BGS13S4N9

Wideband RF SP3T Switch

Data Sheet

Revision 1.0 - 2016-04-12
Final

Power Management & Multimarket

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Information

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Revision History

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Page	**Subjects (major changes since last revision)**

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BGS13S4N9 Wideband RF SP3T Switch

1 Features

- 3 high-linearity TRx paths with power handling capability of up to 30 dBm
- Low insertion loss
- Low harmonic generation
- High port-to-port-isolation
- Suitable for Edge / CDMA2000 / LTE / WCDMA applications
- 0.1 to 3.0 GHz coverage
- No decoupling capacitors required if no DC applied on RF lines
- On-chip control logic including ESD protection
- General Purpose Input-Output (GPIO) Interface
- Small form factor 1.1 mm x 1.1 mm x 0.375 mm
- No power supply blocking required
- High EMI robustness
- RoHS and WEEE compliant package

RoHS

2 Product Description

The BGS13S4N9 RF MOS switch is specifically designed for cell phone and mobile applications. Any of the 3 ports can be used as termination of the diversity antenna handling up to 30 dBm.
This SP3T offers low insertion loss and high robustness against interferer signals at the antenna port and low harmonic generation in termination mode. The on-chip controller integrates CMOS logic and level shifters, driven by control inputs from 1.35 V to VDD . The BGS13S4N9 RF Switch 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. The device has a very small size of only 1.1 x 1.1 mm^2 and a maximum height of 0.375 mm.

No decoupling capacitors are required in typical applications as long as no DC is applied to any RF port.

Table 1: Ordering Information

Type	Package	Marking
BGS13S4N9	TSNP-9-3	W

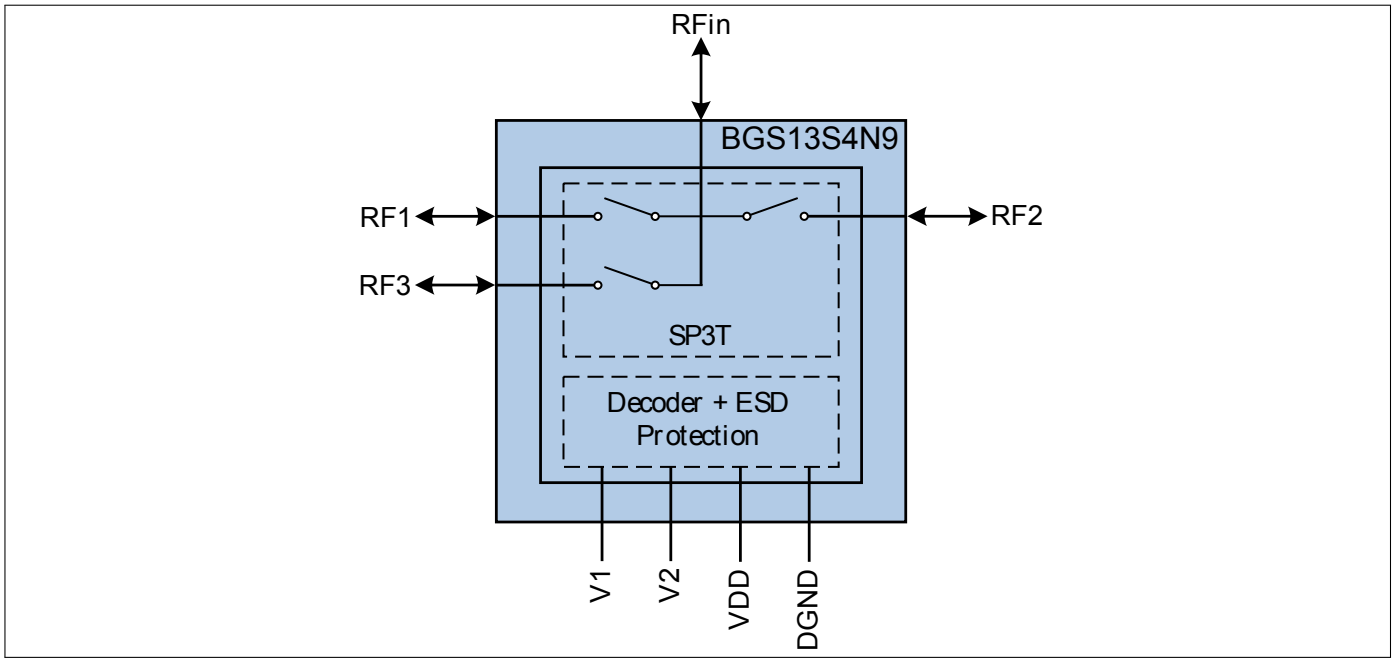

Figure 1: BGS13S4N9 Block Diagram

3 Maximum Ratings

Stresses above the maximum 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.

