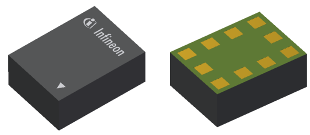
BGSX22G5A10

DPDT Antenna Cross Switch

Features

- RF CMOS DPDT antenna cross switch with power handling capability of up to 37 dBm
- Suitable for multi-mode LTE and WCDMA multi antenna applications
- Ultra-low insertion loss and harmonics generation
- 0.1 to 6.0 GHz coverage
- High port-to-port-isolation
- No decoupling capacitors required if no DC applied on RF lines
- General Purpose Input-Output (GPIO) Interface
- Small form factor 1.1mm x 1.5mm
- No power supply blocking required
- High EMI robustness
- RoHS and WEEE compliant package



$1.1 \times 1.5\ mm^2$

Product Validation

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

Block diagram

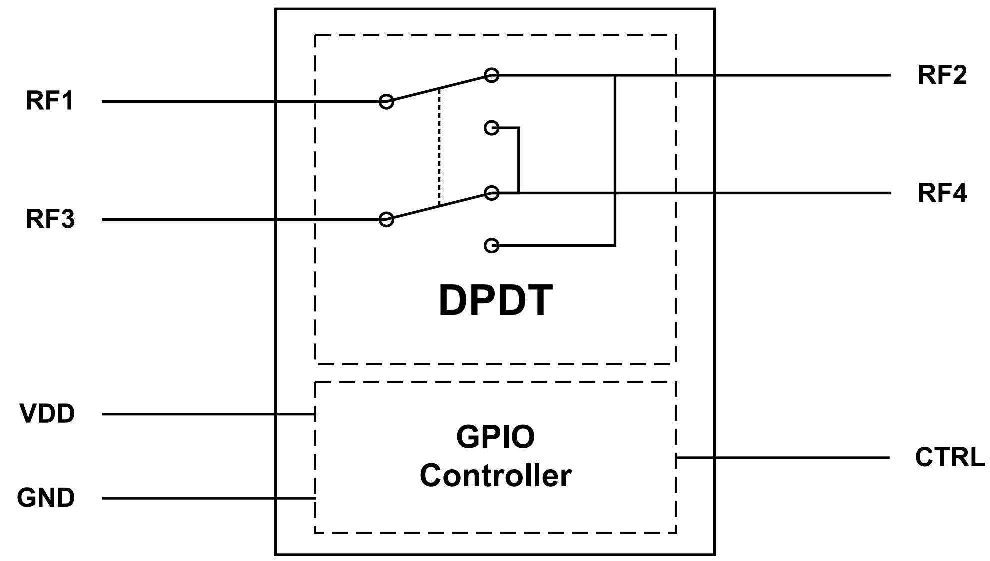


Table of Contents

Table of Contents		1
1	Features	2
2	Maximum Ratings	3
3	Operation Ranges	4
4	RF Characteristics	5
5	Modes of Operation	9
6	Application Information	9
7	Package Information	10

1 Features

- RF CMOS DPDT antenna cross switch with power handling capability of up to 37 dBm
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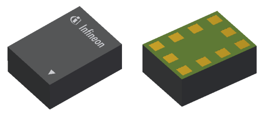

Description

The BGSX22G5A10 RF MOS switch is specifically designed for LTE and WCDMA triple antenna applications. This DPDT offers low insertion loss and low harmonic generation paired with high isolation between RF ports.
The switch is controlled via a GPIO interface. The on-chip controller allows power-supply voltages from 1.65V to 3.4V.
The switch features direct-connect-to-battery functionality and DC-free RF ports. Unlike GaAs technology, external DC blocking capacitors at the RF Ports are only required if DC voltage is applied externally. The BGSX22G5A10 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 1.5mm^2 and a maximum thickness of 0.55mm.

