

SKY85608-11: 5 GHz Switch/Low-Noise Amplifier Front End

Applications

- Wi-Fi®-enabled handsets, tablets, and mobile systems
- System-in-Package (SiP) modules for embedded systems

Features

- Integrates an SPDT switch and LNA with bypass mode
- Receive gain: 12 dB
- Noise figure: 2.0 dB
- Transmit path loss: 0.6 dB
- Small DFN (8-pin, 1.5 x 1.5 mm) package (MSL1, 260 °C per JEDEC-J-STD-020)
- For RoHS and other product compliance information, see the [Skyworks Certificate of Conformance](#).

Description

The SKY85608-11 integrates a single-pole, double-throw (SPDT) switch and low-noise amplifier (LNA) with a bypass mode in an ultra-compact package. The device is capable of switching between WLAN receive and WLAN transmit.

The SKY85608-11 is provided in a small, 8-pin, 1.5 x 1.5 mm Dual Flat No-Lead (DFN) package. 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](#).

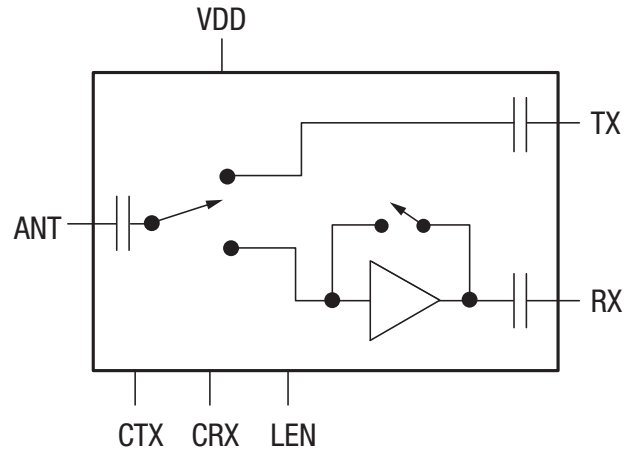


Figure 1. Functional Block Diagram

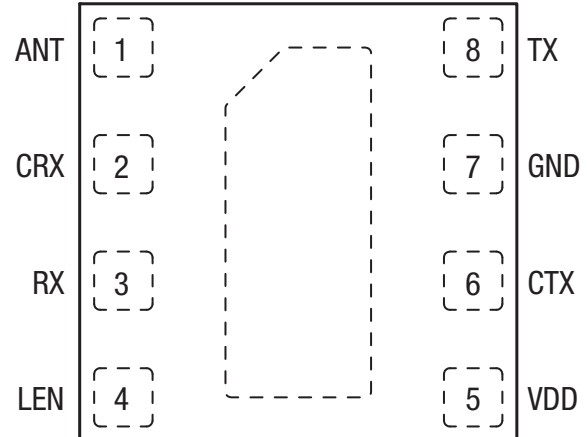


Figure 2. Pinout (Top View)

Table 1. Pinout Descriptions

Pin	Name	Description	Pin	Name	Description
1	ANT	Antenna port	5	VDD	Supply voltage
2	CRX	Control signal	6	CTX	Control signal
3	RX	LNA output	7	GND	Ground
4	LEN	Control signal	8	TX	Transmit input

Electrical and Mechanical Specifications

The absolute maximum ratings of the SKY85608-11 are provided in Table 2. The recommended operating conditions are specified in Table 3, and electrical specifications are provided in Table 4, Table 5, and Table 6. The state of the SKY85608-11 is determined by the logic provided in Table 7.

Table 2. Absolute Maximum Ratings¹

Parameter	Symbol	Minimum	Maximum	Units
Supply voltage	V _{BAT} , V _{CC}	−0.3	+5.5	V
DC input on control pins	V _{IN}	−0.3	+3.6	V
LNA input power (RXOUT terminated in 50 Ω match)	P _{IN}		+5	dBm
Operating temperature	T _A	−40	+85	°C
Storage temperature	T _{STG}	−40	+140	°C

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: 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 when handling or transporting. Static charges may easily produce potentials of several kilovolts on the human body or equipment, which can discharge without detection. Industry-standard ESD handling precautions should be used at all times.

