

# BGA619

Silicon Germanium

High IP3 PCS Low Noise Amplifier

Wireless  
Silicon Discretes



Never stop thinking.

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**BGA619****Data Sheet****Revision History:        April 2004**

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Previous Version:        February 2004

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Page	Subjects (major changes since last revision)
4	Marking corrected

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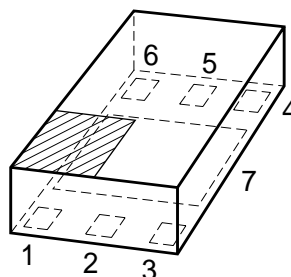
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# Silicon Germanium High IP3 PCS Low Noise Amplifier

**BGA619**

## Features

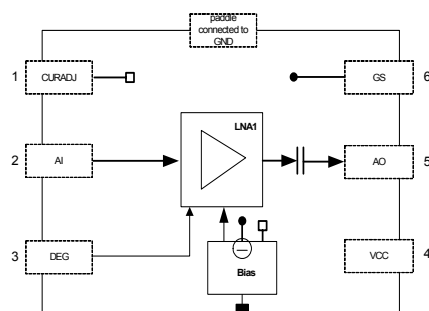
- B7HF silicon germanium technology
- Tiny P-TSLP-7-1 leadless package
- RF output-port internally pre-matched to  $50\Omega$
- Low external component count
- Three gain steps
- Power off function
- High IP3 in all modes
- Typical supply voltage: 2.78 V



## Applications

- 1.9 GHz PCS wireless frontends (CDMA2000)

P-TSLP-7-1



## Description

The BGA619 is a high IP3 PCS low noise amplifier, designed for 1.9GHz applications.

Internal biasing provides stable current conditions for all gain modes over temperature range.

Using the pin GS the BGA619 can be switched between three gain modes (HIGH, MID & LOW) and the OFF mode.

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

Type	Package	Marking	Chip
BGA619	P-TSLP-7-1	BT	T1544

## Pin Definition and Function

Pin No.	Symbol	Function
1	CURADJ	Current adjust LNA
2	AI	LNA input
3	DEG	RF ground
4	VCC	Supply voltage LNA
5	AO	LNA output
6	GS	Gain step control
7	GND	Ground

## Maximum Rating

Parameter	Symbol	Limit value	Unit
Voltage at pin VCC	VCC	-0.3 ... 3.6	V
Voltage at pin AI (LNA input)	AI	-0.3 (min.)	V
Voltage at pin AO (LNA output)	AO	-0.3 ... $V_{VCC}+0.3$ 3.6 (max.)	V
External resistor	$R_{CURADJ}$	6 (min.)	k $\Omega$
Current into VCC	ICC	11	mA
Junction temperature	$T_j$	150	°C
Ambient temperature range	$T_A$	-35... 85	°C
Storage temperature range	$T_{STG}$	-40 ... 150	°C
ESD capability (HBM: JESD22A-114) RF pin AI all other pins	$V_{ESD}$	<500 1000	V

Notes:

All Voltages refer to GND-Node

### Electrical Characteristics

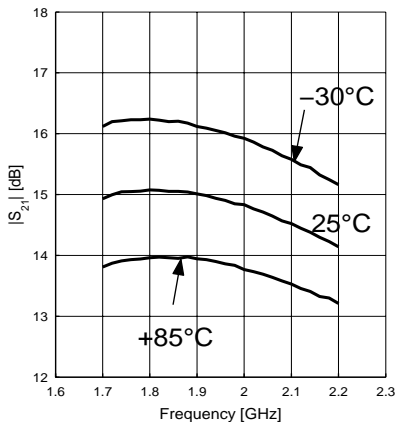
$T_A=25^{\circ}\text{C}$ :  $V_{CC}=2.78\text{V}$ ,  $R_{LNA\_Curadj} = 15\text{k}\Omega$ , frequency=1.96GHz, HIGH:  $GS=2.3\text{V}$ , MID:  $GS=1.7\text{V}$ , LOW:  $GS=1.0\text{V}$ , unless otherwise noted; measured on BGA619 Appl. Board V1.0 including PCB losses

