DATA SHEET

SKY65724-11: Low-Noise Amplifier Front-End Module with Pre-Filter for BDS/GPS/GNSS Applications

Applications

- BDS/GPS/GNSS radio receivers
- Global Navigation Satellite Systems (GLONASS)
- Fitness/activity trackers
- Smartphones
- Laptop PCs and tablets

Features

- Small signal gain: 16 dB typical
- Low noise figure: 1.8 dB typical
- Excellent out-of-band rejection
- Low current consumption
- Input/output impedance internally matched to 50 Ω
- Single DC supply: 1.62 to 3.6 V
- Minimal number of external components required
- Small MCM 8-pin, 1.1 x 1.5 mm package (MSL3, 260°C per JEDEC J-STD-020)

Skyworks Green™ products are compliant with all applicable legislation and are halogen-free. For additional information, refer to *Skyworks Definition of Green™*, document number SQ04–0074.

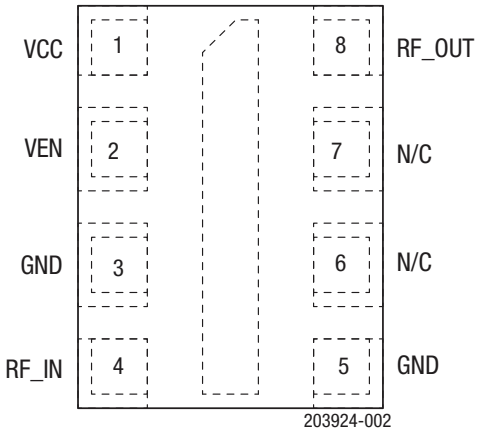


Figure 1. SKY65724-11 Pinout (Top View)

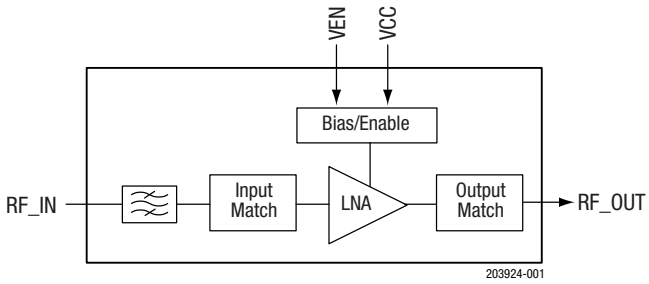


Figure 2. SKY65724-11 Block Diagram

Description

The SKY65724-11 is a front-end module (FEM) with an integrated low-noise amplifier (LNA) and pre-filter designed for Beidou Global Positioning System/Global Navigation Satellite System (BDS/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).

The GPS pre-filter provides the low in-band insertion loss for excellent rejections of the cellular and WLAN frequency bands. The SKY65724-11 uses surface mount technology (SMT) in a Multi-Chip Module (MCM) package, which allows for a highly manufacturable and low-cost solution.

The LNA matching inductor is placed outside the module to enable performance optimization. The pin configuration and package are shown in Figure 1. A functional block diagram is shown in Figure 2. Signal pin assignments and functional pin descriptions are provided in Table 1.

Table 1. SKY65724-11 Signal Descriptions

Pin	Name	Description	Pin	Name	Description
1	VCC	Source voltage	5	GND	Ground
2	VEN	LNA enable	6	N/C	No connection
3	GND	Ground	7	N/C	No connection
4	RF_IN	RF input	8	RF_OUT	RF output

Technical Description

The VEN signal (pin 2) enables or disables the LNA. 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 SKY65724-11 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. SKY65724-11 Absolute Maximum Ratings[1]

Parameter	Symbol	Minimum	Maximum	Units
RF input power	Pin		0	dBm
Supply voltage	Vcc	0	4.5	V
Storage temperature	Tstg	-55	+150	°C
Junction temperature	Tj		+150	°C
Electrostatic discharge: Human Body Model (HBM), Class 1A	ESD		250	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.

