BGS13PN10

SP3T high linearity, high power RF Switch

Data Sheet

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Final

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Revision History

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Previous Version: 0.6

Page	Subjects (major changes since last revision)
5	Updated Title
8	Updated RF characteristics for RF1 and RF3
9	Added RF characteristics for RF2

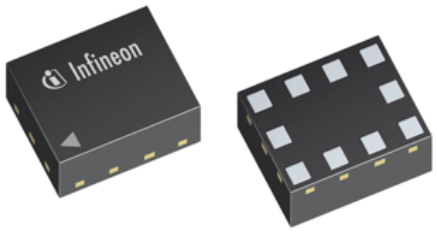
Contents

List of Figures

List of Tables

BGS13PN10 SP3T high linearity, high power RF Switch

1 Features



- High max RF power: 40 dBm CW @ 900 MHz, room temperature
- Three ultra-low loss ports:
  0.19 dB @ f=0.9 GHz, P_{IN}=38 dBm
  0.24 dB @ f=1.9 GHz, P_{IN}=38 dBm
  0.26 dB @ f=2.7 GHz, P_{IN}=33 dBm
  1.06 dB @ f=3.6 GHz, P_{IN}=33 dBm
  1.62 dB @ f=5.5 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
  All 3 RF ports 76 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
- 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 BGS13PN10 is a Single Pole Triple Throw (SP3T) 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
BGS13PN10	TSNP10-1	3P	M4821B

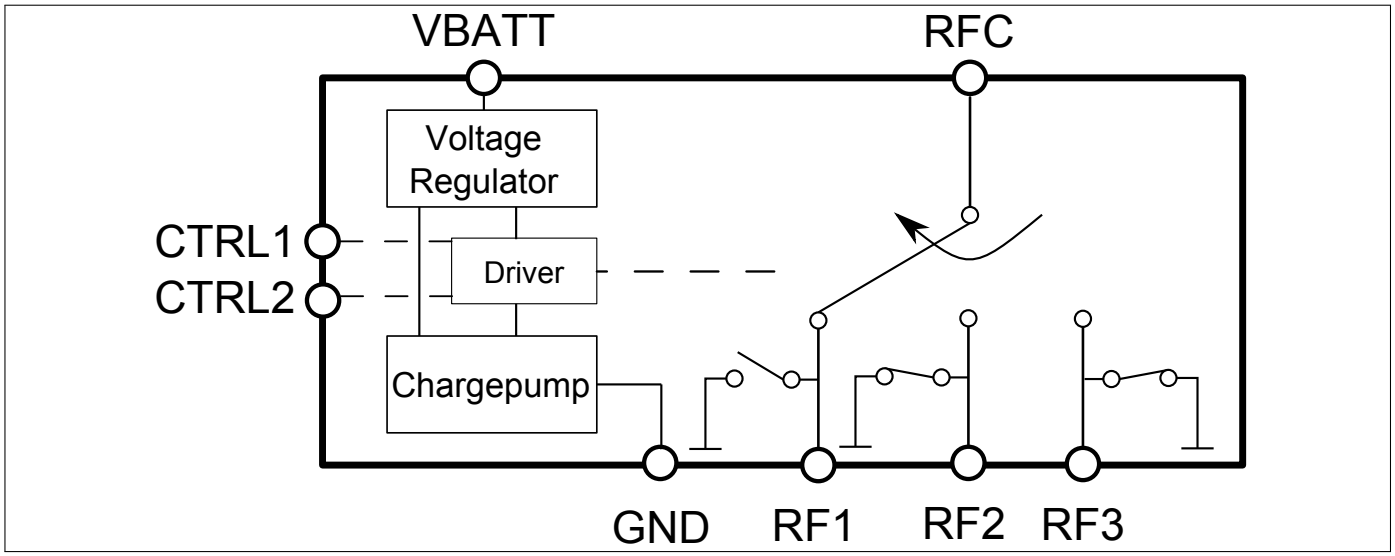


Figure 1: BGS13PN10 block diagram

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	CW
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	$V_{Ctrl,high}$	1.35	1.8	2.85	V	–
Control current low	$I_{Ctrl,low}$	-1	0	1	μA	–
Control current high	$I_{Ctrl,high}$	-1	0	1	μA	–
Ambient temperature	T_A	-40	25	85	°C	–
RF switching time [2)]	t_{sw}	0.5	1	5	μs	–
Startup time [2)]	t_{sw}		10	30	μs	–

