

# SK5160

## Fully-integrated Low Noise Amplifier Front-End module with BDS/GPS/GNSS Pre-Filter

### GENERAL DESCRIPTION

The SK5160 is a high-gain, low-noise amplifier Front-End Module (FEM) with Pre-Filter, designed for GPS, Galileo, Glonass and Beidou GNSS applications. The LNA achieves 29dB gain and 0.85dB noise figure.

The SK5160 can operate from a 1.6V to 3.6V single supply and draws only 8mA DC current. The shutdown leakage current is only 1uA.

The SK5160 sits on a small form factor PCB space, and available in small 1.6mmx1.6mm LGA-6 pin package.

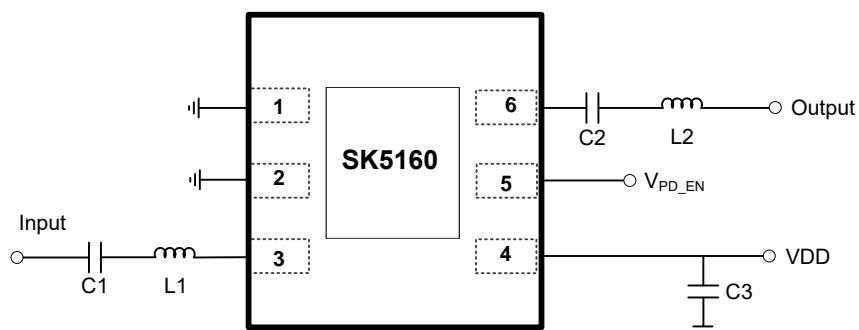
### FEATURES

- Ultra-high power gain: 29dB
- Low noise figure: 0.85dB
- Out-band rejection:
  - 35dB @ 900MHz
  - 36dB @ 2402-2482MHz
  - 63dB @ 3300MHz
  - 74dB @ 4200MHz
  - 81dB @ 5000MHz
- Low-power of 8mA operated from a single 1.6V to 3.6V voltage line
- Operating frequencies: GPS L1
- High integration with few off-chip BOM and low cost
- Lead-free and RoHS-compliant
- Operating Temperature Range: -40°C to 85°C

### APPLICATIONS

- PNDs (Personal Navigation Devices)
- Location-Enabled MID
- PMPs (Personal Media Players)
- Automobile Navigation Systems
- GNSS tracking systems
- GNSS industrial applications

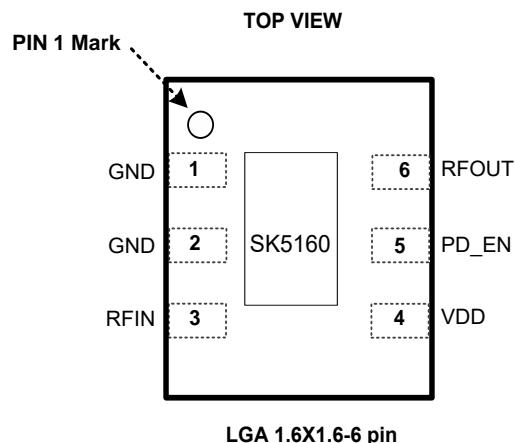
### TYPICAL APPLICATION CIRCUIT



Recommended BOM LIST	Symbol	Size	Value
Chip Capacitor	C1	0402	100pF
Chip inductor	L1	0402	9.5nH
Chip Capacitor	C2	0402	1.2pF
Chip inductor	L2	0402	6.8nH
Chip Capacitor	C3	0402	1uF

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

## PIN CONFIGURATION



## PIN DESCRIPTION

Pin No.	Name	Description	Connection
1/2	GND	Ground connection	Main IC GND connection
3	RFIN	RF Input	Requires a DC-blocking capacitor and external matching components
4	VDD	power supply for LNA	Supply Voltage
5	PD_EN	Shut down Input	A logic-high to active the device
6	RFOUT	RF Output	Requires a DC-blocking capacitor and external matching components
Pad	GND	Ground connection	Main IC GND connection

## ORDERING INFORMATION

Part Number	Temperature	Package	Tape and Reel
SK5160	-40°C ~ 85°C	1.6mm x 1.6 mm x 0.75mm LGA-6	3000

## ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Test Conditions	Min	Max	Unit
Supply Voltage	VDD	TA=+25°C		4.0	V
Power Down Voltage	V <sub>PD_EN</sub>	TA=+25°C		4.0	V
LNA Max RF Input Power	P <sub>in</sub>			0	dBm
ESD: HBM, 150pF/1.5KOhm	-		2.5		kV
Storage Temperature	T <sub>STG</sub>		-40	+150	°C
Solder Reflow Temperature	T <sub>SLDR</sub>			+260	°C

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 <sub>A</sub>	-40	+25	+85	°C
Supply Voltage	V <sub>DD</sub>	1.6	2.7	3.6	V
Power Down Turn-on Voltage	V <sub>PDon</sub>	1.2	-	VDD	V
Power Down Turn-off Voltage	V <sub>PDooff</sub>	0	-	0.4	V

