



SGM13001A

Low Noise Amplifier for GNSS

GENERAL DESCRIPTION

The SGM13001A is a low noise amplifier (LNA) for GLONASS, Galileo, Beidou and GPS applications. The device delivers 18.2dB gain at an extremely low noise figure of 0.9dB. It also features high gain and excellent linearity performance that operates from 1160MHz to 1300MHz and 1550MHz to 1615MHz.

The device requires 6.5mA from a single 1.6V to 3.1V supply, dropping to below 1µA in power down mode.

No external DC blocking capacitors are required on the RF paths as long as no external DC voltage is applied, which can save PCB area and cost.

The SGM13001A is available in a Green UTDFN-1.1×0.7-6L package.

APPLICATIONS

Car Navigation

Personal Navigation Equipment

Mobile Phone with GPS

RF Front End Modules

Digital Video Camera, Digital Camera

FEATURES

- **High Gain:**
 - ◆ 19.2dB at 1176.45MHz
 - ◆ 18.6dB at 1227.6MHz
 - ◆ 18.2dB at 1575.42MHz
- **Low Noise Figure:**
 - ◆ 0.78dB at 1176.45MHz
 - ◆ 0.89dB at 1227.6MHz
 - ◆ 0.90dB at 1575.42MHz
- **Low Operation Current: 6.5mA**
- **Current Less than 1μA in Power Down Mode**
- **Operating Frequency Range:**
 - ◆ 1160MHz to 1300MHz
 - ◆ 1550MHz to 1615MHz
- **Single Supply Voltage Range: 1.6V to 3.1V**
- **Low Cost BOM**
- **Lead-Free and RoHS Compliant**
- **Available in a Green UTDFN-1.1×0.7-6L Package**

BLOCK DIAGRAM

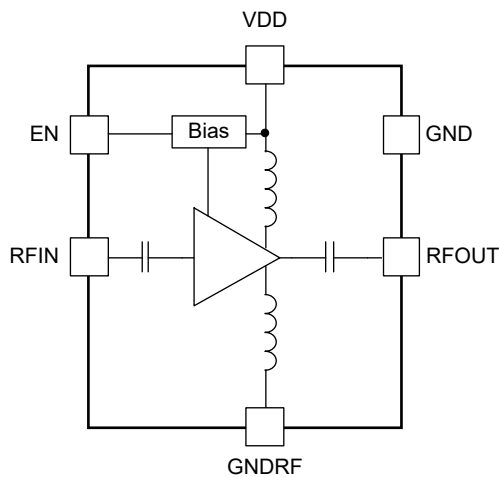


Figure 1. SGM13001A Block Diagram

PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM13001A	UTDFN-1.1×0.7-6L	-40°C to +85°C	SGM13001AYUEC6G/TR	ZY	Tape and Reel, 10000

MARKING INFORMATION

NOTE: Fixed character for ZY.

YY

Serial Number

Green (RoHS & HSF): SG Micro Corp defines "Green" to mean Pb-Free (RoHS compatible) and free of halogen substances. If you have additional comments or questions, please contact your SGMICRO representative directly.

ABSOLUTE MAXIMUM RATINGS

Supply Voltage, V_{DD}	-0.3V to 3.6V
EN to GND	-0.3V to 3.6V
RFIN, RFOUT to GND	-0.3V to 0.3V
RF Input Power, P_{IN}	10dBm
Junction Temperature	+150°C
Storage Temperature Range	-55°C to +150°C
Lead Temperature (Soldering, 10s)	+260°C
ESD Susceptibility	
HBM	4000V
CDM	500V

RECOMMENDED OPERATING CONDITIONS

Operating Temperature Range	-40°C to +85°C
Supply Voltage Range, V_{DD}	1.6V to 3.1V
Operating Frequency Range,	
f_0	1160MHz to 1300MHz
f_1	1550MHz to 1615MHz
Control Voltage High, V_{CTL_H}	1.35V to V_{DD}
Control Voltage Low, V_{CTL_L}	0V to 0.45V

OVERSTRESS CAUTION

Stresses beyond those listed in Absolute Maximum Ratings may cause permanent damage to the device. Exposure to absolute maximum rating conditions for extended periods may affect reliability. Functional operation of the device at any conditions beyond those indicated in the Recommended Operating Conditions section is not implied.

