

# BGA628L7

Silicon Germanium Wide Band Low Noise Amplifier

## Data Sheet

Revision 1.1, 2009-12-17  
Preliminary

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**BGA628L7 Silicon Germanium Wide Band Low Noise Amplifier**
**Revision History: 2009-12-17, Revision 1.1**
**Previous Revision: 2009-08-03, Revision 1.0**

Page	Subjects (major changes since last revision)
5	Features and description updated
6	Table "Pin Definition and Function" added
13	Application Information added

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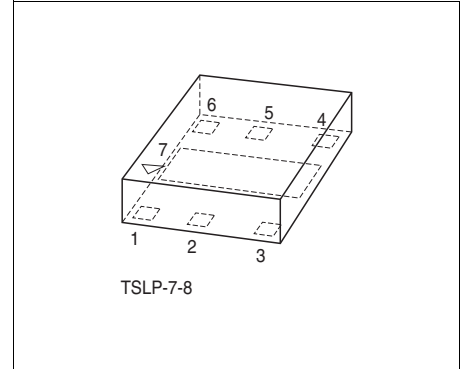
Last Trademarks Update 2009-10-19

## Table of Contents

	<b>Table of Contents</b> .....	4
	<b>Features</b> .....	5
<b>1</b>	<b>Maximum Ratings</b> .....	7
<b>2</b>	<b>Electrical Characteristics</b> .....	8
2.1	DC Characteristics .....	8
2.2	AC Characteristics .....	9
2.2.1	Electrical Characteristics at $f = 450$ MHz .....	9
2.2.2	Electrical Characteristics at $f = 900$ MHz .....	9
2.2.3	Electrical Characteristics at $f = 1.575$ GHz .....	10
2.2.4	Electrical Characteristics at $f = 1.9$ GHz .....	10
2.2.5	Electrical Characteristics at $f = 2.14$ GHz .....	11
2.2.6	Electrical Characteristics at $f = 2.4$ GHz .....	11
2.2.7	Electrical Characteristics at $f = 3.5$ GHz .....	12
2.2.8	Electrical Characteristics at $f = 5.5$ GHz .....	12
<b>3</b>	<b>Application Information</b> .....	13
<b>4</b>	<b>Package Information</b> .....	14

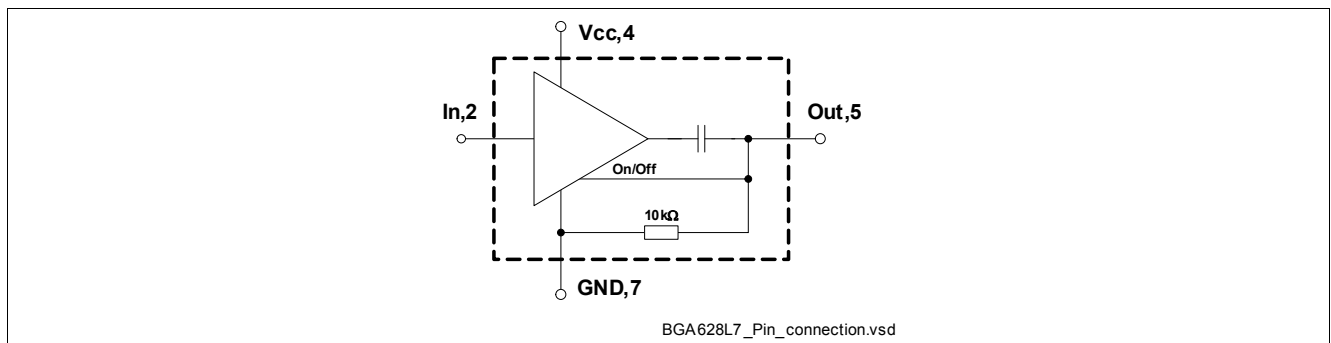
**Features**

- Extremely thin and small dimension (1.4 mm x 1.26 mm x 0.31 mm only)
- Operating frequency range 0.4 - 6 GHz
- High gain at low current consumption of 5.8 mA  
 $G_{ma} = 21.5$  dB at 1.575 GHz  
 $G_{ma} = 19.0$  dB at 2.4 GHz
- Low noise figure  
 $NF_{min} = 0.75$  dB at 1.575 GHz  
 $NF_{min} = 0.8$  dB at 2.4 GHz
- Typical supply voltage: 2.75 V
- Off mode
- Integrated RF choke on internal bias network
- Input and Output pre-matched on chip
- Low external part count
- 2 kV HBM ESD protection on all pins
- Leadless, Pb-free (RoHS compliant) and halogen-free TSLP-7-8 package



