

# BGA615L7

Silicon Germanium GPS Low Noise Amplifier

Small Signal Discretes



Never stop thinking

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**BGA615L7**

**Revision History: 2007-02-12, Rev.1.3**

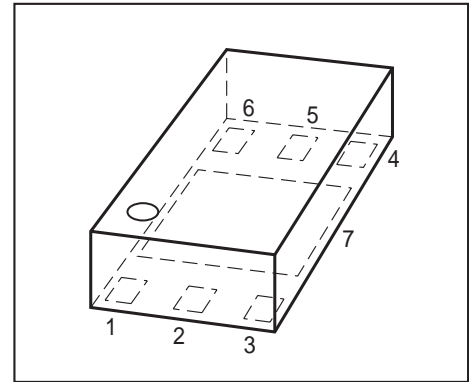
**Previous Version: BGA615L7 V1.2**

<b>Page</b>	<b>Subjects (major changes since last revision)</b>
4	Added moisture sensitivity level
5	Added thermal resistance
6	Adjusted power gain settling times Adjusted inband and out of band compression points
12	Updated recommended land pattern (added solder mask defined layout)
13	Added reel diameter and pcs / reel information

# 1 Silicon Germanium GPS Low Noise Amplifier

## Features

- High gain: 18 dB
- Low Noise Figure: 0.9 dB
- Power off function
- Operating frequency 1575 MHz
- Supply voltage: 2.4 V to 3.2 V
- Tiny TSLP-7-1 leadless package
- B7HF Silicon Germanium technology
- RF output internally matched to 50 Ω
- Low external component count
- 1 kV HBM ESD protection (including AI-pin)
- Moisture sensitivity level: MSL 1



TSLP-7-1

## Application

- 1575 MHz GPS

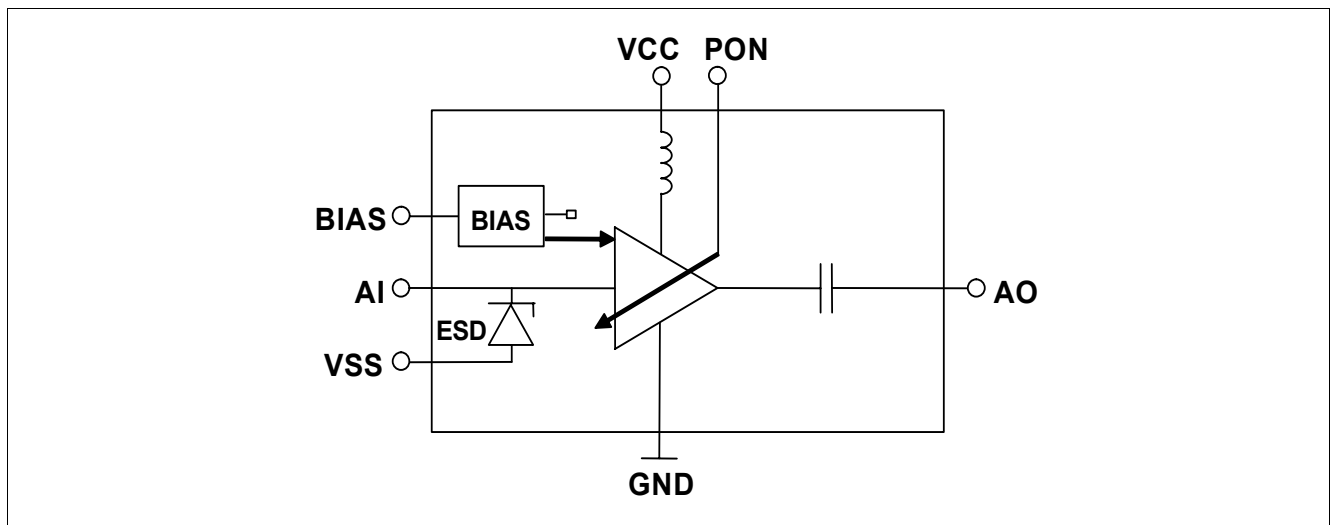


Figure 1 Blockdiagram

## 2 Description

The BGA615L7 is a front-end low noise amplifier for Global Positioning System (GPS) applications. The LNA provides 18 dB gain, 0.9 dB noise figure and high linearity performance, allowing it to be used as a first-stage LNA. Current consumption is as low as 5.6 mA. The BGA615L7 is based upon Infineon Technologies' B7HF Silicon Germanium technology. It operates over a 2.4 V to 3.2 V supply range.

Type	Package	Marking	Chip
BGA615L7	TSLP-7-1	BS	T0595

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

Pin No.	Symbol	Function
1	AI	LNA input
2	BIAS	DC bias
3	GND	RF ground
4	PON	Power on control
5	VCC	Supply control
6	AO	LNA output
7	VSS	DC ground

**Maximum Ratings**
**Table 2 Maximum Ratings**

Parameter <sup>1)</sup>	Symbol	Value	Unit
Voltage at pin VCC	$V_{CC}$	-0.3 ... 3.6	V
Voltage at pin AI	$V_{AI}$	-0.3 ... 0.9	V
Voltage at pin BIAS	$V_{BIAS}$	-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 VSS	$V_{SS}$	-0.3 ... 0.3	V
Current into pin VCC	$I_{CC}$	10	mA
RF input power	$P_{IN}$	10	dBm
Total power dissipation	$P_{tot}$	36	mW
Junction temperature	$T_J$	150	°C
Ambient temperature range	$T_A$	-30 ... 85	°C
Storage temperature range	$T_{STG}$	-65 ... 150	°C
ESD capability all pins (HBM: JESD22A-114)	$V_{ESD}$	1000	V

1) All voltages refer to GND-Node.

