BGM1143N9

Front-End Module for Global Navigation Satellite Systems (GNSS)

Data Sheet

Revision 2.0, 2013-08-13
Preliminary

RF & Protection Devices

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Revision History	
Page or Item	**Subjects (major changes since previous revision)**
Revision 2.0, 2013-08-13	
7	Feature list updated
7	Block diagram updated, no matching inductor at RFIN
10	ESD integrity table updated
11-14	RF characteristics updated
15	Application circuit updated, no matching inductor at RFIN

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Features

- High insertion power gain: 15.8 dB
- Out-of-band input 3rd order intercept point: +66dBm
- Input 1 dB compression point: -5 dBm
- Low noise figure (GPS): 1.45 dB
- Low current consumption: 3.9 mA
- Operating frequencies: 1550 - 1615 MHz
- Supply voltage: 1.5 V to 3.3 V
- Digital on/off switch (1V logic high level)
- Tiny TSNP-9-1 leadless package (footprint: 1.5 x 1.1 mm^2)
- RF output internally matched to 50 Ω
- Only 1 external SMD components necessary
- Pb-free (RoHS compliant) package

RoHS

Application

- Ideal for all Global Navigation Satellite Systems (GNSS) like GPS, GLONASS, Beidou, Galileo and others.

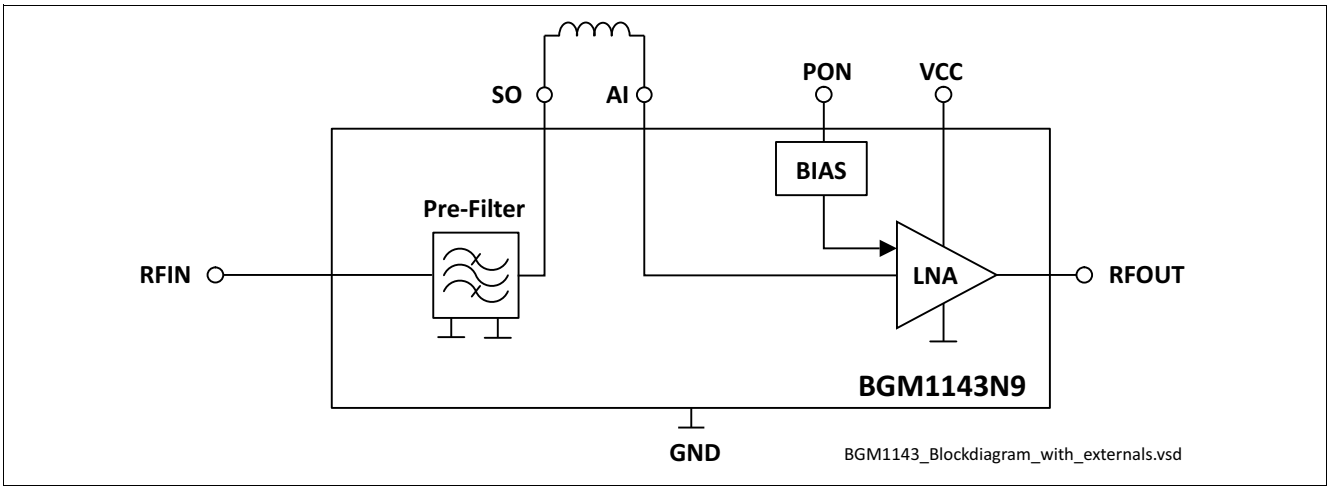

Figure 1 Block Diagram with main external components

Product Name	Marking	Package
BGM1143N9	tbd.	TSNP-9-1

Description

The BGM1143N9 is a combination of a low-insertion-loss pre-filter with Infineon's high performance low noise amplifier (LNA) for Global Navigation Satellite Systems (GNSS) from applications from 1550 MHz to 1615 MHz like GPS, GLONASS, Beidou, Galileo and others. All frequency bands can be used at the same time. Through the low insertion loss of the filter, the BGM1143N9 provides 15.8 dB gain, 1.45 dB noise figure and high linearity performance. In addition BGM1143N9 provides very high out-of-band attenuation in conjunction with a high input compression point. Its current consumption is as low as 3.9 mA. It operates over the 1.5 V to 3.3 V supply voltage range.