**Applications**

- General Purpose LNA for Bluetooth, GPS, ISDB-T Mobile TV, UMTS, Wi-Fi and WLAN



**Figure 1 Pin Connection**

Note: **ESD**: Electrostatic discharge sensitive device, observe handling precaution

Product Name	Marking	Package
BGA628L7	BR	TSLP-7-8

**Description**

The BGA628L7 is a wide band low noise amplifier, based on Infineon Technologies' Silicon Germanium Technology B7HFM. It features extremely small form factor with height of 0.32 mm maximum, and size of 1.4 x 1.26 mm<sup>2</sup> only. Such small dimension, together with the low external part count, has made it ideal for size-critical modules e.g. for WLAN, mobile TV or cellular phones.

Having an On/Off switch on-chip, the LNA's Out pin is simultaneously used for RF Out and On/Off switch. This functionality can be accessed using a RF-Choke at the Out pin, where a DC level of 0 V or an open switches the device on and a DC level of  $V_{CC}$  switches off.

Please refer to the product website ([www.infineon.com](http://www.infineon.com)) for various application examples, application notes and technical reports.

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

Pin No.	Symbol	Function
1	n.c.	not connected
2	In	RF input
3	n.c.	not connected
4	Vcc	DC supply
5	Out	RF output and On/Off switch
6	n.c.	not connected
7	GND	Ground

# 1 Maximum Ratings

**Table 2 Maximum Ratings**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Voltage at pin $V_{CC}$	$V_{CC}$	–	–	3.5	V	–
Voltage at pin Out	$V_{out}$	–	–	4	V	–
Current into pin In	$I_{in}$	–	–	0.1	mA	–
Current into pin Out	$I_{out}$	–	–	1	mA	–
Current into pin $V_{CC}$	$I_{VCC}$	–	–	10	mA	–
RF input power	$P_{in}$	–	–	6	dBm	–
Total power dissipation, $T_S < 138\text{ °C}^{1)}$	$P_{tot}$	–	–	35	mW	–
Junction temperature	$T_J$	–	–	150	°C	–
Ambient temperature range	$T_A$	65	–	150	°C	–
Storage temperature range	$T_{STG}$	65	–	150	°C	–
ESD capability all pins (HBM: JESD22-A114)	$V_{ESD}$	–	–	2000	V	–

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

*Note: All Voltages refer to GND-Node*

## Thermal Resistance

**Table 3 Thermal Resistance**

Parameter	Symbol	Value	Unit
Junction - soldering point <sup>1)</sup>	$R_{thJS}$	330	K/W

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

## 2 Electrical Characteristics

### 2.1 DC Characteristics

Table 4 DC Characteristics at  $T_A = 25\text{ }^\circ\text{C}$

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Total device on current	$I_{\text{tot-on}}$	–	5.8	–	mA	$V_{\text{CC}} = 2.75\text{ V}$
Total device off current	$I_{\text{tot-off}}$	–	260	–	$\mu\text{A}$	$V_{\text{CC}} = 2.75\text{ V}$ , $V_{\text{out}} = V_{\text{CC}}$
On / Off switch control voltage	$V_{\text{on}}$	0	–	0.8	V	$V_{\text{CC}} = 2.75\text{ V}$ ON-Mode: $V_{\text{out}} = V_{\text{on}}$
	$V_{\text{off}}$	2.0	–	3.5	V	$V_{\text{CC}} = 2.75\text{ V}$ OFF-Mode: $V_{\text{out}} = V_{\text{off}}$