**Thermal resistance**
**Table 3 Thermal resistance**

Parameter	Symbol	Value	Unit
Junction - soldering point <sup>1)</sup>	$R_{thJS}$	240	K/W

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

### 3 Electrical Characteristics

**Table 4** Electrical Characteristics<sup>1)</sup>:  $T_A = 25\text{ °C}$ ,  $V_{CC} = 2.8\text{ V}$ ,  $V_{PON,ON} = 2.8\text{ V}$ ,  $V_{PON,OFF} = 0\text{ V}$ ,  $f = 1575\text{ MHz}$ 

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Supply voltage	$V_{CC}$	2.4	2.8	3.2	V	
Supply current	$I_{CC}$	-	5.6	-	mA	ON-mode
		-	0.2	3	$\mu\text{A}$	OFF-mode
Gain switch control voltage	$V_{pon}$	1.5	-	3.2	V	ON-mode
		0	-	0.5	V	OFF-mode
Gain switch control current	$I_{pon}$	-	1.5	3	$\mu\text{A}$	ON-mode
		-	0	1	$\mu\text{A}$	OFF-mode
Insertion power gain	$ S_{21} ^2$	-	18	-	dB	High-gain Mode
Noise figure <sup>2)</sup>	$NF$	-	0.9	-	dB	$Z_S = 50\ \Omega$
Input return loss	$RL_{in}$	-	13	-	dB	
Output return loss	$RL_{out}$	-	>15	-	dB	
Reverse isolation	$1/ S_{12} ^2$	-	35	-	dB	
Power gain settling time <sup>3)</sup>	$t_S$	-	20	-	$\mu\text{s}$	OFF- to ON-mode
		-	50	-	$\mu\text{s}$	ON- to OFF-mode
Inband input 3rd order intercept point	$IIP_3$	-	-1	-	dBm	$f_1 = 1575\text{ MHz}$ $f_2 = f_1 \pm 1\text{ MHz}$
Inband input 1 dB compression point	$IP_{1dB}$	-	-14	-	dBm	
Out of band input 1 dB compression point	$IP_{1dB,900M}$	-	-9	-	dBm	$f = 806\text{ MHz} \dots 928\text{ MHz}$
Out of band input 1 dB compression point	$IP_{1dB,1650M}$	-	-12	-	dBm	$f = 1612\text{ MHz} \dots 1710\text{ MHz}$
Out of band input 1 dB compression point	$IP_{1dB,1900M}$	-	-6	-	dBm	$f = 1710\text{ MHz} \dots 1785\text{ MHz}$ $f = 1850\text{ MHz} \dots 1909\text{ MHz}$
Stability	$k$	-	> 1.5	-		$f = 20\text{ MHz} \dots 10\text{ GHz}$

1) Measured on BGA615L7 application board including PCB losses (unless noted otherwise)

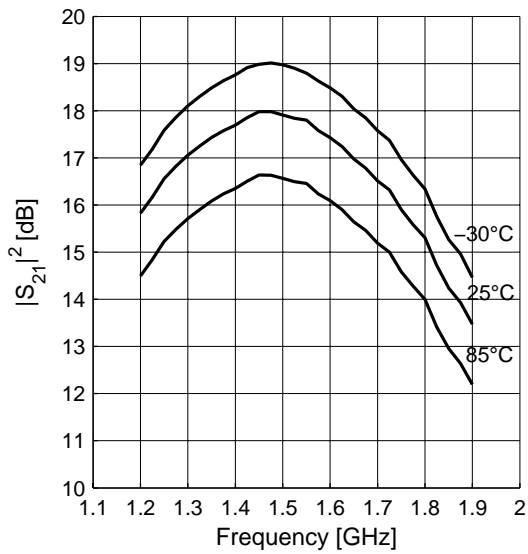
2) PCB losses subtracted

3) To within 1 dB of the final gain OFF- to ON-mode; to within 3 dB of the final gain ON- to OFF-mode

