

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

| Page | Subjects (major changes since last revision) |
|-------------|---|
| 9 | Correction of cross-reference |
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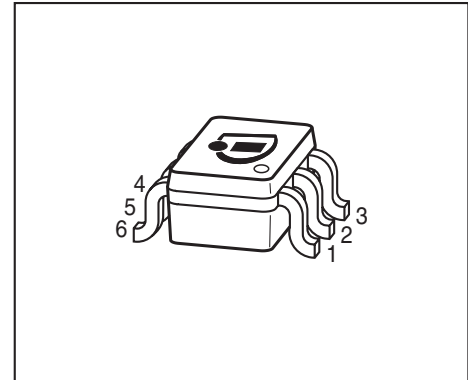
Trademarks

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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[®]-45 technology
- Pb-free (RoHS compliant) package¹⁾



SOT363

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

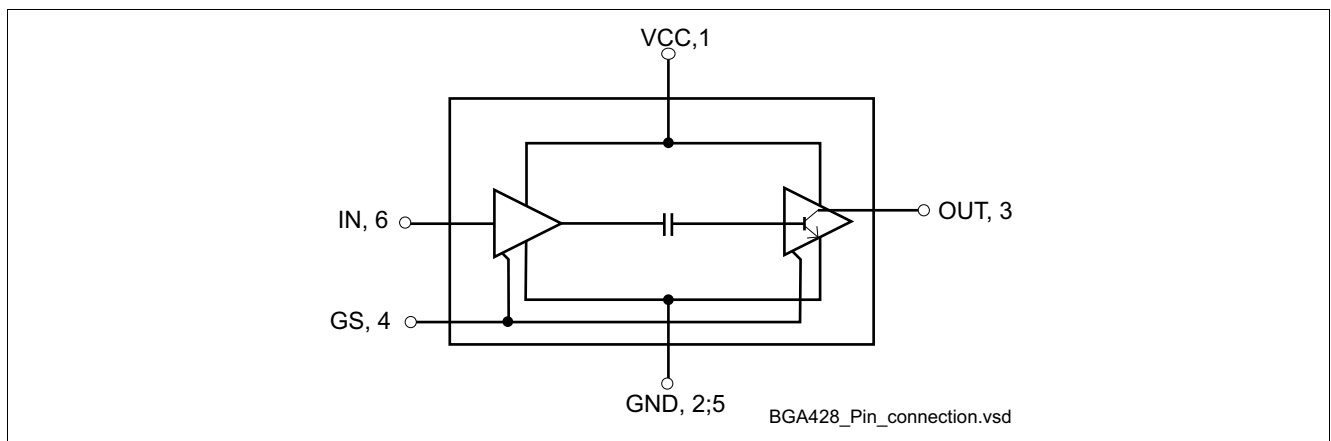


Figure 1 Pin connection

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 ¹⁾ | I_{tot} | 12 | mA |
| Input power ²⁾ | 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 ¹⁾ | 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 | $V_{CC} = 0.0\text{ V}$, $V_{CTRL} = 2.7\text{ V}$, $R_{CRRL} = 3\text{ k}\Omega$ |

