

SK5117TH

Low Noise Amplifier for GNSS Application

GENERAL DESCRIPTION

The SK5117TH is a high-gain, broadband, low-noise amplifier (LNA) designed for GPS, Galileo, Glonass and Beidou GNSS applications.

The SK5117TH achieves 17.8dB high gain at 1.575GHz with a noise figure of 0.52dB, and 18.1dB gain at 1.227GHz with a noise figure of 0.6dB, and 18.1dB gain at 1.176GHz with a noise figure of 0.6dB.

The SK5117TH operates from a 1.6V to 3.6V single supply and draws 3.3mA DC current. The shutdown leakage current is only 1uA.

The SK5117TH is available in a LGA 6-pin 1.1mm x 0.7mm x 0.45mm package.

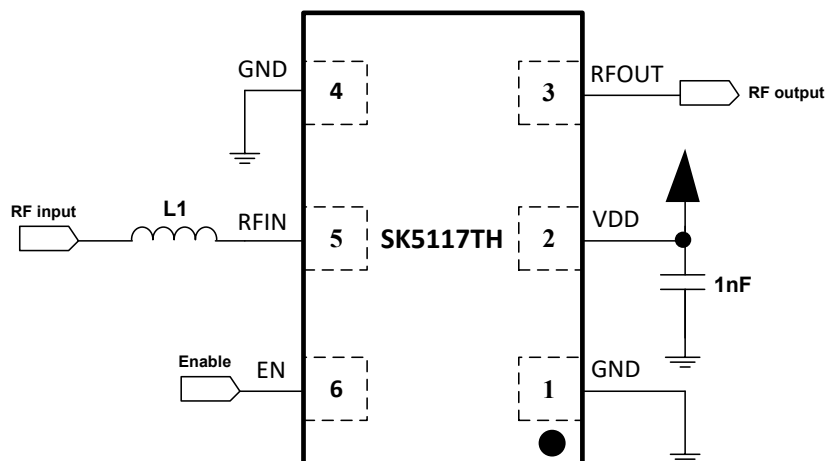
FEATURES

- High-power gain and low noise
0.52dB noise figure and 17.8dB gain at 1.575GHz
0.6dB noise figure and 18.1dB gain at 1.227GHz
0.6dB noise figure and 18.1dB gain at 1.176GHz
- Low-power of 3.3mA 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

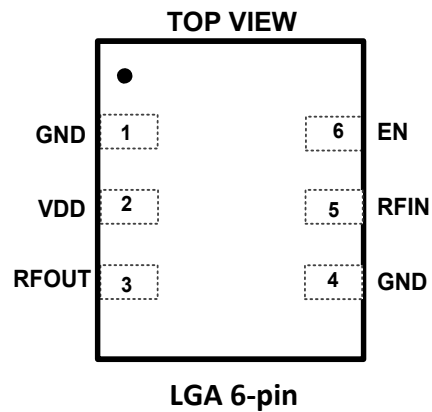
TYPICAL APPLICATION CIRCUIT



Component	Frequency	Recommended Value
L1	1160 ~ 1300MHz	11nH
	1550 ~ 1615MHz	6.8nH

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

PIN CONFIGURATION



PIN DESCRIPTION

Pin Number	Name	Description
1	GND	Ground
2	VDD	Power supply
3	RFOUT	LNA output
4	GND	Ground
5	RFIN	LNA input
6	EN	Enable pin. Pull high enable.

ORDERING INFORMATION

Part Number	Operating Temperature	Package	Tape and Reel
SK5117TH	-40°C ~ 85°C	1.1mm x 0.7 mm x 0.45mm, LGA 6-pin	10000

SK5117TH devices are Pb-free and RoHS compliant.

