

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
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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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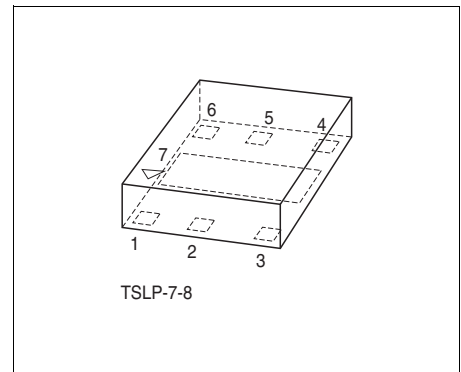
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Table of Contents

	Table of Contents	4
	Features	5
1	Maximum Ratings	7
2	Electrical Characteristics	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
3	Application Information	13
4	Package Information	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

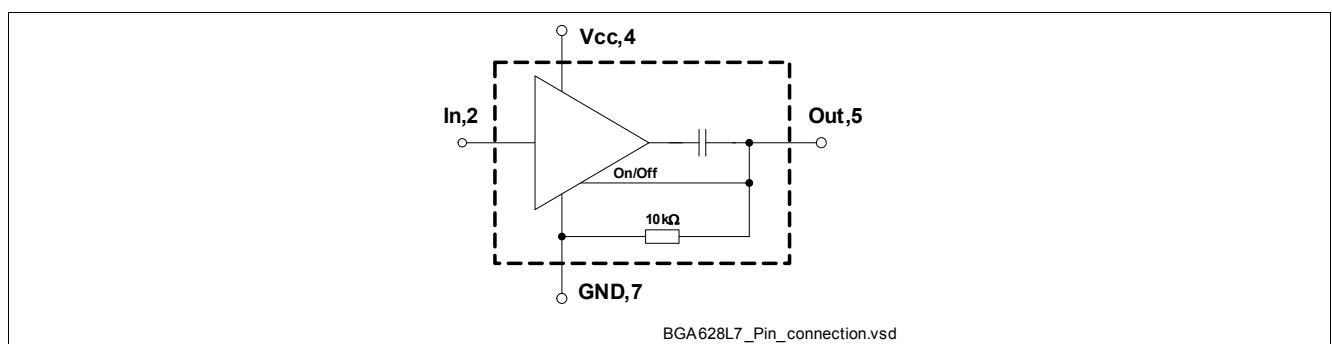


Figure 1 Pin Connection

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 mm² 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) 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 ¹⁾	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 $T_A = 25\text{ °C}$

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	–	μA	$V_{\text{CC}} = 2.75\text{ V}$, $V_{\text{out}} = V_{\text{CC}}$
On / Off switch control voltage	V_{on}	0	–	0.8	V	$V_{\text{CC}} = 2.75\text{ V}$ ON-Mode: $V_{\text{out}} = V_{\text{on}}$
	V_{off}	2.0	–	3.5	V	$V_{\text{CC}} = 2.75\text{ V}$ OFF-Mode: $V_{\text{out}} = V_{\text{off}}$

