BGA825L6S

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

Data Sheet

Revision 2.1, 2012-10-17

RF & Protection Devices

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Revision History	
Page or Item	**Subjects (major changes since previous revision)**
Revision 2.1, 2012-10-17	
all	“Preliminary” status removed
14	Application for improved rejection of out-of-band jammers (LTE-Band-13) added
Revision 2.0, 2012-10-12	
all	Preliminary data sheet
14, 15	Package drawings and information completed
13	Drawing of Application Board updated

Table of Contents

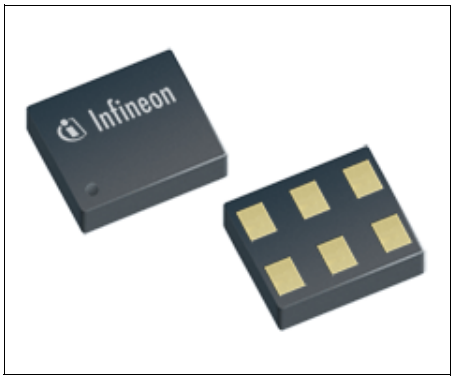
List of Figures

List of Tables

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

BGA825L6S

Features



- Insertion power gain: 17.0 dB
- High out-of-band 3rd-order intercept point at input: +8 dBm
- High 1dB-compression point: -7 dBm
- Low noise figure: 0.60 dB
- Low current consumption: 4.8 mA
- Operating frequencies: 1550 - 1615 MHz
- Supply voltage: 1.5 V to 3.6 V
- Digital on/off switch (1V logic high level)
- Small TSLP-6-3 leadless package (footprint: 0.9 x 1.1 mm^2)
- 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

RoHS

Application

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

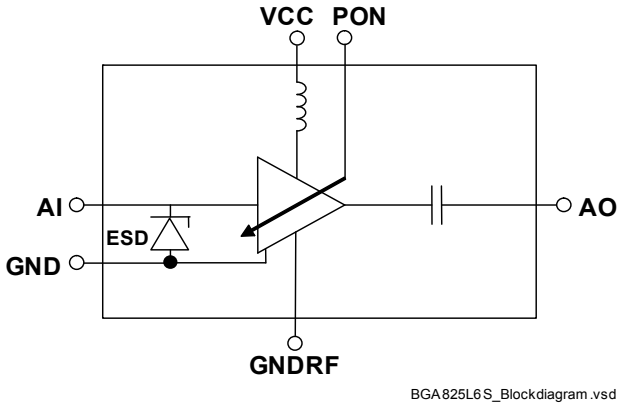


Figure 1 Block Diagram

Product Name	Marking	Package
BGA825L6S	E.	TSLP-6-3

Description

The BGA825L6S 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 17.0 dB gain and 0.6 dB noise figure at a current consumption of 4.8 mA in the application configuration described in **Chapter 3.1**. The BGA825L6S is based upon Infineon Technologies' B7HF Silicon Germanium technology. It operates from 1.5 V to 3.6 V supply voltage.

Pin Definition and Function

Table 1 Pin Definition and Function

Pin No.	Name	Function
1	GND	General ground
2	VCC	DC supply
3	AO	LNA output
4	GNDRF	LNA RF 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}	–	–	20	mA	–
RF input power	P_{IN}	–	–	0	dBm	–
Total power dissipation, T_S < 123 °C 2)	P_{tot}	–	–	72	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. 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}	380	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} = 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}	–	4.8	–	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	$\|S_{21}\|^2$	–	17.0	–	dB	–
Noise figure[2]	NF	–	0.60	–	dB	Z_S = 50 Ω
Input return loss	RL_{in}	–	16	–	dB	–
Output return loss	RL_{out}	–	18	–	dB	–
Reverse isolation	$1/\|S_{12}\|^2$	–	22	–	dB	–
Power gain settling time[3]	t_S	–	5	–	µs	OFF- to ON-mode
		–	5	–	µs	ON- to OFF-mode
Inband input 1dB-compression point	IP_{1dB}	–	-10	–	dBm	–
Inband input 3rd-order intercept point[4]	IIP_3	–	+3	–	dBm	f_1 = 1575 MHz f_2 = f_1 +/-1 MHz
Out-of-band input 3rd-order intercept point[5]	IIP_{3oob}	–	+8	–	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 3.1
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} = 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}	–	4.8	–	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	$\|S_{21}\|^2$	–	17.0	–	dB	–
Noise figure[2]	NF	–	0.60	–	dB	Z_S = 50 Ω
Input return loss	RL_{in}	–	15	–	dB	–
Output return loss	RL_{out}	–	18	–	dB	–
Reverse isolation	$1/\|S_{12}\|^2$	–	22	–	dB	–
Power gain settling time[3]	t_S	–	5	–	µs	OFF- to ON-mode
		–	5	–	µs	ON- to OFF-mode
Inband input 1dB-compression point	IP_{1dB}	–	-7	–	dBm	–
Inband input 3rd-order intercept point[4]	IIP_3	–	+4	–	dBm	f_1 = 1575 MHz f_2 = f_1 +/-1 MHz
Out-of-band input 3rd-order intercept point[5]	IIP_{3oob}	–	+8	–	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

