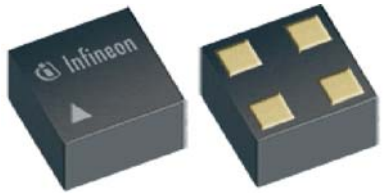
BGA123L4

Small Footprint Ultra Low Current Low Noise Amplifier for Global Navigation Satellite Systems (GNSS)

Features

- Operating frequencies: 1550 - 1615 MHz
- Ultra low current consumption: 1.1 mA
- Wide supply voltage range: 1.1 V to 3.6 V
- High insertion power gain: 18.2 dB
- Low noise figure: 0.75 dB
- 2 kV HBM ESD protection (including AI pin)
- Ultra small TSLP-4-11 leadless package (footprint: 0.7 x 0.7 x 0.31 mm^3)
- RF output internally matched to 50 Ohm
- Only one external SMD compenent necessary
- Pb-free (RoHS complaint) package



0.7 x 0.7 x 0.31 mm^3

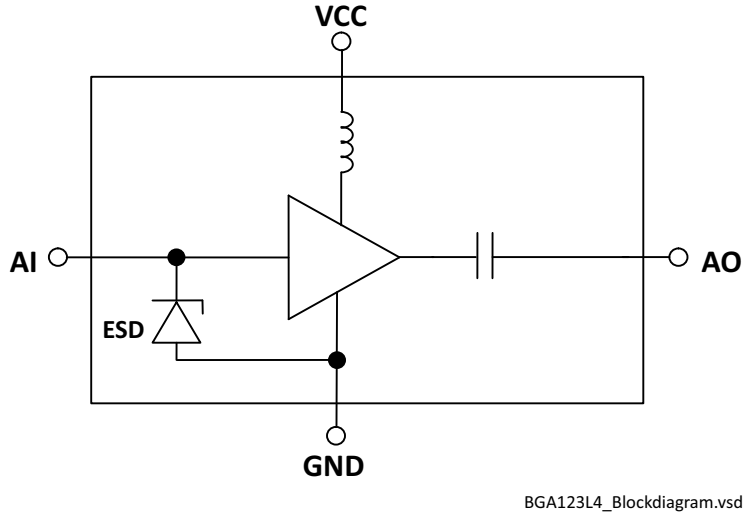
Application

BGA123L4 is designed to enhance GNSS signal sensitivity especially in wearables and mobile cellular IoT devices. With 18.2 dB gain and only 0.75 dB noise figure it ensures high system sensitivity. The current needed is only 1.1 mA which means just 1.3 mW power consumption, which is critical to help to conserve batteries. The wide supply voltage range of 1.1 V to 3.6 V ensures flexible design and high compatibility. It supports all GNSS systems including GPS, GLONASS, Beidou and Galileo.

Product Validation

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

Block diagram



BGA123L4_Blockdiagram.vsd

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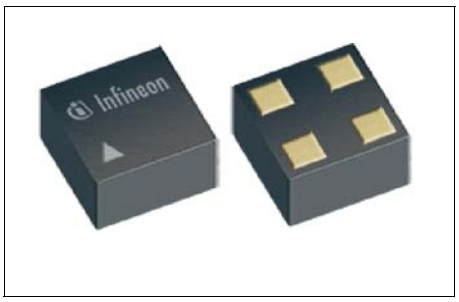
1 Features



- Operating frequencies: 1550 - 1615 MHz
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- B7HF Silicon Germanium technology

