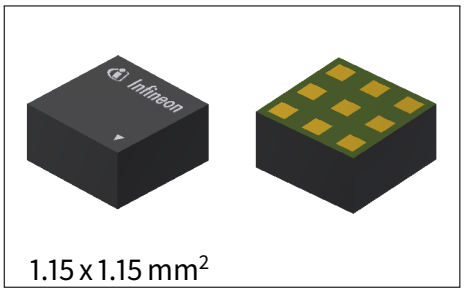
BGM12LBA9

SP2T Low Noise Amplifier Multiplexer Module with Bypass

Features

- Wideband operating frequencies: 703 - 960 MHz
- Insertion power gain: 13.3 dB
- Insertion loss in bypass mode: 3.2 dB
- Ultra low noise figure: 0.7 dB
- Low current consumption: 5.2 mA
- Multi-state control: OFF-, Bypass- and Gain-Mode
- Small ATSLP leadless package



Product Validation

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

Application

The LTE data rate can be significantly improved by using the LNA Multiplexer Module (LMM). The integrated bypass function increases the overall system dynamic range and leads to more flexibility in the front-end. In high gain mode the LMM offers best Noise Figure to ensure high data rates even on the LTE cell edge. Closer to the basestation the bypass mode can be activated reducing current consumption. Thanks to the GPIO control interface, control lines are reduced to a minimum. Up to two 3GPP LTE bands in the low-band can be controlled and dynamically amplified with one Low Noise Amplifier. This reduces PCB area and system cost.

Block diagram

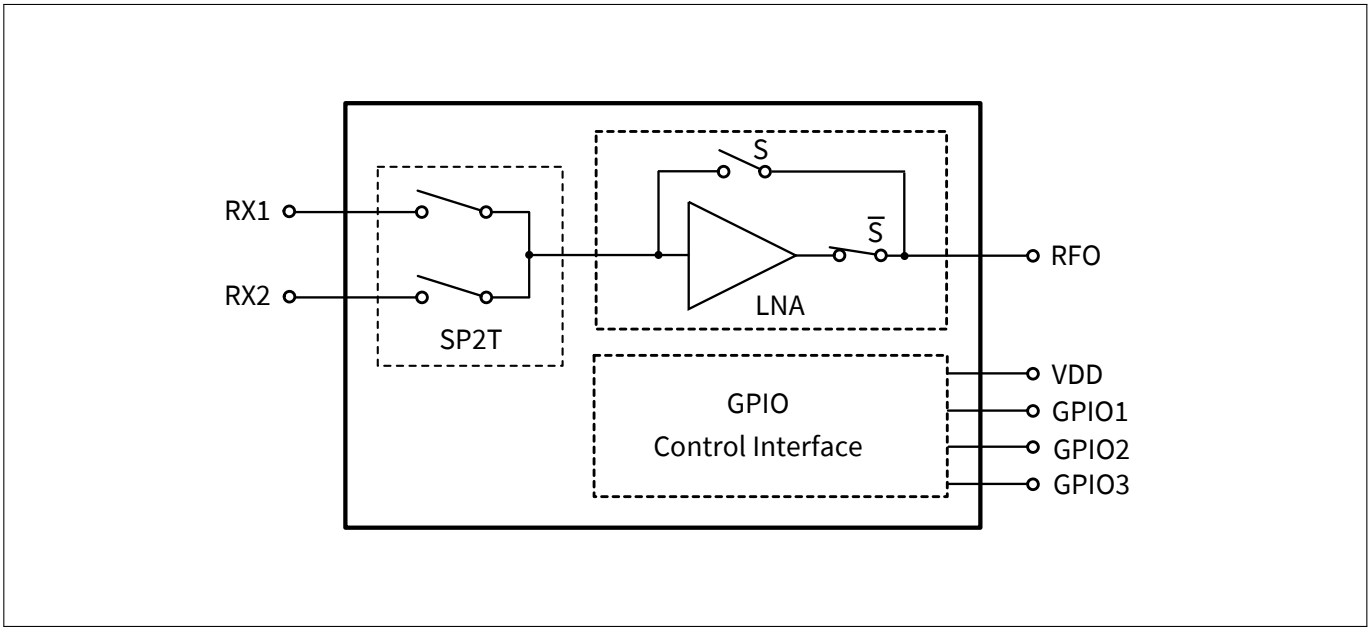
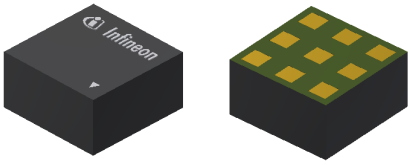