## ELECTRICAL CHARACTERISTICS

(TA = +25°C, VDD = V<sub>PD\_EN</sub> = 2.7V, f<sub>in</sub> = 1575.42MHz, unless otherwise specified)

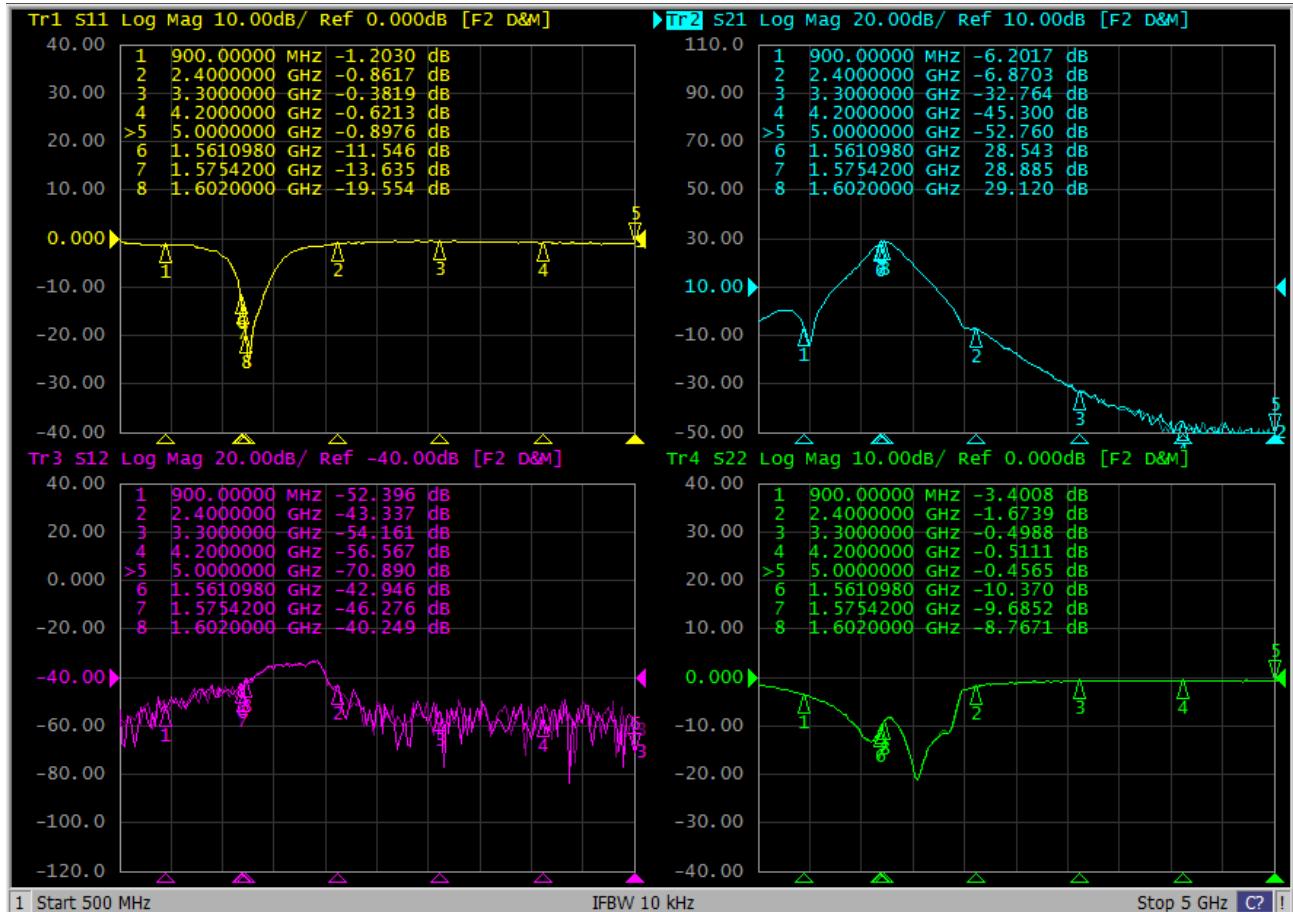
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Circuit Current	I <sub>cc</sub>	No Signal	6.0	8.0	9.5	mA
Power Gain	G <sub>p</sub>	Pin=-35dBm	27.0	29.0	30.5	dB
Noise Figure	NF		-	0.85	1.5	dB
Input Return Loss	RL <sub>in</sub>		10.5	16	-	dB
Output Return Loss	RL <sub>out</sub>		6	10	-	dB

