

SiGe 900 MHz GSM Low-Noise Amplifier with Gain Control

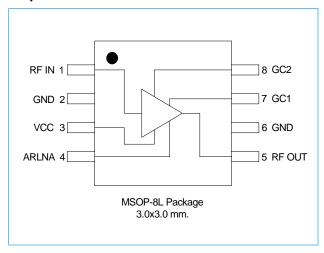
Features

- 925-960 MHz operation for GSM applications
- Low power, single 2.8 volt supply
- Gain control feature with 0, 17, and 25 dB gain settings
- 40 dB of reverse isolation at all gain settings
- Standby Mode with less than 20 μA current consumption
- Compact MSOP-8L package
- High IIP3 and low noise meet demanding system requirements

Applications

GSM portable transceivers

Figure 1. IBM43RCLNA1115 Low Noise Amplifier



Description

The IBM43RCLNA1115 is a gain-controlled low-noise amplifier (LNA) implemented using IBM Microelectronics Silicon Germanium (SiGe) technology.

The LNA is designed for low power consumption and uses a 2.8 volt power supply. It is optimized for GSM applications that require amplifiers with very high reverse isolation such as direct conversion where the LNA is more susceptible to local oscillator leakage.

The IBM43RCLNA1115 is programmable for three levels of gain, and it has a very low power standby mode.

The inputs for gain control and standby mode are 3V CMOS compatible.

External capacitors in series with the input and output are required for DC blocking and as part of the impedance matching networks. A series inductor on the input and a shunt inductor on the output are also part of the matching

network. Proper selection of these components ensures optimized LNA performance in the desired band.

Specifications in this data sheet were obtained using the circuit in the IBM evaluation board for this product.

Ordering Information

To order samples of the LNA or an evaluation board, contact an IBM sales representative or distributor. Regional contact information is located on the IBM Microelectronics Division web site at:

www.ibm.com/chips/support/howtobuy.html

| Part Number | Product |
|--------------------|---|
| IBM43RCLNA1115 | SiGe 900 MHz GSM Low- Noise Amplifier with Gain Control |
| IBM43RCLNA1115EVBA | 900 MHz LNA Evaluation Board |

Note: The low noise amplifier is susceptible to damage from electrostatic discharge (ESD). Observe normal ESD precautions at all times.

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0.01uF 47pF 68pF 0.01uF

0.01uF 47pF 68pF 0.01uF

6.8nH

RF IN 33pF 5.6nH 1

LNA 5 4.7pF PG2
PG1
STANDBY

Figure 2. SiGe 900 MHz GSM LNA Schematic

Technical Description

Table 1. Operating Conditions

| Symbol | Parameter | Min. | Typical | Max | Units | Notes |
|-------------------------|--------------------------------|------|---------|-----|-------|----------------|
| V_{CC1} and V_{CC2} | Supply voltage | 2.7 | 2.8 | 2.9 | Vdc | |
| I _{CC} | I _{CC} Supply current | | 6 | 20 | μA | standby mode |
| | | | 8 | 10 | mA | low gain mode |
| | | | 17 | 22 | | mid gain mode |
| | | | 12 | 15 | | high gain mode |
| I _{GC1} | Gain Control 1 Current | | 7 | 10 | μA | |
| I_{GC2} | Gain Control 2 Current | | 8 | 10 | μA | |
| T _{OPR} | Operating Temperature | -20 | +25 | +70 | °C | |
| T _{STO} | Storage Temperature | -40 | +25 | +85 | | |

Table 2. Control Functions¹

| MODE | STANDBY (pin 4) | Programmable Gain 1 (pin 7) | Programmable Gain 2 (pin 8) |
|---------|-----------------|-----------------------------|-----------------------------|
| High | 1 | 1 | 1 |
| Mid | 1 | 0 | 1 |
| Low | 1 | 0 | 0 |
| Standby | 0 | 0 | 0 |

Note: ¹Control lines PG1, PG2, and STANDBY require CMOS logic levels

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Table 3. AC Characteristics ($V_{CC} = 2.8 Vdc, T_A = 25$ °C)