RoHS

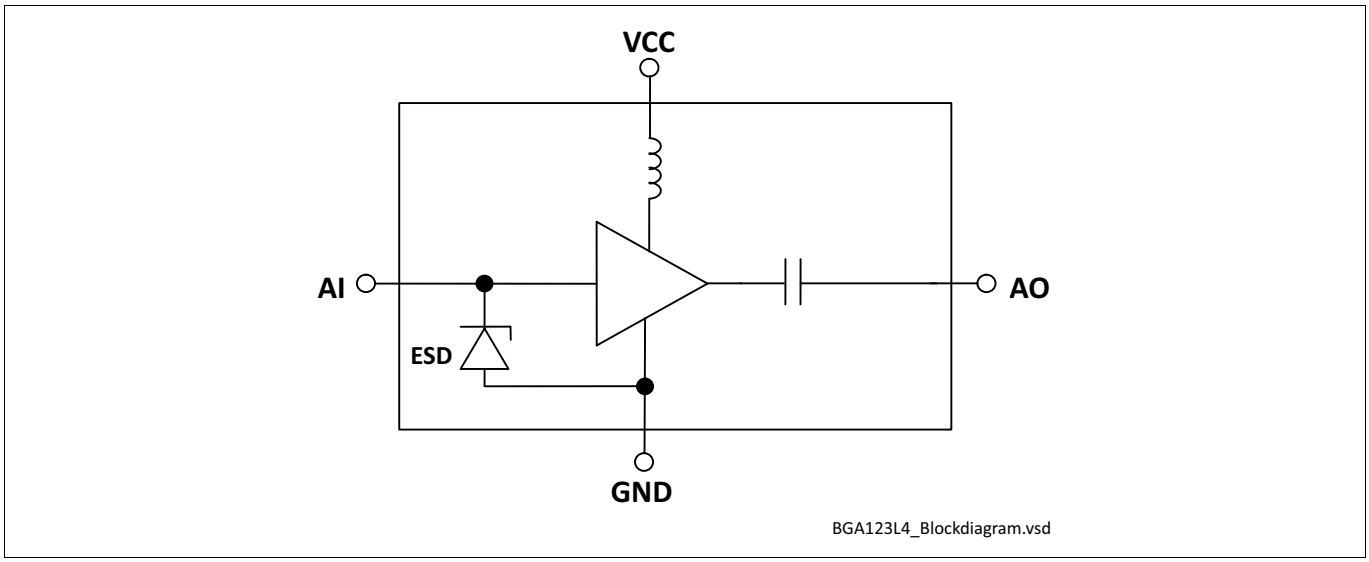

Figure 1 Block Diagram

Product Name	Marking	Package
BGA123L4	B	TSLP-4-11

Features

Description

The BGA123L4 is a ultra low current low noise amplifier for Global Navigation Satellite Systems (GNSS) which covers all GNSS frequency bands from 1550 MHz to 1615 MHz like GPS, GLONASS, Beidou, Galileo and others. The LNA provides 18.2 dB gain and 0.75 dB noise figure at a current consumption of only 1.1 mA in the application configuration described in **Chapter 4**. The BGA123L4 is based upon Infineon Technologies‘ B7HF Silicon Germanium technology. It operates from 1.1 V to 3.6 V supply voltage.

Pin Definition and Function

Table 1 Pin Definition and Function

Pin No.	Name	Function
1	VCC	DC supply
2	AO	LNA output
3	GND	Ground
4	AI	LNA input

2 Maximum Ratings

Table 2 Maximum Ratings

Parameter	Symbol	Values			Unit	Note or 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 GND	V_{GND}	-0.3	–	0.3	V	–
Current into pin VCC	I_{CC}	–	–	10	mA	–
RF input power	P_{IN}	–	–	0	dBm	–
Total power dissipation, T_S < 148 °C 2)	P_{tot}	–	–	40	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	–	2000	V	according to JS-001

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.

3 Electrical Characteristics

Table 3 Electrical Characteristics[1)]

