BGS14PN10

SP4T high linearity, high power RF Switch

Data Sheet

Revision 1.3 - 2016-08-24

Power Management & Multimarket

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Revision History

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1	Updated title

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BGS14PN10 SP4T high linearity, high power RF Switch

1 Features

- High max RF power: 40 dBm CW @ 900 MHz, room temperature
- Two ultra-low loss ports (RF1 and RF3):
  0.19 dB @ f=0.9 GHz, P_{IN}=38 dBm
  0.29 dB @ f=1.9 GHz, P_{IN}=38 dBm
  0.51 dB @ f=2.7 GHz, P_{IN}=33 dBm
  1.20 dB @ f=3.8 GHz, P_{IN}=33 dBm
  1.90 dB @ f=5.8 GHz, P_{IN}=33 dBm
- Two low loss ports (RF2 and RF4):
  0.32 dB @ f=0.9 GHz, P_{IN}=38 dBm
  0.40 dB @ f=1.9 GHz, P_{IN}=38 dBm
  0.64 dB @ f=2.7 GHz, P_{IN}=33 dBm
  1.19 dB @ f=3.8 GHz, P_{IN}=33 dBm
  1.78 dB @ f=5.8 GHz, P_{IN}=33 dBm
- No DC decoupling components required, if no external DC is applied on RF ports
- High ESD robustness
- Low harmonic generation
- High linearity

  RF1/RF3 72 dBm IIP3

  RF2/RF4 74 dBm IIP3
- No power supply blocking required
- Supply voltage range: 1.8 to 3.6 V
- No insertion loss change within supply voltage range
- No linearity change within supply voltage range
- Suitable for EDGE / C2K / LTE / WCDMA / SV-LTE Applications
- Mobile cellular Rx/Tx applications, suitable for LTE/3G
- Applicable for main path and entire RF-Front-end without any power restrictions in mobile communication

  DL/UL CA and MIMO

  Micro/Pico Cells / Cellular base stations

  Test equipment

  Suitable for SV-LTE
- 0.5 to 6.0 GHz coverage
- Small form factor 1.1 mm x 1.5 mm
- 400 μm pad pitch
- RoHS and WEEE compliant package
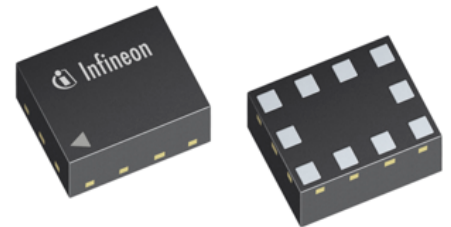
2 Product Description

The BGS14PN10 is a Single Pole Quad Throw (SP4T) RF antenna aperture switch optimized for mobile phone applications up to 6.0 GHz. This single supply chip integrates on-chip CMOS logic driven by a two simple, CMOS or TTL compatible control input signals. Unlike GaAs technology, the 0.1 dB compression point exceeds the switch maximum input power level, resulting in linear performance at all signal levels and external DC blocking capacitors at the RF ports are only required if DC voltage is applied externally.

Table 1: Ordering Information

Type	Package	Marking	Chip
BGS14PN10	TSNP10-1	4P	M4821C
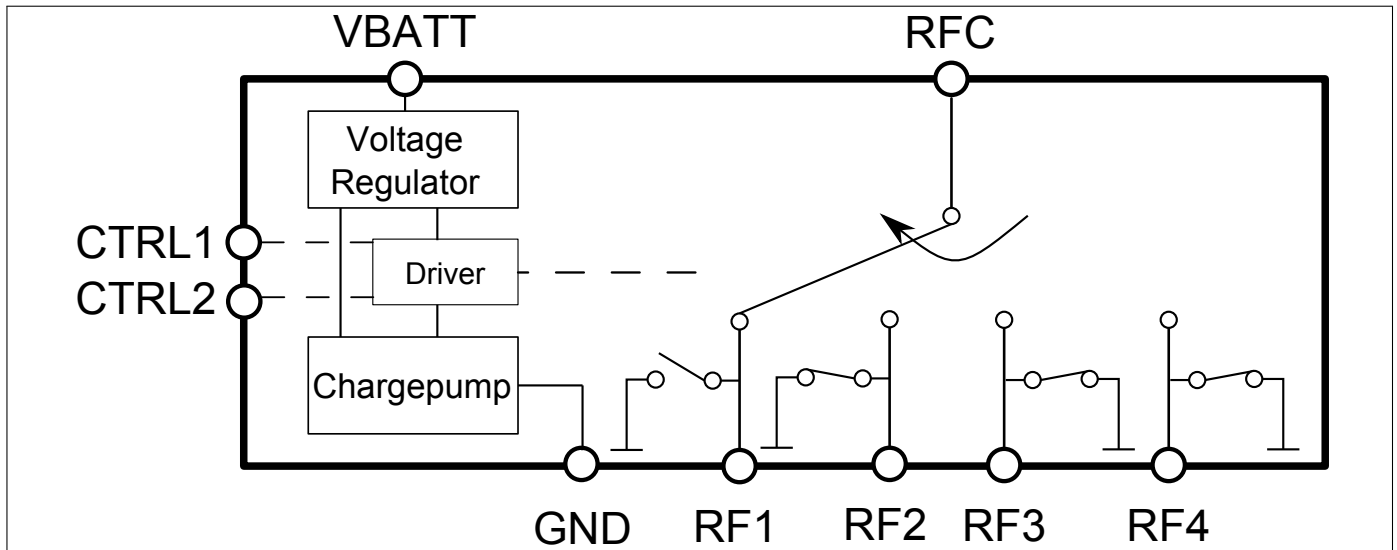
Figure 1: BGS14PN10 block diagram