| Symbol Parameter | | Rating | | | Heita | Natas |
|-----------------------------------|---------------------------------|---------|---------------|---------|-------|-------------------|
| Symbol | Parameter | Minimum | Typical | Maximum | Units | Notes |
| F0 | Frequency | | 925 to 960 | | MHz | |
| | | 24 | 25 | 28 | dB | high gain mode |
| $\left S_{21}\right ^2$ | Insertion power gain | 15.5 | 17 | 20 | | mid gain mode |
| | | -3 | 0 | 3 | | low gain mode |
| | | | +/-1.7 | | dB | high gain mode |
| $\left S_{21}\right ^2$ Variation | Over Supply/Temperature | | +/-1.5 | | dB | mid gain mode |
| | | | +/-0.8 | | dB | low gain mode |
| 1 ~ 12 | | | +/-0.1 | | dB | high gain mode |
| $\left S_{21}\right ^2$ Variation | Over Frequency | | +/-0.1 | | dB | mid gain mode |
| | | | +/-0.1 | | dB | low gain mode |
| _ 2 | Over Process | | +/-0.8 | | dB | high gain mode |
| $\left S_{21}\right ^2$ Variation | | | +/-0.8 | | dB | mid gain mode |
| | | | +/-0.8 | | dB | low gain mode |
| | Noise Figure | | 1.6 | 3.0 | dB | high gain mode |
| NF | | | 2.4 | 3.3 | | mid gain mode |
| _ | | | 3.8 | 5.0 | | low gain mode |
| $\left S_{12}\right ^2$ | Reverse Isolation | | -40 | -35 | dB | in all gain modes |
| | | | 1.7:1 | 3:1 | | high gain mode |
| ISWR | Input SWR | | 2.1:1 | 3:1 | | mid gain mode |
| | | | 2.3:1 | 3:1 | | low gain mode |
| | | | 1.6:1 | 2:1 | | high gain mode |
| OSWR | Output SWR | | 1.2:1 | 2:1 | | mid gain mode |
| | | | 1.3:1 | 2:1 | | low gain mode |
| | | -20 | -17.0 | | | high gain mode |
| IIP3 | Input Third Order Intercept | -9.5 | -6.0 | | dBm | mid gain mode |
| | | -9.5 | -6.3 | | | low gain mode |
| | Input 1 dB Compression Point | -30 | -26.0 | | | high gain mode |
| P1dB | | -20 | -16 | | dBm | mid gain mode |
| | | -20 | -16 | | | low gain mode |
| | Stability | | Unconditional | | | |

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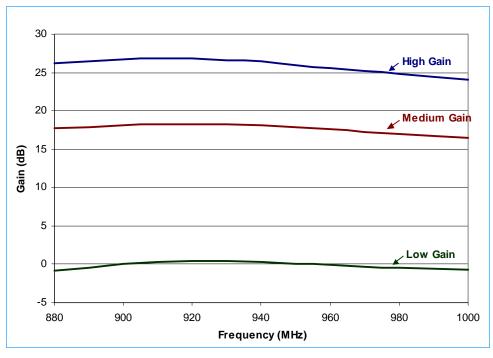
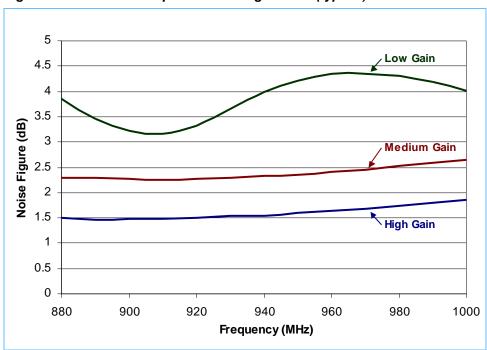


Figure 3. Low Noise Amplifier Gain Plot (typical)





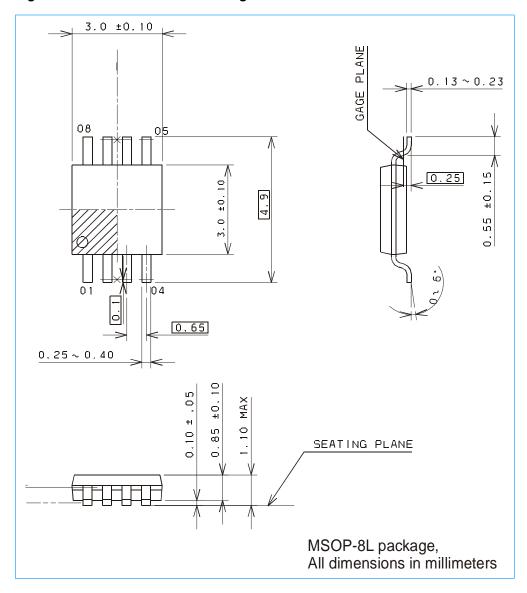
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Table 4. Pin Descriptions

| Pin | Name | Description | Package Type |
|-----|-----------------|----------------------------|------------------|
| 1 | RF IN | RF input | |
| 2 | GND | Ground | RF IN 1 |
| 3 | V _{CC} | DC supply | GND 2 7 GC1 |
| 4 | STANDBY | Mode control (see Table 2) | VCC 3 6 GND |
| 5 | RF OUT | RF output | |
| 6 | GND | Ground | ARLNA 4 5 RF OUT |
| 7 | PG1 | Mode control (see Table 2) | MSOP-8L Package |
| 8 | PG2 | Mode control (see Table 2) | 3.0x3.0 mm. |

Figure 5. 900 MHz GSM LNA Package Dimensions



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Document Revision Log

| Rev. | Contents of Modification |
|-------------------|--|
| July 19, 1999 | Initial release (00) |
| November 21, 2001 | Overall revision (01) |
| April 03, 2002 | Removed preliminary from document for general release (02) |

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