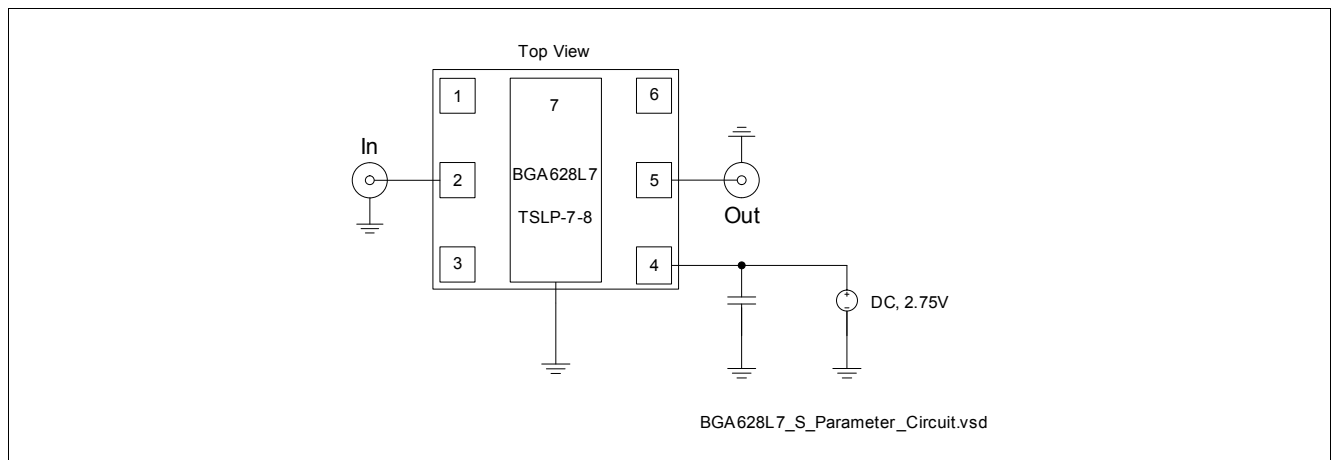


Figure 2 S-Parameter Test Circuit (loss-free microstrip line)

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 Ω System	$NF_{50\Omega}$	–	0.8	–	dB	$Z_S = Z_L = 50$ Ω
Input third order intercept point ¹⁾ (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 Ω 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 Ω System	$NF_{50\Omega}$	–	0.8	–	dB	$Z_S = Z_L = 50$ Ω
Input third order intercept point ¹⁾ (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 Ω 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 Ω System	$NF_{50\Omega}$	–	0.85	–	dB	$Z_S = Z_L = 50$ Ω
Input third order intercept point ¹⁾ (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 Ω 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 Ω System	$NF_{50\Omega}$	–	0.9	–	dB	$Z_S = Z_L = 50$ Ω
Input third order intercept point ¹⁾	$IIP3$	–	-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 Ω 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 Ω System	$NF_{50\Omega}$	–	0.9	–	dB	$Z_S = Z_L = 50$ Ω
Input third order intercept point ¹⁾ (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) IIP_3 values depends on termination of all intermodulation frequency components. Termination used for this measurement is 50 Ω 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 Ω System	$NF_{50\Omega}$	–	0.95	–	dB	$Z_S = Z_L = 50$ Ω
Input third order intercept point ¹⁾	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) IIP_3 values depends on termination of all intermodulation frequency components. Termination used for this measurement is 50 Ω 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 Ω System	$NF_{50\Omega}$	–	1.0	–	dB	$Z_S = Z_L = 50$ Ω
Input third order intercept point ¹⁾	$IIP3$	–	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 Ω 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 Ω System	$NF_{50\Omega}$	–	1.3	–	dB	$Z_S = Z_L = 50$ Ω
Input third order intercept point ¹⁾	$IIP3$	–	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 Ω from 0.1 to 6 GHz