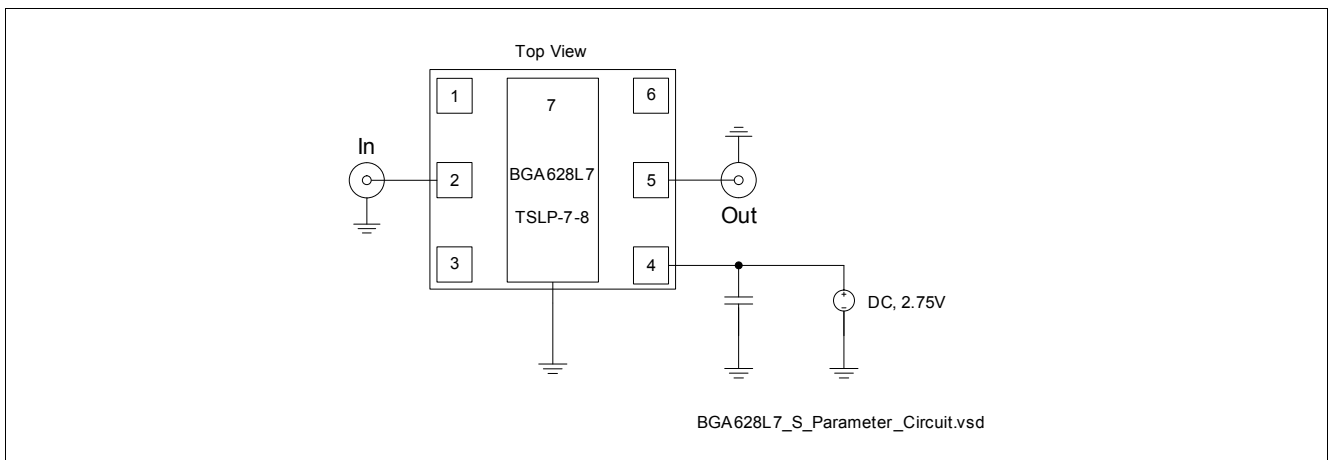


Figure 2 S-Parameter Test Circuit (loss-free microstrip line)



## 2.2 AC Characteristics

### 2.2.1 Electrical Characteristics at $f = 450$ MHz

**Table 5** Electrical Characteristics at  $T_A = 25$  °C (measured according to Figure 2),  $V_{CC} = 2.75$  V, unless otherwise specified

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Maximum available power gain	$G_{ma}$	–	24.5	–	dB	–
Insertion power gain	$ S_{21} ^2$	–	18.8	–	dB	–
Insertion power gain (Off-State)	$ S_{21} ^2$	–	-42	–	dB	$V_{out} = 2.75$ V
Input return loss	$RL_{in}$	–	2	–	dB	–
Output return loss	$RL_{out}$	–	11	–	dB	–
Minimum noise figure	$NF_{min}$	–	0.65	–	dB	$Z_S = Z_{Sopt}$
Noise figure in 50 $\Omega$ System	$NF_{50\Omega}$	–	0.8	–	dB	$Z_S = Z_L = 50$ $\Omega$
Input third order intercept point <sup>1)</sup> (On-State)	$IIP3$	–	-13	–	dBm	$\Delta f = 1$ MHz, $P_{IN} = -28$ dBm
Input power at 1 dB gain compression	$P_{-1dB}$	–	-24.5	–	dBm	–

1)  $IP_3$  values depends on termination of all intermodulation frequency components. Termination used for this measurement is 50  $\Omega$  from 0.1 to 6 GHz

### 2.2.2 Electrical Characteristics at $f = 900$ MHz

**Table 6** Electrical Characteristics at  $T_A = 25$  °C (measured according to Figure 2),  $V_{CC} = 2.75$  V, unless otherwise specified

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Maximum available power gain	$G_{ma}$	–	23	–	dB	–
Insertion power gain	$ S_{21} ^2$	–	18.8	–	dB	–
Insertion power gain (Off-State)	$ S_{21} ^2$	–	-34	–	dB	$V_{out} = 2.75$ V
Input return loss	$RL_{in}$	–	3	–	dB	–
Output return loss	$RL_{out}$	–	14	–	dB	–
Minimum noise figure	$NF_{min}$	–	0.7	–	dB	$Z_S = Z_{Sopt}$
Noise figure in 50 $\Omega$ System	$NF_{50\Omega}$	–	0.8	–	dB	$Z_S = Z_L = 50$ $\Omega$
Input third order intercept point <sup>1)</sup> (On-State)	$IIP3$	–	-10	–	dBm	$\Delta f = 1$ MHz, $P_{IN} = -28$ dBm
Input power at 1 dB gain compression	$P_{-1dB}$	–	-24	–	dBm	–

1)  $IP_3$  values depends on termination of all intermodulation frequency components. Termination used for this measurement is 50  $\Omega$  from 0.1 to 6 GHz