Table of Contents

1 Features



- Power gain: 13.3 dB
- Ultra low noise figure: 0.7 dB
- Low current consumption: 5.2 mA
- Wideband frequency range from 703 to 960 MHz
- RF output internally matched to 50 Ω
- High port-to-port-isolation
- Suitable for LTE / LTE-Advanced and 3G applications
- No decoupling capacitors required if no DC applied on RF lines
- On chip control logic including ESD protection
- Supply voltage: 1.6 to 3.1 V
- General Purpose Input-Output (GPIO) Interface
- Small form factor 1.15 mm x 1.15 mm
- High EMI robustness
- RoHS and WEEE compliant package

Description

The BGM12LBA9 is a LNA multiplexer module for LTE Low-band frequencies that increases the data rate while keeping flexibility and low footprint. It is a perfect solution for multimode handsets for 3G, 4G and Carrier Aggregation. The device configuration is shown in Fig. 1.

Product Name	Marking	Package
BGM12LBA9	2L	ATSLP-9-1

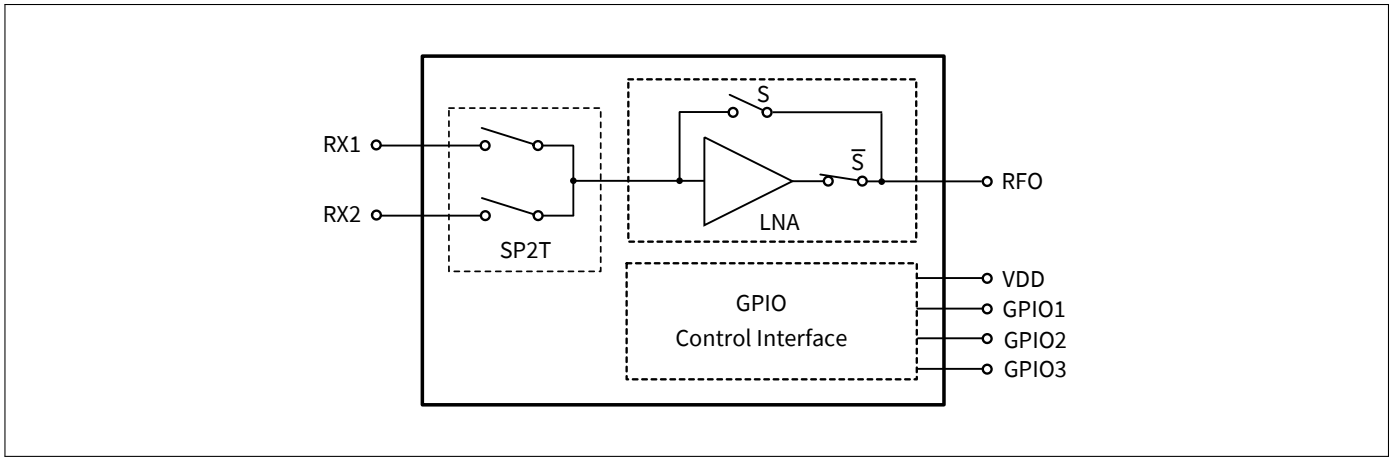


Figure 1: BGM12LBA9 Block diagram

2 Maximum Ratings

Table 1: Maximum Ratings

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Supply Voltage VDD	V_{DD}	0.3	–	3.6	V	[1]
Voltage at RF pins Rx	V_{Rx}	-0.3	–	0.9	V	–
Voltage at RF output pin RFO	V_{RFO}	-0.3	–	V_{DD} + 0.3	V	–
Voltage at GND pins	V_{GND}	-0.3	–	0.3	V	–
Current into pin VDD	I_{DD}	–	–	16	mA	–
RF input power	P_{IN}	–	–	0	dBm	–
Total power dissipation	P_{tot}	–	–	60	mW	–
Junction temperature	T_J	–	–	150	°C	–
Ambient temperature range	T_A	-30	–	85	°C	–
Storage temperature range	T_{STG}	-55	–	150	°C	–
ESD capability, HBM	V_{ESD_HBM}	-2000	–	2000	V	[2]