ABSOLUTE MAXIMUM RATINGS

Parameter	Min	Max	Unit
Supply Voltage	-0.3	4.0	V
Other Pin to GND	-0.3	$V_{DD}+0.3$	V
Max RF Input Power		25	dBm
Junction Temperature		150	°C
Storage Temperature Range	-60	+160	°C
Solder Reflow Temperature		+260	°C

ESD RATINGS

Parameter	Min	Max	Unit
Human Body Mode ESD (HBM)	-2	+2	kV
Machine Mode ESD (MM)	-150	+150	V
Charge Device Mode ESD (CDM)	-1	+1	kV

Caution: SK5117TH device are ESD sensitive and can be damaged by static electric charge. Proper ESD protection techniques should be used when handling these devices.

RECOMMENDED OPERATING CONDITIONS

Parameter	Test condition	Symbol	Min.	Typ.	Max.	Unit
Operating Temperature		T_A	-40	+25	+85	°C
Supply Voltage		V_{CC}	1.6	2.8	3.6	V
Supply Current	$V_{DD}=1.6\sim 3.6V$, EN High	I_{CC}	-	3.3	-	mA
	EN Low	I_{CC}	0	-	1	V
EN Turn-on Voltage		V_{EN_ON}	1.0	1.8	V_{DD}	V
EN Turn-off Voltage		V_{EN_OFF}	0	-	0.3	V

ELECTRICAL CHARACTERISTICS

(T_A = +25°C, V_{DD} = 2.8V, unless otherwise specified)

Parameters	Test Condition	Min.	Typ.	Max.	Units
RF Operating frequency		1550	1575.42	1615	MHz
Power Gain			17.8		dB
Noise Figure			0.52	0.89	dB
Input Return Loss	sweep power -30dBm, 1575.42MHz		-15		dB
Output Return Loss	sweep power -30dBm, 1575.42MHz		-15		dB
Reverse Isolation	sweep power -30dBm, 1575.42MHz		-26		dB
Input Power 1-dB Compression Point	1575MHz	-11	-7		dBm
Input In-Band IP3	f1=1574.42MHz, f2=1575.42MHz, -25dBm	-5	0		dBm
Output In-Band IP3	Note 1	0	5		dBm
Stability	frequency range 500MHz-5GHz	1.5			

Note 1: f1=1713MHz, f2=1851MHz, pin=-20dBm @f1

(T_A = +25°C, V_{DD} = 1.8V, unless otherwise specified)

Parameters	Test Condition	Min.	Typ.	Max.	Units
RF Operating frequency		1550	1575.42	1615	MHz
Power Gain			17.4		dB
Noise Figure			0.51	0.89	dB
Input Return Loss	sweep power -30dBm, 1575.42MHz		-15		dB
Output Return Loss	sweep power -30dBm, 1575.42MHz		-15		dB
Reverse Isolation	sweep power -30dBm, 1575.42MHz		-26		dB
Input Power 1-dB Compression Point	1575MHz	-13.5	-10		dBm
Input In-Band IP3	f1=1574.42MHz, f2=1575.42MHz, -25dBm	-7	12		dBm
Output In-Band IP3	Note 1	-2	3		dBm
Stability	frequency range 500MHz-5GHz	1.5			

Note 1: f1=1713MHz, f2=1851MHz, pin=-20dBm @f1

ELECTRICAL CHARACTERISTICS (Continued)

(T_A = +25°C, V_{DD} = 2.8V, unless otherwise specified)

Parameters	Test Condition	Min.	Typ.	Max.	Units
RF Operating frequency		1215	1227.6	1300	MHz
Power Gain			18.1		dB
Noise Figure			0.60	0.98	dB
Input Return Loss	sweep power -30dBm, 1227.6MHz		-10		dB
Output Return Loss	sweep power -30dBm, 1227.6MHz		-10		dB
Reverse Isolation	sweep power -30dBm, 1227.6MHz		-28		dB
Input Power 1-dB Compression Point	1227MHz	-13	-9		dBm
Input In-Band IP3	f1=1226.6MHz, f2=1227.6MHz, -25dBm	-7	-2		dBm
Output In-Band IP3	Note 1	-2	3		dBm
Stability	frequency range 500MHz-5GHz	1.5			

Note 1: f1=1800MHz, f2=2400MHz, pin=-20dBm @f1

(T_A = +25°C, V_{DD} = 1.8V, unless otherwise specified)