### 2.2.3 Electrical Characteristics at $f = 1.575$ GHz

**Table 7** Electrical Characteristics at  $T_A = 25$  °C (measured according to Figure 2),  $V_{CC} = 2.75$  V, unless otherwise specified

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Maximum available power gain	$G_{ma}$	–	21.5	–	dB	–
Insertion power gain	$ S_{21} ^2$	–	18	–	dB	–
Insertion power gain (Off-State)	$ S_{21} ^2$	–	-27	–	dB	$V_{out} = 2.75$ V
Input return loss	$RL_{in}$	–	4	–	dB	–
Output return loss	$RL_{out}$	–	11	–	dB	–
Minimum noise figure	$NF_{min}$	–	0.75	–	dB	$Z_S = Z_{Sopt}$
Noise figure in 50 $\Omega$ System	$NF_{50\Omega}$	–	0.85	–	dB	$Z_S = Z_L = 50$ $\Omega$
Input third order intercept point <sup>1)</sup> (On-State)	$IIP3$	–	-2	–	dBm	$\Delta f = 1$ MHz, $P_{IN} = -28$ dBm
Input power at 1 dB gain compression	$P_{-1dB}$	–	-20.5	–	dBm	–

1)  $IP_3$  values depends on termination of all intermodulation frequency components. Termination used for this measurement is 50  $\Omega$  from 0.1 to 6 GHz

### 2.2.4 Electrical Characteristics at $f = 1.9$ GHz

**Table 8** Electrical Characteristics at  $T_A = 25$  °C (measured according to Figure 2),  $V_{CC} = 2.75$  V, unless otherwise specified

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Maximum available power gain	$G_{ma}$	–	21.0	–	dB	–
Insertion power gain	$ S_{21} ^2$	–	17.5	–	dB	–
Insertion power gain (Off-State)	$ S_{21} ^2$	–	-26	–	dB	$V_{out} = 2.75$ V
Input return loss	$RL_{in}$	–	5	–	dB	–
Output return loss	$RL_{out}$	–	10	–	dB	–
Minimum noise figure	$NF_{min}$	–	0.8	–	dB	$Z_S = Z_{Sopt}$
Noise figure in 50 $\Omega$ System	$NF_{50\Omega}$	–	0.9	–	dB	$Z_S = Z_L = 50$ $\Omega$
Input third order intercept point <sup>1)</sup>	$IIP3$	–	-1	–	dBm	$\Delta f = 1$ MHz, $P_{IN} = -28$ dBm
Input power at 1 dB gain compression	$P_{-1dB}$	–	-20	–	dBm	–

1)  $IP_3$  values depends on termination of all intermodulation frequency components. Termination used for this measurement is 50  $\Omega$  from 0.1 to 6 GHz

## 2.2.5 Electrical Characteristics at $f = 2.14$ GHz

**Table 9** Electrical Characteristics at  $T_A = 25$  °C (measured according to [Figure 2](#)),  $V_{CC} = 2.75$  V, unless otherwise specified

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Maximum available power gain	$G_{ma}$	–	20	–	dB	–
Insertion power gain	$ S_{21} ^2$	–	17	–	dB	–
Insertion power gain (Off-State)	$ S_{21} ^2$	–	-24	–	dB	$V_{out} = 2.75$ V
Input return loss	$RL_{in}$	–	5	–	dB	–
Output return loss	$RL_{out}$	–	10	–	dB	–
Minimum noise figure	$NF_{min}$	–	0.8	–	dB	$Z_S = Z_{Sopt}$
Noise figure in 50 $\Omega$ System	$NF_{50\Omega}$	–	0.9	–	dB	$Z_S = Z_L = 50$ $\Omega$
Input third order intercept point <sup>1)</sup> (On-State)	$IIP_3$	–	0	–	dBm	$\Delta f = 1$ MHz, $P_{IN} = -28$ dBm
Input power at 1 dB gain compression	$P_{-1dB}$	–	-18.5	–	dBm	–

1)  $IP_3$  values depends on termination of all intermodulation frequency components. Termination used for this measurement is 50  $\Omega$  from 0.1 to 6 GHz

## 2.2.6 Electrical Characteristics at $f = 2.4$ GHz

**Table 10** Electrical Characteristics at  $T_A = 25$  °C (measured according to [Figure 2](#)),  $V_{CC} = 2.75$  V, unless otherwise specified

