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Panasonic

AN26018A

LNA IC for UHF Band (400 MHz to 800 MHz) Applications

FEATURES

- Low voltage operation +2.85 V typ.
- Low current consumption 3.0 mA typ. (High-Gain mode)
  0.1 µA typ. (Low-Gain mode)
- High gain 14.5 dB typ. fRX = 620 MHz (High-Gain mode)
- Low noise figure
  1.40 dB typ. fRX = 620 MHz (High-Gain mode)
- Low distortion
  –8.0 dBm typ. fRX = 620 MHz (High-Gain mode)
  (IIP3 +10 MHz offset)
- Small package
  5 pin Plastic Small Surface Mount Package
  (SMINI Type)

DESCRIPTION

AN26018A is LNA-IC for UHF Band (400 MHz to 800 MHz) Applications.

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

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

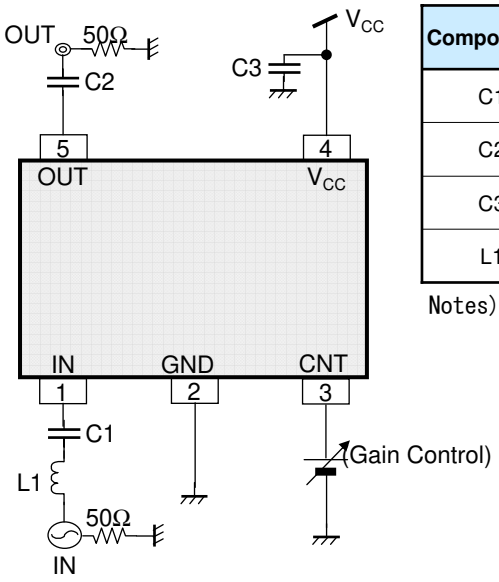
Achieving miniaturization by using small size package.

APPLICATIONS

●DTV（UHF）

SIMPLIFIED APPLICATION

TOP VIEW



Components	Size	Value	Part Number	Vendor
C1	0603	1 000 pF	GRM033B11C102KD01	Murata
C2	0603	1 000 pF	GRM033B11C102KD01	Murata
C3	0603	0.1 uF	GRM033B30J104KE18	Murata
L1	0603	6.8 nH	LQP03T6N8H04	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}	–40 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)	100	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	Condition	Limits			Unit	Note
			Min	Typ	Max		
DC electrical characteristics							
Supply current HG	IccH	Vcc current at High-Gain mode No input signal	—	3.0	4.0	mA	—
Supply current LG	IccL	Vcc current at Low-Gain mode No input signal	—	0.1	9.5	µA	—
Input voltage (High-Gain mode)	VIH	—	1.40	2.85	—	V	—
Input voltage (Low-Gain mode)	VIL	—	—	0.0	0.55	V	—
SW current (High)	IIH	Current at CNT pin VIH = Vcc	—	11	40	µA	—

ELECRTRICAL CHARACTERISTICS (continued)

Note) Vcc = 2.85V, Ta = 25°C±2°C, fRX = 620 MHz, PRX = –30 dBm, CW unless otherwise specified.

Parameter	Symbol	Conditions	Limits			Unit	Note
			Min	Typ	Max		
LNA AC electrical characteristics							
Power Gain HG	GHS	High-Gain mode f = fRX	12.5	14.5	16.5	dB	—
Power Gain LG	GLS	Low-Gain mode f = fRX, PRX = –20 dBm	–2.0	–1.5	—	dB	—
IIP3 +10 MHz offset	IIP31S	f1 = fRX + 10 MHz f2 = fRX + 20 MHz Input 2 signals (f1, f2)	–14.5	–8.0	—	dBm	—

APPLICATION INFORMATION

REFERENCE VALUES FOR DESIGN

Notes) Vcc = 2.85 V

Ta = 25°C±2°C, fRX = 470 MHz, 620 MHz, 770 MHz, PRX = –30 dBm, CW unless otherwise specified.

