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BGT24LTR11N16

Silicon Germanium 24GHz Radar
Transceiver MMIC

Data Sheet

Revision: 1.1

RF and Protection Devices

Edition 2016-09-28

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Data Sheet

Revision History: 2016-09-28

Previous Revision: Datasheet Rev. 1.0

Page	Subjects (major changes since last revision)
8	Minimum value for TX output power is changed to 2 dBm
9	Typical value for SSB noise figure is inserted

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Last Trademarks Update 2011-02-24

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1 Introduction



1.1 Features

- 24GHz transceiver MMIC
- Fully integrated low phase noise VCO
- Built in temperature compensation circuit for VCO stabilization
- Homodyne quadrature receiver
- Frequency divider
- Low power consumption
- Fully ESD protected device
- Single ended RF and IF terminals
- 200 GHz bipolar SiGe:C technology b7hf200
- Single supply voltage 3.3V
- TSNP-16-9 plastic package
- Pb-free (RoHS compliant) package

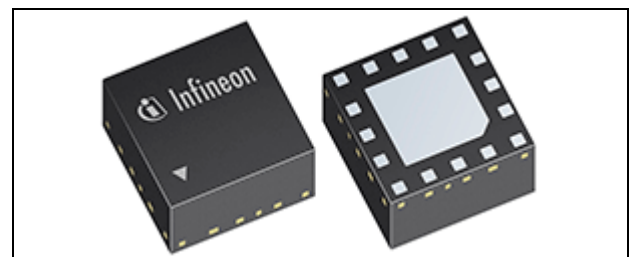


Figure 1 BGT24LTR11N16 in TSNP-16-9

Description

The BGT24LTR11 is a Silicon Germanium Transceiver MMIC operating from 24.0 GHz up to 24.25 GHz. It is based on a 24 GHz fundamental voltage controlled oscillator (VCO). A built in voltage source delivers a VCO tuning voltage (V_{PTAT}) which is proportional to absolute temperature. When connected to the VCO tuning pin (V_{TUNE}) it compensates for the inherent frequency drift of the VCO over temperature thus stabilizing the VCO within the ISM band eliminating the need for a PLL/Microcontroller. An integrated 1:16 frequency divider also allows for external phase lock loop VCO frequency stabilization.

The receiver section uses a low noise amplifier (LNA) in front of a quadrature homodyne down conversion mixer in order to provide excellent receiver sensitivity. Derived from the internal VCO signal, a RC polyphase filter (PPF) generates quadrature LO signals for the quadrature mixer. The I/Q IF outputs are available through a single ended terminal respectively.

The device is manufactured in a 0.18 μ m SiGe:C technology offering a cutoff frequency of 200 GHz. It is packaged in a 16 pin leadless RoHS compliant TSNP package.