Product Name	Marking	Package
BGSX22G5A10	X5	ATSLP-10-50

2 Maximum Ratings

Table 1: Maximum Ratings Table at T_A = 25 °C, unless otherwise specified

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Frequency Range	f	0.1	–	6.0	GHz	1)
Supply voltage[2)]	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 RF ports	P_{RF}	–	–	39	dBm	CW / VSWR 1:1 / 50 Ω
ESD capability, CDM[3)]	V_{ESD_CDM}	-1	–	+1	kV	
ESD capability, HBM[4)]	V_{ESD_HBM}	-1	–	+1	kV	
ESD capability, system level[5)]	V_{ESD_RF}	-8	–	+8	kV	RF versus system GND, with 27 nH
Thermal resistance junction - soldering point	R_{thJS}	–	–	60	K/W	–
Maximum DC-voltage on RF-Ports and RF-Ground	V_{RFDC}	0	–	0	V	No DC voltages allowed on RF-Ports
GPIO control voltage levels	V_{Ctrlx}	-0.7	–	V_{DD}+0.7 (max. 3.6V)	V	–

1) Switch has a lowpass response. For higher frequencies, losses have to be considered for their impact on thermal heating. The DC voltage at RF ports VRFDC has to be 0V.
2) Note: Consider potential ripple voltages on top of V_{DD}. Including RF ripple, V_{DD} must not exceed the maximum ratings: $V_{DD} = V_{DC} + V_{Ripple}$. Furthermore, high pulse voltages at V_{DD} pin will cause the ESD structure to trigger.
3) 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.
4) Human Body Model ANSI/ESDA/JEDEC JS-001 (R=1,5 kΩ, C=100 pF).
5) IEC 61000-4-2 (R=330 Ω, C=150 pF), contact discharge.

Warning: 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.

3 Operation Ranges

Table 2: Operation Ranges at T_A = −40 °C...85 °C, P_{IN} = 0 dBm, Supply Voltage V_{DD}= 1.65V ... 3.4V, unless otherwise specified

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Supply voltage	V_{DD}	1.65	–	3.4	V	–
Supply current	I_{DD}	–	55	–	µA	–
GPIO control voltage high	V_{Ctrl_H}	1.35	–	V_{DD} + 0.3 (max. 3.6V)	V	–
GPIO control voltage low	V_{Ctrl_L}	-0.3	–	0.45	V	–
GPIO control input capacitance	C_{Ctrl}	–	–	2	pF	–
Ambient temperature	T_A	-40	25	85	°C	–

Table 3: RF Input Power

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
RF input power	P_{RF}	–	–	37	dBm	CW / VSWR 1:1 / 50 Ω

4 RF Characteristics

Table 4: RF Characteristics at T_A = 25 °C, P_{IN} = 0 dBm, Supply Voltage V_{DD} = 2.8V, unless otherwise specified

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Insertion Loss[1]						
All RF ports	IL	–	0.28	0.35	dB	699 to 960MHz
		–	0.37	0.50	dB	1710 to 2200MHz
		–	0.45	0.60	dB	2300 to 2690MHz
		–	0.60	1.20	dB	3300 to 4200MHz
		–	0.80	1.30	dB	4400 to 5000MHz
		–	1.10	1.50	dB	5150 to 5925MHz
Return Loss[1]						
All RF ports	RL	19	24	–	dB	699 to 960MHz
		15	17	–	dB	1710 to 2200MHz
		14	16	–	dB	2300 to 2690MHz
		12	15	–	dB	3300 to 4200MHz
		10	13	–	dB	4400 to 5000MHz
		7	10	–	dB	5150 to 5925MHz

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

Table 5: RF Characteristics at T_A = −40 °C...85 °C, P_{IN} = 0 dBm, Supply Voltage V_{DD}= 1.65V ... 3.4V, unless otherwise specified