Table 3. Recommended Operating Conditions¹

Parameter	Symbol	Minimum	Typical	Maximum	Units
Supply voltage relative to ground (= 0 V)	V _{DD}	3.0	3.6	5.0	V
Control voltage					
High	V _{IH}	1.6		3.6	V
Low	V _{IL}	0		0.4	V
Control current					
High	I _{IH}			5	μA
Low	I _{IL}			1	μA
Operating temperature	T _A	−40	+25	+85	°C

1. Exposure to maximum rating conditions for extended periods may reduce device reliability. Exceeding any of the limits listed here may result in permanent damage to the device.

Table 4. Electrical Specifications: DC Characteristics¹

(V_{DD} = 3.6 V, T_A = +25 °C, All Unused Ports Terminated with 50 Ω, Unless Otherwise Noted)

Parameter	Symbol	Test Condition	Minimum	Typical	Maximum	Units
Supply current	I _{CC}	LNA enabled		10.5	15	mA
		Transmit mode		30	40	μA
		Bypass mode		30	40	μA
		All off		9	15	μA

1. Performance is assured only under the conditions listed in this table.

Table 5. Electrical Specifications: Transmit (TXIN to ANT) Characteristics¹

(V_{DD} = 3.6 V, T_A = +25 °C, All Unused Ports Terminated with 50 Ω, Unless Otherwise Noted)

Parameter	Symbol	Test Condition	Minimum	Typical	Maximum	Units
Frequency	f		4900		5925	MHz
Insertion loss	TX _{IL}	Insertion loss from TXIN input to ANT port		0.6	1	dB
1 dB input compression point (TXIN port)	IP1dB		+29	+31		dBm
Transmit input return loss (TXIN port)	S11			−14	−8	dB
Output return loss (ANT port)	S22			−14	−8	dB
TX to RXOUT isolation, bypass (loopback) mode			27	33		dB

1. Performance is assured only under the conditions listed in this table.

Table 6. Electrical Specifications: Receive (ANT to RXOUT Port) Characteristics¹(V_{DD} = 3.6 V, T_A = +25 °C, All Unused Ports Terminated with 50 Ω, Unless Otherwise Noted)

Parameter	Symbol	Test Condition	Minimum	Typical	Maximum	Units
Frequency	f		4900		5925	MHz
Small signal gain	S21	LNA enabled	10	12	14	dB
		Bypass mode		-7		dB
LNA gain step	Gain_STEP	Gain step change between LNA normal and LNA bypass modes	18	19.5	21	dB
Gain flatness		Over 80 MHz			±0.5	dB
		Full band			±1.0	dB
Noise figure	NF	LNA enabled		2	2.4	dB
		Bypass mode				
Third order input intercept point	IIP	LNA enabled	+1	+4		dBm
		Bypass mode	+17	+20		dBm
Second order input intercept point	IIP2	@ 2.6 GHz		+45		dBm
Receive input return loss	S11			-9	-6	dB
Receive output return loss	S22			-14	-6	dB
Receive to transmit switching time	t _{RX-TX}	10% to 90%			300	ns
Transmit to receive switching time	t _{TX-RX}	10% to 90%			500	ns
Receive gain switching time	t _{RX}	10% to 90%			400	ns

1. Performance is assured only under the conditions listed in this table.

Table 7. Control Logic

Description	CRX (Pin 2)	LEN (Pin 4)	CTX (Pin 6)
All off	0	0	0
WLAN receive	1	1	0
WLAN receive bypass	1	0	0
WLAN transmit	0	0	1

Evaluation Board (EVB) Description

The SKY85608-11 Evaluation Board (EVB) is used to test the performance of the SKY85608-11 LNA FEM. An EVB schematic diagram is provided in Figure 3. A photograph of the EVB is shown in Figure 4.

Evaluation Board Setup Procedure

1. Connect the system ground to pin 2 of connector J4.
2. Apply 3.3 V to VDD pin 6 or 12 of connector J4.
3. Refer to Table 7 to set the device in the desired mode of operation. Set CRX, CTX, and LEN to appropriate VIL and VIH voltages, as specified in Table 3.
4. Transmit performance is monitored by applying an RF signal to the connector J1 (TX) and measuring the output power at the antenna port connector J2 (ANT).
5. Monitor performance in either high gain or bypass mode by applying an RF signal to the antenna port connector J2 (ANT) and measuring the output power at the receive port connector J3 (RX).