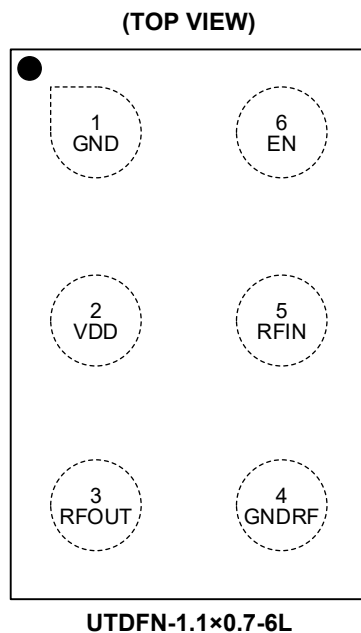
ESD SENSITIVITY CAUTION

This integrated circuit can be damaged if ESD protections are not considered carefully. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because even small parametric changes could cause the device not to meet the published specifications.

DISCLAIMER

SG Micro Corp reserves the right to make any change in circuit design, or specifications without prior notice.

PIN CONFIGURATION



PIN DESCRIPTION

PIN	NAME	FUNCTION
1	GND	Analog Ground.
2	VDD	Power Supply.
3	RFOUT	LNA Output.
4	GNDRF	RF Ground.
5	RFIN	LNA Input from Antenna.
6	EN	Active High Enable Input for the Device. Pull high enable, pull low into power down mode.

ELECTRICAL CHARACTERISTICS

(T_A = +25°C, V_{DD} = 1.6V to 3.1V, f = 1160MHz to 1215MHz, typical values are at V_{DD} = 2.8V, f = 1176.45MHz, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
DC Characteristics						
Supply Voltage	V _{DD}		1.6		3.1	V
Supply Current	I _{VDD}	EN = High		6.5	10.3	mA
	I _{SD}	EN = Low	0	0.01	2.1	μA
Control Voltage	V _{CTL_H}	High	1.35	1.8	V _{DD}	V
	V _{CTL_L}	Low	0	0	0.45	
Turn-On Time	t _{ON}	Time from EN on to 90% of the gain		0.5		μs
Turn-Off Time	t _{OFF}	Time from EN off to 10% of the gain		0.1		μs
RF Characteristics						
RF Frequency Range	f ₀	None		1176.45		MHz
Power Gain	S21			19.2		dB
Noise Figure	NF			0.78		dB
Input Return Loss	S11			-3		dB
Output Return Loss	S22			-11		dB
Reverse Isolation	S12			-33		dB
Stability	Kf	Frequency range from 500MHz to 5GHz	1			
Input Power 1dB Compression Point	P _{1dB}			-12		dBm
Input In-Band IP3	IIP3_inb	f ₁ = 1176MHz, f ₂ = 1177MHz, -30dBm		-6		dBm
Input Out-Band IP3	IIP3_outb	f ₁ = 1785MHz, -20dBm, f ₂ = 2400MHz, -65dBm, IP3 = (2 × P1 + P2 + Gain 1170MHz - IM3)/2		7		dBm

(T_A = +25°C, V_{DD} = 1.6V to 3.1V, f = 1160MHz to 1215MHz, typical values are at V_{DD} = 1.8V, f = 1176.45MHz, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
DC Characteristics						
Supply Voltage	V _{DD}		1.6		3.1	V
Supply Current	I _{VDD}	EN = High		6.3	10.3	mA
	I _{SD}	EN = Low	0	0.01	1.8	μA
Control Voltage	V _{CTL_H}	High	1.35	1.8	V _{DD}	V
	V _{CTL_L}	Low	0	0	0.45	
Turn-On Time	t _{ON}	Time from EN on to 90% of the gain		0.5		μs
Turn-Off Time	t _{OFF}	Time from EN off to 10% of the gain		0.1		μs
RF Characteristics						
RF Frequency Range	f ₀	None		1176.45		MHz
Power Gain	S21			18.8		dB
Noise Figure	NF			0.78		dB
Input Return Loss	S11			-3		dB
Output Return Loss	S22			-11		dB
Reverse Isolation	S12			-32		dB
Stability	Kf	Frequency range from 500MHz to 5GHz	1			
Input Power 1dB Compression Point	P _{1dB}			-15		dBm
Input In-Band IP3	IIP3_inb	f ₁ = 1176MHz, f ₂ = 1177MHz, -30dBm		-6		dBm
Input Out-Band IP3	IIP3_outb	f ₁ = 1785MHz, -20dBm, f ₂ = 2400MHz, -65dBm, IP3 = (2 × P1 + P2 + Gain 1170MHz - IM3)/2		7		dBm