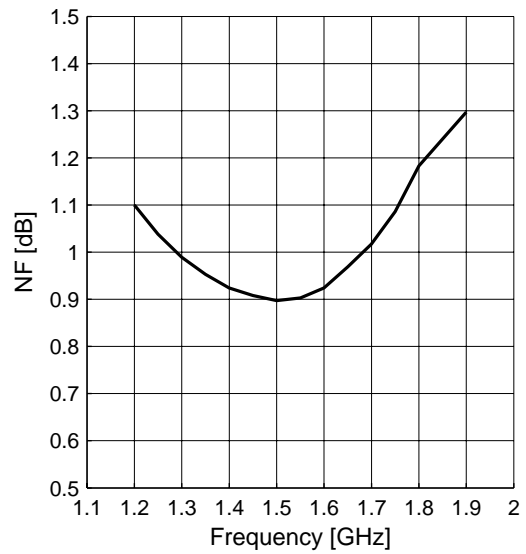
## 4 Measured Parameters

Typical Measurement Results ON Mode;  $T_A = 25\text{ }^\circ\text{C}$

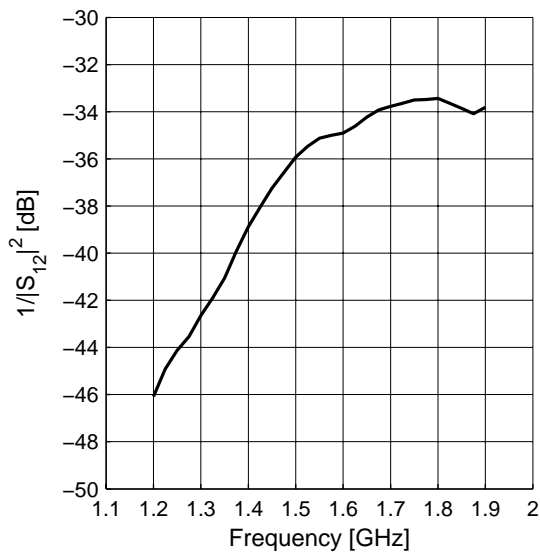
**Gain**  $|S_{21}|^2 = f(f)$   
 $V_{CC} = 2.8\text{ V}$



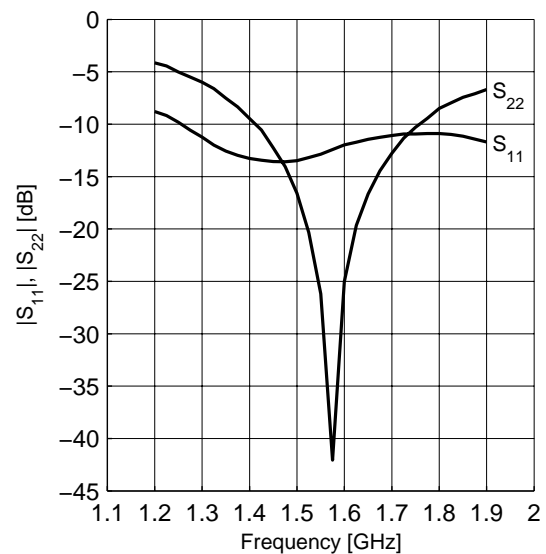
**Noise Figure<sup>1)</sup>**  $NF = f(f)$   
 $V_{CC} = 2.8\text{ V}$



**Reverse Isolation**  $1/|S_{12}|^2 = f(f)$   
 $V_{CC} = 2.8\text{ V}$



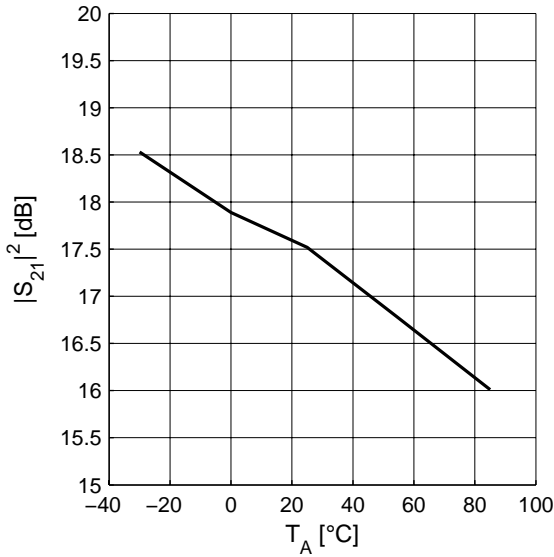
**Matching**  $|S_{11}|, |S_{22}| = f(f)$   
 $V_{CC} = 2.8\text{ V}$



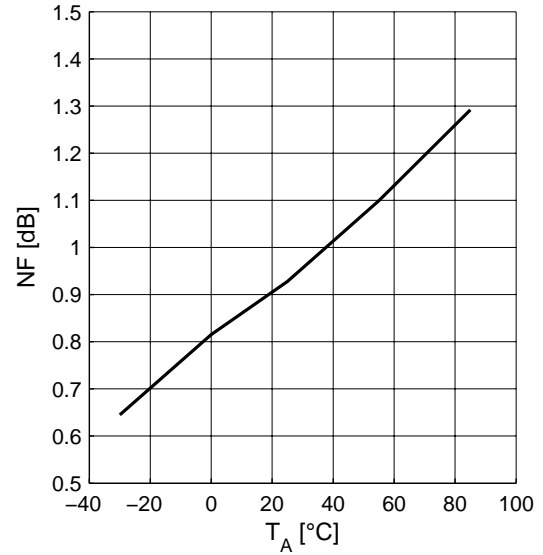
1) PCB losses subtracted

Typical Measurement Results ON Mode vs. Temperature

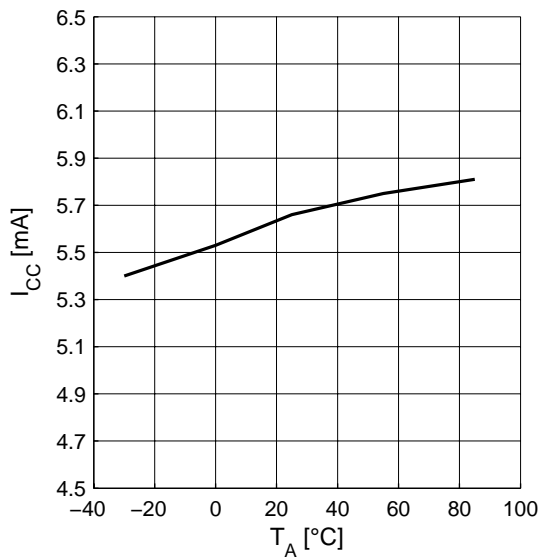
**Power Gain**  $|S_{21}|^2 = f(T_A)$   
 $V_{CC} = 2.8\text{ V}$



