

PRELIMINARY DATA SHEET

SKY65601-477LF: 1.575 GHz GPS/GNSS Low-Noise Amplifier

Applications

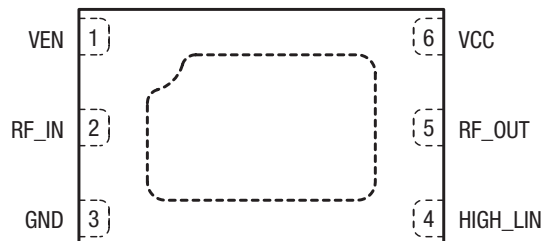
- GPS/GNSS radio receivers
- Global Navigation Satellite Systems (GLONASS)
- Smart phones
- Tablet/laptop PCs
- Personal navigation devices

Features

- All matching components integrated (no inductors required)
- Small signal gain: 16.8 dB typical
- IIP3: +4 dBm
- Low Noise Figure: 0.8 dB typical
- IP1dB: up to -4.8 dBm
- Low current consumption
- Input/output impedance internally matched to 50 Ω
- Single DC supply: 1.8 to 3.6 V
- Minimal number of external components required
- Small, DFN (6-pin, 2.0 x 1.3 mm) package (MSL1, 260 °C per JEDEC J-STD-020)

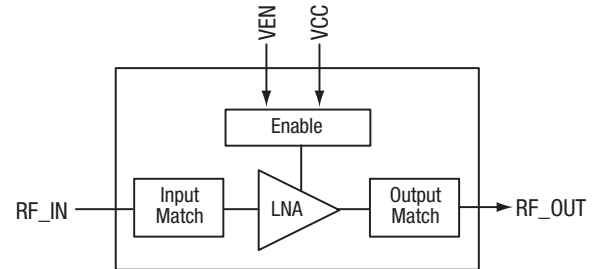


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Figure 2. SKY65601-477LF Pinout – 6-Pin DFN (Top View)



S2412a

Figure 1. SKY65601-477LF Block Diagram

Description

The SKY65601-477LF is a Microwave Monolithic Integrated Circuit (MMIC) front-end Low Noise Amplifier (LNA) designed for Global Positioning System/Global Navigation Satellite System (GPS/GNSS) receiver applications. The device provides high linearity, excellent gain, a high 1 dB Input Compression Point (IP1dB), and a superior Noise Figure (NF). All critical matching components are embedded inside the device. No external matching components are required.

The SKY65601-477LF is optimized to operate at 1.5750 and 1.6018 GHz, which makes it ideal for GPS/GNSS radio receiver applications.

The SKY65601-477LF is fabricated using advanced SiGe BiCMOS technology. The LNA uses Surface Mount Technology (SMT) in the form of a 2.0 x 1.3 mm Dual Flat No-Lead (DFN) package, which allows for a highly manufacturable and low-cost solution.

A functional block diagram is shown in Figure 1. The pin configuration and package are shown in Figure 2. Signal pin assignments and functional pin descriptions are provided in Table 1.

Table 1. SKY65601-477LF Signal Descriptions

Pin #	Name	Description	Pin #	Name	Description
1	VEN	LNA enable	4	HIGH_LIN	High linearity mode
2	RF_IN	RF input	5	RF_OUT	RF output
3	GND	Ground	6	VCC	Source voltage

Table 2. SKY65601-477LF Absolute Maximum Ratings

Parameter	Symbol	Minimum	Maximum	Units
RF input power	P _{IN}		0	dBm
Supply voltage	V _{CC}	1.8	3.6	V
Storage temperature	T _{STG}	−55	+125	°C
Junction temperature	T _J		+150	°C

Note: 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.

CAUTION: Although this device is designed to be as robust as possible, Electrostatic Discharge (ESD) can damage this device. This device must be protected at all times from ESD. Static charges may easily produce potentials of several kilovolts on the human body or equipment, which can discharge without detection. Industry-standard ESD precautions should be used at all times.

Table 3. SKY65601-477LF Recommended Operating Conditions

Parameter	Symbol	Minimum	Typical	Maximum	Units
Frequency range	f	1565	1575	1606	MHz
Supply voltage (measured at terminals of Evaluation Board)	V _{CC}	1.80	2.85	3.60	V
LNA enable:					
Enable (high)	LNA _{ENABLE}	1.5		V _{CC}	V
Disable (low)	LNA _{DISABLE}	0		0.3	V
Case operating temperature	T _C	−40		+85	°C

Technical Description

Power Shut Down

The VEN signal (pin 1) 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 SKY65601-477LF are provided in Table 2. The recommended operating conditions are specified in Table 3 and electrical specifications are provided in Table 4.

