

# BGA622L7

Silicon Germanium Wide Band Low Noise  
Amplifier with 2 kV ESD Protection

Small Signal Discretes



Never stop thinking

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**BGA622L7, Silicon Germanium Wide Band Low Noise Amplifier with 2 kV ESD Protection****Revision History: 2008-04-14, Rev. 2.2****Previous Version: 2006-05-19**

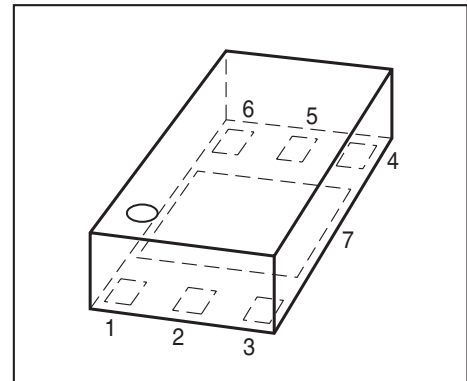
| <b>Page</b> | <b>Subjects (major changes since last revision)</b> |
|-------------|---|
| All         | Document layout change                              |
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# 1 Silicon Germanium Wide Band Low Noise Amplifier with 2 kV ESD Protection

## Feature

- High gain
  - $|S_{21}|^2 = 17.5$  dB at 1.575 GHz
  - $|S_{21}|^2 = 16.8$  dB at 1.9 GHz
  - $|S_{21}|^2 = 16.2$  dB at 2.14 GHz
- Low noise figure,  $NF = 0.95$  dB at 1.575 GHz
- Operating frequency range 0.5 - 6 GHz
- Typical supply voltage: 2.75 V
- On/Off-Switch
- Output-match on chip, input pre-matched
- Low external part count
- Tiny TSLP-7-1 leadless package
- 70 GHz  $f_T$  - Silicon Germanium technology
- 2 kV HBM ESD protection (Pin-to-Pin)
- Pb-free (RoHS compliant) package



TSLP-7-1



## Applications

- LNA for GSM, GPS, DCS, PCS, UMTS, Bluetooth, ISM and WLAN

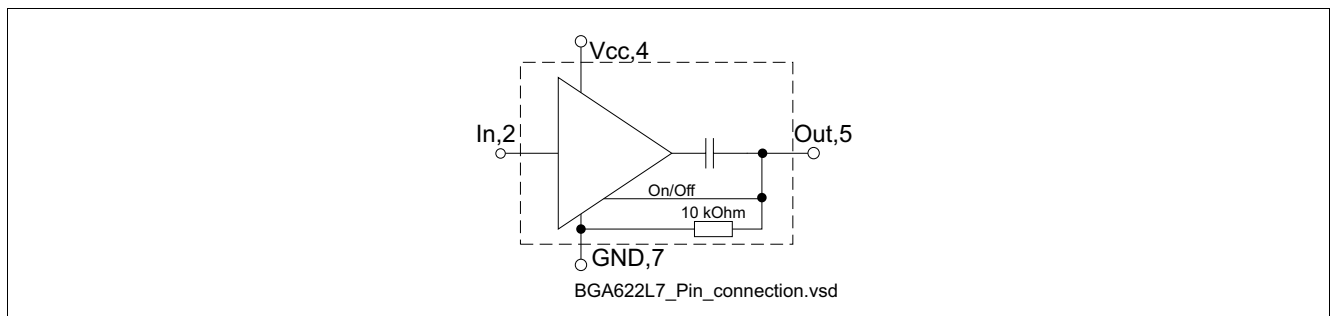


Figure 1 Pin connection

## Description

The BGA622L7 is a wide band low noise amplifier, based on Infineon Technologies' Silicon Germanium Technology B7HF. The 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, it provides an insertion loss of 26 dB together with a high  $IIP_3$  up to 24 dBm at GPS frequencies.

| Type     | Package  | Marking |
|----------|----------|---------|
| BGA622L7 | TSLP-7-1 | BX      |