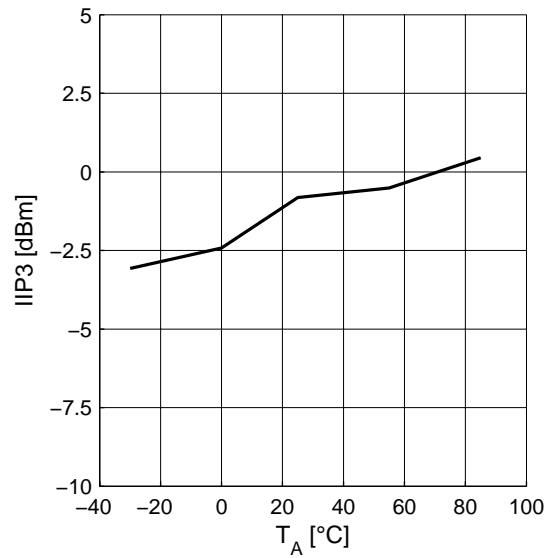
**Noise Figure**<sup>1)</sup>  $NF = f(T_A)$   
 $V_{CC} = 2.8\text{ V}$



**Supply current**  $I_{CC} = f(T_A)$   
 $V_{CC} = 2.8\text{ V}$



**Third Order Input Intercept Point**  $IIP_3 = f(T_A)$   
 $V_{CC} = 2.8\text{ V}$

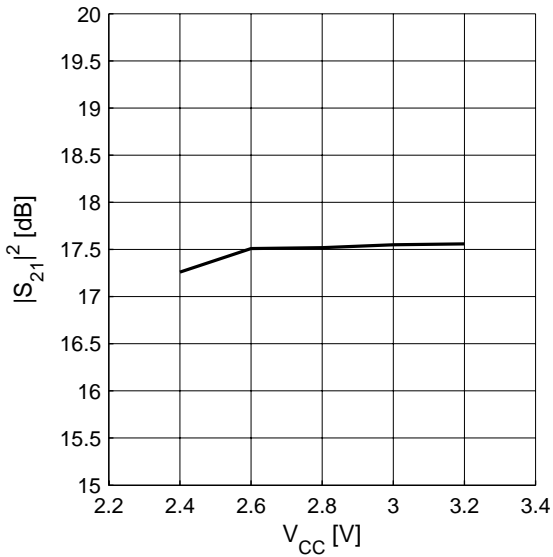


1) PCB losses subtracted

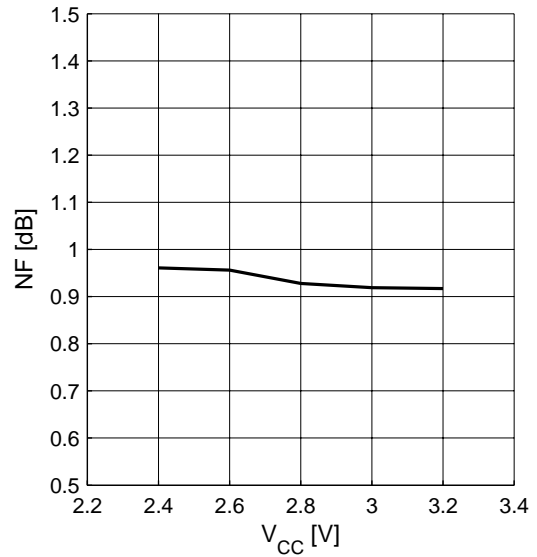


Typical Measurement Results ON Mode vs. Supply Voltage

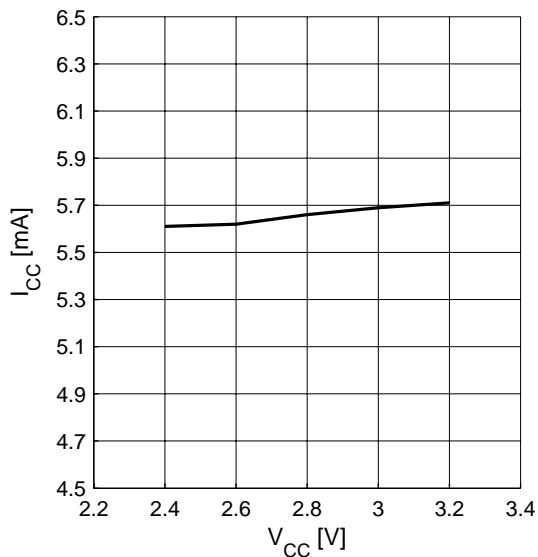
**Power Gain**  $|S_{21}| = f(V_{CC})$   
 $T_A = 25\text{ }^\circ\text{C}$



