BGA622

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

Small Signal Discretes



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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				
-					

Trademarks

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

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

Feature

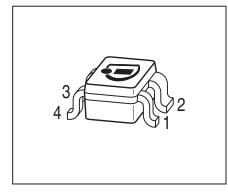
· High gain

 $|S_{21}|^2$ = 15.0 dB at 1.575 GHz

 $|S_{21}|^2$ = 14.2 dB at 1.9 GHz

 $|S_{21}|^2$ = 13.6 dB at 2.14 GHz

- Low noise figure, NF = 1.0 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 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, Bluethooth, ISM and WLAN

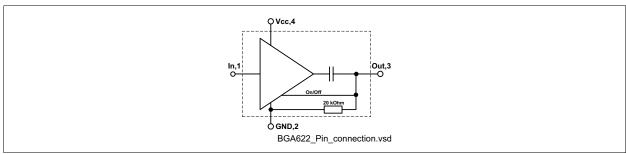


Figure 1 Pin connection

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 $V_{\rm CC}$ 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.

Туре	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 $V_{\rm CC}$	$V_{\sf CC}$	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 $V_{\rm CC}$	$I_{\sf Vcc}$	10	mA	
RF input power	P_{in}	6	dBm	
Total power dissipation, $T_{\rm S}$ < 139 °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⁾ $T_{\rm S}$ 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



Electrical Characteristics

2 Electrical Characteristics

2.1 Electrical characteristics at $T_{\rm A}$ = 25 °C (measured according to Figure 2) $V_{\rm CC}$ = 2.75 V, Frequency = 1.575 GHz, unless otherwise specified

Table 3 Electrical Characteristics

Parameter	Symbol	Values			Unit	Note /
		Min.	Тур.	Max.		Test Condition
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 ($Z_{\rm S}$ = 50 Ω)	$F_{50\Omega}$		1.00		dB	f = 0.1 GHz
Input third order intercept point ¹⁾ (On-State)	IIP_3		0		dBm	Δf = 1 MHz, P_{IN} = -28 dBm
Input third order intercept point ¹⁾ (Off - State)	IIP_3		20		dBm	Δf = 1 MHz, P_{IN} = -8 dBm
Input power at 1 dB gain compression	$P_{ ext{-1dB}}$		-16.5		dBm	
Total device off current	$I_{tot\text{-off}}$	130	260	420	μΑ	$V_{\rm CC}$ = 2.75 V, $V_{\rm out}$ = $V_{\rm CC}$
Total device on current	$I_{tot ext{-on}}$	4.0	5.8	7.8	mA	$V_{\rm CC}$ = 2.75 V
On / Off switch control voltage	V _{on}	0		0.8	V	$V_{\rm CC}$ = 2.75 V ON-Mode: $V_{\rm out}$ = $V_{\rm on}$
	$V_{ m off}$	2.0		3.5	V	$V_{\rm CC}$ = 2.75 V OFF-Mode: $V_{\rm out}$ = $V_{\rm off}$

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



Electrical Characteristics

2.2 Electrical characteristics at $T_{\rm A}$ = 25 °C (measured according to Figure 2) $V_{\rm CC}$ = 2.75 V, Frequency = 2.14 GHz, unless otherwise specified

Table 4 Electrical Characteristics

Parameter	Symbol	Values			Unit	Note /
		Min.	Тур.	Max.		Test Condition
Insertion power gain	$ S_{21} ^2$		13.6		dB	
Insertion power gain (Off-State)	$ S_{21} ^2$		-24		dB	
Input return loss (On-State)	$RL_{\sf in}$		7		dB	
Output return loss (On-State)	RL_{out}		10		dB	
Noise figure ($Z_{\rm S}$ = 50 Ω)	$F_{50\Omega}$		1.05		dB	
Input third order intercept Point ¹⁾ (On-State)	IIP_3		3		dBm	Δf = 1 MHz, P_{IN} = -28 dBm
Input third order intercept point ¹⁾ (Off-State)	IIP_3		20		dBm	Δf = 1 MHz, P_{IN} = -8 dBm
Input power at 1 dB gain compression	$P_{ ext{-1dB}}$		-13		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

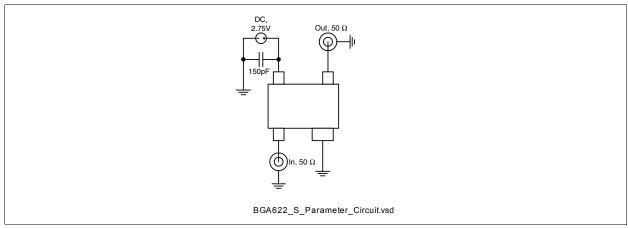


Figure 2 S-Parameter Test Circuit (loss-free microstrip test-fixture)



