

# BGA428

Gain and PCS Low Noise Amplifier

Small Signal Discretes



Never stop thinking

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**BGA428, Gain and PCS Low Noise Amplifier**

**Revision History: 2007-11-06, Rev. 2.2**

**Previous Version: 2002-03-26**

<b>Page</b>	<b>Subjects (major changes since last revision)</b>
9	Correction of cross-reference

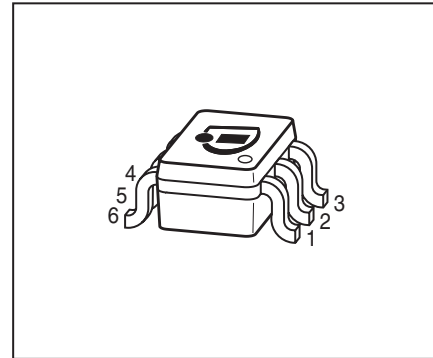
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# 1 Silicon Germanium Broadband MMIC Amplifier

## Feature

- High gain,  $G_{MA} = 20$  dB at 1.8 GHz
- Low noise figure,  $NF = 1.4$  dB at 1.8 GHz
- Prematched
- Ideal for GSM, DCS1800, PCS1900
- Open collector output
- Typical supply voltage: 2.4 - 3 V
- SIEGET<sup>®</sup>-45 technology
- Pb-free (RoHS compliant) package<sup>1)</sup>



SOT363

1) Pb-containing package may be available upon special request

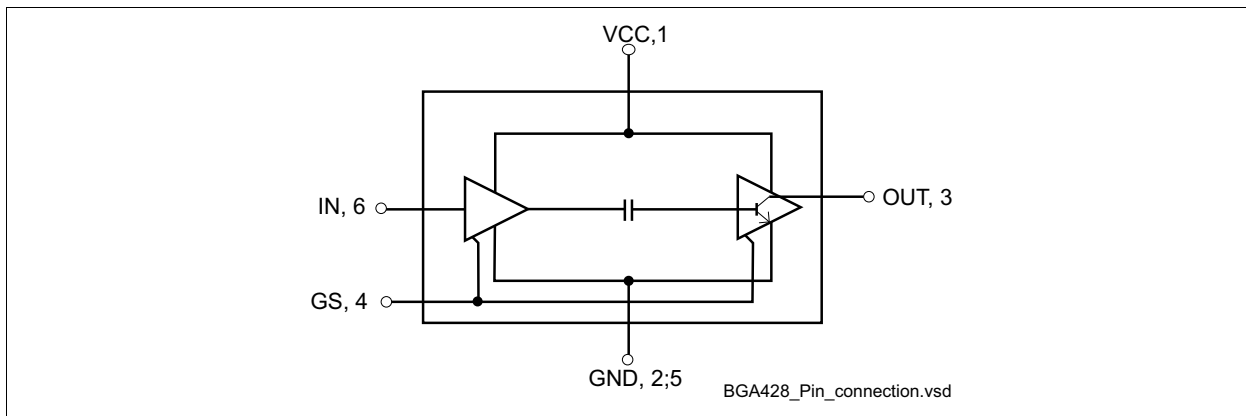


Figure 1 Pin connection

## Description

BGA428 is a high gain, low noise amplifier.

Type	Package	Marking
BGA428	SOT363	PGs

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

**Maximum Ratings**
**Table 1 Maximum ratings**

Parameter	Symbol	Limit Value	Unit
Device voltage	$V_{CC}$	4	V
Voltage at pin Out	$V_{out}$	4	V
Voltage at pin GS	$V_{GS}$	3.5	V
Current into pin In	$I_{in}$	0.5	mA
Total device current <sup>1)</sup>	$I_{tot}$	12	mA
Input power <sup>2)</sup>	$P_{in}$	8	dBm
Total power dissipation, $T_S < 125\text{ °C}^3)$	$P_{tot}$	50	mW
Junction temperature	$T_J$	150	°C
Operating temperature range	$T_{OP}$	-40... 85	°C
Storage temperature range	$T_{STG}$	-65... 150	°C