Evaluation Board Losses

The total track losses from the RF connectors of the EVB to the pins of the SKY85608-11 device are:

ANT: 0.25 dB

TX: 0.25 dB

RX: 0.25 dB

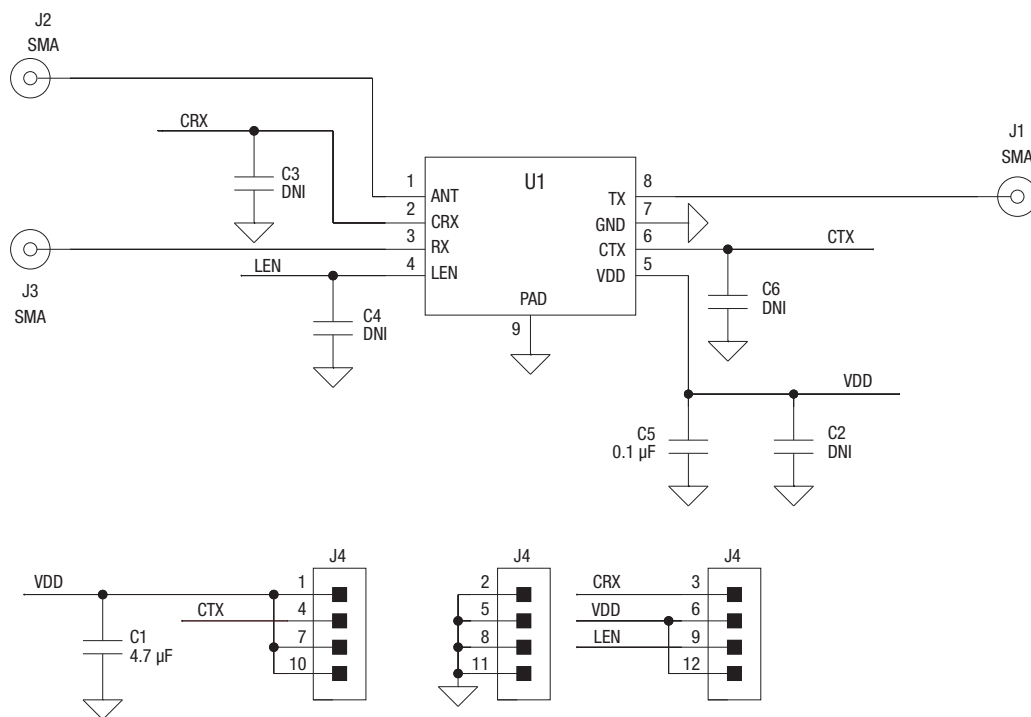


Figure 3. Evaluation Board Schematic

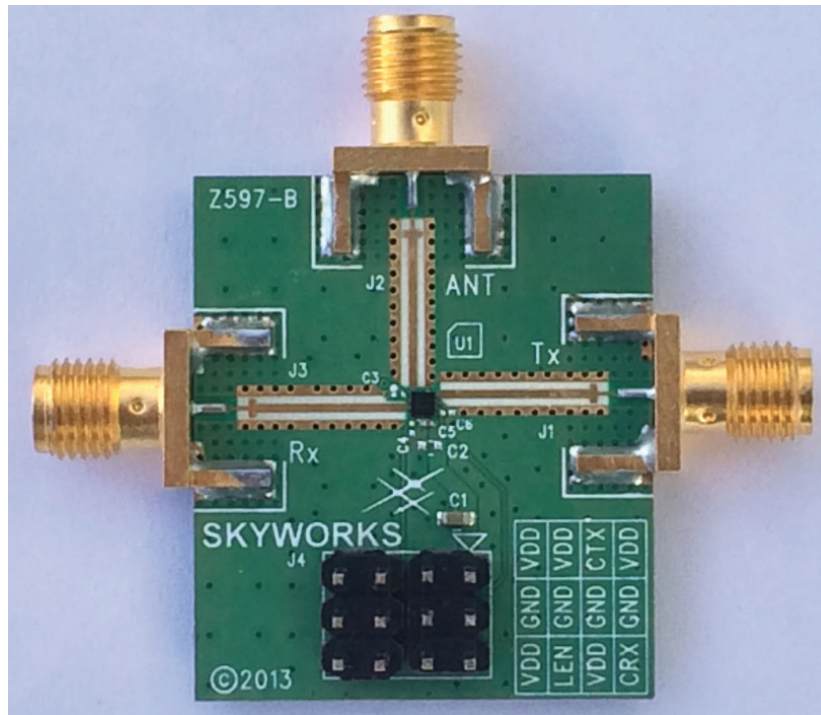


Figure 4. Evaluation Board

Package Dimensions

A typical part marking drawing and sample photograph are shown in [Figure 5](#). Package dimensions are shown in [Figure 6](#). The PCB layout footprint for the SKY85608-11 is provided in [Figure 7](#), and tape and reel information is provided in [Figure 8](#).