[1] All voltages refer to GND-Nodes unless otherwise noted
[2] Human Body Model ANSI/ESDA/JEDEC JS-001-2014 (R = 1.5 kΩ, C = 100 pF).

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.

3 DC Characteristics

Table 3: DC Characteristics at T_A = 25 °C

Parameter [1]	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Supply Voltage	V_{DD}	1.6	2.8	3.1	V	–
Supply Current	I_{DD}	–	5.2	6.7	mA	ON Mode
		–	325	375	µA	Bypass Mode
		–	0.1	2	µA	OFF Mode

[1] Based on the application described in Chapter 6

4 RF Characteristics

Table 4: RF Characteristics in ON Mode at T_A = 25 °C, V_{DD} = 2.8 V, not used RX ports terminated with 50 Ohm

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Insertion power gain	$\|S_{21}\|^2$	11.8	13.3	14.8	dB	f = 830 MHz
Noise figure, Z_S = 50 Ω	NF	–	0.7	1.3	dB	f = 830 MHz
Input return loss	RL_{in}	10	20	–	dB	f = 830 MHz
Output return loss	RL_{out}	7	10	–	dB	f = 830 MHz
Reverse isolation RFO to RX port	$1/\|S_{12}\|^2$	16	21	–	dB	f = 830 MHz
Isolation RX to RX port	ISO	33	38	–	dB	f = 830 MHz
Isolation RX to RFO port	ISO	17	22	–	dB	f = 830 MHz
Inband input 1dB-compression point	IP_{1dB}	-10	-6	–	dBm	f = 830 MHz
Inband input 3rd-order intercept point[1]	$IIP3$	-1	4	–	dBm	f_1 = 830 MHz, $f_2 = f_1$ + 1 MHz
Stability	k	> 1	–	–		f = 20 MHz - 10 GHz

[1] Input power = −30 dBm for each tone

Table 5: RF Characteristics in Bypass Mode at T_A = 25 °C, V_{DD} = 2.8 V, not used RX ports terminated with 50 Ohm

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Insertion power gain	$\|S_{21}\|^2$	-4.2	-3.2	-2.2	dB	f = 830 MHz
Noise figure, Z_S = 50 Ω	NF	–	3.2	4.2	dB	f = 830 MHz
Input return loss	RL_{in}	4	7	–	dB	f = 830 MHz
Output return loss	RL_{out}	3	5	–	dB	f = 830 MHz
Inband input 1dB-compression point	IP_{1dB}	2	6	–	dBm	f = 830 MHz
Inband input 3rd-order intercept point[1]	IIP_3	12	17	–	dBm	f_1 = 830 MHz, $f_2 = f_1$ + 1 MHz
Transient time between ON mode and Bypass mode	t_S	–	1	3	µs	
Phase discontinuity between ON mode and Bypass mode	–	-6	–	6	°	Part to part variation after compensation in Base Band with constant value

[1] Input power = −15 dBm for each tone

5 GPIO Specification

Table 6: Modes of Operation (Truth Table)

		Control Inputs		
State	Mode	GPIO1	GPIO2	GPIO3
1	Off	0	0	0
2	RX2 Bypass	0	0	1
3	RX1 Bypass	0	1	1
4	Off	1	0	0
5	RX2 On	1	0	1
6	RX1 On	1	1	1

6 Application Information

Pin Configuration and Function

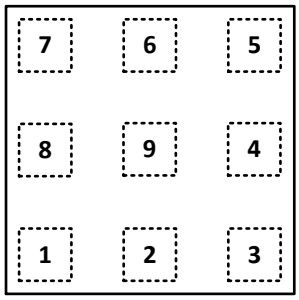


Figure 2: BGM12LBA9 Pin Configuration (top view)

