BGS13SN8

Wideband RF SP3T switch

Features

- Suitable for WiFi, Bluetooth, and cellular applications
- Fast switching speed
- High linearity up to 30 dBm input power
- Low insertion loss and high port-to-port-isolation
- Low power consumption
- General Purpose Input-Output (GPIO) interface
- On-chip control logic including ESD protection
- No blocking capacitors required if no DC applied on RF lines
- 1.1 mm x 1.1 mm and height of 0.375 mm
- RoHS and WEEE compliant package

RoHS
Halogen-Free
Lead-Free
Green

Potential applications

- The BGS13SN8 RF switch is specifically designed for WiFi and Bluetooth applications.

Product validation

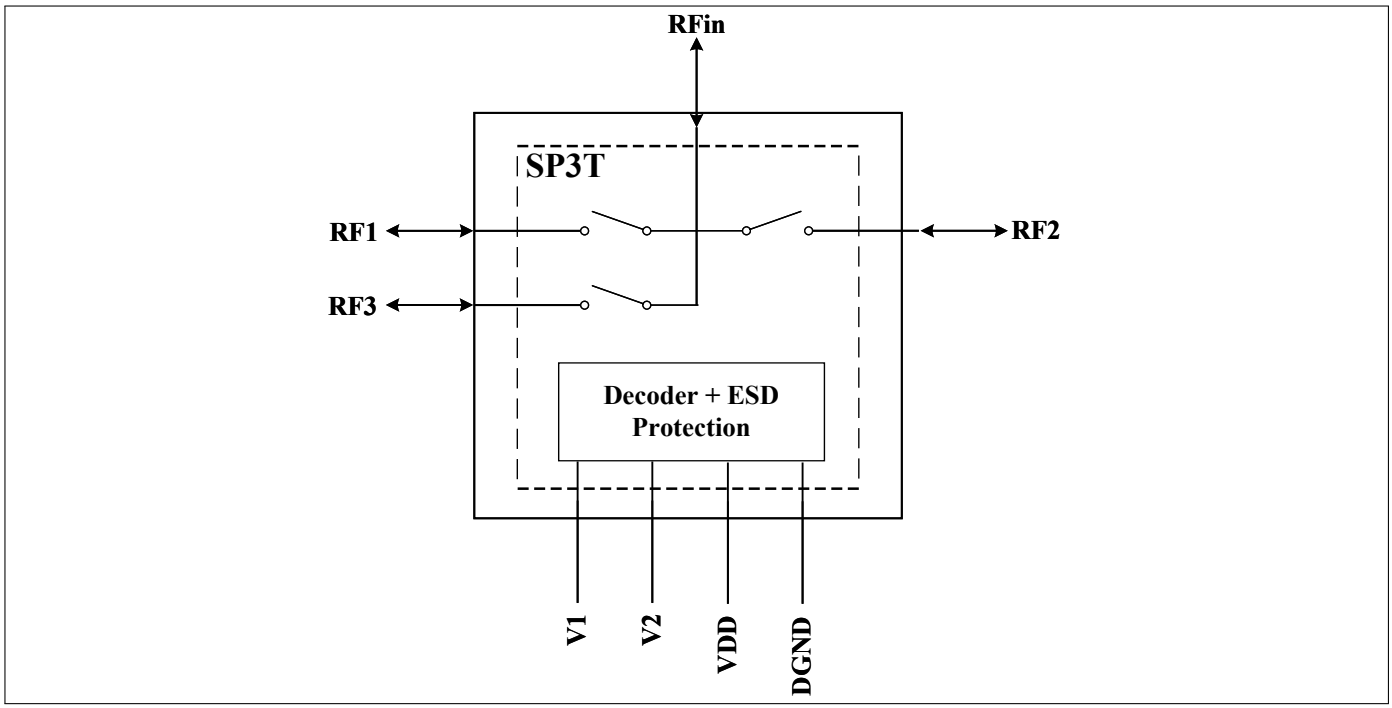
Qualified for industrial applications according to the relevant tests of JEDEC47/20/22.