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Insertion Loss[1]						
All RF ports	IL	–	0.28	0.4	dB	699 to 960MHz
		–	0.37	0.6	dB	1710 to 2200MHz
		–	0.45	0.7	dB	2300 to 2690MHz
		–	0.60	1.3	dB	3300 to 4200MHz
		–	0.80	1.4	dB	4400 to 5000MHz
		–	1.10	1.8	dB	5150 to 5925MHz
Return Loss[1]						
All RF ports	RL	19	24	–	dB	699 to 960MHz
		14	17	–	dB	1710 to 2200MHz
		13	16	–	dB	2300 to 2690MHz
		10	15	–	dB	3300 to 4200MHz
		9	13	–	dB	4400 to 5000MHz
		6	10	–	dB	5150 to 5925MHz

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

Table 6: RF Characteristics at T_A = −40 °C...85 °C, P_{IN} = 0 dBm, Supply Voltage V_{DD}= 1.65V ... 3.4V, unless otherwise specified

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Isolation[1)]						
State 1 RF1-RF3, RF2-RF4	ISO	47	49	–	dB	699 to 960MHz
		41	43	–	dB	1710 to 2200MHz
		39	41	–	dB	2300 to 2690MHz
		37	39	–	dB	3300 to 4200MHz
		36	39	–	dB	4400 to 5000MHz
		34	38	–	dB	5150 to 5925MHz
Isolation[1)]						
State 2 RF1-RF3, RF2-RF4	ISO	41	44	–	dB	699 to 960MHz
		35	37	–	dB	1710 to 2200MHz
		33	35	–	dB	2300 to 2690MHz
		31	33	–	dB	3300 to 4200MHz
		31	33	–	dB	4400 to 5000MHz
		33	35	–	dB	5150 to 5925MHz
Isolation[1)]						
State 1 RF1-RF4, RF3-RF2	ISO	56	58	–	dB	699 to 960MHz
		49	52	–	dB	1710 to 2200MHz
		48	50	–	dB	2300 to 2690MHz
		44	49	–	dB	3300 to 4200MHz
		41	46	–	dB	4400 to 5000MHz
		38	43	–	dB	5150 to 5925MHz
Isolation[1)]						
State 2 RF1-RF2, RF3-RF4	ISO	39	41	–	dB	699 to 960MHz
		32	34	–	dB	1710 to 2200MHz
		31	33	–	dB	2300 to 2690MHz
		28	30	–	dB	3300 to 4200MHz
		28	29	–	dB	4400 to 5000MHz
		29	31	–	dB	5150 to 5925MHz
Harmonic Generation						
H2	P_{Harm}	–	-85	-65	dBm	25 dBm, 50 Ω, CW mode
H3		–	-90	-75	dBm	25 dBm, 50 Ω, CW mode
H2, GSM LB		–	-70	-55	dBm	35 dBm, 50 Ω, 50% duty cycle
H3, GSM LB		–	-60	-55	dBm	35 dBm, 50 Ω, 50% duty cycle
H2, GSM HB		–	-70	-55	dBm	33 dBm, 50 Ω, 50% duty cycle
H3, GSM HB		–	-60	-55	dBm	33 dBm, 50 Ω, 50% duty cycle
Intermodulation Distortion IMD2						
IIP2, low	IIP2,l	110	125	–	dBm	IIP2 conditions, Tab. 7
IIP2, high	IIP2,h	110	130	–	dBm	
Intermodulation Distortion IMD3						
IIP3	IIP3	65	80	–	dBm	IIP3 conditions, Tab. 8

1) Measured on application board without any external matching components.

Table 7: 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	24	190	-10
Band 1 High	2140	1950	24	4090	-10
Band 5 High	880	835	24	1715	-10
Band 7 Low	2655	2535	24	120	-10
Band 7 High	2655	2535	24	5190	-10

Table 8: 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 Low	2140	1950	24	95	-10
Band 1 Mid	2140	1950	24	1760	-10
Band 1 High	2140	1950	24	6040	-10
Band 5 Low	880	835	24	22.5	-10
Band 5 Mid	880	835	24	790	-10
Band 5 High	880	835	24	2550	-10
Band 7 Low	2655	2535	24	60	-10
Band 7 Mid	2655	2535	24	2415	-10
Band 7 High	2655	2535	24	7725	-10