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	0.1	–	3.0	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 Rx ports	P_{RF_Rx}	–	–	32	dBm	CW
ESD capability, CDM[2]	V_{ESD_CDM}	-1000	–	+1000	V	All pins
ESD capability, HBM[3]	V_{ESD_HBM}	-1000	–	+1000	V	All pins excluding RFin
		-1000	–	+1000	V	RFin vs. other pins
ESD capability, system level[4]	V_{ESD_ANT}	-8000	–	+8000	V	ANT versus system GND, with 16 nH shunt inductor Type LQW15AN16NG80

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

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

4 Operation Ranges

Table 4: Operation Ranges

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Supply voltage	V_{DD}	1.8	–	3.3	V	–
Supply current[1)]	I_{DD}	–	80	150	µA	–
GPIO control voltage high	V_{Ctrl_H}	1.35	–	V_{DD}	V	–
GPIO control voltage low	V_{Ctrl_L}	-0.3	–	0.43	V	–
GPIO control input capacitance	C_{Ctrl}	–	–	2	pF	–
Ambient temperature	T_A	-40	25	85	°C	–

[1)] T_A = –40 °C - 85 °C, V_{DD}= 1.8 - 3.3 V

Table 5: RF Input Power

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Rx ports (50 Ω)	P_{RF_Rx}	–	–	30	dBm	–

5 RF Characteristics

Table 6: RF Characteristics at T_A = –40 °C–85 °C, P_{IN} = 0 dBm, Supply Voltage V_{DD}= 1.8 V–3.3 V, Z_0 = 50 Ohm, unless otherwise specified

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Insertion Loss						
All Rx Ports	IL	0.10	0.20	0.25	dB	824–915 MHz
		0.20	0.30	0.40	dB	1710–1910 MHz
		0.25	0.40	0.60	dB	2170–2500 MHz
		0.40	0.55	0.65	dB	2700MHz
Insertion Loss[1]						
All Rx Ports	IL	0.15	0.20	0.25	dB	824–915 MHz
		0.25	0.30	0.35	dB	1710–1910 MHz
		0.35	0.40	0.50	dB	2170–2500 MHz
		0.50	0.55	0.65	dB	2700MHz
Return Loss						
All Rx Ports	RL	28	31	33	dB	824–915 MHz
		18	20	24	dB	1710–1910 MHz
		15	18	20	dB	2170–2500 MHz
		13	14	16	dB	2700MHz
Isolation[1]						
RFin to RF1/RF2/RF3[2]	ISO_{In-RFx}	31	33	–	dB	824–915 MHz
		23	27	–	dB	1710–1910 MHz
		17	22	–	dB	2170–2500 MHz
		16	21	–	dB	2700MHz
RF1 to RF2 / RF2 to RF1[3] RF1 to RF3 / RF3 to RF1[4] RF2 to RF3 / RF3 to RF2[5]	$ISO_{port-port}$	32	34	–	dB	824–915 MHz
		21	25	–	dB	1710–1910 MHz
		17	23	–	dB	2170–2500 MHz
		15	19	–	dB	2700MHz

[1] T_A = 25 °C, V_{DD} = 3V
[2] Any RF Port ON
[3] RF1 ON
[4] RF3 ON
[5] RF2 ON

Table 7: RF Characteristics at T_A = –40 °C–85 °C, P_{IN} = 0 dBm, Supply Voltage V_{DD}= 1.8 V–3.3 V, Z_0 = 50 Ohm, unless otherwise specified

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
P0.1 dB Compression Point, Extrapolated						
All Rx Ports	$P_{0.1dB}$	34	–	–	dBm	698–960 MHz
Harmonic Generation up to 12.75 GHz						
H2	P_{Harm}	–	-80	-70	dBc	27 dBm, 50 Ω, CW mode
H3	P_{Harm}	–	-80	-70	dBc	27 dBm, 50 Ω, CW mode
Intermodulation Distortion in Rx Band[1] (T_A = 25 °C)						
IMD2	IMD2	–	-110	-100	dBm	Tx = 10 dBm, Interferer = –15 dBm, 50 Ω
IMD3	IMD3	–	-115	-100	dBm	
Switching Time						
RF Rise Time	$t_{on/off}$	–	0.085	–	µs	10 % to 90 % RF ON; 90 % to 10 % RF OFF
Ctrl to RF Time	$t_{Ctrl-RF}$	–	0.55	–	µs	50 % of Ctrl Signal to 90 % of RF Signal