1)  $I_{tot}$  = Current into Out + Current into  $V_{CC}$

2) Valid for:

a)  $Z_L = 50\ \Omega$ ,  $Z_S = 50\ \Omega$ ,  $V_{CC} = 2.7\text{ V}$ ,  $V_{out} = 2.7\text{ V}$ ,  $V_{GS} = 0.0\text{ V}$ ,  $GND = 0.0\text{ V}$

b)  $Z_L = 50\ \Omega$ ,  $Z_S = 50\ \Omega$ ,  $V_{CC} = 0.0\text{ V}$ ,  $V_{out} = 0.0\text{ V}$ ,  $V_{GS} = 2.7\text{ V}$ ,  $GND = 0.0\text{ V}$

3)  $T_S$  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>	$R_{thJS}$	220	K/W

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

## 2 Electrical Characteristics

### 2.1 Electrical characteristics at $T_A = 25\text{ }^\circ\text{C}$ (measured in test circuit specified in Figure 2), $V_{CC} = 2.7\text{ V}$ , Frequency = 1.8 GHz, unless otherwise specified

Table 3 Electrical Characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Maximum available power gain	$G_{MA}$		20		dB	
Noise figure ( $Z_S = 50\ \Omega$ )	$NF$		1.4		dB	
Input power at 1 dB gain compression	$P_{-1dB}$		-19		dBm	
Input third order intercept point	$IIP_3$		9		dBm	
Total device current	$I_{tot}$		8.2		mA	
Insertion loss in gain-step-mode	$L_{GS}$		13.5		dB	$V_{CC} = 0.0\text{ V}$ , $V_{CTRL} = 2.7\text{ V}$ , $R_{CRRL} = 3\text{ k}\Omega$

