

Edition 2008-04-14

**Published by Infineon Technologies AG,
81726 München, Germany**

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BGA622, Silicon Germanium Wide Band Low Noise Amplifier with 2 kV ESD Protection**Revision History: 2008-04-14, Rev. 2.2****Previous Version: 2005-11-16**

Page	Subjects (major changes since last revision)
All	Document layout change

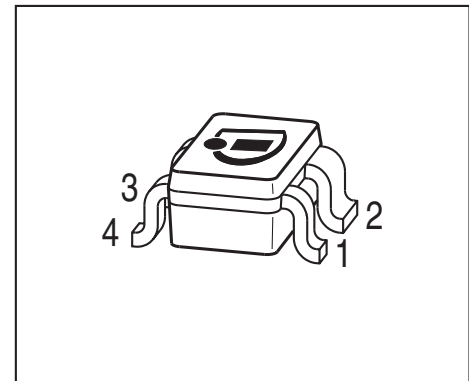
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1 Silicon Germanium Wide Band Low Noise Amplifier with 2 kV ESD Protection

Feature

- High gain
 $|S_{21}|^2 = 15.0 \text{ dB at } 1.575 \text{ GHz}$
 $|S_{21}|^2 = 14.2 \text{ dB at } 1.9 \text{ GHz}$
 $|S_{21}|^2 = 13.6 \text{ dB at } 2.14 \text{ GHz}$
- Low noise figure, $NF = 1.0 \text{ dB at } 1.575 \text{ GHz}$
- Operating frequency range 0.5 - 6 GHz
- Typical supply voltage: 2.75 V
- On/Off-Switch
- Output-match on chip, input pre-matched
- Low part count
- 70 GHz f_T - Silicon Germanium technology
- 2 kV HBM ESD protection (Pin-to-Pin)
- Pb-free (RoHS compliant) package



SOT343



Applications

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

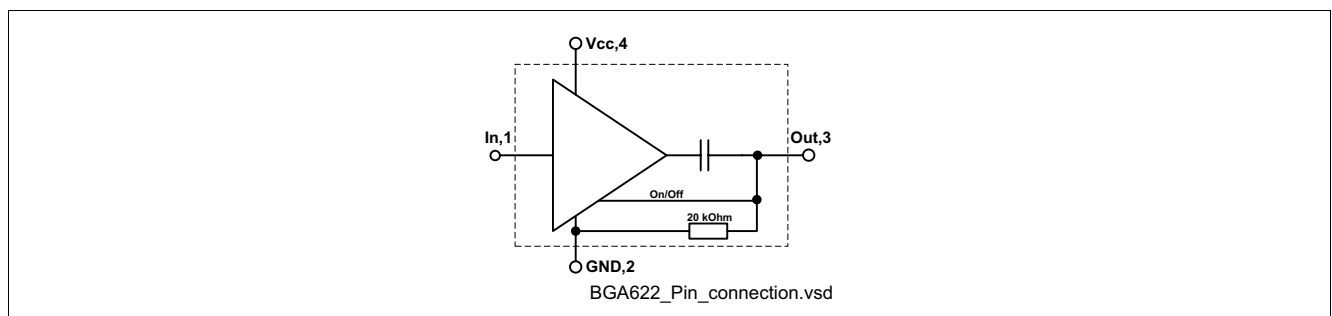


Figure 1 Pin connection

Description

The BGA622 is a wide band low noise amplifier, based on Infineon Technologies' Silicon Germanium Technology B7HF. In order to provide the LNA in a small package 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 the device off. While the device is switched off, it provides an insertion loss of 24 dB together with a high IIP_3 up to 20 dBm.

Type	Package	Marking
BGA622	SOT343	BXs

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

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

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, $T_S < 139\text{ °C}^{1)}$	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 ¹⁾	R_{thJS}	300	K/W