Table 7: Pin Definition and Function

Pin No.	Name	Function
1	GPIO2	Control pin 2
2	VDD	Power supply
3	RFO	RF output port
4	GPIO1	Control pin 1
5	GPIO3	Control pin 3
6	NC	Not connected
7	RX2[1]	RF input port 2
8	RX1[1]	RF input port 1
9	GND	Ground

[1] Need to be terminated with 50 Ohm if not used

Application Board Configuration

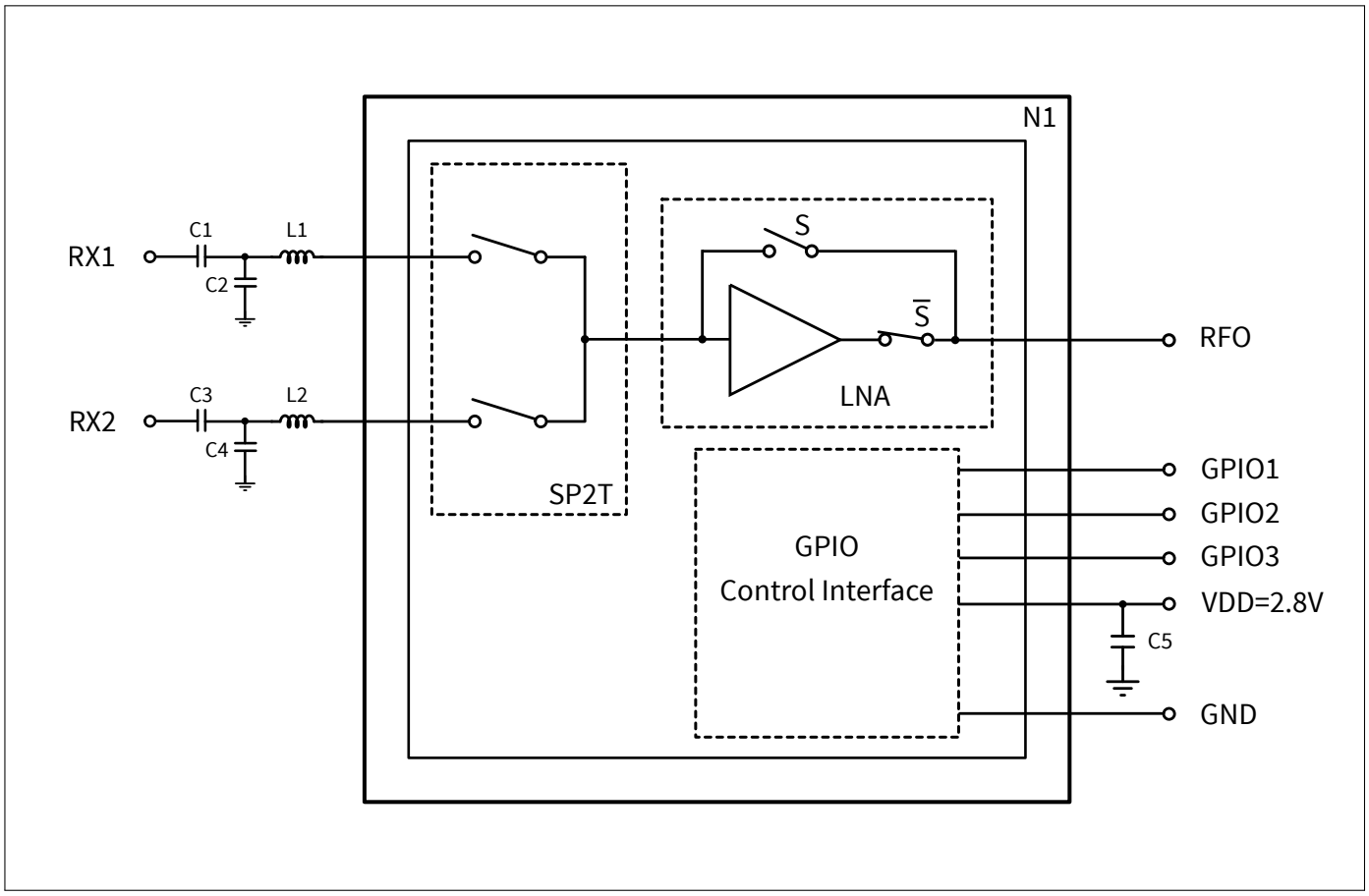


Figure 3: BGM12LBA9 Application Schematic

Table 8: Bill of Materials Table

Name	Value	Package	Manufacturer	Function
C1	1nF	0402	Various	DC block
C2	1pF	0402	Various	Input matching[1]
C3	1nF	0402	Various	DC block