Table 9: Switching Time at T_A = 25 °C, P_{IN} = 0 dBm, Supply Voltage V_{DD}= 1.65V ... 3.4V, unless otherwise specified

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Switching Time						
RF Rise Time	t_{RT}	–	–	1	µs	10 % to 90 % RF signal
Switching Time	t_{ST}	–	3	4	µs	50 % Ctrl signal to 90 % RF signal
Power Up Settling Time	t_{Pup}	–	10	25	µs	After power down mode

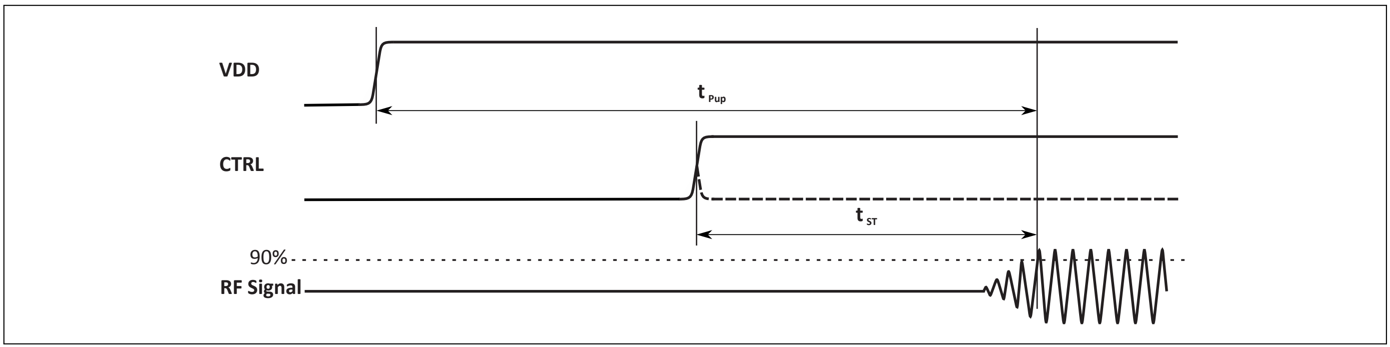

Figure 1: Power Up Settling Time and Switching Time

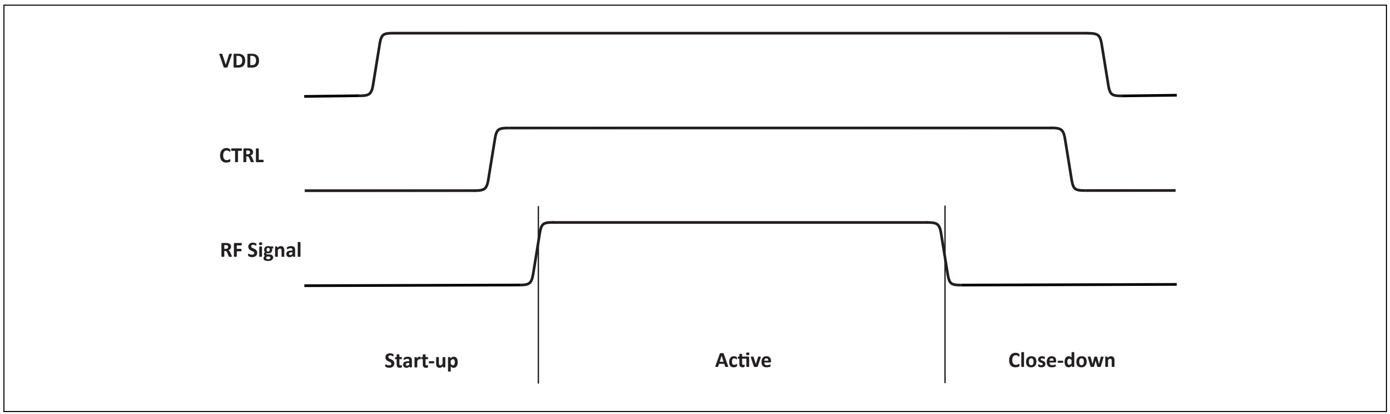

Figure 2: Power On and Off Sequence

5 Modes of Operation

Table 10: Modes of Operation (Truth Table)