Performance characteristics for the SKY65601-477LF are illustrated in Figures 3 through 8.

Table 4. SKY65601-477LF Electrical Specifications (Note 1)
($V_{CC} = 2.85$ V, $V_{BIAS} = 1.5$ V, $T_C = +25$ °C, Unless Otherwise Noted)

Parameter	Symbol	Test Condition	Min	Typical	Max	Units
Small signal gain	S ₂₁	f = 1575.0 MHz		16.8		dB
		f = 1601.8 MHz		16.5		dB
1 dB Input Compression Point	IP1dB	Low linearity		-13.0		dBm
		High linearity		-4.8		dBm
Noise Figure	NF			0.8		dB
Third Order Input Intercept Point (in band)	IIP3	Tone 1 = 1575 MHz, Tone 2 = 1576 MHz, P _{IN} = -30 dBm		+4		dBm
Reverse isolation	S ₁₂			23.5		dB
Input return loss	S ₁₁			-6.5		dB
Output return loss	S ₂₂			-12		dB
Supply current	I _{CC}			4.5		mA
Shut down current				0.2	1.0	μA
Power gain settling time				60		μs

Note 1: Performance is guaranteed only under the conditions listed in this Table.

Typical Performance Characteristics

($V_{CC} = 2.8\text{ V}$, $V_{BIAS} = 1.5\text{ V}$, $T_C = +25\text{ }^{\circ}\text{C}$, Unless Otherwise Noted)

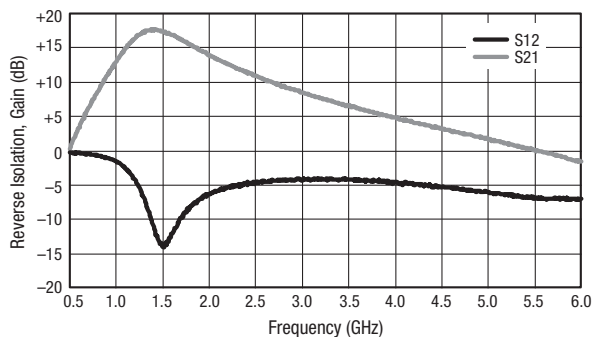


Figure 3. Gain and Reverse Isolation vs Frequency (Broadband)

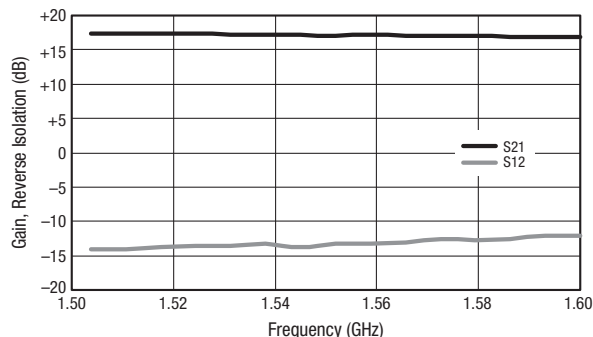


Figure 4. Gain and Reverse Isolation vs Frequency (Narrow Band)

