

# BGA825L6S

Silicon Germanium Low Noise Amplifier  
for Global Navigation Satellite Systems (GNSS)

## Data Sheet

Revision 2.1, 2012-10-17

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**Revision History**

Page or Item	Subjects (major changes since previous revision)
<b>Revision 2.1, 2012-10-17</b>	
all	“Preliminary” status removed
14	Application for improved rejection of out-of-band jammers (LTE-Band-13) added
<b>Revision 2.0, 2012-10-12</b>	
all	Preliminary data sheet
14, 15	Package drawings and information completed
13	Drawing of Application Board updated

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Last Trademarks Update 2011-11-11

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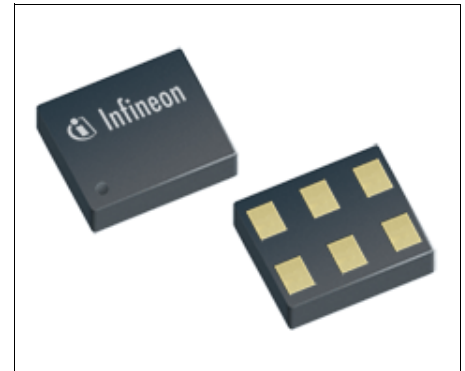
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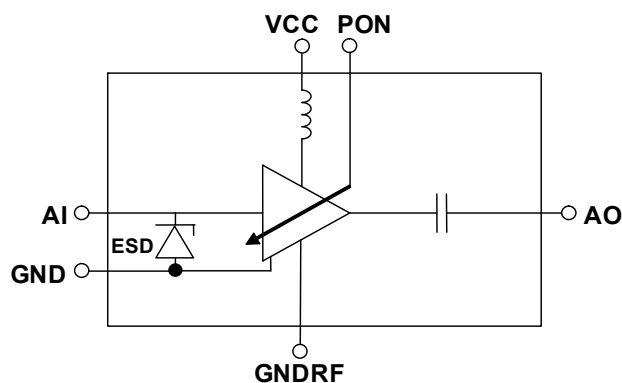
## Features

- Insertion power gain: 17.0 dB
- High out-of-band 3<sup>rd</sup>-order intercept point at input: +8 dBm
- High 1dB-compression point: -7 dBm
- Low noise figure: 0.60 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)
- Small TSLP-6-3 leadless package (footprint: 0.9 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, GLONASS, Beidou, Galileo and others.



BGA825L6S\_Blockdiagram.vsd

**Figure 1 Block Diagram**

Product Name	Marking	Package
BGA825L6S	E.	TSLP-6-3

### Description

The BGA825L6S is a front-end low noise amplifier for Global Navigation Satellite Systems (GNSS) from 1550 MHz to 1615 MHz like GPS, GLONASS, Beidou, Galileo and others.

The LNA provides 17.0 dB gain and 0.6 dB noise figure at a current consumption of 4.8 mA in the application configuration described in [Chapter 3.1](#). The BGA825L6S 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>  $T_A = 25\text{ °C}$ ,  $V_{CC} = 1.8\text{ V}$ ,  $V_{PON,ON} = 1.8\text{ V}$ ,  $V_{PON,OFF} = 0\text{ V}$ ,  
 $f = 1550 - 1615\text{ MHz}$  (GPS / Glonass / Beidou / Galileo)

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$	–	17.0	–	dB	–
Noise figure <sup>2)</sup>	$NF$	–	0.60	–	dB	$Z_S = 50\ \Omega$
Input return loss	$RL_{in}$	–	16	–	dB	–
Output return loss	$RL_{out}$	–	18	–	dB	–
Reverse isolation	$1/ S_{12} ^2$	–	22	–	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	$IP_{1dB}$	–	-10	–	dBm	–
Inband input 3 <sup>rd</sup> -order intercept point <sup>4)</sup>	$IIP_3$	–	+3	–	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>	$IIP_{3oob}$	–	+8	–	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 3.1