Pin Definition and Function

Table 1 Pin Definition and Function

Pin No.	Name	Function
1	VCC	DC supply
2	PON	Power on control
3	GND	Ground
4	RFIN	RF Input
5	GND	Ground
6	SO	Pre-Filter Output
7	AI	LNA Input
8	RFOUT	RF Output
9	GND	Ground

1 Electrical Characteristics

1.1 Absolute Maximum Ratings

Table 2 Maximum Ratings

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Voltage at pin PON to GND	V_{PON}	-0.3	–	V_{CC} + 0.3	V	–
Voltage at pin VCC to GND	V_{CC}	-0.3	–	3.6	V	–
Voltage at pin RFIN to GND	V_{RFIN}	-3	–	3	V	–
Voltage at pin SO to GND	V_{SO}	-3	–	3	V	–
Voltage at pin AI to GND	V_{AI}	-0.3	–	0.9	V	–
Voltage at pin RFOUT to GND	V_{RFOUT}	-0.3		V_{CC} + 0.3	V	–
Current into pin VCC	I_{CC}	–	–	16	mA	–
RF input power inband	P_{IN}	–	–	0	dBm	Continuous wave signal f = 1575.42 MHz 50 Ω source and load impedances
RF input power out of band	$P_{IN,OBB}$	–	–	25		Continuous wave signal f = 50 - 1460 MHz and 1710 - 4000 MHz 50 Ω source and load impedances
Total power dissipation	P_{tot}	–	–	60	mW	–
Junction temperature	T_J	–	–	150	°C	–
Ambient temperature range	T_A	-40	–	85	°C	–
Storage temperature range	T_{STG}	-65	–	150	°C	–

1.2 ESD Integrity

Table 3 ESD Integrity

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
ESD capability HBM of all pins, except pins 4 and 6	V_{ESD1}	–	–	2	kV	According to JESD22-A114
ESD capability HBM of pins 4 and 6	V_{ESD2}	–	–	250	V	According to JESD22-A114

1.3 RF Characteristics

Table 4 Electrical Characteristics: T_A = 25 °C, V_{CC} = 1.8 V, $V_{PON,ON}$ = 1.8 V, $V_{PON,OFF}$ = 0 V, f = 1550 - 1615 MHz (GPS / Glonass / Beidou / Galileo)

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Supply voltage	V_{CC}	1.5	–	3.3	V	–
Supply current	I_{CC}	–	3.9	–	mA	ON-mode
		–	0.2	3	µA	OFF-mode
Power On voltage	V_{pon}	1.0	–	Vcc	V	ON-mode
		0	–	0.4	V	OFF-mode
Power On current	I_{pon}	–	5	10	µA	ON-mode
		–	–	1	µA	OFF-mode
Passband Parameters @ f = 1561.098, 1575.42, 1598.06-1605.38 MHz	–	–	–	–	–	–
Insertion power gain GPS	$\|S_{21}\|^2$	–	15.5	–	dB	f = 1575.42 MHz
Insertion power gain GLONASS	$\|S_{21}\|^2$	–	14.3	–	dB	f = 1598.06-1605.38 MHz
Insertion power gain Beidou	$\|S_{21}\|^2$	–	15.7	–	dB	f = 1561.098 MHz
Noise figure GPS[1)]	NF	–	1.45	–	dB	Z_S = 50 Ω f = 1575.42 MHz
Noise figure GLONASS[1)]	NF		1.85			Z_S = 50 Ω f = 1598.06-1605.38 MHz
Noise figure Beidou[1)]	NF		1.6			Z_S = 50 Ω f = 1561.098 MHz
Input return loss GPS, Beidou	RL_{in}	–	13	–	dB	f = 1575.42 MHz, f = 1561.098 MHz
Input return loss GLONASS	RL_{in}	–	8	–	dB	f = 1598.06-1605.38 MHz
Output return loss GPS, Beidou	RL_{out}	–	17	–	dB	f = 1575.42 MHz, f = 1561.098 MHz
Output return loss GLONASS	RL_{out}	–	17	–	dB	f = 1598.06-1605.38 MHz
Reverse isolation	$1/\|S_{12}\|^2$	–	24	–	dB	–
Power gain settling time[2)]	t_S	–	5	–	µs	OFF- to ON-mode
		–	5	–	µs	ON- to OFF-mode
Inband Input 3rd Order Intercept Point	IIP_3	–	-4	–	dBm	f_1 = 1575.42 MHz f_2 = f_1 +/- 1 MHz
Inband Input 1 dB Compression Point	IP_{1dB}	–	-8	–	dBm	f_1 = 1575.42 MHz
Out-of-band 3rd Order Intercept Point[3)]	IIP_{3OOB}	–	66	–	dBm	f_1 = 1712.7 MHz f_2 = 1850 MHz
Out-of-band Input 1 dB Compression Point[4)]	IP_{1dB_900M}	–	>30	–	dBm	f_1 = 900 MHz