Parameters	Test Condition	Min.	Typ.	Max.	Units
RF Operating frequency		1215	1227.6	1300	MHz
Power Gain			18.0		dB
Noise Figure			0.60	0.98	dB
Input Return Loss	sweep power -30dBm, 1227.6MHz		-10		dB
Output Return Loss	sweep power -30dBm, 1227.6MHz		-10		dB
Reverse Isolation	sweep power -30dBm, 1227.6MHz		-28		dB
Input Power 1-dB Compression Point	1227MHz	-16	-12		dBm
Input In-Band IP3	f1=1226.6MHz, f2=1227.6MHz, -25dBm	-9	-4		dBm
Output In-Band IP3	Note 1	-4	1		dBm
Stability	frequency range 500MHz-5GHz	1.5			

Note 1: f1=1800MHz, f2=2400MHz, pin=-20dBm @f1

ELECTRICAL CHARACTERISTICS (Continued)

(T_A = +25°C, V_{DD} = 2.8V, unless otherwise specified)

Parameters	Test Condition	Min.	Typ.	Max.	Units
RF Operating frequency		1160	1176.45	1215	MHz
Power Gain			18.1		dB
Noise Figure			0.60	1.0	dB
Input Return Loss	sweep power -30dBm, 1176.45MHz		-9		dB
Output Return Loss	sweep power -30dBm, 1176.45MHz		-9		dB
Reverse Isolation	sweep power -30dBm, 1176.45MHz		-29		dB
Input Power 1-dB Compression Point	1176MHz	-13	-9		dBm
Input In-Band IP3	f1=1175.45MHz, f2=1176.45MHz, -25dBm	-9	-4		dBm
Output In-Band IP3	Note 1	-2	3		dBm
Stability	frequency range 500MHz-5GHz	1.5			

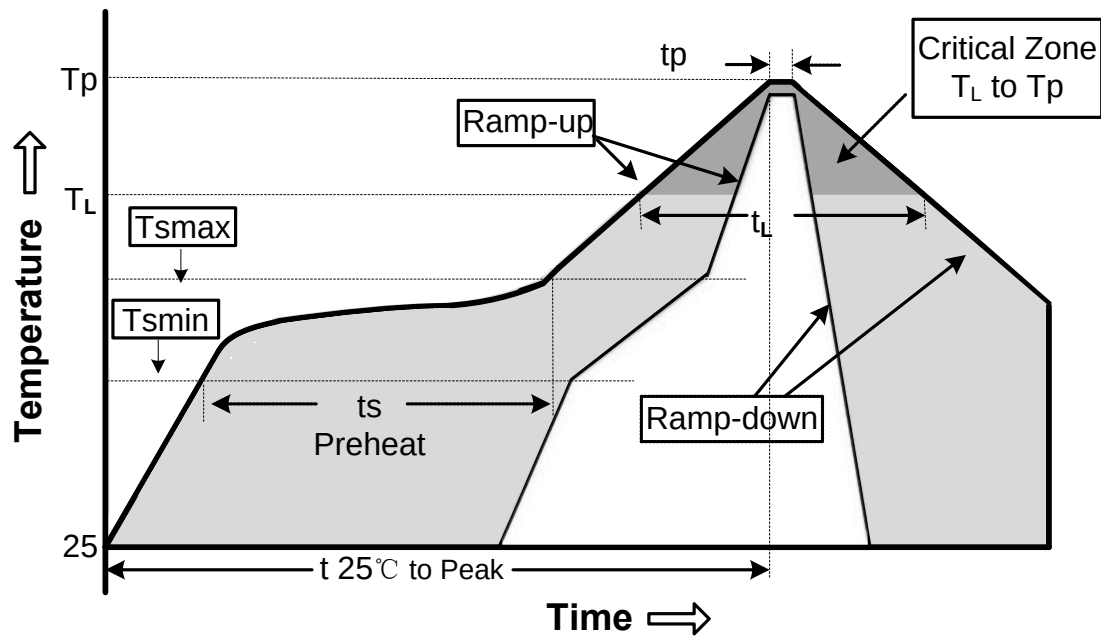
Note 1: f1=1800MHz, f2=2400MHz, pin=-20dBm @f1