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>  $T_A = 25\text{ °C}$ ,  $V_{CC} = 2.8\text{ V}$ ,  $V_{PON,ON} = 2.8\text{ V}$ ,  $V_{PON,OFF} = 0\text{ V}$ ,  
 $f = 1550 - 1615\text{ MHz}$  (GPS / Glonass / Beidou / Galileo)

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	$\mu$ 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$	–	17.0	–	dB	–
Noise figure <sup>2)</sup>	$NF$	–	0.60	–	dB	$Z_S = 50\ \Omega$
Input return loss	$RL_{in}$	–	15	–	dB	–
Output return loss	$RL_{out}$	–	18	–	dB	–
Reverse isolation	$1/ S_{12} ^2$	–	22	–	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	$IP_{1dB}$	–	-7	–	dBm	–
Inband input 3 <sup>rd</sup> -order intercept point <sup>4)</sup>	$IIP_3$	–	+4	–	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>	$IIP_{3oob}$	–	+8	–	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

#### 3.1 Standard Application

##### Application Board Configuration

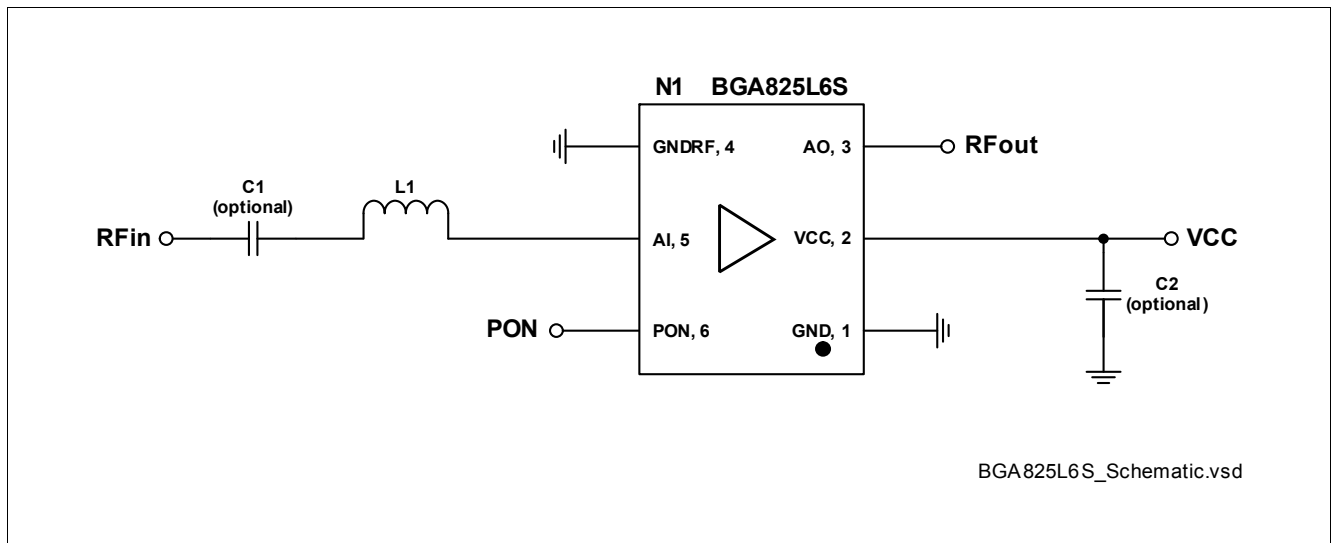


Figure 2 Application Schematic BGA825L6S

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	6.2nH	0402	Murata LQW type	Input matching
N1	BGA825L6S	TSLP-6-3	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/gpslna.appnotes>.