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Maximum available power gain	$G_{ma}$	–	19	–	dB	–
Insertion power gain	$ S_{21} ^2$	–	16	–	dB	–
Insertion power gain (Off-State)	$ S_{21} ^2$	–	-24	–	dB	$V_{out} = 2.75$ V
Input return loss	$RL_{in}$	–	6	–	dB	–
Output return loss	$RL_{out}$	–	9	–	dB	–
Minimum noise figure	$NF_{min}$	–	0.8	–	dB	$Z_S = Z_{Sopt}$
Noise figure in 50 $\Omega$ System	$NF_{50\Omega}$	–	0.95	–	dB	$Z_S = Z_L = 50$ $\Omega$
Input third order intercept point <sup>1)</sup>	$IIP_3$	–	2	–	dBm	$\Delta f = 1$ MHz, $P_{IN} = -28$ dBm
Input power at 1 dB gain compression	$P_{-1dB}$	–	-17.5	–	dBm	–

1)  $IP_3$  values depends on termination of all intermodulation frequency components. Termination used for this measurement is 50  $\Omega$  from 0.1 to 6 GHz

## 2.2.7 Electrical Characteristics at $f = 3.5$ GHz

**Table 11** Electrical Characteristics at  $T_A = 25$  °C (measured according to Figure 2),  $V_{CC} = 2.75$  V, unless otherwise specified

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Maximum available power gain	$G_{ma}$	–	16	–	dB	–
Insertion power gain	$ S_{21} ^2$	–	13.5	–	dB	–
Insertion power gain (Off-State)	$ S_{21} ^2$	–	-22	–	dB	$V_{out} = 2.75$ V
Input return loss	$RL_{in}$	–	7	–	dB	–
Output return loss	$RL_{out}$	–	8	–	dB	–
Minimum noise figure	$NF_{min}$	–	0.9	–	dB	$Z_S = Z_{Sopt}$
Noise figure in 50 $\Omega$ System	$NF_{50\Omega}$	–	1.0	–	dB	$Z_S = Z_L = 50$ $\Omega$
Input third order intercept point <sup>1)</sup>	$IIP3$	–	5	–	dBm	$\Delta f = 1$ MHz, $P_{IN} = -28$ dBm
Input power at 1 dB gain compression	$P_{-1dB}$	–	-14.5	–	dBm	–

1)  $IP_3$  values depends on termination of all intermodulation frequency components. Termination used for this measurement is 50  $\Omega$  from 0.1 to 6 GHz

## 2.2.8 Electrical Characteristics at $f = 5.5$ GHz

**Table 12** Electrical Characteristics at  $T_A = 25$  °C (measured according to Figure 2),  $V_{CC} = 2.75$  V, unless otherwise specified

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Maximum available power gain	$G_{ma}$	–	10	–	dB	–
Insertion power gain	$ S_{21} ^2$	–	8	–	dB	–
Insertion power gain (Off-State)	$ S_{21} ^2$	–	-23	–	dB	$V_{out} = 2.75$ V
Input return loss	$RL_{in}$	–	8	–	dB	–
Output return loss	$RL_{out}$	–	6	–	dB	–
Minimum noise figure	$NF_{min}$	–	1.1	–	dB	$Z_S = Z_{Sopt}$
Noise figure in 50 $\Omega$ System	$NF_{50\Omega}$	–	1.3	–	dB	$Z_S = Z_L = 50$ $\Omega$
Input third order intercept point <sup>1)</sup>	$IIP3$	–	9	–	dBm	$\Delta f = 1$ MHz, $P_{IN} = -28$ dBm
Input power at 1 dB gain compression	$P_{-1dB}$	–	-11	–	dBm	–

1)  $IP_3$  values depends on termination of all intermodulation frequency components. Termination used for this measurement is 50  $\Omega$  from 0.1 to 6 GHz

### 3 Application Information

A list of all application notes is available at <http://goto.infineon.com/smallsignaldiscretes-appnotes>.