[1] With external shunt inductor

6 GPIO Specification

Table 8: Modes of Operation Truth Table

		Control Inputs				
State	**Mode**	**V1**	**V2**	**RF1**	**RF2**	**RF3**
1	Isolation	0	0	off	off	off
2	RFin - RF1	1	0	on	off	off
3	RFin - RF2	0	1	off	on	off
4	RFin - RF3	1	1	off	off	on

7 Pin Definition and Package Outline

Table 9: Pin Configuration

No	Name	Pin Type	Buffer Type	Function
1	V1	I		Control Pin 1
2	RF3	I/O		RF-Port3
3	RF1	I/O		RF-Port1
4	RFin	I/O		RF-Input
5	RF2	I/O		RF-Port2
6	DGND	GND		Digital Ground
7	VDD	PWR		Power Supply
8	V2	I		Control Pin 2
9	GND	GND		Ground

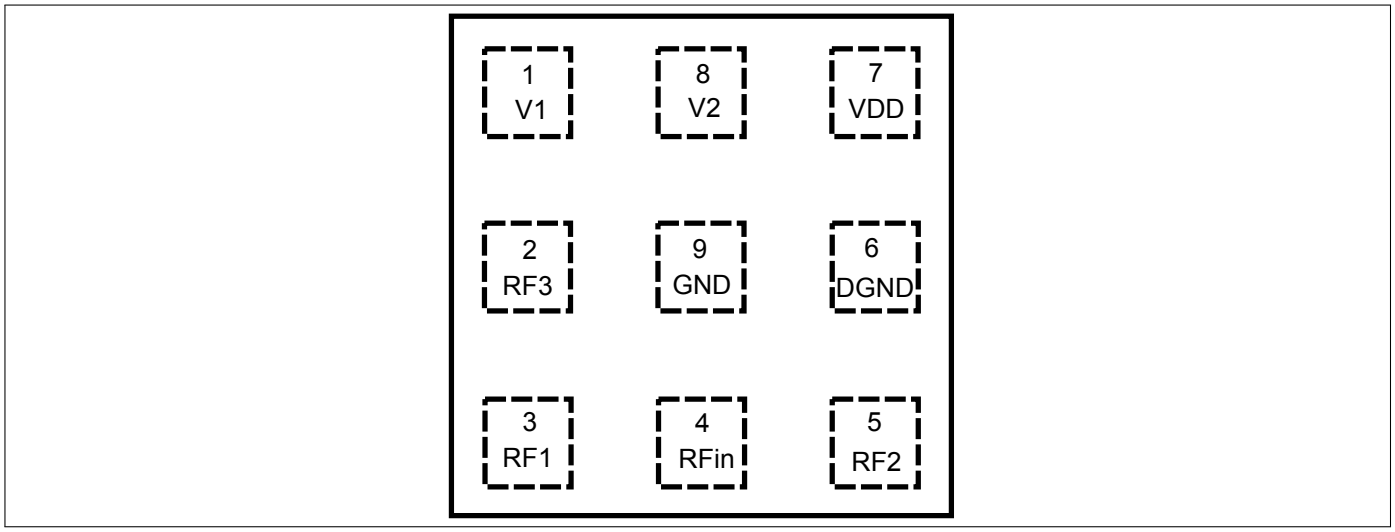

Figure 2: Pin out (top view)

Table 10: Mechanical Data

Parameter	Symbol	Value	Unit
X-Dimension	X	1.1 ± 0.05	*mm*
Y-Dimension	Y	1.1 ± 0.05	*mm*
Size	Size	1.21	mm^2
Height	H	0.375 ± 0.025	*mm*
Pad-Pitch		0.4	*mm*