ELECTRICAL CHARACTERISTICS (continued)(T_A = +25°C, V_{DD} = 1.6V to 3.1V, f = 1215MHz to 1300MHz, typical values are at V_{DD} = 2.8V, f = 1227.6MHz, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
DC Characteristics						
Supply Voltage	V _{DD}		1.6		3.1	V
Supply Current	I _{VDD}	EN = High		6.5	10.3	mA
	I _{SD}	EN = Low	0	0.01	2.1	μA
Control Voltage	V _{CTL_H}	High	1.35	1.8	V _{DD}	V
	V _{CTL_L}	Low	0	0	0.45	
Turn-On Time	t _{ON}	Time from EN on to 90% of the gain		0.5		μs
Turn-Off Time	t _{OFF}	Time from EN off to 10% of the gain		0.1		μs
RF Characteristics						
RF Frequency Range	f ₀	None		1227.6		MHz
Power Gain	S21			18.6		dB
Noise Figure	NF			0.89		dB
Input Return Loss	S11			-3		dB
Output Return Loss	S22			-12		dB
Reverse Isolation	S12			-34		dB
Stability	Kf	Frequency range from 500MHz to 5GHz	1			
Input Power 1dB Compression Point	P _{1dB}			-11		dBm
Input In-Band IP3	IIP3_inb	f ₁ = 1227MHz, f ₂ = 1228MHz, -30dBm		-2		dBm
Input Out-Band IP3	IIP3_outb	f ₁ = 1850MHz, -20dBm, f ₂ = 2480MHz, -65dBm, IP3 = (2 × P1 + P2 + Gain 1220MHz - IM3)/2		7		dBm

(T_A = +25°C, V_{DD} = 1.6V to 3.1V, f = 1215MHz to 1300MHz, typical values are at V_{DD} = 1.8V, f = 1227.6MHz, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
DC Characteristics						
Supply Voltage	V _{DD}		1.6		3.1	V
Supply Current	I _{VDD}	EN = High		6.3	10.3	mA
	I _{SD}	EN = Low	0	0.01	1.8	μA
Control Voltage	V _{CTL_H}	High	1.35	1.8	V _{DD}	V
	V _{CTL_L}	Low	0	0	0.45	
Turn-On Time	t _{ON}	Time from EN on to 90% of the gain		0.5		μs
Turn-Off Time	t _{OFF}	Time from EN off to 10% of the gain		0.1		μs
RF Characteristics						
RF Frequency Range	f ₀	None		1227.6		MHz
Power Gain	S21			18.1		dB
Noise Figure	NF			0.89		dB
Input Return Loss	S11			-3		dB
Output Return Loss	S22			-12		dB
Reverse Isolation	S12			-33		dB
Stability	Kf	Frequency range from 500MHz to 5GHz	1			
Input Power 1dB Compression Point	P _{1dB}			-15		dBm
Input In-Band IP3	IIP3_inb	f ₁ = 1227MHz, f ₂ = 1228MHz, -30dBm		-2		dBm
Input Out-Band IP3	IIP3_outb	f ₁ = 1850MHz, -20dBm, f ₂ = 2480MHz, -65dBm, IP3 = (2 × P1 + P2 + Gain 1220MHz - IM3)/2		7		dBm

ELECTRICAL CHARACTERISTICS (continued)

(T_A = +25°C, V_{DD} = 1.6V to 3.1V, f = 1550MHz to 1615MHz, typical values are at V_{DD} = 2.8V, f = 1575.42MHz, unless otherwise noted.)