Product Name	Package	Chip	Marking
BGT24LTR11N16	TSNP-16-9	T1811	LTR11

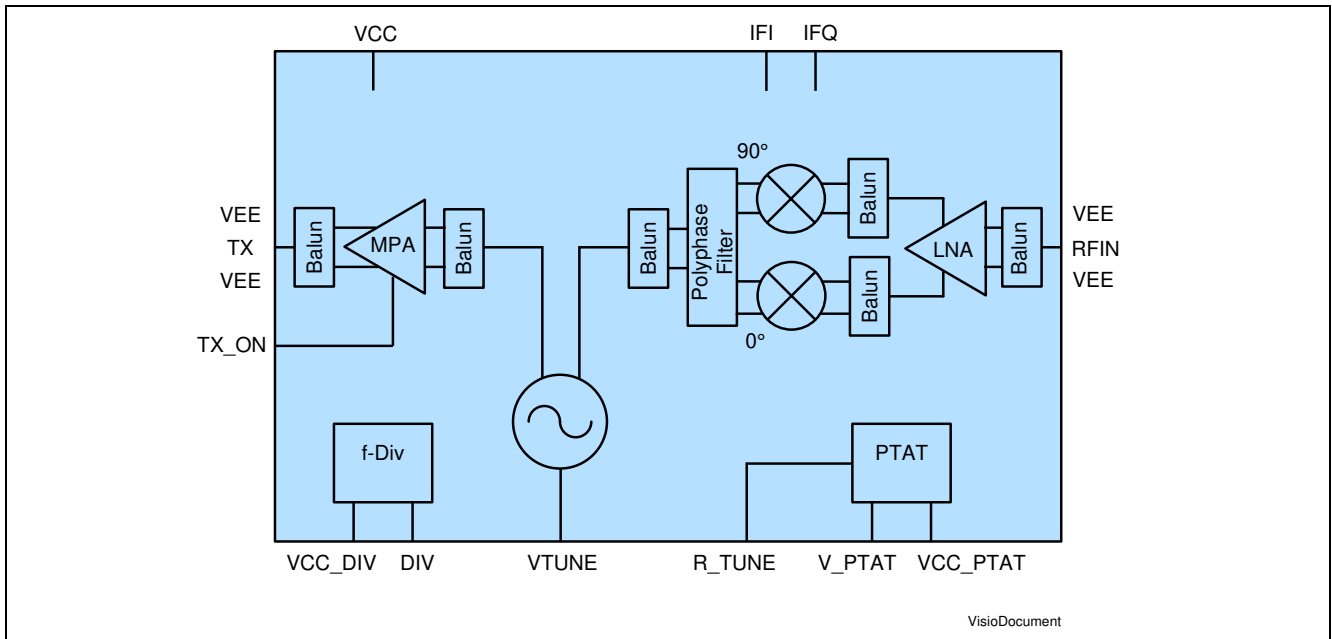


Figure 2 BGT24LTR11N16 block diagram

2 Electrical Characteristics

2.1 Absolute Maximum Ratings

Table 1 Absolute maximum ratings: $T_A = -40\text{ °C} \dots 85\text{ °C}$; all voltages with respect to ground

Parameter	Symbol	Value			Unit	Note/ Test Condition
		Min.	Typ.	Max.		
Supply voltage	V_{CC}	-0.3		3.6	V	
Supply voltage divider	V_{CC_DIV}	-0.3		3.6	V	
Supply voltage PTAT voltage source	V_{CC_PTAT}	-0.3		3.6	V	
DC voltage at RF pins	V_{DC_RF}			0		MMIC provides short circuit to GND for RF_IN and TX_OUT
Voltage applied to none-RF I/O pins	$V_{DC_I/O}$	-0.3		$V_{CC} + 0.3$	V	
Total power dissipation	P			300	mW	
Ambient temperature range	T_A	-40		85	°C	
Storage temperature range	T_{STG}	-50		125	°C	

2.2 ESD Integrity

Table 2 ESD integrity

Parameter	Symbol	Value			Unit	Note/ Test Condition
		Min.	Typ.	Max.		
ESD robustness HBM ¹	$V_{ESD-HBM}$	-1		1	kV	
ESD robustness CDM ²	$V_{ESD-CDM}$	-500		500	V	

1) According to ANSI/ESDA/JEDEC JS-001 (R = 1.5kOhm, C = 100pF) for Electrostatic Discharge Sensitivity Testing, Human Body Model (HBM)-Component Level

2) According to JEDEC JESD22-C101 Field-Induced Charged Device Model (CDM), Test Method for Electrostatic-Discharge-Withstand Thresholds of Microelectronic Components

Please note that this result is subject to:

- lot variations within the manufacturing process as specified by Infineon
- changes in the specific test setup

2.3 Power Supply

Table 3 Power supply characteristics: $T_A = -40\text{ °C} \dots 85\text{ °C}$

Parameter	Symbol	Value			Unit	Note/ Test Condition
		Min.	Typ.	Max.		
Supply voltage	V_{CC}	3.2	3.3	3.4	V	
Supply current	I_{CC}		45	55	mA	
Duty cycle		1 : 1000		1		
Pulse duration	t_P	1			µs	

