.5	dB	Bypass mode
Noise figure ²⁾ $Z_S = 50\ \Omega$	NF	–	0.9	1.5	dB	High gain mode
		–	2.7	3.7	dB	Bypass mode
Input return loss $f = 2500\text{ MHz}$	RL_{in}	9	12	–	dB	High gain mode
		5	8	–	dB	Bypass mode
Output return loss $f = 2500\text{ MHz}$	RL_{out}	10	15	–	dB	High gain mode
		4	6	–	dB	Bypass mode
Reverse isolation	$1/ S_{12} ^2$	16	20	–	dB	High gain mode
		-4.5	-3.5	–	dB	Bypass mode
Power gain settling time ³⁾	t_S	–	3	6	μs	OFF- to ON-mode
Inband input 1dB-compression point, $f = 2500\text{ MHz}$	IP_{1dB}	-5	-1	–	dBm	High gain mode
		+1	+5	–	dBm	Bypass mode
Inband input 3 rd -order intercept point ⁴⁾ $f_1 = 2500\text{ MHz}$, $f_2 = f_1 + 1\text{ MHz}$	IIP_3	0	+5	–	dBm	High gain mode
		+11	+16	–	dBm	Bypass mode
Phase shift	PS	-5	0	5	°	High gain mode and bypass mode
Stability	k	> 1	–	–		$f = 20\text{ MHz} \dots 10\text{ GHz}$

1) Based on the application described in chapter 3

2) PCB losses are subtracted

3) To be within 1 dB of the final gain

4) High gain mode: Input power = -30 dBm for each tone / Bypass mode: Input power = -10 dBm for each tone

2.2 Measured RF Characteristics Midband

Table 4 Electrical Characteristics:¹⁾ $T_A = 25\text{ °C}$, $V_{CC} = 2.8\text{ V}$, $V_{C,ON} = 2.8\text{ V}$, $V_{C,BYP} = 0\text{ V}$, $f = 1805 - 2200\text{ MHz}$

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Supply voltage	V_{CC}	1.5	–	3.6	V	–
Supply current	I_{CC}	–	4.3	5.3	mA	High gain mode
		–	87	120	μA	Bypass mode
		–	110	150	μA	Bypass mode / $V_{CC} = 5.0\text{ V}$
Control voltage	V_C	1.0	–	V_{CC}	V	High gain mode
		0	–	0.4	V	Bypass mode
Insertion power gain $f = 2000\text{ MHz}$	$ S_{21} ^2$	10.8	12.3	13.8	dB	High gain mode
		-4.1	-3.1	-2.1	dB	Bypass mode
Noise figure ²⁾ $Z_S = 50\text{ }\Omega$	NF	–	0.85	1.4	dB	High gain mode
		–	1.7	2.7	dB	Bypass mode
Input return loss $f = 2000\text{ MHz}$	RL_{in}	5	8	–	dB	High gain mode
		6	9	–	dB	Bypass mode
Output return loss $f = 2000\text{ MHz}$	RL_{out}	10	13	–	dB	High gain mode
		5	7	–	dB	Bypass mode
Reverse isolation	$1/ S_{12} ^2$	18	22	–	dB	High gain mode
		-4.1	-3.1	–	dB	Bypass mode
Power gain settling time ³⁾	t_S	–	3	6	μs	OFF- to ON-mode
Inband input 1dB-compression point, $f = 2000\text{ MHz}$	IP_{1dB}	-7	-3	–	dBm	High gain mode
		-1	+3	–	dBm	Bypass mode
Inband input 3 rd -order intercept point ⁴⁾ $f_1 = 2000\text{ MHz}$, $f_2 = f_1 + 1\text{ MHz}$	IIP_3	-3	+2	–	dBm	High gain mode
		+10	+15	–	dBm	Bypass mode
Phase shift	PS	-5	0	5	°	High gain mode and bypass mode
Stability	k	> 1	–	–		$f = 20\text{ MHz} \dots 10\text{ GHz}$

1) Based on the application described in chapter 3

2) PCB losses are subtracted

3) To be within 1 dB of the final gain

4) High gain mode: Input power = -30 dBm for each tone / Bypass mode: Input power = -10 dBm for each tone

