

DATA SHEET

SKYA21002: 0.1 to 3.0 GHz SP3T Switch

Automotive Applications

- Infotainment
- Automated toll systems
- Garage door opener
- 802.11 b/g/n WLAN, Bluetooth systems
- Wireless control systems
- Outdoor lighting control
- Remote keyless entry
- Telematics
- GPS/Navigation

Features

- Excellent linearity performance: P1dB = +29 dBm @ 3 V
- Low insertion loss: 0.5 dB @ 2.5 GHz
- High isolation: 25 dB @ 2.5 GHz
- Positive low voltage control: 0/3 V
- Miniature, ultra-thin DFN (8-pin, 2 x 2 mm) package
- Designed and manufactured in an ISO/TS16949-certified facility
- AEC-Q100 qualified at 25 °C
- JEDEC (JESD22) qualified at 25 °C
- Lead (Pb)-free and RoHS-compliant MSL-1 @ 260 °C per JEDEC J-STD-020



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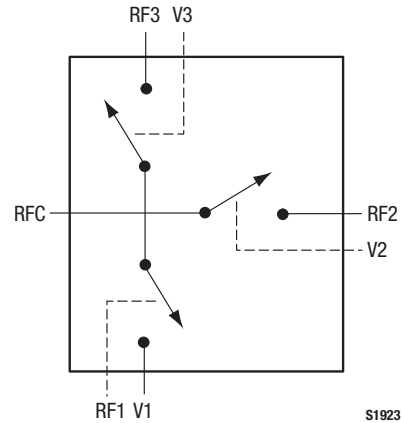


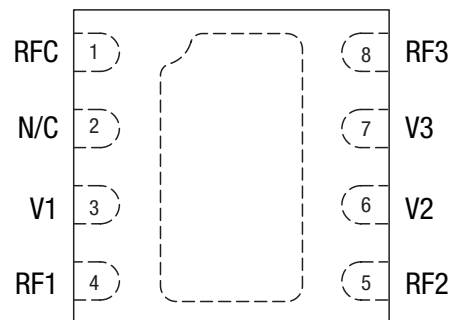
Figure 1. SKYA21002 Block Diagram

Description

The SKYA21002 is a Single-Pole, Triple-Throw (SP3T) antenna switch that operates in the 0.1 to 3.0 GHz frequency range. Switching between the antenna (RFC signal) and the RF1, RF2, and RF3 ports is accomplished with three control voltages.

The low loss, high isolation, high linearity, and small size make this switch ideal for all WLAN and Bluetooth systems operating in the 2.4 to 2.5 GHz band.

The switch is manufactured in a compact, 2 x 2 mm, 8-pin 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.



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Figure 2. SKYA21002 Pinout – 8-Pin DFN (Top View)

Table 1. SKYA21002 Signal Descriptions

| Pin # | Name | Description | Pin # | Name | Description |
|-------|------|--|-------|------|--|
| 1 | RFC | Antenna. DC blocking capacitor required. | 5 | RF2 | RF port 2. DC blocking capacitor required. |
| 2 | N/C | No connection | 6 | V2 | Switch logic control (see Table 4) |
| 3 | V1 | Switch logic control (see Table 4) | 7 | V3 | Switch logic control (see Table 4) |
| 4 | RF1 | RF port 1. DC blocking capacitor required. | 8 | RF3 | RF port 3. DC blocking capacitor required. |

Table 2. SKYA21002 Absolute Maximum Ratings

| Parameter | Symbol | Minimum | Maximum | Units |
|------------------------------------|------------------|---------|------------|------------|
| Input power: @ 0/3 V @ 0/5 V | P _{IN} | | +30 +32 | dBm dBm |
| Operating voltage | V _{DD} | | +8.0 | V |
| Operating temperature | T _{OP} | −40 | +85 | °C |
| Storage temperature | T _{STG} | −65 | +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.