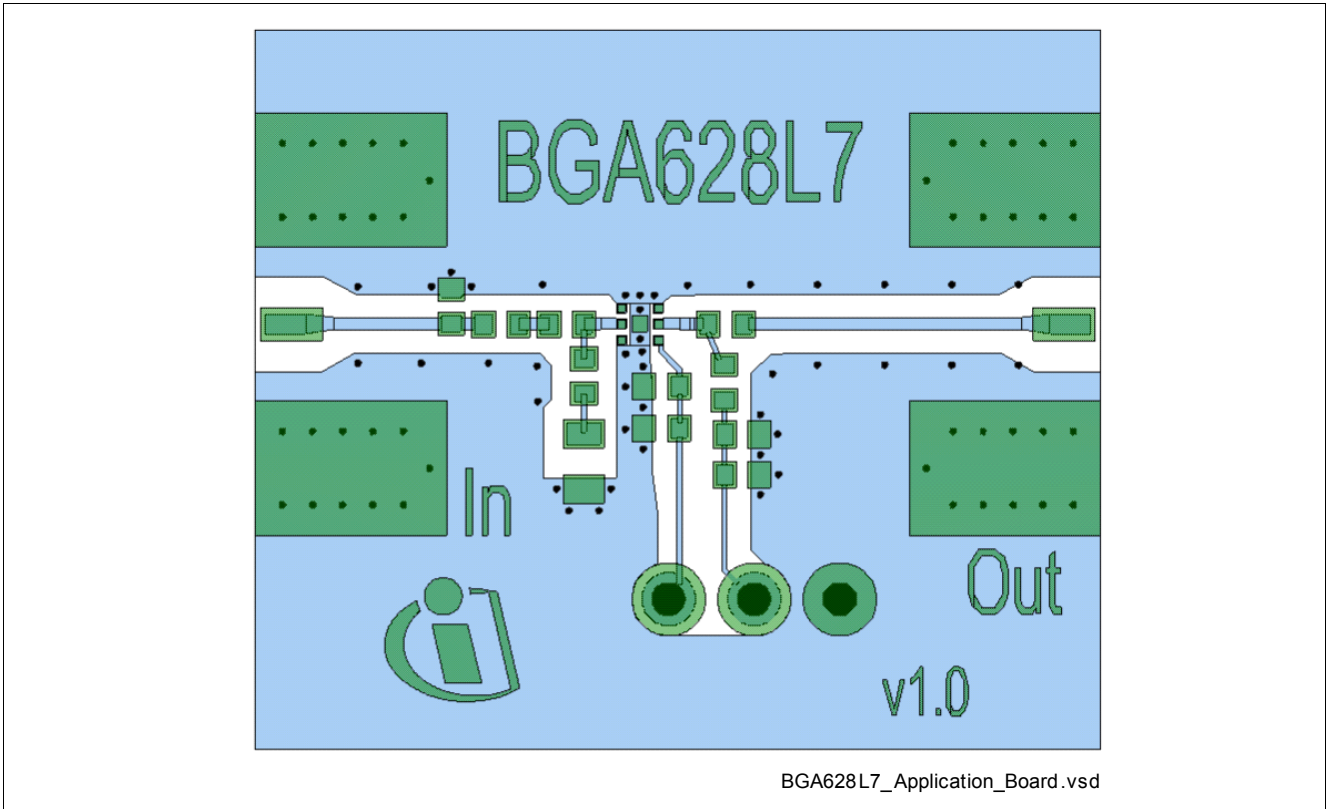


Figure 3 Drawing of Application Board

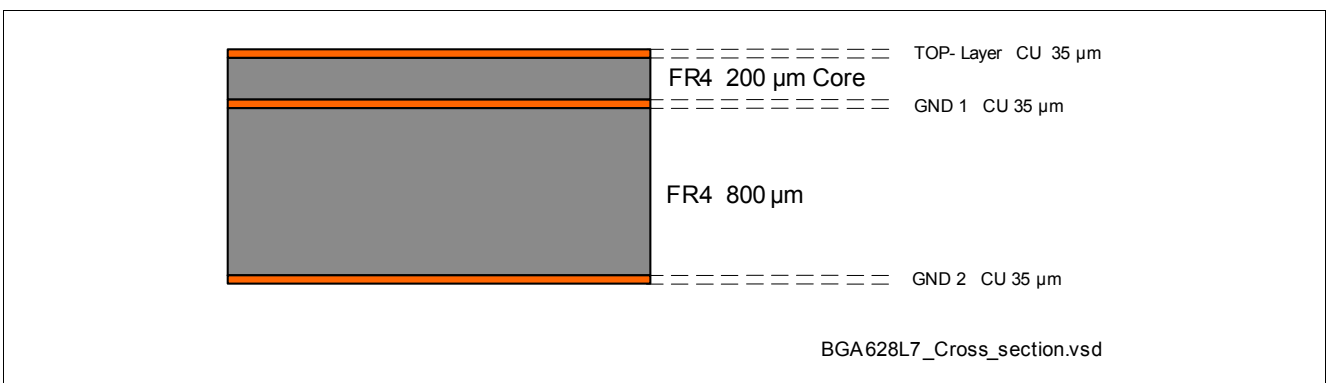


Figure 4 Cross-section of Application Board