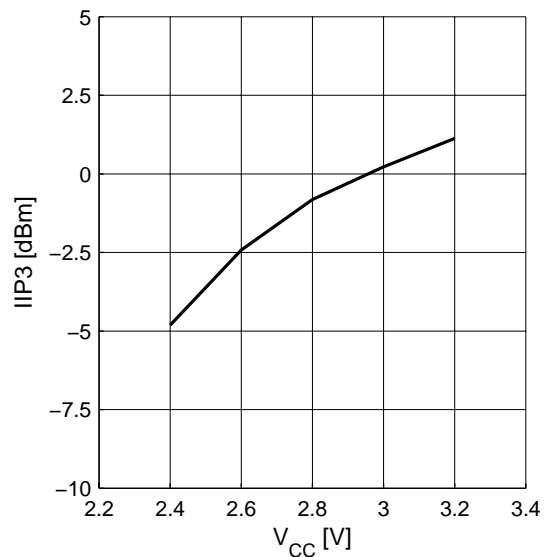
**Noise Figure**<sup>1)</sup>  $NF = f(V_{CC})$   
 $T_A = 25\text{ }^\circ\text{C}$



**Supply current**  $I_{CC} = f(V_{CC})$   
 $T_A = 25\text{ }^\circ\text{C}$



**Third Order Input Intercept Point**  $IIP_3 = f(V_{CC})$   
 $T_A = 25\text{ }^\circ\text{C}$



1) PCB losses subtracted

## 5 Application Information

### PCB Configuration

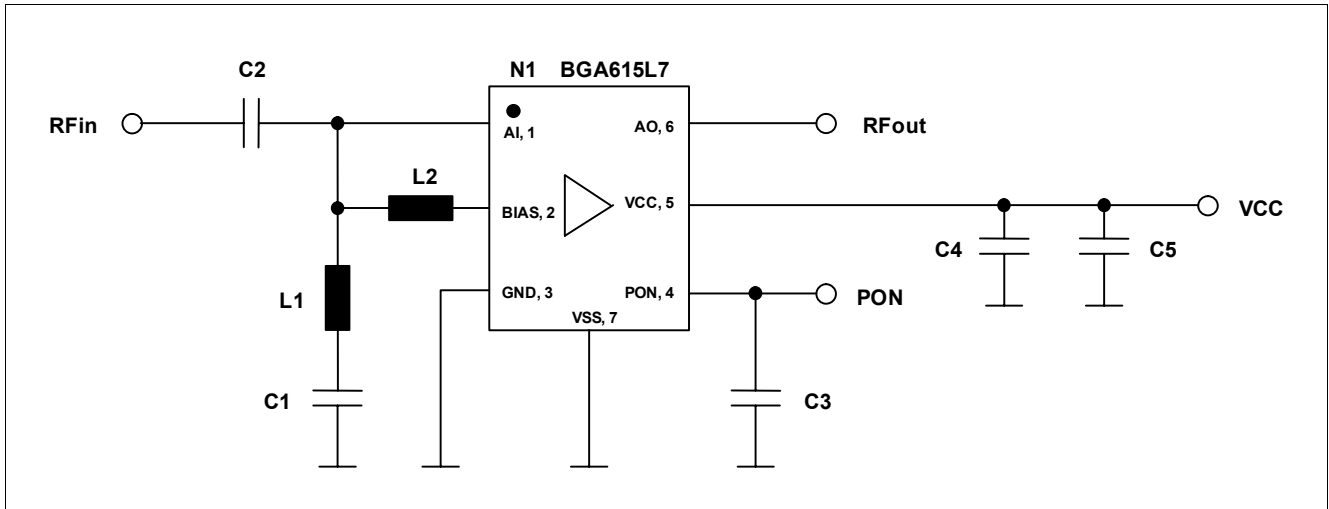


Figure 2 Schematic of BGA615L7

Table 5 Bill of Materials

Name	Value	Package	Manufacturer	Function
C1	10 nF	0402	Various	LF trap
C2	5 pF	0402	Various	DC block
C3	10 pF	0402	Various	Control voltage filtering optional
C4	100 pF	0402	Various	Supply filtering optional
C5	2.2 nF	0402	Various	Supply filtering
L1	3.3 nH	0402	Various	LF trap & input matching
L2	100 nH	0402	Various	Biasing
N1	BGA615L7	PG-TSLP-7-1	Infineon	SiGe LNA

