DATA SHEET

SKYA21040: 2.4 GHz 802.11ac AEC-Q100 Switch / Low-Noise Amplifier Front End

Applications

- Automotive embedded Wi-Fi and vehicle-to-vehicle (V2V) systems

Features

- Integrates an SP3T switch and LNA with bypass mode
- AEC-Q100 Grade 2 qualified (-40 °C to +105 °C)
- Extended production life
- Level-3 PPAP available
- IMDS material declaration supported
- Receive gain: 14 dB
- Noise figure: 1.9 dB
- Transmit/Bluetooth® path loss: 0.65 dB
- Small DFN (8-pin, 1.5 x 1.5 mm) package (MSL1, 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.

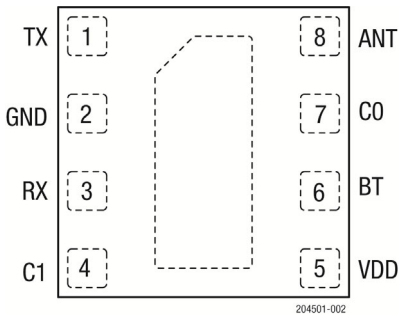


Figure 2. SKYA21040 Pinout (Top View)

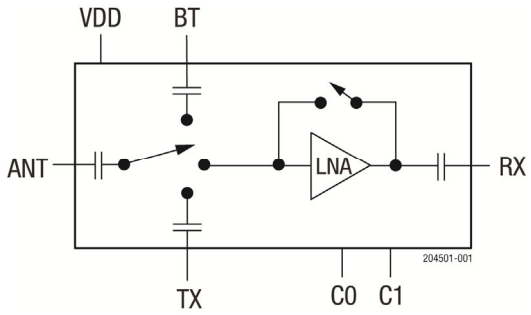


Figure 1. SKYA21040 Block Diagram

Description

The SKYA21040 integrates a single-pole, triple-throw (SP3T) switch and low-noise amplifier (LNA) with a bypass mode in an ultra-compact package. The device is capable of switching between WLAN receive, WLAN transmit, and Bluetooth.

The SKYA21040 is provided in a small Dual Flat No-Lead (DFN) 8-pin, 1.5 x 1.5 mm 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.

Table 1. SKYA21040 Signal Descriptions

Pin	Name	Description	Pin	Name	Description
1	TX	Transmit input	5	VDD	Supply voltage
2	GND	Ground	6	BT	Bluetooth port
3	RX	LNA output	7	C0	Control signal
4	C1	Control signal	8	ANT	Antenna port

Electrical and Mechanical Specifications

The absolute maximum ratings of the SKYA21040 are provided in Table 2. The recommended operating conditions are specified in Table 3, and electrical specifications are provided in Tables 4 to 8.

Table 2. SKYA21040 Absolute Maximum Ratings[1]

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 ohm match)	P_{IN}	+5		dBm
Operating temperature	T_A	-40	+105	°C
Storage temperature	T_{STG}	-40	+140	°C
Electrostatic discharge: Human Body Model (HBM)	ESD		 1500	 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**: 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 Conditions

Parameter	Symbol	Min	Typ	Max	Units
Supply voltage relative to ground (= 0 V)	V_{DD}	3.0	3.6	5.0	V
Control voltage: High Low	 V_{IH} V_{IL}	 1.6 0		 3.6 0.4	 V V
Control current: High Low	 I_{IH} I_{IL}			 5 1	 uA uA
Operating temperature	T_A	-40	+25	+105	°C

Table 4. SKYA21040 Electrical Specifications: DC Characteristics[1]
(V_{DD} = 3.6 V, T_A = +25 °C, All Unused Ports Terminated with 50 ohms, Unless Otherwise Noted)

Parameter	Symbol	Test Condition	Min	Typ	Max	Units
Supply current	I_{CC}	LNA enabled, -40 to +105 °C Transmit/BT mode Bypass mode All off		9 8 8 8	13.5 10 10 10	mA µA µA µA