Parameter	Symbol	GS mode	min.	typ.	max.	Unit
Supply current	$I_{cc}$	HIGH		6.5		mA
		MID		4.5		
		LOW		2.9		
		OFF		280		
	$\mu\text{A}$					
Power gain	$S_{21}$	HIGH		14.9		dB
		MID		2.2		
		LOW		-9.5		
Noise figure ( $Z_s = 50\Omega$ )	$NF$	HIGH		1.5		dB
		MID		8		
		LOW		16		
Input Return Loss	$S_{11}$	HIGH		10.5		dB
		MID		8.5		
		LOW		12.5		
Output Return Loss	$S_{22}$	HIGH		11.5		dB
		MID		13		
		LOW		13		
Reverse isolation	$S_{12}$	HIGH		25		dB
		MID		21		
		LOW		23		
Power gain settling time (within 1dB of the final gain)	$t_s$	ALL		70		$\mu\text{s}$
3rd order input intercept point f1= 1950MHz, f2= f1 +/-1MHz P(f1,f2)= -30dBm P(f1,f2)= -27dBm P(f1,f2)= -15dBm	$IIP_3$					dBm
		HIGH		7		
		MID		6.5		
		LOW		15		
Gain step input voltage	$GS$	HIGH	2.2		2.4	V
		MID	1.6		1.8	
		LOW	0.9		1.1	
		OFF	0.0		0.3	
Gain control current	$I_{GS}$	HIGH			95	$\mu\text{A}$
		OFF			-55	