Application Board

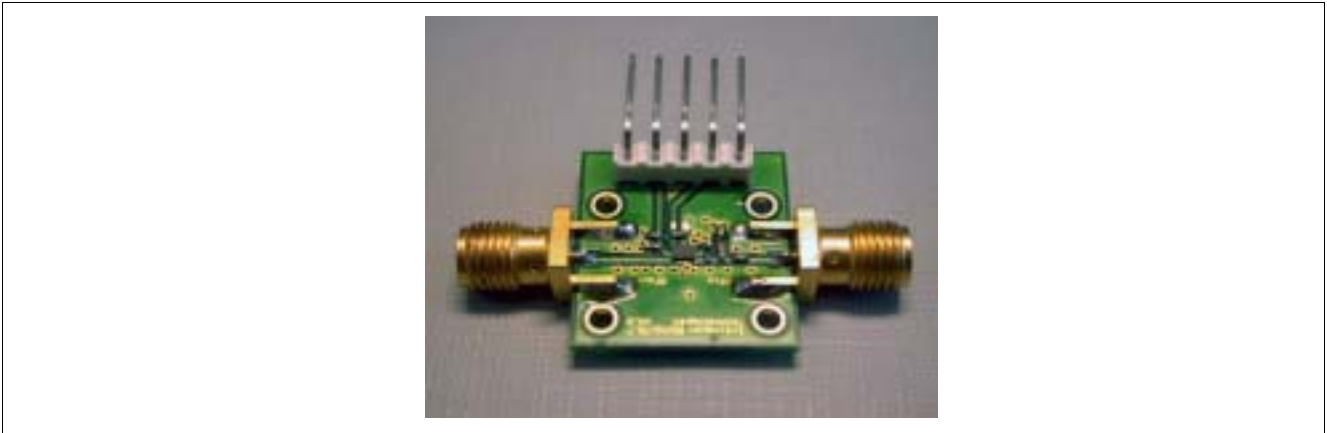


Figure 3 Photograph of Application Board

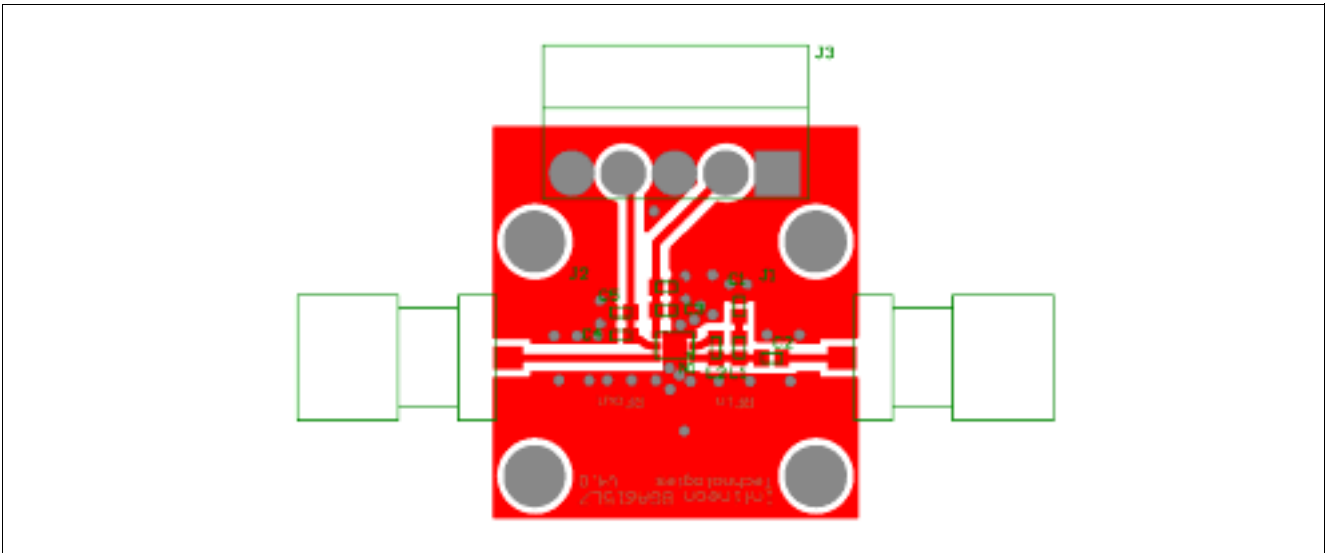


Figure 4 Top View of Application Board

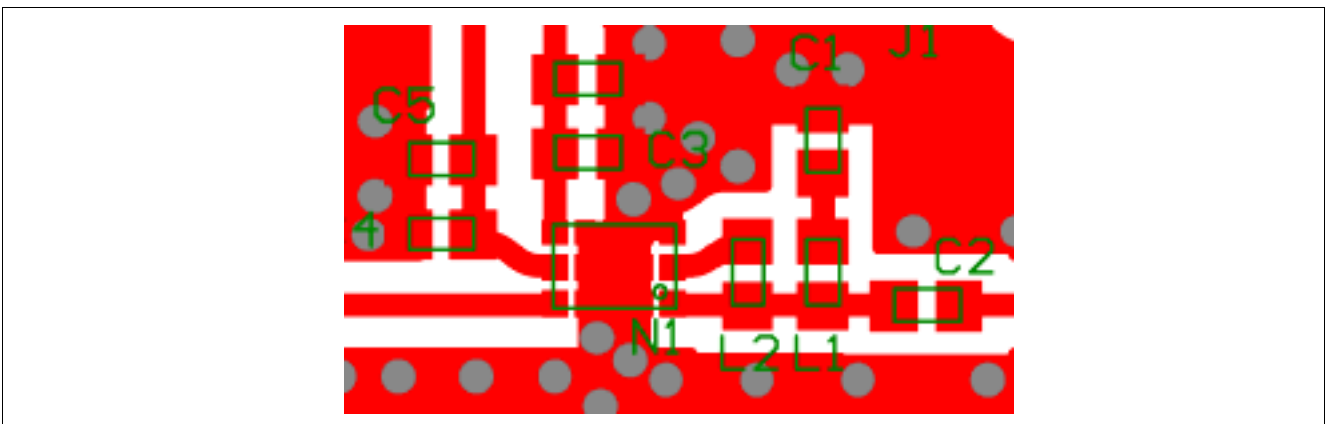


Figure 5 Detailed View of Application Board

Please note that RF-ground is connected via pin 3 only. In order to achieve the same performance as given in this data sheet, it is necessary to provide good RF-grounding on this pin. Furthermore, the LF trap consisting of inductor L1 and capacitor C1 should be placed as close as possible to pin 3.