Parameter	Symbol	Conditions	Reference values			Unit	Note
			Min	Typ	Max		
LNA AC electrical characteristics							
Power Gain HG	GH	High-Gain mode f = fRX	12.0	14.5	17.0	dB	*1
Power Gain LG	GL	Low-Gain mode f = fRX, PRX = –20 dBm	–2.5	–1.5	—	dB	*1
Noise Figure HG	NFH	High-Gain mode f = fRX	—	1.5	1.9	dB	*1 , *2
Noise Figure LG	NFL	Low-Gain mode f = fRX	—	1.5	2.5	dB	*1
IIP3 +10 MHz offset HG	IIP3H1	High-Gain mode f1 = fRX + 10 MHz f2 = fRX + 20 MHz Input 2 signals (f1, f2)	–16.5	–8.0	—	dBm	*1
IIP3 –10 MHz offset HG	IIP3H2	High-Gain mode f1 = fRX – 10 MHz f2 = fRX – 20 MHz Input 2 signals (f1, f2)	–17.0	–8.5	—	dBm	*1
Input P1dB	IP1dBH	High-Gain mode f = fRX	–11	–5	—	dBm	*1
Reverse Isolation HG	ISOH	High-Gain mode f = fRX	—	–24	–18	dB	*1
Reverse Isolation LG	ISOL	Low-Gain mode f = fRX	—	–1.6	–1.0	dB	*1
Input Return Loss HG	S11H	High-Gain mode f = fRX	5.0	9.5	—	dB	*1
Input Return Loss LG	S11L	Low-Gain mode f = fRX	12	20	—	dB	*1
Output Return Loss HG	S22H	High-Gain mode f = fRX	7	23	—	dB	*1
Output Return Loss LG	S22L	Low-Gain mode f = fRX	10	12	—	dB	*1
K-Factor	KH	High-Gain mode f = 300 kHz to 6 GHz	1.0	1.5	—	—	*1
Switching Time	TSW	High-Gain mode → Low-Gain mode Low-Gain mode → High-Gain mode	—	3.2	10.0	us	*1

Note) *1 : Checked by design, not production tested.
*2 : Connector & substrate loss (0.10 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

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	—	3.0	4.5	mA	*1
Supply current LG	IccLT	Vcc current at Low-Gain mode No input signal	—	0.1	10	μA	*1
Input voltage (High-Gain mode)	VIHT	—	1.50	2.85	—	V	*1
Input voltage (Low-Gain mode)	VILT	—	—	0.0	0.40	V	*1
SW current (High)	IIHT	Current at CNT pin VIH = Vcc	—	11	50	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 = 470 MHz, 620 MHz, 770 MHz, PRX = –30 dBm, CW

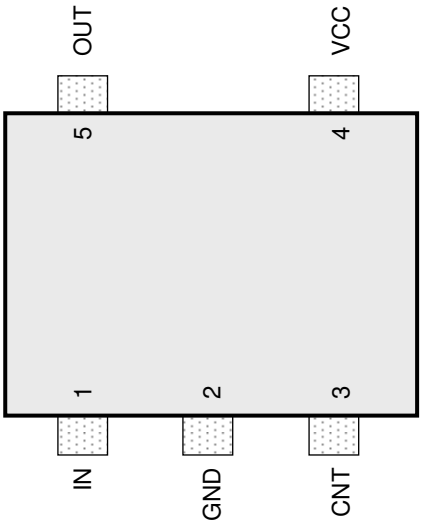
Parameter	Symbol	Conditions	Reference values			Unit	Note
			Min	Typ	Max		
LNA AC electrical characteristics							
Power Gain HG	GHT	High-Gain mode f = fRX	11.5	14.5	17.5	dB	*1
Power Gain LG	GLT	Low-Gain mode f = fRX, PRX = –20 dBm	–2.7	–1.5	—	dB	*1
Noise Figure HG	NFHT	High-Gain mode f = fRX	—	1.5	2.3	dB	*1 , *2
Noise Figure LG	NFLT	Low-Gain mode f = fRX	—	1.5	2.7	dB	*1
IIP3 +10 MHz offset HG	IIP3H1T	High-Gain mode f1 = fRX + 10 MHz f2 = fRX + 20 MHz Input 2 signals (f1, f2)	–17.0	–8.0	—	dBm	*1
IIP3 –10 MHz offset HG	IIP3H2T	High-Gain mode f1 = fRX – 10 MHz f2 = fRX – 20 MHz Input 2 signals (f1, f2)	–17.5	–8.5	—	dBm	*1
Input P1dB HG	IP1dBHT	High-Gain mode f = fRX	–13	–5	—	dBm	*1
K-Factor	KHT	High-Gain mode f = 300 kHz to 6 GHz	1.0	1.5	—	—	*1
Switching Time	TSWT	High-Gain mode → Low-Gain mode Low-Gain mode → High-Gain mode	—	3.2	10.0	µs	*1

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

*2 : Connector & substrate loss (0.10 dB) included.