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

## 2 Maximum Ratings

**Table 1** Maximum ratings

| Parameter   | Symbol    | Limit Value | Unit |
|---|-----------|-------------|------|
| 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, $T_S < 142\text{ °C}^{1)}$ | $P_{tot}$ | 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

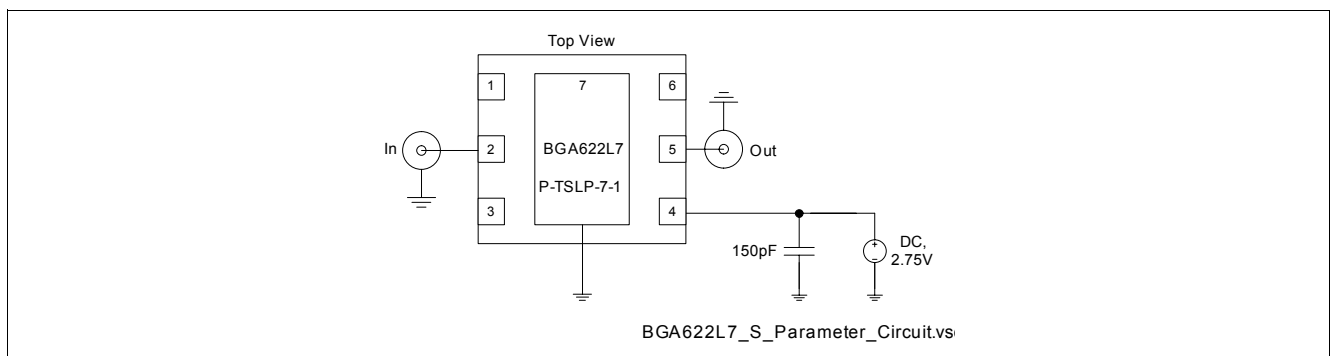
Note: All Voltages refer to GND-Node

### Thermal resistance

**Table 2** 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



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

### 3 Electrical Characteristics

#### 3.1 Electrical Characteristics at $T_A = 25\text{ °C}$ (measured according to [Figure 2](#)) $V_{CC} = 2.75\text{ V}$ , Frequency = 1.575 GHz, unless otherwise specified

**Table 3 Electrical Characteristics**

| Parameter  | Symbol         | Values |      |      | Unit          | Note / Test Condition  |
|--|----------------|--------|------|------|---------------|--|
|  |                | Min.   | Typ. | Max. |               |  |
| Insertion power gain   | $ S_{21} ^2$   |        | 17.5 |      | dB            |  |
| Insertion power gain (Off-State)                                 | $ S_{21} ^2$   |        | -26  |      | dB            |  |
| Input return loss (On-State)                                     | $RL_{in}$      |        | 5    |      | dB            |  |
| Output return loss (On-State)                                    | $RL_{out}$     |        | 12   |      | dB            |  |
| Noise figure ( $Z_S = 50\ \Omega$ )                              | $F_{50\Omega}$ |        | 0.95 |      | dB            |  |
| Input third order intercept point <sup>1)</sup><br>(On-State)    | $IIP_3$        |        | -2   |      | dBm           | $\Delta f = 1\text{ MHz}$ ,<br>$P_{IN} = -28\text{ dBm}$     |
| Input third order intercept point <sup>1)</sup><br>(Off - State) | $IIP_3$        |        | 24   |      | dBm           | $\Delta f = 1\text{ MHz}$ ,<br>$P_{IN} = -8\text{ dBm}$      |
| Input power at 1 dB gain compression                             | $P_{-1dB}$     |        | -20  |      | dBm           |  |
| Total device off current   | $I_{tot-off}$  |        | 260  |      | $\mu\text{A}$ | $V_{CC} = 2.75\text{ V}$ ,<br>$V_{out} = V_{CC}$             |
| Total device on current  | $I_{tot-on}$   |        | 5.8  |      | mA            | $V_{CC} = 2.75\text{ V}$                                     |
| On / Off switch control voltage                                  | $V_{on}$       | 0      |      | 0.8  | V             | $V_{CC} = 2.75\text{ V}$<br>ON-Mode:<br>$V_{out} = V_{on}$   |
|  | $V_{off}$      | 2.0    |      | 3.5  | V             | $V_{CC} = 2.75\text{ V}$<br>OFF-Mode:<br>$V_{out} = V_{off}$ |