		Control Input
State	**Mode**	**CTRL**
1	RF1 - RF2	0
	RF3 - RF4	
2	RF1 - RF4	1
	RF3 - RF2	

6 Application Information

Pin Configuration and Function

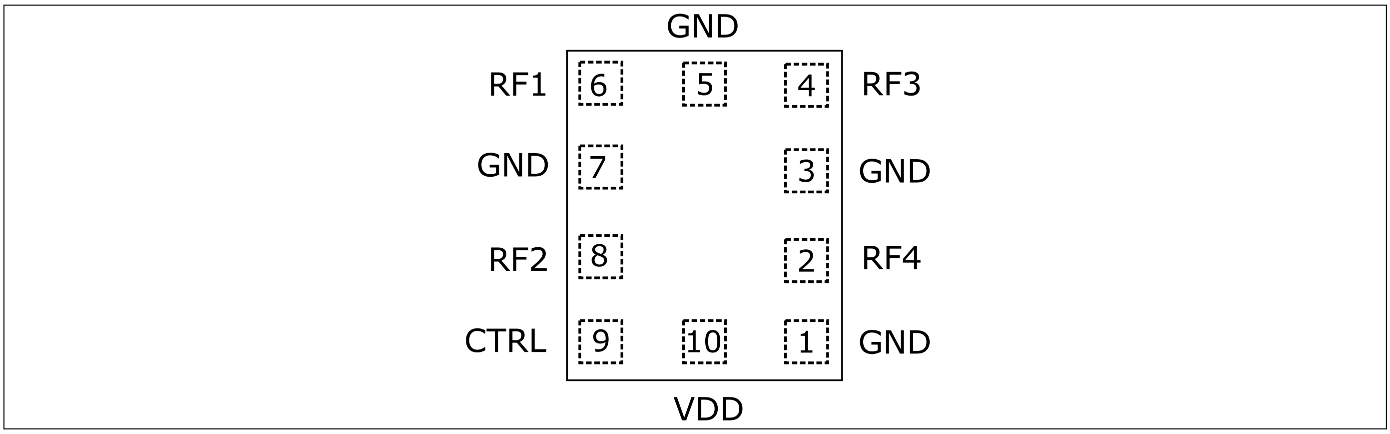

Figure 3: BGSX22G5A10 Pin Configuration (top view)

Table 11: Pin Definition and Function

Pin No.	Name	Function
1	GND	DC ground
2	RF4	RF port 4
3	GND	RF ground
4	RF3	RF port 3
5	GND	RF ground
6	RF1	RF port 1
7	GND	RF ground
8	RF2	RF port 2
9	CTRL	GPIO control pin
10	VDD	Power supply