3 Application Information

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

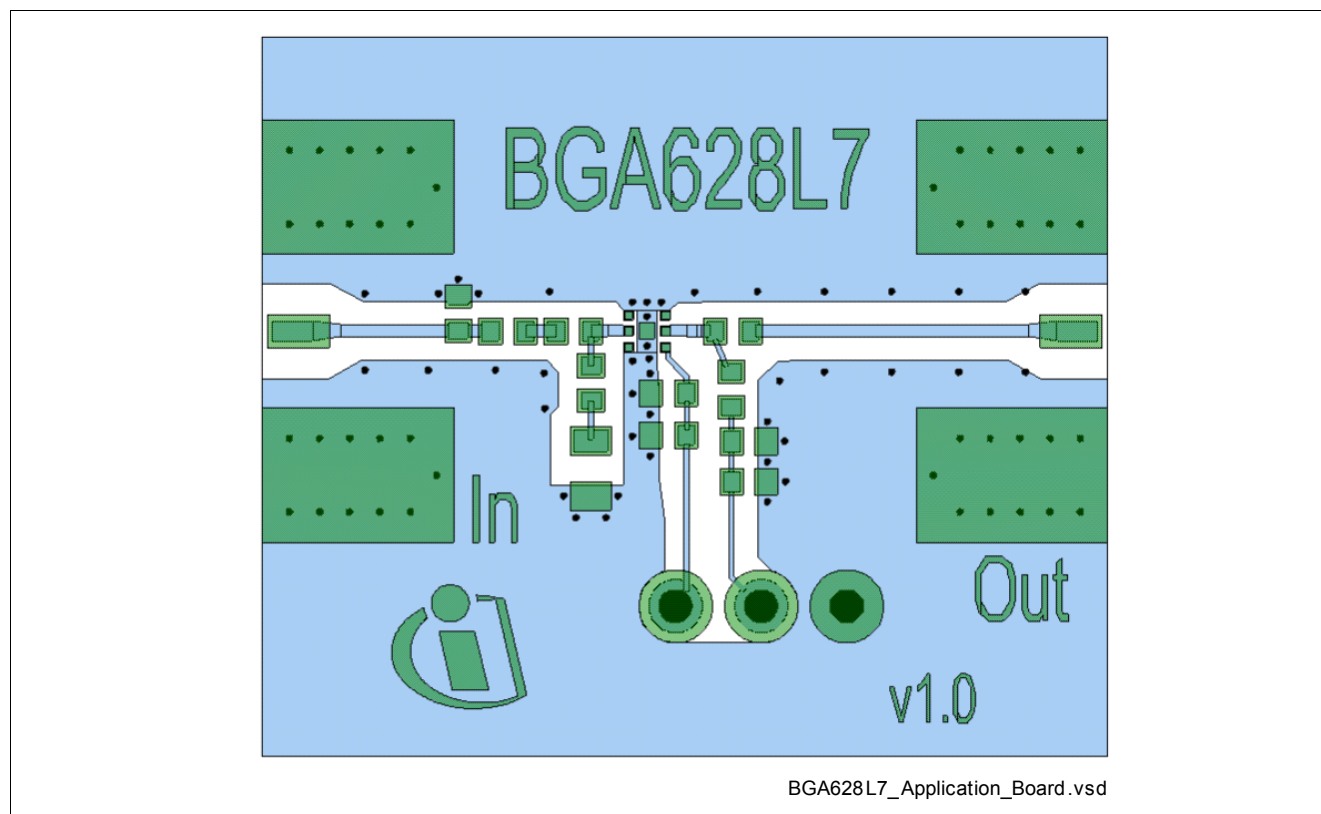


Figure 3 Drawing of Application Board

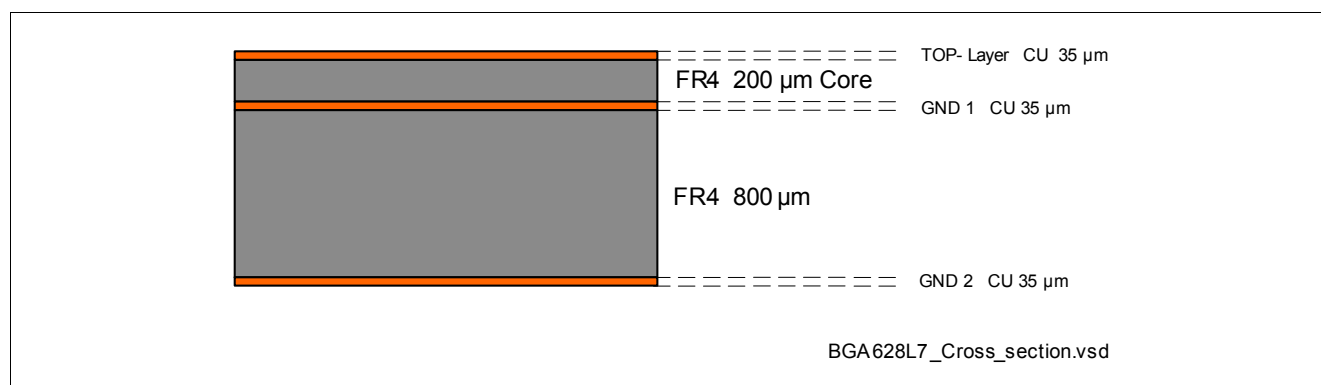