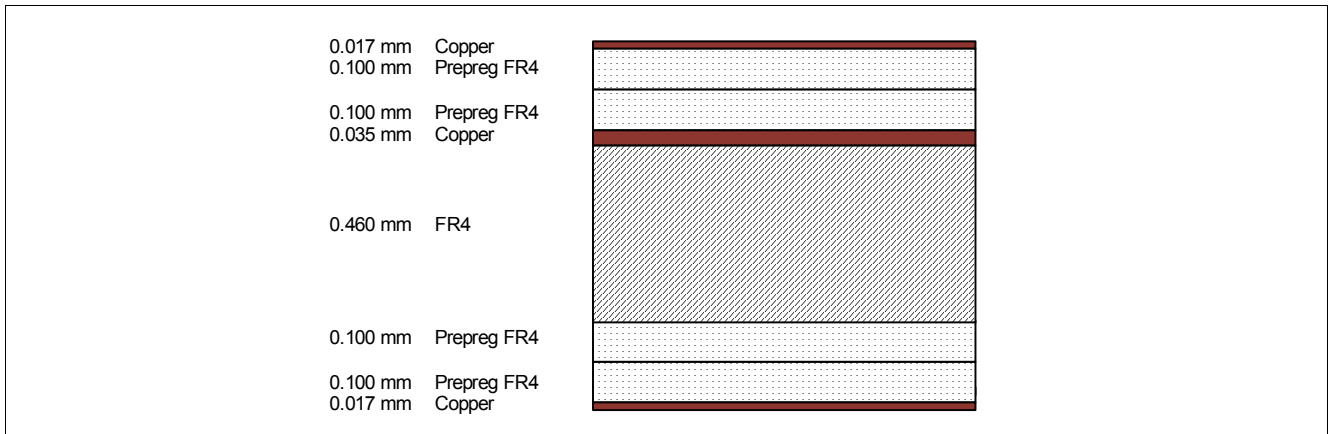


Figure 6 Cross-Section View of Application Board

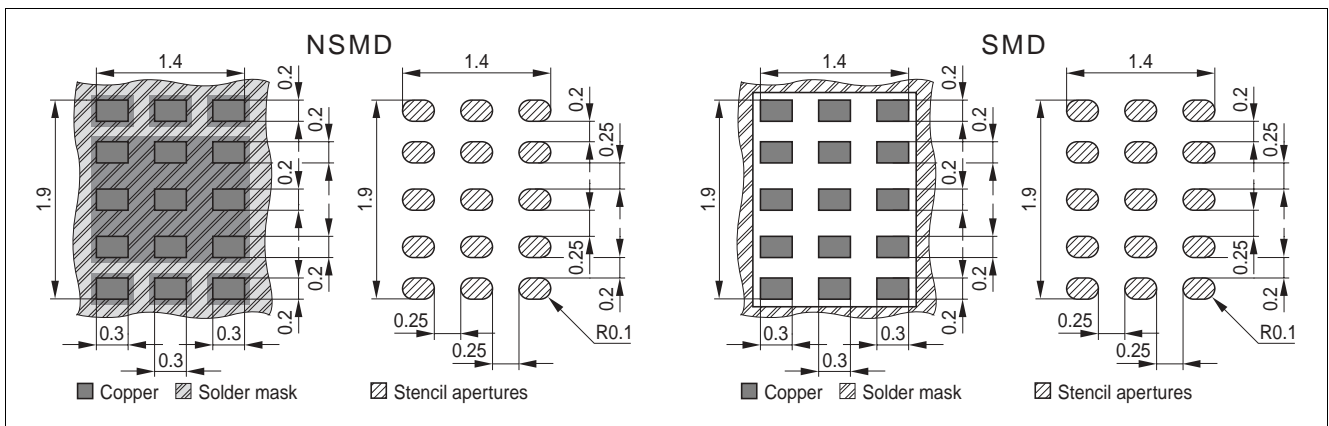


Figure 7 Recommended Land Pattern

Table 6 Application Notes

No.	Description
AN091	The BGA615L7 Silicon-Germanium Low Noise Amplifier in GPS Applications
AN093	The BGA615L7 Silicon-Germanium Low Noise Amplifier with 0201 chip components
AN094	The BGA615L7 Silicon-Germanium Low Noise Amplifier for Low-Current GPS Applications