C4	1pF	0402	Various	Input matching[1]
C5	$\geq$ 10nF	0402	Various	RF Bypass[2]
L1	16nH	0402	Murata LQW15 type	Input matching[1]
L2	16nH	0402	Murata LQW15 type	Input matching[1]
N1	BGM12LBA9	ATSLP-9-1	Infineon	LNA Multiplexer Module

[1]The matching elements must be optimized with reference to the frequency band of interest. Each band can be arbitrarily assigned to an RF port.
[2]RF bypass recommended to mitigate power supply noise.

7 Package Information

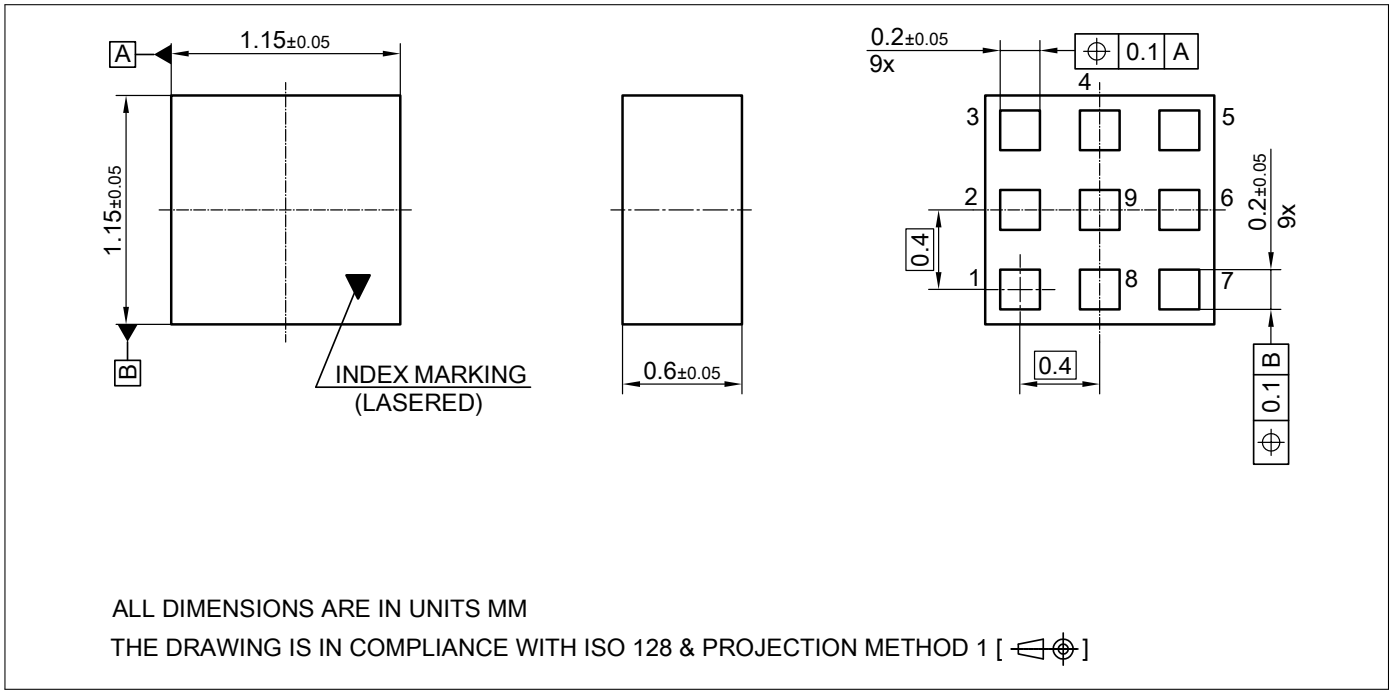


Figure 4: ATSLP-9-1 Package Outline (top, side and bottom views)

