



SKYWORKS®

DATA SHEET

SKY65611-11: Low-Noise Amplifier (LNA) for GPS/GLONASS/Galileo/BDS Applications

Applications

- GPS/GLONASS/Galileo/BDS radio receivers
- Compass (Beidou)
- Smartphones
- Tablet/laptop PCs
- Personal navigation devices

Features

- Small signal gain: 16.5 dB typical
- Low noise figure: 0.65 dB typical
- Out-of-band IIP3: +4 dBm typical
- Low current consumption
- Output impedance internally matched to $50\ \Omega$
- Single DC supply: 1.5 to 3.0 V
- LNA enable: 1.2 V
- Minimal number of external components required
- Small DFN 6-pin, 1.1 x 0.9 mm package (MSL1, 260°C per JEDEC J-STD-020)
- For RoHS and other product compliance information, see the [Skyworks Certificate of Conformance](#)

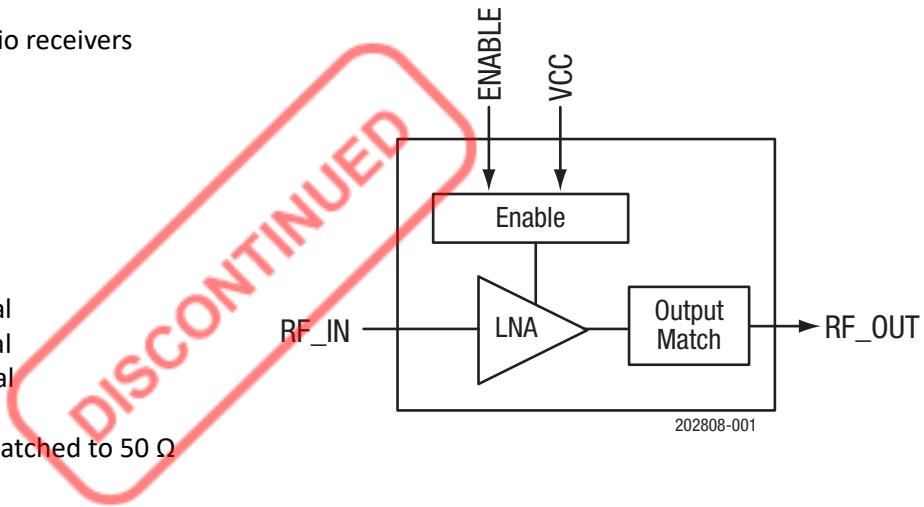


Figure 2. SKY65611-11 Block Diagram

Description

The SKY65611-11 is a Microwave Monolithic Integrated Circuit (MMIC) front-end low-noise amplifier (LNA) for Global Positioning System/Global Navigation Satellite System (GPS/GLONASS)/Galileo and Beidou Navigation Satellite System (BDS) receiver applications. The device provides high linearity, excellent gain, a high 1 dB input compression point (IP1dB), and 0.65 dB typical noise figure (NF). Output matching components are embedded inside the device, minimizing input matching components.

The SKY65611-11 is optimized to operate at 1559 to 1606 MHz, making it ideal for GPS/GLONASS/Galileo/BDS radio receiver applications.

The SKY65611-11 is fabricated using advanced SiGe BiCMOS technology. The LNA uses surface-mount technology (SMT) in a Dual Flat No-Lead (DFN) package, which allows for a highly manufacturable and low-cost solution. The pin configuration and package are shown in Figure 1. Pin assignments and descriptions are in Table 1.

