

# BGA925L6

Silicon Germanium GNSS Low Noise Amplifier  
in ultra small package with 0.77mm<sup>2</sup> footprint

## Data Sheet

Revision 3.0, 2012-01-13

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**Revision History**

Page or Item	Subjects (major changes since previous revision)
<b>Revision 3.0, 2012-01-13</b>	
all	“Preliminary” status removed
14	Tolerance for package height tightened
<b>Revision 2.1, 2011-12-02</b>	
12	More detailed application information provided
15	Number of pieces/reel modified: 15000

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Last Trademarks Update 2011-11-11

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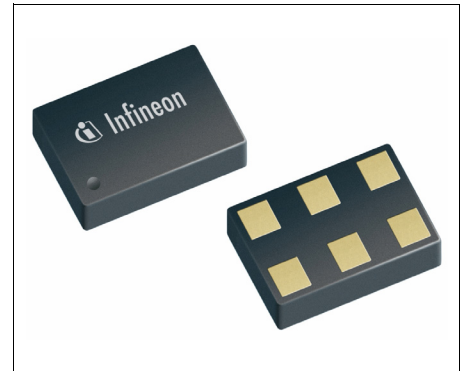
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## Silicon Germanium GNSS Low Noise Amplifier in ultra small package with 0.77mm<sup>2</sup> footprint

BGA925L6

### Features

- Insertion power gain: 15.8 dB
- High out-of-band 3<sup>rd</sup>-order intercept point at input: +7 dBm
- High 1dB-compression point: -5 dBm
- Low noise figure: 0.65 dB
- Low current consumption: 4.8 mA
- Operating frequencies: 1550 - 1615 MHz
- Supply voltage: 1.5 V to 3.6 V
- Digital on/off switch (1V logic high level)
- Ultra small TSLP-6-2 leadless package (footprint: 0.7 x 1.1 mm<sup>2</sup>)
- B7HF Silicon Germanium technology
- RF output internally matched to 50 Ω
- Only 1 external SMD component necessary
- 2kV HBM ESD protection (including AI-pin)
- Pb-free (RoHS compliant) package



### Application

- Ideal for all Global Navigation Satellite Systems (GNSS) like GPS, Galileo, GLONASS, COMPASS

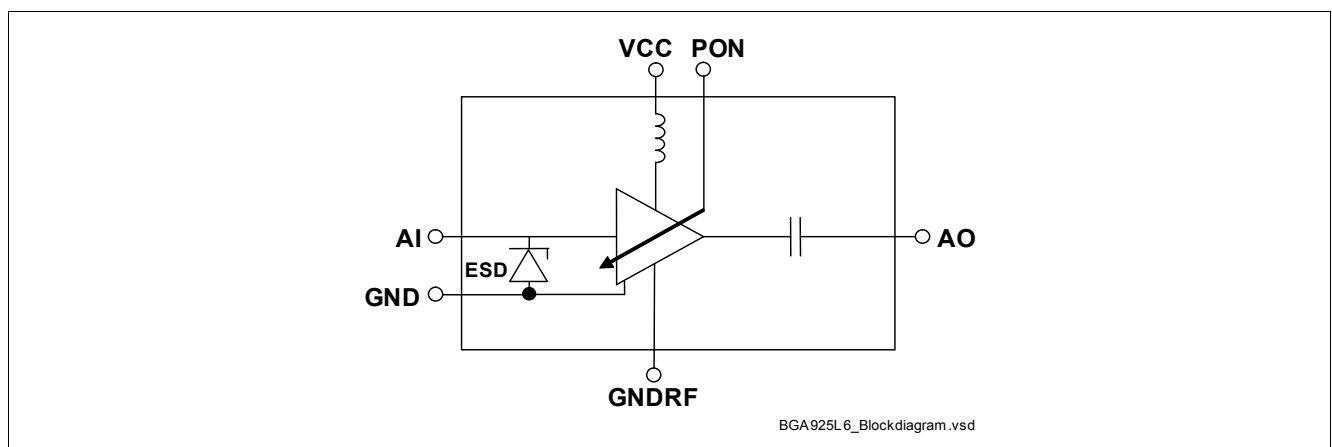


Figure 1 Block Diagram

Product Name	Marking	Package
BGA925L6	C	TSLP-6-2

**Description**

The BGA925L6 is a front-end low noise amplifier for Global Navigation Satellite Systems (GNSS) from 1550 MHz to 1615 MHz like GPS, Galileo, GLONASS and COMPASS and others. The LNA provides 15.8 dB gain and 0.65 dB noise figure at a current consumption of 4.8 mA in the application configuration described in [Chapter 3](#). The BGA925L6 is based upon Infineon Technologies' B7HF Silicon Germanium technology. It operates from 1.5 V to 3.6 V supply voltage.