7 Package Information

Table 12: 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*	0.55 ± 0.05	mm

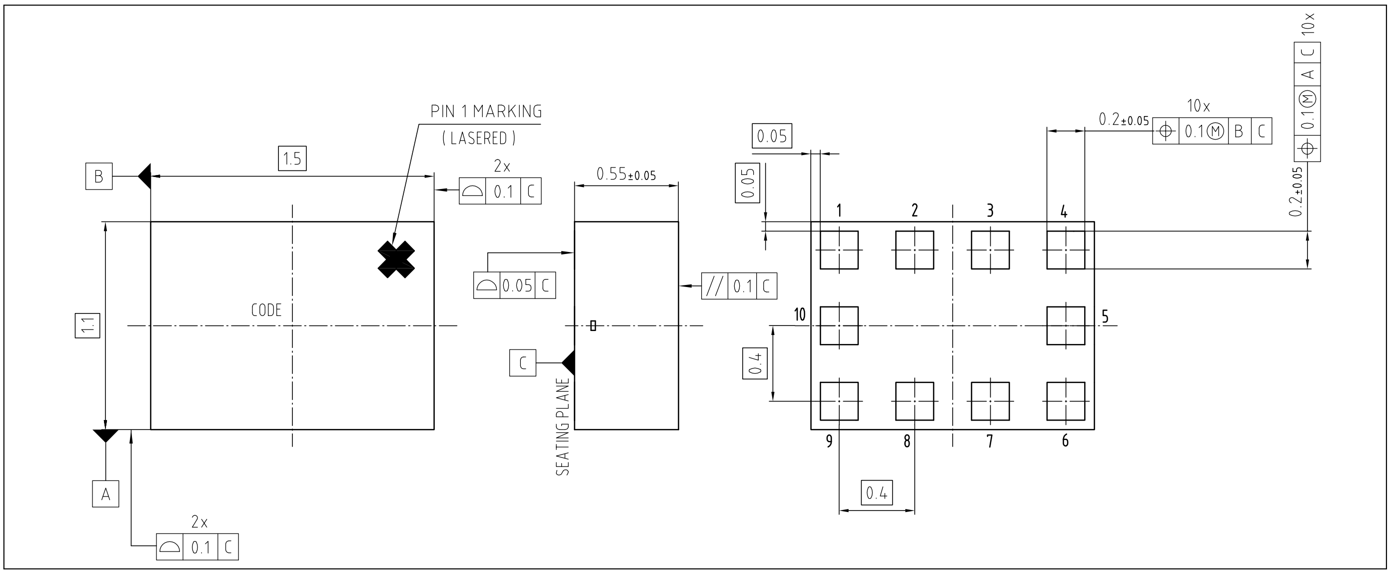

Figure 4: ATSLP-10-50 Package Outline (top, side and bottom views)