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 SKY85608-11 is rated to Moisture Sensitivity Level 1 (MSL1) at 260 °C. The device can be used for lead or lead-free soldering. For additional information, refer to the Skyworks Application Note, “PCB Design & SMT Assembly/Rework Guidelines for MCM-L Packages,” document number 101752.

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.

Package and Handling Information

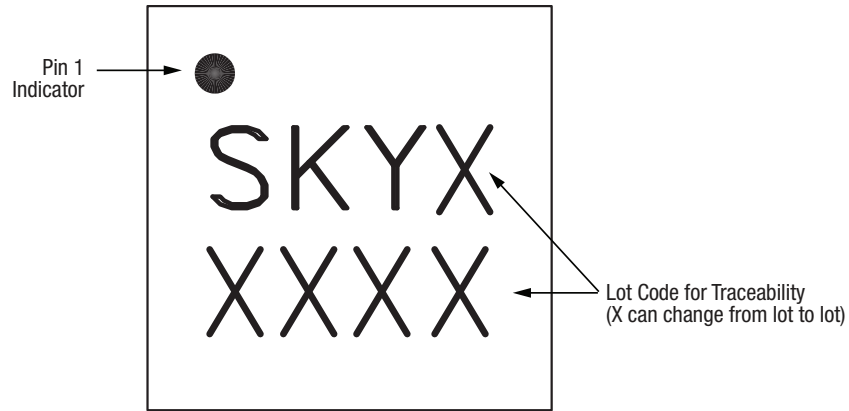
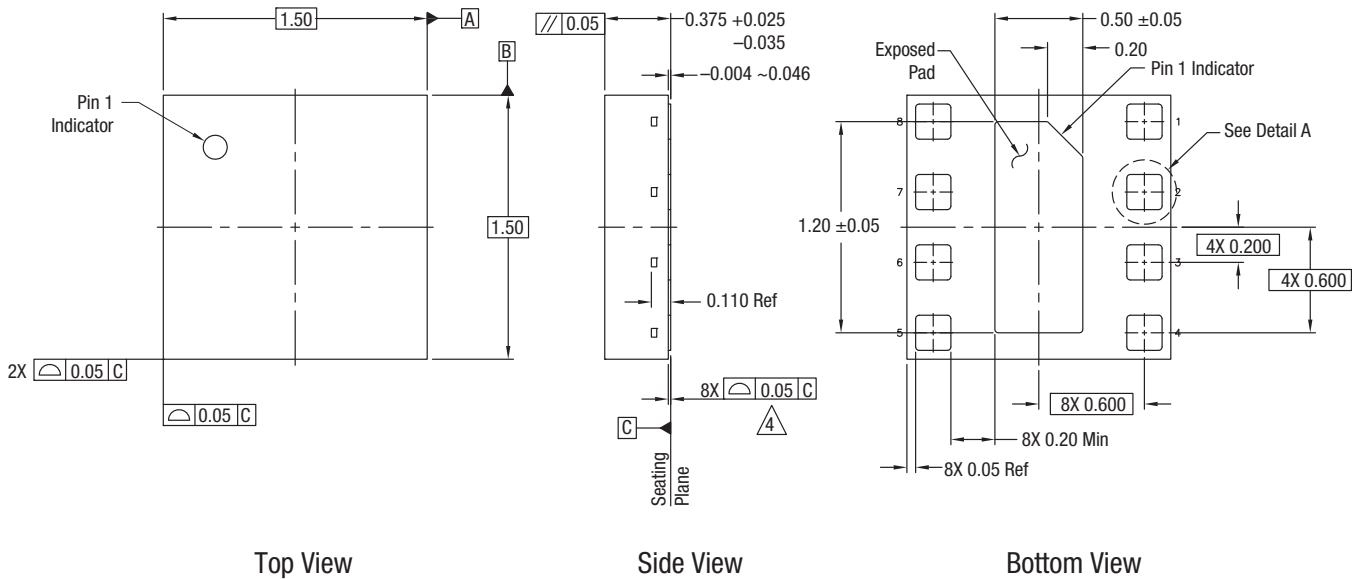