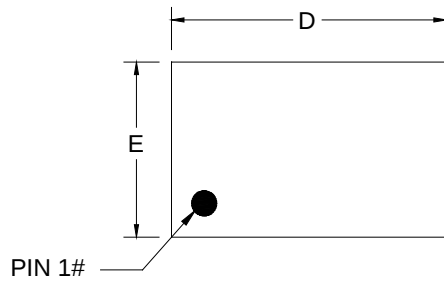
PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
DC Characteristics						
Supply Voltage	V _{DD}		1.6		3.1	V
Supply Current	I _{VDD}	EN = High		6.5	10.3	mA
	I _{SD}	EN = Low	0	0.01	2.1	μA
Control Voltage	V _{CTL_H}	High	1.35	1.8	V _{DD}	V
	V _{CTL_L}	Low	0	0	0.45	
Turn-On Time	t _{ON}	Time from EN on to 90% of the gain		0.5		μs
Turn-Off Time	t _{OFF}	Time from EN off to 10% of the gain		0.1		μs
RF Characteristics						
RF Frequency Range	f ₀	None		1575.42		MHz
Power Gain	S ₂₁		17.0	18.2	19.8	dB
Noise Figure	NF			0.90		dB
Input Return Loss	S ₁₁			-4		dB
Output Return Loss	S ₂₂			-16		dB
Reverse Isolation	S ₁₂			-31		dB
Stability	K _f	Frequency range from 500MHz to 5GHz	1			
Input Power 1dB Compression Point	P _{1dB}			-10		dBm
Input In-Band IP3	IIP3_inb	f ₁ = 1574.5MHz, f ₂ = 1575.5MHz, -30dBm		0		dBm
Input Out-Band IP3	IIP3_outb	f ₁ = 1712.7MHz, -30dBm, f ₂ = 1850MHz, -30dBm, IP3 = (2 × P1 + P2 + Gain 1575MHz - IM3)/2		0		dBm

(T_A = +25°C, V_{DD} = 1.6V to 3.1V, f = 1550MHz to 1615MHz, typical values are at V_{DD} = 1.8V, f = 1575.42MHz, unless otherwise noted.)

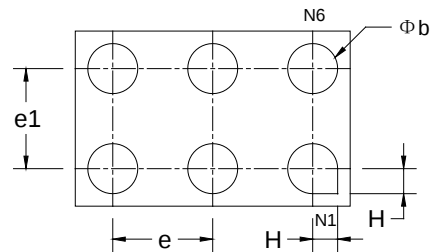
PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
DC Characteristics						
Supply Voltage	V _{DD}		1.6		3.1	V
Supply Current	I _{VDD}	EN = High		6.3	10.3	mA
	I _{SD}	EN = Low	0	0.01	1.8	μA
Control Voltage	V _{CTL_H}	High	1.35	1.8	V _{DD}	V
	V _{CTL_L}	Low	0	0	0.45	
Turn-On Time	t _{ON}	Time from EN on to 90% of the gain		0.5		μs
Turn-Off Time	t _{OFF}	Time from EN off to 10% of the gain		0.1		μs
RF Characteristics						
RF Frequency Range	f ₀	None		1575.42		MHz
Power Gain	S ₂₁		16.7	17.7	19.2	dB
Noise Figure	NF			0.90		dB
Input Return Loss	S ₁₁			-4		dB
Output Return Loss	S ₂₂			-15		dB
Reverse Isolation	S ₁₂			-30		dB
Stability	K _f	Frequency range from 500MHz to 5GHz	1			
Input Power 1dB Compression Point	P _{1dB}			-14		dBm
Input In-Band IP3	IIP3_inb	f ₁ = 1574.5MHz, f ₂ = 1575.5MHz, -30dBm		-2		dBm
Input Out-Band IP3	IIP3_outb	f ₁ = 1712.7MHz, -30dBm, f ₂ = 1850MHz, -30dBm, IP3 = (2 × P1 + P2 + Gain 1575MHz - IM3)/2		-1		dBm

PACKAGE OUTLINE DIMENSIONS

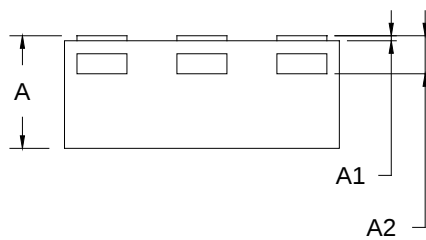
UTDFN-1.1×0.7-6L



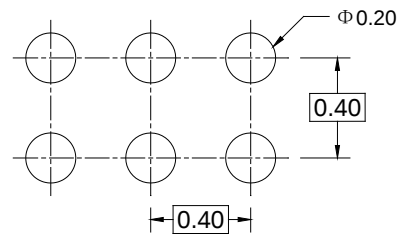
TOP VIEW



BOTTOM VIEW



SIDE VIEW



RECOMMENDED LAND PATTERN (Unit: mm)