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

Table 3. SKY65724-11 Recommended Operating Conditions

Parameter	Symbol	Minimum	Typical	Maximum	Units
Frequency range	f	1559	1575	1606	MHz
Supply voltage (measured at terminals of Evaluation Board)	Vcc	1.62	1.8	3.6	V
LNA enable: Enable (high) Disable (low)	 LNA_{ENABLE} $LNA_{DISABLE}$	 Vcc - 0.3	 0	 Vcc 0.3	 V V
Case operating temperature	Tc	-40		+85	°C

Table 4. SKY65724-11 Electrical Specifications[1]
(VCC = 1.8 V, VEN = 1.8 V, f = 1575 MHz, TC= +25 °C, Unless Otherwise Noted)

Parameter	Symbol	Test Condition	Min	Typ	Max	Units
Small signal gain	|S21|	P_{IN} = -30 dBm		15.5		dB
Noise figure	NF			1.8[2]		dB
In-band third order input intercept point	IIP3	f = 1575 MHz @ P_N = -30 dBm f = 1576 MHz @ P_{IN} = -30 dBm		-11		dBm
1 dB input compression point	IP1dB			-20		dBm
Reverse isolation	|S12|	P_{IN} = -30 dBm		30		dB
Input return loss	|S11|	P_{IN} = -30 dBm		8		dB
Output return loss	|S22|	P_{IN} = -30 dBm		9		dB
Supply current	I_{CC}	No RF		3.8		mA
Shutdown current	I_{LEAK}	No RF, V_{EN} = 0 V		0.1		mA
Out-of-band rejection:	OOB	P_{IN} = 0 dBm: @ 777 to 798 MHz @ 806 to 928 MHz @ 1710 to 1980 MHz @ 2400 to 2500 MHz @ 5160 to 5560 MHz		 55 55 45 45 45		 dBc dBc dBc dBc dBc
Band 13 2nd harmonic	$B13_{2fo}$	P_{IN} = +15 dBm @ 787.76 MHz measured @ 1575.52 MHz output referred		-43		dBm
LNA turn-on time	t_{ON}	P_{IN} = -30 dBm, V_{CC} = 1.8 V, 50% of V_{ENABLE} to 90% final RF power		1		µs
LNA turn-off time	t_{OFF}	P_{IN} = -30 dBm, V_{CC} = 1.8 V, 50% of V_{ENABLE} to 10% final RF power		0.2		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.
2. 0.1 dB has been de-embedded for input connector and trace loss.

Table 5. SKY65724-11 Electrical Specifications[1]

Parameter	Symbol	Test Condition	Min	Typ	Max	Units
Small signal gain	|S21|		13	16		dB
Noise figure	NF		1	1.8[2]	3	dB
In-band third order input intercept point	IIP3	f = 1575 MHz @ P_N = -30 dBm f = 1576 MHz @ P_{IN} = -30 dBm		-10.5		dBm
1 dB input compression point	IP1dB	@ 1575 MHz		-19		dBm
Reverse isolation	|S12|	P_{IN} = -30 dBm		29		dB
Input return loss	|S11|	P_{IN} = -30 dBm		7.5		dB
Output return loss	|S22|	P_{IN} = -30 dBm		9		dB
Supply current	ICC	No RF	3	4.2	6	mA
Shutdown current	I_{LEAK}	No RF, V_{EN} =0 V		0.1	1.0	mA
Out-of-band rejection	OOB	P_{IN} = 0 dBm (in-band referred): @ 777 to 798 MHz @ 806 to 928 MHz @ 1710 to 1980 MHz @ 2400 to 2500 MHz @ 5160 to 5560 MHz		 55 55 45 45 45		 dBc dBc dBc dBc dBc
Band 13 2nd harmonic	$B13_{2fo}$	PIN = +15 dBm @ 787.76 MHz measured @ 1575.52 MHz output referred		-45		dBm
LNA turn-on time	tON	PIN = -30 dBm, VCC = 2.8 V, 50% of VENABLE to 90% final RF power		1	2	µs
LNA turn-off time	tOFF	PIN = -30 dBm, VCC = 2.8 V, 50% of VENABLE to 10% final RF power		0.2	1	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.
2. 0.1 dB has been de-embedded for input connector and trace loss.

Evaluation Board Description

The SKY65724-11 Evaluation Board is used to test the performance of the SKY65724-11 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.

