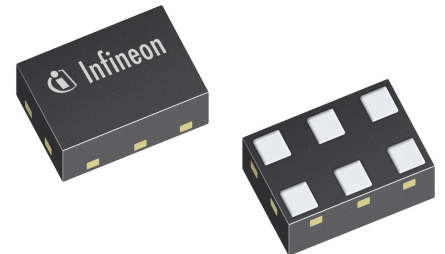


# BGS12WN6

## 0.05–9 GHz SPDT switch with fast switching speed

### Features

- Frequency range from 0.05 to 9 GHz
- Small size  $0.7 \times 1.1 \text{ mm}^2$  and ultra-low profile of 0.375 mm height max
- Fast switching speed
- Low insertion loss and high port to port isolation up to 9 GHz
- RF input power up to 30 dBm power
- Low current consumption
- No DC blocking capacitors required if no DC applied on RF lines
- RoHS and WEEE compliant package



- ✓ RoHS
- ⊘ Halogen-Free
- ⊘ Lead-Free
- 🌿 Green

### Potential applications

Antenna selection and switching of transmit signals (Tx/Rx) in

- IEEE 802.11a/b/g/n/ac/ax WLAN Networks
- Bluetooth (up to 6.0)
- Ultra-Wide-Band (UWB IEEE 802.15.4)
- Cellular applications (up to 6G)

### Product validation

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

### Description

The BGS12WN6 is a broadband SPDT RF switch suitable for various wireless systems, including WiFi \BT, UWB, and cellular. Its high linearity performance and low insertion loss make it an ideal choice for switching transmit signals, e.g., as Tx \Rx switch or as antenna diversity switch. The integrated on-chip CMOS logic allows direct connection to a digital control pin, eliminating the need for extra interface circuitry, thereby simplifying system design, and reducing component count. The isolated port is a reflective short. The device's flexible voltage supply and control enable easy adaptation to diverse applications and use cases. The BGS12WN6 is fabricated using Infineon's proprietary RF CMOS technology. Housed in a miniature package, this device is particularly well-suited for applications where PCB space is critical, allowing for optimal utilization of available board real estate.

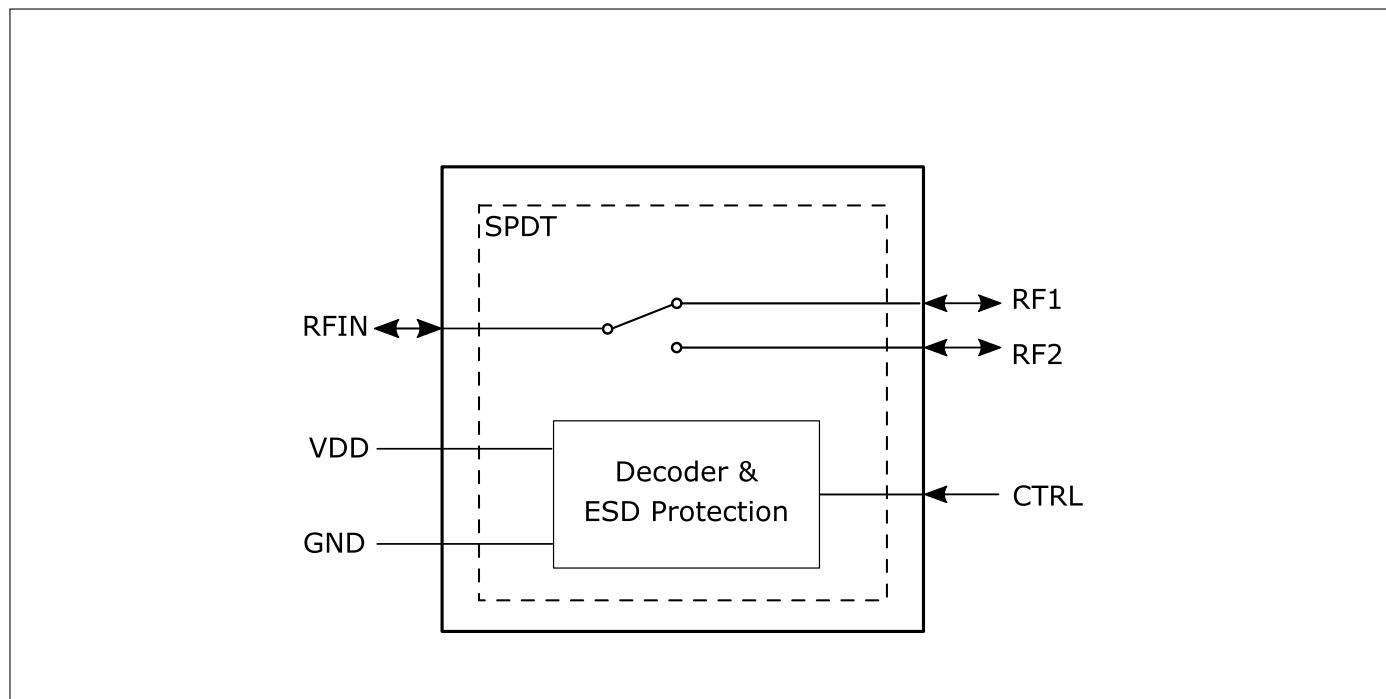
Type	Marking	Package	Ordering Information
BGS12WN6	K	PG-TSNP-6-10 PG-TSNP-6-2	BGS 12WN6 E6327 BGS 12WN6 E6329