# Typical measurement results HIGH Gain Mode; $T_A = 25^\circ\text{C}$

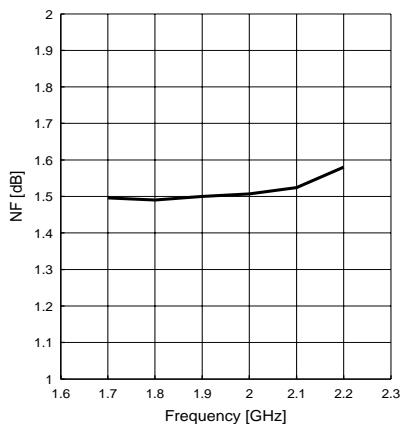
## Gain $|S_{21}| = f(f)$

$V_{CC} = 2.78\text{V}$ ,  $I_{CC} = 6.5\text{mA}$



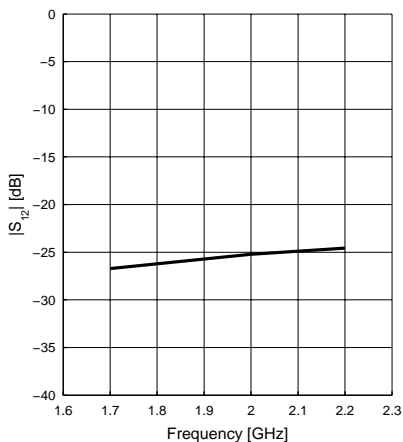
## Noise Figure $NF = f(f)$

$V_{CC} = 2.78\text{V}$ ,  $I_{CC} = 6.5\text{mA}$ , Gain = 14.9dB



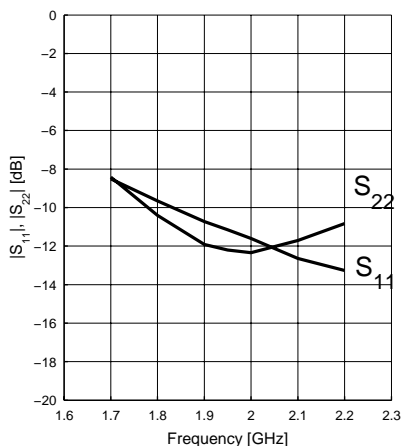
## Reverse Isolation $|S_{12}| = f(f)$

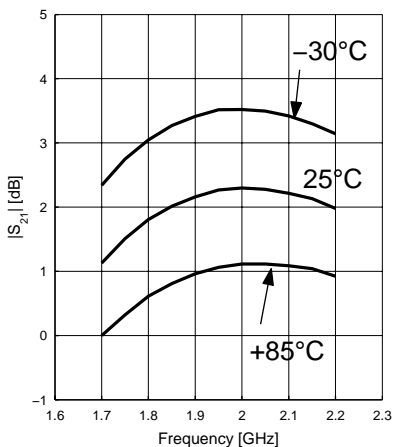
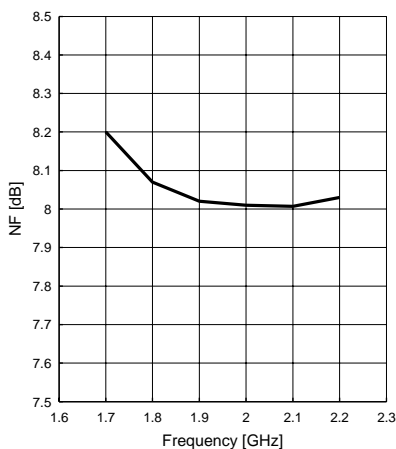
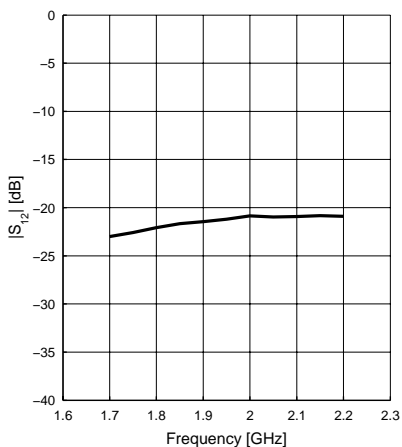
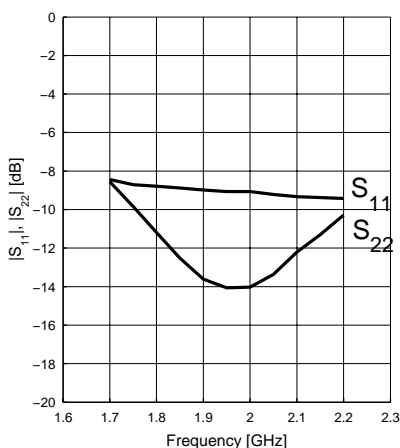
$V_{CC} = 2.78\text{V}$ ,  $I_{CC} = 6.5\text{mA}$



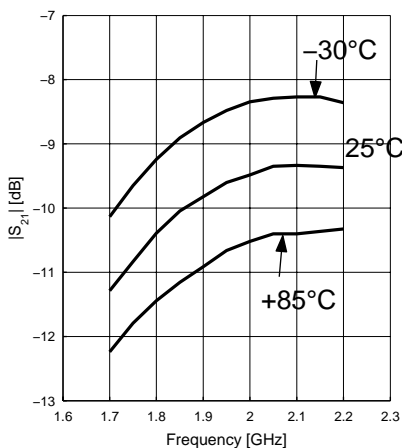
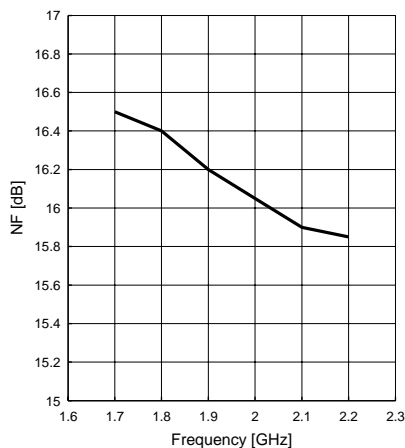
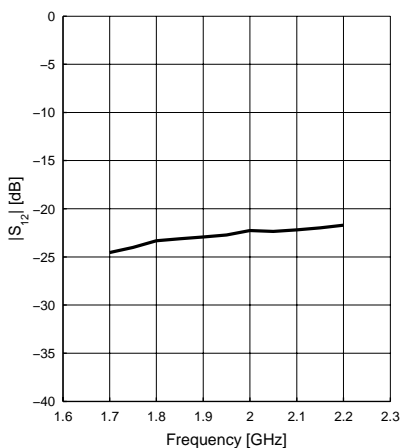
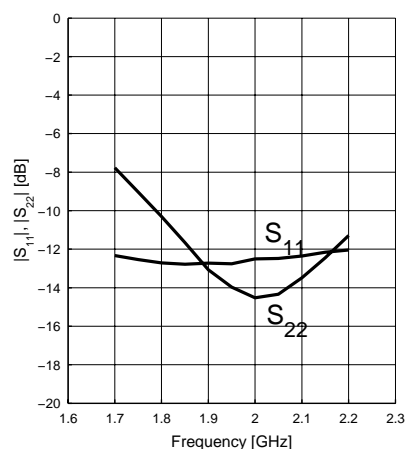
## Matching $|S_{11}|, |S_{22}| = f(f)$