2.4 TX Section
Table 4 TX characteristics: $T_A = -40\text{ °C} \dots 85\text{ °C}$

Parameter	Symbol	Value			Unit	Note/ Test Condition
		Min.	Typ.	Max.		
VCO frequency range	f_{VCO}	24.050		24.250	GHz	V_PTAT connected to VTUNE; 16 kOhm resistor connected from R_TUNE to GND
VCO phase noise	P_N			-55 -80	dBc/ Hz	@ 10 kHz offset @ 100 kHz offset
VCO AM noise	P_{AM}			-135	dBc/ Hz	@ 100 kHz offset
Tuning voltage to cover VCO frequency range	$VTUNE$	0.7		2.5	V	
VCO tuning sensitivity within VCO frequency range			720	2000	MHz/V	
Harmonic suppression		25			dBc	
Non-harmonic suppression		62			dBc	$f > 10\text{ GHz}$; $D_{DIV} = 16$
Non-harmonic suppression		45			dBc	$f \leq 10\text{ GHz}$; $D_{DIV} = 16$
TX output power	P_{TX}	2	6	10	dBm	
TX load impedance	Z_{TXOUT}		50		Ω	Single ended
TX_ON low level input voltage	$V_{TX_ON_low}$			0.8	V	
TX_ON high level input voltage	$V_{TX_ON_high}$	2			V	
TX_ON input voltage hysteresis	$V_{TX_ON_hys}$	50			mV	
TX_ON input current	I_{TX_ON}	-100		100	μA	
TX_ON switching time	t_{TX_ON}			2	ns	
Power up TX settling time	$t_{TX_Power_up}$			100ns		Defines the time TX section requires to settle after VCC supply voltage is within specified range

2.5 RX Section (Measured with TX_ON=0V)

Table 5 RX characteristics: $T_A = -40\text{ °C} \dots 85\text{ °C}$

Parameter	Symbol	Value			Unit	Note/ Test Condition
		Min.	Typ.	Max.		
RX frequency range	f_{RX}	24.0		24.25	GHz	
RX input impedance	Z_{RXIN}		50		Ω	Single ended
Voltage conversion gain	G_C	15.5	20	26.5	dB	
SSB noise figure	NF_{SSB}		10	18	dB	Single sideband @ $f_{IF} = 100\text{ kHz}$
Input compression point	IP_{1dB}	-28			dBm	
Quadrat. phase imbalance	ϵ_P	0		24	deg	
Quadrat. amplitude imbalance	ϵ_A	-1		1	dB	
IF output impedance	Z_{IF}			1	k Ω	Single ended

2.6 Frequency Divider

Table 6 Frequency divider characteristics: $T_A = -40\text{ °C} \dots 85\text{ °C}$

Parameter	Symbol	Value			Unit	Note/ Test Condition
		Min.	Typ.	Max.		
Prescaler division ratio	D_{DIV}	16		8192	-	16 if $V_{CC_PTAT} = 0\text{ V}$, 8192 if $V_{CC_PTAT} = 3.3\text{ V}$
Prescaler output voltage	V_{DIV}	60		500	mV	Peak to Peak voltage when DIV out is terminated with 50 Ohm and $D_{DIV}=16$
Prescaler supply voltage	V_{CC_DIV}	3.2	3.3	3.4	V	
Prescaler supply current	I_{CC_DIV}	13	19	25	mA	

2.7 Proportional to absolute temperature (PTAT) voltage source

Table 7 PTAT voltage source characteristics: $T_A = -40\text{ °C} \dots 85\text{ °C}$