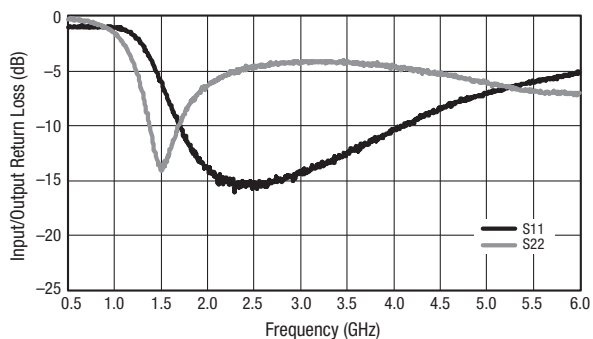


Figure 5. Input and Output Return Loss vs Frequency

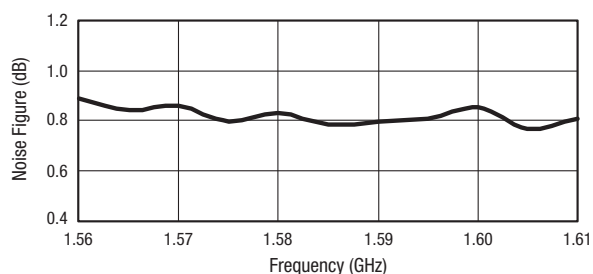


Figure 6. Noise Figure vs Frequency

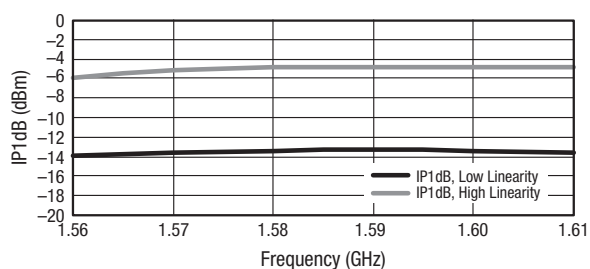


Figure 7. IP1dB vs Frequency

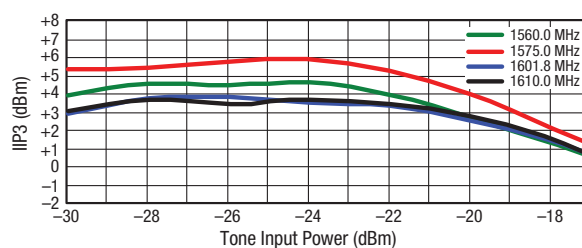


Figure 8. IIP3 vs Frequency

Evaluation Board Description

The SKY65601-477LF Evaluation Board is used to test the performance of the SKY65601-477LF LNA. The Evaluation Board schematic diagram is shown in Figure 9. Table 5 provides the Bill of Materials (BOM) list for Evaluation Board components.

An assembly drawing for the Evaluation Board is shown in Figure 10. The layer detail is shown in Figure 11. Layer detail physical characteristics are noted in Figure 12.

Package Dimensions

The PCB footprint drawing for the SKY65601-477LF is shown in Figure 13. Package dimensions for the 6-pin DFN are shown in Figure 14, and tape and reel dimensions are provided in Figure 15.

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 SKY65601-477LF 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.

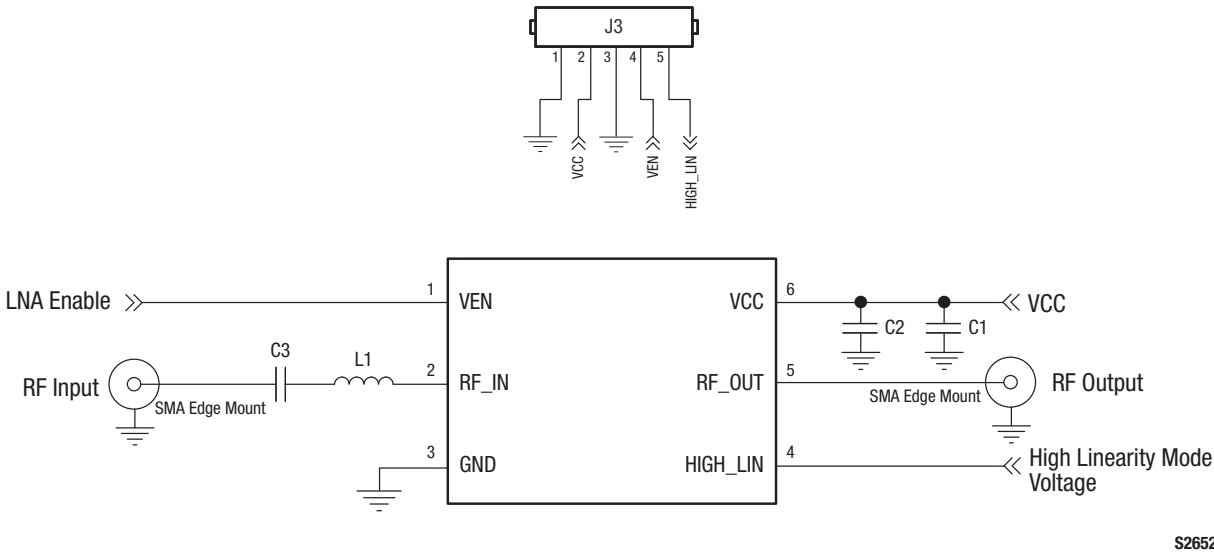


Figure 9. SKY65601-477LF Evaluation Board Schematic

Table 5. SKY65601-477LF (QFN Package) Evaluation Board Bill of Materials

Component	Size	Value	Vendor
C1 (optional)	0402	0.1 μ F	*** TBD ***
C2 (optional)	0402	22 nF	*** TBD ***
C3	0402	22 nF	*** TBD ***
L1	0402	2.2 nH	Murata