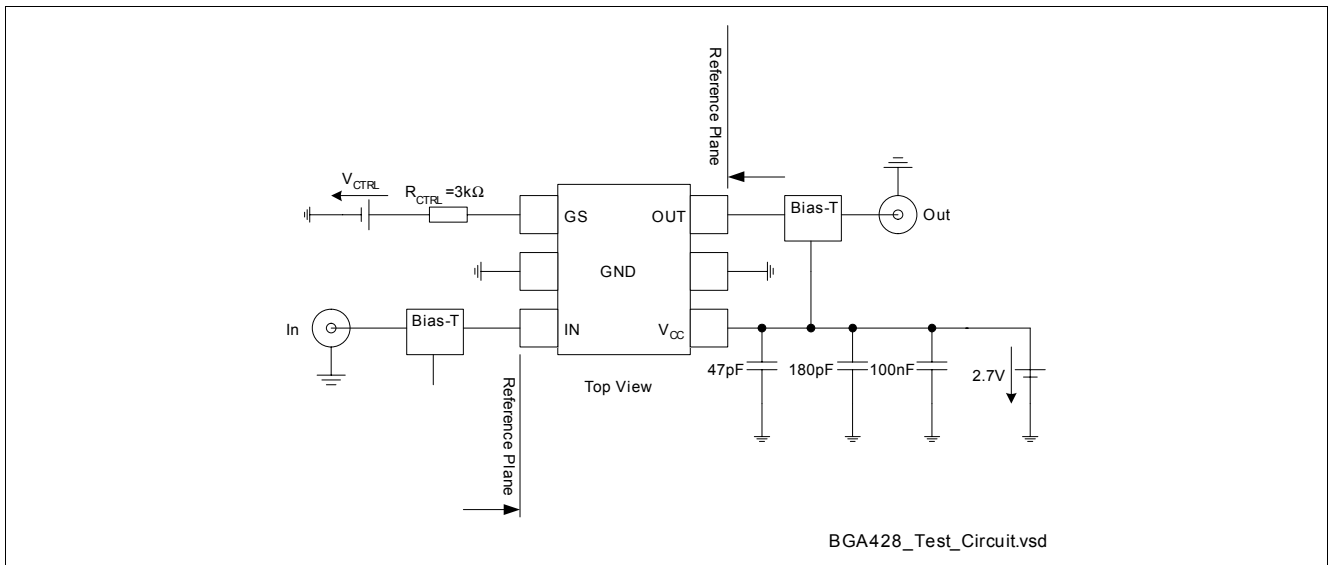


Figure 2 Test Circuit for Electrical Characteristics and S-Parameter

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 | $V_{CC} = 0.0\text{ V}$, $V_{CTRL} = 2.7\text{ V}$, $R_{CRRL} = 3\text{ k}\Omega$ |

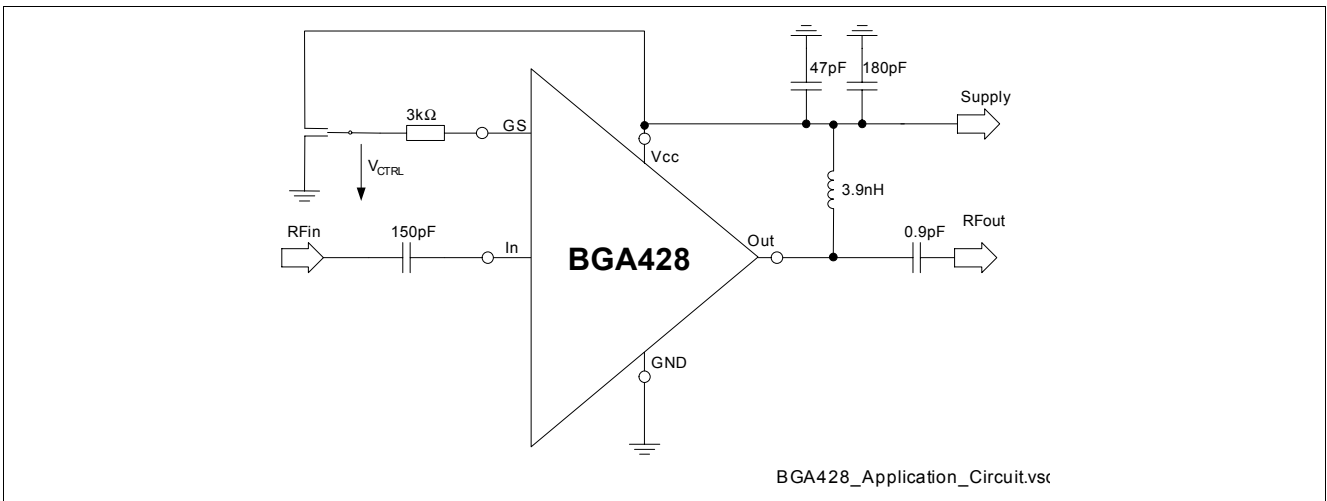


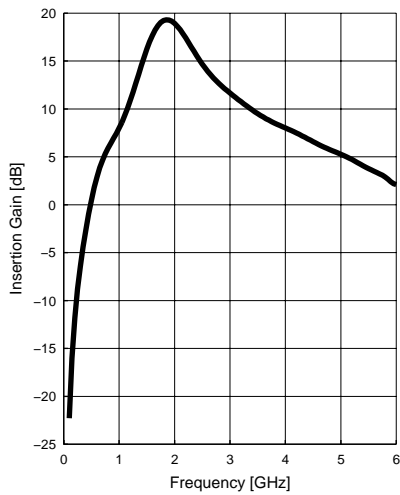
Figure 3 Application Circuit for 1850 MHz