Electrical Characteristics

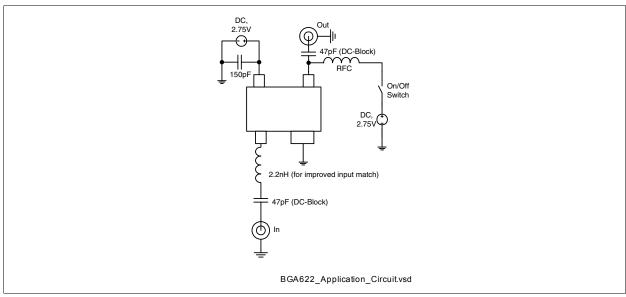
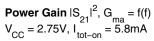


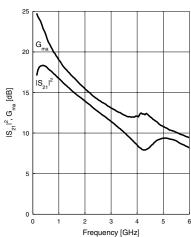
Figure 3 Application Circuit for 1800 - 2500 MHz



Measured Parameters

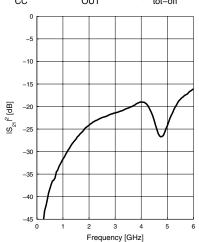
3 Measured Parameters





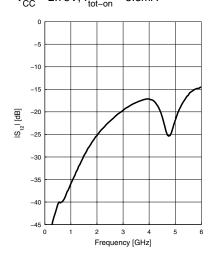
Off Gain
$$|S_{21}|^2 = f(f)$$

 $V_{CC} = 2.75V, V_{OUT} = 2.75V, I_{tot-off} = 0.3mA$

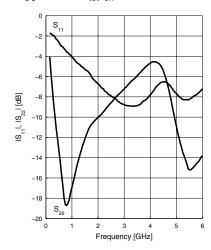


Reverse Isolation
$$|S_{12}| = f(f)$$

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



$$\begin{aligned} & \textbf{Matching} \ |S_{11}|, \ |S_{22}| = f(f) \\ & V_{CC} = 2.75V, \ I_{tot-on} = 5.8 \text{mA} \end{aligned}$$

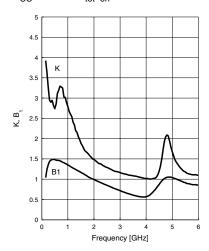




Measured Parameters

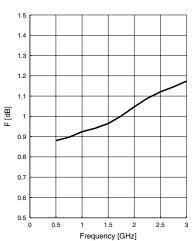
Stability K, B₁ = f(f)

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

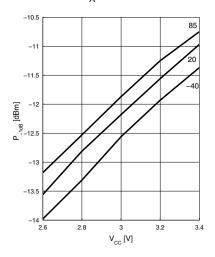


Noise Figure F = f(f)

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

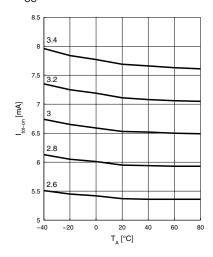


Input Compression Point $P_{-1dB} = f(V_{CC})$ f = 2.14GHz, T_A = parameter in $^{\circ}C$



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

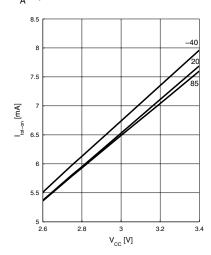
V $_{CC} = parameter in V$





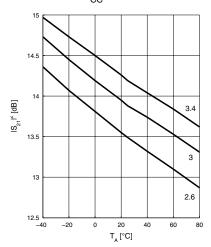
Measured Parameters

$$\begin{array}{l} \textbf{Device Current I}_{\text{tot-on}} = f(V_{CC}, \, T_{A}) \\ T_{A} = \text{parameter in } ^{\circ}C \end{array}$$

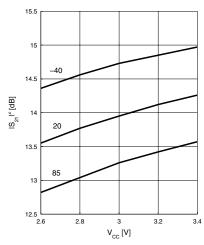


Power Gain
$$|S_{21}|^2 = f(T_A, V_{CC})$$

f = 2.14GHz, V_{CC} = parameter in V



$$\begin{array}{l} \textbf{Power Gain} \ |S_{21}|^2 = f(V_{CC}^{}, T_{A}^{}) \\ f = 2.14 \text{GHz}, \ T_{A}^{} = \text{parameter in } ^{\circ}\text{C} \end{array}$$





Package Information

4 Package Information

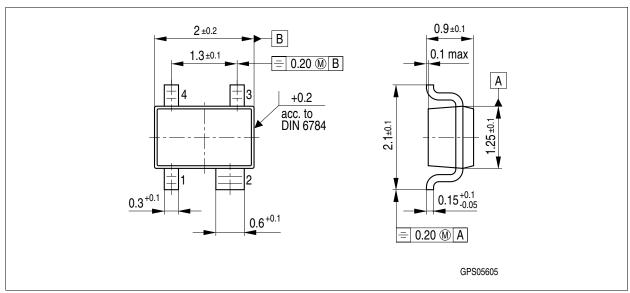


Figure 4 Package Outline SOT343

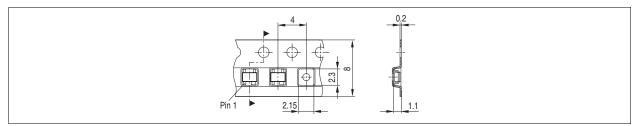


Figure 5 Tape for SOT343