Description

The BGS13SN8 is a single-pole, triple-throw (SP3T) antenna switch for 2.4 GHz WiFi, Bluetooth and cellular applications. It offers low insertion loss and high isolation with low harmonic distortion. BGS13SN8 is manufactured in Infineon's patented MOS technology, offering the performance of GaAs with the economy and integration of conventional CMOS including the inherent higher ESD robustness.

Type	Marking	Package	Ordering Information
BGS13SN8	R	PG-TSNP-8-1	BGS 13SN8 E6327

Block diagram



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1 Absolute maximum ratings

Table 1: Absolute maximum ratings at T_A = 25 °C, unless otherwise specified

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Frequency range	f	0.1	–	6	GHz	[1]
Supply voltage	V_{DD}	-0.5	–	3.6	V	–
Storage temperature range	T_{STG}	-55	–	150	°C	–
Junction temperature	T_j	–	–	125	°C	–
RF input power at all RFx ports	P_{RF_RFx}	–	–	32	dBm	CW
ESD capability, CDM[2]	V_{ESD_CDM}	-1	–	+1	kV	All pins
ESD capability, HBM[3]	V_{ESD_HBM}	-1	–	+1	kV	
Maximum DC-voltage on RF-ports and RF-ground	V_{RFDC}	0	–	0	V	No DC voltages allowed on RF-Ports

[1] There is also a DC connection between switched paths. The DC voltage at RF ports V_{RFDC} has to be 0V.
[2] Field-induced charged-device model JESD22-C101. Simulates charging/discharging events that occur in production equipment and processes. Potential for CDM ESD events occurs whenever there is metal-to-metal contact in manufacturing.
[3] Human body model ANSI/ESDA/JEDEC JS-001-2012 (R = 1.5 kΩ, C=100 pF).

Warning: Stresses above the maximum values listed in Table 1 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 maximum operation conditions specified in Table 2 may affect device reliability and life time. Functionality of the device might not be given under these conditions.

2 Operation ranges and general characteristics

Table 2: Operation ranges

Parameter	Symbol	Values			Unit	Note / Test condition
		Min.	Typ.	Max.		
RFx ports (50 Ω)	P_{RF_RFx}	–	–	30	dBm	–
Supply voltage	V_{DD}	1.65	–	3.4	V	–
Ambient temperature	T_A	-40	25	85	°C	–

Table 3: General characteristics at T_A = −40 °C...85 °C, Supply voltage V_{DD}= 1.65 V–3.4 V, unless otherwise specified

Parameter	Symbol	Values			Unit	Note / Test condition
		Min.	Typ.	Max.		
Supply current	I_{DD}	–	80	–	µA	–
GPIO control voltage high	V_{Ctrl_H}	1.35	–	V_{DD} + 0.3	V	–
GPIO control voltage low	V_{Ctrl_L}	-0.3	–	0.45	V	–
GPIO control input capacitance	C_{Ctrl}	–	–	2	pF	–

3 RF characteristics

Table 4: RF characteristics at T_A = −40 °C...85 °C, P_{IN} = 0 dBm, Supply voltage V_{DD}= 1.65 V–3.4 V, unless otherwise specified

