Panasonic

AN26025A

Ultra small, Single Band LNA-IC for 5 GHz Band Applications

FEATURES

- Low voltage operation +3.3 V typ.
- Low current consumption
  - 7.5 mA typ. (High-Gain mode)
  - 7.5 µA typ. (Low-Gain mode)
- High gain 14 dB typ. (High-Gain mode)
- Low noise figure 1.65 dB typ. (High-Gain mode)
- Low distortion +5 dBm typ. (High-Gain mode)
- 5 pin Wafer level chip size package (WLCSP)

DESCRIPTION

AN26025A is a single band LNA (Low Noise Amplifier)-IC for 5 GHz Band applications.

Realizing high performance by using 0.18 µm SiGeC Bi-CMOS process (f_T = 90 GHz, f_{max} = 140 GHz).

High/Low Gain-mode is changeable, controlled by integrated CMOS logic circuit.

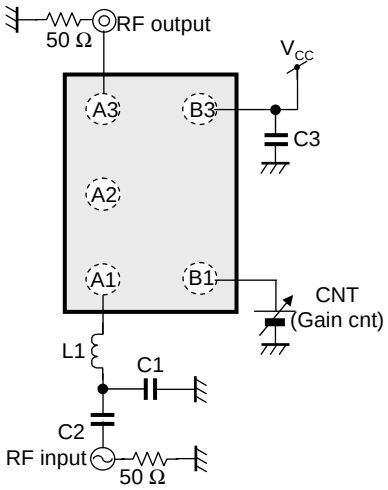
Achieving miniaturization by using small size Wafer Level Chip Size Package (WLCSP).

APPLICATIONS

●WLAN

SIMPLIFIED APPLICATION

TOP VIEW



Components	Size	Value	Part Number	Vendor
L1	0603	1.0 nH	LQP03TN1N0B02	Murata
C1	0603	0.5 pF	GRM0334C1HR50WD01D	Murata
C2	0603	1 000 pF	GRM033B11C102KD01	Murata
C3	0603	100 000 pF	GRM33B30J104KE18	Murata

Notes) This application circuit is an example. The operation of mass production set is not guaranteed. You should perform enough evaluation and verification on the design of mass production set. You are fully responsible for the incorporation of the above application circuit and information in the design of your equipment.

ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Rating	Unit	Note
Supply voltage	V_{CC}	3.7	V	*1
Supply current	I_{CC}	18	mA	—
Operating ambient temperature	T_{opr}	–40 to +85	°C	*2
Operating junction temperature	T_j	-40 to +125	°C	*2
Storage temperature	T_{stg}	–55 to +150	°C	*2
Output Voltage Range	IN (Pin No.A1)	—	V	*3
	CNT (Pin No.B1)	-0.3 to V_{CC}	V	—
	OUT (Pin No.A3)	-0.3 to V_{CC}	V	—
ESD	HBM (Human Body Model)	2	kV	—

Notes). This product may sustain permanent damage if subjected to conditions higher than the above stated absolute maximum rating. This rating is the maximum rating and device operating at this range is not guaranteeable as it is higher than our stated recommended operating range.
When subjected under the absolute maximum rating for a long time, the reliability of the product may be affected.
*1:The values under the condition not exceeding the above absolute maximum ratings and the power dissipation.
*2:Except for the operating ambient temperature, operating junction temperature and storage temperature, all ratings are for Ta = 25°C.
*3:RF signal input pin. Do not apply DC. Do not apply more than 0 dBm to RF input.

POWER DISSIPATION RATING

PACKAGE	θ_{JA}	PD (Ta=25 °C)	PD (Ta=85 °C)
WLCSP	1391°C/W	0.090W	0.047W

Note). For the actual usage, please refer to the PD-Ta characteristics diagram in the package specification, supply voltage, load and ambient temperature conditions to ensure that there is enough margin follow the power and the thermal design does not exceed the allowable value.

CAUTION

Although this has limited built-in ESD protection circuit, but permanent damage may occur on it.
Therefore, proper ESD precautions are recommended to avoid electrostatic damage to the MOS gates

RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Supply voltage range	V_{CC}	2.7	3.3	3.6	V	*1

Note) *1 : The values under the condition not exceeding the above absolute maximum ratings and the power dissipation.