$V_{CC} = 2.78\text{V}$ ,  $I_{CC} = 6.5\text{mA}$



**Typical measurement results MID Gain Mode;  $T_A = 25^\circ\text{C}$** 
**Gain**  $|S_{21}| = f(f)$ 
 $V_{CC} = 2.78\text{V}, I_{CC} = 4.5\text{mA}$ 

**Noise Figure**  $NF = f(f)$ 
 $V_{CC} = 2.78\text{V}, I_{CC} = 4.5\text{mA}, \text{Gain} = 2.2\text{dB}$ 

**Reverse Isolation**  $|S_{12}| = f(f)$ 
 $V_{CC} = 2.78\text{V}, I_{CC} = 4.5\text{mA}$ 

**Matching**  $|S_{11}|, |S_{22}| = f(f)$ 
 $V_{CC} = 2.78\text{V}, I_{CC} = 4.5\text{mA}$ 




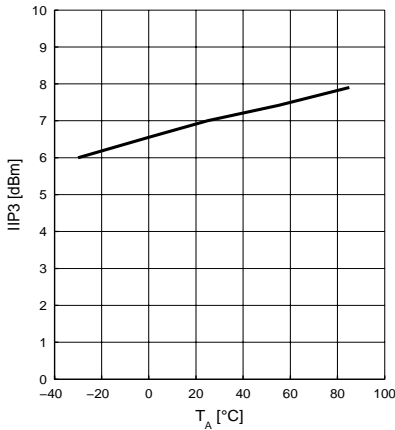
**Typical measurement results LOW Gain Mode;  $T_A = 25^\circ\text{C}$** 
**Gain**  $|S_{21}| = f(f)$ 
 $V_{CC} = 2.78\text{V}, I_{CC} = 2.9\text{mA}$ 

**Noise Figure**  $NF = f(f)$ 
 $V_{CC} = 2.78\text{V}, I_{CC} = 2.9\text{mA}, \text{Gain} = -9.5\text{dB}$ 

**Reverse Isolation**  $|S_{12}| = f(f)$ 
 $V_{CC} = 2.78\text{V}, I_{CC} = 2.9\text{mA}$ 

**Matching**  $|S_{11}|, |S_{22}| = f(f)$ 
 $V_{CC} = 2.78\text{V}, I_{CC} = 2.9\text{mA}$ 


## Typical measurement results 3rd Order Intercept Point

### High Gain Mode

**Intercept Point 3rd O.**  $IIP3 = f(T_A)$

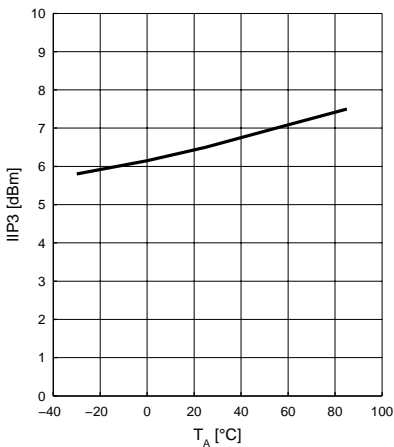
$V_{CC} = 2.78V$ ,  $I_{CC} = 6.5mA$ , Gain = 14.9dB



### Mid Gain Mode

**Intercept Point 3rd O.**  $IIP3 = f(T_A)$

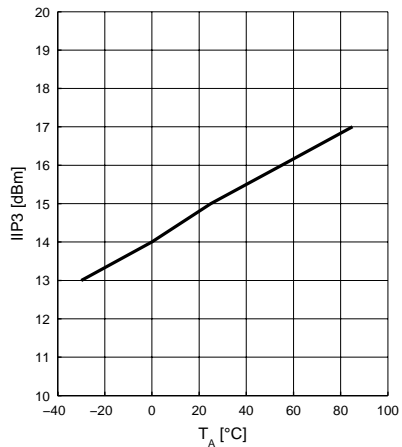
$V_{CC} = 2.78V$ ,  $I_{CC} = 4.5mA$ , Gain = 2.2dB