3 Maximum Ratings

Table 2: Maximum Ratings, Table I at T_A = 25 °C, unless otherwise specified

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Frequency Range	f	0.5	–	–	GHz	[1]
Supply voltage	V_{DD}	-0.5	–	3.6	V	–
Storage temperature range	T_{STG}	-55	–	150	°C	–
RF input power	P_{RF_TRx}	–	–	40	dBm	25% duty cycle
ESD capability Human Body Model	$V_{ESD_{HBM}}$	-1	–	+1	kV	
ESD capability ANT port (according IEC 61000-4-2 contact)	$V_{ESD_{ANT}}$	-8	–	+8	kV	On application board with 27nH shunt inductor
Junction temperature	T_j	–	–	125	°C	–

[1] Switch has no highpass response. There is also a high ohmic DC to the RF path. The DC voltage at RF ports V_{RFDC} has to be 0V.

Table 3: Maximum Ratings, Table II at T_A = 25 °C, unless otherwise specified

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Maximum DC-voltage on RF-Ports and RF-Ground	V_{RFDC}	0	–	0	V	No DC voltages allowed on RF-Ports
Control Voltage Levels	V_{CTRL}	-0.7	–	3.3	V	–

4 Operation Ranges

Table 4: Operation Ranges

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Supply voltage	V_{DD}	1.8	2.85	3.6	V	–
Supply current[1]	I_{DD}	–	75	120	μA	–
Control voltage low	$V_{Ctrl,low}$	0		0.45	V	–
Control voltage high	$V_{Ctrl,high}$	1.2	1.8	2.85	V	$V_{Ctrl,high} \ll V_{DD}$
Control current low	$I_{Ctrl,low}$	-1	0	1	μA	–
Control current high	$I_{Ctrl,high}$	-1	0	1	μA	$V_{Ctrl,high} \ll V_{DD}$
Ambient temperature	T_A	-40	25	85	°C	–
RF switching time [2]	t_{sw}	1	2	5	μs	–
Startup time [2]	t_{sw}		10	30	μs	–

[1] T_A = -30 °C − +85 °C, V_{BATT} = 1.8 − 3.6 V
[2], Represents actual alpha status. To be updated.

5 Logic Table

Table 5: Logic Table

CTRL 1	CTRL 2	Mode
0	0	RF1 connected to ANT
0	1	RF2 connected to ANT
1	0	RF3 connected to ANT
1	1	RF4 connected to ANT

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6 RF Characteristics for RF1 and RF3