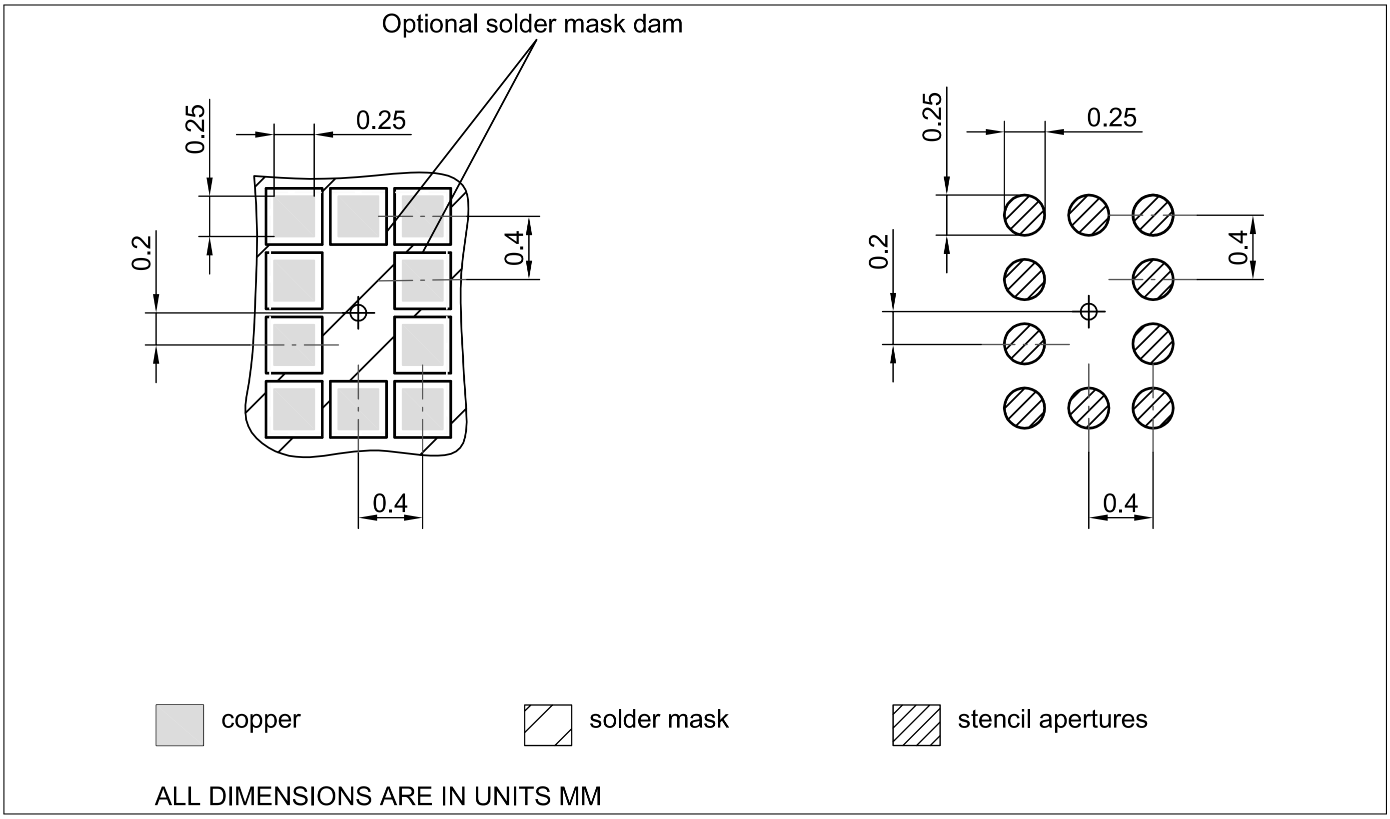

Figure 5: Footprint Recommendation

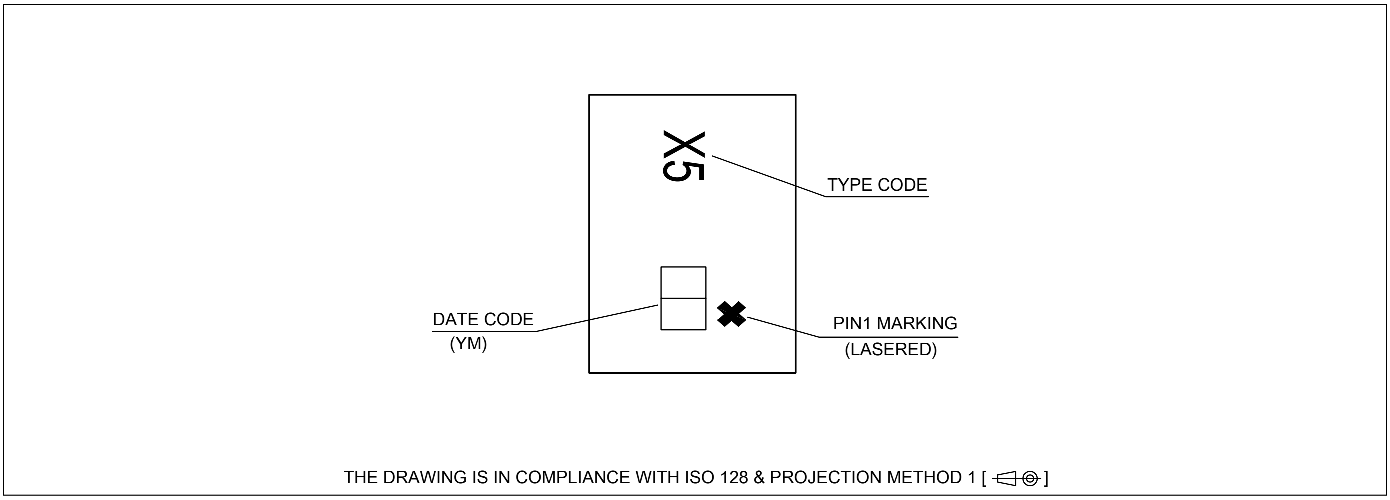

Figure 6: Marking Specification (top view): Date code digits Y and W defined in Table 13/14

Table 13: 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 14: 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		