**Pin Definition and Function****Table 1 Pin Definition and Function**

Pin No.	Name	Function
1	GND	General ground
2	VCC	DC supply
3	AO	LNA output
4	GNDRF	LNA RF ground
5	AI	LNA input
6	PON	Power on control



## 1 Maximum Ratings

**Table 2 Maximum Ratings**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Voltage at pin VCC	$V_{CC}$	-0.3	–	3.6	V	1)
Voltage at pin AI	$V_{AI}$	-0.3	–	0.9	V	–
Voltage at pin AO	$V_{AO}$	-0.3	–	$V_{CC} + 0.3$	V	–
Voltage at pin PON	$V_{PON}$	-0.3	–	$V_{CC} + 0.3$	V	–
Voltage at pin GNDRF	$V_{GNDRF}$	-0.3	–	0.3	V	–
Current into pin VCC	$I_{CC}$	–	–	20	mA	–
RF input power	$P_{IN}$	–	–	0	dBm	–
Total power dissipation, $T_S < 123\text{ °C}^2)$	$P_{tot}$	–	–	72	mW	–
Junction temperature	$T_J$	–	–	150	°C	–
Ambient temperature range	$T_A$	-40	–	85	°C	–
Storage temperature range	$T_{STG}$	-65	–	150	°C	–
ESD capability all pins	$V_{ESD\_HBM}$	–	–	2000	V	according to JESD22A-114

1) All voltages refer to GND-Node unless otherwise noted

2)  $T_S$  is measured on the ground lead at the soldering point

**Attention: Stresses above the max. 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.**

### Thermal Resistance

**Table 3 Thermal Resistance**

Parameter	Symbol	Value	Unit
Junction - soldering point <sup>1)</sup>	$R_{thJS}$	380	K/W

1) For calculation of  $R_{thJA}$  please refer to Application Note Thermal Resistance

## 2 Electrical Characteristics

**Table 4** Electrical Characteristics:<sup>1)</sup>  $T_A = 25\text{ °C}$ ,  $V_{CC} = 1.8\text{ V}$ ,  $V_{PON,ON} = 1.8\text{ V}$ ,  $V_{PON,OFF} = 0\text{ V}$ ,  
 $f = 1550 - 1615\text{ MHz}$

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Supply voltage	$V_{CC}$	1.5	–	3.6	V	–
Supply current	$I_{CC}$	–	4.8	–	mA	ON-mode
		–	0.2	3	$\mu\text{A}$	OFF-mode
Power On voltage	$V_{pon}$	1.0	–	$V_{CC}$	V	ON-mode
		0	–	0.4	V	OFF-mode
Power On current	$I_{pon}$	–	5	–	$\mu\text{A}$	ON-mode
		–	–	1	$\mu\text{A}$	OFF-mode
Insertion power gain	$ S_{21} ^2$	–	15.8	–	dB	–
Noise figure <sup>2)</sup>	$NF$	–	0.65	–	dB	$Z_S = 50\ \Omega$
Input return loss	$RL_{in}$	–	12	–	dB	–
Output return loss	$RL_{out}$	–	18	–	dB	–
Reverse isolation	$1/ S_{12} ^2$	–	20	–	dB	–
Power gain settling time <sup>3)</sup>	$t_S$	–	5	–	$\mu\text{s}$	OFF- to ON-mode
		–	5	–	$\mu\text{s}$	ON- to OFF-mode
Inband input 1dB-compression point	$IP_{1dB}$	–	-8	–	dBm	–
Inband input 3 <sup>rd</sup> -order intercept point <sup>4)</sup>	$IIP_3$	–	+2	–	dBm	$f_1 = 1575\text{ MHz}$ $f_2 = f_1 +/ -1\text{ MHz}$
Out-of-band input 3 <sup>rd</sup> -order intercept point <sup>5)</sup>	$IIP_{3oob}$	–	+7	–	dBm	$f_1 = 1712.7\text{ MHz}$ $f_2 = 1850\text{ MHz}$
Stability	$k$	–	> 1	–		$f = 20\text{ MHz} \dots 10\text{ GHz}$