# BGS12WN6

## 0.05–9 GHz SPDT switch with fast switching speed



### Block diagram



# BGS12WN6

## 0.05–9 GHz SPDT switch with fast switching speed

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## Table of contents

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# BGS12WN6

## 0.05–9 GHz SPDT switch with fast switching speed

### Absolute maximum ratings

## 1 Absolute maximum ratings

**Table 1: Absolute maximum ratings** at  $T_A = 25\text{ °C}$ , unless otherwise specified

Parameter	Symbol	Values			Unit	Note / Test condition
		Min.	Typ.	Max.		
Frequency range <sup>1)</sup>	$f$	0.05	–	9	GHz	–
Supply voltage	$V_{DD}$	0	–	4.2	V	–
Storage temperature range	$T_{STG}$	–55	–	150	°C	–
RF input power at all RF ports	$P_{RF,max}$	–	–	30	dBm	CW / VSWR 1:1 / $Z_0 = 50\ \Omega$
ESD capability, CDM <sup>2)</sup>	$V_{ESD,CDM}$	–1	–	+1	kV	–
ESD capability, HBM <sup>3)</sup>	$V_{ESD,HBM}$	–1	–	+1	kV	–
ESD capability RF ports <sup>4)</sup>	$V_{ESD,RF}$	–8	–	+8	kV	Each single RF-in/out port versus GND, with 27 nH shunt inductor
		–6	–	+6	kV	Each single RF-in/out port versus GND, with 56 nH shunt inductor
Junction temperature	$T_j$	–	–	125	°C	–
Thermal resistance junction - soldering point	$R_{thJS}$	–	–	70	K/W	–
Maximum DC-voltage on RF ports and RF-Ground	$V_{RFDC}$	0	–	0	V	No DC voltages allowed on RF-Ports

<sup>1)</sup>There is also a DC connection between switched paths. The DC voltage at RF ports  $V_{RFDC}$  has to be 0 V.

<sup>2)</sup>Field-Induced Charged-Device Model ANSI/ESDA/JEDEC JS-002. 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.

<sup>3)</sup>Human Body Model ANSI/ESDA/JEDEC JS-001 ( $R = 1.5\text{ k}\Omega$ ,  $C = 100\text{ pF}$ ).

<sup>4)</sup>IEC 61000-4-2 ( $R = 330\ \Omega$ ,  $C = 150\text{ pF}$ ), contact discharge.

**Attention:** Stresses above the max. values listed here 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 specified maximum operation conditions may affect device reliability and life time. Functionality of the device might not be given under these conditions.

# BGS12WN6

## 0.05–9 GHz SPDT switch with fast switching speed

### Operation ranges

## 2 Operation ranges

**Table 2: Operation ranges**, at  $T_A = -40\text{ °C} \dots 85\text{ °C}$ ,  $V_{DD} = 1.65\text{ V} \dots 3.6\text{ V}$ , unless otherwise specified

Parameter	Symbol	Values			Unit	Note / Test condition
		Min.	Typ.	Max.		
Ambient temperature	$T_A$	-40	25	85	°C	-
Supply voltage	$V_{DD}$	1.65	1.8	3.6	V	-
Control voltage Low	$V_{Ctrl,L}$	-0.3	-	0.45	V	-
Control voltage High	$V_{Ctrl,H}$	1.0	-	$V_{DD}$	V	-
Supply current	$I_{DD}$	-	63	100	μA	$T_A = 25\text{ °C}$ , $V_{DD} = 1.8\text{ V}$ , $V_{Ctrl} = -0.3\text{ V} \dots 0.45\text{ V}$ 1.35 V...1.8 V
		-	63	120	μA	$V_{Ctrl} = -0.3\text{ V} \dots 0.45\text{ V}$ 1.35 V... $V_{DD}$
		-	63	125	μA	$V_{Ctrl} = 1.0\text{ V} \dots 1.35\text{ V}$
Control current	$I_{Ctrl}$	-	2	10	nA	-

**Table 3: RF Input power**, at  $T_A = -40\text{ °C} \dots 85\text{ °C}$ ,  $V_{DD} = 1.65\text{ V} \dots 3.6\text{ V}$ , VSWR 1:1 /  $Z_0 = 50\ \Omega$ , unless otherwise specified

Parameter	Symbol	Values			Unit	Note / Test condition
		Min.	Typ.	Max.		
RF input power at all RF ports	$P_{RF}$	-	-	26	dBm	CW
				30	dBm	$T_A = 25\text{ °C}$ , duty cycle $\leq 1\%$
				29	dBm	$T_A = 85\text{ °C}$ , duty cycle $\leq 1\%$

RF characteristics

**3 RF characteristics**

**Table 4: RF characteristics** at  $T_A = -40\text{ °C} \dots 85\text{ °C}$ ,  $P_{RF} = 0\text{ dBm}$ ,  $V_{DD} = 1.65\text{ V} \dots 3.6\text{ V}$ , unless otherwise specified

Parameter	Symbol	Values			Unit	Note / Test condition
		Min.	Typ.	Max.		
<b>Insertion loss<sup>1)</sup> at <math>T_A = 25\text{ °C}</math>, <math>V_{DD} = 1.8\text{ V}</math></b>						
All RF ports	<i>IL</i>	–	0.15	0.20	dB	50–698 MHz
		–	0.16	0.21	dB	699–960 MHz
		–	0.19	0.26	dB	1200–2170 MHz
		–	0.22	0.29	dB	2170–2690 MHz
		–	0.30	0.42	dB	3300–4200 MHz
		–	0.38	0.52	dB	4400–5000 MHz
		–	0.46	0.68	dB	5150–5925 MHz
		–	0.62	0.93	dB	5925–7125 MHz
		–	0.79	1.15	dB	7125–7737 MHz
		–	0.91	1.34	dB	7737–8237 MHz
–	1.12	1.85	dB	8237–9000 MHz		
<b>Insertion loss<sup>1)</sup></b>						
All RF ports	<i>IL</i>	–	0.15	0.25	dB	50–698 MHz
		–	0.16	0.25	dB	699–960 MHz
		–	0.19	0.31	dB	1200–2170 MHz
		–	0.22	0.34	dB	2170–2690 MHz
		–	0.30	0.48	dB	3300–4200 MHz
		–	0.38	0.58	dB	4400–5000 MHz
		–	0.46	0.75	dB	5150–5925 MHz
		–	0.62	1.00	dB	5925–7125 MHz
		–	0.79	1.25	dB	7125–7737 MHz
		–	0.91	1.45	dB	7737–8237 MHz
–	1.12	2.00	dB	8237–9000 MHz		
<b>Return loss<sup>1)</sup></b>						
All RF ports	<i>RL</i>	28	33	–	dB	50–698 MHz
		26	29	–	dB	699–960 MHz
		20	23	–	dB	1200–2170 MHz
		18	20	–	dB	2170–2690 MHz
		14	16	–	dB	3300–4200 MHz
		13	14	–	dB	4400–5000 MHz
		11	13	–	dB	5150–5925 MHz
		9.5	11	–	dB	5925–7125 MHz
		9	10	–	dB	7125–7737 MHz
		8	9	–	dB	7737–8237 MHz
7	8	–	dB	8237–9000 MHz		

<sup>1)</sup> Measured on prober station to exclude board effects, without any matching components.