## 4 Package Information

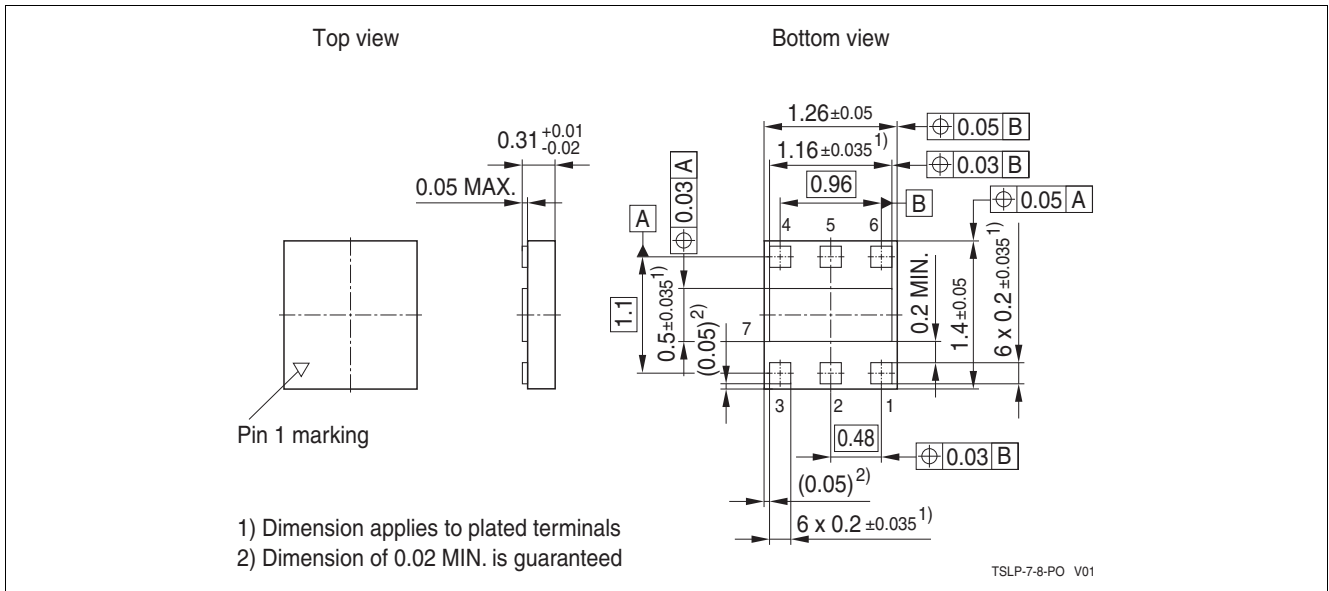


Figure 5 Package Dimensions for TSLP-7-8

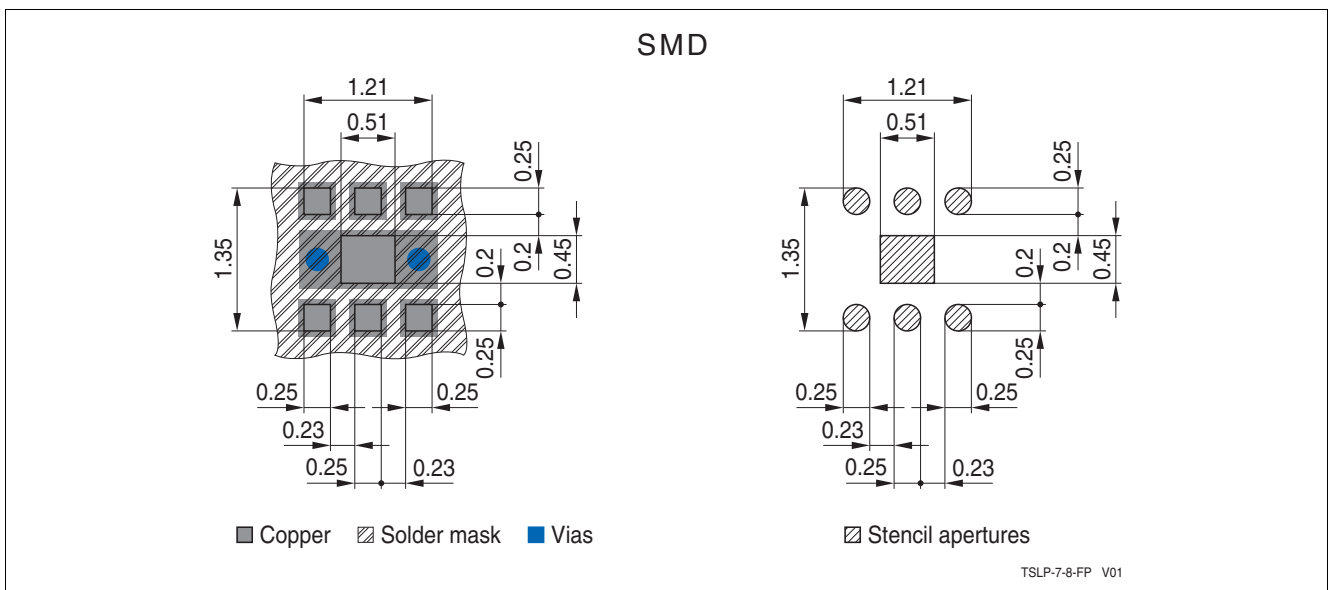


Figure 6 Footprint TSLP-7-8

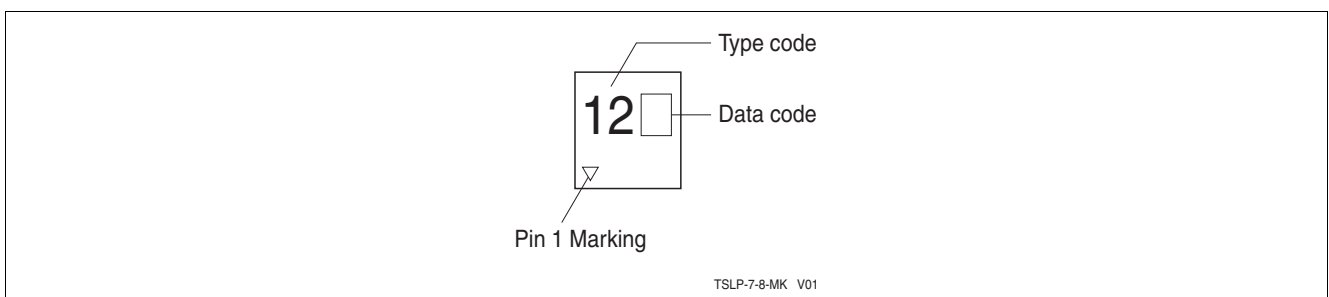