Parameter	Symbol	Values			Unit	Note / Test condition
		Min.	Typ.	Max.		
Insertion loss (T_A = 25 °C)						
All RFx ports	IL	0.15	0.22	0.42	dB	698–960 MHz
		0.18	0.25	0.45	dB	1428–1990 MHz
		0.18	0.28	0.63	dB	1920–2170 MHz
		0.20	0.33	0.63	dB	2170–2690 MHz
		0.30	0.65	1.10	dB	5150–5725 MHz
Return loss						
All RFx ports	RL	20	30	40	dB	698–960 MHz
		19	23	38	dB	1428–1990 MHz
		17	21	35	dB	1920–2170 MHz
		15	19	32	dB	2170–2690 MHz
		12	14	28	dB	5150–5725 MHz
Isolation						
All RFx ports	ISO	30	35	48	dB	698–960 MHz
		22	30	38	dB	1428–1990 MHz
		18	27	38	dB	1920–2170 MHz
		18	25	35	dB	2170–2690 MHz
		10	15	30	dB	5150–5725 MHz
Compression point P0.1 dB (T_A = 25 °C)						
All RFx ports [1]	$P_{0.1dB}$	34	–	–	dBm	824–960 MHz
		34	–	–	dBm	2170–2690 MHz
Harmonic distortion up to 12.75 GHz						
H2	P_{Harm}	–	-90	-75	dBc	23 dBm, 50 Ω, CW mode
H3	P_{Harm}	–	-95	-80	dBc	23 dBm, 50 Ω, CW mode
Intermodulation distortion[2] (T_A = 25 °C)						
IMD2, low	$IMD2_{low}$	–	–	-105	dBm	Test cases see Table 5 and Table 6, 50 Ω
IMD3	IMD3	–	–	-115	dBm	
IMD2, high	$IMD2_{high}$	–	–	-105	dBm	

[1] Guaranteed by design. Theoretical value, no compression observable in specified operation range.
[2] On application board with shunt inductor, Min/Max-values measured with phase shifter.
[3] Guaranteed by characterization.

Table 5: IMD2 testcases

Band	Symbol	In-band frequency (MHz)	Blocker frequency 1 (MHz)	Blocker power 1 (dBm)	Blocker frequency 2 (MHz)	Blocker power 2 (dBm)
Band 1	$B1_{IMD2,high}$	2140	1950	10	4090	-15
	$B1_{IMD2,low}$	2140	1950	10	190	-15
Band 5	$B5_{IMD2,high}$	880	835	10	1715	-15
	$B5_{IMD2,low}$	880	835	10	45	-15
Band 7	$B7_{IMD2,high}$	2655	2535	10	5190	-15
	$B7_{IMD2,low}$	2655	2535	10	120	-15

Table 6: IMD3 testcases

Band	Symbol	In-band frequency (MHz)	Blocker frequency 1 (MHz)	Blocker power 1 (dBm)	Blocker frequency 2 (MHz)	Blocker power 2 (dBm)
Band 1	$B1_{IMD3,high}$	2140	1950	10	6040	-15
	$B1_{IMD3,mid}$	2140	1950	10	1760	-15
Band 5	$B5_{IMD3,high}$	880	835	10	2550	-15
	$B5_{IMD3,mid}$	880	835	10	790	-15
Band 7	$B7_{IMD3,high}$	2655	2535	10	7725	-15
	$B7_{IMD3,mid}$	2655	2535	10	2415	-15

Table 7: Switching time at T_A = −40 °C...85 °C, P_{RF} = 0 dBm, V_{DD} = 1.65 V...3.4 V, unless otherwise specified

Parameter	Symbol	Values			Unit	Note / Test condition
		Min.	Typ.	Max.		
Switching time[1)]						
Switching time	t_{ST}	–	500	1000	ns	Time between RF states in active mode $V_{Ctrl,H}$ Min. or $V_{Ctrl,L}$ max. level to 90% RF-signal
RF rise and fall time	t_{RT}	–	90	150	ns	Time between 10% to 90% RF-signal respectivly 90% to 10%

[1)] Measured on application board, without any matching components.