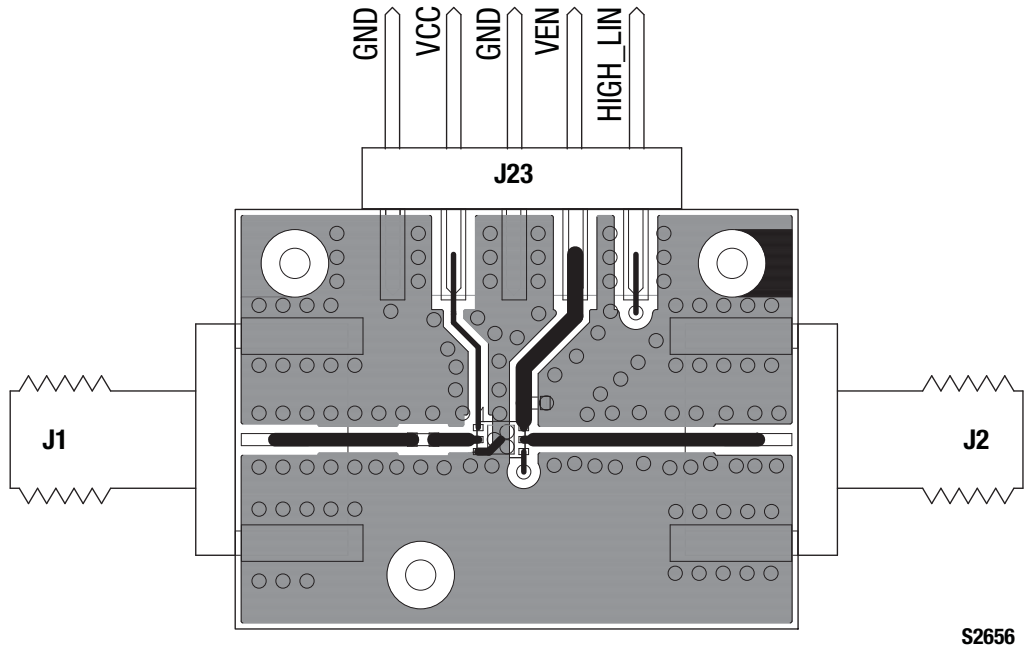
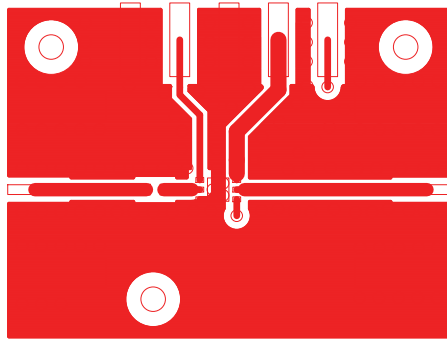
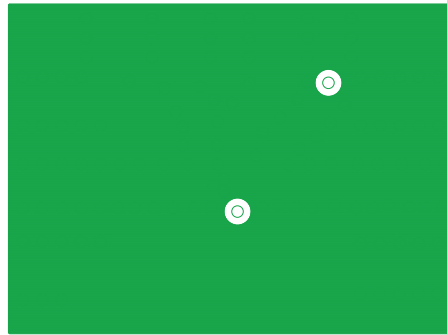


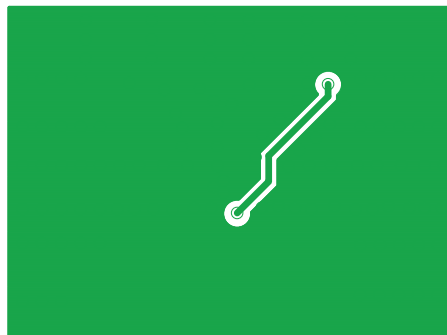
Figure 10. SKY65601-477LF Evaluation Board Assembly Diagram