Parameter	Symbol	Value			Unit	Note/ Test Condition
		Min.	Typ.	Max.		
Supply voltage	V_{CC_PTAT}	3.2	3.3	3.4	V	
Supply current	I_{CC_PTAT}		1.5	2.5	mA	
Output voltage	V_{OUT_PTAT}	0.7	1.3	2	V	

3 Pin description

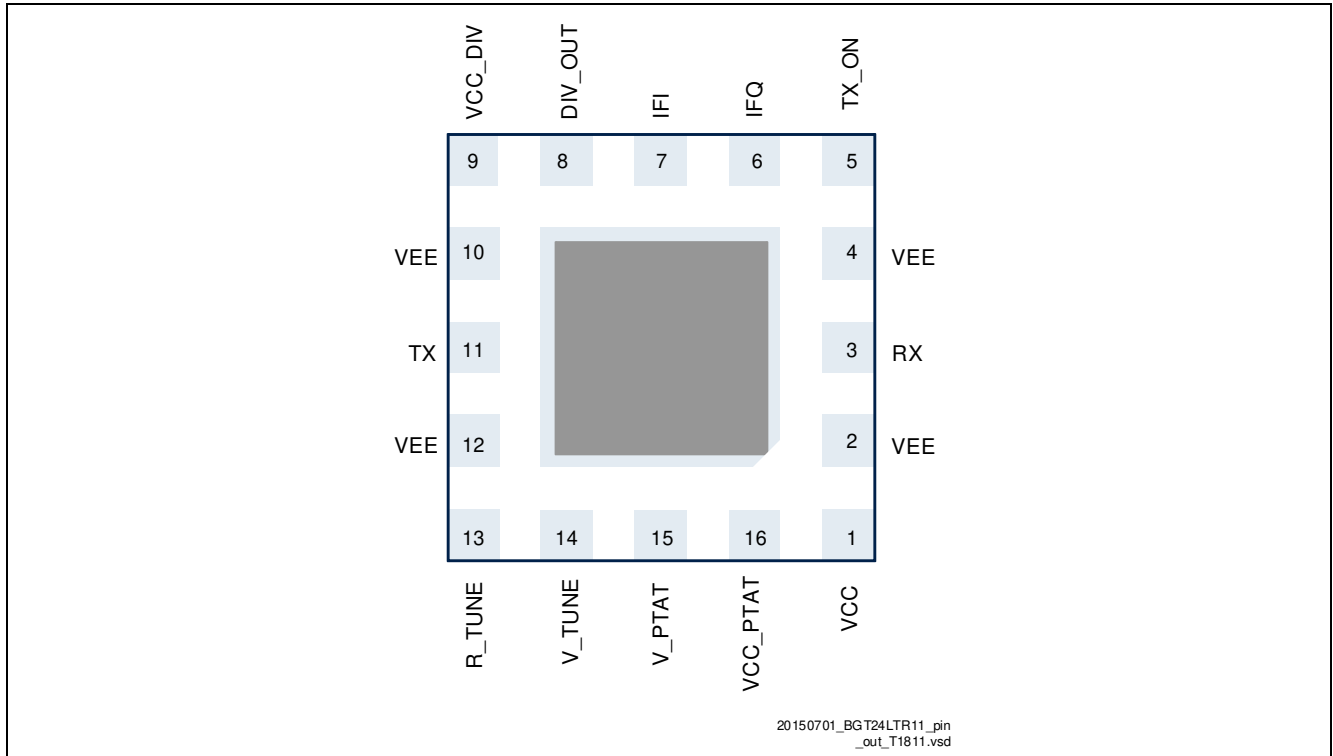


Figure 3 Pin-out (top view)