1) Based on the application described in chapter 3

2) PCB losses are subtracted

3) 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

4) Input power = -30 dBm for each tone

5) Input power = -20 dBm for each tone

**Table 5 Electrical Characteristics:**<sup>1)</sup>  $T_A = 25\text{ °C}$ ,  $V_{CC} = 2.8\text{ V}$ ,  $V_{PON,ON} = 2.8\text{ V}$ ,  $V_{PON,OFF} = 0\text{ V}$ ,  
 $f = 1550 - 1615\text{ MHz}$ 

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Supply voltage	$V_{CC}$	1.5	–	3.6	V	–
Supply current	$I_{CC}$	–	4.9	–	mA	ON-mode
		–	0.2	3	$\mu$ A	OFF-mode
Power On voltage	$V_{pon}$	1.0	–	$V_{cc}$	V	ON-mode
		0	–	0.4	V	OFF-mode
Power On current	$I_{pon}$	–	5	–	$\mu$ A	ON-mode
		–	–	1	$\mu$ A	OFF-mode
Insertion power gain	$ S_{21} ^2$	–	15.8	–	dB	–
Noise figure <sup>2)</sup>	$NF$	–	0.65	–	dB	$Z_S = 50\ \Omega$
Input return loss	$RL_{in}$	–	12	–	dB	–
Output return loss	$RL_{out}$	–	18	–	dB	–
Reverse isolation	$1/ S_{12} ^2$	–	20	–	dB	–
Power gain settling time <sup>3)</sup>	$t_S$	–	5	–	$\mu$ s	OFF- to ON-mode
		–	5	–	$\mu$ s	ON- to OFF-mode
Inband input 1dB-compression point	$IP_{1dB}$	–	-5	–	dBm	–
Inband input 3 <sup>rd</sup> -order intercept point <sup>4)</sup>	$IIP_3$	–	+2	–	dBm	$f_1 = 1575\text{ MHz}$ $f_2 = f_1 \pm 1\text{ MHz}$
Out-of-band input 3 <sup>rd</sup> -order intercept point <sup>5)</sup>	$IIP_{3oob}$	–	+7	–	dBm	$f_1 = 1712.7\text{ MHz}$ $f_2 = 1850\text{ MHz}$
Stability	$k$	–	> 1	–		$f = 20\text{ MHz} \dots 10\text{ GHz}$