Table 6: RF Specifications

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Insertion Loss						
698 - 960 MHz	IL	–	0.18	0.26	dB	
1710 - 1980 MHz		–	0.29	0.36	dB	
1981 - 2170 MHz		–	0.30	0.41	dB	
2171 - 2690 MHz		–	0.51	0.68	dB	
3400 - 3800 MHz		–	1.20	1.40	dB	
5150 - 5850 MHz		–	1.90	2.35	dB	$V_{DD} = 1.8 - 3.6\ V$,
Return Loss						T_A = -30 ... +85 °C,
All Ports @ 698 - 915 MHz	RL	23	30	–	dB	$Z_0 = 50\ \Omega$,
All Ports @ 1710 - 1980 MHz		16	19	–	dB	P_{IN} up to 38 dBm
All Ports @ 1981 - 2170 MHz		14	17	–	dB	
All Ports @ 2171 - 2690 MHz		11	12	–	dB	
All Ports @ 3400 - 3800 MHz		7	8	–	dB	
All Ports @ 5150 - 5850 MHz		6	7	–	dB	
Isolation RFC						
698 - 915 MHz	ISO	34	41	–	dB	
1710 - 1980 MHz		27	32	–	dB	
1981 - 2170 MHz		26	30	–	dB	
2171 - 2690 MHz		24	28	–	dB	
3400 - 3800 MHz		20	24	–	dB	
5150 - 5850 MHz		15	18	–	dB	
Isolation RF1,2,3,4 - RF4,3,2,1						
698 - 915 MHz	ISO	43	50	–	dB	
1710 - 1980 MHz		34	38	–	dB	
1981 - 2170 MHz		33	36	–	dB	
2170 - 2690 MHz		30	33	–	dB	
3400 - 3800 MHz		24	28	–	dB	
5150 - 5850 MHz		18	21	–	dB	

7 RF Characteristics for RF2 and RF4

Table 7: RF Specifications

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	**Typ.**	**Max.**		
Insertion Loss						
698 - 960 MHz	*IL*	–	0.30	0.40	dB	
1710 - 1980 MHz		–	0.40	0.50	dB	
1981 - 2170 MHz		–	0.41	0.54	dB	
2171 - 2690 MHz		–	0.64	0.80	dB	
3400 - 3800 MHz		–	1.19	1.45	dB	
5150 - 5850 MHz		–	1.78	2.09	dB	V_{DD} = 1.8 − 3.6 V,
Return Loss						T_A = -30 ... +85 $°$C,
All Ports @ 698 - 915 MHz	*RL*	23	27	–	dB	Z_0 = 50 Ω,
All Ports @ 1710 - 1980 MHz		17	20	–	dB	P_{IN} up to 38 dBm
All Ports @ 1981 - 2170 MHz		14	18	–	dB	
All Ports @ 2171 - 2690 MHz		11	15	–	dB	
All Ports @ 3400 - 3800 MHz		7	9	–	dB	
All Ports @ 5150 - 5850 MHz		6	8	–	dB	
Isolation RFC						
698 - 915 MHz	*ISO*	34	41	–	dB	
1710 - 1980 MHz		27	32	–	dB	
1981 - 2170 MHz		26	30	–	dB	
2171 - 2690 MHz		24	28	–	dB	
3400 - 3800 MHz		20	24	–	dB	
5150 - 5850 MHz		14	18	–	dB	
Isolation RF1,2,3 - RF3,2,1						
698 - 915 MHz	*ISO*	43	50	–	dB	
1710 - 1980 MHz		34	38	–	dB	
1981 - 2170 MHz		33	36	–	dB	
2170 - 2690 MHz		30	33	–	dB	
3400 - 3800 MHz		24	28	–	dB	
5150 - 5850 MHz		18	21	–	dB	

8 RF large signal parameter

Table 8: RF large signal specifications for RF1 and RF3

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Max. RF input power	–	–	–	38	dBm	for typical H_x behavior
Harmonic Generation up to 12.75 GHz[1,2,3]						
Second Order Harmonics	P_{H2}	–	-100	–	dBc	25 dBm, 50Ω, CW mode
Third Order Harmonics	P_{H3}	–	-115	–	dBc	25 dBm, 50Ω, CW mode
All RF Ports	P_{Hx}	–	-100	–	dBc	25 dBm, 50Ω, CW mode
Intermodulation Distortion IMD2 [1,2,3]						
IIP2, low	IIP2,l	–	110	–	dBm	IIP2 conditions table 8
IIP2, high	IIP2,h	–	125	–	dBm	
Intermodulation Distortion IMD3 [1,2,3]						
IIP3	IIP3	–	72	–	dBm	IIP3 conditions table 9
SV LTE Intermodulation [1,2,3]						
IIP3,SVLTE	IIP3,SV	–	73	–	dBm	SV-LTE conditions table 10

[1]Terminating Port Impedance: $Z_0 = 50\ \Omega$ [2]Supply Voltage: $V_{DD} = 1.8 - 3.6\ V$ [3]On application board without any matching components