[1)] T_A = -40 °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	Isolation Mode

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*	–	0.19	0.25	dB	V_{DD} = 1.8 – 3.6 *V*, T_A = -40 ... +85 °C, Z_0 = 50 Ω, P_{IN} up to 38 dBm
1710 - 1980 MHz		–	0.24	0.33	dB	
1981 - 2170 MHz		–	0.26	0.36	dB	
2171 - 2690 MHz		–	0.35	0.43	dB	
3400 - 3800 MHz		–	0.55	0.75	dB	
5150 - 5850 MHz		–	1.50	1.80	dB	
Return Loss						
All Ports @ 698 - 960 MHz	*RL*	18.5	23	–	dB	
All Ports @ 1710 - 2690 MHz		14.5	20	–	dB	
All Ports @ 3400 - 3800 MHz		9	11	–	dB	
All Ports @ 5150 - 5850 MHz		6.5	9	–	dB	
Isolation RFC						
698 - 915 MHz	*ISO*	33	40	–	dB	
1710 - 1980 MHz		27	31.5	–	dB	
1981 - 2170 MHz		26	30.5	–	dB	
2171 - 2690 MHz		23.5	27	–	dB	
3400 - 3800 MHz		19.5	23.5	–	dB	
5150 - 5850 MHz		14	17	–	dB	
Isolation RF1,2,3 - RF3,2,1						
698 - 915 MHz	*ISO*	43	47	–	dB	
1710 - 1980 MHz		34	37	–	dB	
1981 - 2170 MHz		32	35	–	dB	
2170 - 2690 MHz		28	32	–	dB	
3400 - 3800 MHz		24	27	–	dB	
5150 - 5850 MHz		16	20	–	dB	

7 RF Characteristics for RF2

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	V_{DD} = 1.8 – 3.6 *V*, T_A = -40 ... +85 °C, Z_0 = 50 Ω, P_{IN} up to 38 dBm
1710 - 1980 MHz		–	0.35	0.45	dB	
1981 - 2170 MHz		–	0.40	0.50	dB	
2171 - 2690 MHz		–	0.45	0.55	dB	
3400 - 3800 MHz		–	0.70	1.00	dB	
5150 - 5850 MHz		–	1.50	1.80	dB	
Return Loss						
All Ports @ 698 - 960 MHz	*RL*	19	25	–	dB	
All Ports @ 1710 - 2690 MHz		14.5	20	–	dB	
All Ports @ 3400 - 3800 MHz		9.5	13	–	dB	
All Ports @ 5150 - 5850 MHz		8.5	11	–	dB	
Isolation RFC						
698 - 915 MHz	*ISO*	33	40	–	dB	
1710 - 1980 MHz		27	31.5	–	dB	
1981 - 2170 MHz		26	30.5	–	dB	
2171 - 2690 MHz		23.5	27	–	dB	
3400 - 3800 MHz		19.5	23.5	–	dB	
5150 - 5850 MHz		14	17	–	dB	
Isolation RF1,2,3 - RF3,2,1						
698 - 915 MHz	*ISO*	43	47	–	dB	
1710 - 1980 MHz		34	37	–	dB	
1981 - 2170 MHz		32	35	–	dB	
2170 - 2690 MHz		28	32	–	dB	
3400 - 3800 MHz		24	27	–	dB	
5150 - 5850 MHz		16	20	–	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.		
Harmonic Generation up to 12.75 GHz[1,2,3]						
Second Order Harmonics	P_{H2}	–	-95	–	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	–	120	–	dBm	
Intermodulation Distortion IMD3 [1,2,3]						
IIP3	IIP3	–	76	–	dBm	IIP3 conditions table 9
SV LTE Intermodulation [1,2,3]						
IIP3,SVLTE	IIP3,SV	–	77	–	dBm	SV-LTE conditions table 10

[1)]Terminating Port Impedance: Z_0 = 50 Ω [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

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
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}	–	-105	–	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	–	120	–	dBm	
Intermodulation Distortion IMD3 [1,2,3]						
IIP3	IIP3	–	76	–	dBm	IIP3 conditions table 9
SV LTE Intermodulation [1,2,3]						
IIP3,SVLTE	IIP3,SV	–	77	–	dBm	SV-LTE conditions table 10

[1)]Terminating Port Impedance: Z_0 = 50 Ω [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