Figure 5. Typical Part Marking



Notes:

1. Dimensions and tolerances according to ASME Y14.5M-1994.
2. All measurements are in millimeters.
3. Unless otherwise specified, the following values apply:

Decimal Tolerance: Angular Tolerance:
 X.X (1 place) ± 0.1 mm $\pm 1/2^\circ$
 X.XX (2 places) ± 0.05 mm
 X.XXX (3 places) ± 0.025 mm

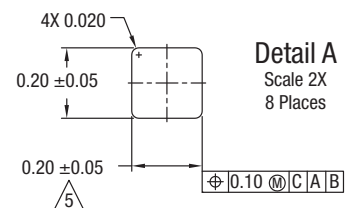
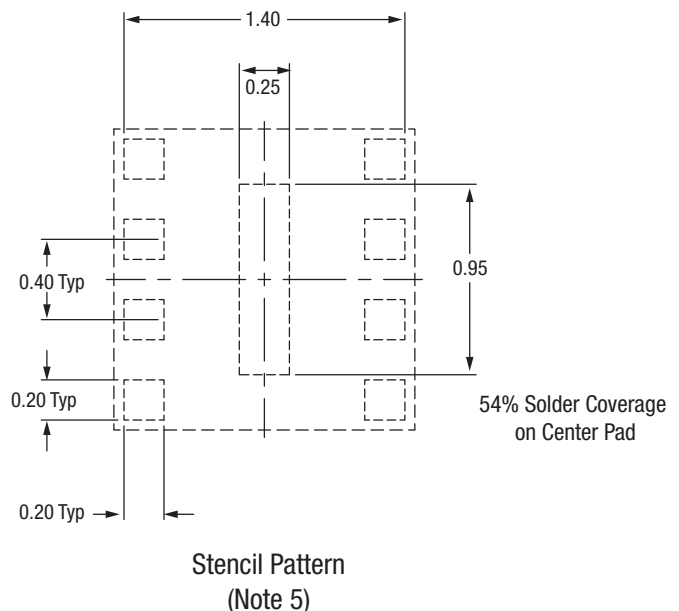
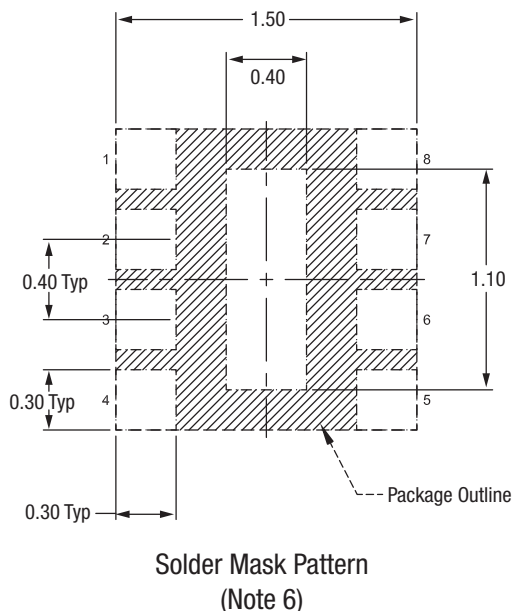
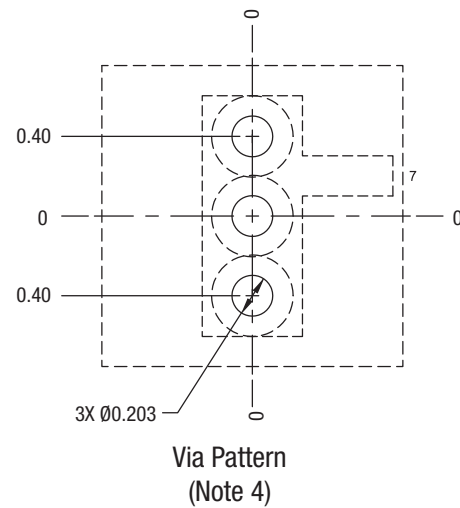
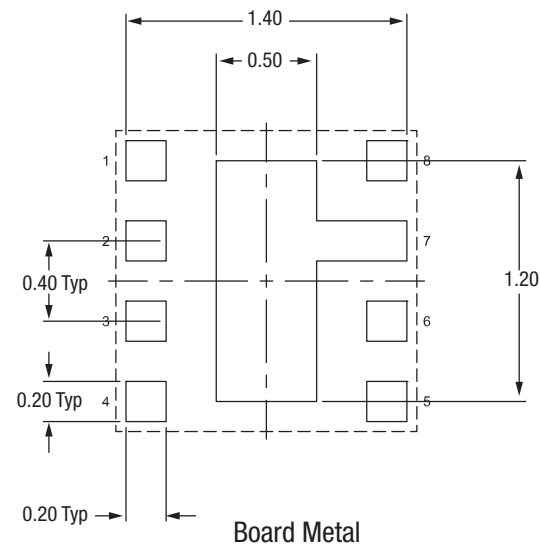