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

Table 5. SKYA21040 Electrical Specifications: Transmit (TX to ANT) Characteristics[1]
(V_{DD} = 3.6 V, T_A = +25 °C, All Unused Ports Terminated with 50 ohms, Unless Otherwise Noted)

Parameter	Symbol	Test Condition	Min	Typ	Max	Units
Frequency	f		2400		2500	MHz
Insertion loss	TX_{IL}	From TX to ANT, -40 to +105 °C		0.65	1.3	dB
1 dB input compression point (TX port)	IP1dB			+31		dBm
Transmit input return loss (TX port)	S11			-20		dB
Output return loss (ANT port)	S22			-20		dB
ANT to RX isolation, TX (loopback) mode				43		dB
TX to ANT isolation: All other modes	RX_{ISO}			26		dB

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

Table 6. SKYA21040 Electrical Specifications: Transmit (BT to ANT) Characteristics[1]
(V_{DD} = 3.6 V, T_A = +25 °C, All Unused Ports Terminated with 50 ohms, Unless Otherwise Noted)

Parameter	Symbol	Test Condition	Min	Typ	Max	Units
Frequency	f		2400		2500	MHz
Insertion loss	BT_{IL}	From BT to ANT, -40 to +105 °C		0.65	1.3	dB
1 dB input compression point (BT port)	IP1dB			+31		dBm
Transmit input return loss (BT port)	S11			-20		dB
Output return loss (ANT port)	S22			-20		dB
BT to ANT isolation: All other modes	BT_{ISO}			26		dB

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

Table 7. SKYA21040 Electrical Specifications: Receive (ANT to RX Port) Characteristics[1]
(V_{DD} = 3.6 V, T_A = +25 °C, All Unused Ports Terminated with 50 ohms, Unless Otherwise Noted)

Parameter	Symbol	Test Condition	Min	Typ	Max	Units
Frequency	f		2400		2500	MHz
Small signal gain	S21	LNA enabled LNA enabled, -40 to +105 °C Bypass mode	12 12	14 14 -7.5	16 16.5	dB dB dB
LNA gain step	$Gain_{STEP}$	Gain step change between LNA enabled and LNA bypass modes	19.5	21.5	23.5	dB
Gain flatness		Over 20 MHz Full band			±0.25 ±0.50	dB dB
Noise figure	NF	LNA enabled Bypass mode		1.9 7.5		dB dB
Third order input intercept point	IIP3	LNA enabled, -40 to +105 °C Bypass mode	+1.5 +24	+5 +26		dBm dBm
Receive input return loss	S11			-11		dB
Receive output return loss	S22			-15		dB
Receive to transmit (or BT) switching time	$t_{RX-TX(BT)}$	10% to 90%			400	ns
Transmit (or BT) to receive switching time	$t_{TX(BT)-RX}$	10% to 90%			400	ns
LNA turn-on time	$t_{OFF} - t_{ON}$	10% to 90%			400	ns
LNA turn-off time	$t_{ON} - t_{OFF}$	90% to 10%			200	ns
RX to ANT isolation: Non-RX modes	RX_{ISO}			40		dB

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

Table 8. SKYA21040 Control Logic[1]

Mode	C0	C1
WLAN receive LNA	1	1
WLAN receive bypass	1	0
Bluetooth	0	0
WLAN transmit	0	1

1 "0" = 0 V to +0.4 V. "1" = +1.6 V to +3.6 V. Any state other than described in this table places the switch into an undefined state. An undefined state will not damage the device.

Evaluation Board Description

The SKYA21040 Evaluation Board is used to test the performance of the SKYA21040. An Evaluation Board schematic diagram is provided in Figure 3. A photograph of the Evaluation Board is shown in Figure 4. Table 9 lists the Evaluation Board Bill of Materials (BoM).

