BGT24LTR11N16

Silicon Germanium 24GHz Radar Transceiver MMIC

Data Sheet

Revision: 1.3

RF and Protection Devices

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Data Sheet	
Revision History: 2018-05-08	
Previous Revision: Datasheet Rev. 1.1	
Page	**Subjects (major changes since last revision)**
8,9	Reference to matching structures and footprint according to AN472
8	Specification of Harmonic Suppression is limited to second harmonic only
8	Note is added to TX_ON low /high level input voltage specification

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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

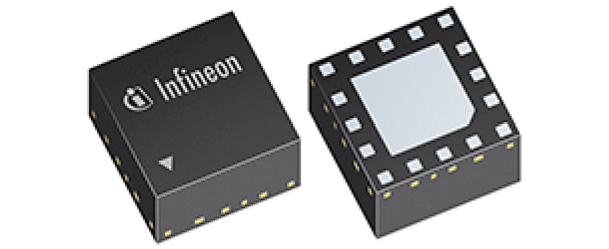

Figure 1 BGT24LTR11N16 in TSNP-16-9

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 0.18µm 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

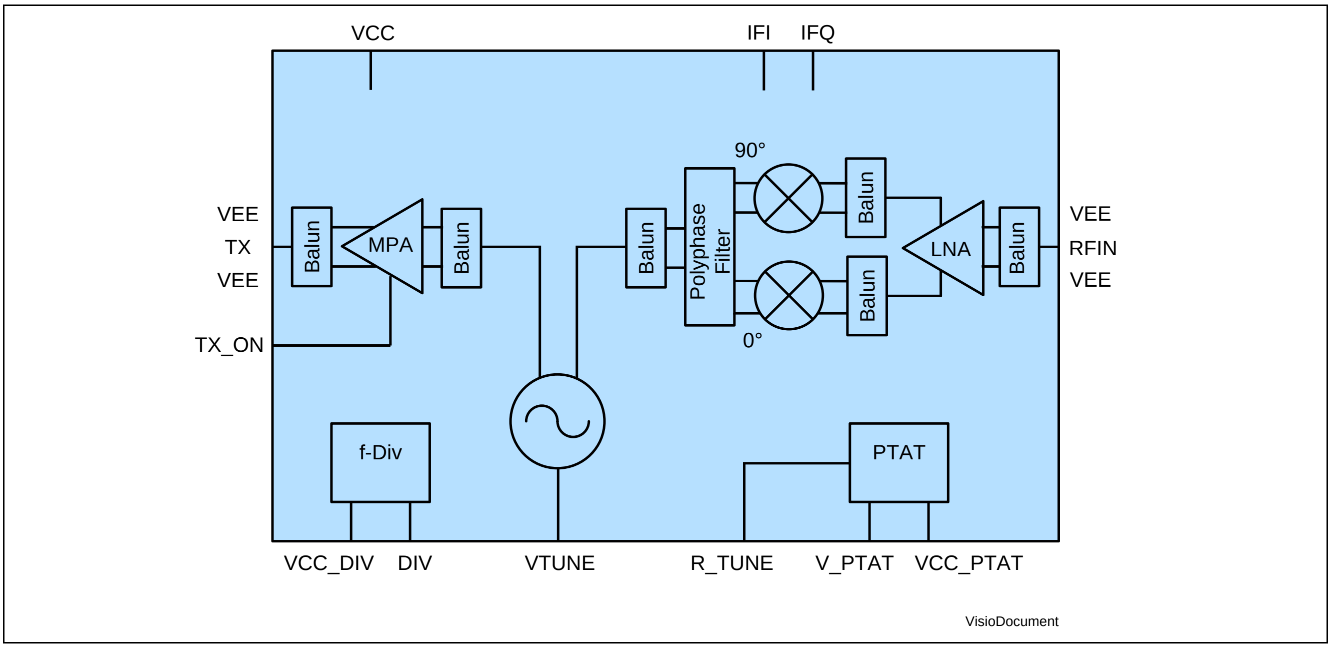

Figure 2 BGT24LTR11N16 block diagram

2 Electrical Characteristics

2.1 Absolute Maximum Ratings

Table 1 Absolute maximum ratings: T_A = -40 °C ... 85 °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	

***Attention:** Stresses exceeding 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.*

2.2 ESD Integrity

Table 2 ESD integrity

Parameter	Symbol	Value			Unit	Note/ Test Condition
		Min.	Typ.	Max.		
ESD robustness HBM[1]	$V_{ESD\text{-}HBM}$	-1		1	kV	
ESD robustness CDM[2]	$V_{ESD\text{-}CDM}$	-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 °C … 85 °C