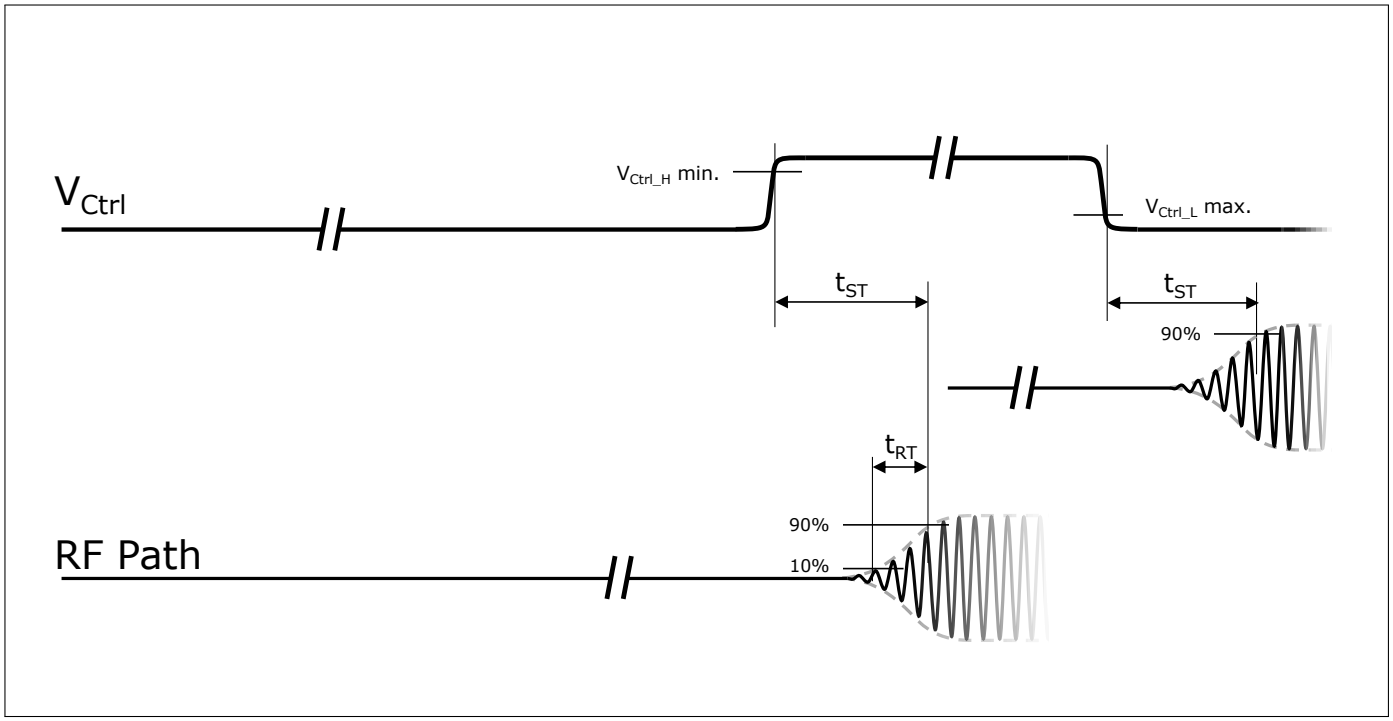

Figure 1: CTRL to RF time

4 Application information

Pin configuration and function

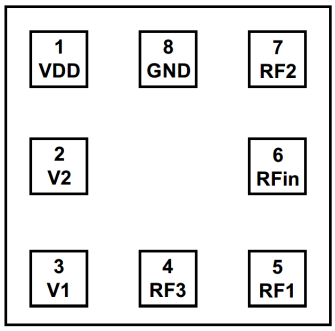

Figure 2: Footprint (top view)

Table 8: Pin configuration

No	Name	Function
1	VDD	Power supply
2	V2	Control pin 2
3	V1	Control pin 1
4	RF3	RF port 3
5	RF1	RF port 1
6	RFin	RF port in
7	RF2	RF port 2
8	GND	Ground

Table 9: Modes of operation (truth table)

State	Mode	Control inputs	
		V1	V2
1	Isolation	0	0
2	RFin - RF1	1	0
3	RFin - RF2	0	1
4	RFin - RF3	1	1

ESD system level test robustness

Table 10: ESD SLT robustness

Parameter	Symbol	Values			Unit	Note / Test condition
		Min.	Typ.	Max.		
ESD robustness, SLT[1)]	$V_{ESD,RF}$	-8	–	+8	kV	Each RF port versus GND, with 27 nH shunt inductor

[1)] IEC 61000-4-2 (R = 330 Ω, C = 150 pF), contact discharge.