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

2 Electrical Characteristics

2.1 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$		15.0		dB	
Insertion power gain (Off-State)	$ S_{21} ^2$		-27		dB	
Input return loss (On-State)	RL_{in}		5		dB	
Output return loss (On-State)	RL_{out}		12		dB	
Noise figure ($Z_S = 50\text{ }\Omega$)	$F_{50\Omega}$		1.00		dB	$f = 0.1\text{ GHz}$
Input third order intercept point ¹⁾ (On-State)	IIP_3		0		dBm	$\Delta f = 1\text{ MHz}$, $P_{IN} = -28\text{ dBm}$
Input third order intercept point ¹⁾ (Off - State)	IIP_3		20		dBm	$\Delta f = 1\text{ MHz}$, $P_{IN} = -8\text{ dBm}$
Input power at 1 dB gain compression	P_{-1dB}		-16.5		dBm	
Total device off current	$I_{tot-off}$	130	260	420	μA	$V_{CC} = 2.75\text{ V}$, $V_{out} = V_{CC}$
Total device on current	I_{tot-on}	4.0	5.8	7.8	mA	$V_{CC} = 2.75\text{ V}$
On / Off switch control voltage	V_{on}	0		0.8	V	$V_{CC} = 2.75\text{ V}$ ON-Mode: $V_{out} = V_{on}$
	V_{off}	2.0		3.5	V	$V_{CC} = 2.75\text{ V}$ OFF-Mode: $V_{out} = V_{off}$

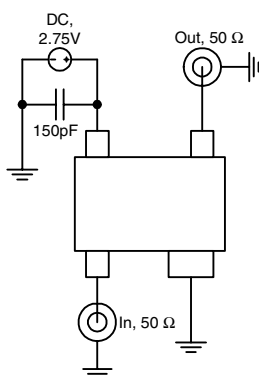
1) IP_3 values depends on termination of all intermodulation frequency components. Termination used for this measurement is 50 Ω from 0.1 to 6 GHz

2.2 Electrical characteristics at $T_A = 25\text{ }^{\circ}\text{C}$ (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$		13.6		dB	
Insertion power gain (Off-State)	$ S_{21} ^2$		-24		dB	
Input return loss (On-State)	RL_{in}		7		dB	
Output return loss (On-State)	RL_{out}		10		dB	
Noise figure ($Z_S = 50\text{ }\Omega$)	$F_{50\Omega}$		1.05		dB	
Input third order intercept Point ¹⁾ (On-State)	IIP_3		3		dBm	$\Delta f = 1\text{ MHz}$, $P_{IN} = -28\text{ dBm}$
Input third order intercept point ¹⁾ (Off-State)	IIP_3		20		dBm	$\Delta f = 1\text{ MHz}$, $P_{IN} = -8\text{ dBm}$
Input power at 1 dB gain compression	P_{-1dB}		-13		dBm	

1) IIP_3 values depends on termination of all intermodulation frequency components. Termination used for this measurement is $50\text{ }\Omega$ from 0.1 to 6 GHz



BGA622_S_Parameter_Circuit.vsd

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

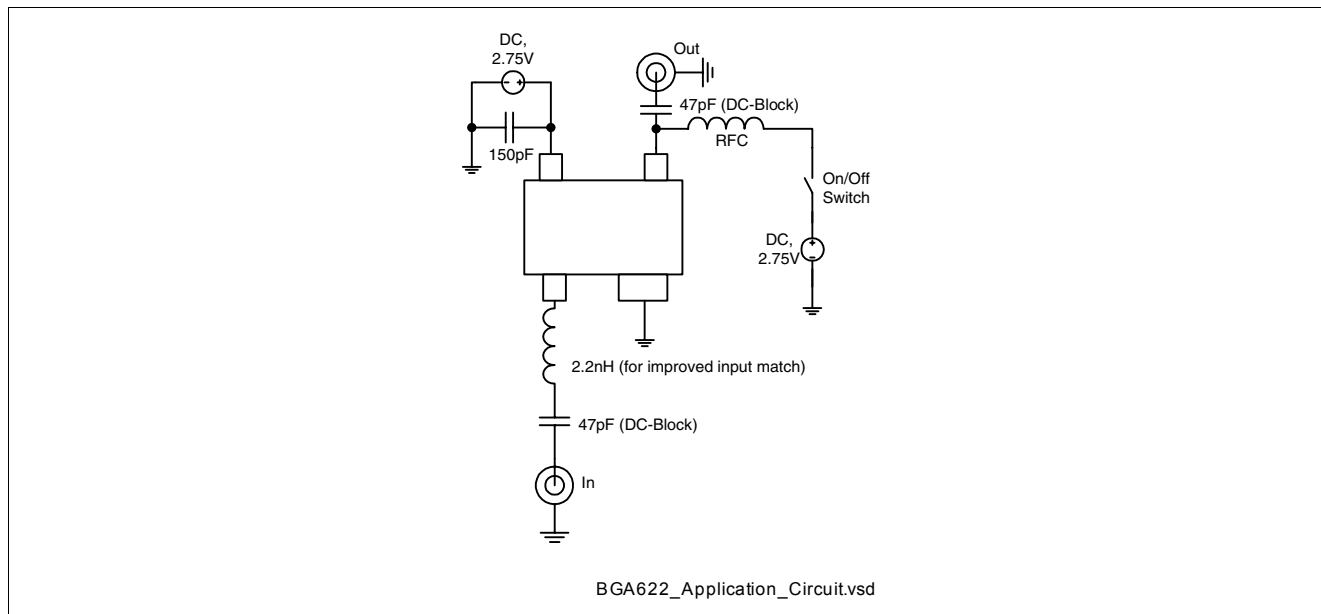
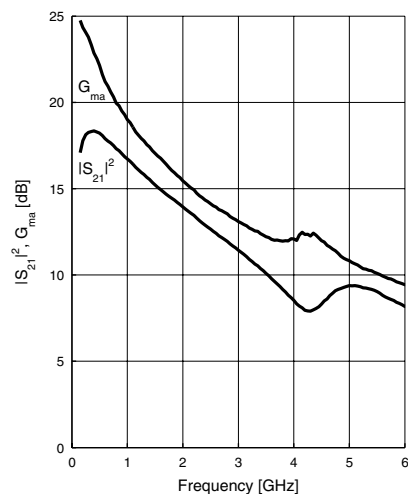