3 Application Information

3.1 Application Circuit Schematic Highband

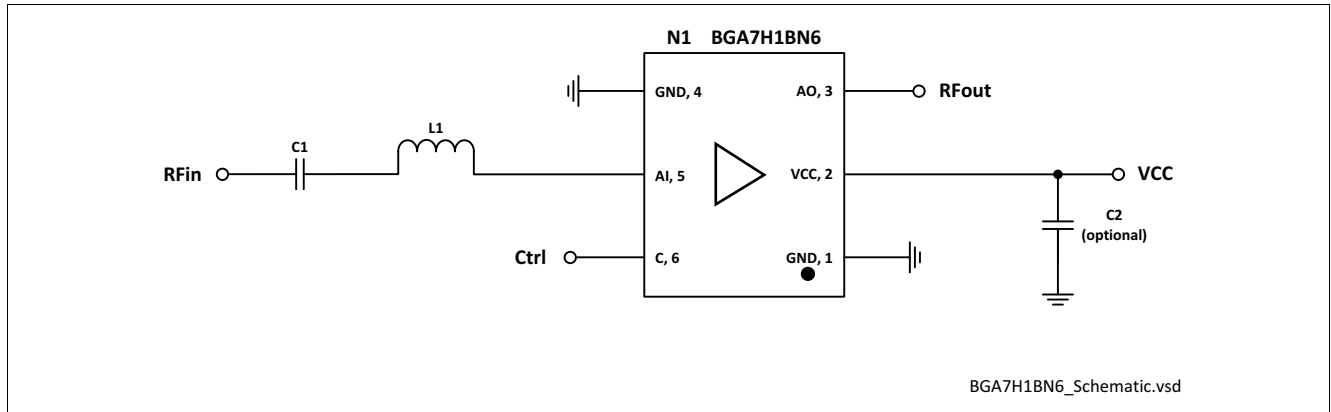


Figure 2 Application Schematic BGA7H1BN6

Table 5 Bill of Materials

Name	Value	Package	Manufacturer	Function
C1	1nF	0402	Various	DC block ¹⁾
C2 (optional)	≥ 1nF	0402	Various	RF bypass ²⁾
L1	3.4nH	0402	Murata LQW type	Input matching
N1	BGA7H1BN6	TSNP-6-2	Infineon	SiGe LNA

1) DC block might be necessary due to internal LNA bias voltage @ AI (LNA Analog Input pin). The DC block can be realized with pre-filter (e.g. SAW)

2) RF bypass recommended to mitigate power supply noise

Note: No external DC blocking capacitor at RFout is required in typical applications as long as no DC is applied.