Table 4 Electrical Characteristics: T_A = 25 °C, V_{CC} = 1.8 V, $V_{PON,ON}$ = 1.8 V, $V_{PON,OFF}$ = 0 V, f = 1550 - 1615 MHz (GPS / Glonass / Beidou / Galileo) (cont'd)

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Out-of-band Input 1 dB Compression Point[4]	IP_{1dB_1710M}	–	>30	–	dBm	f_1 = 1710 MHz
Stopband Parameters	–	–	–	–	–	–
Rejection[5]	Rej_{750M}	–	54	–	dBc	f = 750 MHz
Rejection[5]	Rej_{900M}	–	54	–	dBc	f = 806 MHz - 928 MHz
Rejection[5]	Rej_{1800M}	–	47	–	dBc	f = 1710 MHz - 1980 MHz
Rejection[5]	Rej_{2400M}	–	44	–	dBc	f = 2400 MHz - 2500 MHz
Stability	k	–	>1	–	–	f = 20 MHz - 20 GHz

1) PCB losses are subtracted
2) To be within 1 dB of the final gain OFF- to ON-mode; to be within 3 dB of the final gain ON- to OFF-mode
3) Input power = +10 dBm for each tone
4) Guaranteed by device design, not measured in production
5) Rejection = $|(1/|S_{21}|^2$ at stopband frequency)| + $|(1/|S_{21}|^2$ at 1575.42 MHz)|

Table 5 Electrical Characteristics: T_A = 25 °C, V_{CC} = 2.8 V, $V_{PON,ON}$ = 2.8 V, $V_{PON,OFF}$ = 0 V, f = 1550 - 1615 MHz (GPS / Glonass / Beidou / Galileo)

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Supply voltage	V_{CC}	1.5	–	3.3	V	–
Supply current	I_{CC}	–	4.0	–	mA	ON-mode
		–	0.2	3	µA	OFF-mode
Power On voltage	V_{pon}	1.0	–	Vcc	V	ON-mode
		0	–	0.4	V	OFF-mode
Power On current	I_{pon}	–	10	15	µA	ON-mode
		–	–	1	µA	OFF-mode
Passband Parameters @ f = 1561.098, 1575.42, 1598.06-1605.38 MHz	–	–	–	–	–	–
Insertion power gain GPS	$\|S_{21}\|^2$	–	15.6	–	dB	f = 1575.42 MHz
Insertion power gain GLONASS	$\|S_{21}\|^2$	–	14.5	–	dB	f = 1598.06-1605.38 MHz
Insertion power gain Beidou	$\|S_{21}\|^2$	–	15.8	–	dB	f = 1561.098 MHz
Noise figure GPS[1)]	NF	–	1.45	–	dB	Z_S = 50 Ω f = 1575.42 MHz
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Input return loss GPS, Beidou	RL_{in}	–	13	–	dB	f = 1575.42 MHz, f = 1561.098 MHz
Input return loss GLONASS	RL_{in}	–	8	–	dB	f = 1598.06-1605.38 MHz
Output return loss GPS, Beidou	RL_{out}	–	18	–	dB	f = 1575.42 MHz, f = 1561.098 MHz
Output return loss GLONASS	RL_{out}	–	18	–	dB	f = 1598.06-1605.38 MHz
Reverse isolation	$1/\|S_{12}\|^2$	–	24	–	dB	–
Power gain settling time[2)]	t_S	–	5	–	µs	OFF- to ON-mode
		–	5	–	µs	ON- to OFF-mode
Inband Input 3rd Order Intercept Point	IIP_3	–	-4	–	dBm	f_1 = 1575.42 MHz f_2 = f_1 +/- 1 MHz
Inband Input 1 dB Compression Point	IP_{1dB}	–	-5	–	dBm	f_1 = 1575.42 MHz
Out-of-band 3rd Order Intercept Point[3)]	IIP_{3OOB}	–	66	–	dBm	f_1 = 1712.7 MHz f_2 = 1850 MHz
Out-of-band Input 1 dB Compression Point[4)]	IP_{1dB_900M}	–	>30	–	dBm	f_1 = 900 MHz
Out-of-band Input 1 dB Compression Point[4)]	IP_{1dB_1710M}	–	>30	–	dBm	f_1 = 1710 MHz
Stopband Parameters	–	–	–	–	–	–