# BGS12WN6

## 0.05–9 GHz SPDT switch with fast switching speed



### RF characteristics

**Table 5: RF characteristics** at  $T_A = -40\text{ }^{\circ}\text{C} \dots 85\text{ }^{\circ}\text{C}$ ,  $P_{RF} = 0\text{ dBm}$ ,  $V_{DD} = 1.65\text{ V} \dots 3.6\text{ V}$ , unless otherwise specified

Parameter	Symbol	Values			Unit	Note / Test condition
		Min.	Typ.	Max.		
<b>Isolation<sup>1)</sup></b>						
RFIN to RF1 port	$ISO_{RFIN-RF1}$	43	53	–	dB	50–698 MHz
		40	46	–	dB	699–960 MHz
		33	39	–	dB	1200–2170 MHz
		31	37	–	dB	2170–2690 MHz
		26	33	–	dB	3300–4200 MHz
		24	30	–	dB	4400–5000 MHz
		21	28	–	dB	5150–5925 MHz
		20	25	–	dB	5925–7125 MHz
		19	24	–	dB	7125–7737 MHz
		18	23	–	dB	7737–8237 MHz
RFIN to RF2 port	$ISO_{RFIN-RF2}$	43	52	–	dB	50–698 MHz
		40	45	–	dB	699–960 MHz
		33	39	–	dB	1200–2170 MHz
		31	36	–	dB	2170–2690 MHz
		26	31	–	dB	3300–4200 MHz
		24	29	–	dB	4400–5000 MHz
		21	26	–	dB	5150–5925 MHz
		20	25	–	dB	5925–7125 MHz
		19	24	–	dB	7125–7737 MHz
		18	23	–	dB	7737–8237 MHz
RF1 to RF2 port / RF2 to RF1 port	$ISO_{Port-Port}$	53	63	–	dB	50–698 MHz
		50	56	–	dB	699–960 MHz
		41	49	–	dB	1200–2170 MHz
		39	45	–	dB	2170–2690 MHz
		34	40	–	dB	3300–4200 MHz
		30	36	–	dB	4400–5000 MHz
		25	33	–	dB	5150–5925 MHz
		23	31	–	dB	5925–7125 MHz
		21	29	–	dB	7125–7737 MHz
		19	28	–	dB	7737–8237 MHz
		17	27	–	dB	8237–9000 MHz

<sup>1)</sup> Measured on application board, without any matching components.

# BGS12WN6

## 0.05–9 GHz SPDT switch with fast switching speed



### RF characteristics

**Table 6: WIFI RF characteristics** at  $T_A = 25\text{ °C}$ ,  $V_{DD} = 1.65\text{ V} \dots 3.6\text{ V}$ , unless otherwise specified

Parameter	Symbol	Values			Unit	Note / Test condition
		Min.	Typ.	Max.		
<b>Compression point 0.1 dB<sup>1)</sup></b>						
P0.1dB	$P_{0.1dB}$	30	–	–	dBm	
<b>Harmonic generation<sup>1)</sup></b> at $P_{RF} = 24\text{ dBm}$ , CW-mode, $Z_0 = 50\ \Omega$						
2 <sup>nd</sup> Harmonic	$P_{H2,WIFI}$	–	–79	–56	dBm	2400 MHz
		–	–67	–40	dBm	5800 MHz
		–	–67	–40	dBm	7100 MHz
3 <sup>rd</sup> Harmonic	$P_{H3,WIFI}$	–	–58	–54	dBm	2400 MHz
		–	–67	–54	dBm	5800 MHz
		–	–68	–51	dBm	7100 MHz
<b>Error vector magnitude<sup>1)</sup></b> of WIFI signal (802.11ac, VHT40, MCS9) at $P_{RF} = 24\text{ dBm}$						
EVM	$EVM$	–	–49	–44	dB	2450 MHz
<b>Intercept point<sup>1)</sup></b> at $P_{RF} = 20\text{ dBm/}$ tone						
IIP3 2.4 GHz band	$IIP3_{2.4,WIFI}$	58	63	–	dBm	2400 MHz
IIP3 5–7 GHz band	$IIP3_{5-7,WIFI}$	60	66	–	dBm	6000 MHz

<sup>1)</sup> Measured on application board, without any matching components.

**Table 7: Cellular RF characteristics** at  $T_A = -40\text{ °C} \dots 85\text{ °C}$ ,  $P_{RF} = 0\text{ dBm}$ ,  $V_{DD} = 1.65\text{ V} \dots 3.6\text{ V}$ , unless otherwise specified

Parameter	Symbol	Values			Unit	Note / Test condition
		Min.	Typ.	Max.		
<b>Harmonic generation<sup>1)</sup></b> at $P_{RF} = 26\text{ dBm}$ , CW-mode, $Z_0 = 50\ \Omega$						
2 <sup>nd</sup> Harmonic	$P_{H2,cellular}$	–	–74	–65	dBm	600–915 MHz
		–	–76	–67	dBm	1447–1980 MHz
		–	–83	–60	dBm	2300–2690 MHz
3 <sup>rd</sup> Harmonic	$P_{H3,cellular}$	–	–68	–60	dBm	600–915 MHz
		–	–68	–60	dBm	1447–1980 MHz
		–	–64	–60	dBm	2300–2690 MHz
<b>Intermodulation distortion<sup>1)</sup></b>						
IMD2	$IMD2$	–	–112	–103	dBm	Testcases see Table 8
IMD3	$IMD3$	–	–116	–109	dBm	Testcases see Table 9
<b>Intercept point<sup>1)</sup></b>						
IIP2	$IIP2$	108	117	–	dBm	Testcases see Table 8
IIP3	$IIP3$	67	70	–	dBm	Testcases see Table 9

<sup>1)</sup> Measured on application board, without any matching components.