3.1 Standard Application

Application Board Configuration

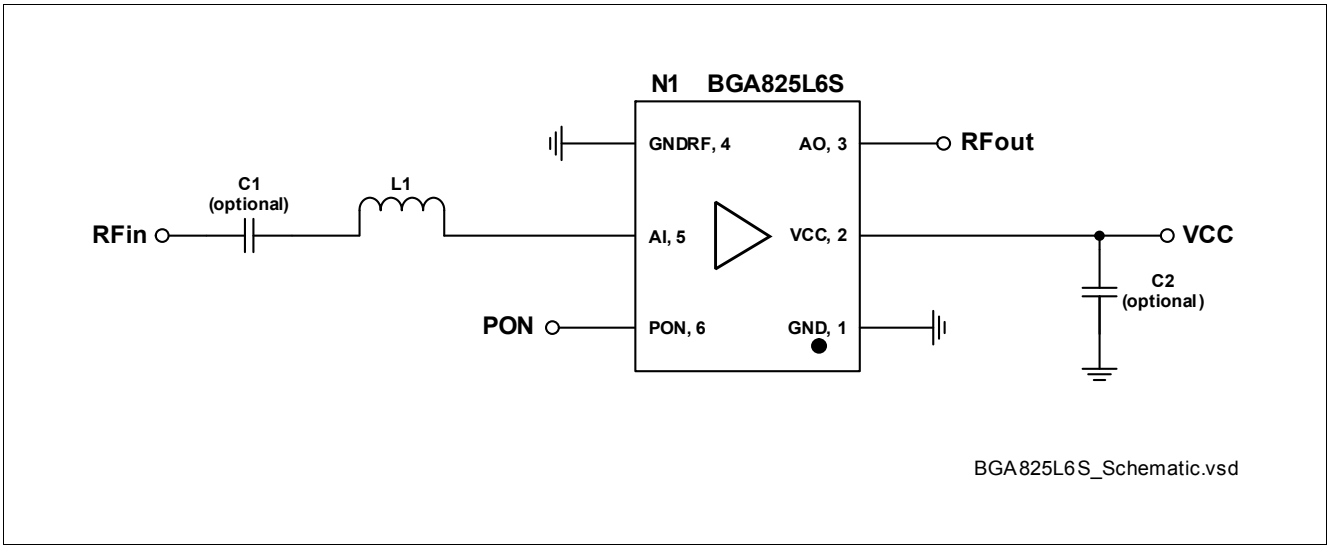


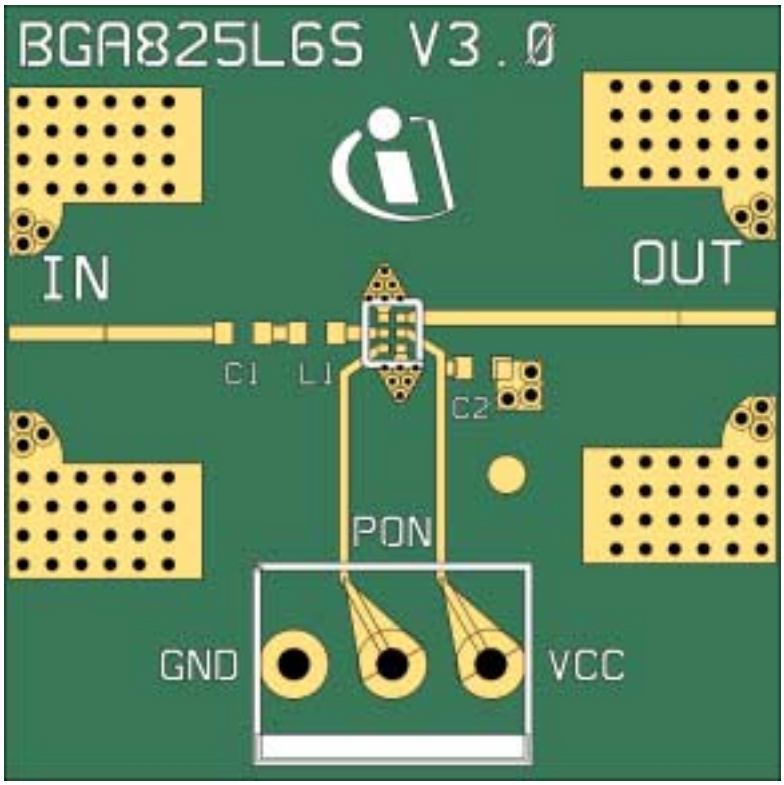
Figure 2 Application Schematic BGA825L6S

Table 6 Bill of Materials

Name	Value	Package	Manufacturer	Function
C1 (optional)	1nF	0402	Various	DC block [1]
C2 (optional)	> 10nF[2]	0402	Various	RF bypass [3]
L1	6.2nH	0402	Murata LQW type	Input matching
N1	BGA825L6S	TSLP-6-3	Infineon	SiGe LNA

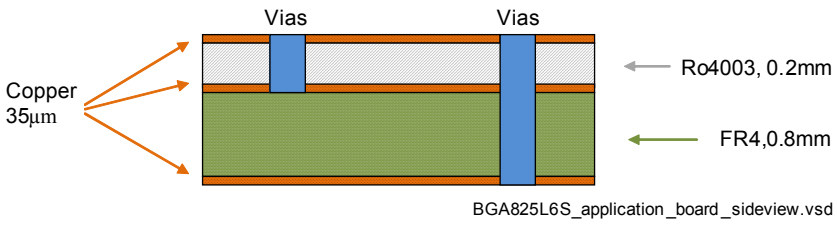
1) DC block might be realized with pre-filter in GNSS applications
2) For data sheet characteristics 1µF used
3) RF bypass recommended to mitigate power supply noise

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



BGA825L6S_Application_Board.vsd

Figure 3 Drawing of Application Board



BGA825L6S_application_board_sideview.vsd

Figure 4 Application Board Cross-Section

3.2 Application for improved rejection of out-of-band jammers (LTE-Band-13)

Application Board Configuration according to Application Note AN304:
"Improving Immunity of BGA825SL6 against Out-Of-Band Jammer for LTE Band-13"