Parameter	Symbol	Value			Unit	Note/ Test Condition
		Min.	Typ.	Max.		
Supply voltage	V_{CC}	3.2	3.3	3.4	V	

Table 3 Power supply characteristics: T_A = -40 °C … 85 °C

Parameter	Symbol	Value			Unit	Note/ Test Condition
		Min.	Typ.	Max.		
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 °C ... 85 °C; all parameters specified including a TX port matching structure and package footprint provided by Infineon in AN472

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	
Second Harmonic Suppression		25			dBc	
Non-harmonic suppression		62			dBc	f>10 GHz; D_{DIV}=16
Non-harmonic suppression		45			dBc	f≤10 GHz; D_{DIV}=16
TX output power	P_{TX}	2	6	10	dBm	
TX load impedance	Z_{TXOUT}		50		Ω	Including TX port matching structure according to AN472
TX_ON low level input voltage (TX=OFF)	$V_{TX\_ON\_low}$			0.8	V	TX_ON pin is chip internally pulled up to V_{CC} via typ. 98 kOhm resistor
TX_ON high level input voltage (TX=ON)	$V_{TX\_ON\_high}$	2			V	TX_ON pin is chip internally pulled up to V_{CC} via typ. 98 kOhm resistor
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 °C … 85 °C; all parameters specified including RX port matching structure and package footprint provided by Infineon in AN472

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	Including RX port matching structure according to AN472
Voltage conversion gain	G_C	15.5	20	26.5	dB	
SSB noise figure	NF_{SSB}		10	18	dB	Single sideband @ f_{IF} = 100 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	kΩ	Single ended

2.6 Frequency Divider

Table 6 Frequency divider characteristics: T_A = -40 °C ... 85 °C

Parameter	Symbol	Value			Unit	Note/ Test Condition
		Min.	Typ.	Max.		
Prescaler division ratio	D_{DIV}	16		8192	-	16 if V_{CC_PTAT} = 0 V, 8192 if V_{CC_PTAT} = 3.3 V
Prescaler output voltage for division ratio 16	V_{DIV16}	60	120	350	mV	Peak to Peak voltage when DIV_OUT is terminated with 50 Ohm and D_{DIV}=16
Prescaler output “high” voltage for division ratio 8192	$V_{DIV8192H}$	2.4			V	DIV_OUT is loaded with 1MOhm, 13 pF
Prescaler output “low” voltage for division ratio 8192	$V_{DIV8192L}$			0.8	V	DIV_OUT is loaded with 1MOhm, 13 pF
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 °C ... 85 °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	

Table 7 PTAT voltage source characteristics: T_A = -40 °C ... 85 °C

Parameter	Symbol	Value			Unit	Note/ Test Condition
		Min.	Typ.	Max.		
Output voltage	V_{OUT_PTAT}	0.7	1.3	2	V	