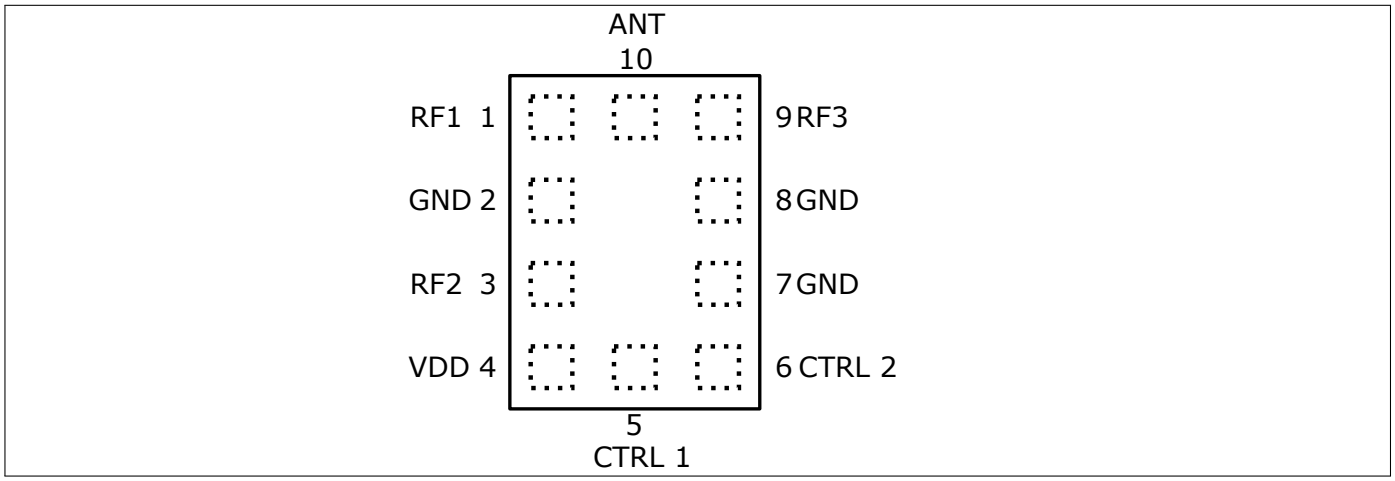


Figure 2: Pinout (top view)

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	GND	GND		Ground
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 $\pm$ 0.05	*mm*
Y-Dimension	*Y*	1.5 $\pm$ 0.05	*mm*
Size	*Size*	1.65	mm^2
Height	*H*	0.375	*mm*