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

3.2 Application Circuit Schematic Midband

Application Board Configuration

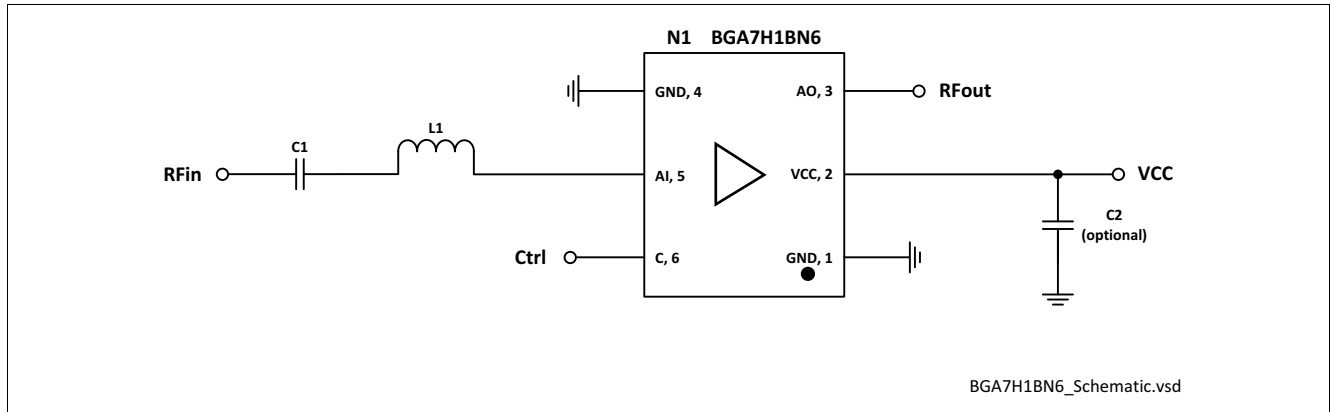


Figure 3 Application Schematic BGA7H1BN6

Table 6 Bill of Materials

Name	Value	Package	Manufacturer	Function
C1	1nF	0402	Various	DC block ¹⁾
C2 (optional)	≥ 1nF	0402	Various	RF bypass ²⁾
L1	4.7nH	0402	Murata LQW type	Input matching
N1	BGA7H1BN6	TSNP-6-2	Infineon	SiGe LNA

1) DC block might be necessary due to internal LNA bias voltage @ AI (LNA Analog Input pin). The DC block can be realized with pre-filter (e.g. SAW)

2) RF bypass recommended to mitigate power supply noise

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

4 Package Information

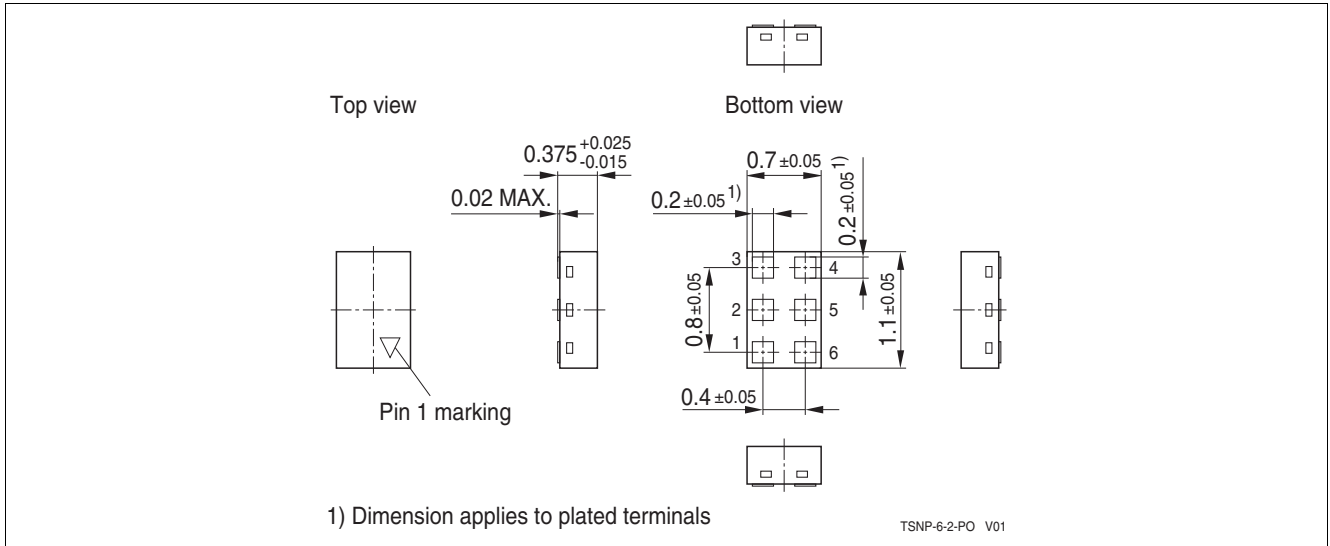


Figure 4 TSNP-6-2 Package Outline (top, side and bottom views)