Table 9: RF large signal specifications for RF2 and RF4

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Max. RF input power	–	–	–	38	dBm	for typical H_x behavior
Harmonic Generation up to 12.75 GHz[1,2,3]						
Second Order Harmonics	P_{H2}	–	-105	–	dBc	25 dBm, 50Ω, CW mode
Third Order Harmonics	P_{H3}	–	-105	–	dBc	25 dBm, 50Ω, CW mode
All RF Ports	P_{Hx}	–	-105	–	dBc	25 dBm, 50Ω, CW mode
Intermodulation Distortion IMD2 [1,2,3]						
IIP2, low	IIP2,l	–	110	–	dBm	IIP2 conditions table 8
IIP2, high	IIP2,h	–	130	–	dBm	
Intermodulation Distortion IMD3 [1,2,3]						
IIP3	IIP3	–	74	–	dBm	IIP3 conditions table 9
SV LTE Intermodulation [1,2,3]						
IIP3,SVLTE	IIP3,SV	–	74	–	dBm	SV-LTE conditions table 10

[1]Terminating Port Impedance: $Z_0 = 50\ \Omega$ [2]Supply Voltage: $V_{DD} = 1.8 - 3.6\ V$ [3]On application board without any matching components

Table 10: IIP2 conditions table

Band	In-Band Frequency [MHz]	Blocker Frequency 1 [MHz]	Blocker Power 1 [dBm]	Blocker Frequency 2 [MHz]	Blocker Power 2 [dBm]
Band 1 Low	2140	1950	20	190	-15
Band 1 High	2140	1950	20	4090	-15
Band 5 Low	881.5	836.5	20	45	-15
Band 5 High	881.5	836.5	20	1718	-15

Table 11: IIP3 conditions table

Band	In-Band Frequency [MHz]	Blocker Frequency 1 [MHz]	Blocker Power 1 [dBm]	Blocker Frequency 2 [MHz]	Blocker Power 2 [dBm]
Band 1	2140	1950	20	1760	-15
Band 5	881.5	836.5	20	791.5	-15

Table 12: SV-LTE conditions table

Band	In-Band Frequency [MHz]	Blocker Frequency 1 [MHz]	Blocker Power 1 [dBm]	Blocker Frequency 2 [MHz]	Blocker Power 2 [dBm]
Band 5	872	827	23	872	14
Band 13	747	786	23	747	14
Band 20	878	833	23	2544	14

9 Package Outline and Pin Configuration
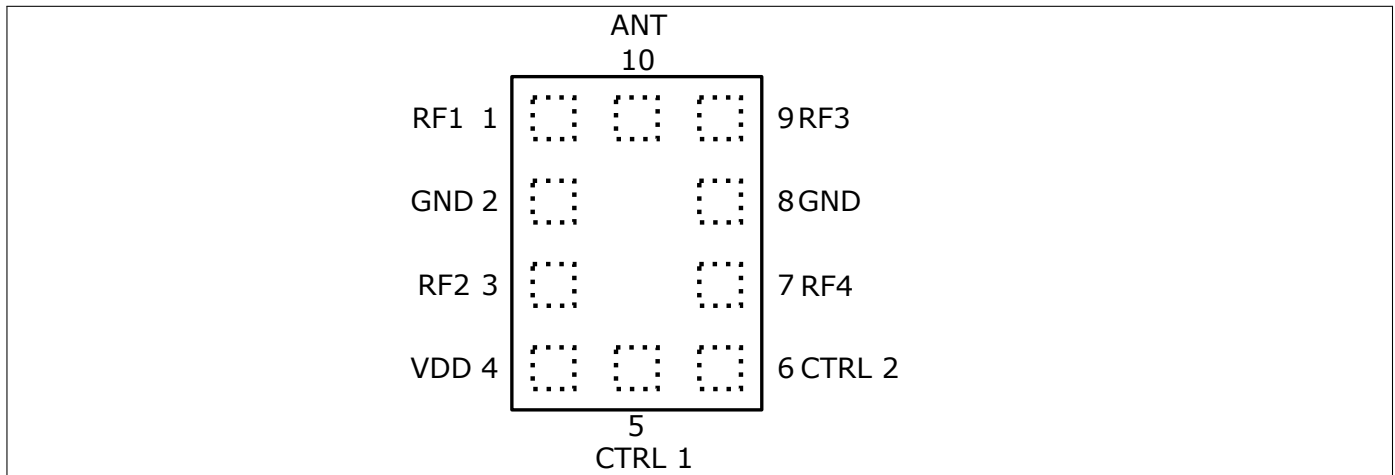
Figure 2: Pinout (top view)

Table 13: Pin Description

Pin No.	Name	Pin Type	Buffer Type	Function
1	RF1	I/O		RF1
2	GND	GND		Ground
3	RF2	I/O		RF2
4	VDD	PWR		Supply voltage
5	CTRL 1	I		Control Pin 1
6	CTRL 2	I		Control Pin 2
7	RF4	I/O		RF4
8	GND	GND		Ground
9	RF3	I/O		RF3
10	ANT	I/O		Common RF / Antenna