Figure 7 Marking Layout

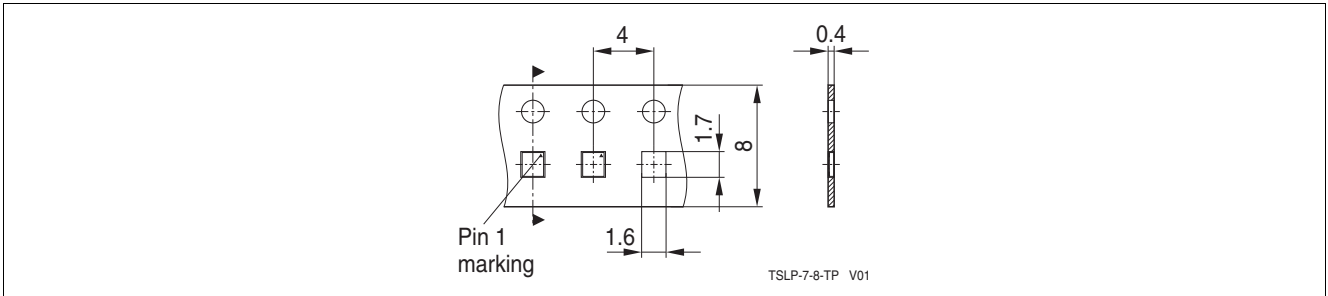


Figure 8 Tape & Reel Dimensions (Ø reel 180 mm, pieces/reel 7500)

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