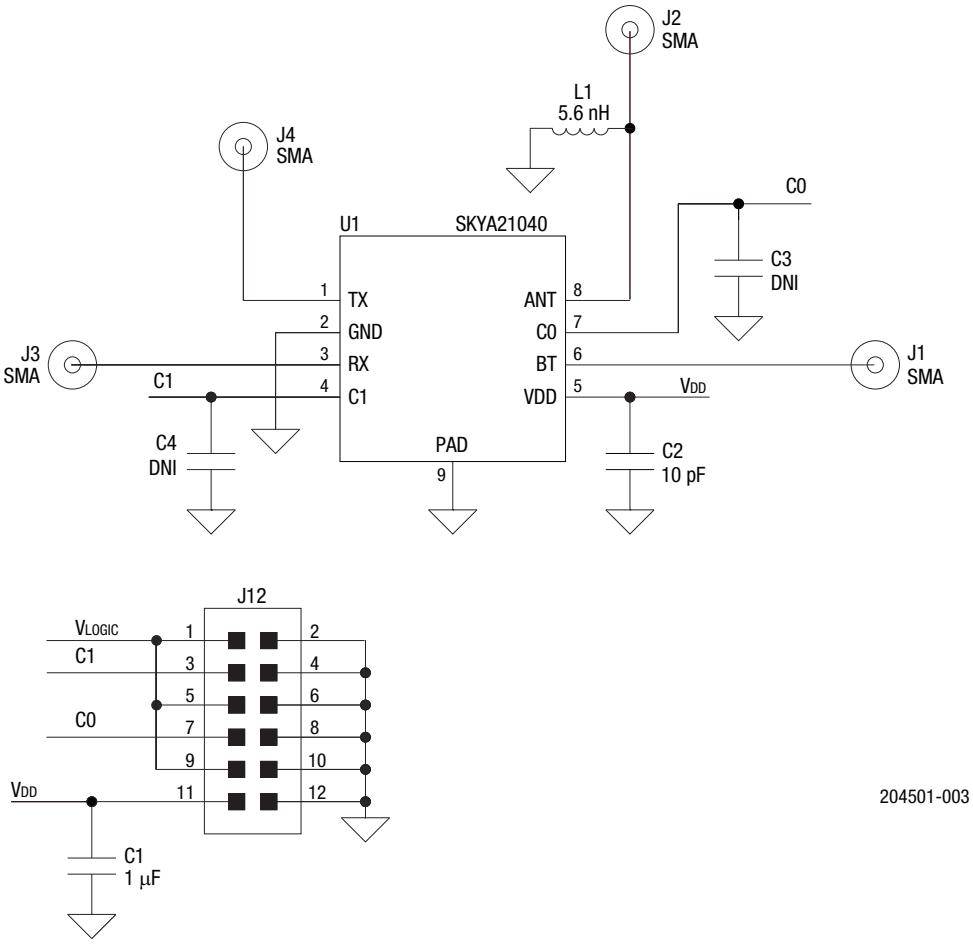


Figure 3. SKYA21040 Evaluation Board Schematic

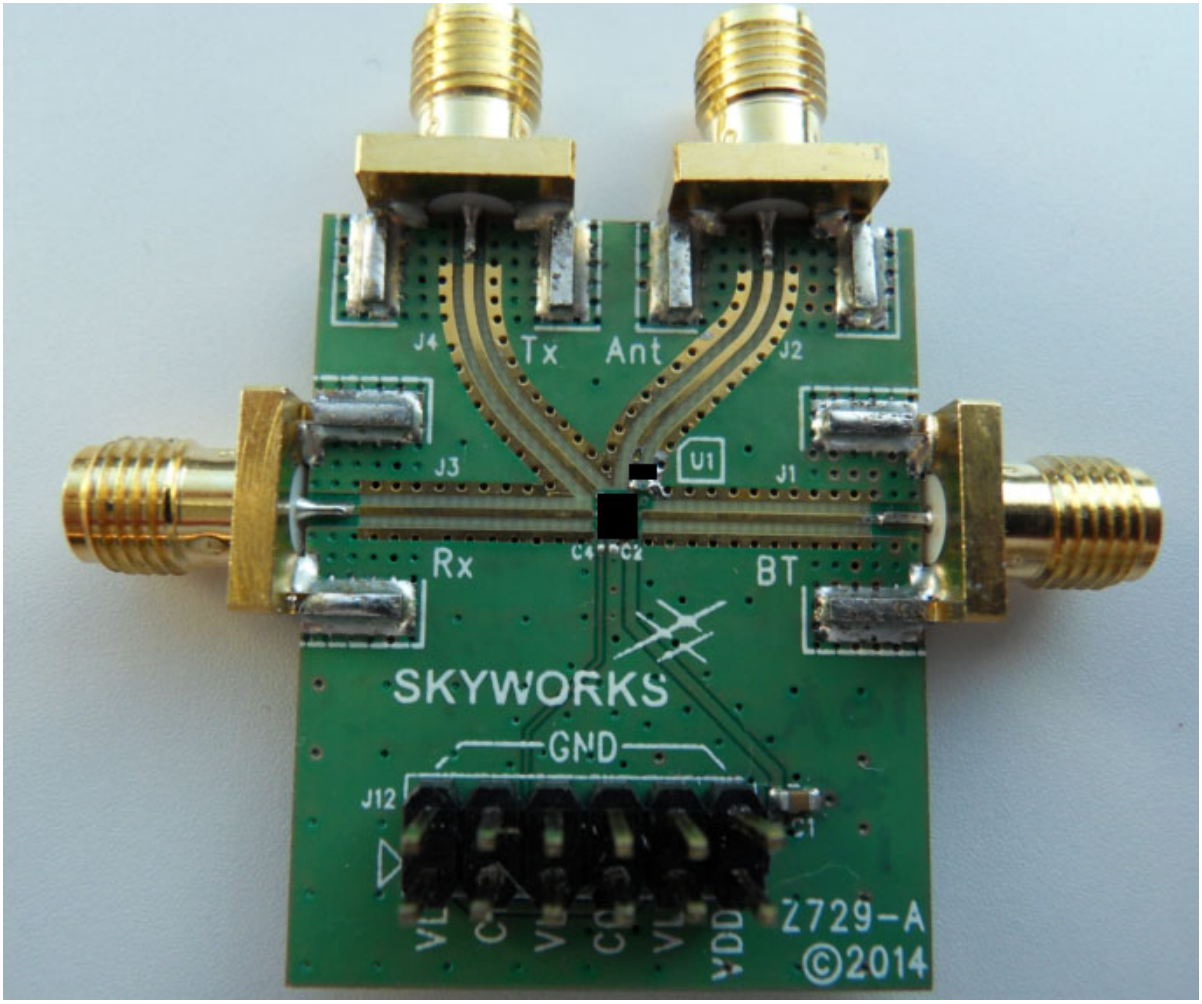


Figure 4. SKYA21040 Evaluation Board

Table 9. SKYA21040 Evaluation Board Bill of Materials (BoM)

Component	Value	Manufacturer	Mfr Part Number	Package	Description
C1	1 µF	muRata	GRM188R61A105KA61	0603	Multilayer ceramic
L1	5.6 nH	muRata	LQP03TG5N6H02	0201	Chip coils for high frequency film type
C2	10 pF	muRata	GRM0335C1E100JD01	0201	Multilayer ceramic

Package Dimensions

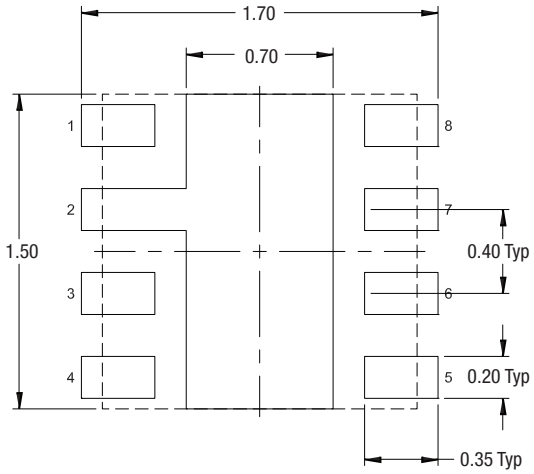
The PCB layout footprint for the SKYA21040 is provided in Figure 5. Typical part markings are shown in Figure 6. Package dimensions are shown in Figure 7, and tape and reel dimensions are provided in Figure 8.