5 Package information

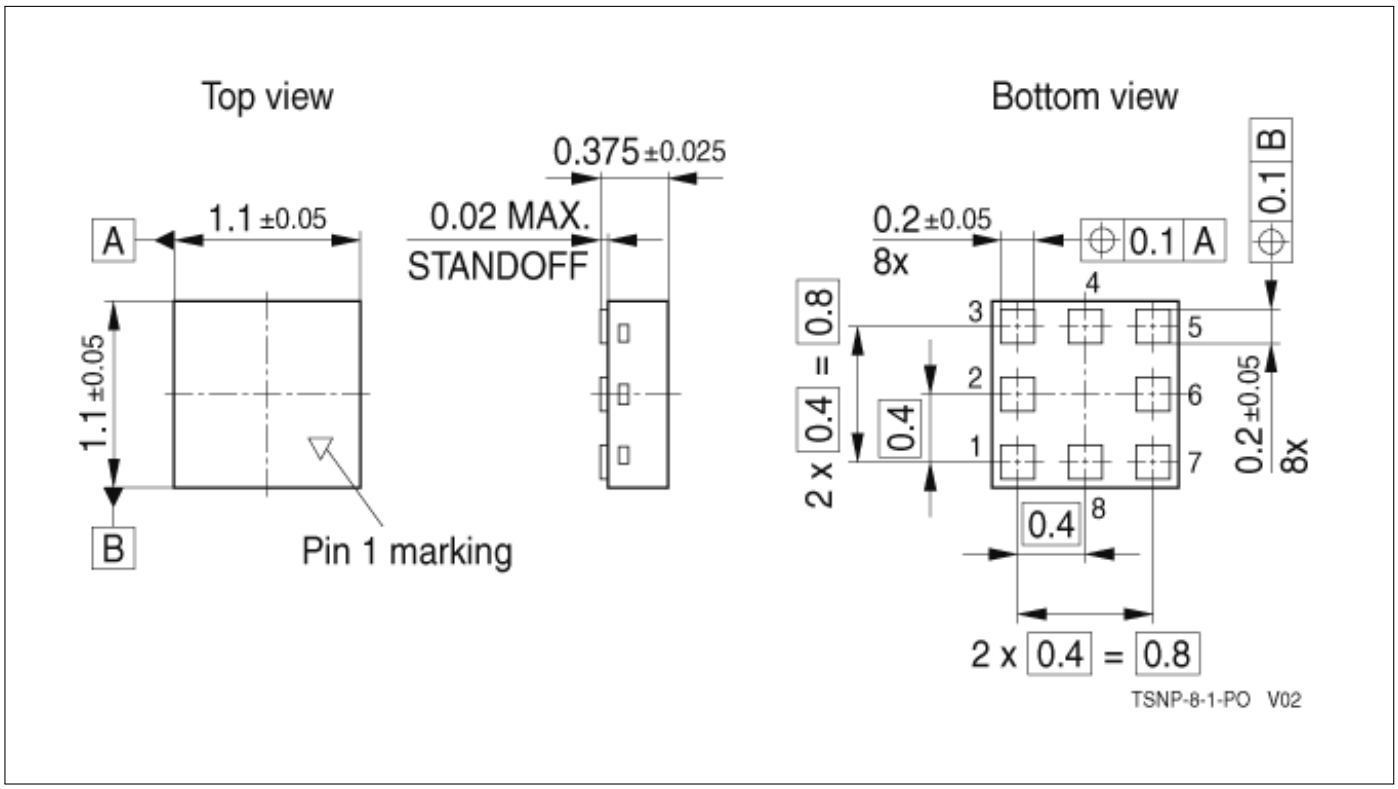

Figure 3: PG-TSNP-8-1 package outline drawing (top, side and bottom views)

