SK5119TS 1.1-1.7GHz Broad Band GNSS Low Noise Amplifier

GENERAL DESCRIPTION

The SK5119TS is a high-gain, broadband, low-noise amplifier (LNA) designed for GPS, Galileo, Glonass and Beidou GNSS applications.

This SK5119TS achieves 18.56dB high gain at 1.575GHz with a noise figure of 0.9dB, and 19.69dB gain at 1.207GHz with a noise figure of 0.8dB, and 19.8dB gain at 1.176GHz with a noise figure of 0.78dB

The SK5119TS operates from a 1.6V to 3.6V single supply and draws 6.5mA DC current. The shutdown leakage current is only 1uA.

The SK5119TS is available in a 6-pin DFN 1.5mmx1.0mm package.

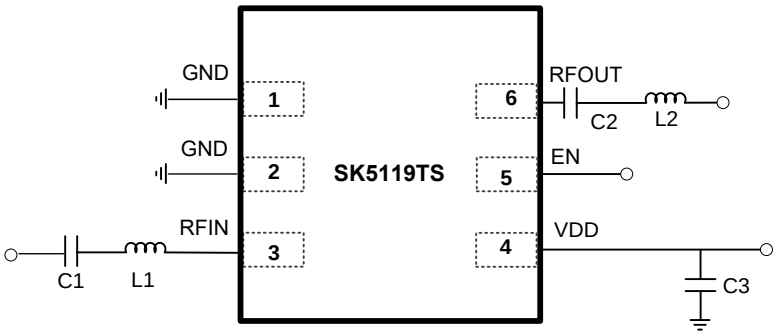
FEATURES

- Working frequency: 1.1-1.7GHz frequency
- High-power gain and low noise
  0.9dB noise figure and 18.56dB gain at 1.575GHz
  0.8dB noise figure and 19.69dB gain at 1.207GHz
  0.78dB noise figure and 19.8dB gain at 1.176GHz
- Low-power of 6.5mA operated from a single 1.6V to 3.6V voltage line
- Lead-free and RoHS-compliant package
- High integration with few off-chip BOM and low cost

APPLICATIONS

- PNDs (Personal Navigation Devices)
- Location-Enabled MID
- PMPs (Personal Media Players)
- Automobile Navigation Systems
- GNSS tracking systems
- GNSS industrial applications
- Software GPS
- iPad like Mobile PCs

TYPICAL APPLICATION CIRCUIT



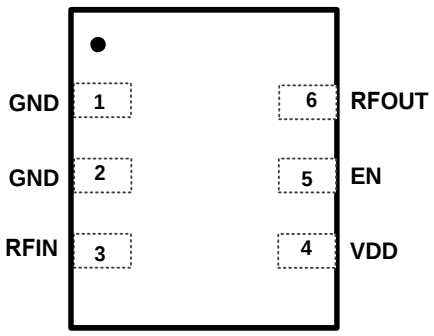
Typical application circuit for working frequency:1.1-1.7GHz

Recommended Components	Symbol	Size	Value	Unit
Chip Capacitor	C1	0402	820	pF
Chip inductor	L1	0402	9.1	nH
Chip Capacitor	C2	0402	1.8	pF
Chip inductor	L2	0402	7.5	nH
Chip Capacitor	C3	0402	10	nF

These component values are for reference only and are subject to change with customer specific PCB layout design.

PIN CONFIGURATION

TOP VIEW



DFN1.5X1.0-6

PIN DESCRIPTION

Pin No.	Name	Description	Connection
6	RFOUT	RF Output	Requires a DC-blocking capacitor and a matching inductor
5	EN	Chip enable, active high	A logic-low disables the device
4	VDD	power supply for LNA	Supply Voltage
3	RFIN	RF Input	Requires a DC-blocking capacitor and a matching inductor
1,2	GND	Ground connection	Main IC GND connection
Pad	GND	Ground connection	Main IC GND connection

ORDERING INFORMATION

Part Number	Temperature	Package	Tape and Reel
SK5119TS	-40°C ~ 85°C	1.5mm x 1.0 mm x 0.55mm DFN-6L	5000

SK5119TS devices are Pb-free and RoHS compliant.

ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Test Conditions	Min	Max	Unit
Supply Voltage	V_{DD}	T_A=+25 °C		4.0	V
Power Down Voltage	V_{EN}	T_A=+25 °C		4.0	V
LNA Max RF Input Power	P_{in}			10	dBm
ESD: HBM, 150pF/1.5KOhm	-		3.0		kV
Storage Temperature	T_{STG}		-40	+150	°C
Solder Reflow Temperature	T_{SLDR}			+260	°C

Note: This device should be handled with care within the above stress ratings. This IC has ESD protection circuits within but must be handled and assembled according to the industry practice and at the ESD protected work platforms.

RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Min.	Typ.	Max.	Unit
Ambient Operating Temperature	T_A	-40	+25	+85	°C
Supply Voltage	V_{DD}	1.6	2.7	3.6	V
EN Turn-on Voltage	V_{EN_ON}	1.6	-	V_{DD}	V
EN Turn-off Voltage	V_{EN_OFF}	0	-	0.4	V

ELECTRICAL CHARACTERISTICS

(T_A = +25℃, V_{DD} = V_{EN} = 2.7V, f_{in} = 1575.42MHz, unless otherwise specified)

Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
circuit current	I_{cc}	No Signal	5.25	6.5	7.8	mA
Power Gain	G_p	Pin=-35dBm	17.0	18.56	20.5	dB
Noise Figure	NF		-	0.90	-	dB
Input Return Loss	RL_{in}		-	12.73	-	dB
Output Return Loss	RL_{out}		-	8.48	-	dB

(T_A = +25℃, V_{DD} = V_{EN} = 2.7V, f_{in} = 1207.14MHz, unless otherwise specified)

Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
circuit current	I_{cc}	No Signal	5.25	6.5	7.8	mA
Power Gain	G_p	Pin=-35dBm	17.0	19.69	21.0	dB
Noise Figure	NF		-	0.80	-	dB
Input Return Loss	RL_{in}		-	-10.50	-	dB
Output Return Loss	RL_{out}		-	-11.56	-	dB

(T_A = +25℃, V_{DD} = V_{EN} = 2.7V, f_{in} = 1176.45MHz, unless otherwise specified)

Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
circuit current	I_{cc}	No Signal	5.25	6.5	7.8	mA
Power Gain	G_p	Pin=-35dBm	17.0	19.8	21.0	dB
Noise Figure	NF		-	0.78	-	dB
Input Return Loss	RL_{in}		-	8.60	-	dB
Output Return Loss	RL_{out}		-	12.05	-	dB

STANDARD CHARACTERISTICS FOR REFERENCE

(T_A = +25℃, V_{DD} = V_{EN} = 2.7V, f_{in} = 1575.42MHz, unless otherwise specified)

Parameter	Symbol	Test Conditions	Reference	Unit
Isolation	ISL		29.40	dB
Input 3rd Order Distortion Intercept Point	IIP_3	fin1 = 1575 MHz, fin2 = 1574 MHz	-8	dBm
Gain 1 dB Compression Input Power	$P_{in(1dB)}$		-18.5	dBm

(T_A = +25℃, V_{DD} = V_{EN} = 2.7V, f_{in} = 1207.14MHz, unless otherwise specified)

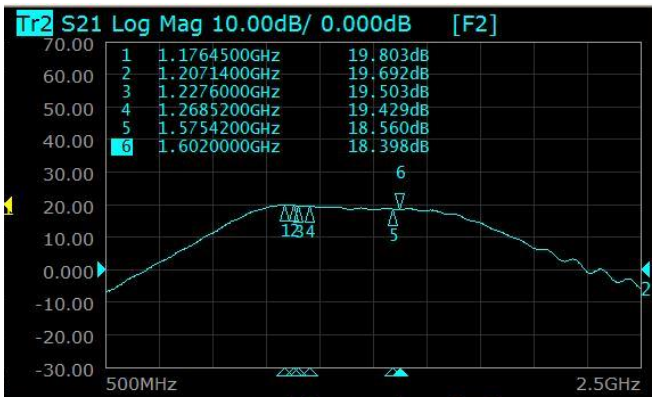
Parameter	Symbol	Test Conditions	Reference	Unit
Isolation	ISL		24.72	dB
Input 3rd Order Distortion Intercept Point	IIP_3	fin1 = 1207 MHz, fin2 = 1206 MHz	-7	dBm
Gain 1 dB Compression Input Power	$P_{in(1dB)}$		-18.0	dBm

(T_A = +25℃, V_{DD} = V_{EN} = 2.7V, f_{in} = 1176.45MHz, unless otherwise specified)

