Panasonic

AN26014A

LNA-IC for 1.5GHz Band Applications

FEATURES

- Low voltage operation +2.85 V typ.
- Low current consumption 9.5 mA typ.
- High gain 19 dB typ. fRX = 1 575 MHz
- Low noise figure 0.86 dB typ. fRX = 1 575 MHz
- Low distortion +4 dBm typ. fRX = 1 575 MHz
  (IIP3 +10 MHz offset)
- Small package5 pin Plastic Small Surface Mount Package
  (SMINI Type)

DESCRIPTION

AN26014A is LNA-IC for 1.5 GHz Band Applications.

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

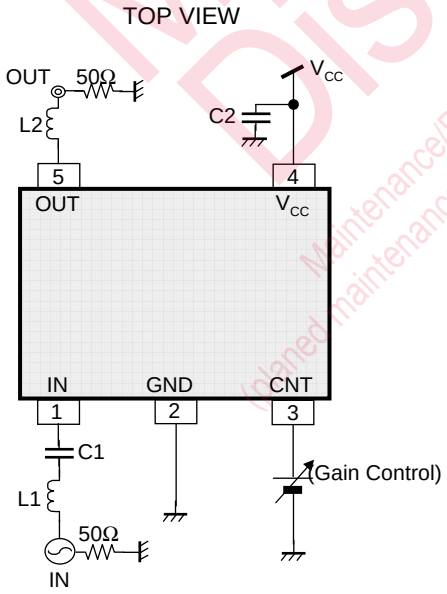
Sleep mode is available, controlled by integrated CMOS logic circuit.

Achieving miniaturization by using small size package.

APPLICATIONS

●GPS

SIMPLIFIED APPLICATION



Components	Size	Value	Part Number	Vendor
L1	0603	3.0 nH	LQP03T3N0B04	Murata
L2	0603	5.6 nH	LQP03T5N6H04	Murata
C1	0603	1 000 pF	GRM033B11C102KD01	Murata
C2	0603	0.1 uF	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}	3.6	V	*1
Supply current	I_{CC}	18	mA	—
Operating ambient temperature	T_{opr}	–20 to 70	°C	*2
Operating junction temperature	T_j	–40 to +125	°C	*2
Storage temperature	T_{stg}	–55 to +125	°C	*2
Input Voltage Range	IN (Pin No.1)	—	V	*3
	CNT (Pin No.3)	-0.3 to (V_{CC} + 0.3)	V	*4
	OUT (Pin No.5)	-0.3 to (V_{CC} + 0.3)	V	*4
ESD	HBM (Human Body Model)	2	kV	—
	MM (Machine Model)	200	V	—

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 power dissipation, operating ambient temperature, and storage temperature, all ratings are for Ta = 25°C.
*3:RF signal input pin. Do not apply DC current.
*4:(Vcc + 0.3) V must not be exceeded 3.6 V

POWER DISSIPATION RATING

PACKAGE	θ_{JA}	PD (Ta=25 °C)	PD (Ta=70 °C)
SSMINI-5DC	833.3°C/W	0.12W	0.06W

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}	2.70	2.85	3.0	V	*1

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

ELECRTRICAL CHARACTERISTICS

Note) Vcc = 2.85 V, Ta = 25°C±2°C unless otherwise specified.

Parameter		Symbol	Conditions	Limits			Unit	Note
				Min	Typ	Max		
DC electrical characteristics								
	Supply current	IccH	Vcc current at Active mode No input signal	—	9.5	13.0	mA	—
	Sleep current	IccS	Vcc current at Sleep mode No input signal	—	1	10	µA	—
	CNT current (On)	IcntH	CNT current at Active mode No input signal	—	5	35	µA	—
	CNT current (Sleep)	IcntL	CNT current at Sleep mode No input signal	—	0.5	10	µA	—
	CNT voltage (On)	VIH		2.57	2.85	—	V	—
	CNT voltage (Sleep)	VIL		—	0	0.37	V	—

ELECRTRICAL CHARACTERISTICS (continued)

Note) Vcc = 2.85 V, Ta = 25°C±2°C, fRX = 1 575 MHz, PRX = –30 dBm, CW unless otherwise specified.