Figure 4 Cross-section of Application Board

4 Package Information

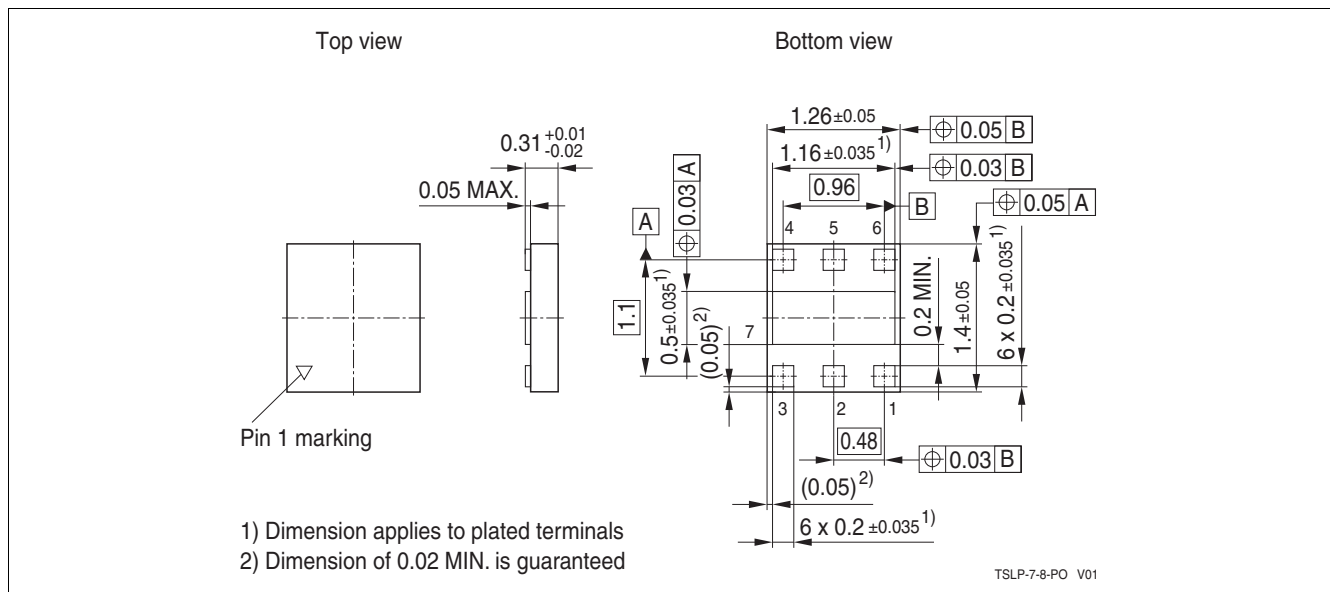


Figure 5 Package Dimensions for TSLP-7-8

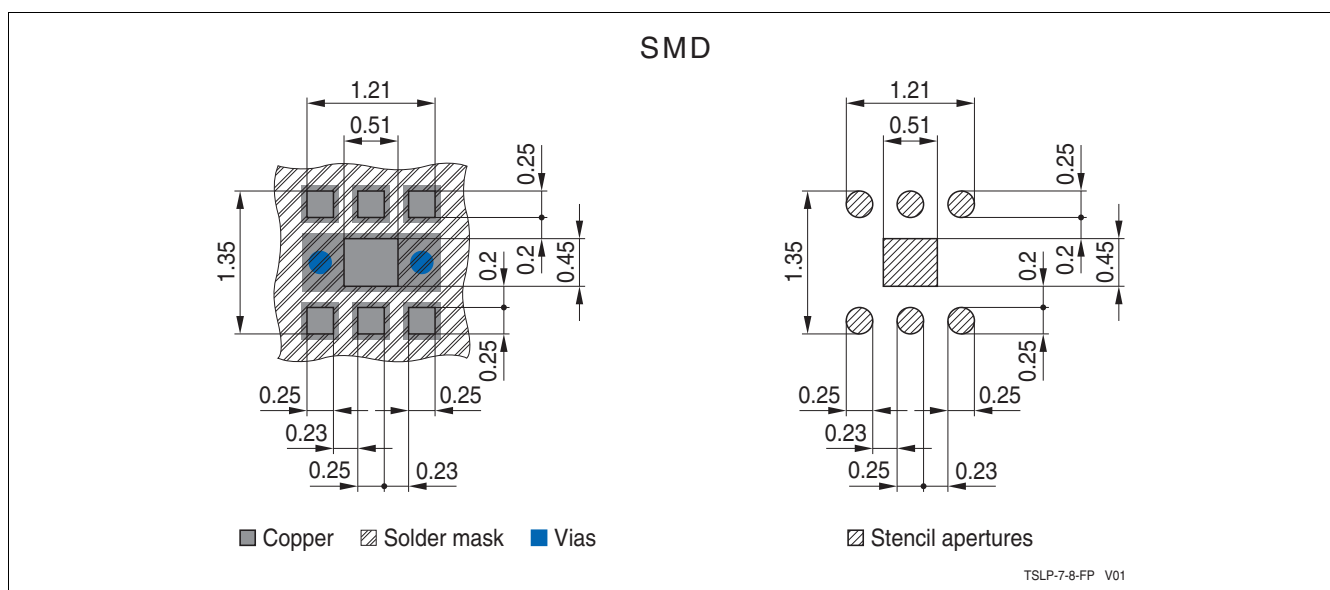


Figure 6 Footprint TSLP-7-8