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

### 3.2 Electrical Characteristics at $T_A = 25\text{ °C}$ (measured according to [Figure 2](#)) $V_{CC} = 2.75\text{ V}$ , Frequency = 2.14 GHz, unless otherwise specified

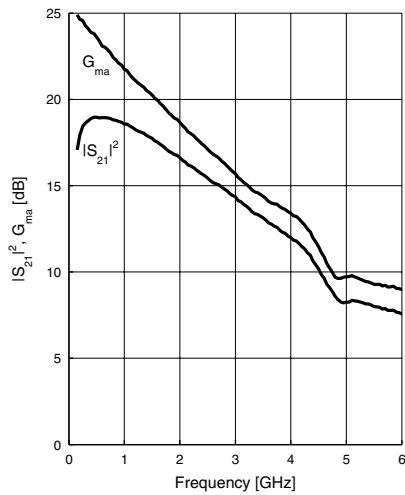
**Table 4 Electrical Characteristics**

| Parameter  | Symbol         | Values |      |      | Unit | Note / Test Condition                                    |
|--|----------------|--------|------|------|------|--|
|  |                | Min.   | Typ. | Max. |      |  |
| Insertion power gain   | $ S_{21} ^2$   |        | 16.2 |      | dB   |  |
| Insertion power gain (Off-State)                               | $ S_{21} ^2$   |        | -23  |      | dB   |  |
| Input return loss (On-State)                                   | $RL_{in}$      |        | 6    |      | dB   |  |
| Output return loss (On-State)                                  | $RL_{out}$     |        | 12   |      | dB   |  |
| Noise figure ( $Z_S = 50\ \Omega$ )                            | $F_{50\Omega}$ |        | 1.05 |      | dB   |  |
| Input third order intercept point <sup>1)</sup><br>(On-State)  | $IIP_3$        |        | 0    |      | dBm  | $\Delta f = 1\text{ MHz}$ ,<br>$P_{IN} = -28\text{ dBm}$ |
| Input third order intercept point <sup>1)</sup><br>(Off-State) | $IIP_3$        |        | 22   |      | dBm  | $\Delta f = 1\text{ MHz}$ ,<br>$P_{IN} = -8\text{ dBm}$  |
| Input power at 1 dB gain compression                           | $P_{-1dB}$     |        | -16  |      | dBm  |  |

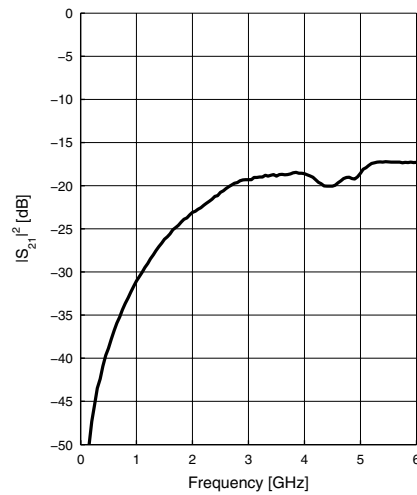
1)  $IP_3$  values depends on termination of all intermodulation frequency components. Termination used for this measurement is 50  $\Omega$  from 0.1 to 6 GHz

## 4 Measured Parameters

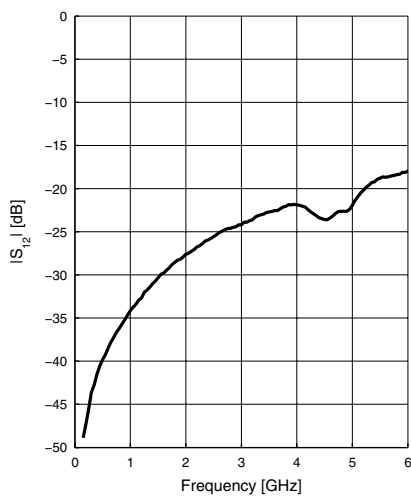
**Power Gain**  $|S_{21}|^2, G_{ma} = f(f)$   
 $V_{CC} = 2.75V, I_{tot-on} = 5.8mA$