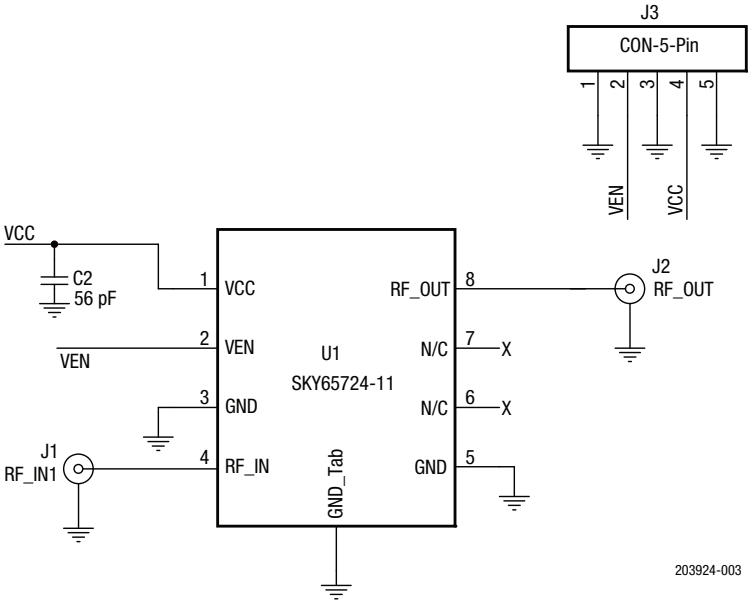


Figure 3. SKY65724-11 Application Schematic

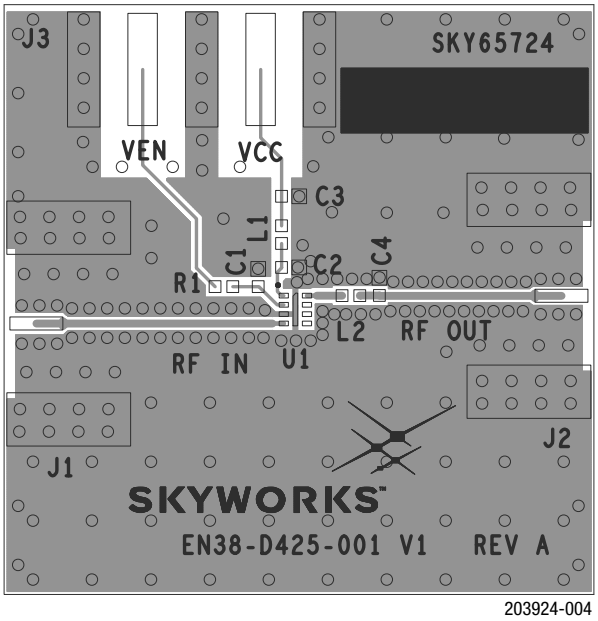


Figure 4. SKY65724-11 Evaluation Board Assembly Diagram

Table 6. SKY65724-11 Evaluation Board Bill of Materials

Component	Size	Value	Manufacturer	Mfr Part Number
C2	0402	56 pF	MuRata	GRM0222C1H560JA02
C1, C3, C4	DNI			
R1, L1, L2	0402	0 Ω	Panasonic ECG	ERJ2GE0R00X