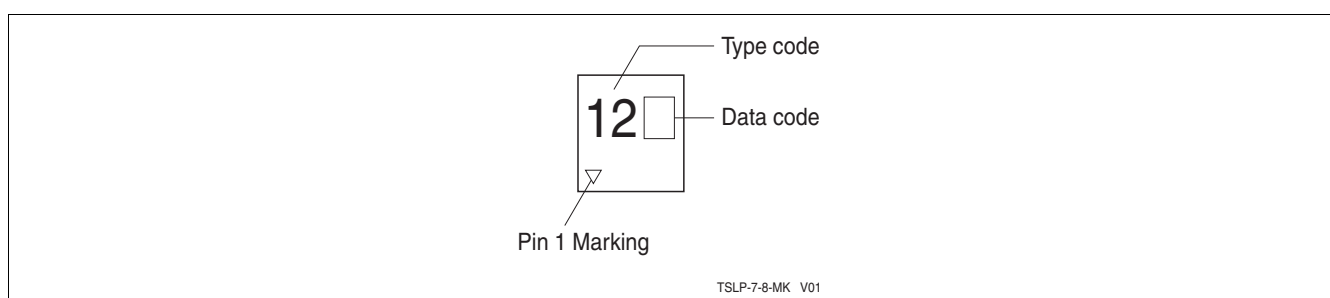


Figure 7 Marking Layout

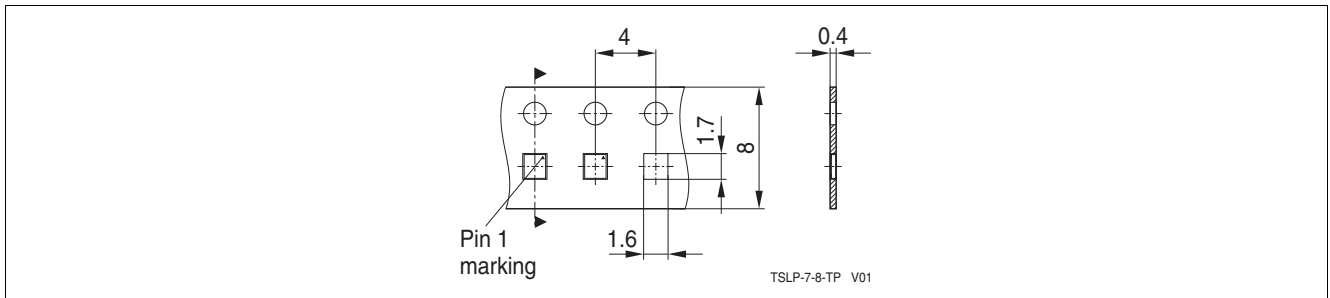


Figure 8 Tape & Reel Dimensions (Ø reel 180 mm, pieces/reel 7500)

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