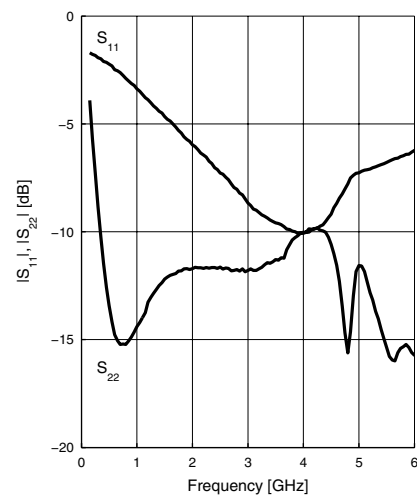
**Off Gain**  $|S_{21}|^2 = f(f)$   
 $V_{CC} = 2.75V, V_{OUT} = 2.75V, I_{tot-off} = 0.3mA$



**Reverse Isolation**  $|S_{12}| = f(f)$   
 $V_{CC} = 2.75V, I_{tot-on} = 5.8mA$



**Matching**  $|S_{11}|, |S_{22}| = f(f)$   
 $V_{CC} = 2.75V, I_{tot-on} = 5.8mA$

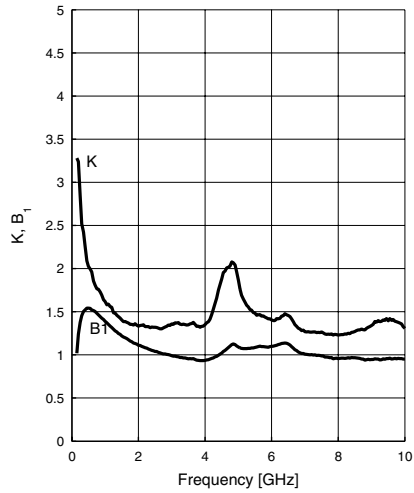




Measured Parameters

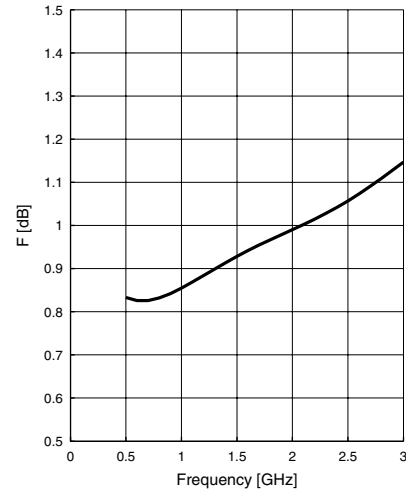
**Stability  $K, B_1 = f(f)$**

$V_{CC} = 2.75V, I_{tot-on} = 5.8mA$



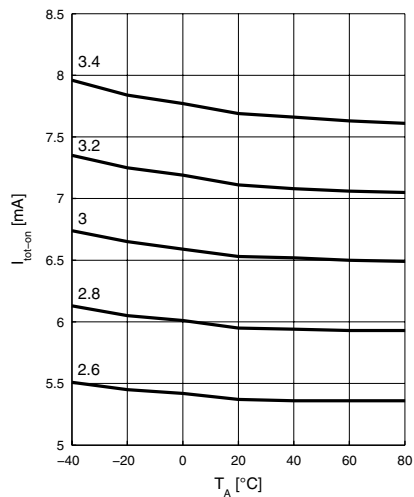
**Noise Figure  $F = f(f)$**

$V_{CC} = 2.75V, I_{tot-on} = 5.8mA, Z_S = 50\Omega$



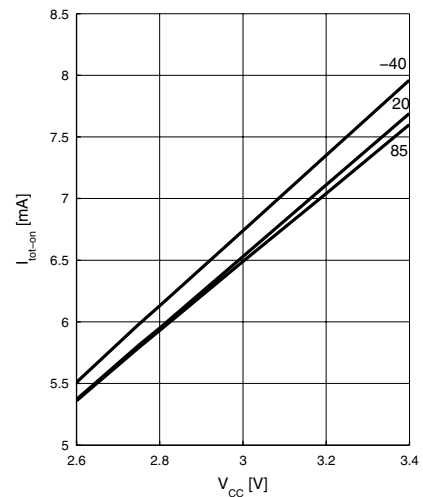
**Device Current  $I_{tot-on} = f(T_A, V_{CC})$**