Table 5 Electrical Characteristics: T_A = 25 °C, V_{CC} = 2.8 V, $V_{PON,ON}$ = 2.8 V, $V_{PON,OFF}$ = 0 V, f = 1550 - 1615 MHz (GPS / Glonass / Beidou / Galileo) (cont'd)

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Rejection[5]	Rej_{750M}	–	54	–	dBc	f = 750 MHz
Rejection[5]	Rej_{900M}	–	54	–	dBc	f = 806 MHz - 928 MHz
Rejection[5]	Rej_{1800M}	–	47	–	dBc	f = 1710 MHz - 1980 MHz
Rejection[5]	Rej_{2400M}	–	44	–	dBc	f = 2400 MHz - 2500 MHz
Stability	k	–	>1	–	–	f = 20 MHz - 20 GHz

1) PCB losses are subtracted
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3) Input power = +10 dBm for each tone
4) Guaranteed by device design, not measured in production
5) Rejection = $|(1/|S_{21}|^2$ at stopband frequency)| + $|(1/|S_{21}|^2$ at 1575.42 MHz)|

2 Application Information

2.1 Application Circuit Schematic

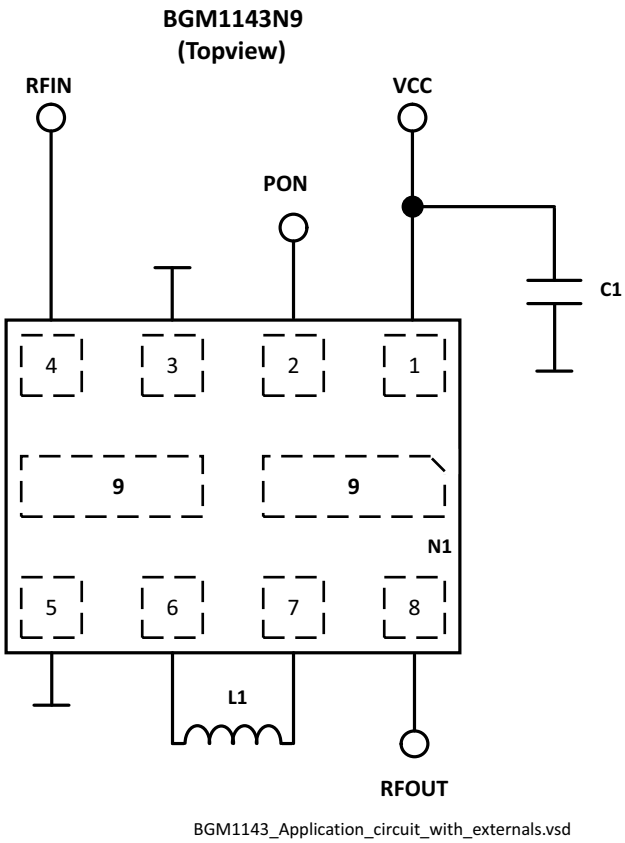

Figure 2 Application Schematic BGM1143N9

Table 6 Bill of Materials

Name	Value	Package	Manufacturer	Function
C1 (optional)	> 10nF[1)]	0402	Various	RF bypass [2)]
L1	8.2nH	0402	Murata LQW type	Input Matching
N1	BGM1143N9	TSNP-9-1	Infineon	GNSS FE-Module