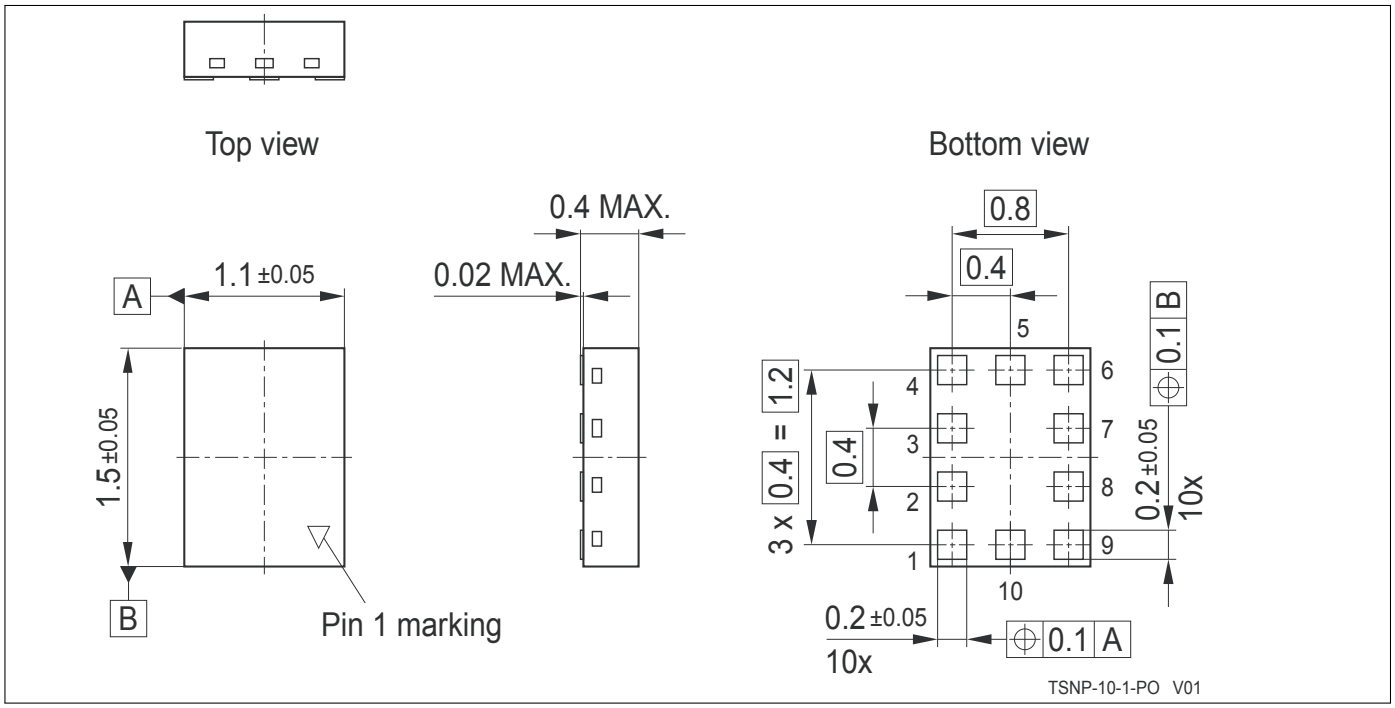


Figure 3: Package Dimensions Drawing

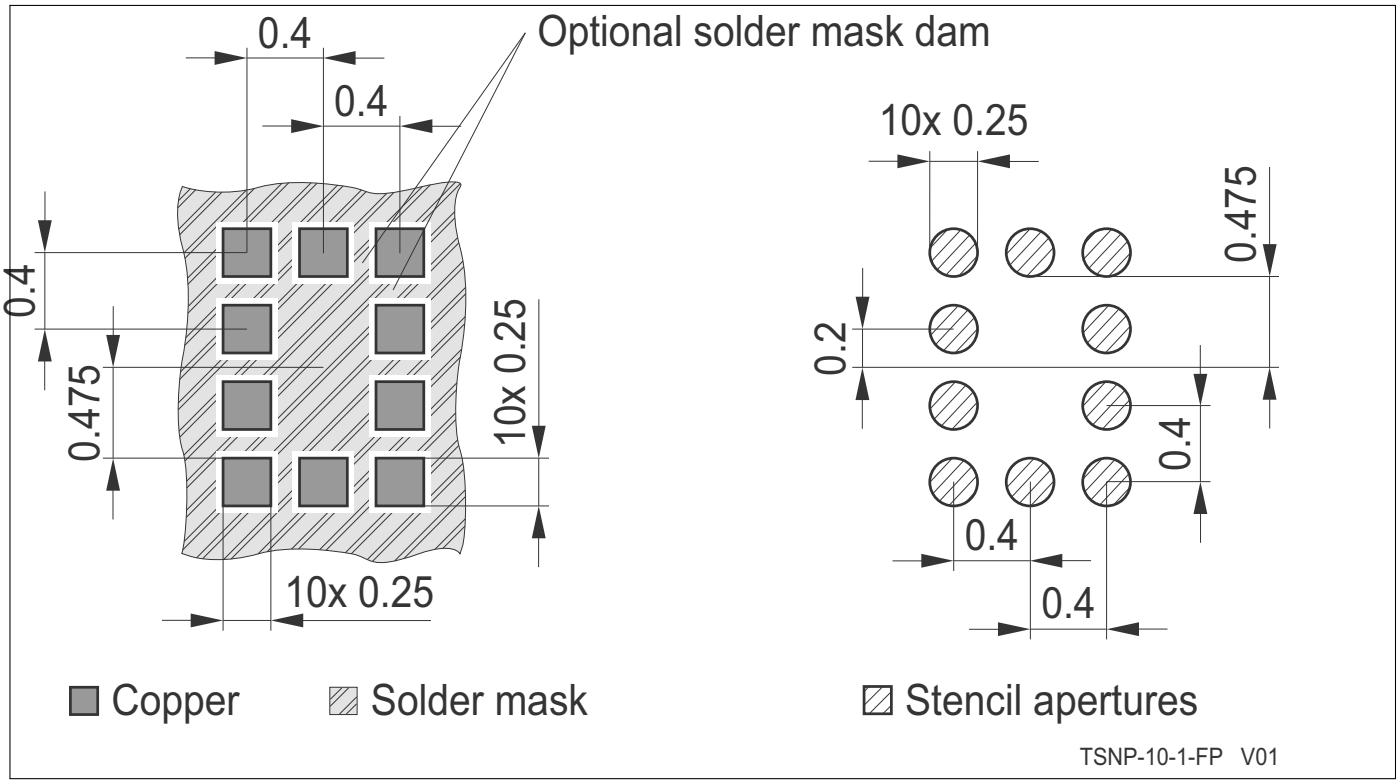


Figure 4: Land pattern and stencil mask