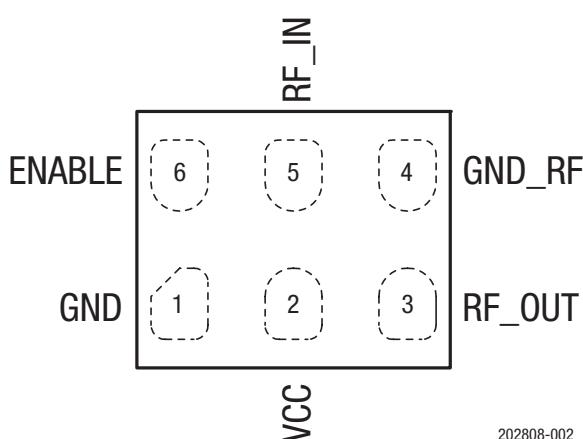


Figure 1. SKY65611-11 Pinout (Top View)

Table 1. SKY65611-11 Signal Descriptions

Pin	Name	Description	Pin	Name	Description
1	GND	Ground	4	GND	Ground
2	VCC	Source voltage	5	RF_IN	RF input
3	RF_OUT	RF output	6	ENABLE	LNA enable

Technical Description

The ENABLE signal (pin 6) enables or disables the LNA DC power. A logic high signal powers on the LNA and a logic low signal powers off the device.

Electrical and Mechanical Specifications

The absolute maximum ratings of the SKY65611-11 are provided in Table 2. The recommended operating conditions are specified in Table 3, and electrical specifications are provided in Tables 4 and 5.

Table 2. SKY65611-11 Absolute Maximum Ratings^{1, 2}

Parameter	Symbol	Minimum	Maximum	Units
RF input power	Pin		0	dBm
Supply voltage	Vcc	0	3.1	V
Storage temperature	Tstg	-55	+125	°C
Junction temperature	Tj		+125	°C
Electrostatic discharge: Charged Device Model (CDM), Class C3 Human Body Model (HBM), Class 2	ESD		1000 2000	V V

1. Exposure to maximum rating conditions for extended periods may reduce device reliability. There is no damage to device with only one parameter set at the limit and all other parameters set at or below their nominal value. Exceeding any of the limits listed here may result in permanent damage to the device.
 2. Specifications are based on simulations.

ESD Handling: Industry-standard ESD handling precautions must be adhered to at all times to avoid damage to this device.

Table 3. SKY65611-11 Recommended Operating Conditions¹

Parameter	Symbol	Minimum	Typical	Maximum	Units
Frequency range	f	1559	1575	1606	MHz
Supply voltage (measured at terminals of Evaluation Board)	Vcc	1.5	1.8	3.0	V
Case operating temperature	Tc	-40		+85	°C

1. Enable OFF voltage: 0.3 V (highest)
 Enable ON voltage: Vcc-0.3 V (lowest)

Table 4. SKY65611-11 Electrical Specifications¹
(f = 1575 MHz, VCC = 1.8 V, VEN = 1.8 V, Tc = +25 °C, Unless Otherwise Noted)

Parameter	Symbol	Test Condition	Min	Typical	Max	Units
Small signal gain	S21	PIN = -30 dBm	14	15.5	18	dB
1 dB input compression point	IP1dB			-15.5		dBm
Noise figure	NF			0.65		dB
In-band third order input intercept point	IIP3	f1 = 1575 MHz @ PIN = -30 dBm f2 = 1576 MHz @ PIN = -30 dBm		-7.5		dBm
Out-of-band third order input intercept point	OOB-IIP3	f1 = 1713 MHz @ PIN = -20 dBm f2 = 1851 MHz @ PIN = -65 dBm IMD3 @ 1575 MHz = -93 dBm at output		+2.5		dBm
Reverse isolation	S12	PIN = -30 dBm		30		dB
Input return loss	S11	PIN = -30 dBm		7		dB
Output return loss	S22	PIN = -30 dBm		12		dB
Supply current	ICC	No RF		3.5	4.5	mA
Shut down current	I _{LEAK}	No RF, V _{EN} = 0 V			1	µA
2nd harmonic of 787 MHz	HD2_787	PIN = -25 dBm, f1 = 787 MHz, measure output at 1574 MHz		-28		dBm
Power gain settling time				1.33		µs

1. Performance is guaranteed only under the conditions listed in this Table and is not guaranteed over the full operating or storage temperature ranges. Operation at elevated temperatures may reduce reliability of the device.