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

## 6 Package Information

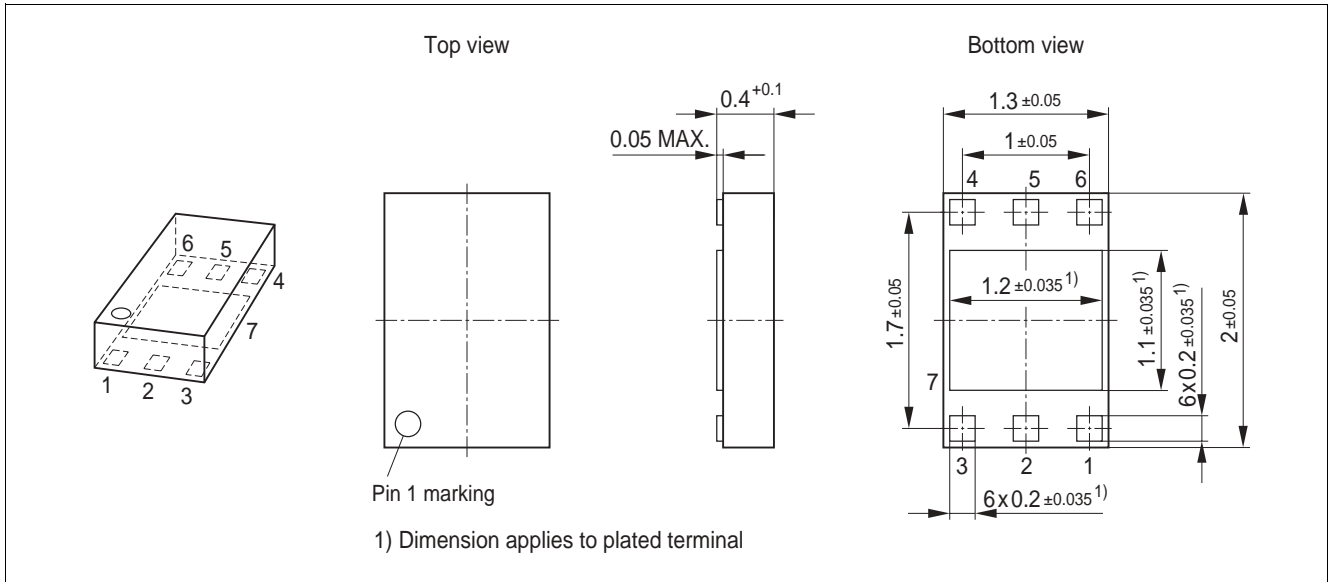


Figure 8 Package Dimensions

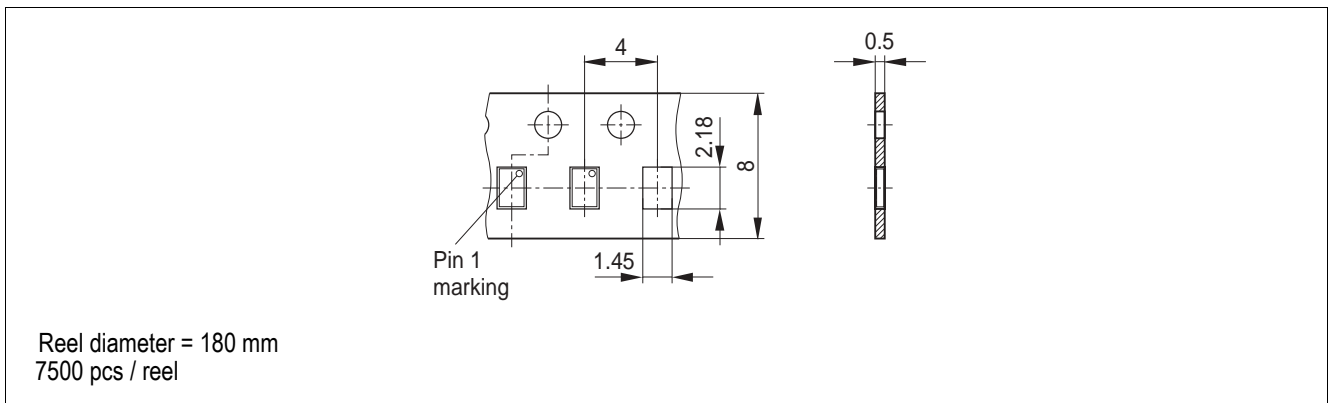


Figure 9 Tape & Reel Dimensions

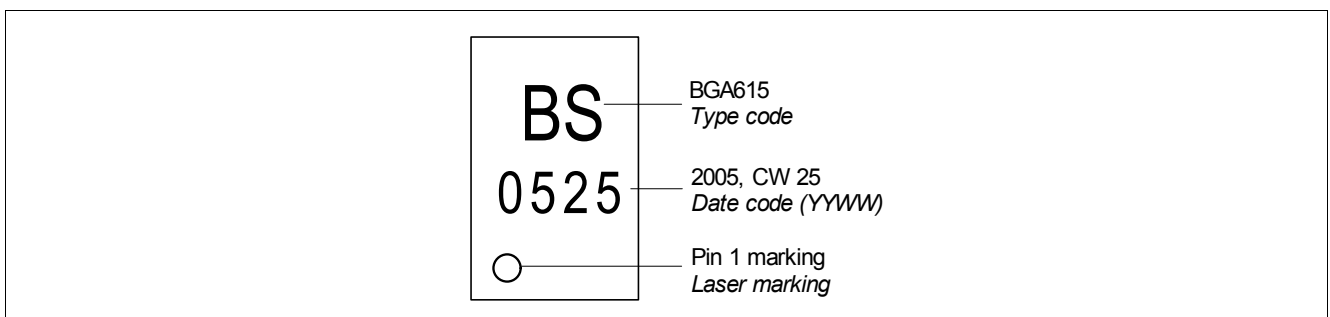


Figure 10 Marking Layout