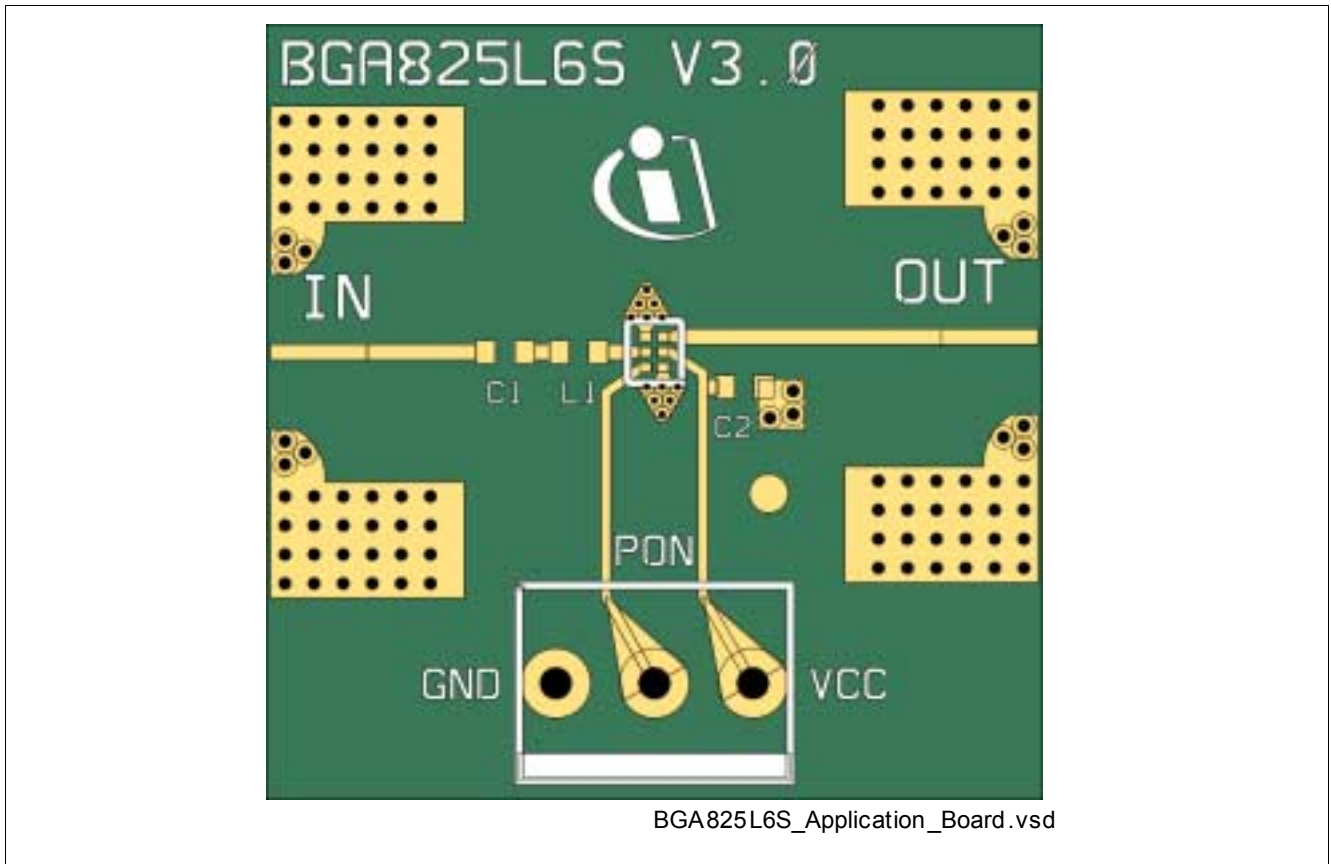


Figure 3 Drawing of Application Board

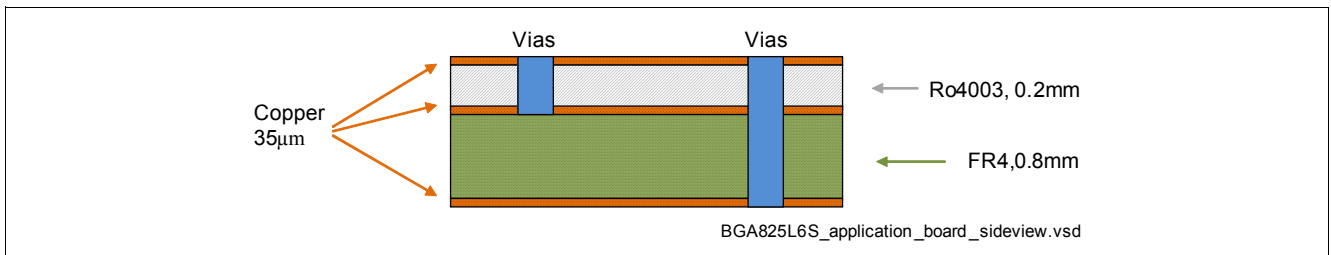


Figure 4 Application Board Cross-Section

### 3.2 Application for improved rejection of out-of-band jammers (LTE-Band-13)

Application Board Configuration according to Application Note AN304:  
 “Improving Immunity of BGA825SL6 against Out-Of-Band Jammer for LTE Band-13”

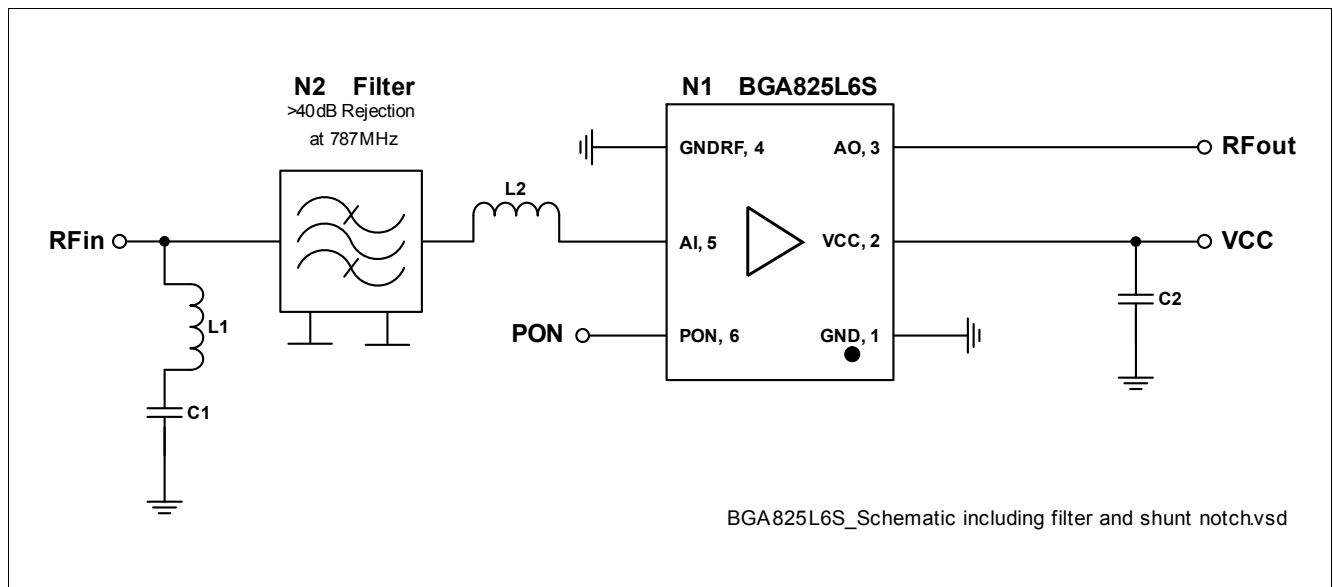


Figure 5 Application Schematic BGA825L6S including filter and shunt notch

Table 7 Bill of Materials

Name	Value	Package	Manufacturer	Function
C1	3.3pF	0201	Various	Band-13 notch
C2	10nF	0201	Various	RF bypass <sup>1)</sup>
L1	12nF	03015	Murata LQW type	Band-13 notch
L2	7.5nF	03015	Murata LQW type	Input matching
N1	BGA825L6S	TSLP-6-3	Infineon	SiGe LNA
N2	Filter	-	Various	Filter with >40dB rejection at 787MHz