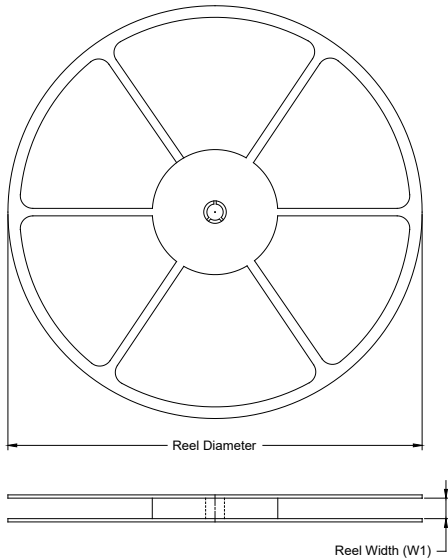
Symbol	Dimensions In Millimeters		
	MIN	MOD	MAX
A	0.400	0.450	0.500
A1	0.000	0.020	0.050
A2	0.152 REF		
D	1.050	1.100	1.150
E	0.650	0.700	0.750
b	0.150	0.200	0.250
e	0.300	0.400	0.500
e1	0.300	0.400	0.500
H	0.100 REF		

NOTE: This drawing is subject to change without notice.

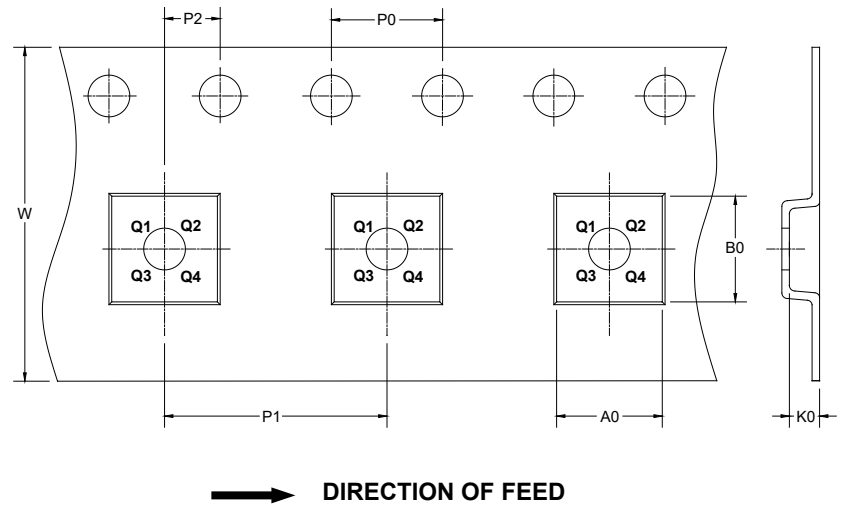
PACKAGE INFORMATION

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



NOTE: The picture is only for reference. Please make the object as the standard.

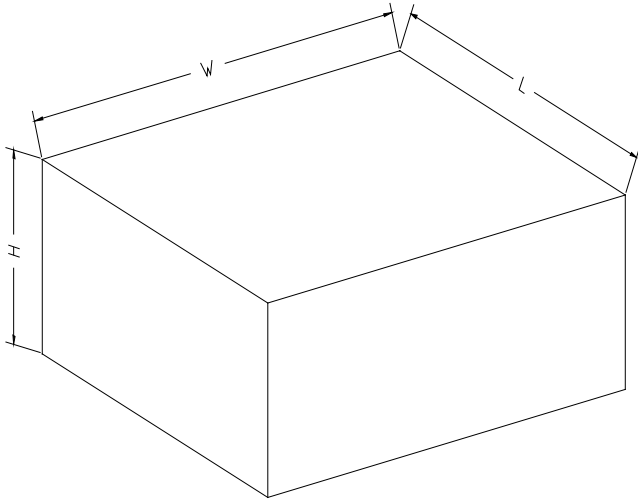
KEY PARAMETER LIST OF TAPE AND REEL

Package Type	Reel Diameter	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	P1 (mm)	P2 (mm)	W (mm)	Pin1 Quadrant
UTDFN-1.1×0.7-6L	7"	9.5	0.80	1.20	0.55	4.0	2.0	2.0	8.0	Q1

DD00001

PACKAGE INFORMATION

CARTON BOX DIMENSIONS



NOTE: The picture is only for reference. Please make the object as the standard.

KEY PARAMETER LIST OF CARTON BOX

Reel Type	Length (mm)	Width (mm)	Height (mm)	Pizza/Carton
7" (Option)	368	227	224	8
7"	442	410	224	18

DD0002