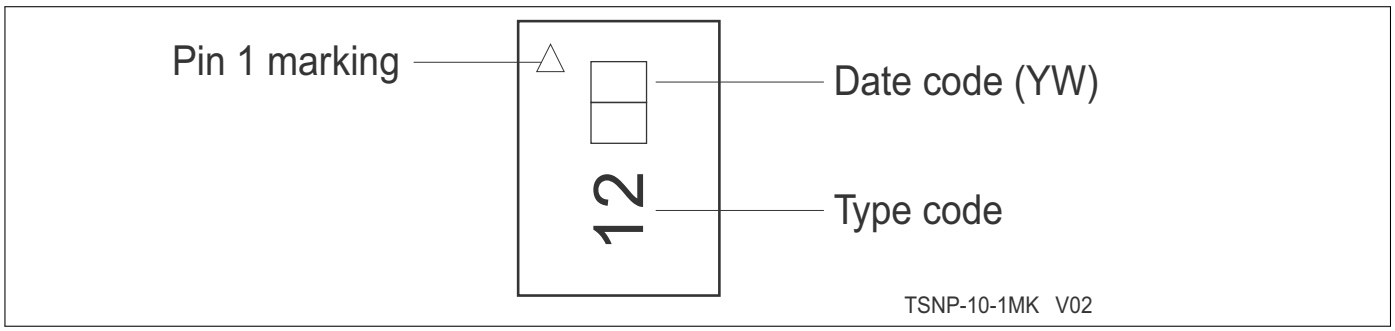


Figure 5: Marking

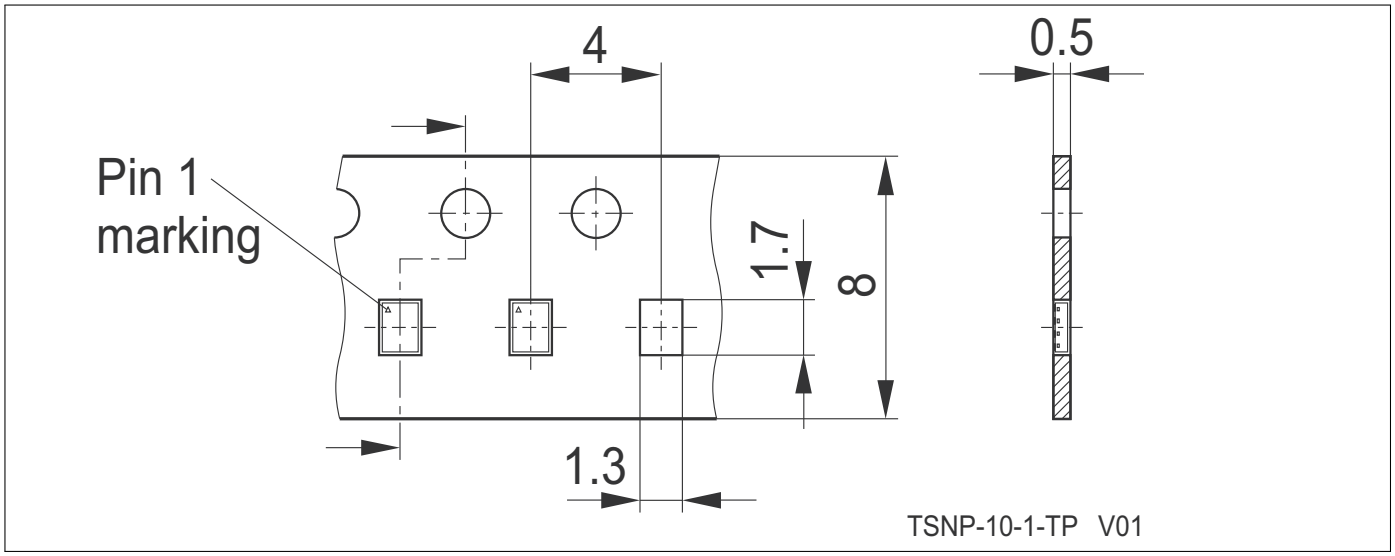


Figure 6: Tape drawing

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