Table 14: Mechanical Data

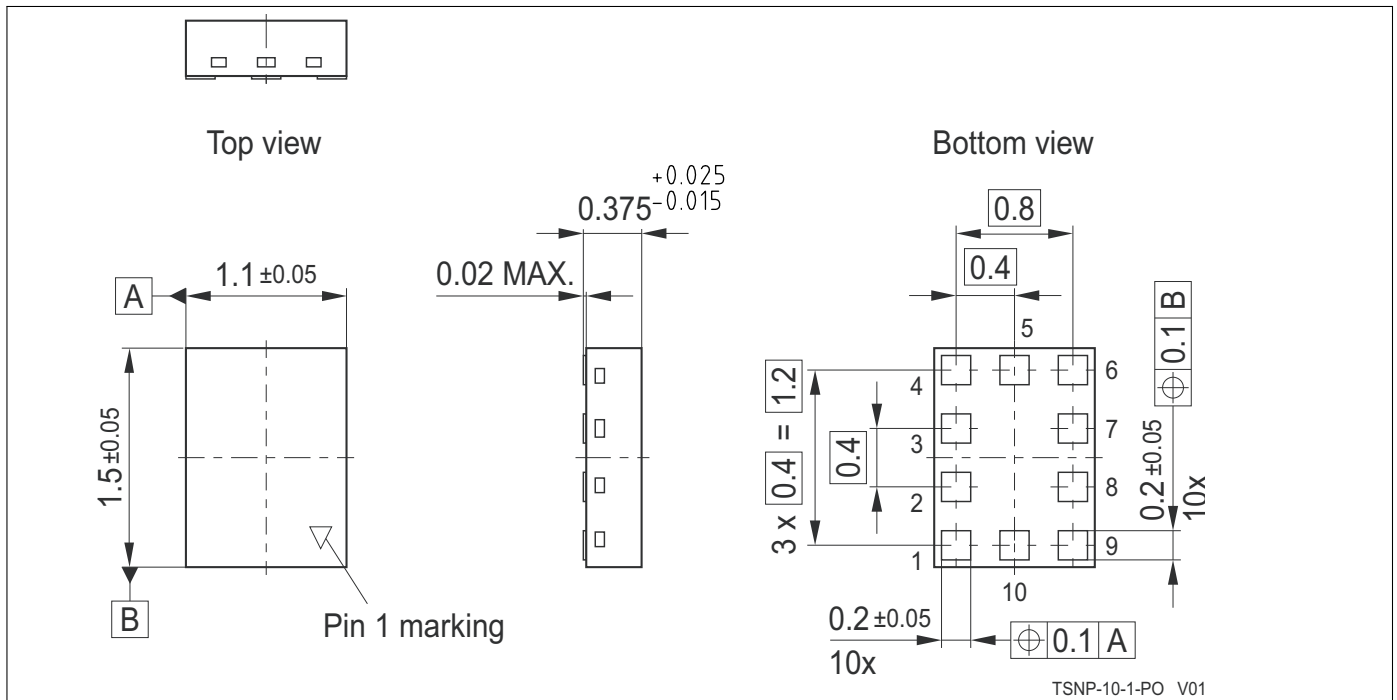| Parameter	Symbol	Value	Unit
X-Dimension	X	1.1 ± 0.05	mm
Y-Dimension	Y	1.5 ± 0.05	mm
Size	$Size$	1.65	mm^2
Height	H	0.375	mm