### Low Gain Mode

**Intercept Point 3rd O.**  $IIP3 = f(T_A)$

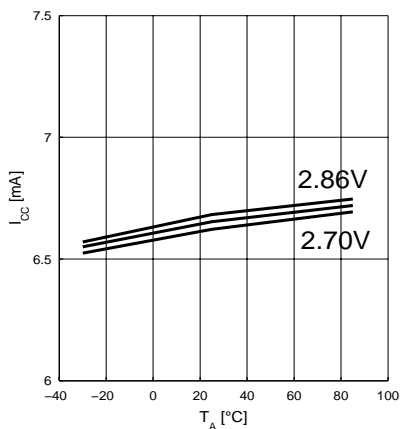
$V_{CC} = 2.78V$ ,  $I_{CC} = 2.9mA$ , Gain = -9.5dB



## Typical measurement results Supply Current vs.Temp & Supply (2.7..2.86V)

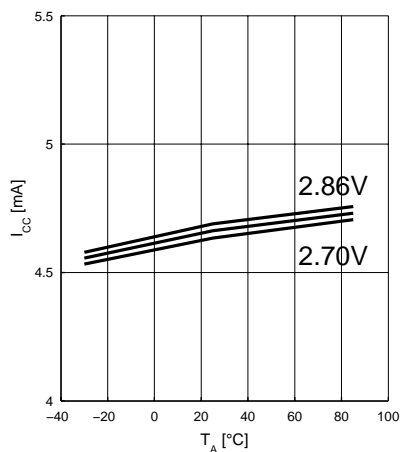
### HIGH Gain Mode

Supply current vs. Temp.  $I_{CC} = f(T_A, V_{CC})$



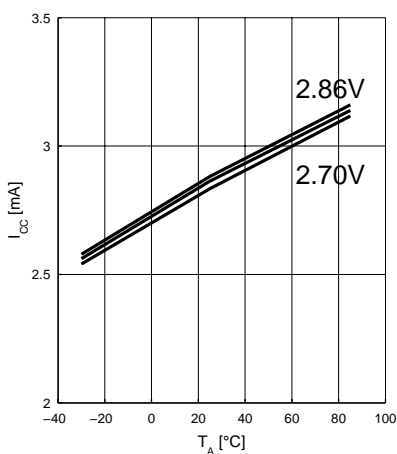
### MID Gain Mode

Supply current vs. Temp.  $I_{CC} = f(T_A, V_{CC})$



### LOW Gain Mode

Supply current vs. Temp.  $I_{CC} = f(T_A, V_{CC})$

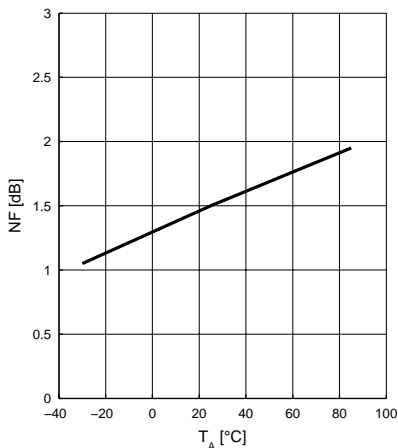


## Typical measurement results Noise Figure

HIGH Gain Mode

**Noise Figure**  $NF = f(T_A)$

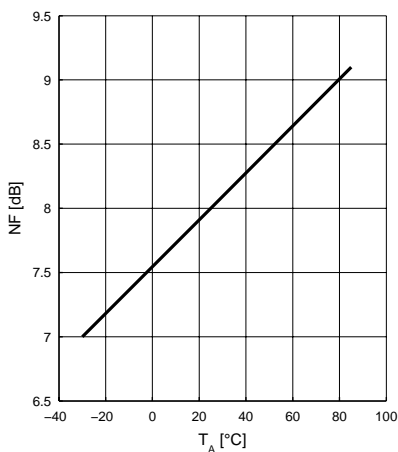
$V_{CC} = 2.78V$ ,  $I_{CC} = 6.5mA$ , Gain = 14.9dB