# BGS12WN6

## 0.05–9 GHz SPDT switch with fast switching speed



### RF characteristics

**Table 8: Cellular 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	$B1_{\text{IMD2,high}}$	2140	1950	20	4090	–15
	$B1_{\text{IMD2,low}}$	2140	1950	20	190	–15
Band 4	$B4_{\text{IMD2,high}}$	2132	1732	20	3864	–15
	$B4_{\text{IMD2,low}}$	2132	1732	20	400	–15
Band 5	$B5_{\text{IMD2,high}}$	881.5	836.5	20	1718	–15
	$B5_{\text{IMD2,low}}$	881.5	836.5	20	45	–15
Band 7	$B7_{\text{IMD2,high}}$	2655	2535	20	5190	–15
	$B7_{\text{IMD2,low}}$	2655	2535	20	120	–15

**Table 9: Cellular 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	$B1_{\text{IMD3,high}}$	2140	1950	20	6040	–15
	$B1_{\text{IMD3,mid}}$	2140	1950	20	1760	–15
Band 4	$B4_{\text{IMD3,high}}$	2132	1732	20	5596	–15
	$B4_{\text{IMD3,mid}}$	2132	1732	20	1332	–15
Band 5	$B5_{\text{IMD3,high}}$	881.5	836.5	20	2554.5	–15
	$B5_{\text{IMD3,mid}}$	881.5	836.5	20	791.5	–15
Band 7	$B7_{\text{IMD3,high}}$	2655	2535	20	7725	–15
	$B7_{\text{IMD3,mid}}$	2655	2535	20	2415	–15

# BGS12WN6

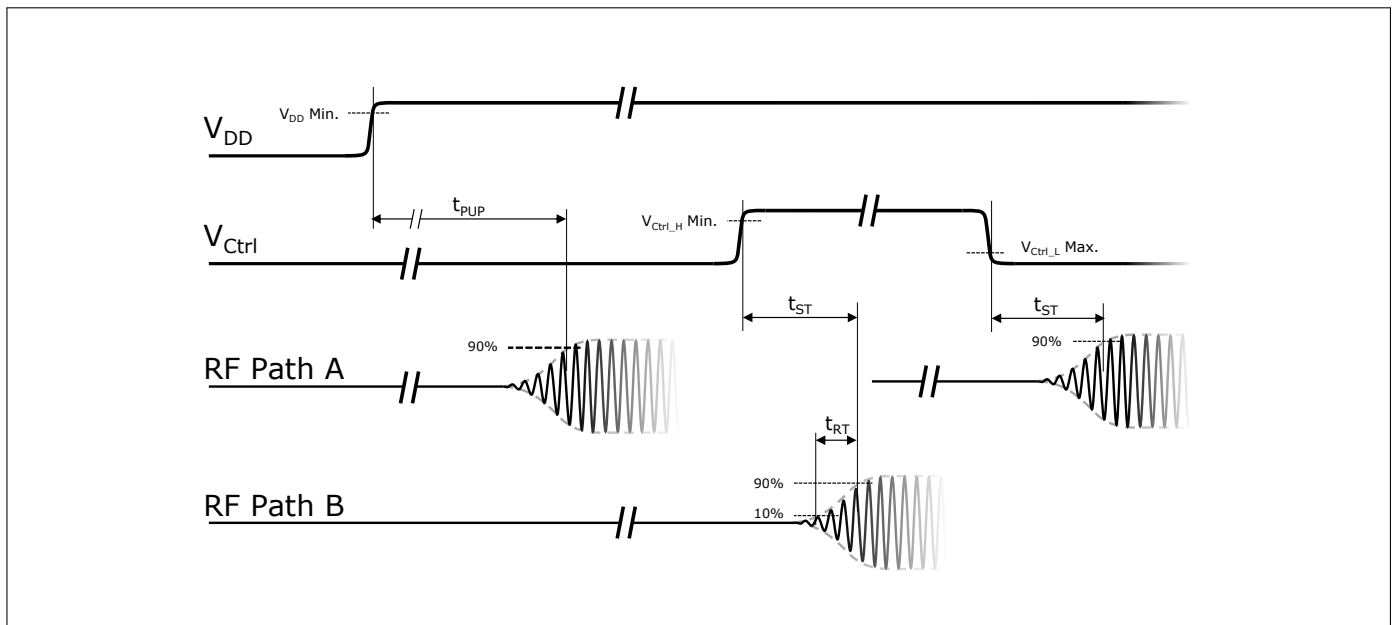
## 0.05–9 GHz SPDT switch with fast switching speed

### RF characteristics

**Table 10: Switching time** at  $T_A = -40\text{ }^\circ\text{C} \dots 85\text{ }^\circ\text{C}$ ,  $P_{RF} = 0\text{ dBm}$ ,  $V_{DD} = 1.65\text{ V} \dots 3.6\text{ V}$ , unless otherwise specified

Parameter	Symbol	Values			Unit	Note / Test condition
		Min.	Typ.	Max.		
<b>Switching time<sup>1)</sup></b>						
Switching time	$t_{ST}$	–	160	220	ns	Time between RF states in active mode $V_{Ctrl,H}$ Min. or $V_{Ctrl,L}$ max. level to 90% RF-signal
RF rise time	$t_{RT}$	–	35	80	ns	Time between 10% to 90% RF-signal
Power up settling time	$t_{PUP}$	–	5.8	7	$\mu\text{s}$	Time from $V_{DD}$ Min. power level to 90% RF-signal

<sup>1)</sup> Measured on application board, without any matching components.