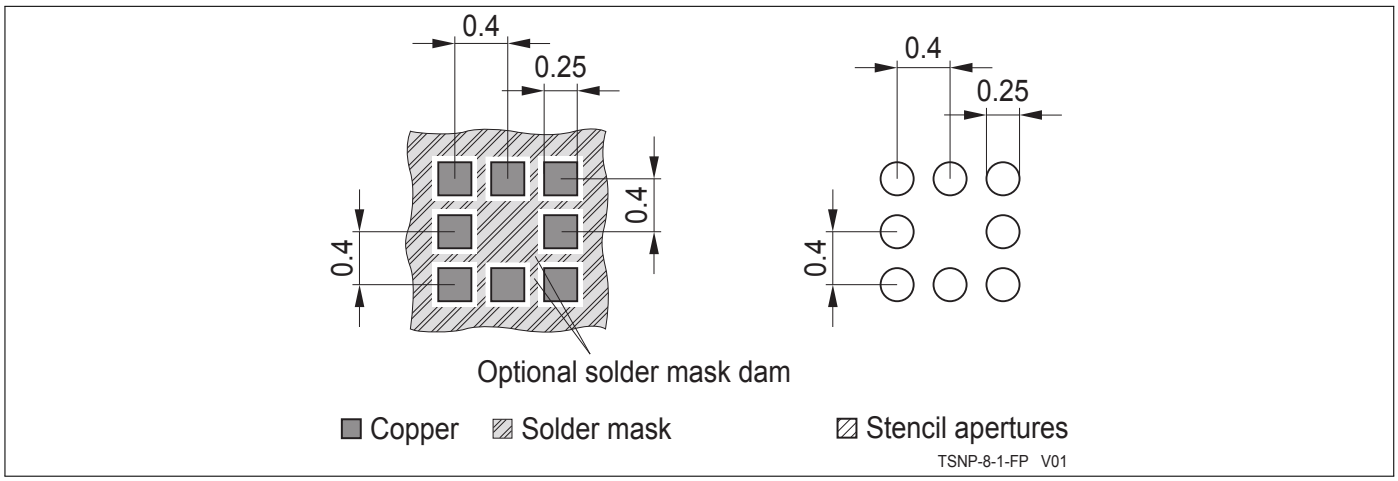

Figure 4: Footprint recommendation

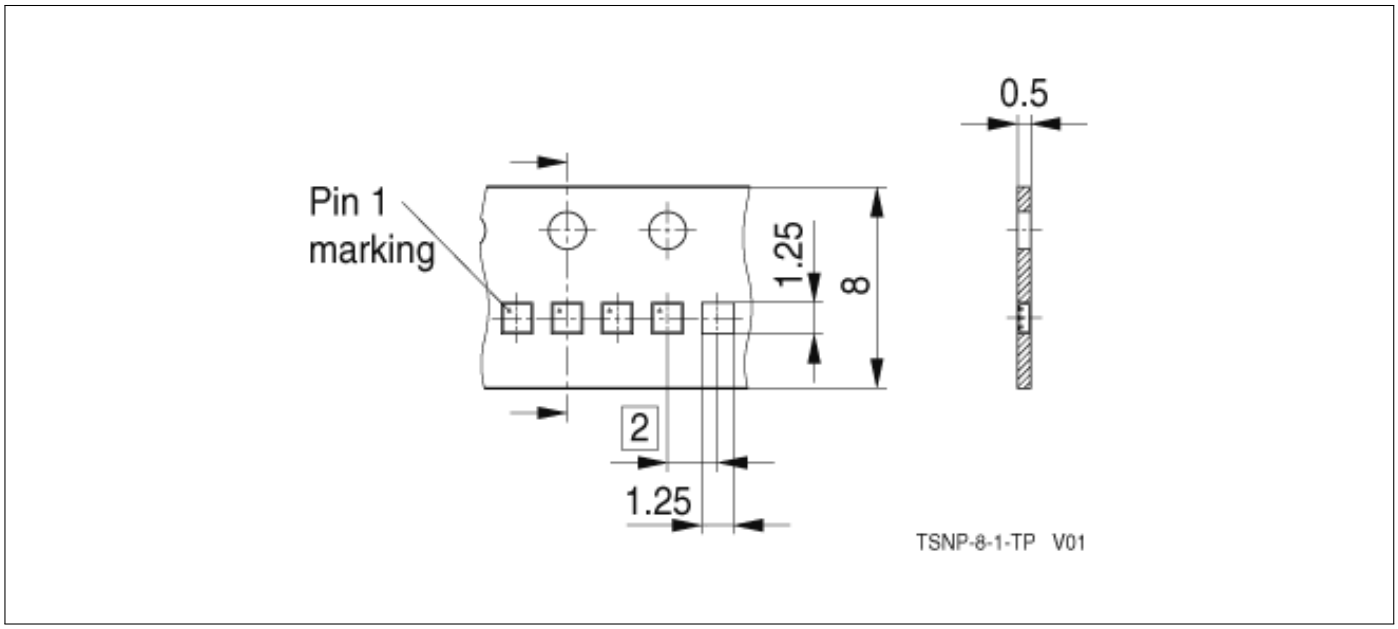

Figure 5: PG-TSNP-8-1 carrier tape drawing (top and side views)

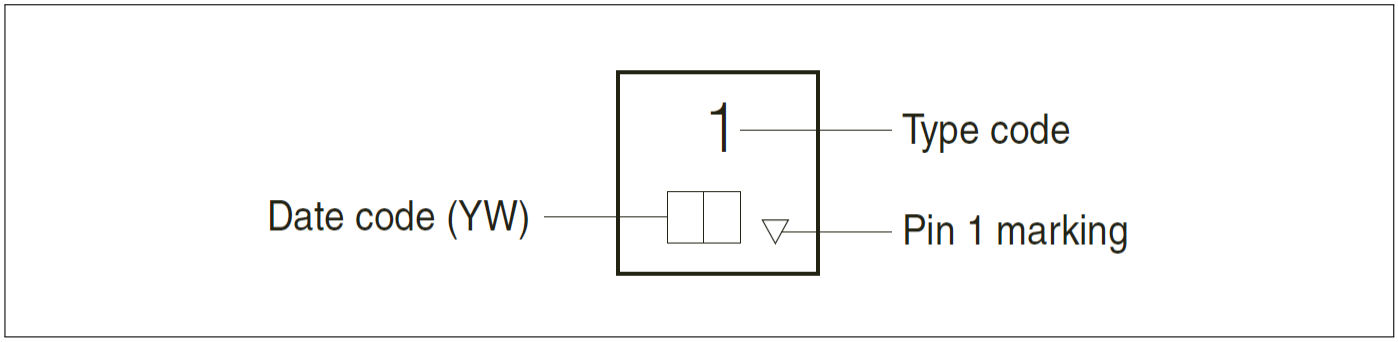

Figure 6: PG-TSNP-8-1 marking specification (top view): date code digits Y and W defined in Table 11 and 12

Table 11: Year date code marking - digit "Y"

Year	"Y"	Year	"Y"	Year	"Y"
2010	0	2020	0	2030	0
2011	1	2021	1	2031	1
2012	2	2022	2	2032	2
2013	3	2023	3	2033	3
2014	4	2024	4	2034	4
2015	5	2025	5	2035	5
2016	6	2026	6	2036	6
2017	7	2027	7	2037	7
2018	8	2028	8	2038	8
2019	9	2029	9	2039	9

Table 12: Week date code marking - digit "W"

Week	"W"	Week	"W"	Week	"W"	Week	"W"	Week	"W"
1	A	12	N	23	4	34	h	45	v
2	B	13	P	24	5	35	j	46	x
3	C	14	Q	25	6	36	k	47	y
4	D	15	R	26	7	37	l	48	z
5	E	16	S	27	a	38	n	49	8
6	F	17	T	28	b	39	p	50	9
7	G	18	U	29	c	40	q	51	2
8	H	19	V	30	d	41	r	52	3
9	J	20	W	31	e	42	s	53	M
10	K	21	Y	32	f	43	t		
11	L	22	Z	33	g	44	u		

Revision history	
Revision v2.3, 2020-12-10	
Page or Item	**Subjects (major changes since previous revision)**
Revision 2.4, 2024-06-24	
all	Update to latest style guide and template
6-7	Compression point for 2690 MHz added, IMD2/3 testcases added

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