Parameter		Symbol	Conditions	Limits			Unit	Note
				Min	Typ	Max		
LNA AC electrical characteristics								
	Power Gain	PGS	f = 1 575 MHz, PRX = – 30 dBm	16.7	19.0	20.7	dB	—
	IIP3 +10 MHz offset	IIP31S	f1 = fRX + 10 MHz f2 = fRX + 20 MHz Input 2 signals (f1, f2)	0	4.0	—	dBm	—
	IIP3 –10 MHz offset	IIP32S	f1 = fRX – 10 MHz f2 = fRX – 20 MHz Input 2 signals (f1, f2)	0	4.0	—	dBm	—

APPLICATION INFORMATION

REFERENCE VALUES FOR DESIGN

Note) Vcc = 2.85 V

All characteristics are specified under Ta = 25°C ±2°C, fRX = 1575 MHz , PRX = -30 dBm , CW

Parameter		Symbol	Conditions	Reference values			Unit	Note
				Min	Typ	Max		
LNA AC electrical characteristics								
	Noise Figure	NF	f = fRX	—	1.0	1.4	dB	*1 , *2
	Reverse Isolation	ISO	f = fRX	—	–32	–21	dB	*1
	Input Return Loss	S11	f = fRX	7	9.5	—	dB	*1
	Output Return Loss	S22	f = fRX	10	13	—	dB	*1

Note) *1 : Checked by design, not production tested.
*2 : Connector & substrate loss (0.14 dB) included.

APPLICATION INFORMATION (continued)

REFERENCE VALUES FOR DESIGN (continued)

Notes) Vcc = 2.7 V to 3.0 V
All characteristics are specified under Ta = –20°C to 70°C, fRX = 1 575 MHz, PRX = –30 dBm, CW

Parameter		Symbol	Conditions	Reference values			Unit	Note
				Min	Typ	Max		
DC electrical characteristics								
	Supply current	IccHT	Vcc current No input signal	—	9.5	14.0	mA	*1
	Sleep current	IccST	Vcc current at Sleep mode No input signal	—	1	12	µA	*1
	CNT current (On)	IcntHT	CNT current at Active mode No input signal	—	5	40	µA	*1
	CNT current (Sleep)	IcntLT	CNT current at Sleep mode No input signal	—	0.5	12	µA	*1

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

APPLICATION INFORMATION (continued)

REFERENCE VALUES FOR DESIGN (continued)

Notes) Vcc = 2.7 V to 3.0 V

All characteristics are specified under Ta = –20°C to 70°C, fRX = 1 575 MHz, PRX = –30 dBm, CW

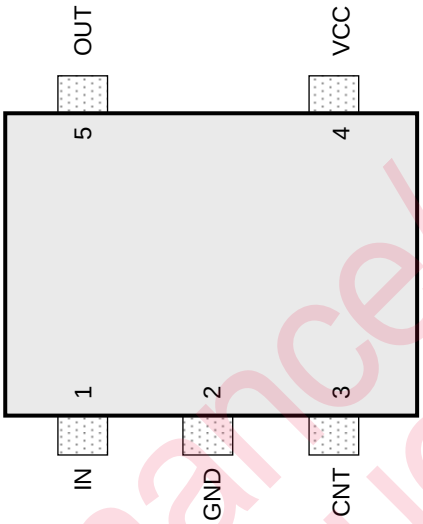
Parameter	Symbol	Conditions	Reference Values			Unit	Note
			Min	Typ	Max		
LNA AC electrical characteristics							
Power Gain	GT	f = fRX	16.0	19.0	21.5	dB	*1
Noise Figure	NFT	f = fRX	—	1.0	1.6	dB	*1 , *2
IIP3 +10 MHz offset	IIP31T	f1 = fRX + 10 MHz f2 = fRX + 20 MHz Input 2 signals (f1, f2)	– 1.0	4.0	—	dBm	*1
IIP3 –10 MHz offset	IIP32T	f1 = fRX – 10 MHz f2 = fRX – 20 MHz Input 2 signals (f1, f2)	– 1.0	4.0	—	dBm	*1

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

*2 : Connector & substrate loss (0.14 dB) included.

PIN CONFIGURATION

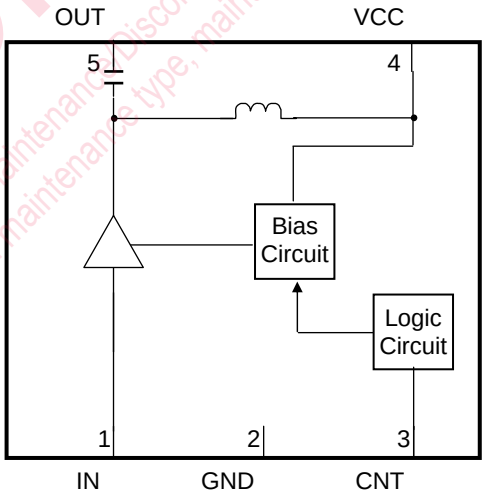
Top View



PIN FUNCTIONS

Pin No.	Pin name	Type	Description
1	IN	Input	RF Input
2	GND	Ground	GND
3	CNT	Input	CNT (Sleep mode) L: Sleep Mode H: On Mode
4	VCC	Power Supply	V_{CC}
5	OUT	Output	RF Output