Figure 6. Package Dimensions



Notes:

1. All dimensions are in millimeters
2. Dimensions and tolerances according to ASME Y14.5M-1994
3. Unless specified, dimensions are symmetrical about center lines.
4. Via hole recommendations: 0.025 mm Cu via wall plating (minimum), via holes to be filled with conductive paste and plated over.
5. Stencil recommendations: 0.10 mm stencil thickness, laser cut apertures, trapezoidal walls and rounded corners offer better paste release.
6. Solder mask recommendations: contact board fabricator for recommended solder mask offset and tolerance.

Figure 7. PCB Layout Footprint (Top View)

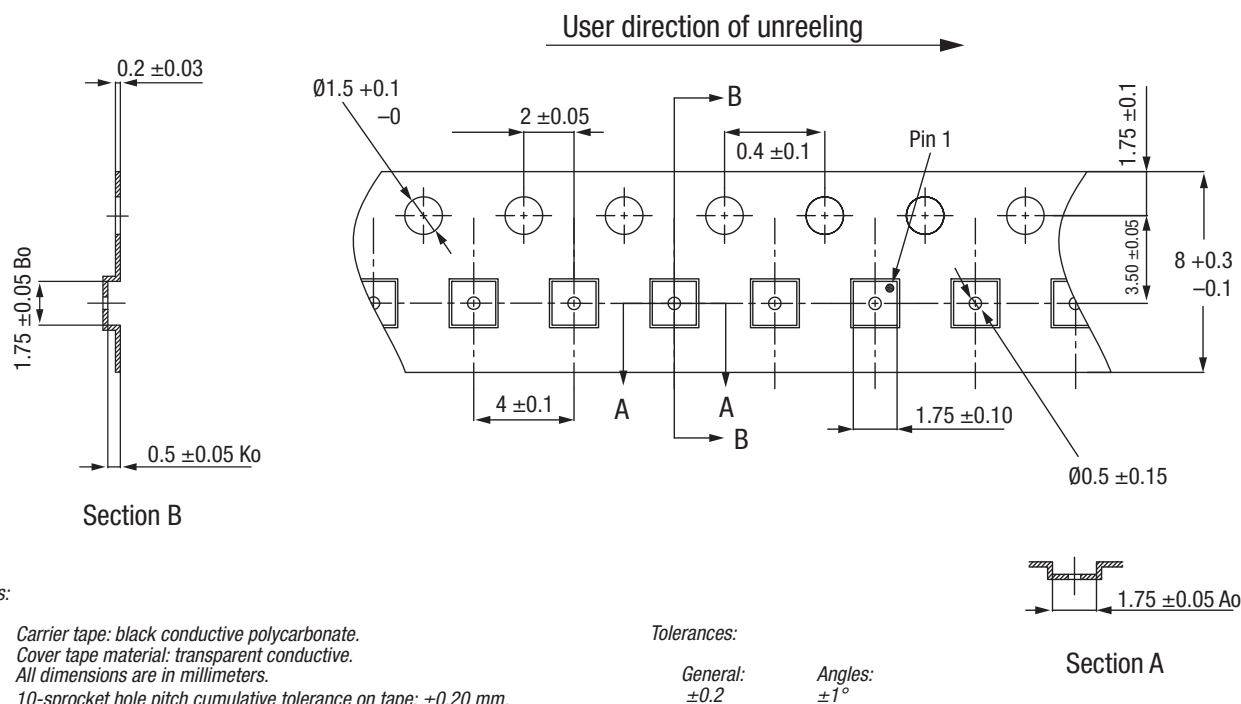


Figure 8. Tape and Reel Information

Ordering Information

Part Number	Description	Evaluation Board Part Number
SKY85608-11	5 GHz Switch/Low-Noise Amplifier Front End	SKY85608-11EK1

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