Package and Handling Information

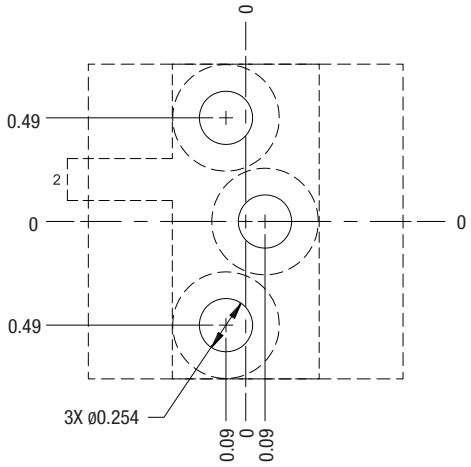
Instructions on the shipping container label regarding exposure to moisture after the container seal is broken must be followed. Otherwise, problems related to moisture absorption may occur when the part is subjected to high temperature during solder assembly.

The SKYA21040 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.

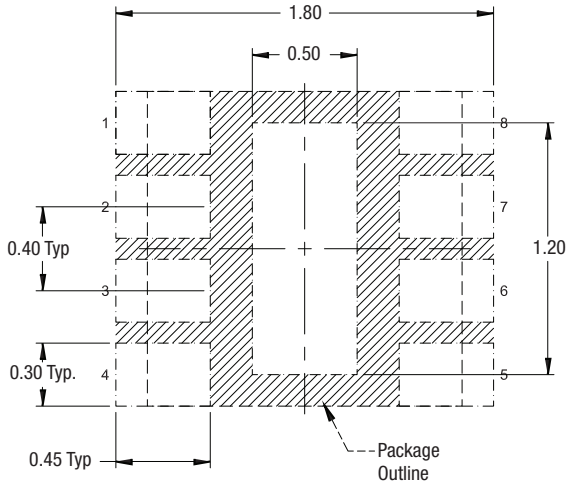
Care must be taken when attaching this product, whether it is done manually or in a production solder reflow environment. Production quantities of this product are shipped in a standard tape and reel format.



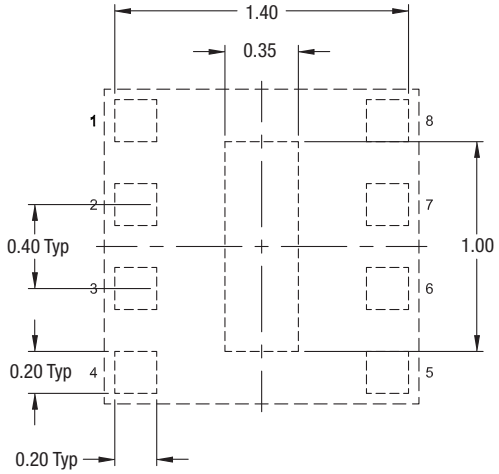
Board Metal



Via Pattern (Note 4)



Solder Mask Pattern
(Note 6)



Stencil Pattern (Note 5)
58% Solder Coverage
on Center Pad

Notes:

1. *All dimensions are in millimeters.*
2. *Interpret dimensions and tolerances per 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 the best paste release.*
6. *Solder mask recommendations: Contact board fabricator for recommended solder mask offset and tolerance.*

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Figure 5. SKYA21040 PCB Layout Footprint