ELECRTRICAL CHARACTERISTICS

Note) Ta = 25°C±2°C,
Vcc = 3.3 V

Parameter	Symbol	Condition	Limits			Unit	Note
			Min	Typ	Max		
DC electrical characteristics							
Supply current HG	IccH	Vcc current at High-Gain mode, No input signal	—	7.5	10	mA	—
Supply current LG	IccL	Vcc current at Low-Gain mode, No input signal	—	7.5	15	µA	—
Input voltage (High-Gain mode)	VIH	—	1.48	—	3.6	V	—
Input voltage (Low-Gain mode)	VIL	—	0	—	0.6	V	—
SW current (High)	IIH	Current at CNT pin VIH = Vcc	—	19	30	µA	—

ELECRTRICAL CHARACTERISTICS (continued)

Note) Ta = 25°C±2°C,
Vcc = 3.3 V,
fRX = 5.50 GHz, PRX = –30 dBm, CW unless otherwise specified.

Parameter	Symbol	Condition	Limits			Unit	Note
			Min	Typ	Max		
AC electrical characteristics							
Power Gain HG	GHS	High-Gain mode	12.0	14.0	16.0	dB	—
Power Gain LG	GLS	Low-Gain mode	–12.6	–10.5	–8.4	dB	—

APPLICATION INFORMATION

REFERENCE VALUES FOR DESIGN

Notes) Vcc = 3.3 V, Ta = 25°C±2°C,
fRX = 5.15 GHz, 5.5 GHz, 5.85 GHz, PRX = –30 dBm, CW unless otherwise specified.

Parameter	Symbol	Conditions	Reference values			Unit	Note
			Min	Typ	Max		
AC electrical characteristics							
Power Gain HG	GHa	High-Gain mode	11.5	14	16.5	dB	*1
Power Gain LG	GLa	Low-Gain mode	–13	–10.5	–8	dB	*1
Noise Figure HG	NFHa	High-Gain mode	—	1.9	2.25	dB	*1,*2
Noise Figure LG	NFLa	Low-Gain mode	—	10.5	13.5	dB	*1,*2
IIP3 –10 MHz offset HG	IIP3H1a	High-Gain mode f1 = fRX – 10 MHz f2 = fRX – 20 MHz Input 2 signals (f1, f2)	–1	5	—	dBm	*1
IIP3 +10 MHz offset HG	IIP3H2a	High-Gain mode f1 = fRX + 10 MHz f2 = fRX + 20 MHz Input 2 signals (f1, f2)	–1	4	—	dBm	*1
Input P1dB HG	IP1dBHa	High-Gain mode	–13.5	-9	—	dBm	*1
IIP3 +100 kHz offset LG	IIP3La	Low-Gain mode f1 = fRX f2 = fRX + 100 kHz Input 2 signals (f1, f2)	10	25	—	dBm	*1
Input P1dB LG	IP1dBLa	Low-Gain mode	0	9	—	dBm	*1
Reverse Isolation HG	ISOHa	High-Gain mode	21	26	—	dB	*1
Reverse Isolation LG	ISOLa	Low-Gain mode	8	10.5	—	dB	*1
Input Return Loss HG	S11Ha	High-Gain mode	6.5	12	—	dB	*1
Input Return Loss LG	S11La	Low-Gain mode	3.5	5	—	dB	*1
Output Return Loss HG	S22Ha	High-Gain mode	9	16	—	dB	*1
Output Return Loss LG	S22La	Low-Gain mode	5	6.5	—	dB	*1

Note) *1 : Checked by design, not production tested.
*2 : RF input Connector & substrate loss (0.26 dB) included.

APPLICATION INFORMATION (continued)

REFERENCE VALUES FOR DESIGN (continued)

Notes) Vcc = 3.0 V to 3.6 V

Ta = –40°C to 85°C unless otherwise specified.

Parameter	Symbol	Conditions	Reference values			Unit	Note
			Min	Typ	Max		
DC electrical characteristics							
Supply current HG	IccHT	Vcc current at High-Gain mode No input signal	—	7.5	12	mA	*1
Supply current LG	IccLT	Vcc current at Low-Gain mode No input signal	—	7.5	18	µA	*1
SW current (High)	IIHT	Current at CNT pin VIH = Vcc	—	19	35	µA	*1

Note) *1 : Checked by design, not production tested.

APPLICATION INFORMATION (continued)

REFERENCE VALUES FOR DESIGN (continued)

Notes) Vcc = 3.0 V to 3.6 V

Ta = –40°C to 85°C、fRX = 5.15 GHz, 5.5 GHz, 5.85 GHz, PRX = –30 dBm, CW unless otherwise specified.