T_A = 25 °C, V_{CC} = 1.2 V, f = 1550 - 1615 MHz

Parameter	Symbol	Values			Unit	Note or Test Condition
		Min.	Typ.	Max.		
Supply voltage	V_{CC}	1.1	1.8	3.6	V	ON-Mode
		0.0	–	0.4	V	OFF-Mode
Supply current	I_{CC}	–	1.05	1.55	mA	ON-Mode, Vcc=1.2V
		–	0.1	2	µA	OFF-Mode
Insertion power gain f = 1575 MHz	$\|S_{21}\|^2$	16.4	17.9	19.4	dB	ON-Mode
Noise figure[2)] f = 1575 MHz, Z_S = 50 Ω	NF	–	0.75	1.25	dB	ON-Mode, Z_S = 50 Ω
Input return loss[3)] f = 1575 MHz	RL_{IN}	7	9	–	dB	ON-Mode
Output return loss[3)] f = 1575 MHz	RL_{OUT}	10	16	–	dB	ON-Mode
Reverse isolation[3)] f = 1575 MHz	$1/\|S_{12}\|^2$	25	36	–	dB	ON-Mode
Transient time[4)7)]	t_S	–	0.5	2	µs	ON- to OFF-Mode
		–	9	12	µs	OFF- to ON-Mode
Inband input 1dB-compression point, f = 1575 MHz[3)]	IP_{1dB}	-21	-17	–	dBm	ON-Mode
Inband input 3rd-order intercept point[3)5)] f_1 = 1575 MHz, f_2 = f_1 +/- 1 MHz	IIP_3	-19	-14	–	dBm	ON-Mode
Out of band input 3rd-order intercept point[3)6)] f_1 = 1713 MHz, f_2 = 1851 MHz	$OOB\text{-}IIP_3$	-14	-9	–	dBm	ON-Mode
Stability[7)]	k	> 1	–	–		f = 20 MHz ... 10 GHz

1) Based on the application described in chapter 4
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
5) Input power = -30 dBm for each tone
6) Input power = -20 dBm at f_1 and -65 dBm at f_2
7) Guaranteed by device design; not tested in production

Table 4 Electrical Characteristics[1)]

T_A = 25 °C, V_{CC} = 1.8 V, f = 1550 - 1615 MHz

Parameter	Symbol	Values			Unit	Note or Test Condition
		Min.	Typ.	Max.		
Supply voltage	V_{CC}	1.1	1.8	3.6	V	ON-Mode
		0.0	–	0.4	V	OFF-Mode
Supply current	I_{CC}	–	1.1	1.6	mA	ON-Mode, Vcc=1.8V
		–	0.1	2	µA	OFF-Mode
Insertion power gain f = 1575 MHz	$\|S_{21}\|^2$	16.7	18.2	19.7	dB	ON-Mode
Noise figure[2)] f = 1575 MHz, Z_S = 50 Ω	NF	–	0.75	1.25	dB	ON-Mode, Z_S = 50 Ω
Input return loss[3)] f = 1575 MHz	RL_{IN}	7	9	–	dB	ON-Mode
Output return loss[3)] f = 1575 MHz	RL_{OUT}	10	16	–	dB	ON-Mode
Reverse isolation[3)] f = 1575 MHz	$1/\|S_{12}\|^2$	25	36	–	dB	ON-Mode
Transient time[4)7)]	t_S	–	0.5	2	µs	ON- to OFF-Mode
		–	6	9	µs	OFF- to ON-Mode
Inband input 1dB-compression point, f = 1575 MHz[3)]	IP_{1dB}	-19	-15	–	dBm	ON-Mode
Inband input 3rd-order intercept point[3)5)] f_1 = 1575 MHz, f_2 = f_1 +/- 1 MHz	IIP_3	-19	-14	–	dBm	ON-Mode
Out of band input 3rd-order intercept point[3)6)] f_1 = 1713 MHz, f_2 = 1851 MHz	$OOB\text{-}IIP_3$	-14	-9	–	dBm	ON-Mode
Stability[7)]	k	> 1	–	–		f = 20 MHz ... 10 GHz

1) Based on the application described in chapter 4
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
5) Input power = -30 dBm for each tone
6) Input power = -20 dBm at f_1 and -65 dBm at f_2
7) Guaranteed by device design; not tested in production

Table 5 Electrical Characteristics[1)]