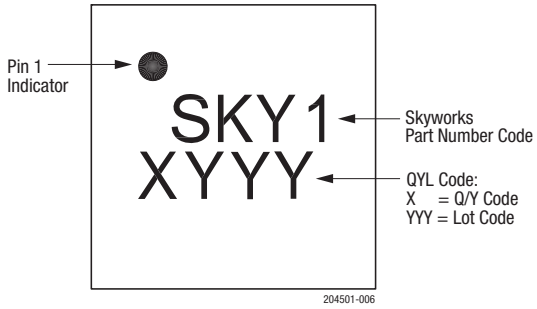
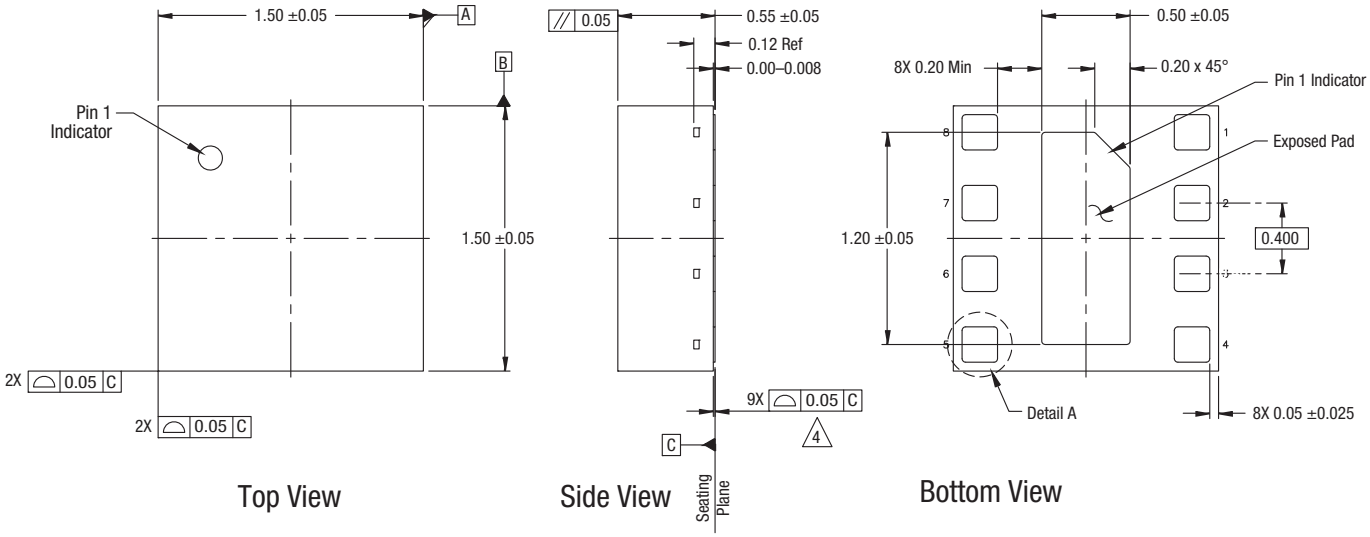
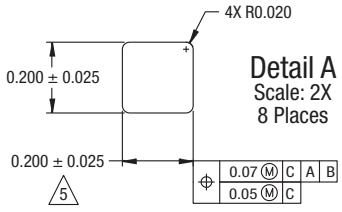


Figure 6. Typical Part Marking





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	*± 0.5°*
X.XX (2 places) ± 0.05 mm	
X.XXX (3 places) ± 0.025 mm	

4. *Coplanarity applies to the terminals as well as all other bottom surface metallization.*
5. *Dimension applies to metallized terminal. If terminal tip has a radius, dimension should not be measured in that radius area.*
6. *Plating requirements per source control drawing (SCD) 2504.*
7. *Unless specified, dimensions are symmetrical about center lines.*