Table 5. SKY65611-11 Electrical Specifications¹
(f = 1575 MHz, VCC = 2.8 V, VEN = 2.8 V, Tc = +25 °C, Unless Otherwise Noted)

Parameter	Symbol	Test Condition	Min	Typical	Max	Units
Small signal gain	S21	PIN = -30 dBm	15	16.5	19	dB
1 dB input compression point	IP1dB			-14.5		dBm
Noise figure	NF			0.65		dB
In-band third order input intercept point	IIP3	f1 = 1575 MHz @ PIN = -30 dBm f2 = 1576 MHz @ PIN = -30 dBm		-7.5		dBm
Out-of-band third order input intercept point	OOB-IIP3	f1 = 1713 MHz @ PIN = -20 dBm f2 = 1851 MHz @ PIN = -65 dBm IMD3 @ 1575 MHz = -96 dBm at output		+4		dBm
Reverse isolation	S12	PIN = -30 dBm		30		dB
Input return loss	S11	PIN = -30 dBm		7		dB
Output return loss	S22	PIN = -30 dBm		14		dB
Supply current	ICC	No RF		4	5	mA
Shut down current	I _{LEAK}	No RF, V _{EN} = 0 V			1	µA
2nd harmonic of 787 MHz	HD2_787	PIN = -25 dBm, f1 = 787 MHz, measure output at 1574 MHz		-27		dBm
Power gain settling time				1.33		µs

1. Performance is guaranteed only under the conditions listed in this Table and is not guaranteed over the full operating or storage temperature ranges. Operation at elevated temperatures may reduce reliability of the device.

Evaluation Board Description

The SKY65611-11 Evaluation Board is used to test the performance of the SKY65611-11 LNA. An application schematic diagram is shown in Figure 3. An assembly drawing for the Evaluation Board is shown in Figure 4. Table 6 provides the Bill of Materials (BOM) list for Evaluation Board, layer details are shown in Figure 5, and the layer physical characteristics are shown in Figure 6.

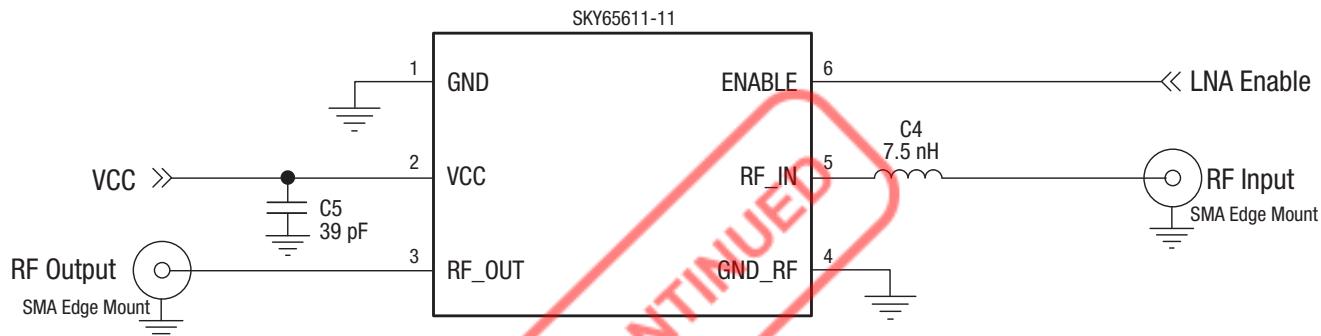
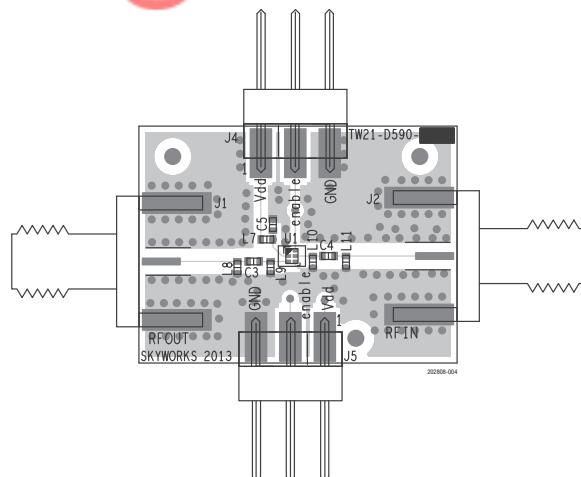


Figure 3. SKY65611-11 Application Schematic



Note: Evaluation Board Gerber files are available on request.