(T_A = +25°C, V_{DD} = 1.8V, unless otherwise specified)

Parameters	Test Condition	Min.	Typ.	Max.	Units
RF Operating frequency		1160	1176.45	1215	MHz
Power Gain			17.8		dB
Noise Figure			0.60	1.0	dB
Input Return Loss	sweep power -30dBm, 1176.45MHz		-9		dB
Output Return Loss	sweep power -30dBm, 1176.45MHz		-9		dB
Reverse Isolation	sweep power -30dBm, 1176.45MHz		-29		dB
Input Power 1-dB Compression Point	1176MHz	-16	-12		dBm
Input In-Band IP3	f1=1175.45MHz, f2=1176.45MHz, -25dBm	-9	-4		dBm
Output In-Band IP3	Note 1	-4	1		dBm
Stability	frequency range 500MHz-5GHz	1.5			

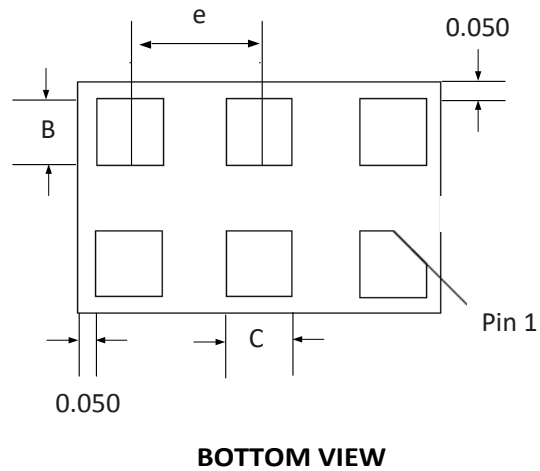
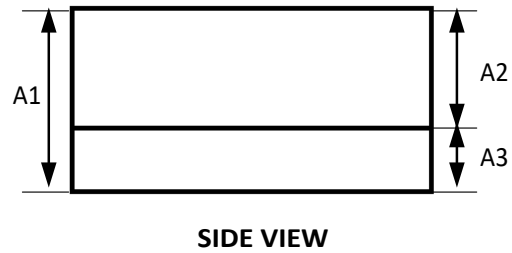
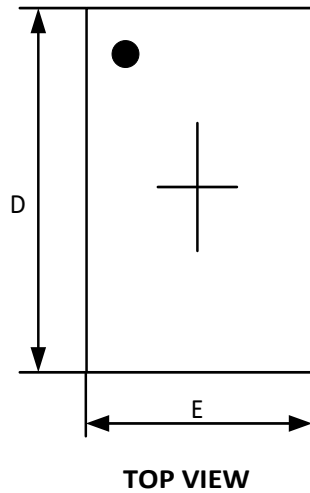
Note 1: f1=1800MHz, f2=2400MHz, pin=-20dBm @f1

RECOMMENDED REFLOW PROFILE



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

Profile Parameter	Lead-Free Assembly, Convection, IR/Convection
Ramp-up rate (T_{smax} to T_p)	3°C/second max.
Preheat temperature (T_{smin} to T_{smax})	150°C to 200°C
Preheat time (t_s)	60-180 seconds
Time above T_L , 217°C (t_L)	60-150 seconds
Peak temperature (T_p)	260°C
Time within 5°C of peak temperature (t_p)	20-40 seconds
Ramp-down rate	6°C/second max.
Time 25°C to peak temperature	8 minutes max.

PACKAGE DIMENSIONS: LGA-6L

Unit: mm

symbol	Dimensions In Millimeters		
	Min.	Nor.	Max.
A1	0.400	0.450	0.500
A2	0.310	0.330	0.350
A3	0.090	0.120	0.150
B	0.165	0.200	0.235
C	0.165	0.200	0.235
D	1.050	1.100	1.150
E	0.650	0.700	0.850
e	0.350	0.400	0.450