1) RF bypass recommended to mitigate power supply noise

Table 8 Electrical Characteristics:  $T_A = 25\text{ }^\circ\text{C}$

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
LTE band-13 2 <sup>nd</sup> Harmonic	$H2$			-85	dBm	$V_{CC} = 1.8\text{ V}$ , $V_{PON} = 1.8\text{ V}$ $f_{IN} = 787.76\text{ MHz}$ , $P_{IN} = +15\text{ dBm}$ , $f_{H2} = 1575.52\text{ MHz}$
LTE band-13 2 <sup>nd</sup> Harmonic	$H2$			-85	dBm	$V_{CC} = 2.8\text{ V}$ , $V_{PON} = 2.8\text{ V}$ $f_{IN} = 787.76\text{ MHz}$ , $P_{IN} = +15\text{ dBm}$ , $f_{H2} = 1575.52\text{ MHz}$

## 4 Package Information

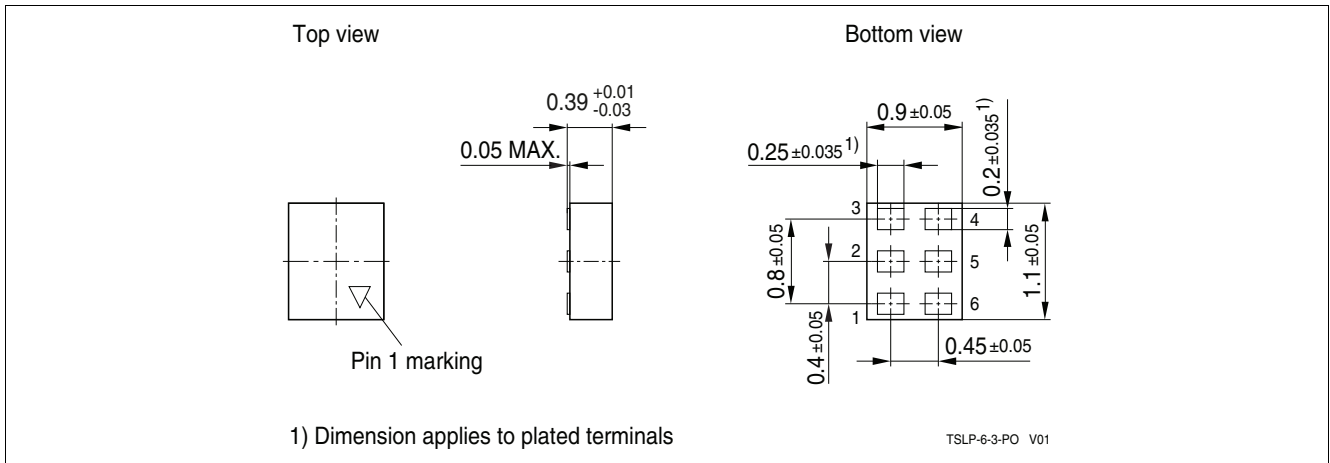


Figure 6 TSLP-6-3 Package Outline (top, side and bottom views)