Table 8 Pin definition and function

Pin Number	Name	Function
1	VCC	Supply voltage
2	VEE	Ground
3	RX	Receiver RF input
4	VEE	GND
5	TX_EN	Output power enable
6	IFQ	Quadrature phase down converter IF output
7	IFI	In phase down converter IF output
8	DIV_OUT	Frequency divider output
9	VCC_DIV	Supply voltage of prescaler
10	VEE	Ground
11	TX	Transmitter RF output
12	VEE	Ground
13	R_TUNE	VCO operating frequency band select
14	V_TUNE	VCO frequency tuning input
15	V_PTAT	PTAT voltage source output
16	VCC_PTAT	PTAT voltage source power supply

4 Physical Dimension

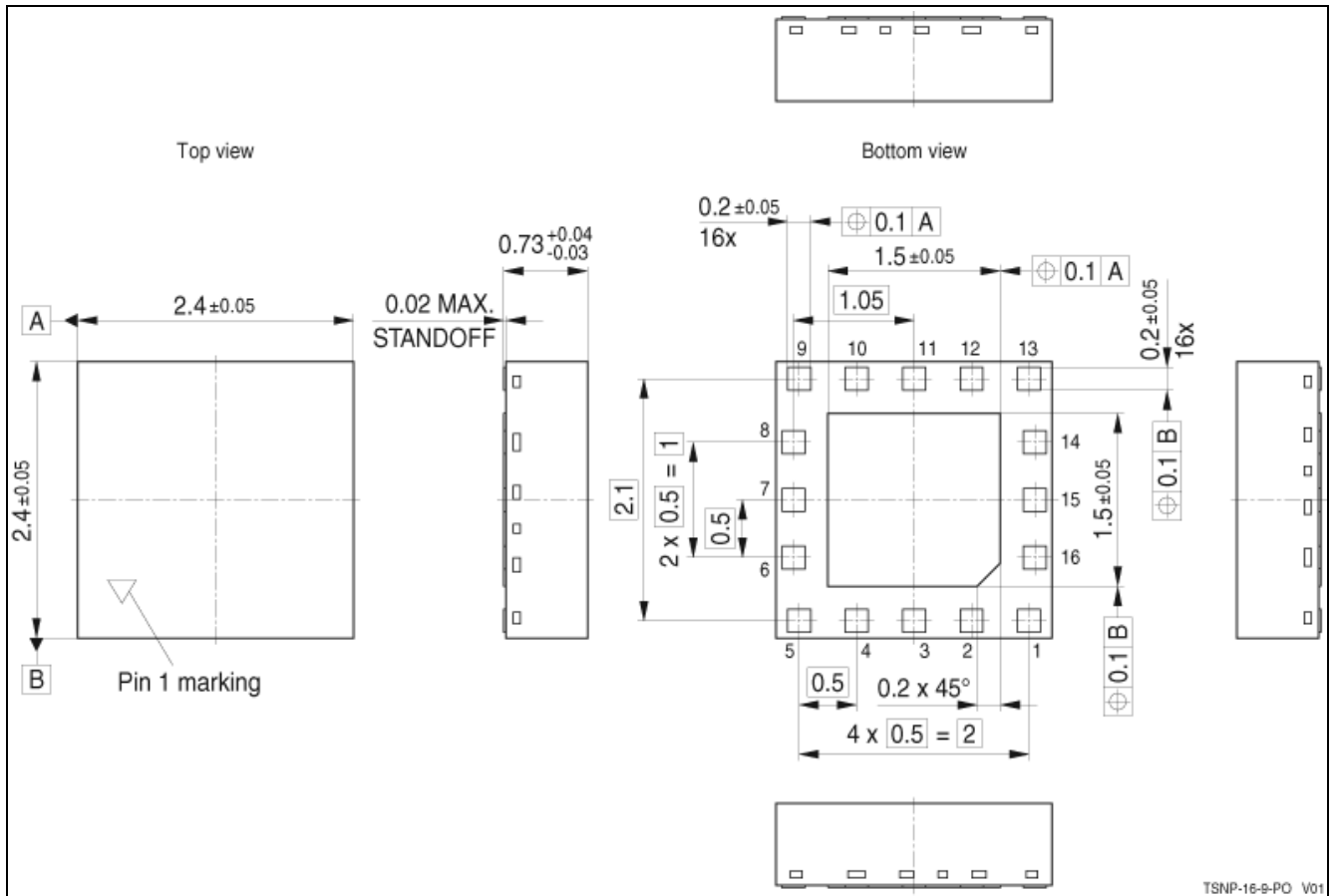


Figure 4 Package Outline (top, side and bottom view) of TSNP-16-9

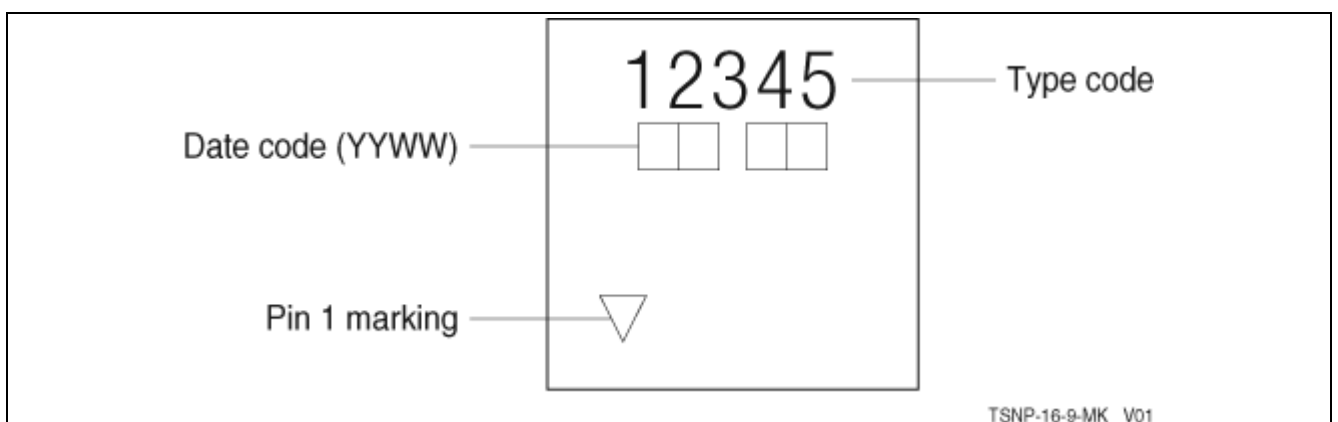


Figure 5 Marking Layout of TSNP-16-9 (example)