**Figure 1:** CTRL to RF time

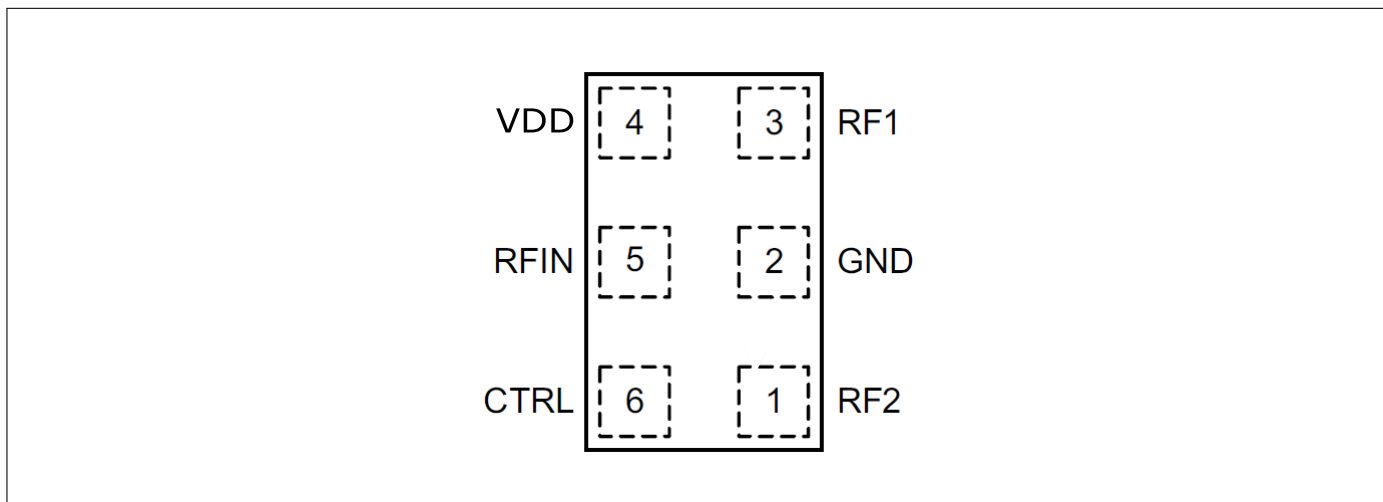
# BGS12WN6

## 0.05–9 GHz SPDT switch with fast switching speed

### Application information

## 4 Application information

### Pin configuration and function



**Figure 2:** BGS12WN6 Pin configuration (top view)

**Table 11: Pin definition and function**

Pin No.	Name	Function
1	RF2	RF port 2
2	GND	Ground
3	RF1	RF port 1
4	VDD	Supply voltage
5	RFIN	RF port In
6	CTRL	Control pin

**Table 12: Truth table switch control**

Switched paths	CTRL
RFIN - RF1	0
RFIN - RF2	1

# BGS12WN6

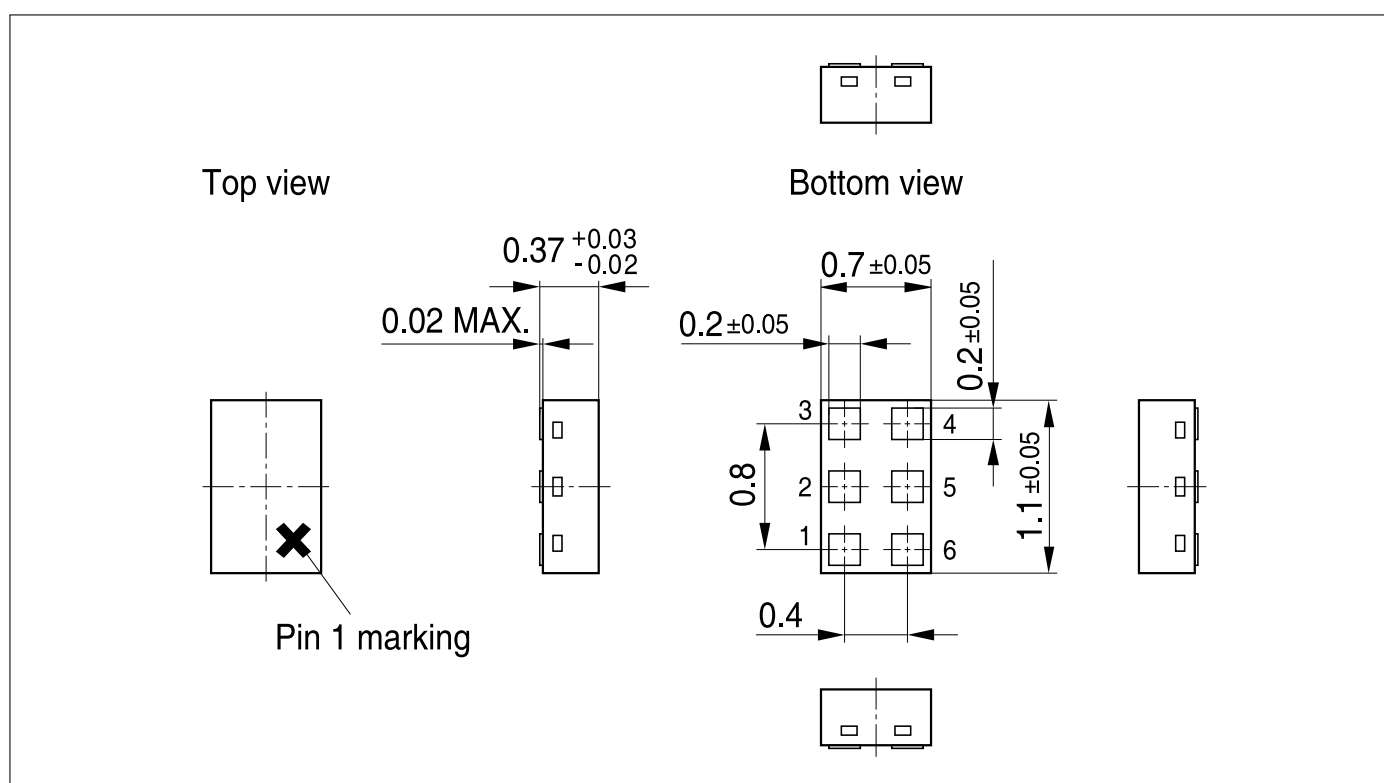
## 0.05–9 GHz SPDT switch with fast switching speed