1) For data sheet characteristics 1µF used

2) RF bypass recommended to mitigate power supply noise

3 Package Information

3.1 Package Dimensions

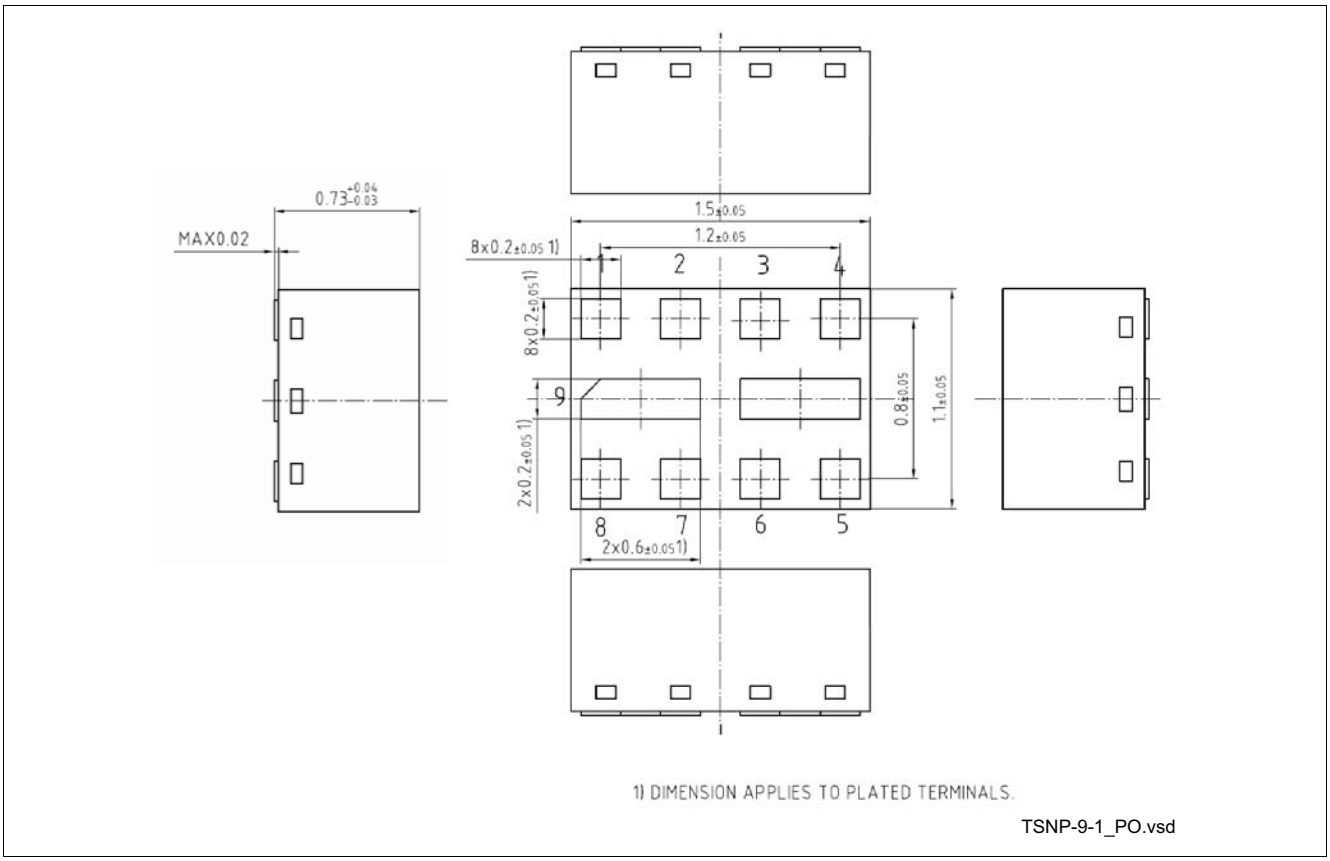

Figure 3 TSNP-9-1 Package Outline (bottom and side views)