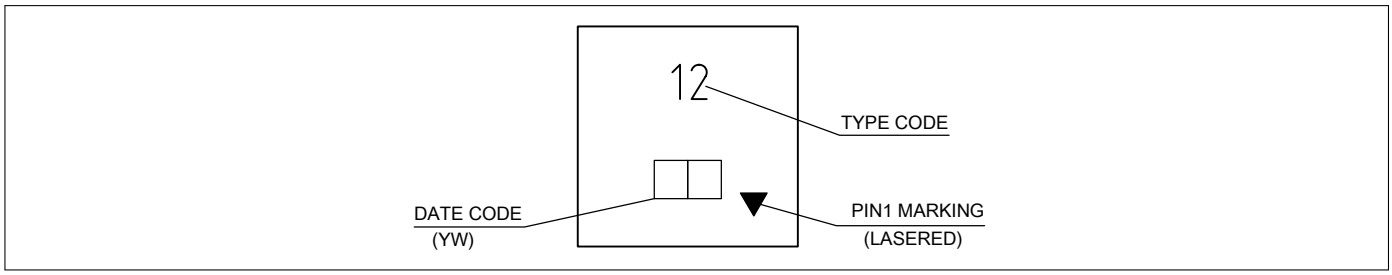


Figure 5: Marking Specification (top view)

Table 9: 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 10: 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		