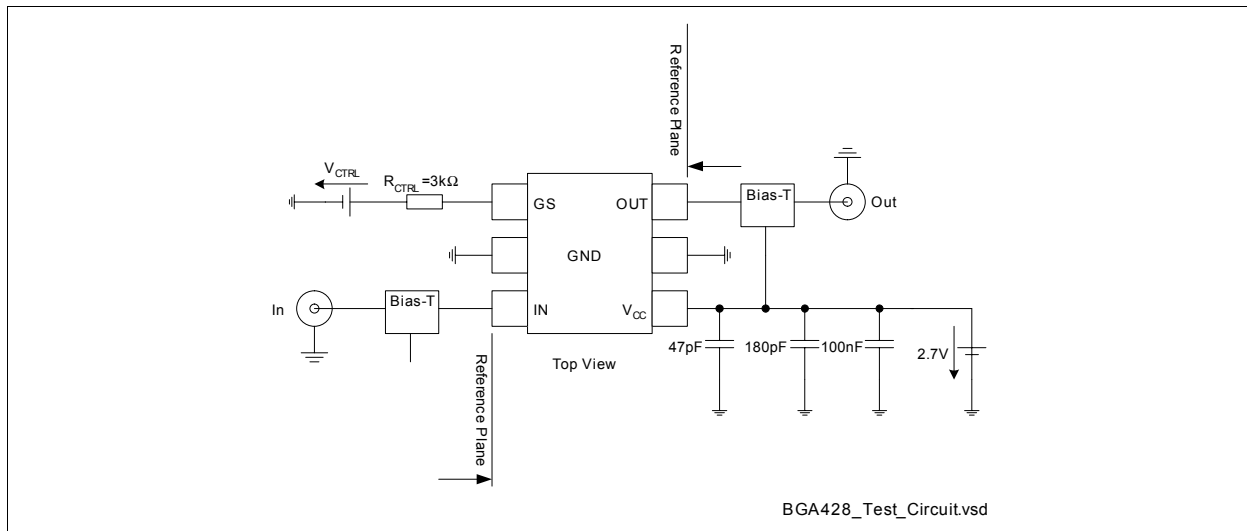


Figure 2 Test Circuit for Electrical Characteristics and S-Parameter

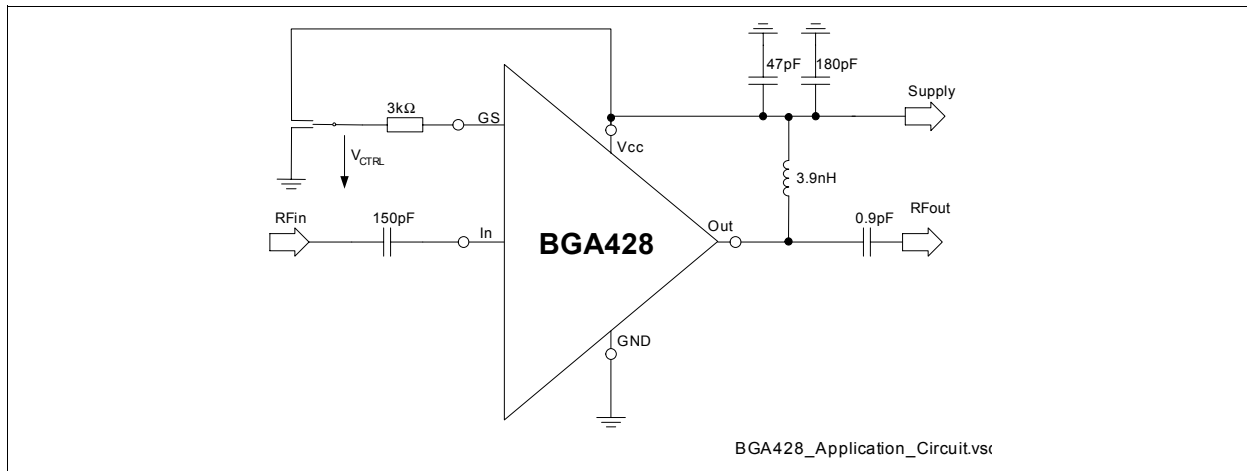
**Table 4 S-Parameter at 2.7 V (see Electrical Characteristics for conditions)**

Frequency [GHz]	S11 Mag	S11 Ang	S21 Mag	S21 Ang	S12 Mag	S12 Ang	S22 Mag	S22 Ang
0.100	0.6756	-31.7	58.775	-19.6	0.0005	153.5	0.9491	-3.9
0.200	0.5936	-53.6	47.806	-43.1	0.0014	138.4	0.9327	-6.3
0.300	0.5150	-71.4	39.232	-59.5	0.0021	119.0	0.9174	-8.3
0.400	0.4587	-86.6	31.740	-71.8	0.0028	104.9	0.9035	-10.3
0.600	0.4004	-110.7	23.868	-89.6	0.0042	105.9	0.8807	-14.0
0.800	0.3743	-129.1	18.509	-103.2	0.0063	94.3	0.8593	-17.7
1.000	0.3743	-143.0	14.825	-114.5	0.0082	92.4	0.8352	-21.4
1.200	0.3816	-154.5	12.288	-124.7	0.0093	87.2	0.8116	-25.1
1.400	0.3922	-164.4	10.353	-134.2	0.0110	85.3	0.7865	-28.7
1.600	0.4086	-172.4	8.879	-143.2	0.0132	79.4	0.7597	-32.2
1.800	0.4265	-178.9	7.732	-151.4	0.0141	79.4	0.7309	-36.0
1.900	0.4314	-178.8	7.214	-155.2	0.0146	76.1	0.7199	-37.5
2.000	0.4371	176.1	6.771	-159.1	0.0150	77.0	0.7097	-39.1
2.200	0.4505	171.2	5.976	-166.6	0.0169	75.2	0.6791	-42.3
2.400	0.4640	167.2	5.298	-173.5	0.0181	73.2	0.6593	-45.6
3.000	0.4935	155.9	3.935	167.0	0.0217	68.3	0.5925	-53.3
4.000	0.5181	141.2	2.605	139.2	0.0282	65.1	0.5284	-64.9
5.000	0.5202	126.9	1.911	113.6	0.0319	62.2	0.4829	-75.1
6.000	0.5128	110.0	1.479	89.9	0.0489	56.0	0.4323	-81.7

**2.2 Application Circuit Characteristics (measured in test circuit specified in Figure 3),  $T_A = 25\text{ }^\circ\text{C}$ ,  $V_{CC} = 2.7\text{ V}$ , Frequency = 1.85 GHz, unless otherwise specified**

**Table 5 Application Circuit Characteristics**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Insertion power gain	$ S_{21} ^2$		19		dB	
Noise figure ( $Z_S = 50\ \Omega$ )	$NF$		1.4		dB	
Input power at 1 dB gain compression	$P_{-1dB}$		-19		dBm	
Input third order intercept point	$IIP_3$		-9		dBm	
Total device current	$I_{tot}$		8.2		mA	
Insertion loss in gain-step-mode	$L_{GS}$		13.5		dB	$V_{CC} = 0.0\text{ V}$ , $V_{CTRL} = 2.7\text{ V}$ , $R_{CRRL} = 3\text{ k}\Omega$