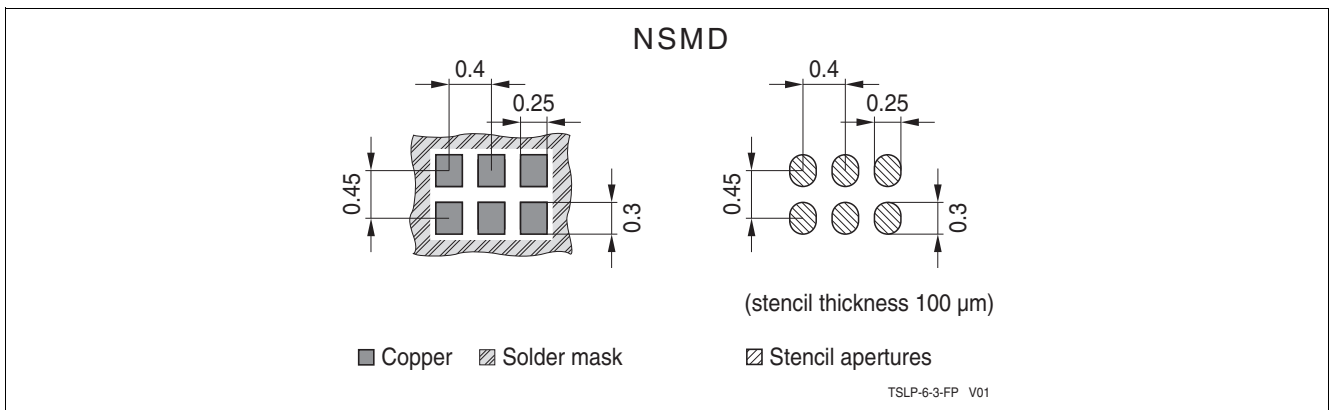


Figure 7 Footprint TSLP-6-3

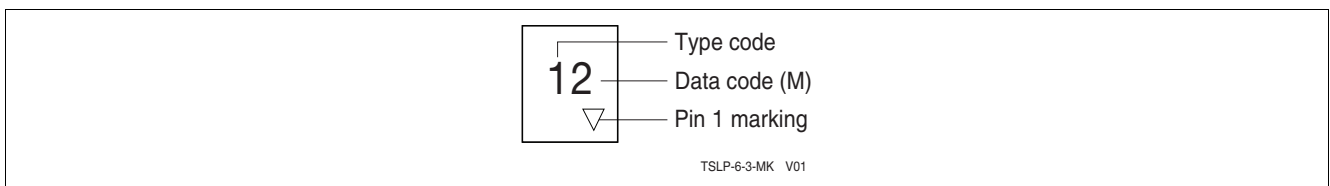


Figure 8 Marking Layout (top view)

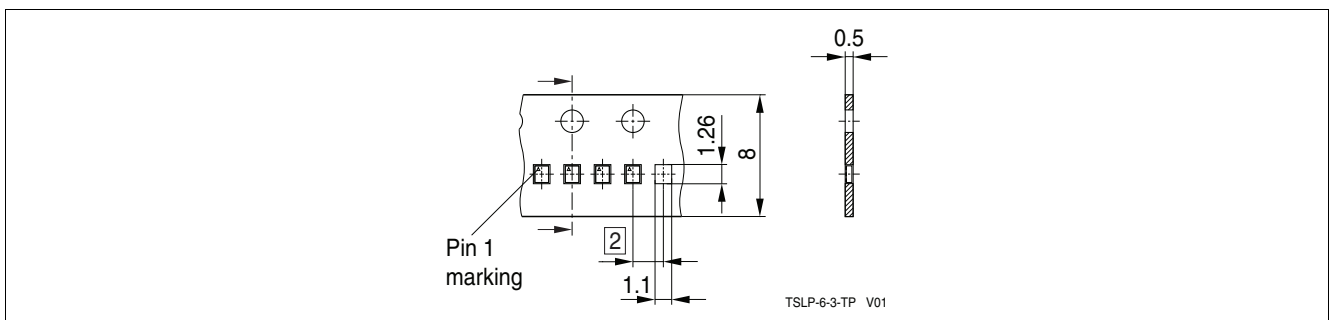


Figure 9 Tape & Reel Dimensions (Ø reel 180 mm, pieces/reel 15000)

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