### Package information

## 5 Package information

**Table 13: Mechanical data**

Parameter	Symbol	Value	Unit
X-dimension	$X$	$0.7 \pm 0.05$	mm
Y-dimension	$Y$	$1.1 \pm 0.05$	mm
Size	Size	0.77	mm <sup>2</sup>
Height PG-TSNP-6-10	$H$	$0.37 + 0.03 / - 0.02$	mm
Height PG-TSNP-6-2	$H$	$0.375 + 0.025 / - 0.015$	mm

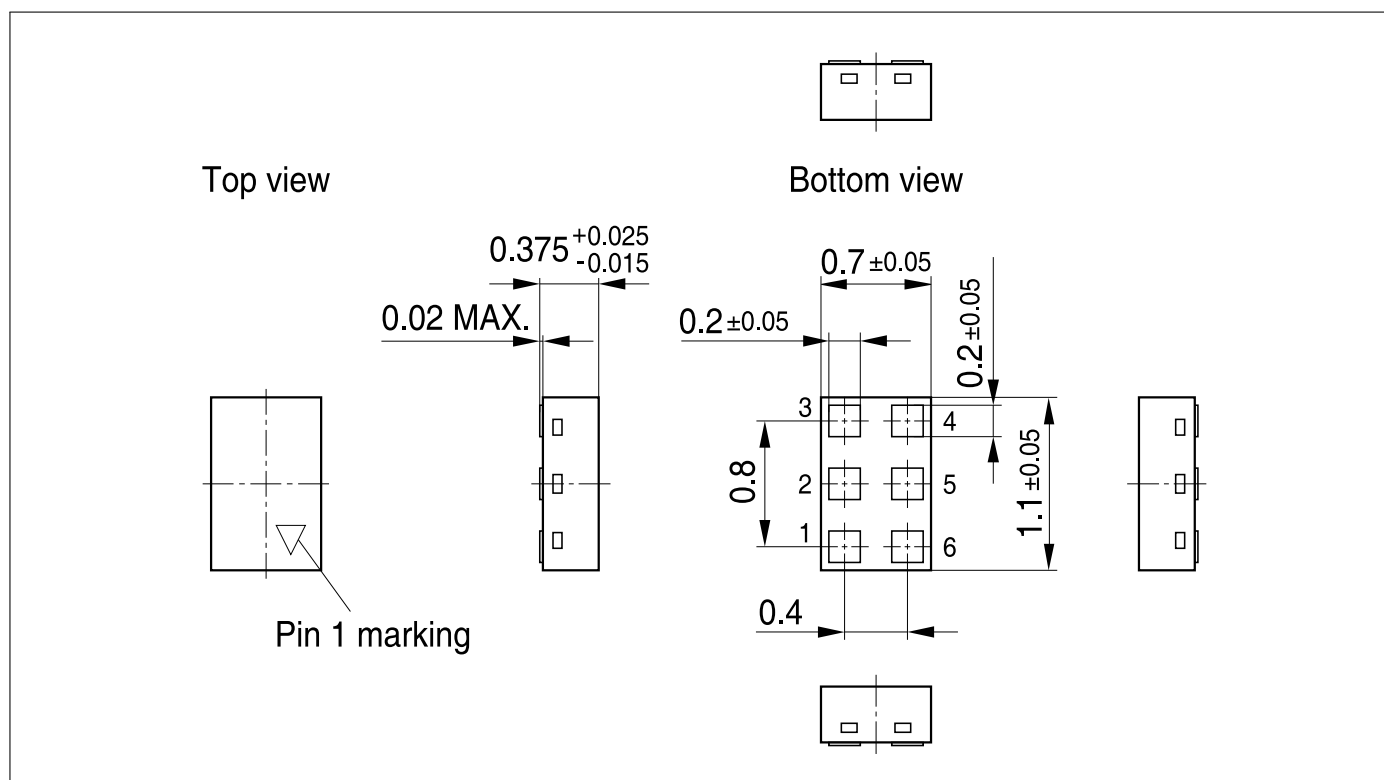


**Figure 3:** PG-TSNP-6-10 package outline (top, side and bottom views)

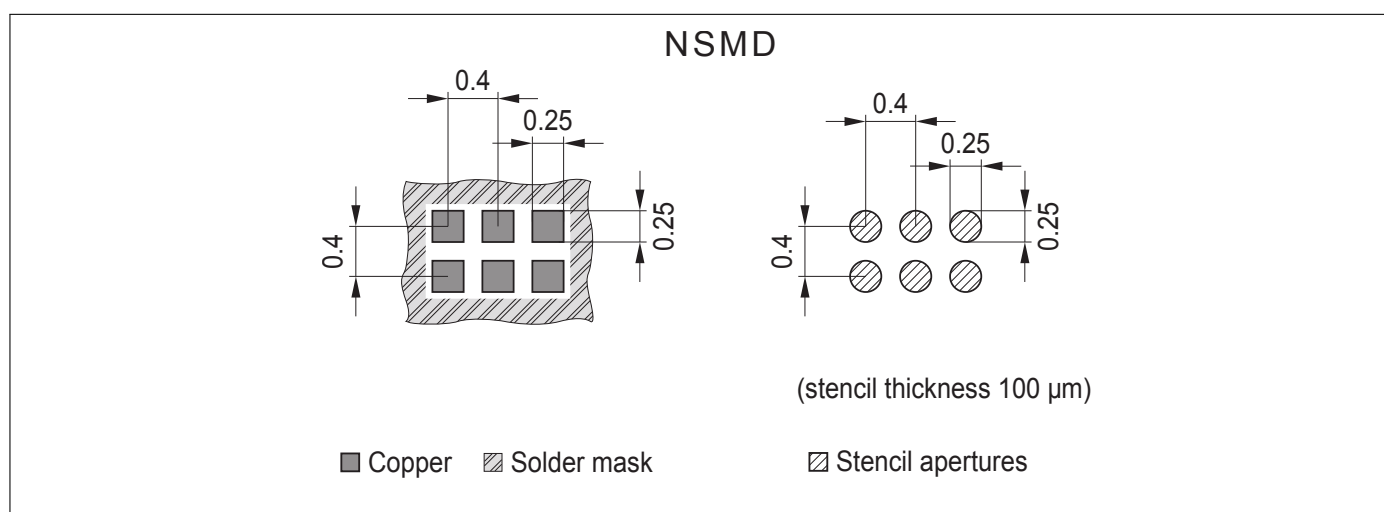
# BGS12WN6

## 0.05–9 GHz SPDT switch with fast switching speed

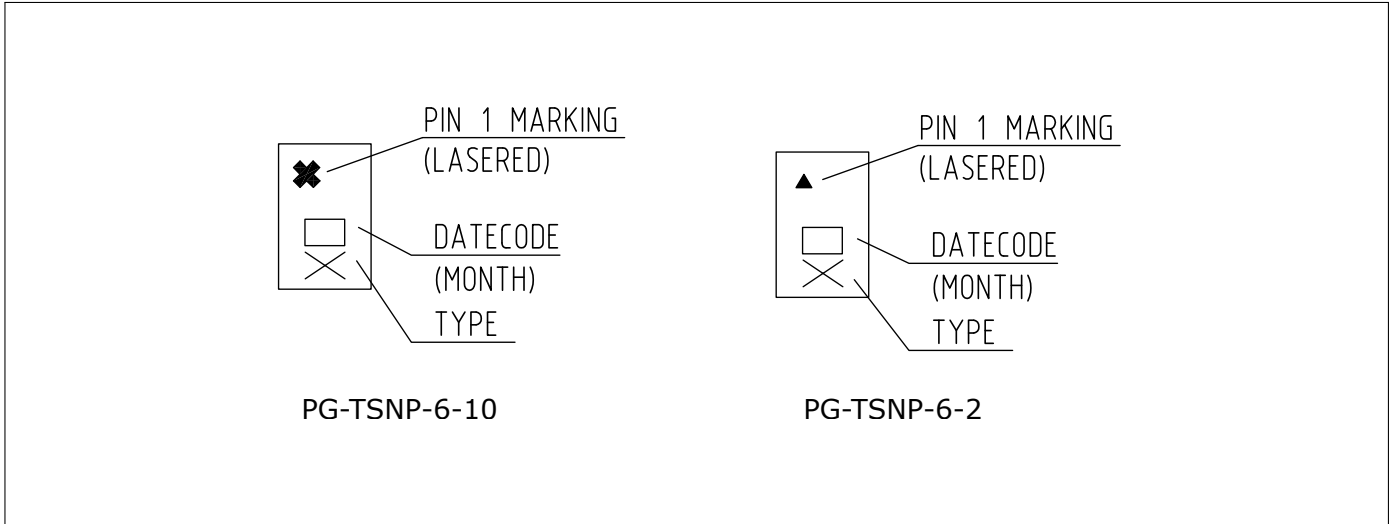