3.2 Package Footprint

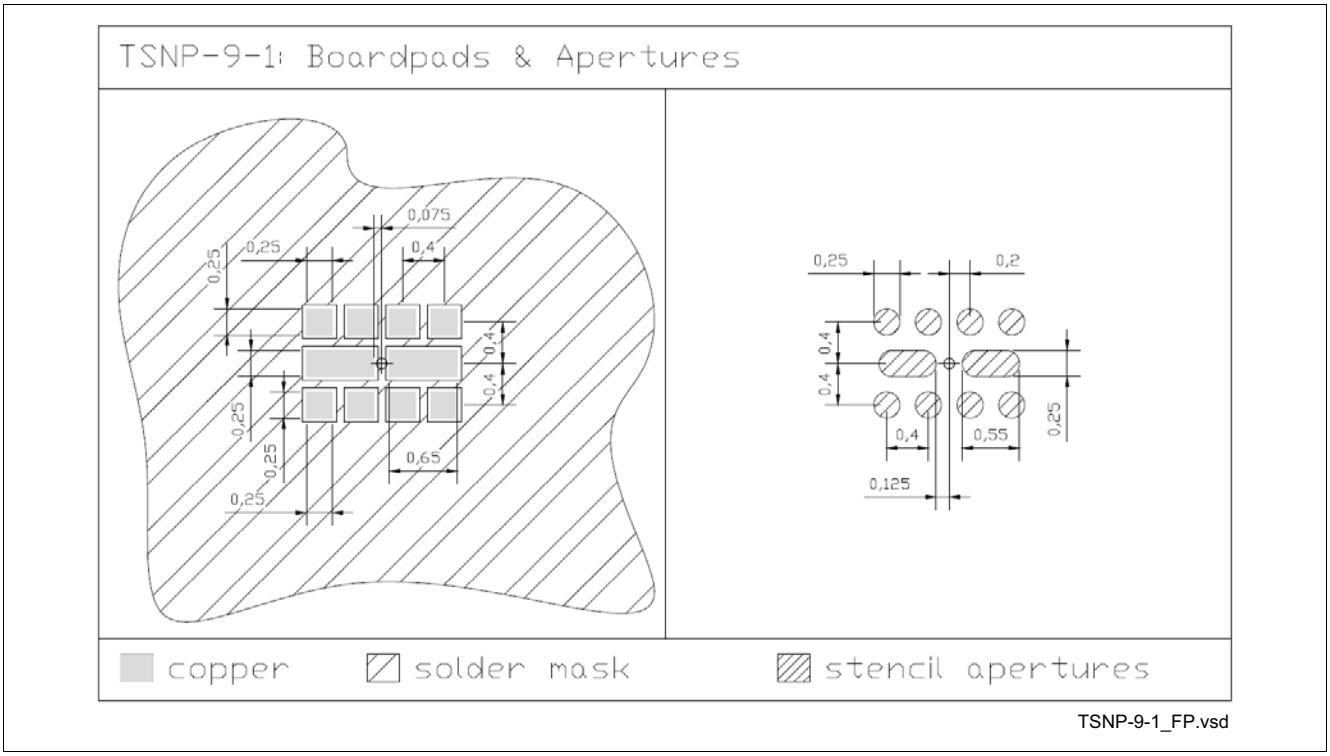

Figure 4 Footprint Recommendation TSNP-9-1

3.3 Product Marking Pattern

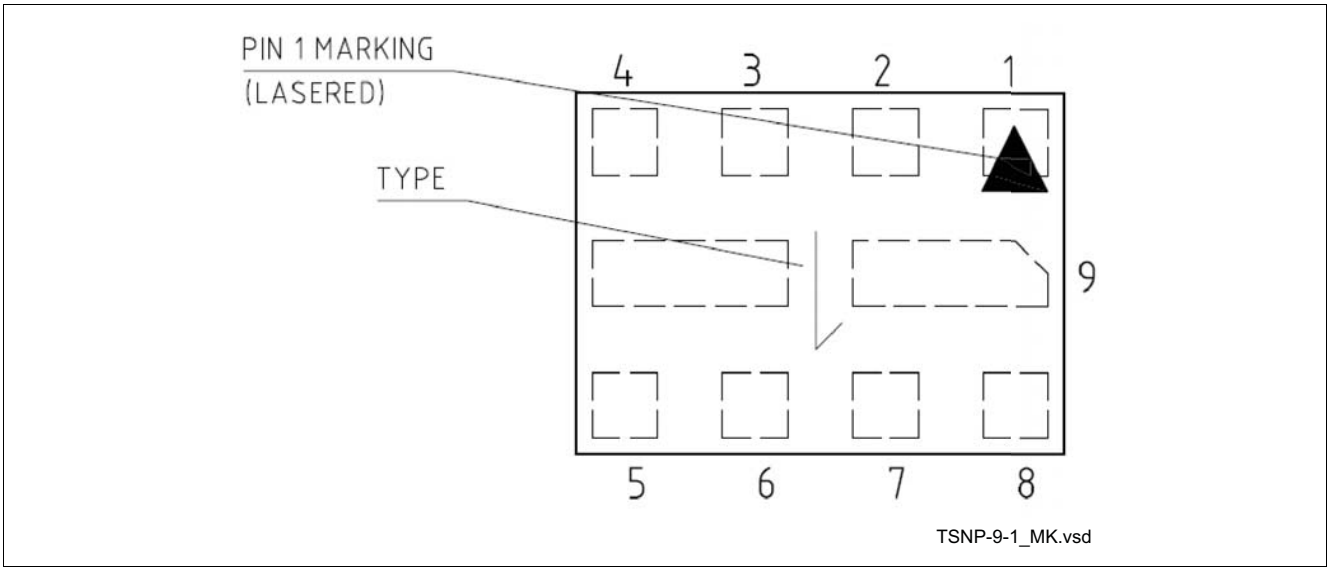

Figure 5 Marking Layout (top view)

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