T_A = 25 °C, V_{CC} = 2.8 V, f = 1550 - 1615 MHz

Parameter	Symbol	Values			Unit	Note or Test Condition
		Min.	Typ.	Max.		
Supply voltage	V_{CC}	1.1	1.8	3.6	V	ON-Mode
		0.0	–	0.4	V	OFF-Mode
Supply current	I_{CC}	–	1.2	1.7	mA	ON-Mode, Vcc=2.8V
		–	0.1	2	µA	OFF-Mode
Insertion power gain f = 1575 MHz	$\|S_{21}\|^2$	16.9	18.4	19.9	dB	ON-Mode
Noise figure[2)] f = 1575 MHz, Z_S = 50 Ω	NF	–	0.75	1.25	dB	ON-Mode, Z_S = 50 Ω
Input return loss[3)] f = 1575 MHz	RL_{IN}	7	9	–	dB	ON-Mode
Output return loss[3)] f = 1575 MHz	RL_{OUT}	10	15	–	dB	ON-Mode
Reverse isolation[3)] f = 1575 MHz	$1/\|S_{12}\|^2$	25	36	–	dB	ON-Mode
Transient time[4)7)]	t_S	–	0.5	2	µs	ON- to OFF-Mode
		–	5	8	µs	OFF- to ON-Mode
Inband input 1dB-compression point, f = 1575 MHz[3)]	IP_{1dB}	-17	-13	–	dBm	ON-Mode
Inband input 3rd-order intercept point[3)5)] f_1 = 1575 MHz, f_2 = f_1 +/- 1 MHz	IIP_3	-19	-14	–	dBm	ON-Mode
Out of band input 3rd-order intercept point[3)6)] f_1 = 1713 MHz, f_2 = 1851 MHz	$OOB\text{-}IIP_3$	-14	-9	–	dBm	ON-Mode
Stability[7)]	k	> 1	–	–		f = 20 MHz ... 10 GHz

1) Based on the application described in chapter 4
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4 Application Information

Application Board Configuration

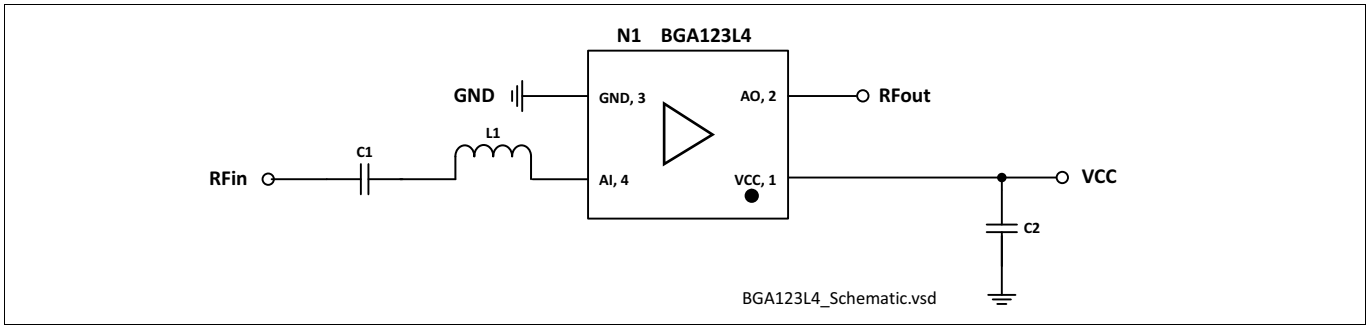

Figure 2 Application Schematic BGA123L4

Table 6 Bill of Materials

Name	Value	Package	Manufacturer	Function
C1 (optional)	1nF	0402	Various	DC block[1)]
C2	≥ 1nF[2)]	0402	Various	RF bypass [3)]
L1	10nH	0402	Murata LQW15 type	Input matching
N1	BGA123L4	TSLP-4-11	Infineon	SiGe LNA

1) DC block might be realized with pre-filter in GNSS applications
2) For data sheet charcteristics 1nF 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**