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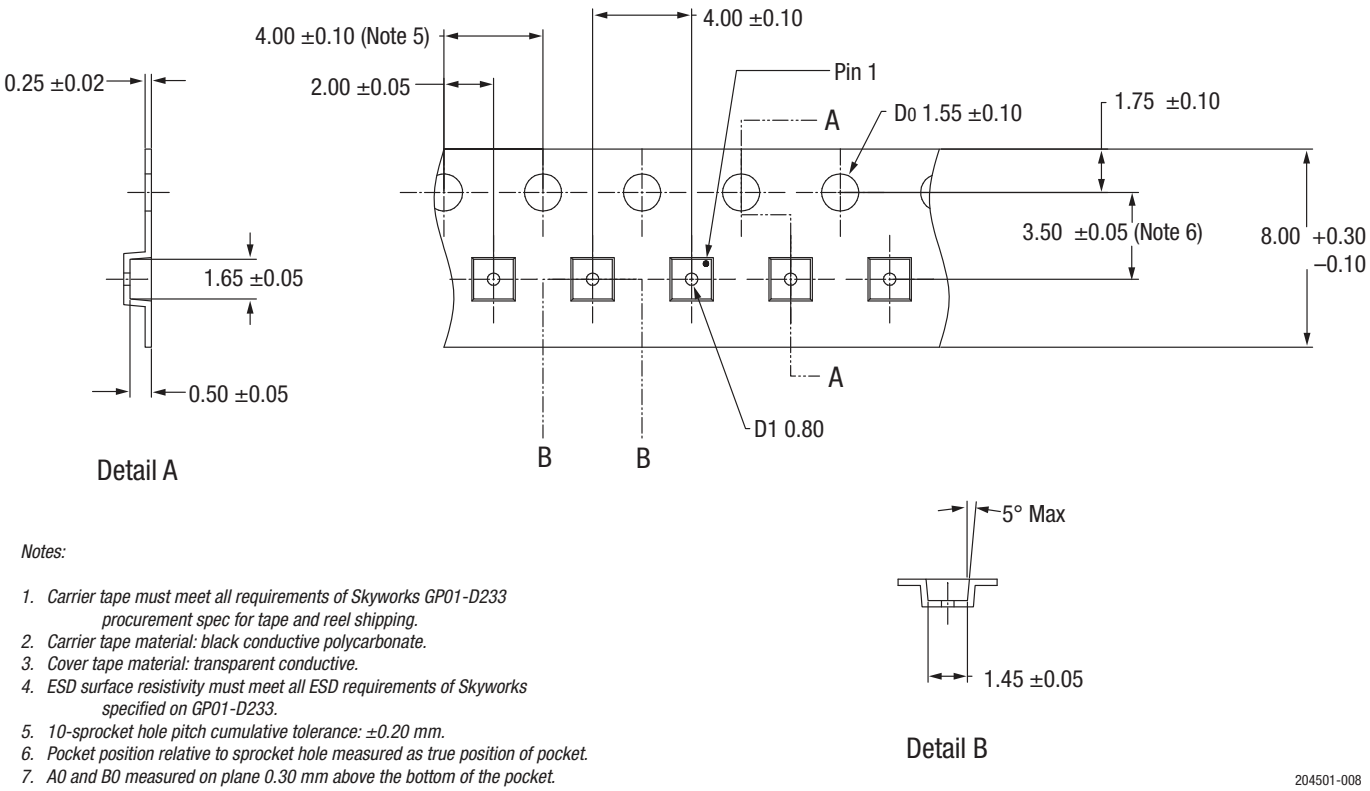
Figure 7. SKYA21040 Package Dimensions



Notes:

1. *Carrier tape must meet all requirements of Skyworks GP01-D233 procurement spec for tape and reel shipping.*
2. *Carrier tape material: black conductive polycarbonate.*
3. *Cover tape material: transparent conductive.*
4. *ESD surface resistivity must meet all ESD requirements of Skyworks specified on GP01-D233.*
5. *10-sprocket hole pitch cumulative tolerance: ±0.20 mm.*
6. *Pocket position relative to sprocket hole measured as true position of pocket.*
7. *A0 and B0 measured on plane 0.30 mm above the bottom of the pocket.*
8. *All dimensions are in millimeters.*

Figure 8. SKYA21040 Tape and Reel Dimensions

Ordering Information

Part Number	Product Description	Evaluation Board Part Number
SKYA21040	2.4 GHz 802.11ac AEC-Q100 Switch/LNA Front-End	SKYA21040-EK1