### Package information



**Figure 4:** PG-TSNP-6-2 package outline (top, side and bottom views)



**Figure 5:** Footprint recommendation



**Figure 6:** Marking specification (top view). Monthly date code specified in Table 14.

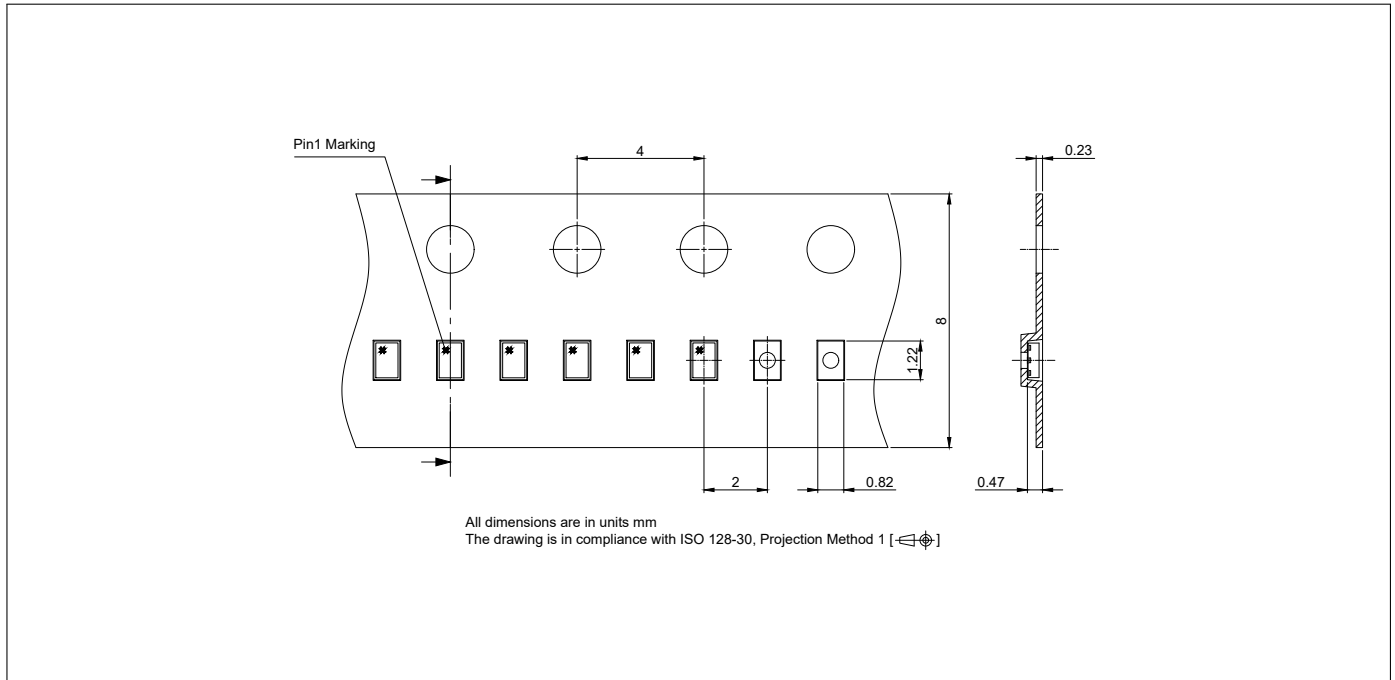
**Table 14: Monthly date code marking**

Month	2018	2019	2020	2021	2022	2023	2024	2025	2026
1	P	a	p	A	P	a	p	A	P
2	Q	b	q	B	Q	b	q	B	Q
3	R	c	r	C	R	c	r	C	R
4	S	d	s	D	S	d	s	D	S
5	T	e	t	E	T	e	t	E	T
6	U	f	u	F	U	f	u	F	U
7	V	g	v	G	V	g	v	G	V
8	X	h	x	H	X	h	x	H	X
9	Y	j	y	J	Y	j	y	J	Y
10	Z	k	z	K	Z	k	z	K	Z
11	4	l	2	L	4	l	2	L	4
12	5	n	3	N	5	n	3	N	5

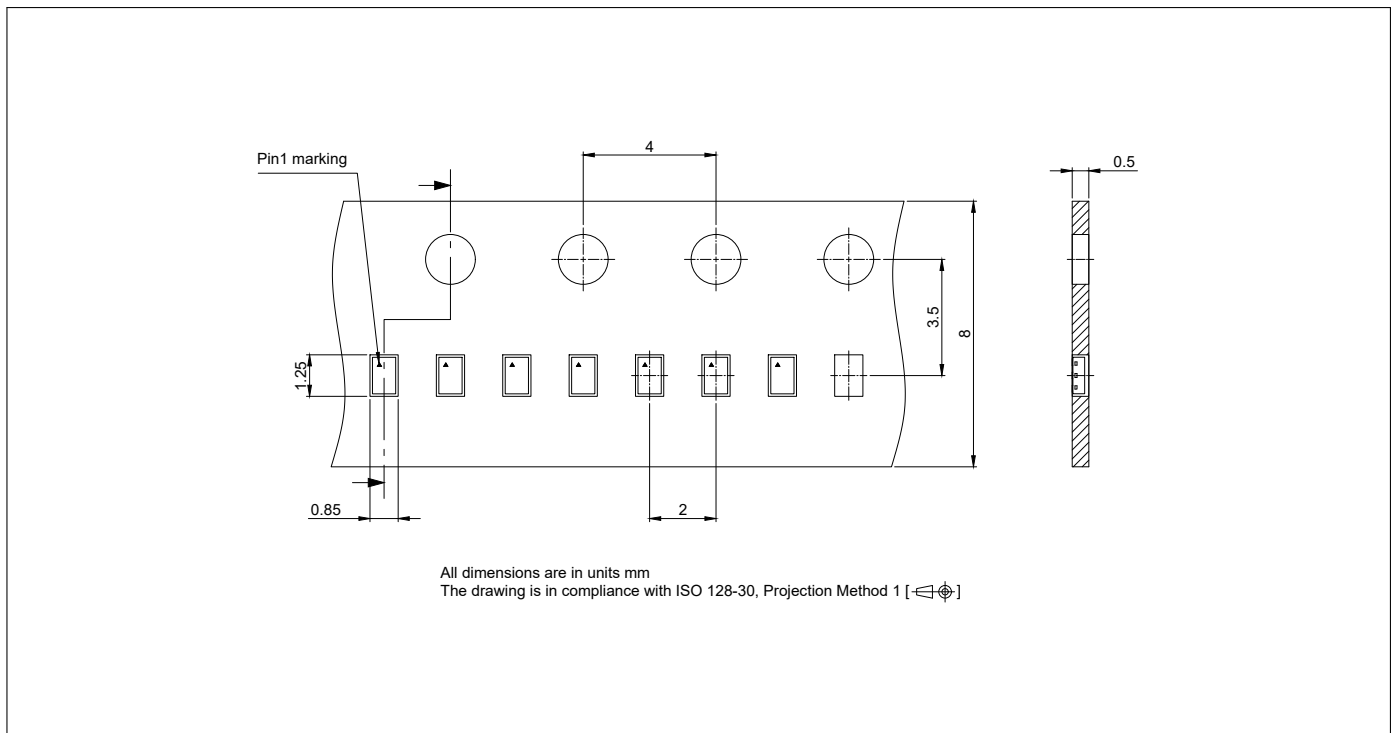
# BGS12WN6

## 0.05–9 GHz SPDT switch with fast switching speed

### Package information



**Figure 7:** PG-TSNP-6-10 carrier tape drawing (top and side view)



**Figure 8:** PG-TSNP-6-2 carrier tape drawing (top and side view)

# BGS12WN6

## 0.05–9 GHz SPDT switch with fast switching speed

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### Revision History

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#### Revision v2.8, 2024-10-01

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Page or Item	Subjects (major changes since previous revision)
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#### Revision 2.9, 2026-04-24

13	Figure 7 and 8 carrier tape drawing updated

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