1) Based on the application described in chapter 3

2) PCB losses are subtracted

3) 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

4) Input power = -30 dBm for each tone

5) Input power = -20 dBm for each tone

### 3 Application Information

#### Application Board Configuration

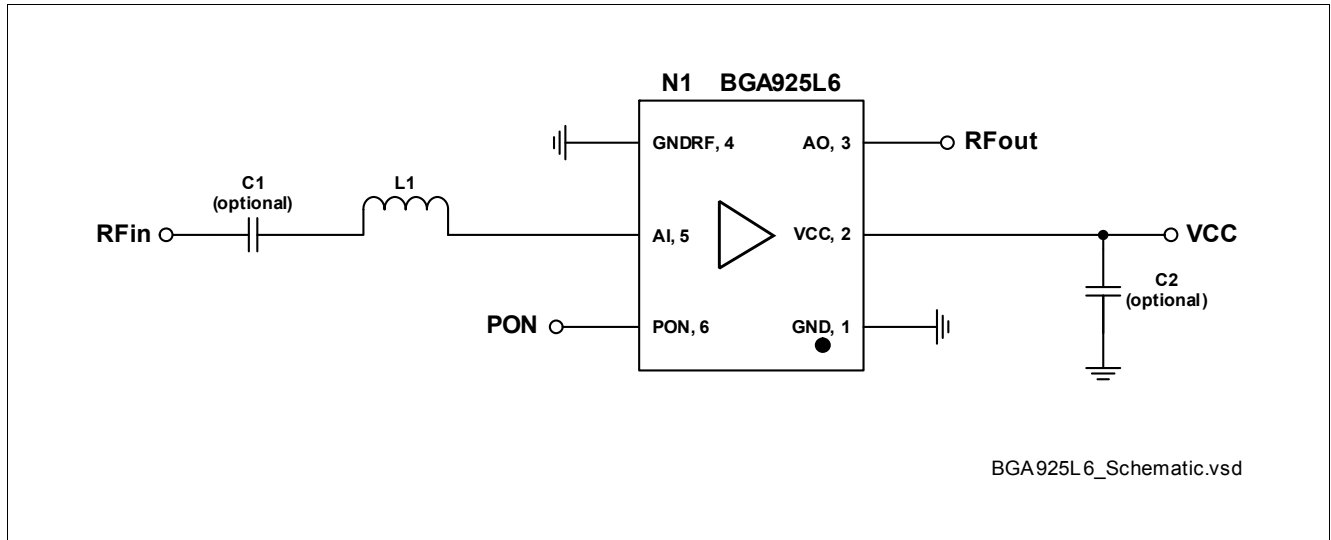


Figure 2 Application Schematic BGA925L6

Table 6 Bill of Materials

Name	Value	Package	Manufacturer	Function
C1 (optional)	1nF	0402	Various	DC block <sup>1)</sup>
C2 (optional)	> 10nF <sup>2)</sup>	0402	Various	RF bypass <sup>3)</sup>
L1	6.8nH	0402	Murata LQW type	Input matching
N1	BGA925L6	TSLP-6-2	Infineon	SiGe LNA

1) DC block might be realized with pre-filter in GNSS applications

2) For data sheet characteristics 1μF used

3) RF bypass recommended to mitigate power supply noise

A list of all application notes is available at <http://www.infineon.com/gpsIna.appnotes>.