3 Pin description

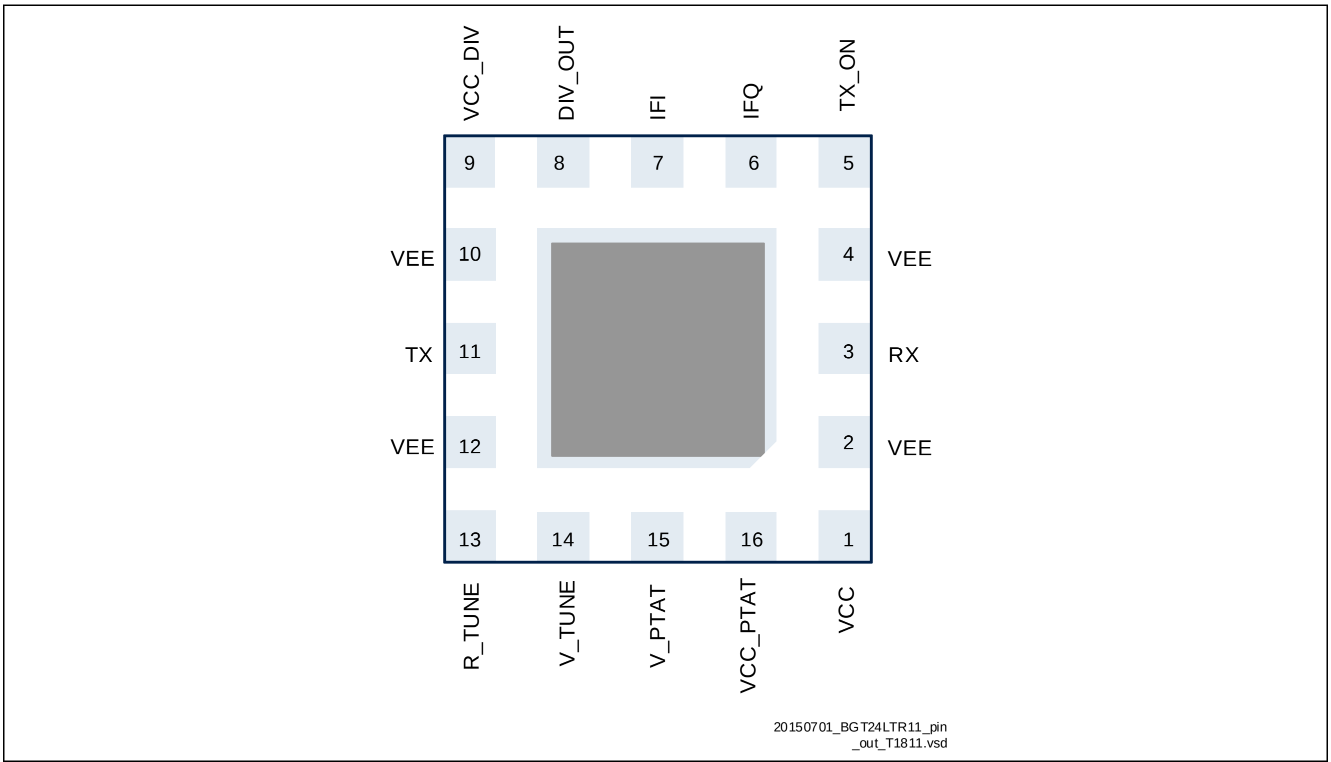

Figure 3 Pin-out (top view)

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	Tranmitter RF output
12	VEE	Ground