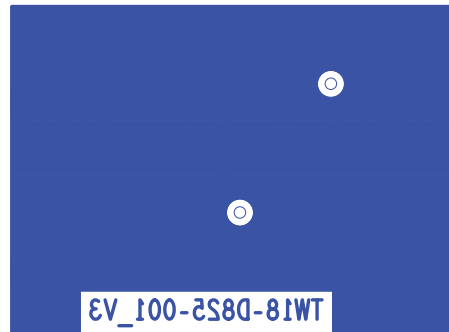
Layer 1: Top Layer



Layer 2: Ground Layer





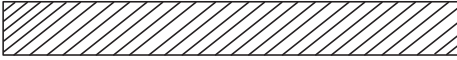



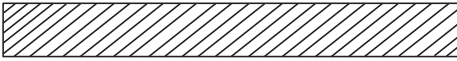


Layer 3: Signal Layer



Layer 4: Bottom Layer

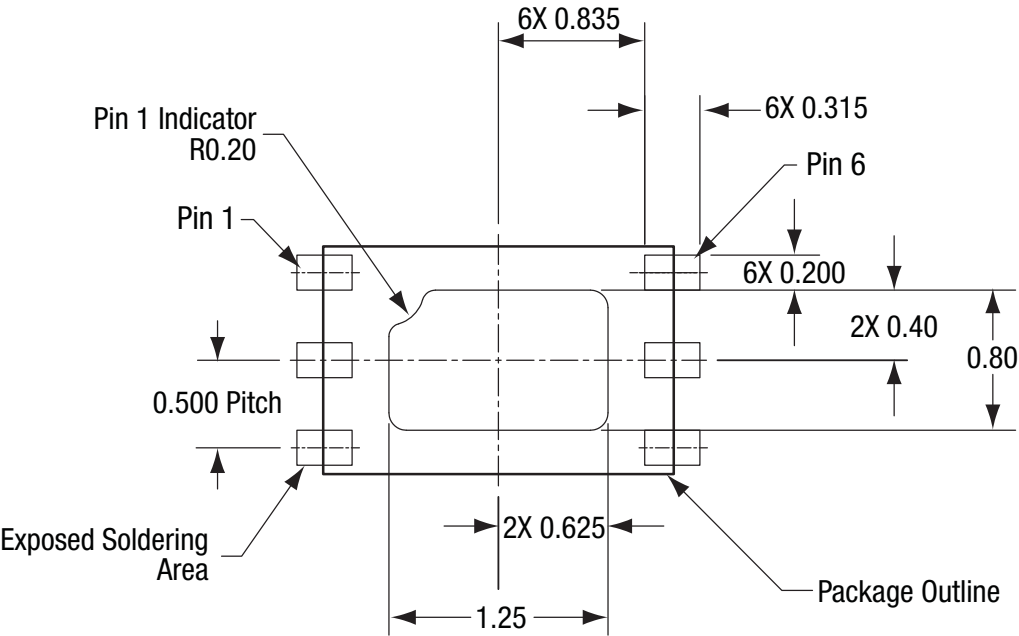
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Figure 11. SKY65601-477LF Evaluation Board Layer Detail

Cross Section	Name	Thickness (mm)	Material
	Tmask	0.010	Solder Resist
	L1	0.025	Cu, 1 oz.
	Dielectric	0.250	FR4
	L2	0.035	Cu, 1 oz
	Dielectric	1.000	FR4
	L3	0.035	Cu, 1 oz
	Dielectric	0.250	FR4
	L4	0.200	Cu, 1 oz
	Bmask	0.010	Solder resist