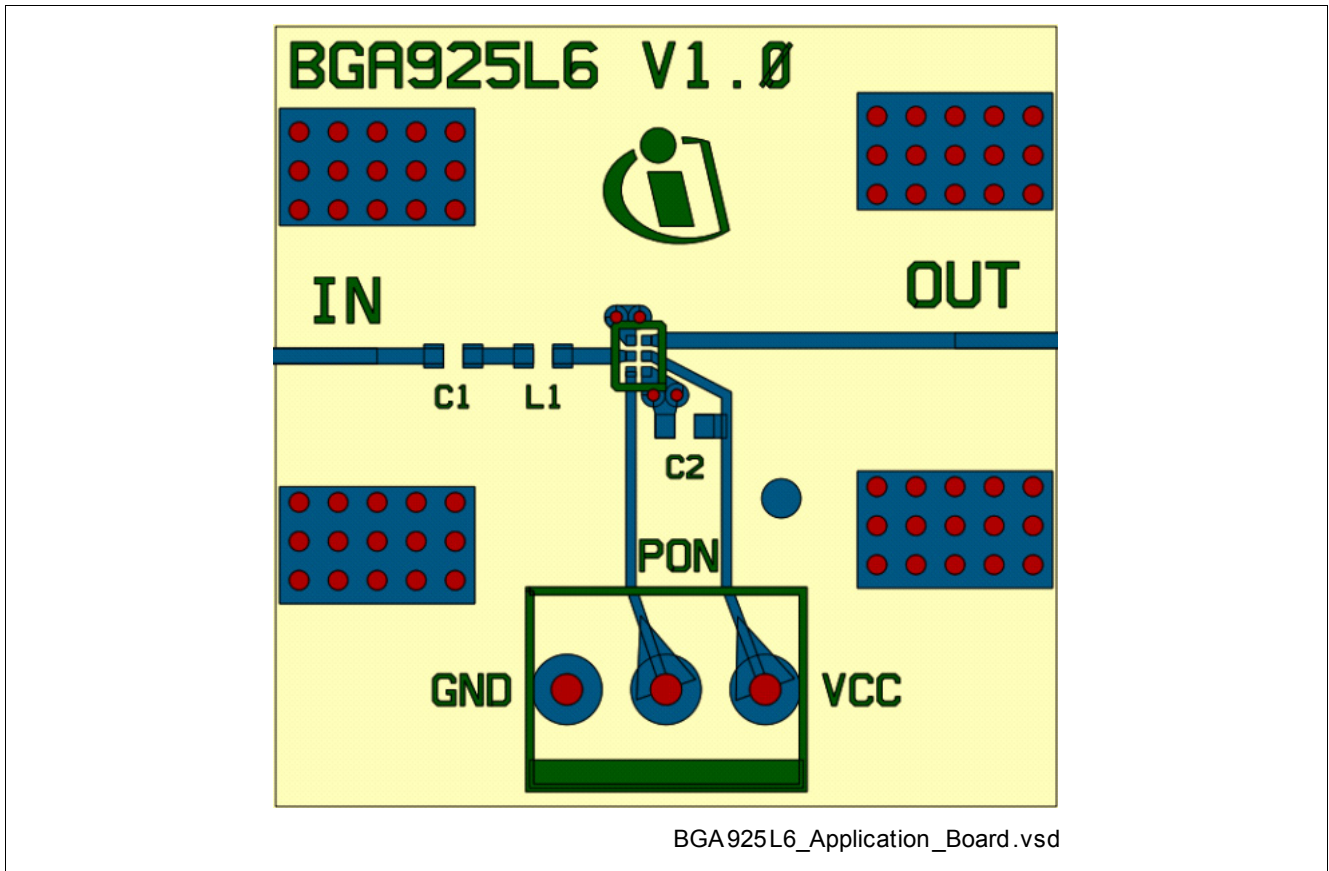


Figure 3 Drawing of Application Board

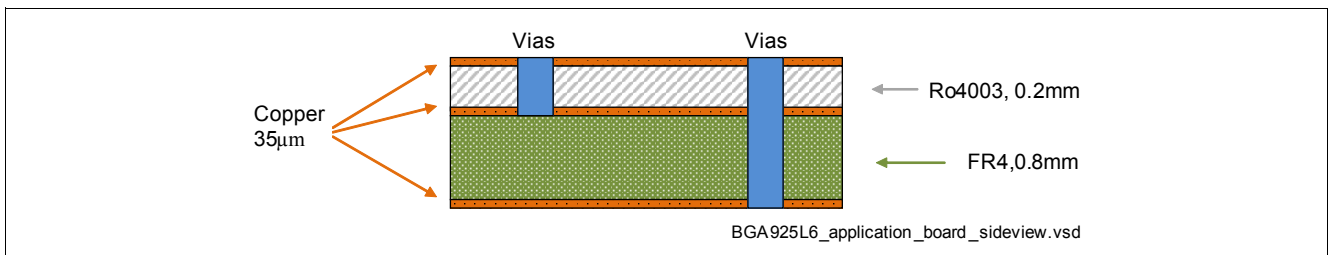
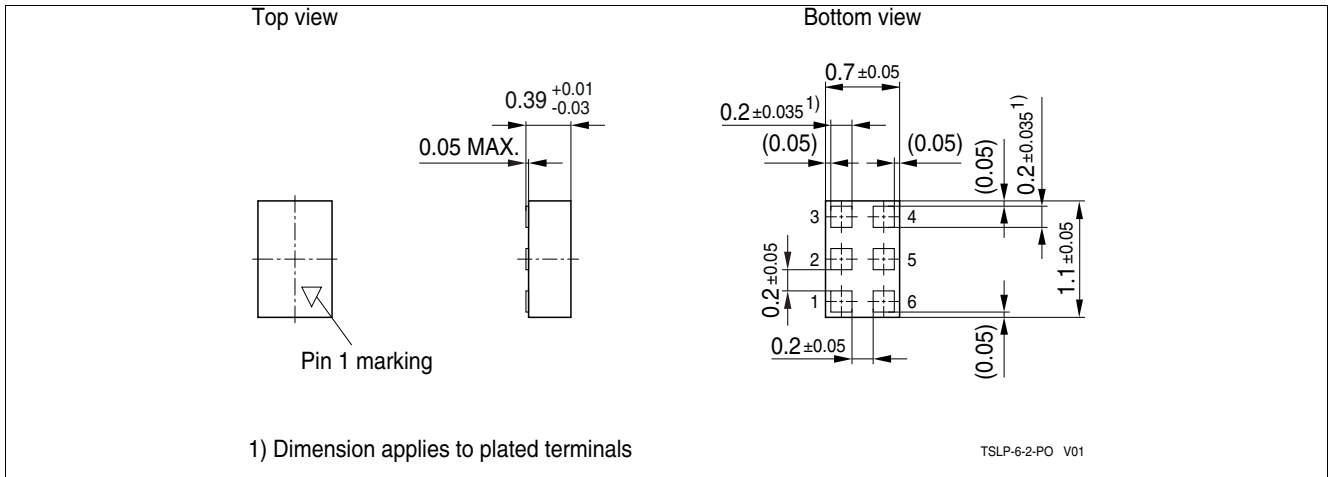
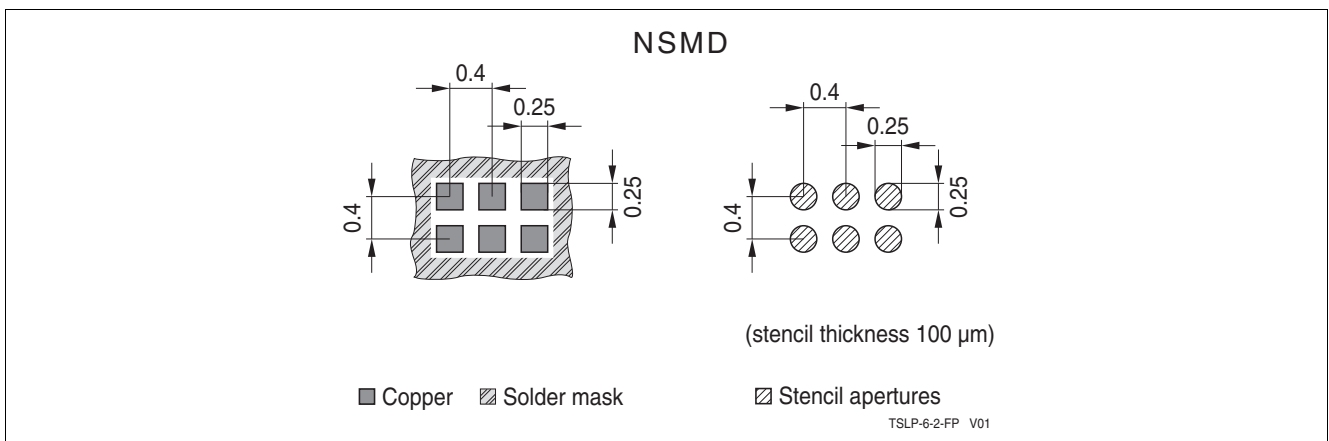