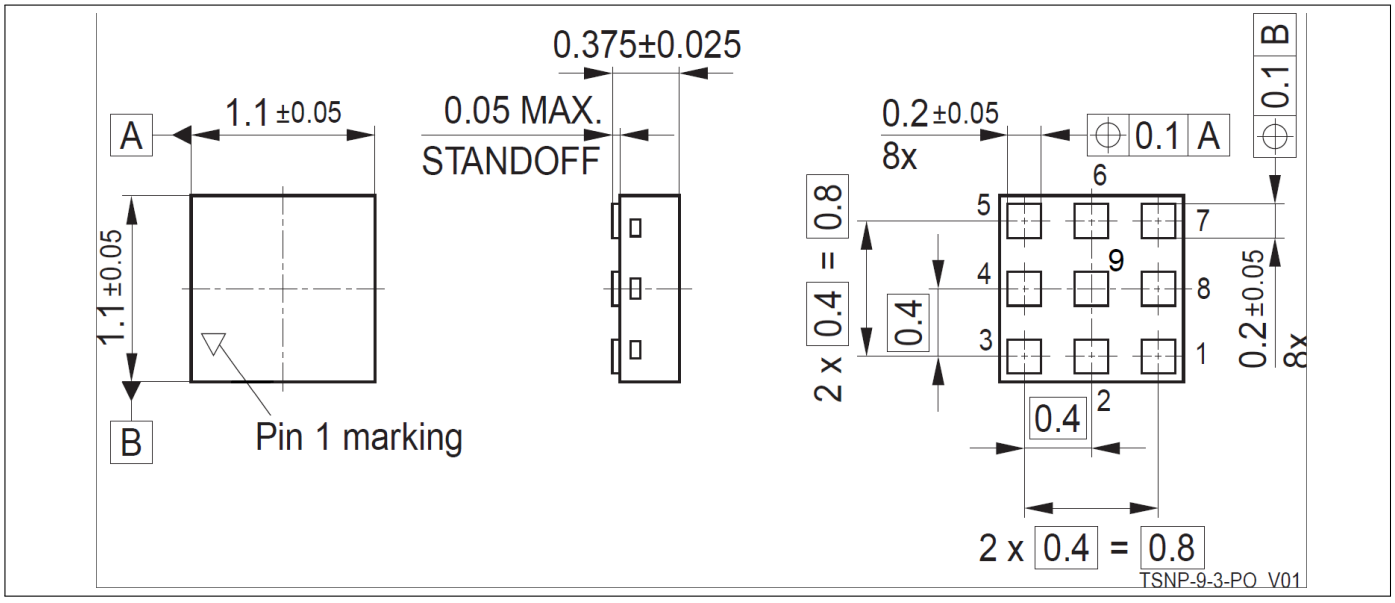

Figure 3: Package Outline (bottom and side view)