Figure 3: Package Dimensions Drawing
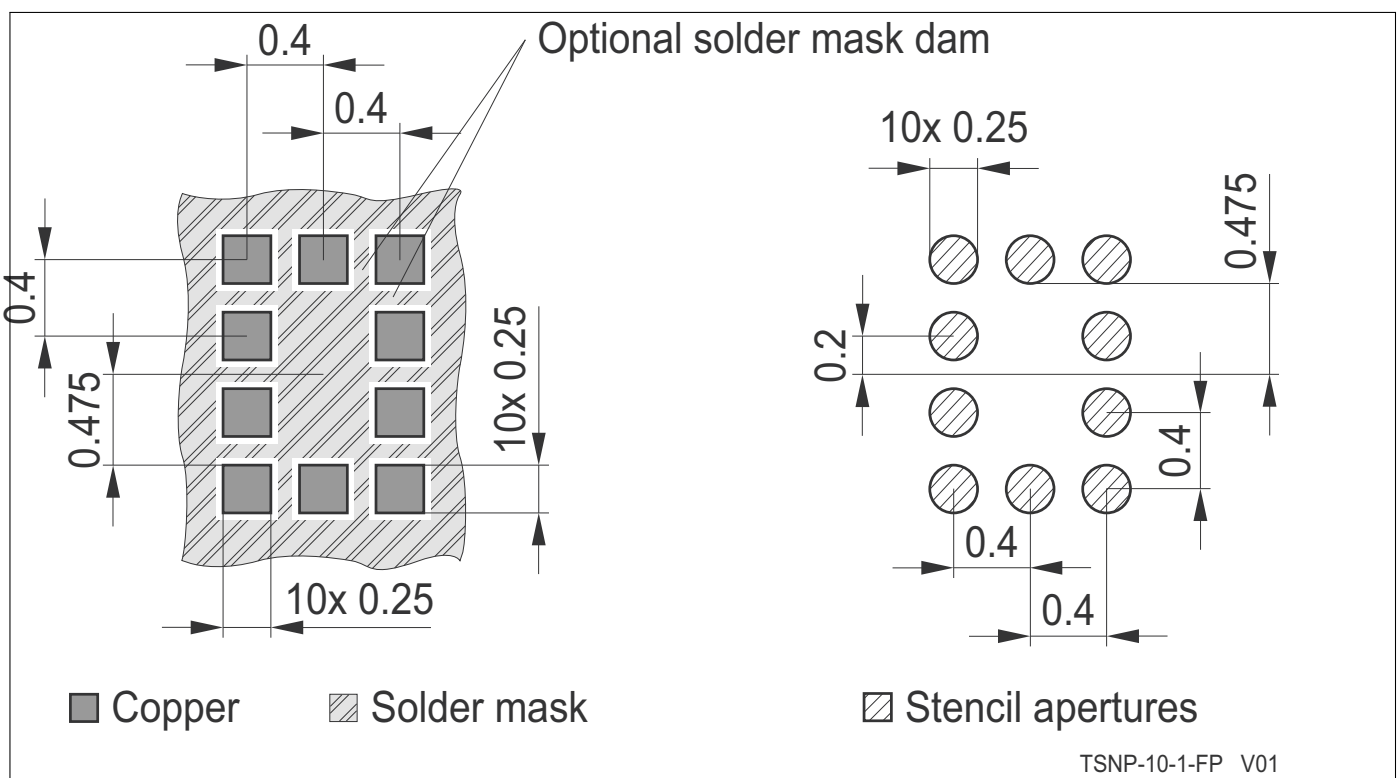

Figure 4: Land pattern and stencil mask
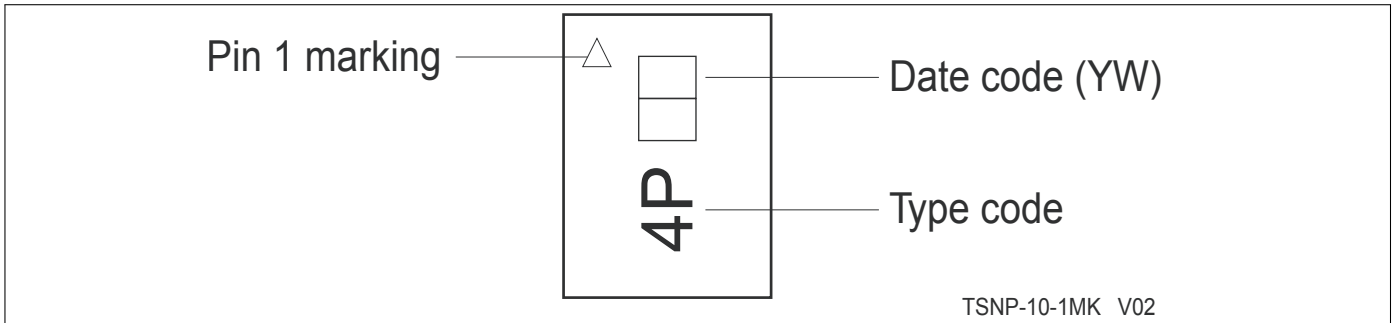
Figure 5: Marking

Figure 6: Tape drawing