Figure 4. SKY65611-11 Evaluation Board Assembly Diagram

Table 6. SKY65611-11 Evaluation Board Bill of Materials

Component	Size	Value
C5 ¹	0402	39 pF
C4	0402	7.5 nH (Murata LQW04AN7N5D00)
L7, C3	0402	0 Ω
L8, L9, L10, L11	0402	DNI

1. C5 must be placed as close as possible to the device in the application circuit.

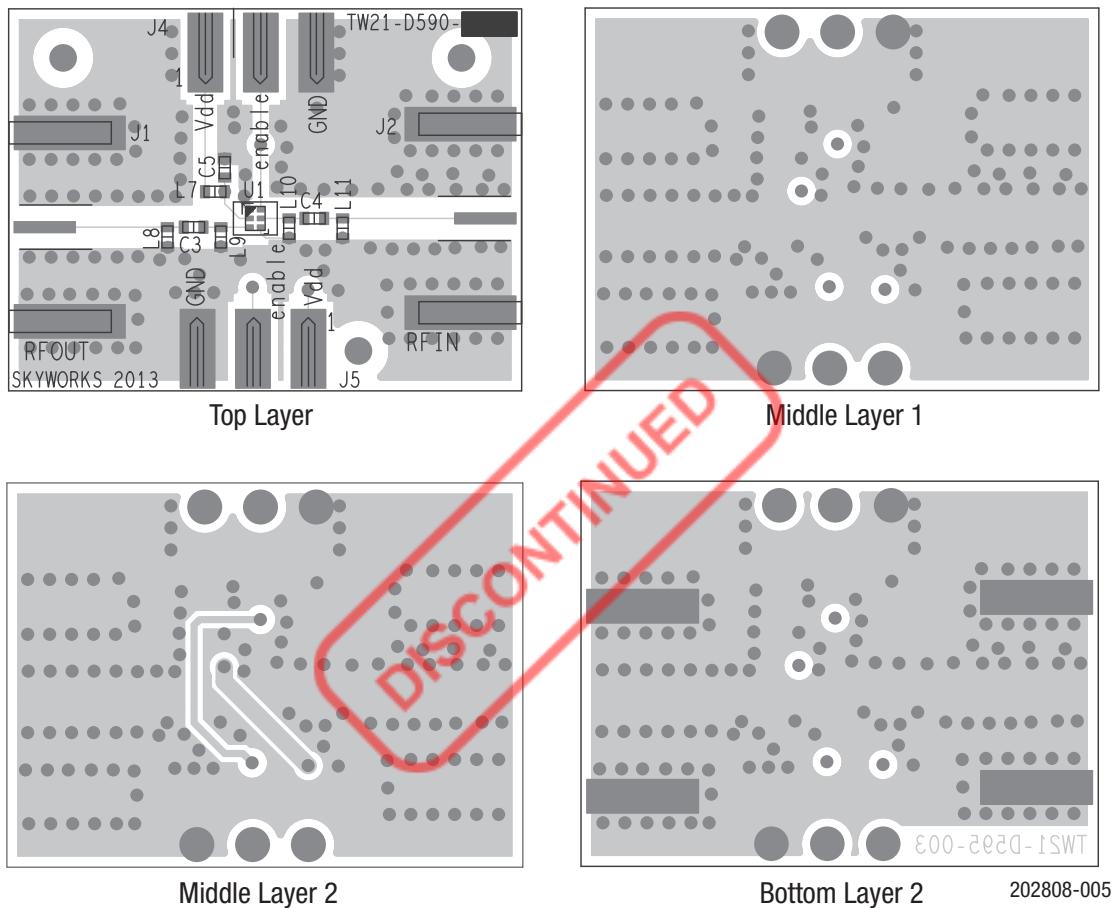


Figure 5. Evaluation Board Layer Details

50 Ω	CROSS SECTION	NAME	THICKNESS	MATERIALS
W = 0.500 mm	_____	TMASK	0.010 mm	SOLDER RESIST
	_____	L1	0.025 mm	Cu – 1 oz
		DIELECTRIC	0.250 mm	RO4350B
	_____	L2	0.035 mm	Cu – 1 oz
		DIELECTRIC	1.000 mm	FR4
	_____	L3	0.035 mm	Cu – 1 oz
		DIELECTRIC	0.250 mm	FR4
	_____	L4	0.200 mm	Cu – 1 oz
	_____	BMASK	0.010 mm	SOLDER RESIST

202808-006

Figure 6. Layer Detail Physical Characteristics

Package Dimensions

The PCB layout footprint for the SKY65611-11 is provided in Figure 7. Typical part marking for the SKY65611-11 is shown in Figure 8. Package dimensions are shown in Figure 9, and tape and reel dimensions are provided in Figure 10.

Package and Handling Information

Instructions on the shipping container label regarding exposure to moisture after the container seal is broken must be followed. Otherwise, problems related to moisture absorption may occur when the part is subjected to high temperature during solder assembly.

The SKY65611-11 is rated to Moisture Sensitivity Level 1 (MSL1) at 260 °C. It can be used for lead or lead-free soldering. For additional information, refer to the Skyworks Application Note, Solder Reflow Information, document number 200164.

Care must be taken when attaching this product, whether it is done manually or in a production solder reflow environment. Production quantities of this product are shipped in a standard tape and reel format.