## STANDARD CHARACTERISTICS FOR REFERENCE

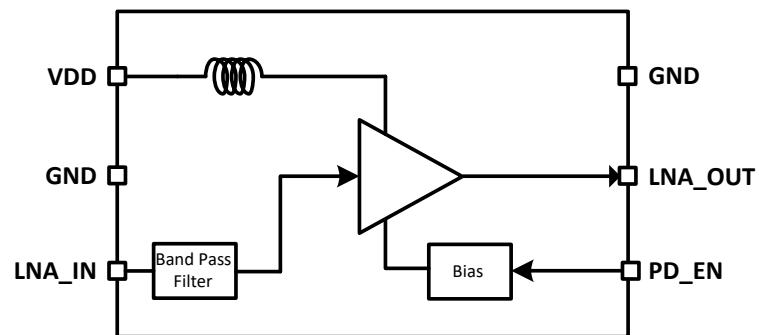
(TA = +25°C, VDD = V<sub>PD\_EN</sub> = 2.7V, f<sub>in</sub> = 1575.42MHz, unless otherwise specified)

Parameter	Symbol	Test Conditions	Reference	Unit
Isolation	ISL		45	dB
Input 3rd Distortion Intercept Point	IIP <sub>3</sub>	f <sub>in1</sub> = 1575 MHz, f <sub>in2</sub> = 1574 MHz	-16	dBm
1 dB Compression Point	P <sub>in(1dB)</sub>	f <sub>in</sub> = 1575 MHz	-26	dBm
1 dB Compression Point	P <sub>in(1dB)</sub>	f <sub>in</sub> = 750-900 MHz	-8	dBm
1 dB Compression Point	P <sub>in(1dB)</sub>	f <sub>in</sub> = 2402-2482 MHz	+1	dBm

## FREQUENCY CHARACTERISTICS



Frequency Sp	0.9G	2.4G	3.3G	4.2G	5G	1561.098G	1575.42G	1602G
S11(dB)	-1.25	-0.8	-0.4	-0.6	-0.9	-11.5	-13.6	-19.6
S21(dB)	-6.2	-6.9	-32.8	-45.3	-52.8	28.5	28.9	29.1
S12(dB)	-52.4	-43.3	-54.2	-56.6	-70.1	-42.9	-46.3	-40.3
S22(dB)	-3.4	-1.7	-0.5	-0.5	-0.46	-10.4	-9.7	-8.8

**BLOCK DIAGRAM**

## RECOMMENDED REFLOW PROFILE

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

(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  $\pm 2^\circ\text{C}$  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.

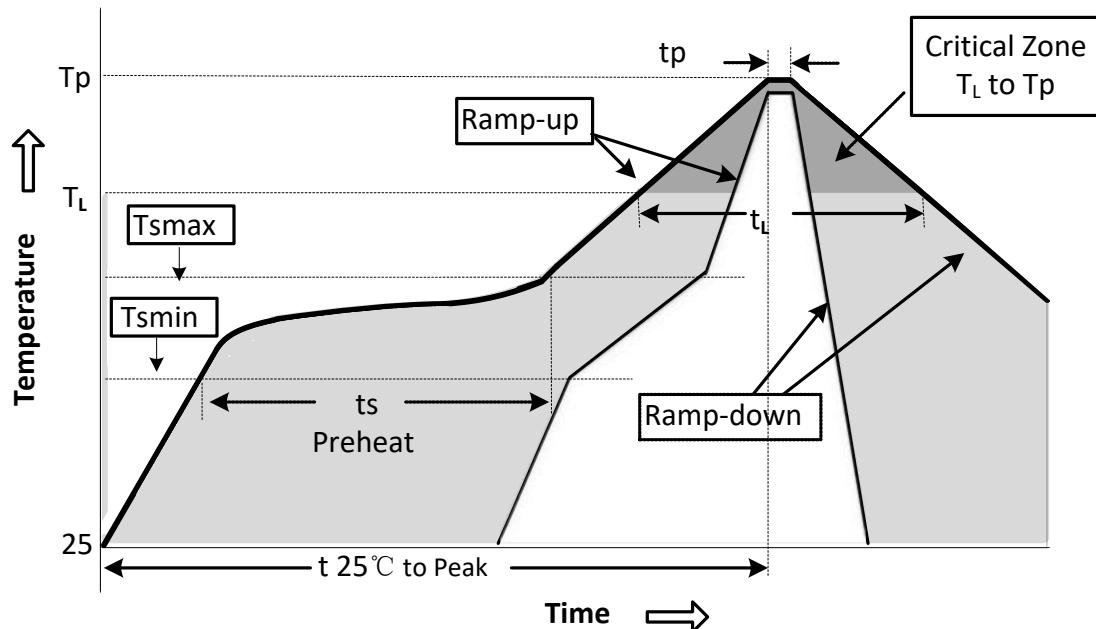
(4) All components in the test load shall meet the classification profile requirements.

(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 mm <sup>3</sup> < 350	Volume mm <sup>3</sup> 350 - 2000	Volume mm <sup>3</sup> > 2000
< 1.6 mm	260°C	260°C	260°C
1.6 mm - 2.5 mm	260°C	250°C	245°C
> 2.5 mm	250°C	245°C	245°C

## REFLOW PROFILE



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

**PACKAGE DIMENSIONS: LGA1.6x1.6-6**