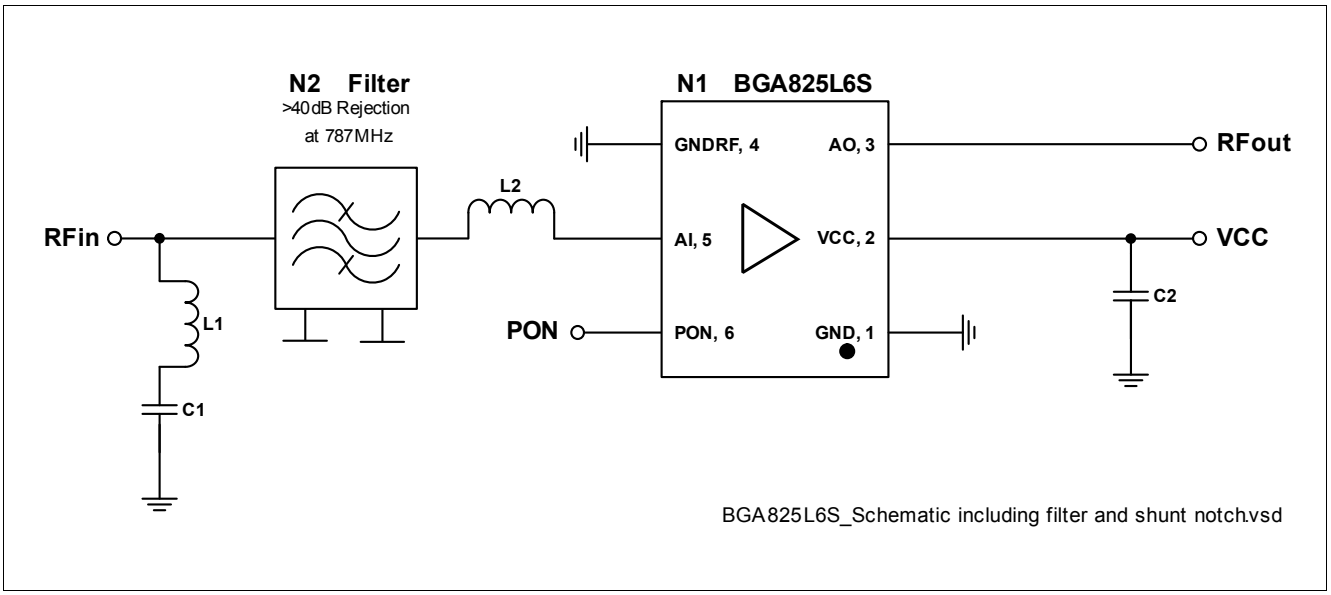


Figure 5 Application Schematic BGA825L6S including filter and shunt notch

Table 7 Bill of Materials

Name	Value	Package	Manufacturer	Function
C1	3.3pF	0201	Various	Band-13 notch
C2	10nF	0201	Various	RF bypass[1)]
L1	12nF	03015	Murata LQW type	Band-13 notch
L2	7.5nF	03015	Murata LQW type	Input matching
N1	BGA825L6S	TSLP-6-3	Infineon	SiGe LNA
N2	Filter	-	Various	Filter with >40dB rejection at 787MHz

1) RF bypass recommended to mitigate power supply noise

Table 8 Electrical Characteristics: T_A = 25 °C

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
LTE band-13 2nd Harmonic	*H2*			-85	dBm	V_{CC} = 1.8 V, V_{PON} = 1.8 V f_{IN} = 787.76 MHz, P_{IN} = +15 dBm, f_{H2} = 1575.52 MHz
LTE band-13 2nd Harmonic	*H2*			-85	dBm	V_{CC} = 2.8 V, V_{PON} = 2.8 V f_{IN} = 787.76 MHz, P_{IN} = +15 dBm, f_{H2} = 1575.52 MHz

4 Package Information

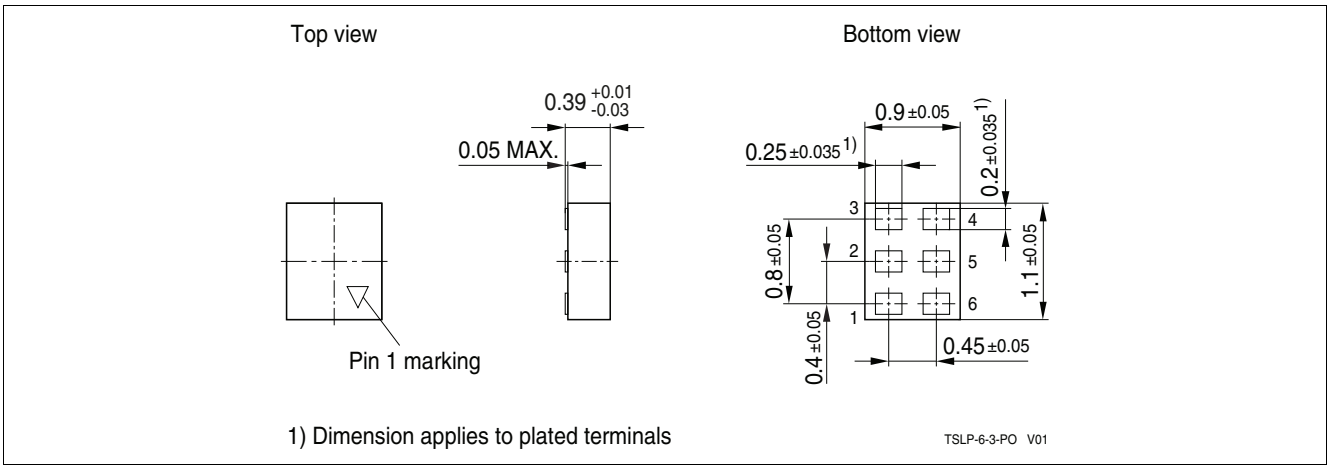


Figure 6 TSLP-6-3 Package Outline (top, side and bottom views)