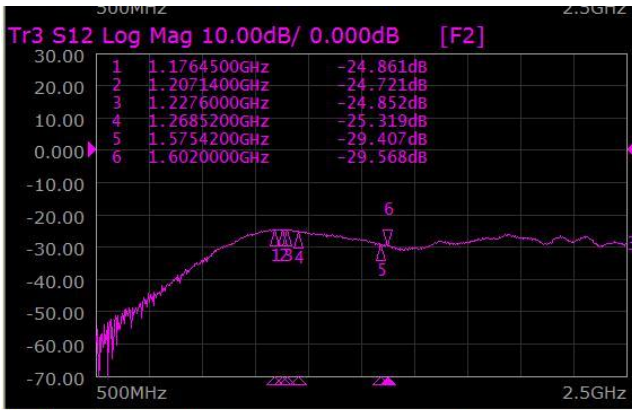
Parameter	Symbol	Test Conditions	Reference	Unit
Isolation	ISL		24.86	dB
Input 3rd Order Distortion Intercept Point	IIP_3	fin1 = 1176MHz, fin2 = 1175MHz	-7	dBm
Gain 1 dB Compression Input Power	$P_{in(1dB)}$		-18.0	dBm

S-PARAMETERS:

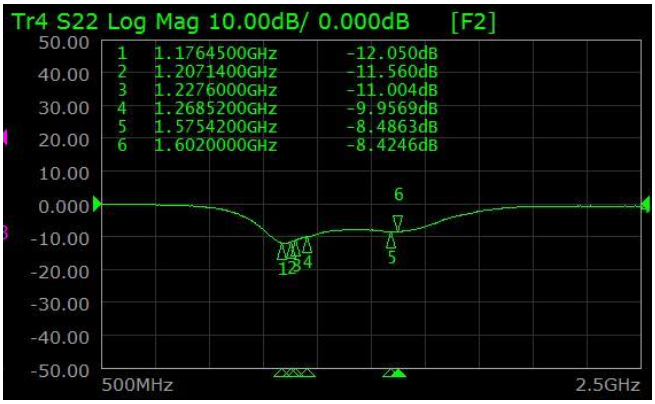
S11



S21



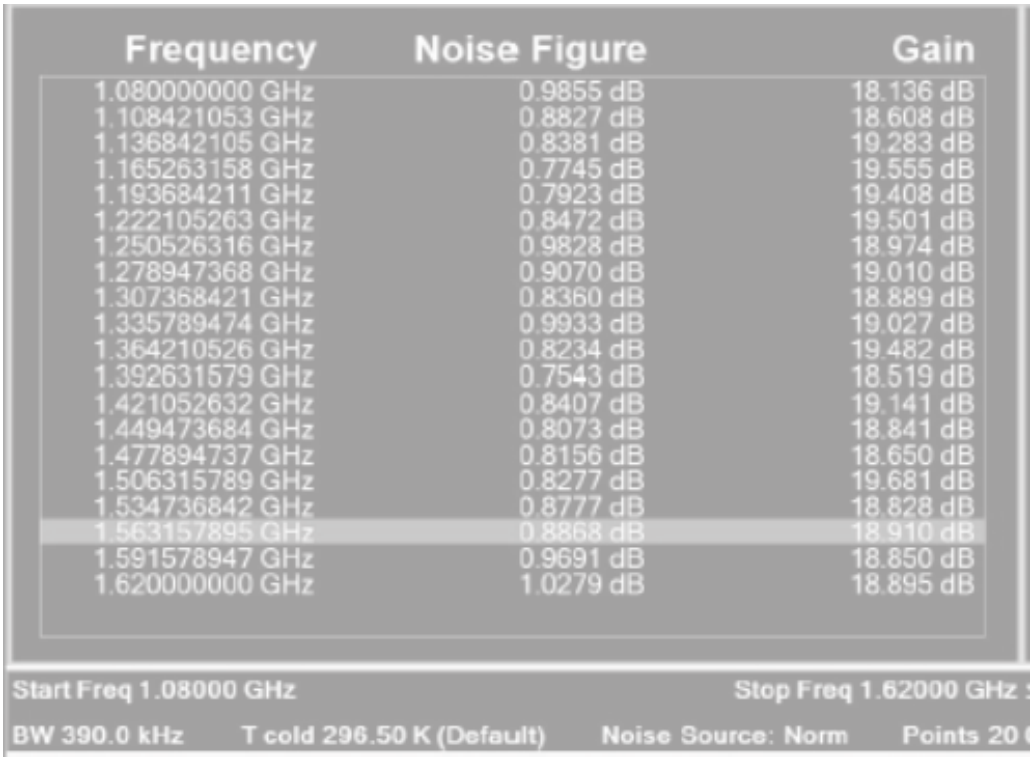
S12



S22

Frequency / SP	1176.45 MHz	1207.14 MHz	1227.6 MHz	1268.52 MHz	1575.42 MHz	1602 MHz
S11(dB)	-8.60	-10.50	-11.83	-13.60	-12.73	-11.75
S21(dB)	19.80	19.69	19.50	19.42	18.56	18.39
S12(dB)	-24.86	-24.72	-24.85	-25.32	-29.40	-29.57
S22(dB)	-12.05	-11.56	-11.00	-9.95	-8.48	-8.42