Figure 4 Application Board Cross-Section

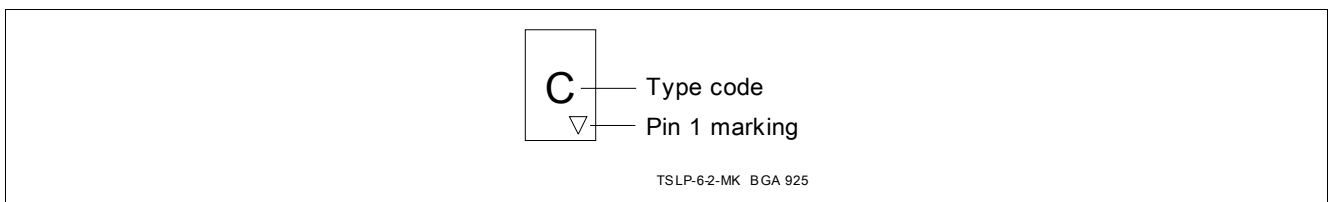
## 4 Package Information



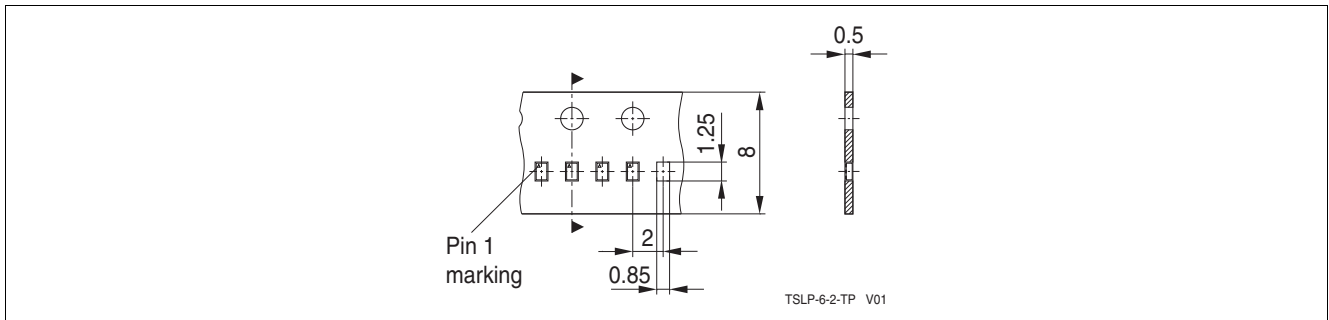
**Figure 5** TSLP-6-2 Package Outline (top, side and bottom views)



**Figure 6** Footprint TSLP-6-2



**Figure 7** Marking Layout (top view)



**Figure 8 Tape & Reel Dimensions (reel diameter 180 mm, pieces/reel 15000)**

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