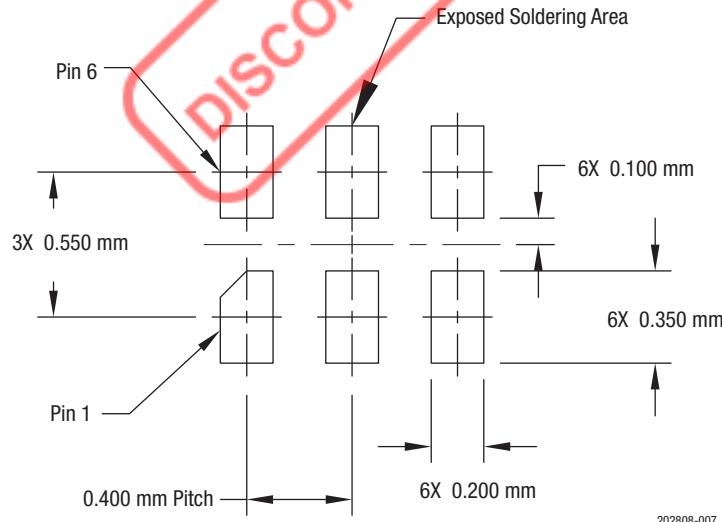


Figure 7. SKY65611-11 PCB Layout Footprint

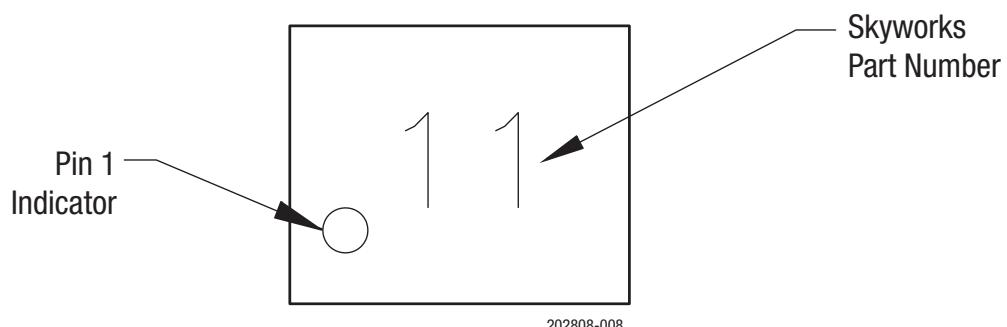
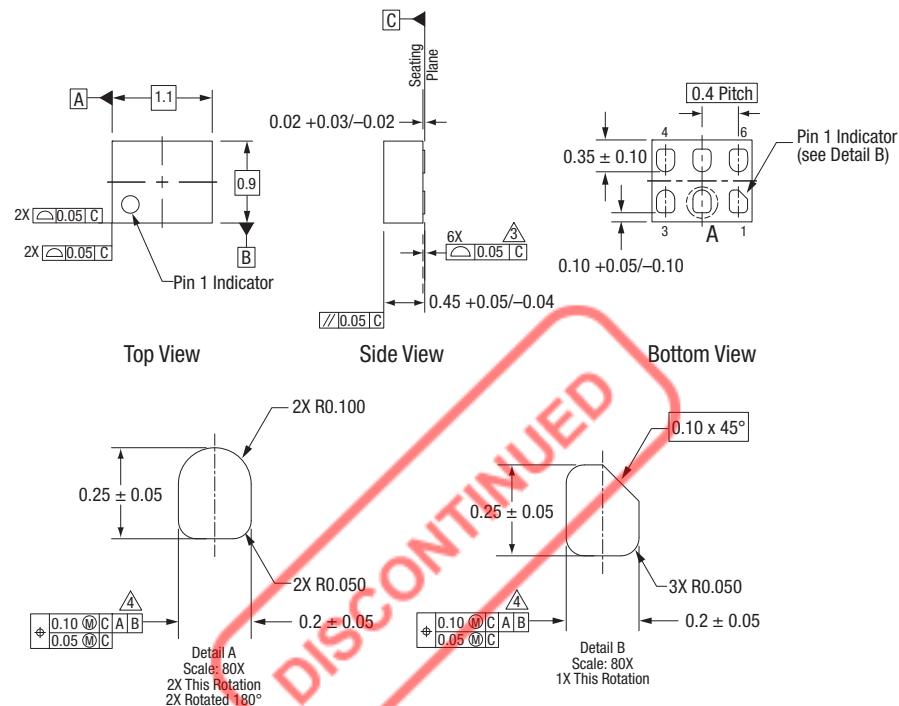
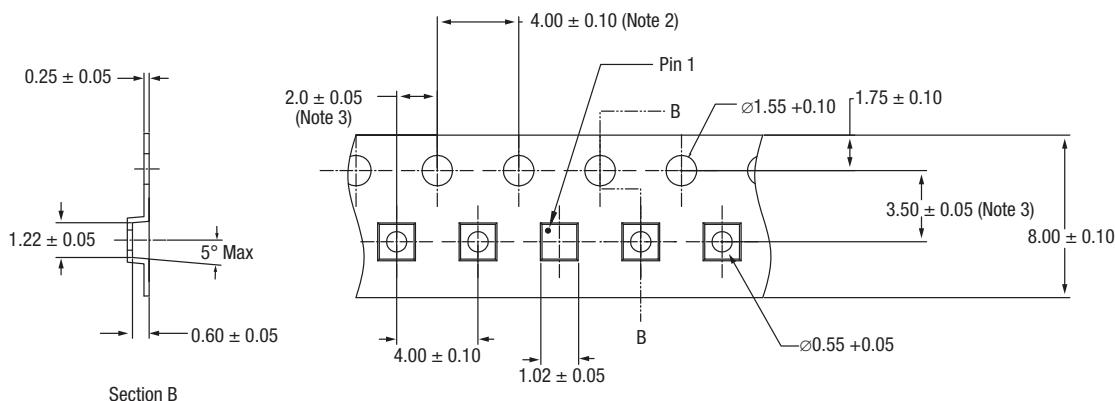


Figure 8. SKY65611-11 Typical Part Marking (Top View)



202808-009

Figure 9. SKY65611-11 Package Dimensions



202808-010

Figure 10. SKY65611-11 Tape and Reel Dimensions

Ordering Information

Part Number	Part Description	Evaluation Board Part Number
SKY65611-11	Low-Noise Amplifier (LNA) for GPS/GLONASS/Galileo/BDS Applications	SKY65611-11-EVB



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