PIN CONFIGURATION

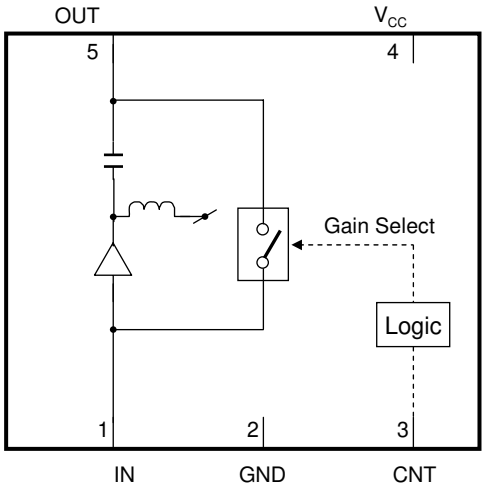
Top View



PIN FUNCTIONS

Pin No.	Pin name	Type	Description
1	IN	Input	RF Input
2	GND	Ground	GND
3	CNT	Input	High-Gain / Low-Gain switch L: Low-Gain Mode H: High-Gain Mode
4	VCC	Power Supply	V_{CC}
5	OUT	Output	RF Output

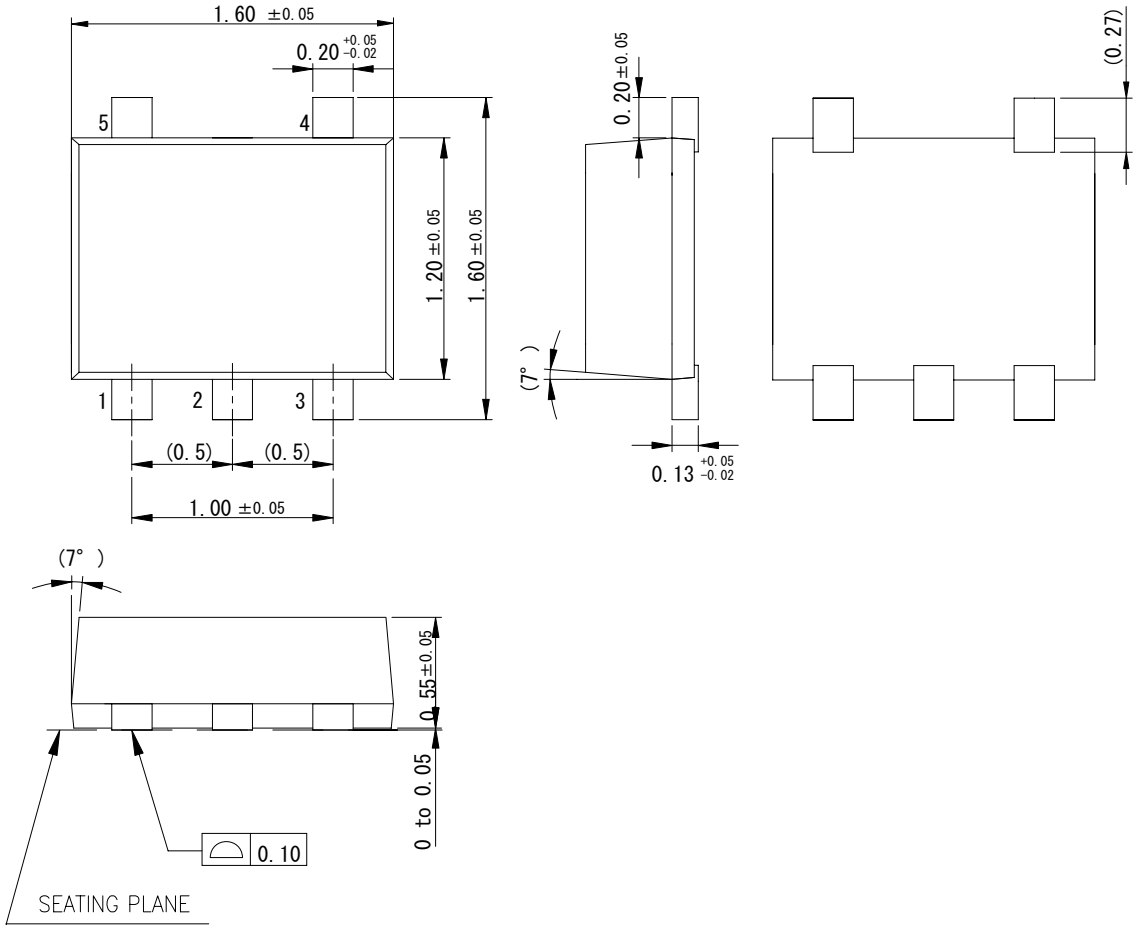
FUNCTIONAL BLOCK DIAGRAM



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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(6) Disaster prevention and security device
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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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