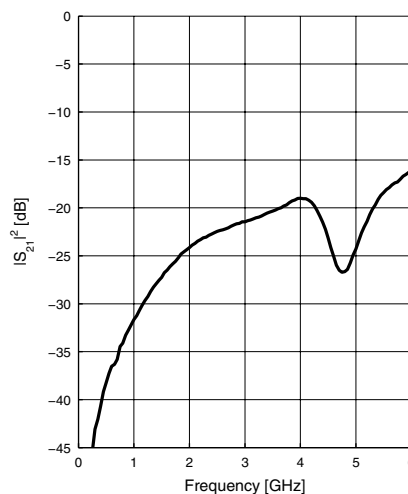
Figure 3 Application Circuit for 1800 - 2500 MHz

3 Measured Parameters

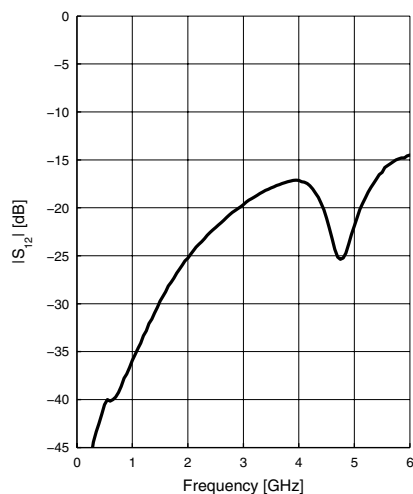
Power Gain $|S_{21}|^2$, $G_{ma} = f(f)$
 $V_{CC} = 2.75V$, $I_{tot-on} = 5.8mA$



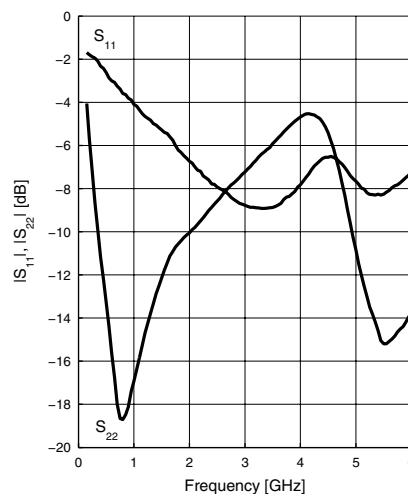
Off Gain $|S_{21}|^2 = f(f)$
 $V_{CC} = 2.75V$, $V_{OUT} = 2.75V$, $I_{tot-off} = 0.3mA$



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



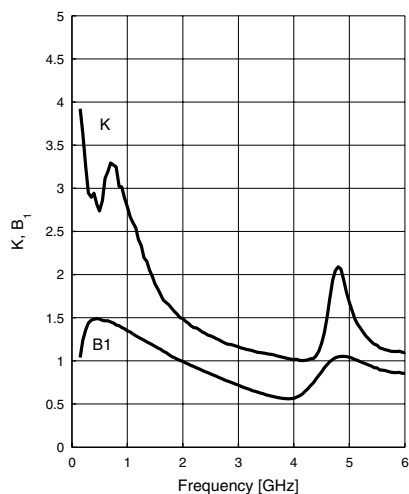
Matching $|S_{11}|$, $|S_{22}| = f(f)$
 $V_{CC} = 2.75V$, $I_{tot-on} = 5.8mA$