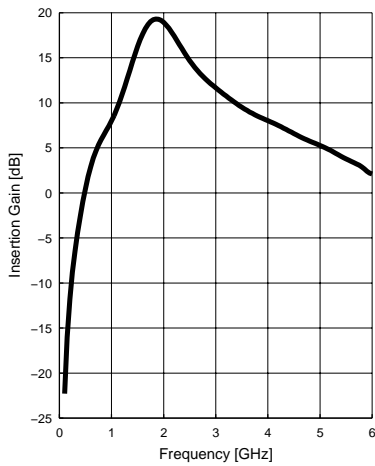
**Figure 3 Application Circuit for 1850 MHz**



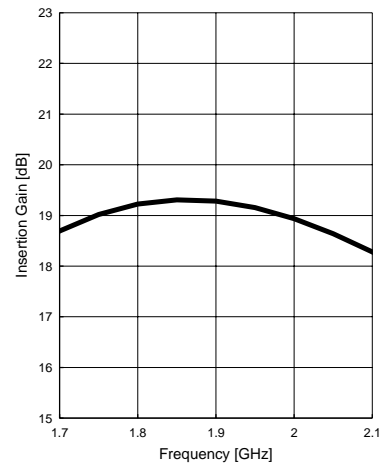
### 3 Measured Parameters

Refer to the application circuit given in [Figure 3](#)

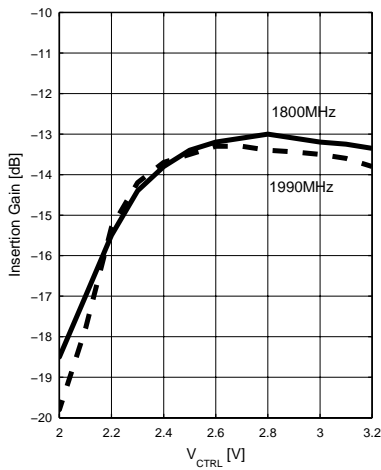
**Power Gain  $|S_{21}|^2=f(f)$**   
 $V_{CC} = 2.7V, V_{Out} = 2.7V$



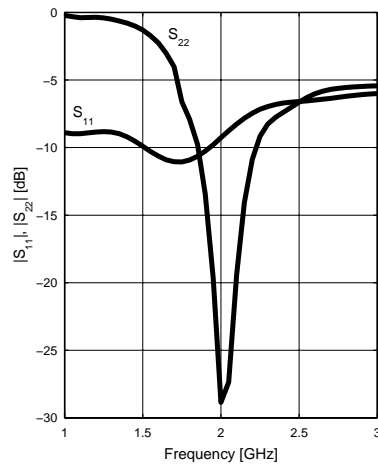
**Power Gain  $|S_{21}|^2=f(f)$**   
 $V_{CC} = 2.7V, V_{Out} = 2.7V$



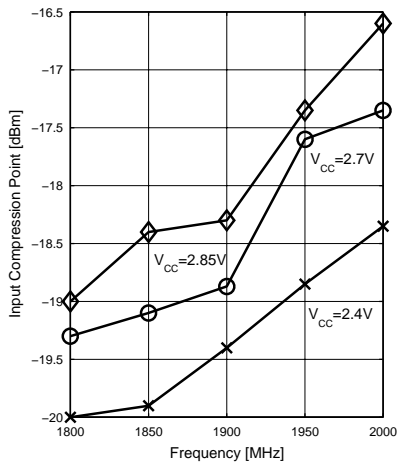
**Off-Gain  $|S_{21}|^2=f(V_{CTRL})$**   
 $V_{CC} = 0.0V, V_{Out} = 0.0V, R_{CTRL} = 2.7k\Omega$