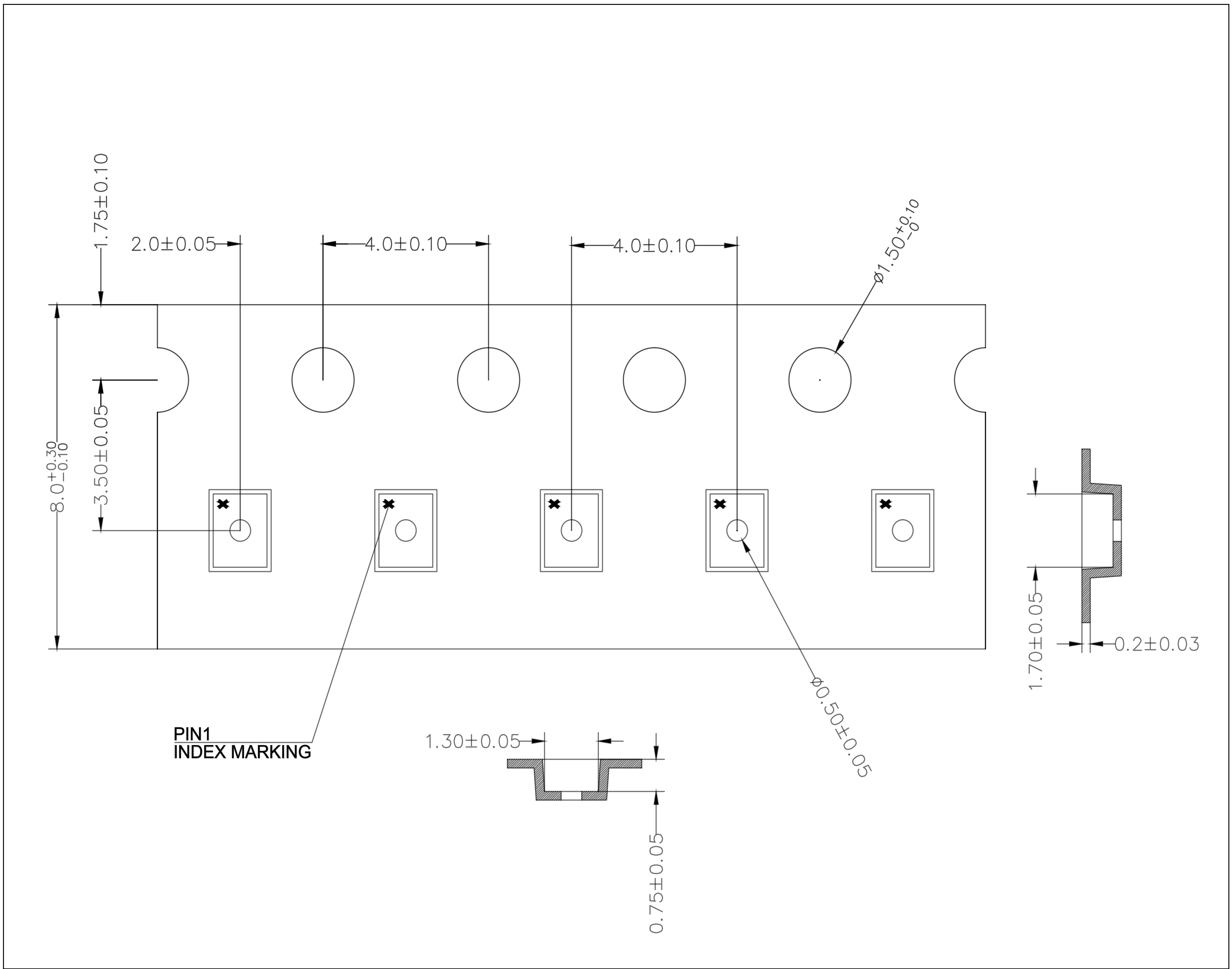

Figure 7: ATSLP-10-50 Carrier Tape

Revision History	
Page or Item	Subjects (major changes since previous revision)
Revision 8.1, 2018-10-01	
5	RF Characteristics update

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