$V_{CC} = \text{parameter in V}$



**Device Current  $I_{tot-on} = f(V_{CC}, T_A)$**

$T_A = \text{parameter in } ^\circ C$



## 5 Package Information

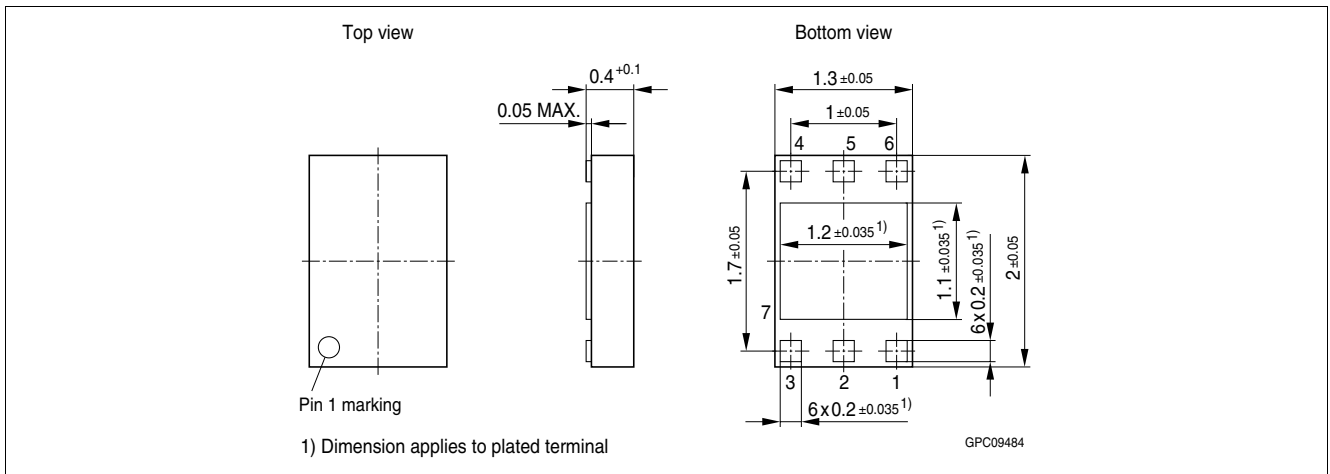


Figure 3 Package Outline TSLP-7-1

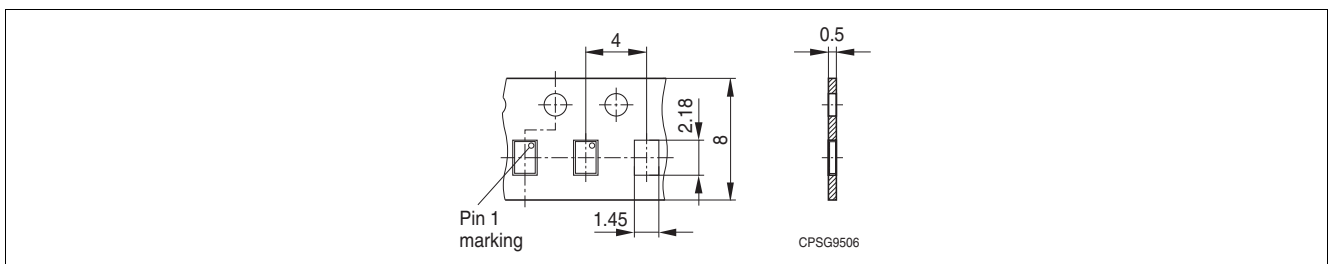


Figure 4 Tape for TSLP-7-1