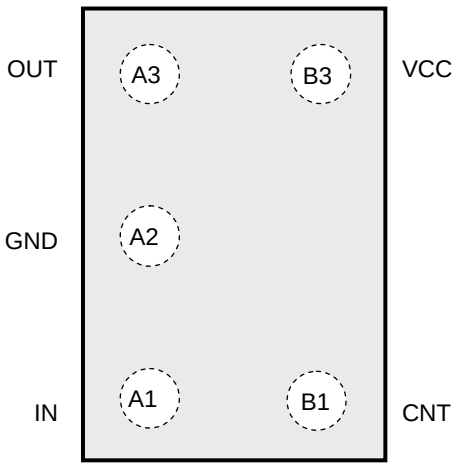
Parameter		Symbol	Conditions	Reference values			Unit	Note
				Min	Typ	Max		
AC electrical characteristics								
	Power Gain HG	GHTa	High-Gain mode	10	14	18	dB	*1
	Power Gain LG	GLTa	Low-Gain mode	–14	–10.5	–7	dB	*1
	Noise Figure HG	NFHTa	High-Gain mode	—	1.90	2.85	dB	*1,*2
	Noise Figure LG	NFLTa	Low-Gain mode	—	10.5	14.5	dB	*1,*2
	IIP3 –10 MHz offset HG	IIP3H1Ta	High-Gain mode f1 = fRX – 10 MHz f2 = fRX – 20 MHz Input 2 signals (f1, f2)	–4	5	—	dBm	*1
	IIP3 +10 MHz offset HG	IIP3H2Ta	High-Gain mode f1 = fRX + 10 MHz f2 = fRX + 20 MHz Input 2 signals (f1, f2)	–4	4	—	dBm	*!
	Input P1dB HG	P1dBHTa	High-Gain mode	–16.5	–9	—	dBm	*1

Note) *1 : Checked by design, not production tested.

*2 : RF input Connector & substrate loss (0.26 dB) included.

PIN CONFIGURATION

Top View

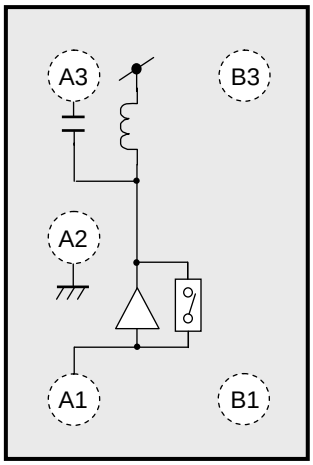


PIN FUNCTIONS

Pin No.	Pin name	Type	Description
A1	IN	Input	RF Input
A2	GND	Ground	GND
A3	OUT	Output	RF Output
B1	CNT	Input	High-Gain / Low-Gain switch L: Low-Gain Mode H: High-Gain Mode
B3	VCC	Power Supply	V_{CC}