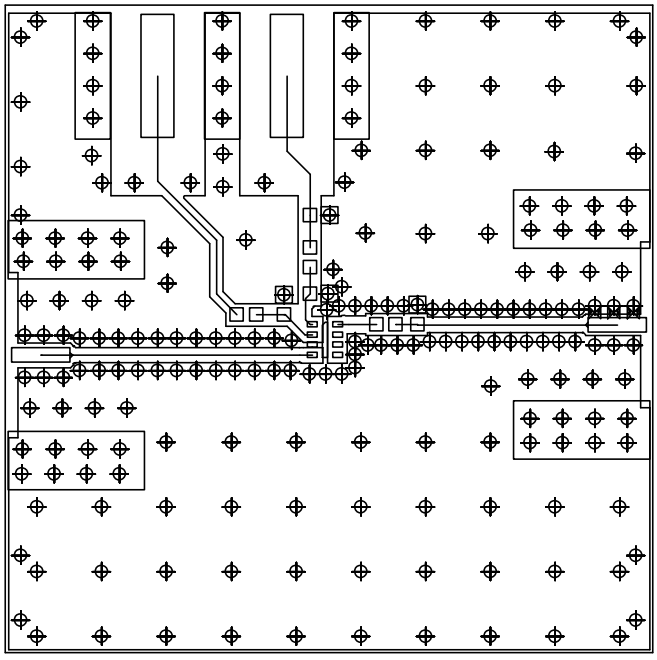


Figure 5. Evaluation Board Layer Details

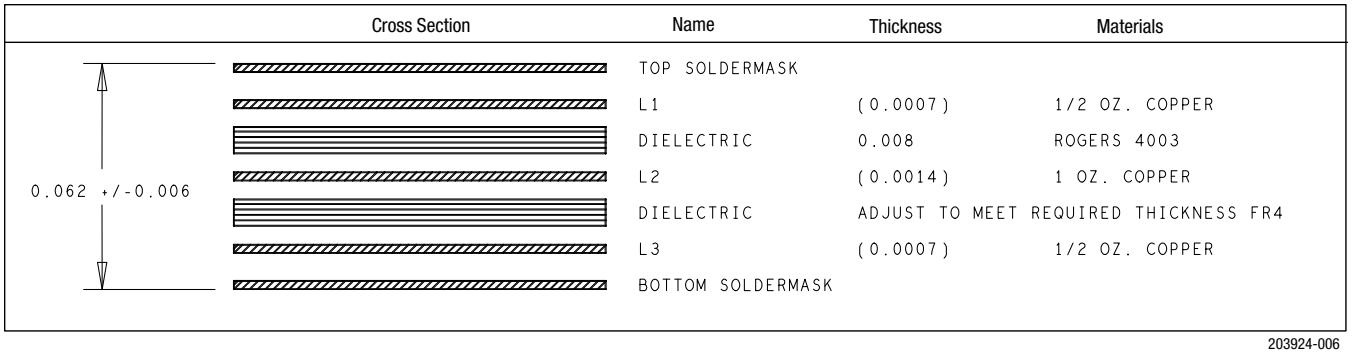


Figure 6. Layer Detail Physical Characteristics

Package Dimensions

The PCB layout footprint for the SKY65724-11 is provided in Figure 7. Typical part marking 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

Since the device package is sensitive to moisture absorption, it is baked and vacuum packed before shipping. 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 SKY65724-11 is rated to Moisture Sensitivity Level 3 (MSL3) 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.