Table 8 Pin definition and function

Pin Number	Name	Function
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

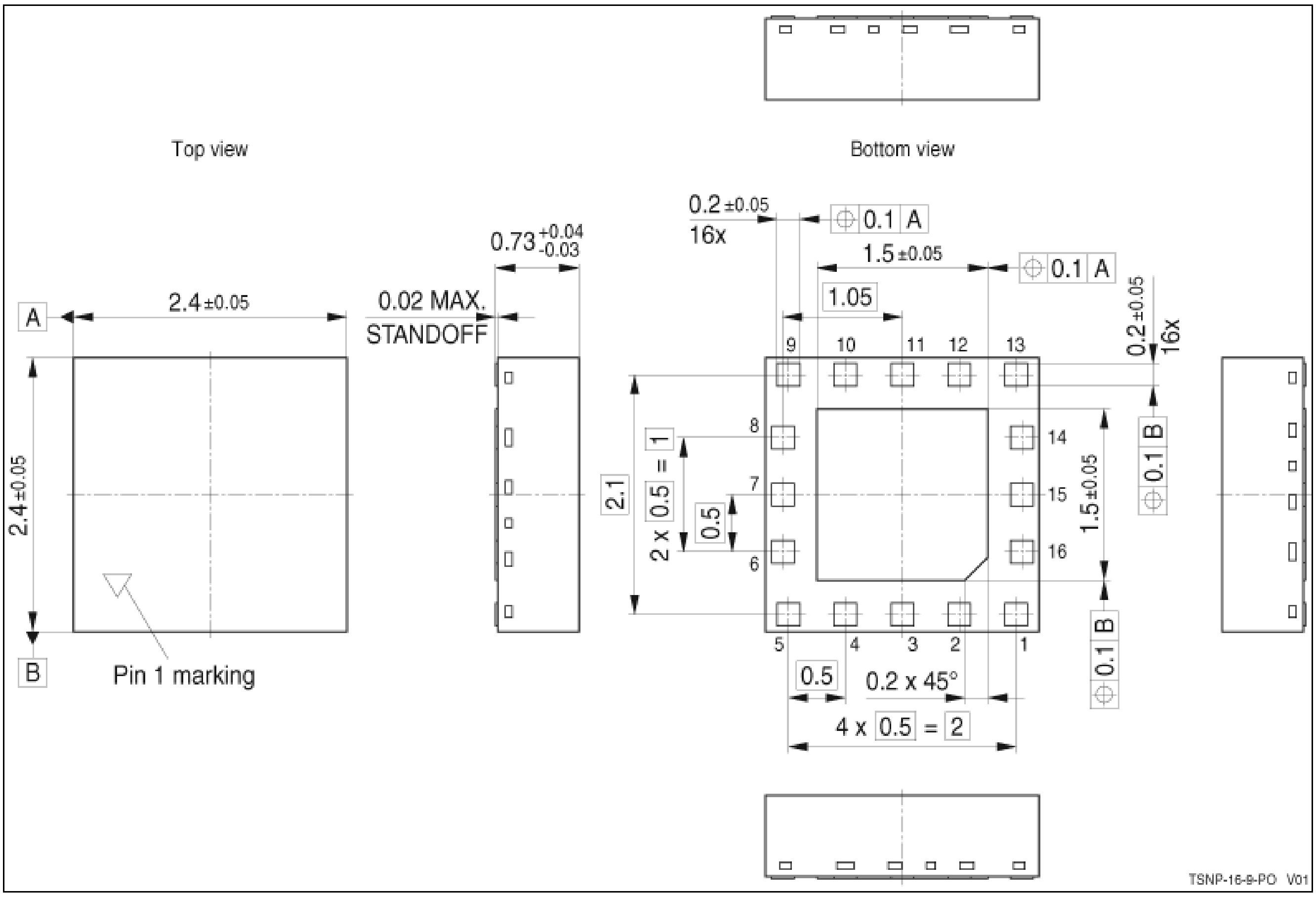

Figure 4 Package Outline (top, side and bottom view) of TSNP-16-9

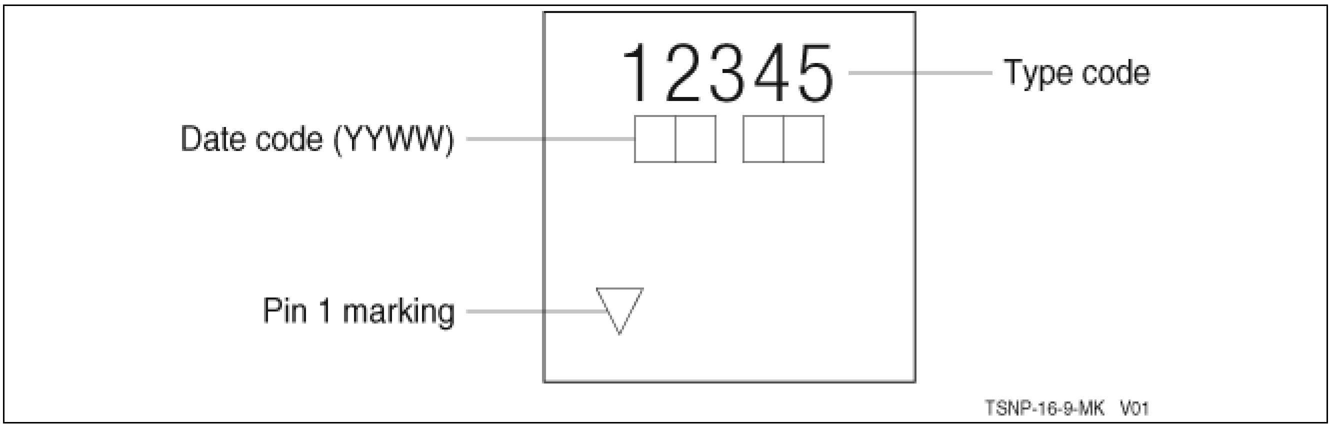

Figure 5 Marking Layout of TSNP-16-9 (example)