Measured Parameters

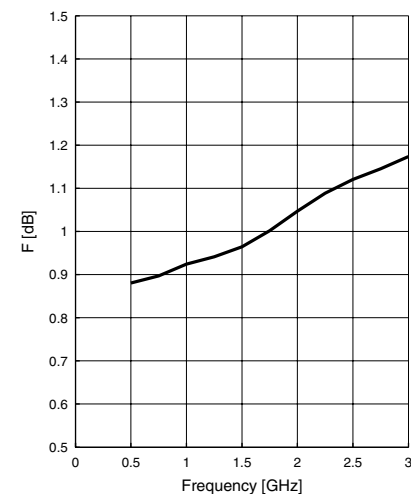
Stability $K, B_1 = f(f)$

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



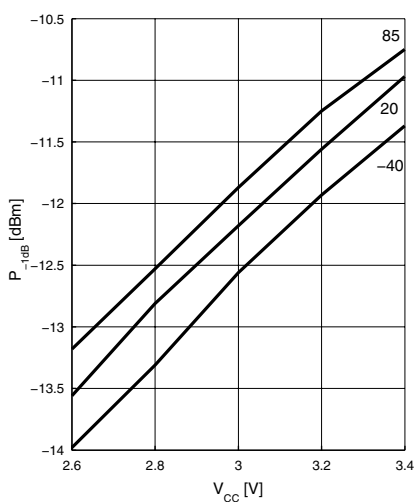
Noise Figure $F = f(f)$

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



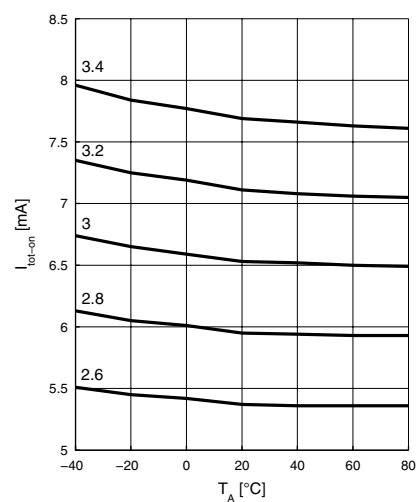
Input Compression Point $P_{-1dB} = f(V_{CC})$

$f = 2.14GHz, T_A = \text{parameter in } ^\circ C$

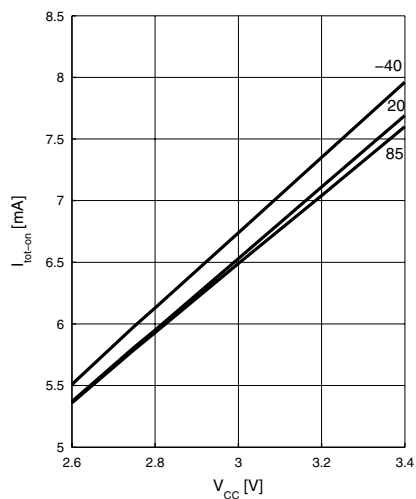


Device Current $I_{tot-on} = f(T_A, V_{CC})$

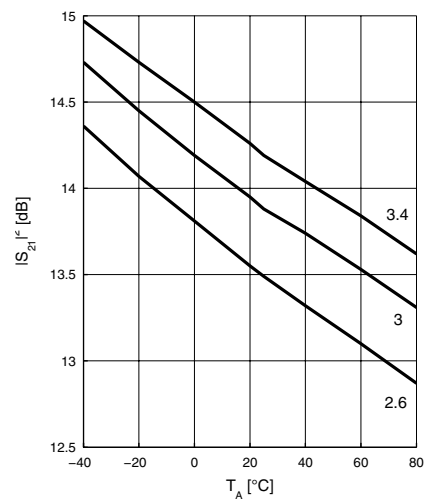
$V_{CC} = \text{parameter in V}$



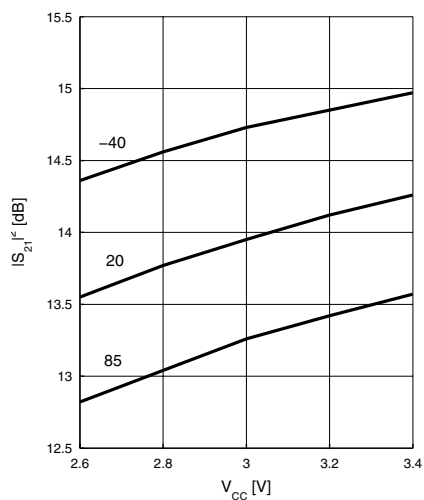
Device Current $I_{\text{tot-on}} = f(V_{\text{CC}}, T_A)$
 T_A = parameter in °C