5 Package Information

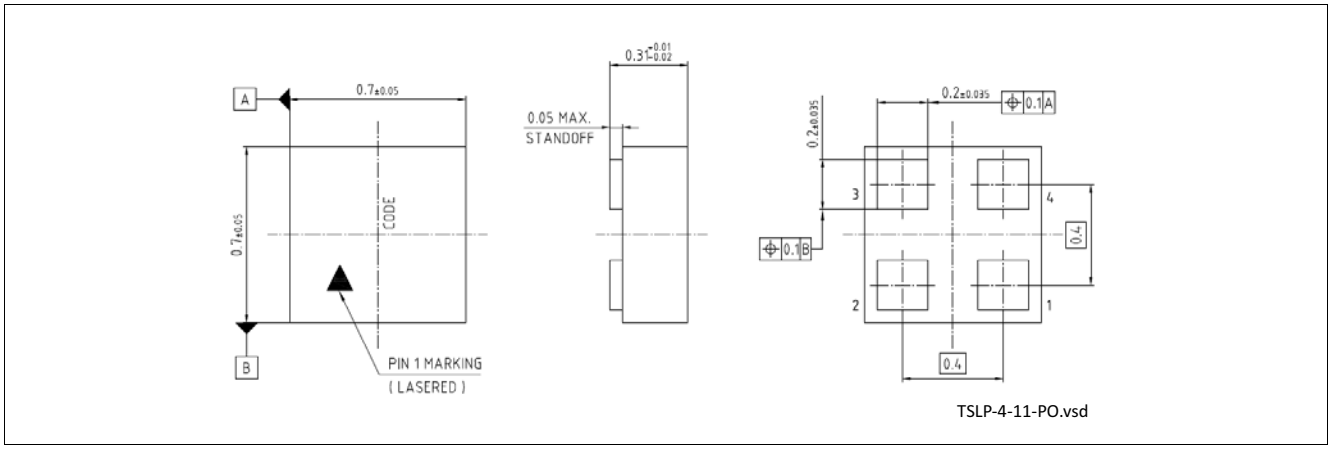

Figure 3 TSLP-4-11 Package Outline (top, side and bottom views)