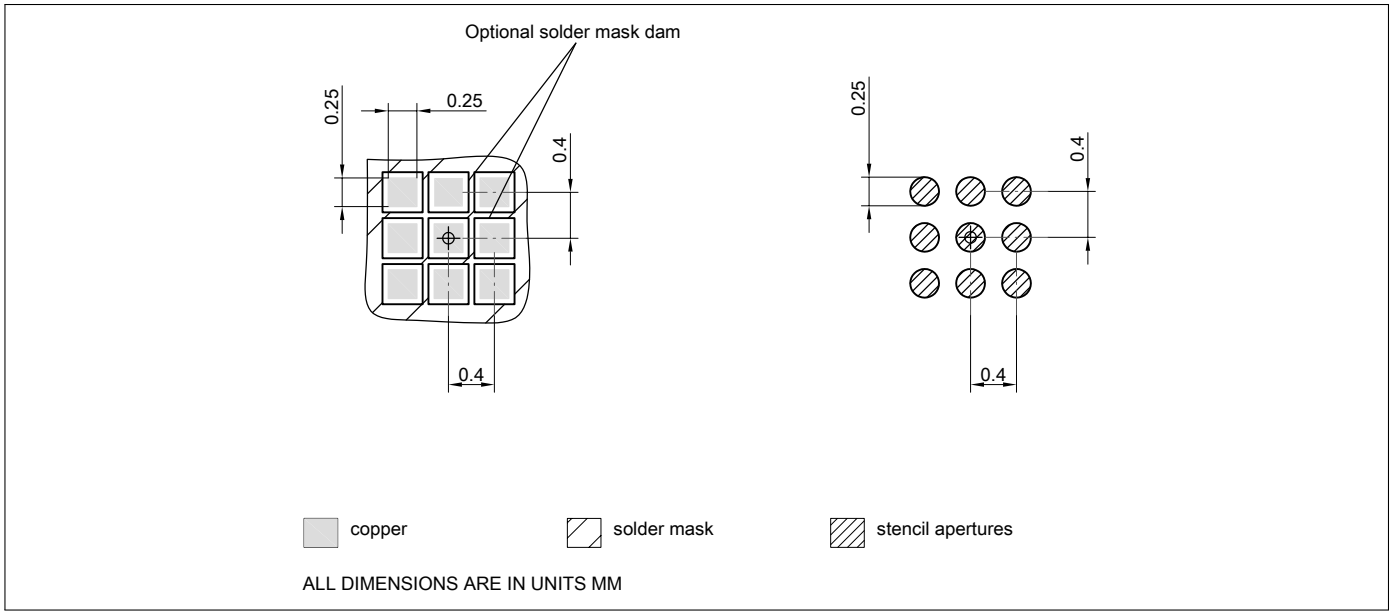


Figure 6: Footprint Recommendation

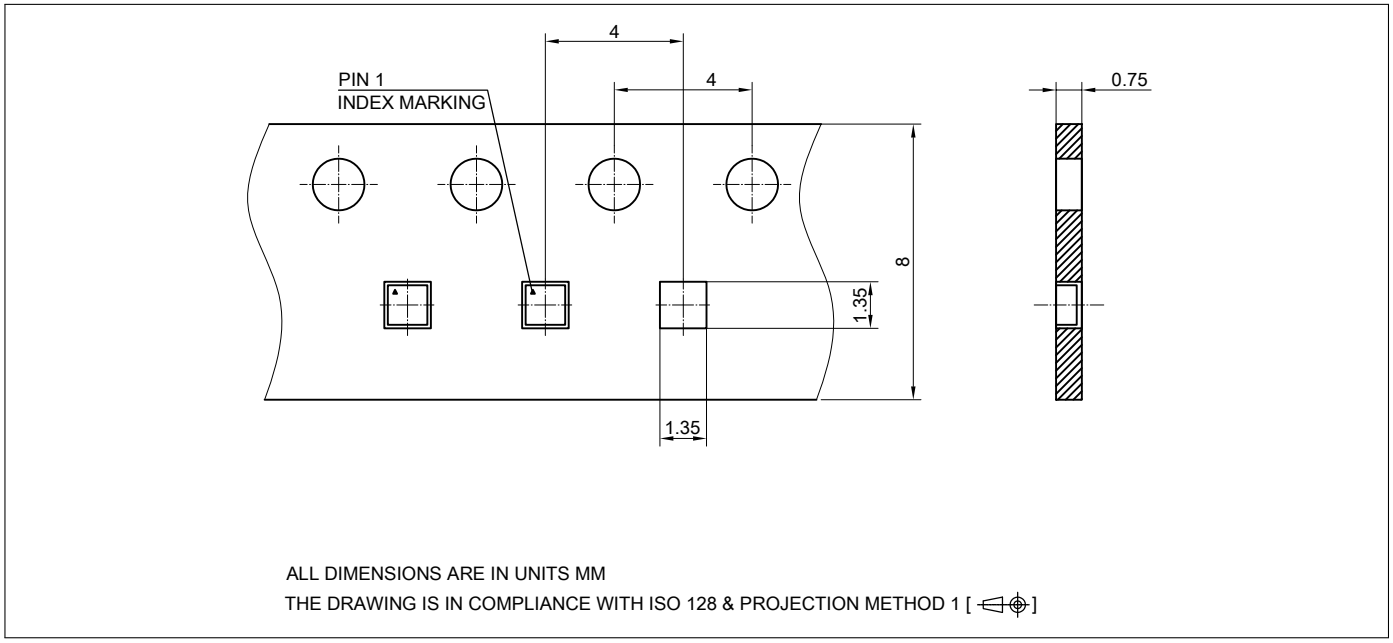


Figure 7: ATSLP-9-1 Carrier Tape

Revision History	
Previous Revision 2.0 - 2016-10-19	
Page or Item	**Subjects (major changes since previous revision)**
Revision 3.1, 2017-11-09	
2	Final marking added
3	Maximum ratings comment updated
3	ESD capability updated
4	DC characteristics updated
4-5	RF characteristics updated
5	1dB-compression point for bypass mode added
6	Footnote updated in Table 7
7	Application schematic drawing updated
7	Bill of materials table updated
8	Package outline drawing updated
8	Marking specification added
9	Date code description added in Tables 9 and 10
10	Footprint recommendation drawing updated
10	Carrier tape drawing added

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