FUNCTIONAL BLOCK DIAGRAM

Top View

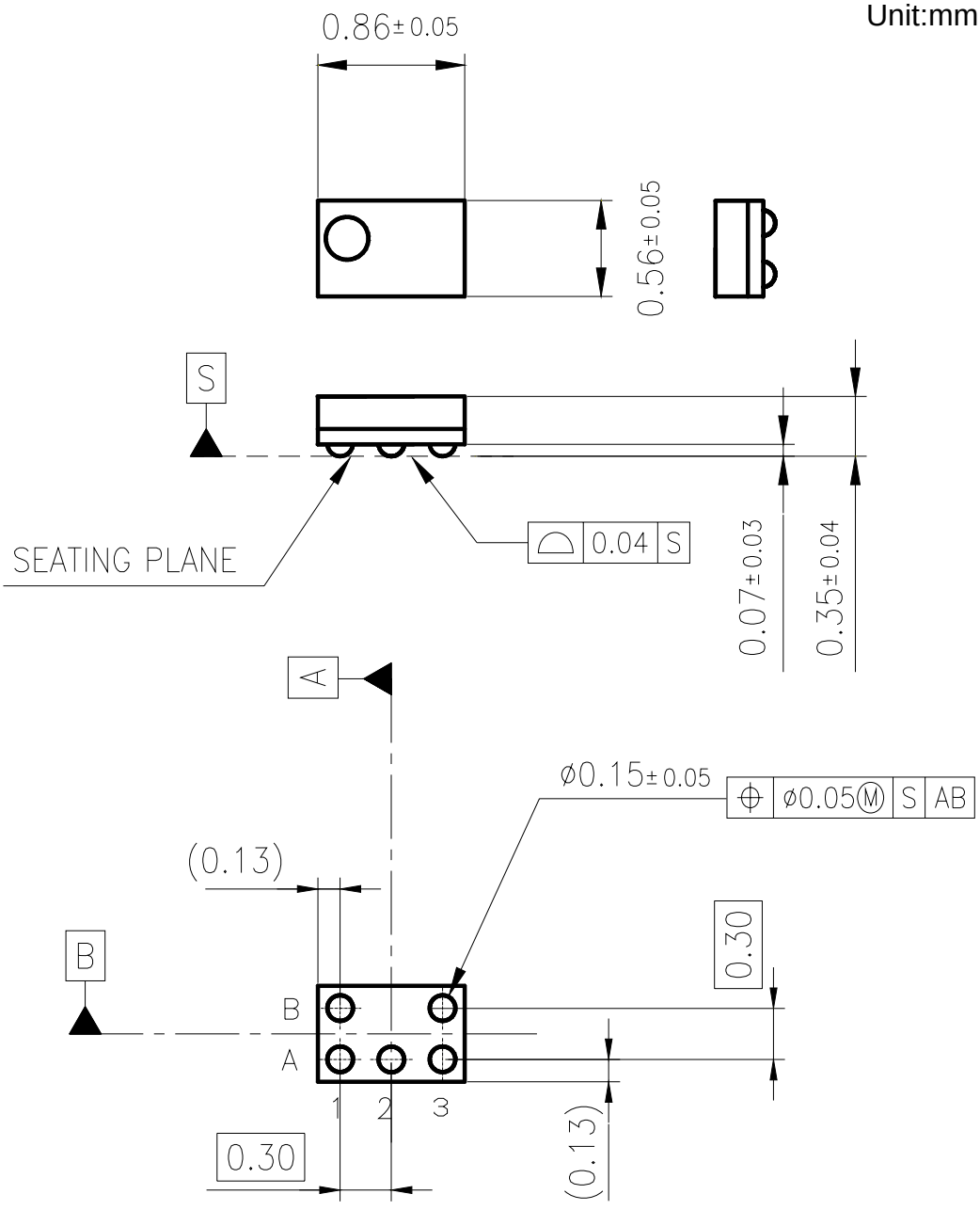


Notes) This block diagram is for explaining functions. Part of the block diagram may be omitted, or it may be simplified.

PACKAGE INFORMATION (Reference Data)

Package Code:ALGA005-W-0609ANA

Unit:mm



Body Material : Br/Sb Free Epoxy Resin
Reroute Material : Cu
Bump : SnAgCu

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(5) Control equipment for power plant
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USAGE NOTES

1. When designing your equipment, comply with the range of absolute maximum rating and the guaranteed operating conditions (operating power supply voltage and operating environment etc.). Especially, please be careful not to exceed the range of absolute maximum rating on the transient state, such as power-on, power-off and mode-switching. Otherwise, we will not be liable for any defect which may arise later in your equipment.

   Even when the products are used within the guaranteed values, take into the consideration of incidence of break down and failure mode, possible to occur to semiconductor products. Measures on the systems such as redundant design, arresting the spread of fire or preventing glitch are recommended in order to prevent physical injury, fire, social damages, for example, by using the products.

2. Comply with the instructions for use in order to prevent breakdown and characteristics change due to external factors (ESD, EOS, thermal stress and mechanical stress) at the time of handling, mounting or at customer's process. When using products for which damp-proof packing is required, satisfy the conditions, such as shelf life and the elapsed time since first opening the packages.

3. Pay attention to the direction of LSI. When mounting it in the wrong direction onto the PCB (printed-circuit-board), it might smoke or ignite.

4. Pay attention in the PCB (printed-circuit-board) pattern layout in order to prevent damage due to short circuit between pins. In addition, refer to the Pin Description for the pin configuration.

5. Perform a visual inspection on the PCB before applying power, otherwise damage might happen due to problems such as a solder-bridge between the pins of the semiconductor device. Also, perform a full technical verification on the assembly quality, because the same damage possibly can happen due to conductive substances, such as solder ball, that adhere to the LSI during transportation.

6. Take notice in the use of this product that it might break or occasionally smoke when an abnormal state occurs such as output pin-VCC short (Power supply fault), output pin-GND short (Ground fault), or output-to-output-pin short (load short) .

   And, safety measures such as an installation of fuses are recommended because the extent of the above-mentioned damage and smoke emission will depend on the current capability of the power supply.

7. Due to unshielded structure of this LSI, under exposure of light, function and characteristic of the product cannot be guaranteed. During normal operation or even under testing condition, please ensure that LSI is not exposed to light.

8. Basically, chip surface is ground potential. Please design to ensure no contact between chip surface and metal shielding.

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