MID Gain Mode

**Noise Figure**  $NF = f(T_A)$

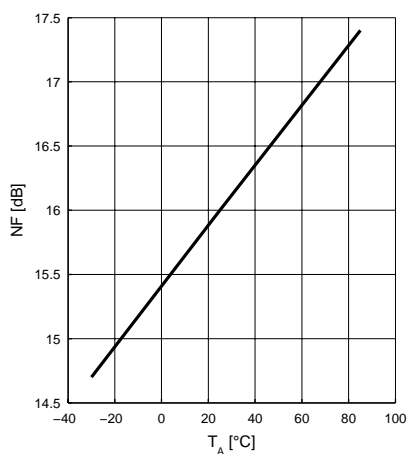
$V_{CC} = 2.78V$ ,  $I_{CC} = 4.5mA$ , Gain = 2.2dB



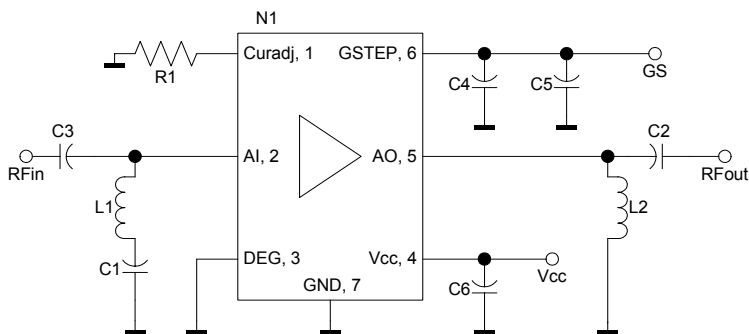
LOW Gain Mode

**Noise Figure**  $NF = f(T_A)$

$V_{CC} = 2.78V$ ,  $I_{CC} = 2.9mA$ , Gain = -9.5dB



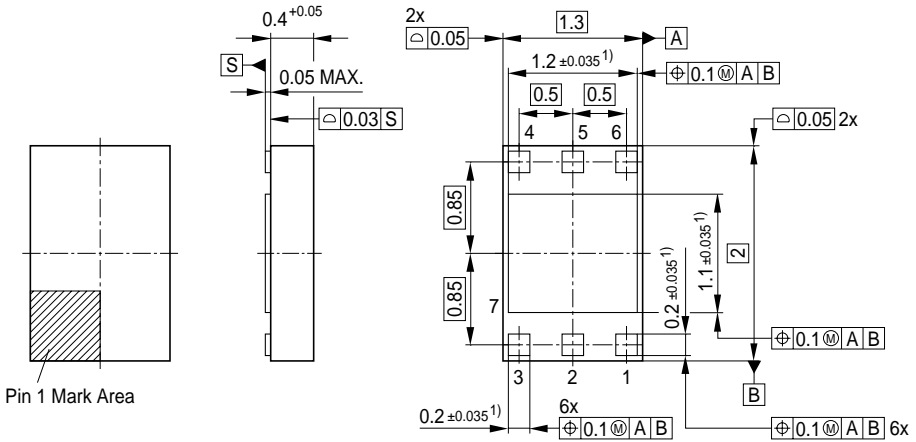
## PCB Board Configuration



## Bill of Materials

Name	Value	Package	Manufacturer	Function
R1	15 k $\Omega$	0402	various	bias resistance
L1	3.3 nH	0402	various	LF trap & input matching
L2	4.7 nH	0402	various	output matching
C1	10 nF	0402	various	LF trap
C2	10 pF	0402	various	DC block
C3	10 pF	0402	various	DC block
C4	10p	0402	various	control voltage filtering - OPTIONAL
C5	1 nF	0402	various	control voltage filtering - OPTIONAL
C6	1 nF	0402		supply filtering
N1	BGA619	P-TSLP-7-1	Infineon	SiGe LNA

## Package Outline



## Tape & Reel Outline