**Matching  $|S_{11}|, |S_{22}|=f(f)$**   
 $V_{CC} = 2.7V, V_{Out} = 2.7V$

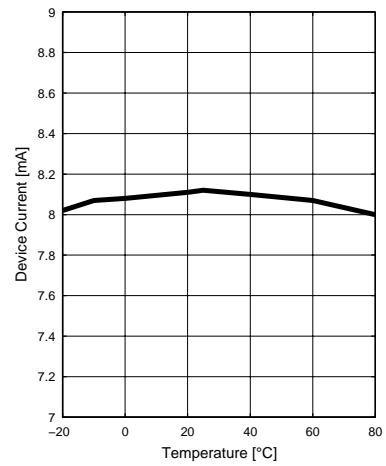


**Input Compression Point  $P_{-1dB}=f(f)$**



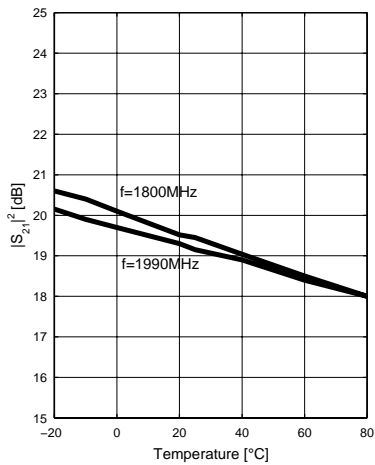
**Device Current  $I=f(\vartheta)$**

$V_{CC}=2.7V, V_{Out}=2.7V$



**Insertion Gain  $|S_{21}|^2=f(\vartheta)$**

$V_{CC}=2.7V, V_{Out}=2.7V$



## 4 Package Information

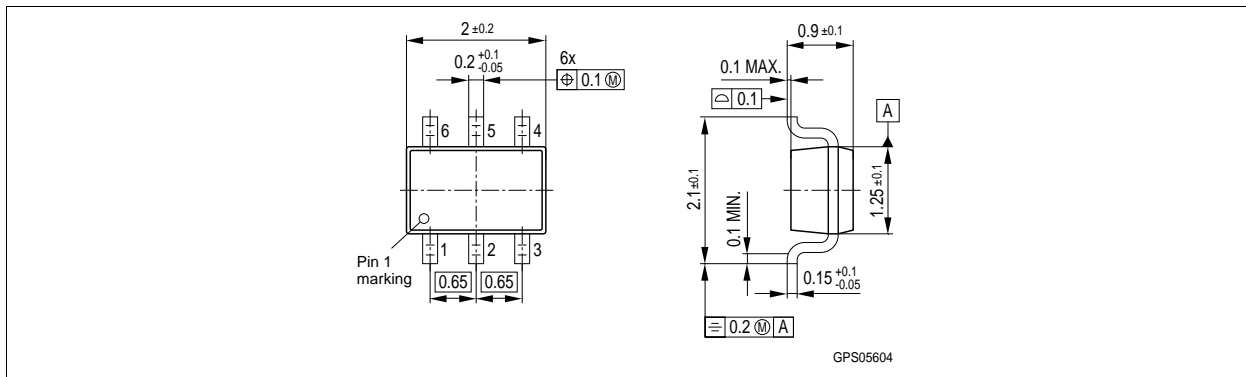


Figure 4 Package Outline SOT363

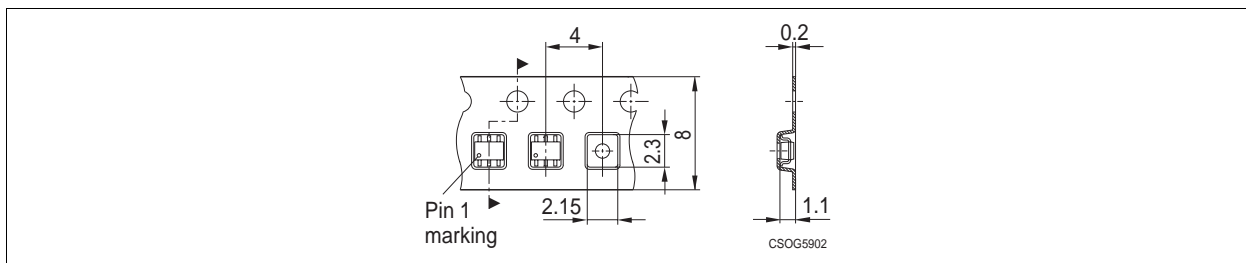


Figure 5 Tape for SOT363