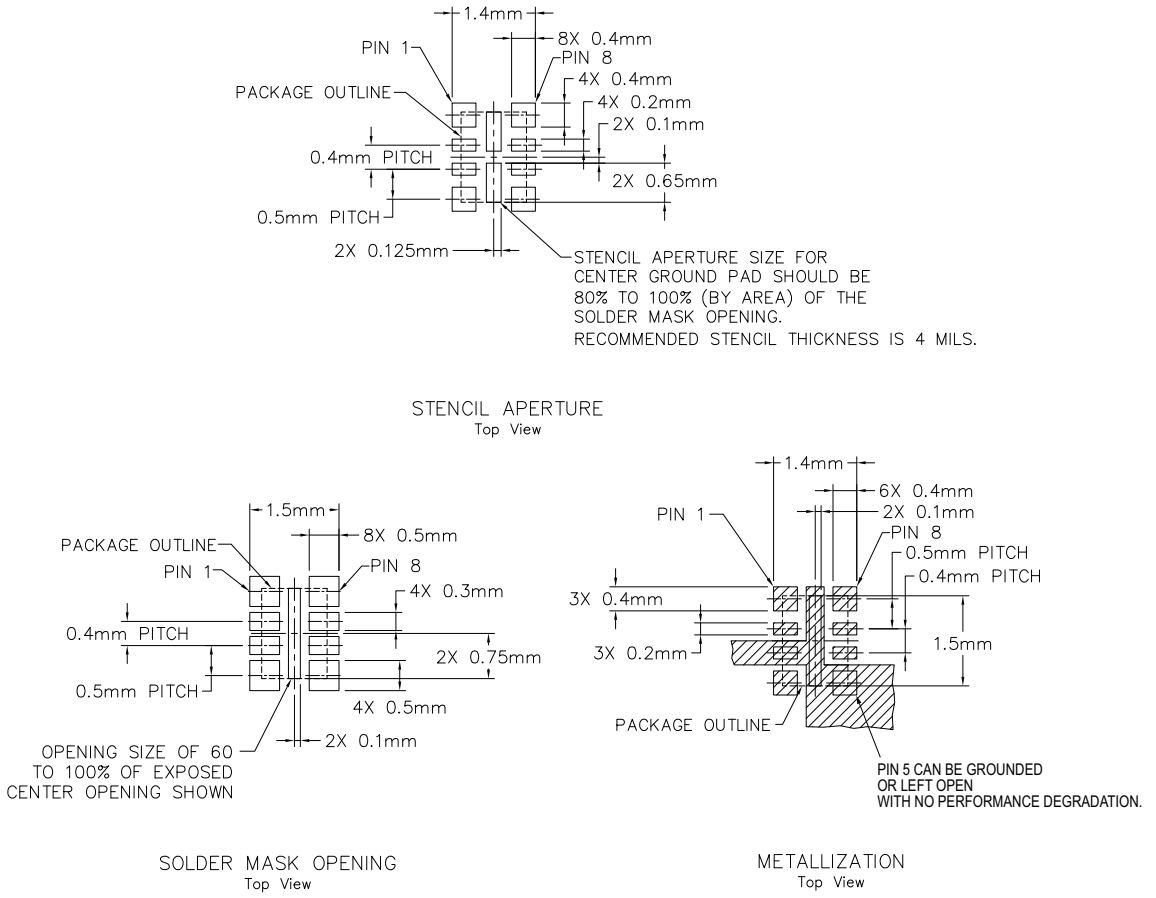


Figure 7. SKY65724-11 PCB Layout Footprint

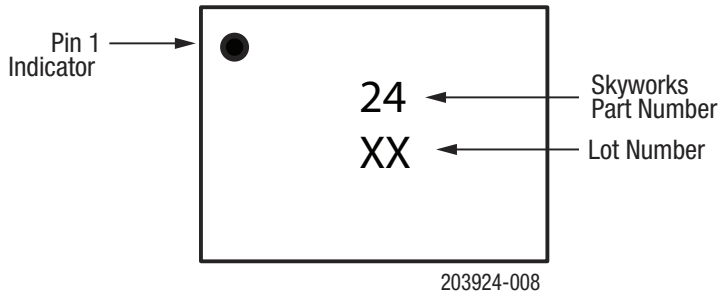


Figure 8. SKY65724-11 Typical Part Marking (Top View)