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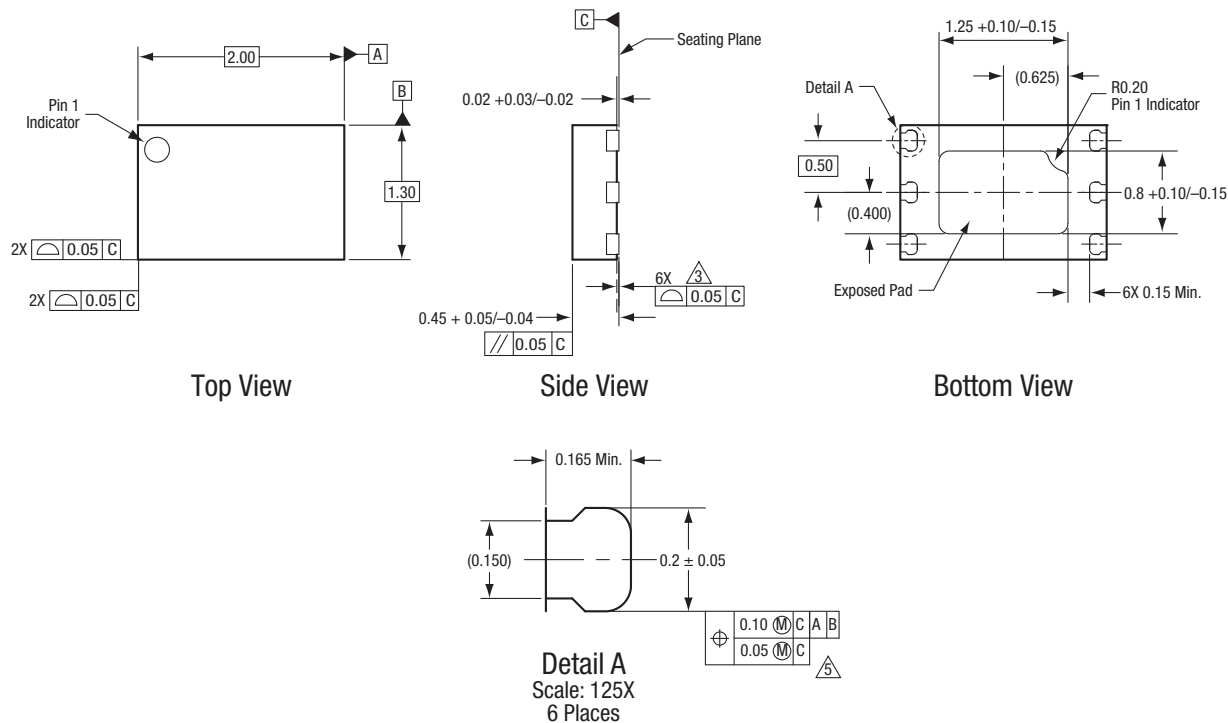
Figure 12. Layer Detail Physical Characteristics



All measurements in millimeters

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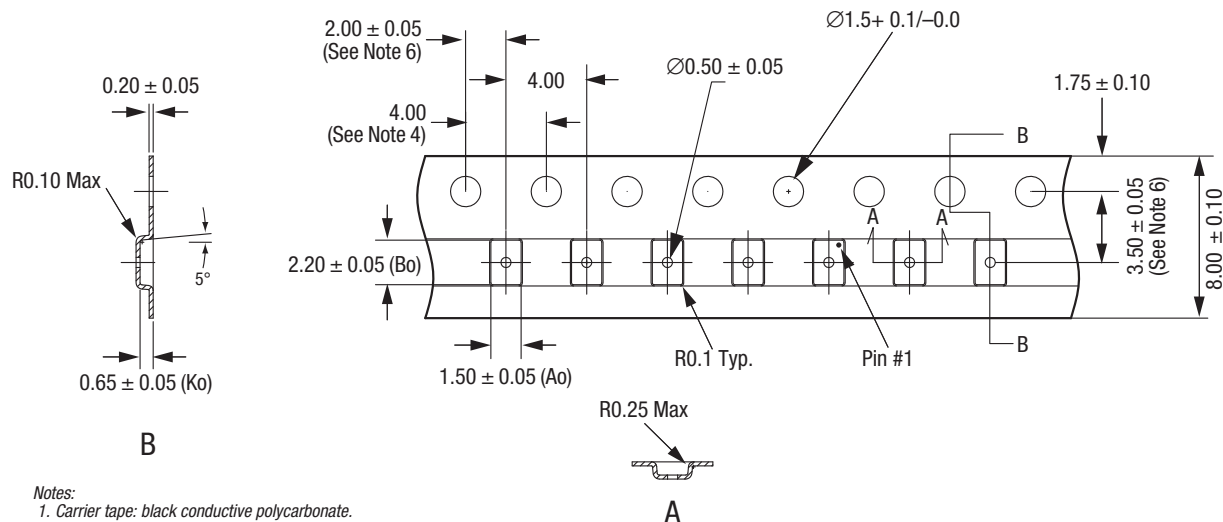
Figure 13. SKY65601-477LF PCB Layout Footprint



All measurements are in millimeters.
 Dimensioning and tolerancing according to ASME Y14.5M-1994.
 Coplanarity applies to the terminals and all other bottom surface metalization.
 Dimension applies to metalized terminal. If the terminal has a radius on its end,
 the width dimension should not be measured in that radius area.

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Figure 14. SKY65601-477LF 6-Pin DFN Package Dimensions



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Figure 15. SKY65601-477LF Tape and Reel Dimensions

Ordering Information

Model Name	Manufacturing Part Number	Evaluation Board Part Number
SKY65601-477LF GPS/GNSS Low-Noise Amplifier	SKY65601-477LF	TW18-D820

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