FUNCTIONAL BLOCK DIAGRAM

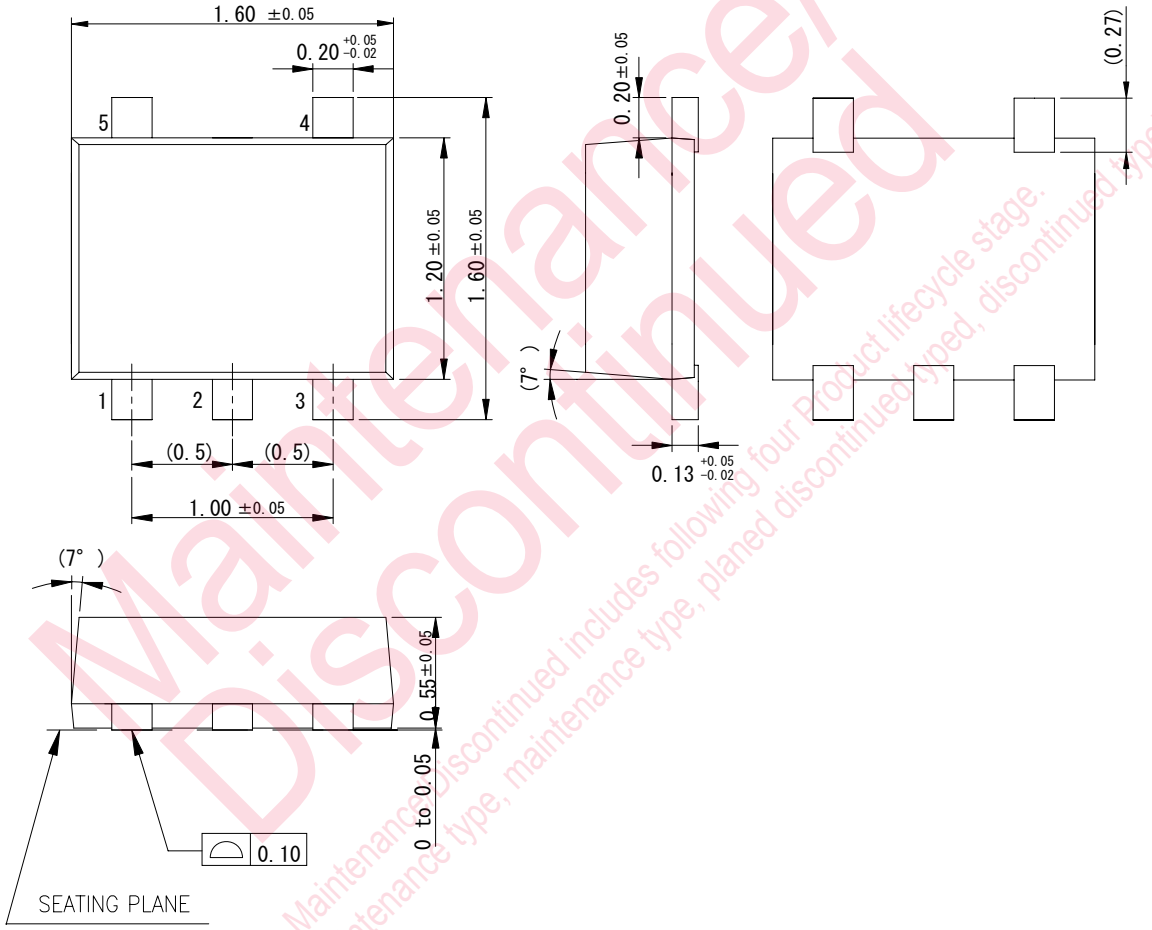


Notes) ・This block diagram is for explaining functions. Part of the block diagram may be omitted, or it may be simplified.

PACKAGE INFORMATION (Reference Data)

Package Code:SSMINI-5DC

Unit:mm



Body Material	:	Br / Sb Free Epoxy Resin
Lead Material	:	Cu Alloy
Lead Finish Method	:	SnBi Plating

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(4) Submarine transponder
(5) Control equipment for power plant
(6) Disaster prevention and security device
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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.

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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.

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