3 Measured Parameters

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

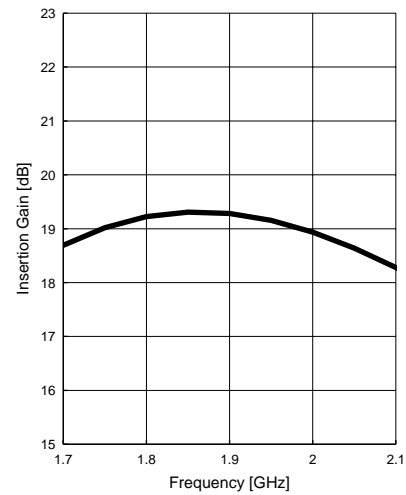
Power Gain $|S_{21}|^2=f(f)$

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



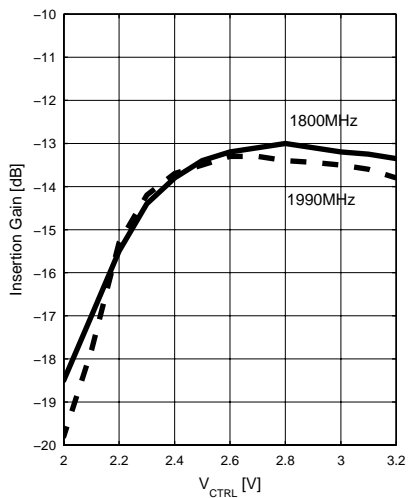
Power Gain $|S_{21}|^2=f(f)$

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



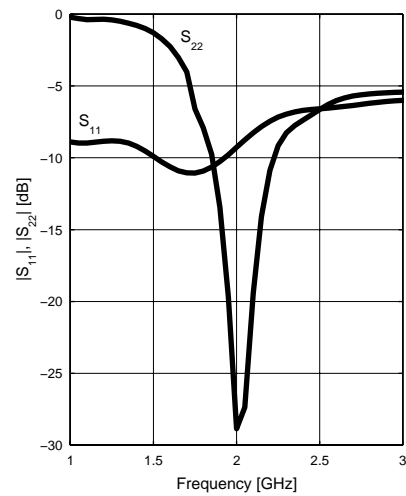
Off-Gain $|S_{21}|^2=f(V_{CTRL})$

$V_{CC} = 0.0V, V_{Out}=0.0V, R_{CTRL}=2.7k\Omega$

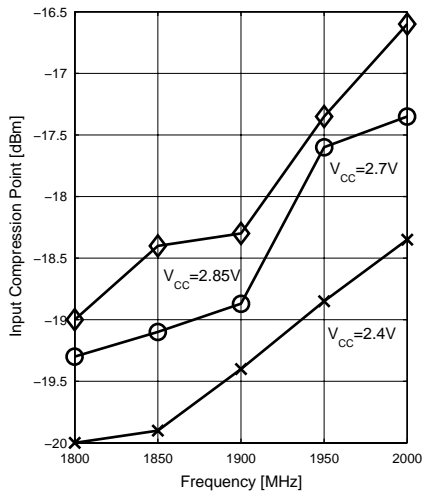


Matching $|S_{11}|, |S_{22}|=f(f)$