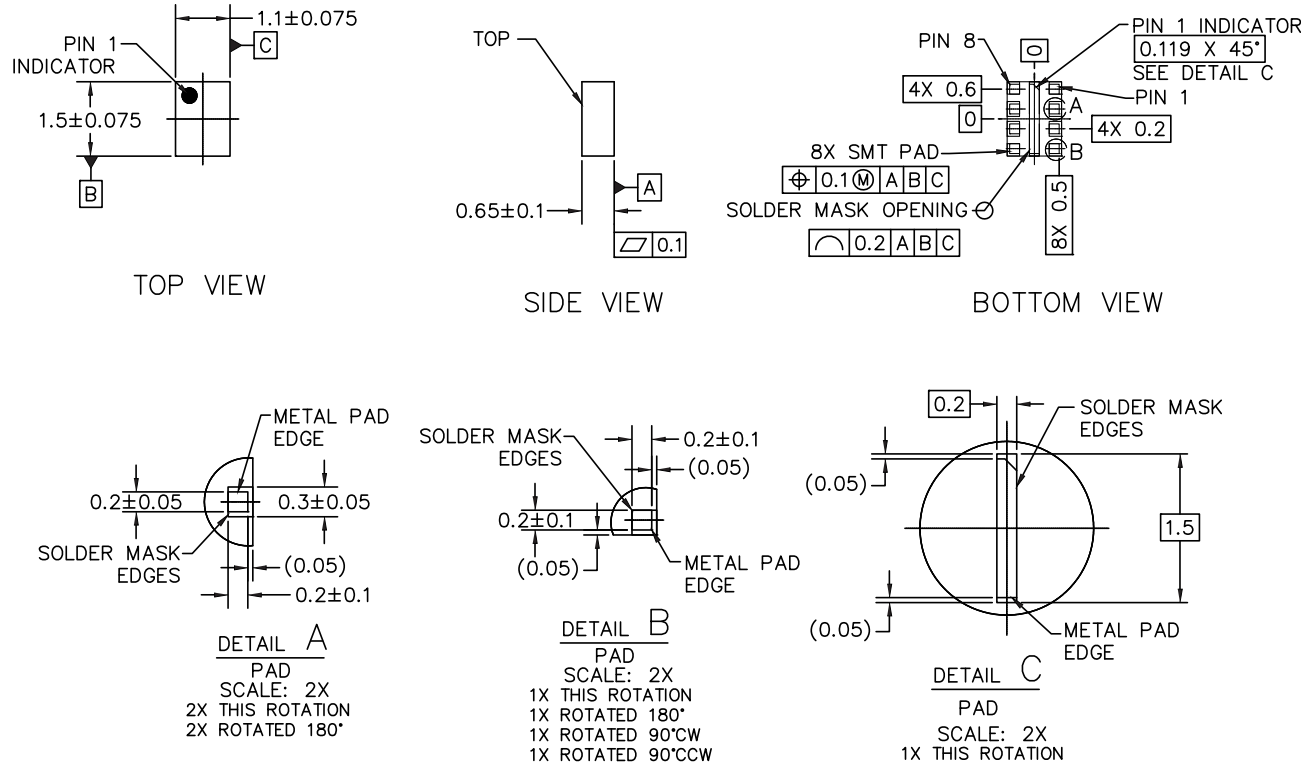
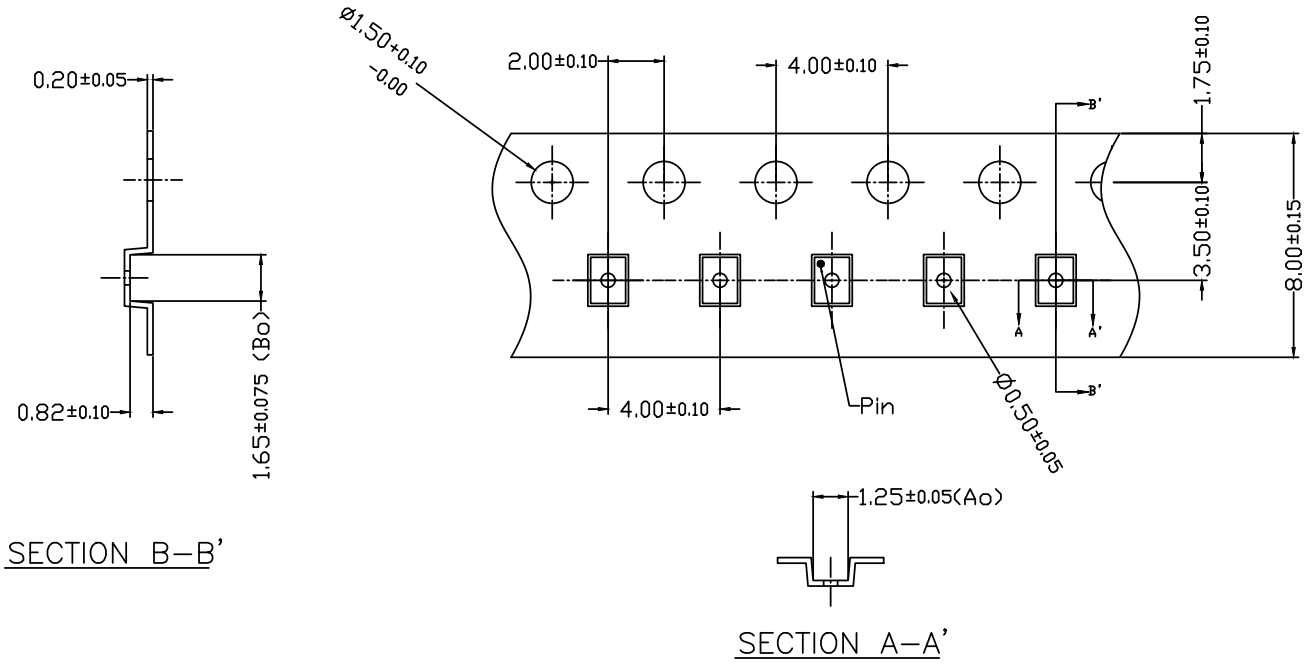


Figure 9. SKY65724-11 Package Dimensions



10 SPROCKET HOLE PITCH CUMULATIVE TOLERANCE : ±0.20mm
Ao & Bo MEASURED ON PLANE 0.30mm ABOVE THE BOTTOM OF THE POCKET.
ALL DIMENSIONS ARE IN MILLIMETERS.

203924-010

Figure 10. SKY65724-11 Tape and Reel Dimensions

Ordering Information

Part Number	Part Description	Evaluation Board Part Number
SKY65724-11	Low-Noise Amplifier Front-End Module with Pre-Filter for BDS/GPS/GNSS Applications	SKY65724-11EK1