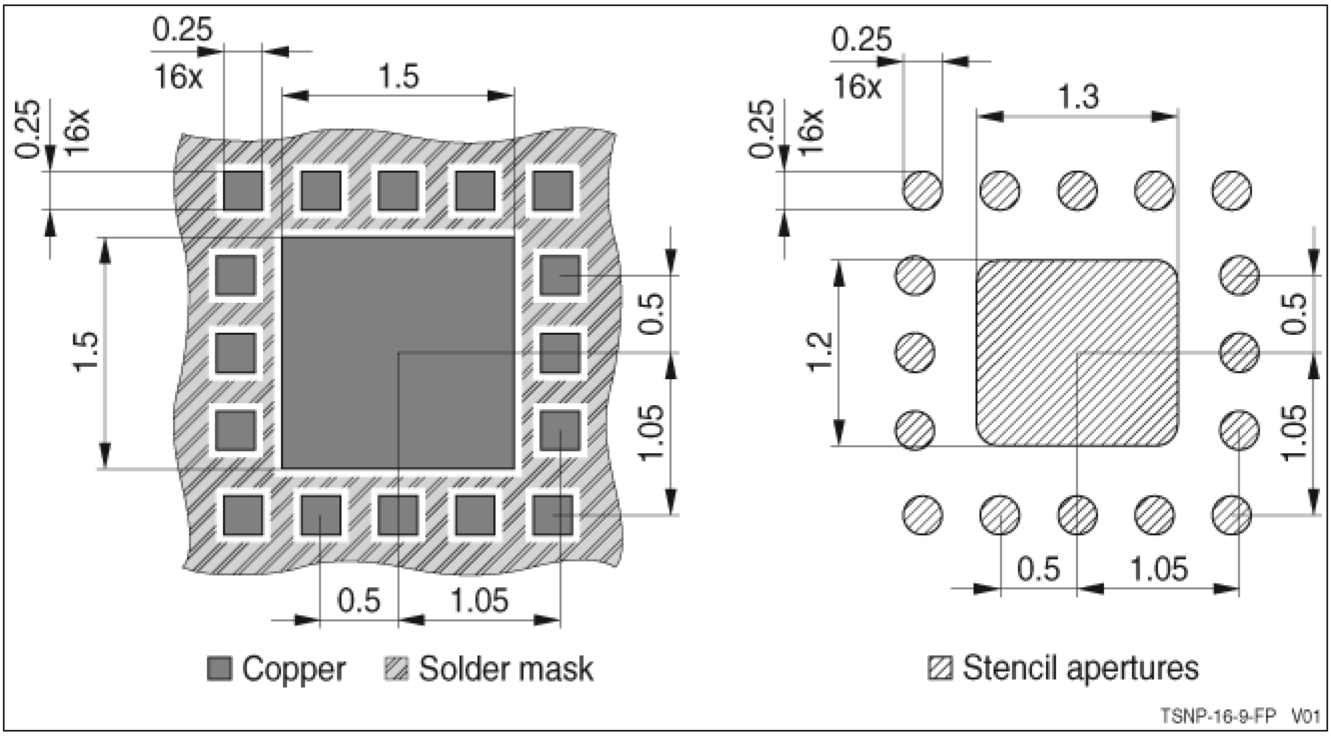

Figure 6 Soldering Footprint of TSNP-16-9

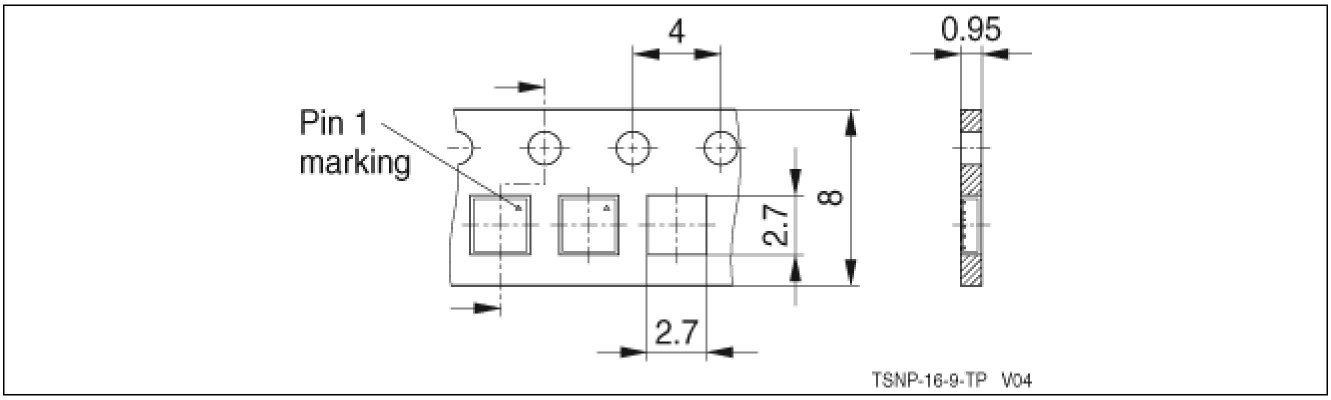

Figure 7 Packing Description of TSNP-16-9; Ø Reel: 180 mm, Pieces / Reel: 3000, Reels / Box: 1

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