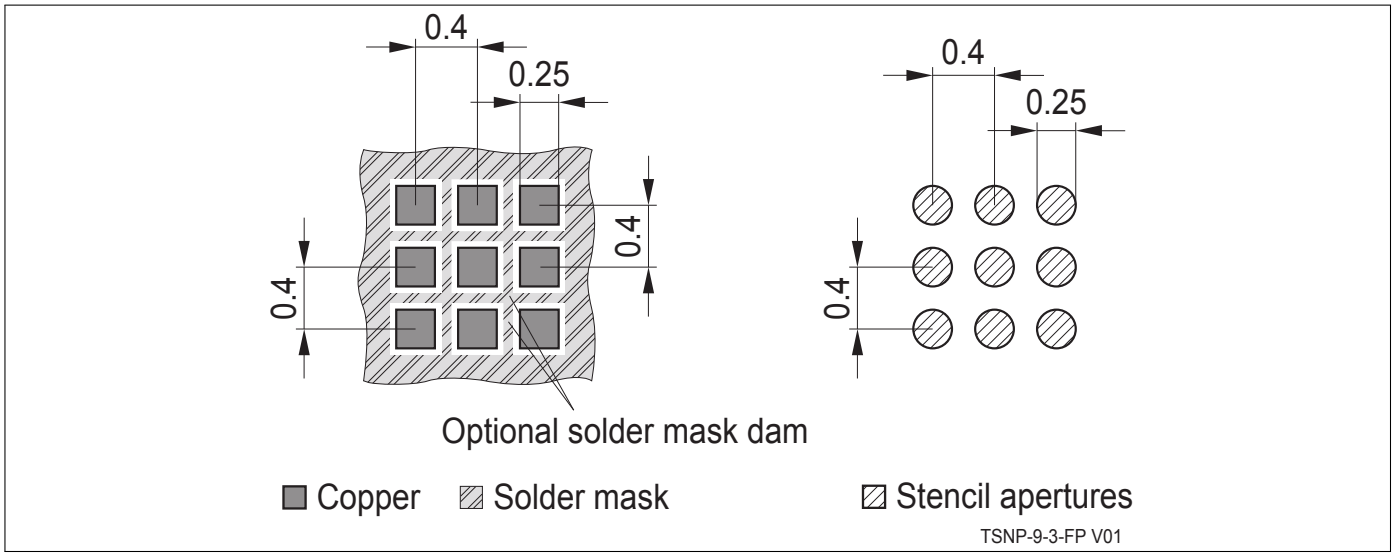

Figure 4: Land pattern and stencil mask

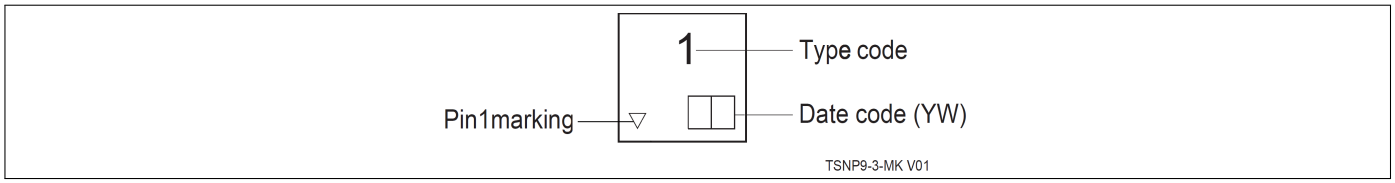

Figure 5: Marking Pattern

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

Year	"Y"	Year	"Y"	Year	"Y"
2000	0	2010	0	2020	0
2001	1	2011	1	2021	1
2002	2	2012	2	2022	2
2003	3	2013	3	2023	3
2004	4	2014	4	2024	4
2005	5	2015	5	2025	5
2006	6	2016	6	2026	6
2007	7	2017	7	2027	7
2008	8	2018	8	2028	8
2009	9	2019	9	2029	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		
10	K	21	Y	32	f	43	t		
11	L	22	Z	33	g	44	u		

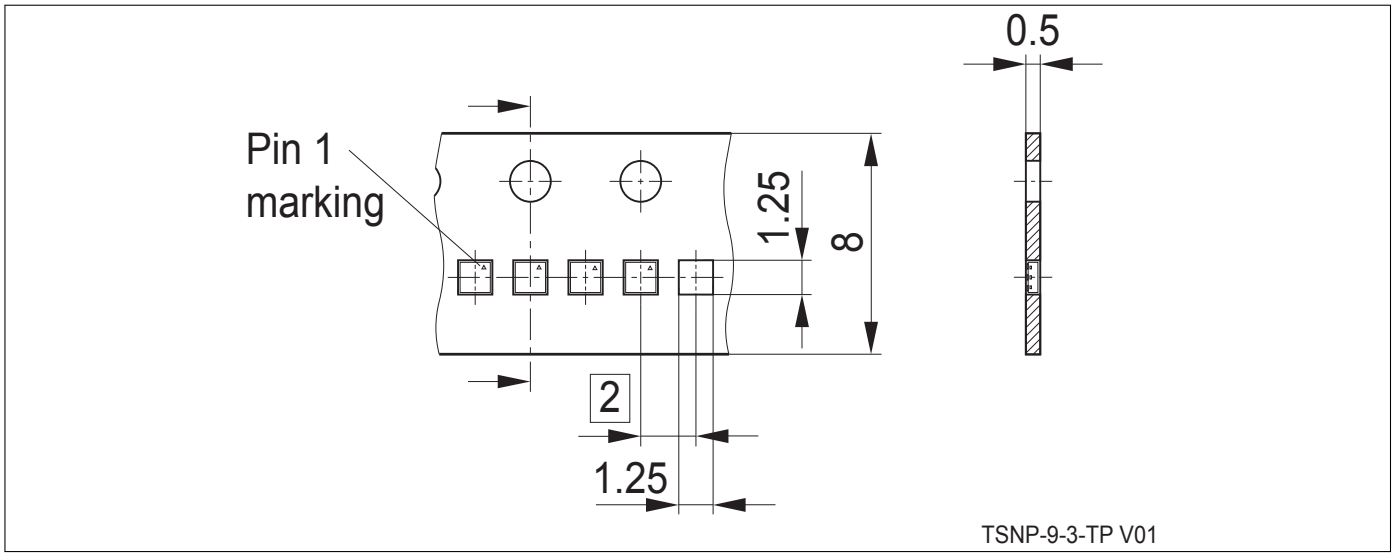

Figure 6: Tape and Reel (Reel ϕ 180 mm: 15.000 Pieces/Reel)

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