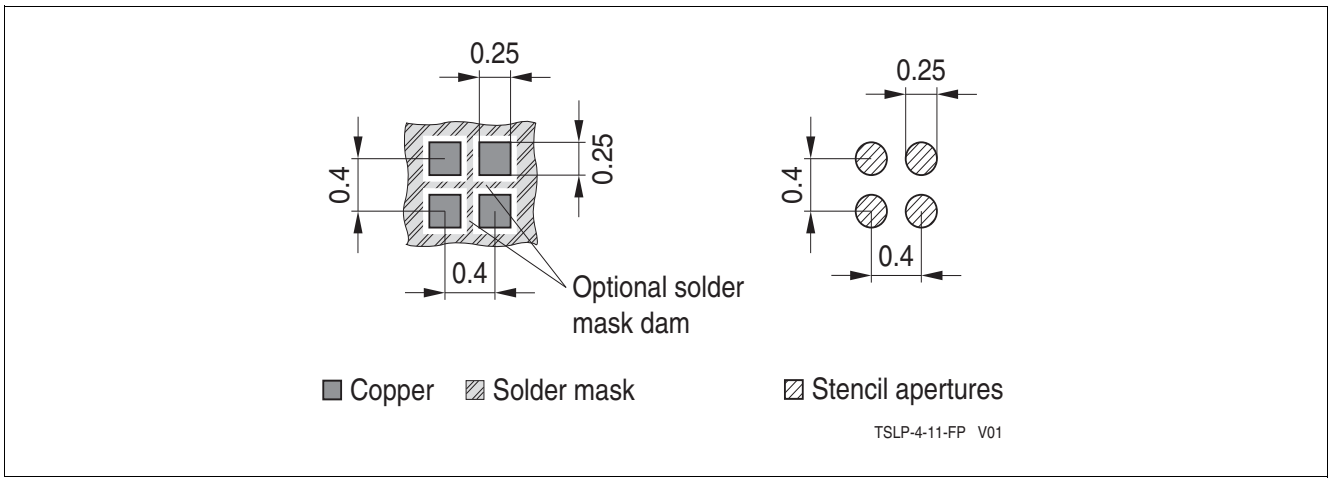

Figure 4 Footprint Recommendation TSLP-4-11

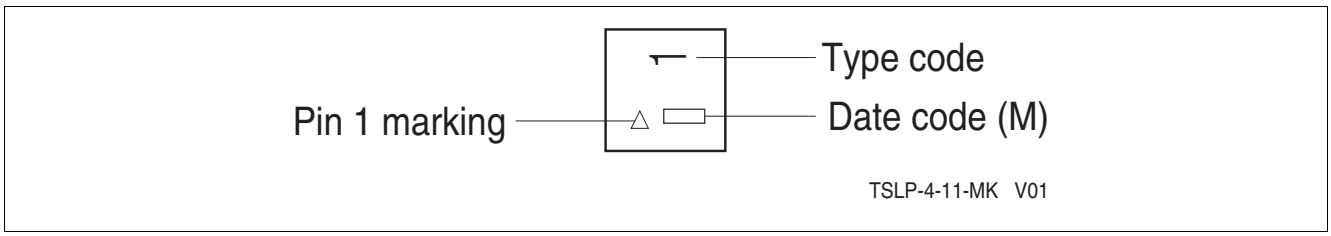

Figure 5 Marking Layout (top view)

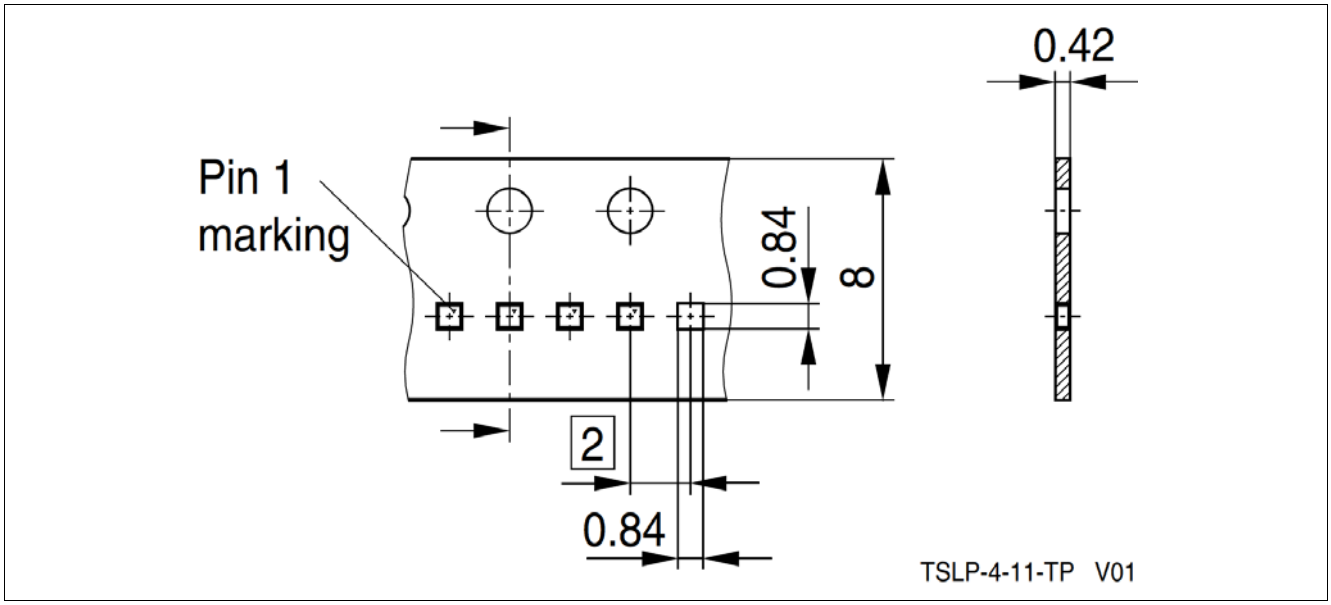

Figure 6 Tape & Reel Dimensions (reel diameter 180 mm, pieces/reel 15000)

Revision History	
Page or Item	**Subjects (major changes since previous revision)**
Revision 2.0 (min/max), 2017-09-14	
1, 3, 4, 6, 7 , 8	Update Electrical Characteristics
13	Update Trademark Information

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