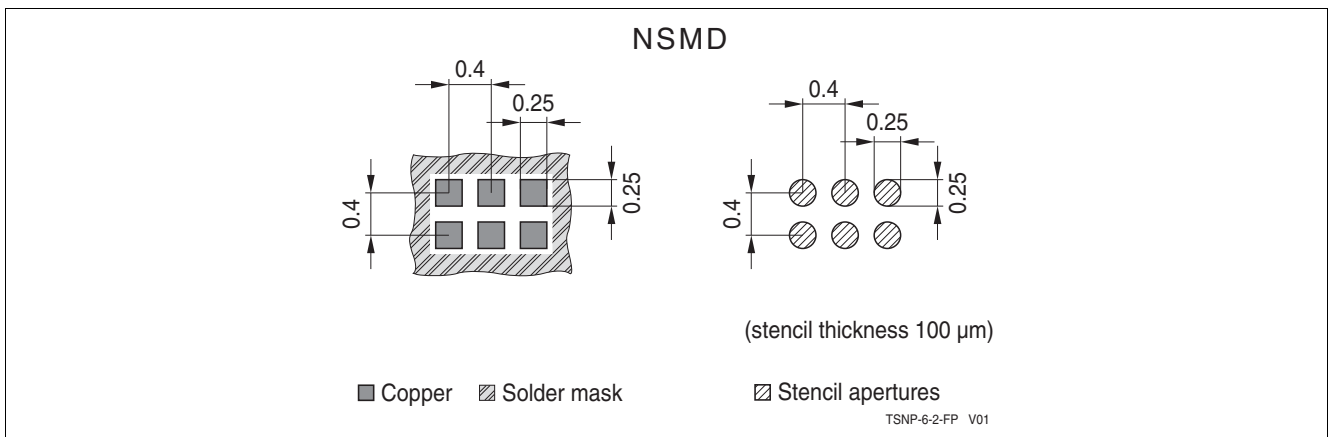


Figure 5 Footprint Recommendation TSNP-6-2

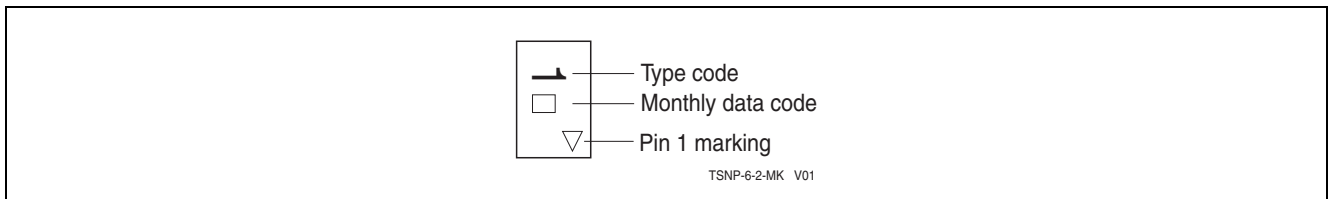


Figure 6 Marking Layout (top view)

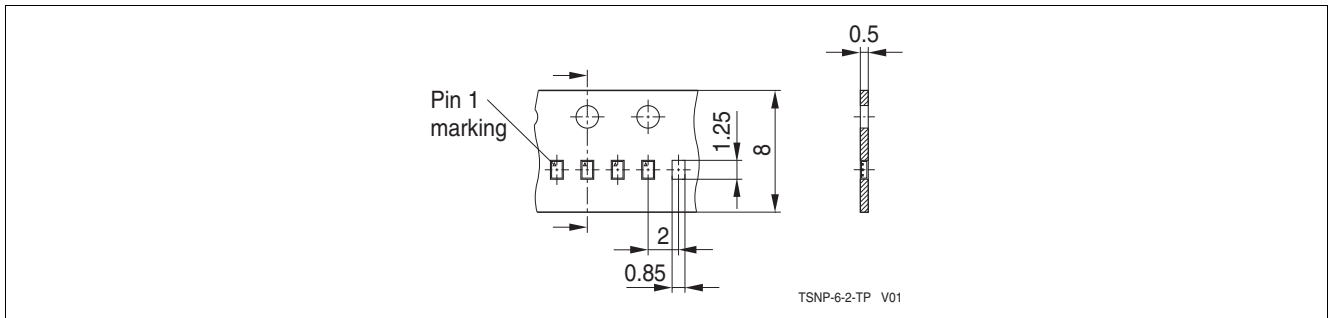


Figure 7 Tape & Reel Dimensions (reel diameter 180 mm, pieces/reel 15000)

www.infineon.com

Published by Infineon Technologies AG