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

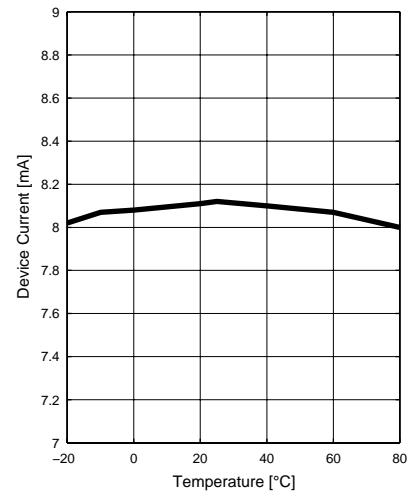


Input Compression Point $P_{-1dB}=f(f)$



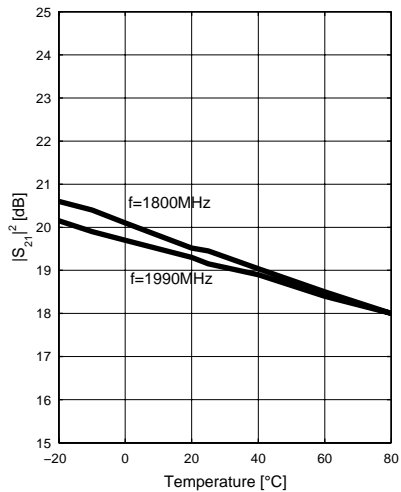
Device Current $I=f(\vartheta)$

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



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

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



4 Package Information

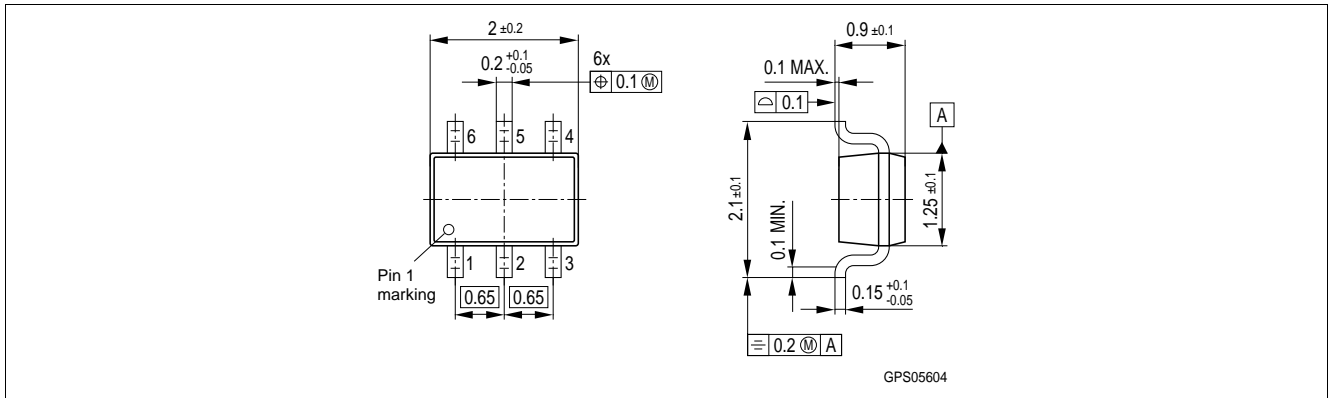


Figure 4 Package Outline SOT363

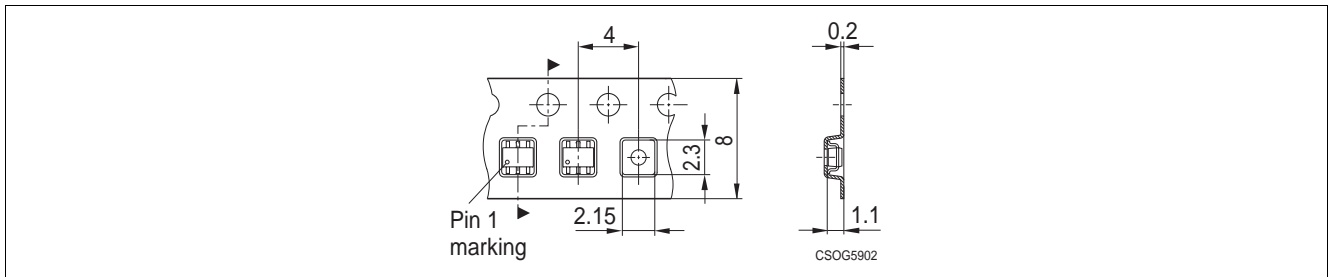


Figure 5 Tape for SOT363