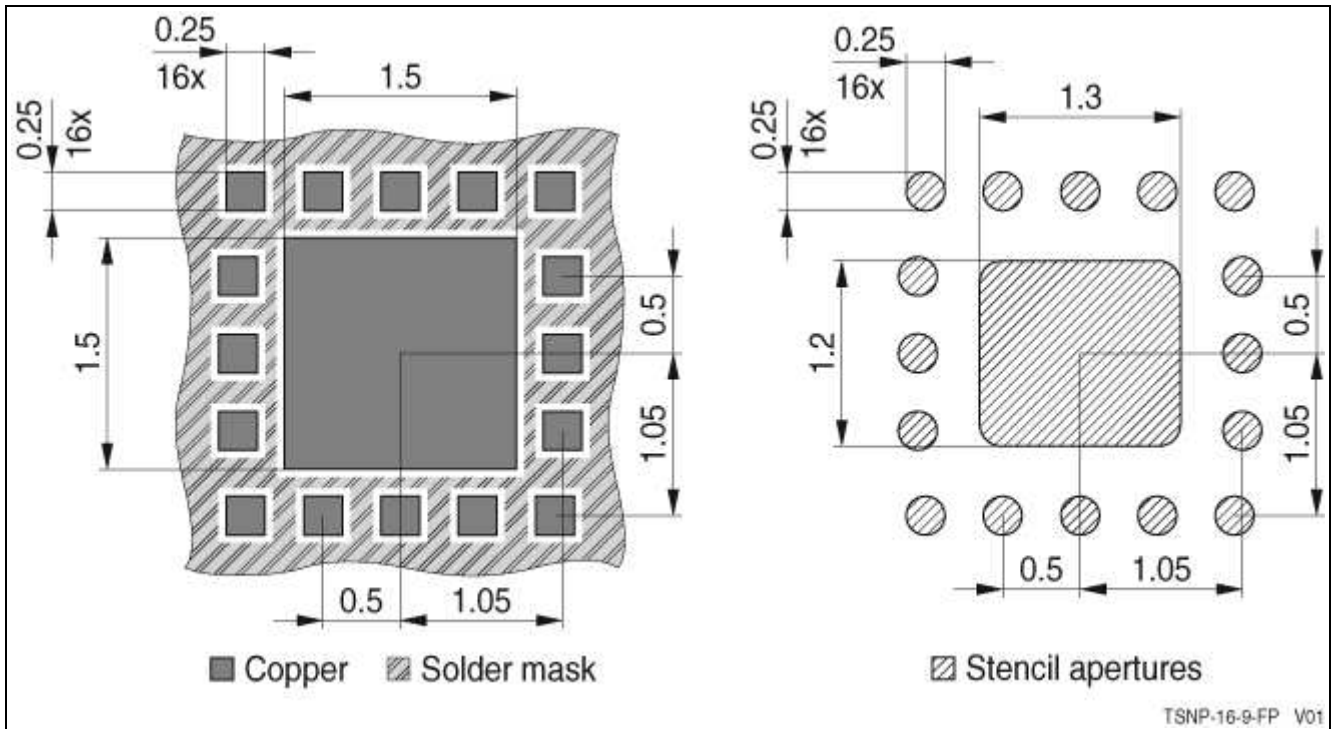


Figure 6 Soldering Footprint of TSNP-16-9

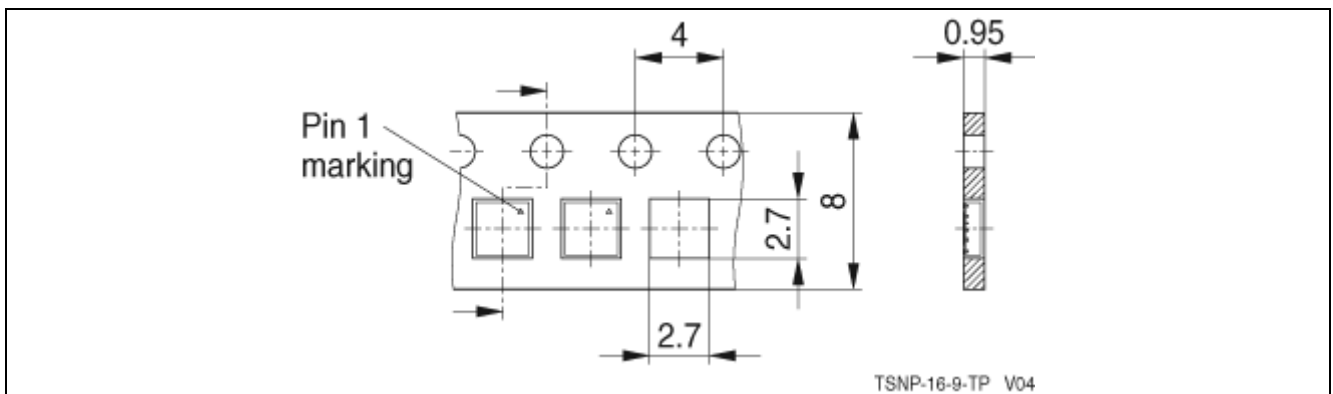


Figure 7 Packing Description of TSNP-16-9; Ø Reel: 180 mm, Pieces / Reel: 3000, Reels / Box: 1

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