Power Gain $|S_{21}|^2 = f(T_A, V_{\text{CC}})$
 $f = 2.14\text{GHz}$, V_{CC} = parameter in V



Power Gain $|S_{21}|^2 = f(V_{\text{CC}}, T_A)$
 $f = 2.14\text{GHz}$, T_A = parameter in °C



4 Package Information

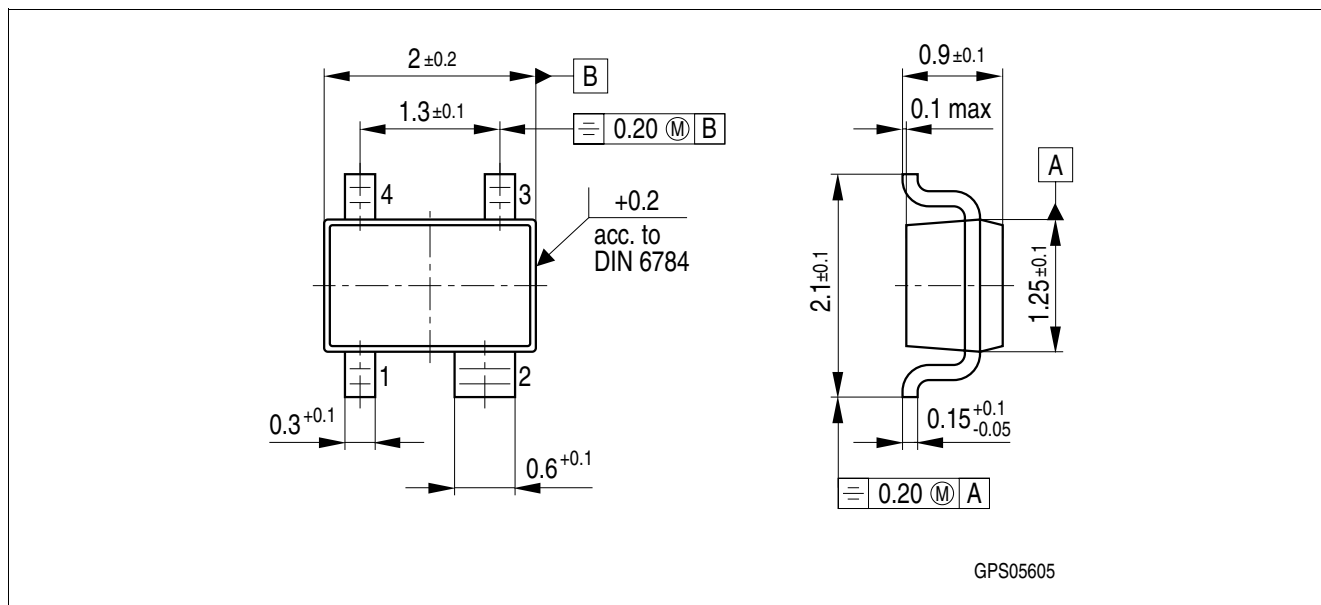


Figure 4 Package Outline SOT343

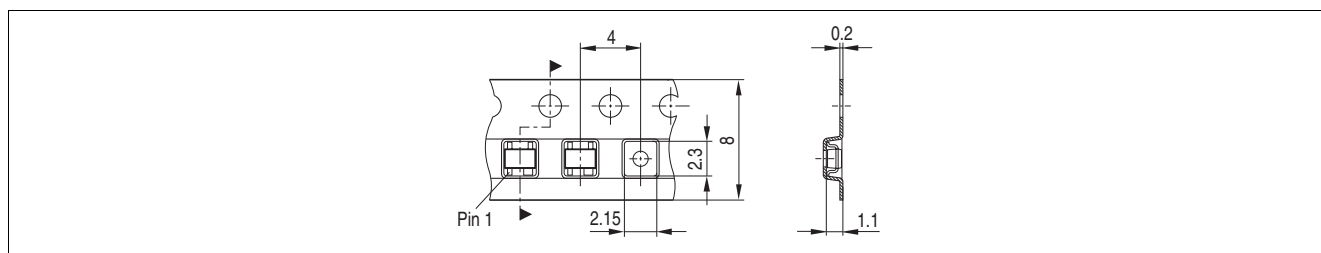


Figure 5 Tape for SOT343