NOISE FIGURES:



Frequency	Noise Figure	Gain
1.080000000 GHz	0.9855 dB	18.136 dB
1.108421053 GHz	0.8827 dB	18.608 dB
1.136842105 GHz	0.8381 dB	19.283 dB
1.165263158 GHz	0.7745 dB	19.555 dB
1.193684211 GHz	0.7923 dB	19.408 dB
1.222105263 GHz	0.8472 dB	19.501 dB
1.250526316 GHz	0.9828 dB	18.974 dB
1.278947368 GHz	0.9070 dB	19.010 dB
1.307368421 GHz	0.8360 dB	18.889 dB
1.335789474 GHz	0.9933 dB	19.027 dB
1.364210526 GHz	0.8234 dB	19.482 dB
1.392631579 GHz	0.7543 dB	18.519 dB
1.421052632 GHz	0.8407 dB	19.141 dB
1.449473684 GHz	0.8073 dB	18.841 dB
1.477894737 GHz	0.8156 dB	18.650 dB
1.506315789 GHz	0.8277 dB	19.681 dB
1.534736842 GHz	0.8777 dB	18.828 dB
1.563157895 GHz	0.8868 dB	18.910 dB
1.591578947 GHz	0.9691 dB	18.850 dB
1.620000000 GHz	1.0279 dB	18.895 dB

Start Freq 1.08000 GHz Stop Freq 1.62000 GHz

BW 390.0 kHz T cold 296.50 K (Default) Noise Source: Norm Points 20

Frequency (MHz)	1176.45	1207.14	1227.6	1246	1268.52	1561.098	1575.42
NF (dB)	0.78	0.80	0.84	0.97	0.95	0.88	0.9

Note: The above noise figure is actually test results on the Suntek's EVB with substract the PCB losses. Usually , the loss of pcb is about 0.15dB-0.2dB.

RECOMMANDED REFLOW PROFILE

Profile Feature	Pb-Free Assembly
Preheat & Soak Temperature min (Tsmin) Temperature max (Tsmax) Time (Tsmin to Tsmax)(ts)	 150℃ 200℃ 60-120 seconds
Average ramp-up rate (Tsmax to Tp)	3℃/second max.
Liquidous temperature (TL) Time at liquidous (tL)	217℃ 60-150 seconds
Peak package body temperature (Tp)(1)	See classification temperatures in next table
Time (tp)(2) within 5℃ of the specified clsssification temperature (Tc)	30**seconds
Average ramp-down rate (Tp to Tsmax)	6℃/second max.
Time 25℃ to peak temperature	8 minutes max.

Note:

(1) Tolerance for peak profile temperature (TP) is defined as a supplier minimum and a user maximum.

(2) Tolerance for time at peak profile temperature (tp) is defined as a supplier minimum and a user maximum.

Remark:

(1) All temperatures refer to the package body surface temperature. The highest temperature of reflow profile can not exceed 265℃.

(2) All temperatures refer to the center of the package, measured on the package body surface that is facing up during assembly reflow (e.g., live-bug). If parts are reflowed in other than the normal live-bug assembly reflow orientation (i.e., dead-bug), Tp shall be within ±2℃ of the live-bug Tp and still meet the Tc requirements, otherwise, the profile shall be adjusted to achieve the latter. To accurately measure actual peak package body temperatures refer to JEP140 for recommended thermocouple use.

(3) Reflow profiles in this document are for classification/preconditioning and are not meant to specify board assembly profiles. Actual board assembly profiles should be developed based on specific process needs and board designs and should not exceed the parameters.