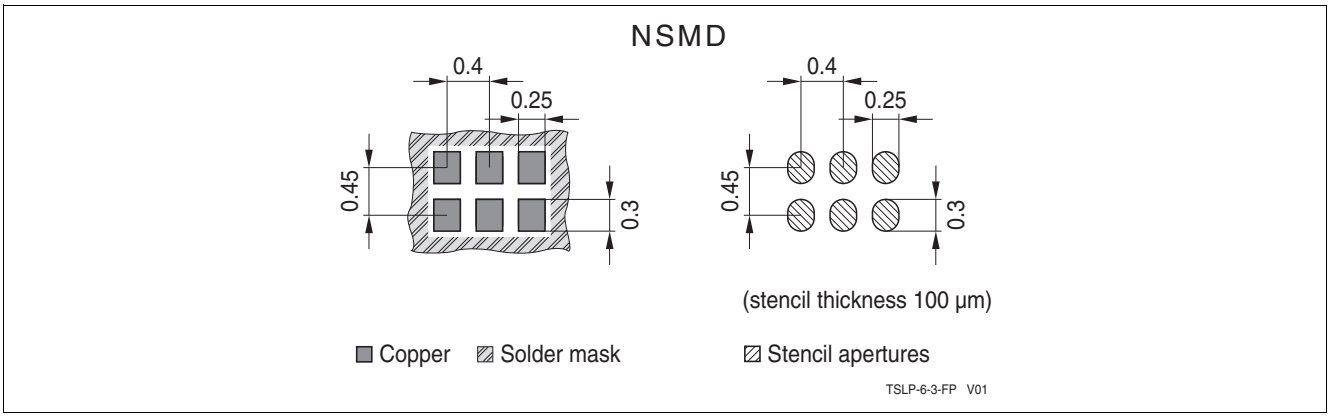


Figure 7 Footprint TSLP-6-3

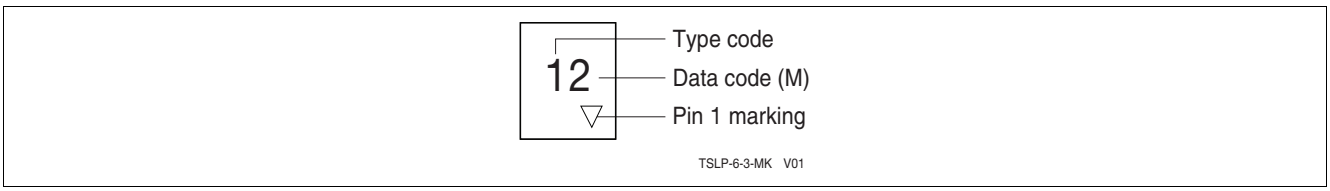


Figure 8 Marking Layout (top view)

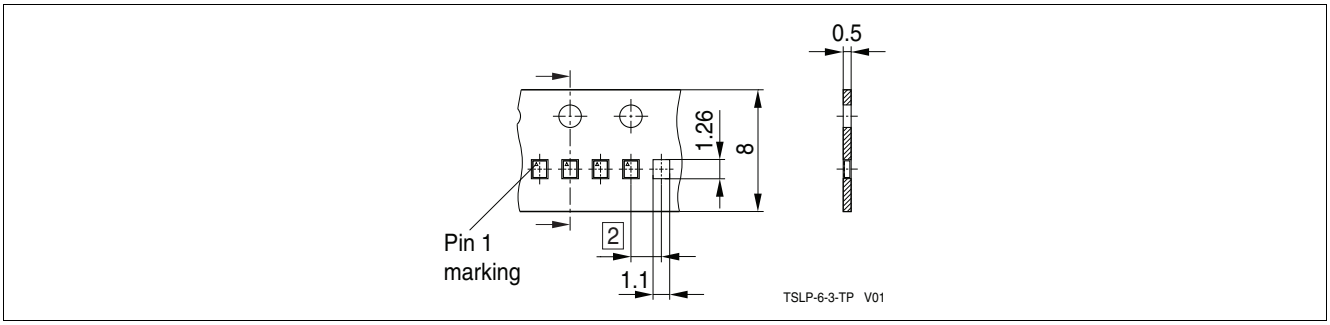


Figure 9 Tape & Reel Dimensions (Ø reel 180 mm, pieces/reel 15000)

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