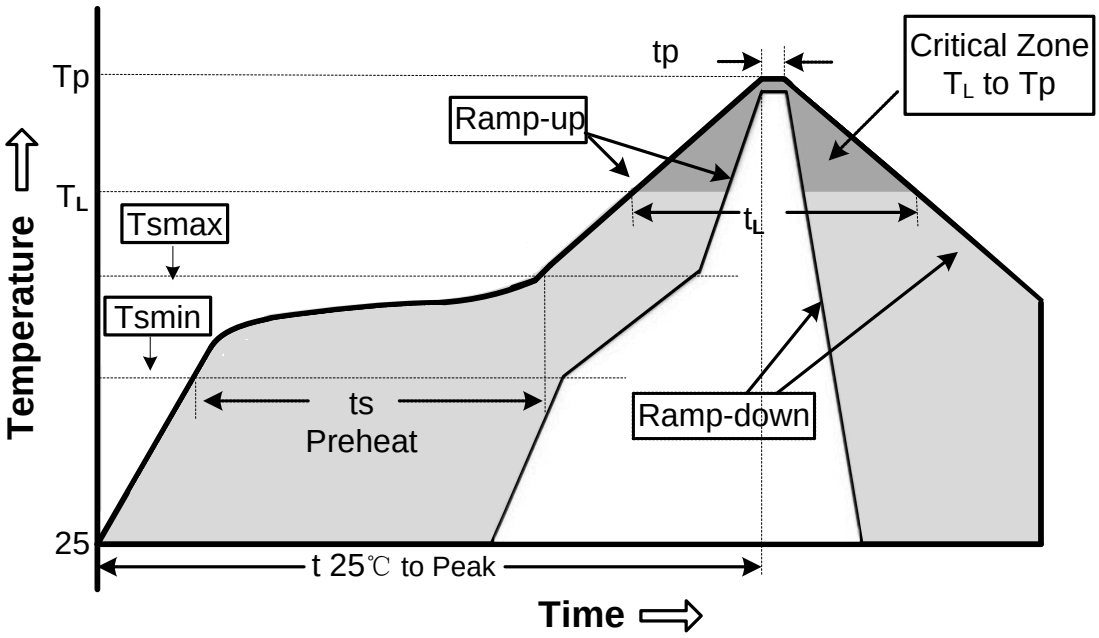
(4) All components in the test load shall meet the classification profile requirements.

(5) SMD packages classified to a given moisture sensitivity level by using Procedures or Criteria defined within any previous version of J-STD-020, JESD22-A112 (rescinded), IPC-SM-786 (rescinded) do not need to be reclassified to the current revision unless a change in classification level or a higher peak classification temperature is desired.

Pb-Free Process – Classification Temperatures (Tc)

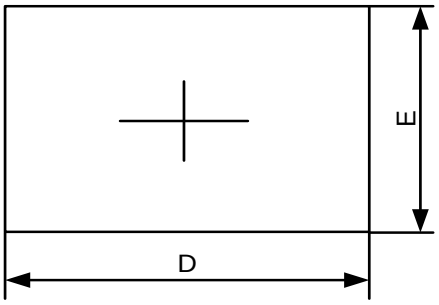
Package Thickness	Volume mm3 < 350	Volume mm3 350 - 2000	Volume mm3 > 2000
< 1.6 mm	260℃	260℃	260℃
1.6 mm - 2.5 mm	260℃	250℃	245℃
> 2.5 mm	250℃	245℃	245℃

REFLOW PROFILE

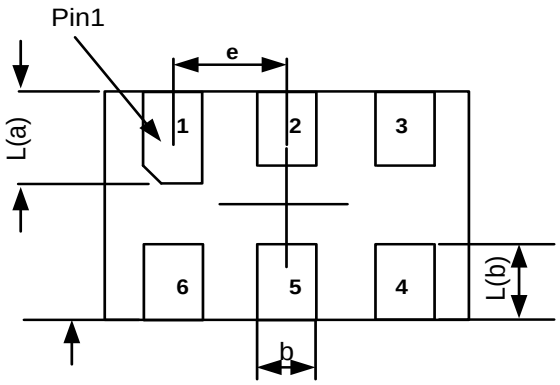


The reflow profile shown above should not be exceeded, since excessive temperatures or transport times during reflow can damage the chip.

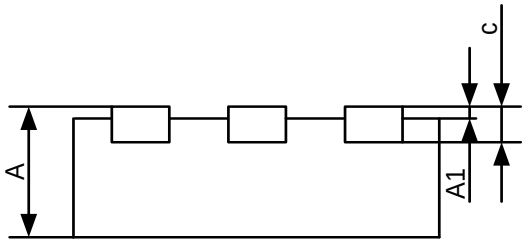
PACKAGE DIMENSIONS: DFN1.5X1.0-6L



TOP VIEW



BOTTOM VIEW



SIDE VIEW

Unit: mm

symbol	Dimensions In Millimeters		
	Min.	Nor.	Max.
A	0.50	0.55	0.60
A1		0.025	
D		1.50	
E		1.00	
L(a)	0.35	0.40	0.45
L(b)	0.30	0.35	0.40
c		0.05	
b	0.15	0.20	0.25
e		0.50	