Electrical and Mechanical Specifications

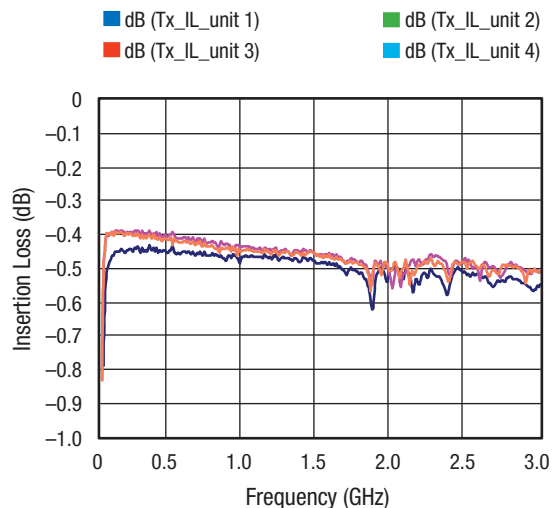
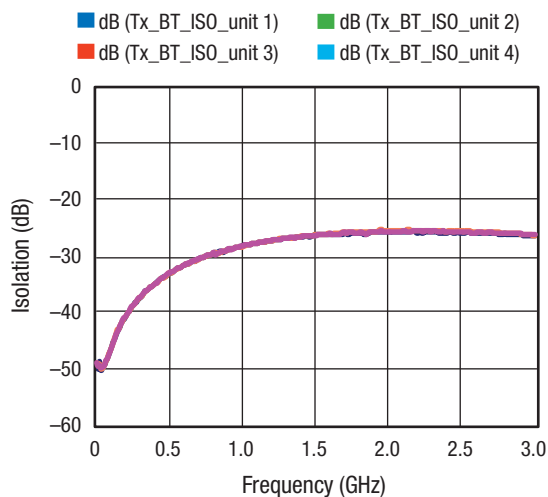
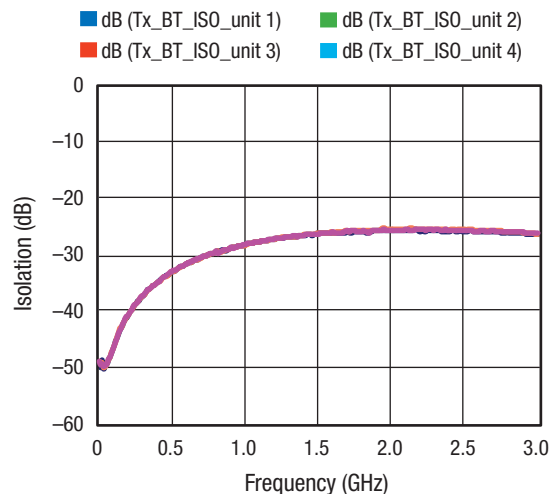
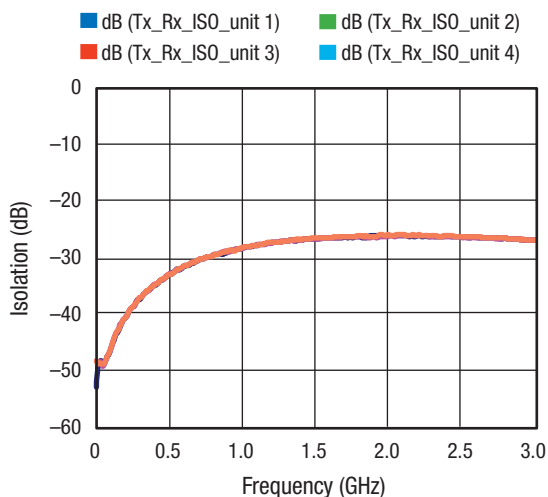
The absolute maximum ratings of the SKYA21002 are provided in Table 2. Electrical specifications are provided in Table 3.

Typical performance characteristics of the SKYA21002 are illustrated in Figures 3 through 20. The state of the SKYA21002 is determined by the logic provided in Table 4.

Table 3. SKYA21002 Electrical Specifications (Note 1)
($V_{HIGH} = 2.1$ to 5.0 V, $T_{OP} = +25$ °C, Unless Otherwise Noted)

| Parameter | Symbol | Test Condition | Min | Typical | Max | Units |
|---|--------|---|----------|--------------|--------------|------------|
| Insertion loss | IL | RFC to RF1, RF2, RF3 0.1 to 3.0 GHz 2.4 to 2.5 GHz | | 0.60 0.50 | 0.75 0.65 | dB dB |
| Return loss (insertion loss state) | IS11I | RFC to RF1, RF2, RF3 0.1 to 3.0 GHz 2.4 to 2.5 GHz | | 20 20 | | dB dB |
| Isolation | ISO | RFC to RF1, RF2, RF3 0.1 to 3.0 GHz 2.4 to 2.5 GHz | 22 22 | 25 25 | | dB dB |
| Switching speed: | | | | | | |
| Rise time | | 10/90% RF | | 50 | | ns |
| Fall time | | 90/10% RF | | 18 | | ns |
| On time | | 50% control to 90/10% RF | | 55 | | ns |
| Off time | | 50% control to 90/10% RF | | 20 | | ns |
| Video feedthrough | | | | 40 | | mV |
| 1 dB input compression point | IP1dB | @ 2450 MHz, $V_{LOW} = 0$ V, $V_{HIGH} = 3.3$ V | | +29.0 | | dBm |
| 3 rd order input intercept point | IIP3 | @ 2450 MHz, two-tone input power @ +17 dBm $V_{LOW} = 0$ V, $V_{HIGH} = 2.1$ V $V_{LOW} = 0$ V, $V_{HIGH} = 3.3$ V | | +37 +45 | | dBm dBm |
| Control voltage | | $V_{LOW} = 0$ to 0.25 V @ 5 μ A typical $V_{HIGH} = 2.1$ to 5.0 V @ 10 μ A typical | | 0 3.3 | | V V |

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

Typical Performance Characteristics**(V_{DD} = 0/3.3 V, T_{OP} = +25 °C, Unless Otherwise Noted)****Figure 3. RFC to RF1 Insertion Loss****Figure 4. RFC to RF3 Isolation****Figure 5. RFC to RF1 Return Loss****Figure 6. RFC to RF2 Isolation**

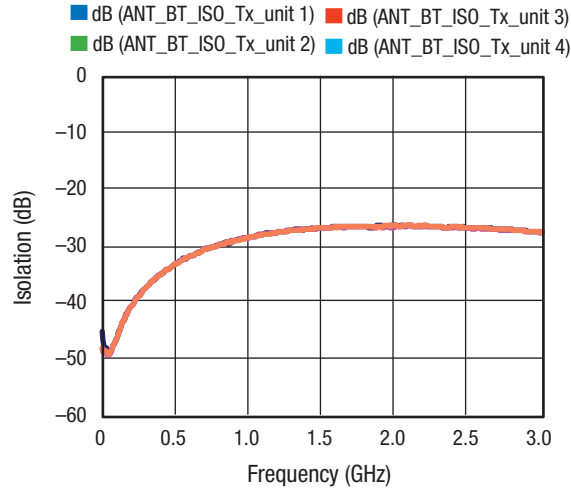


Figure 7. RF1 to RF2 Isolation

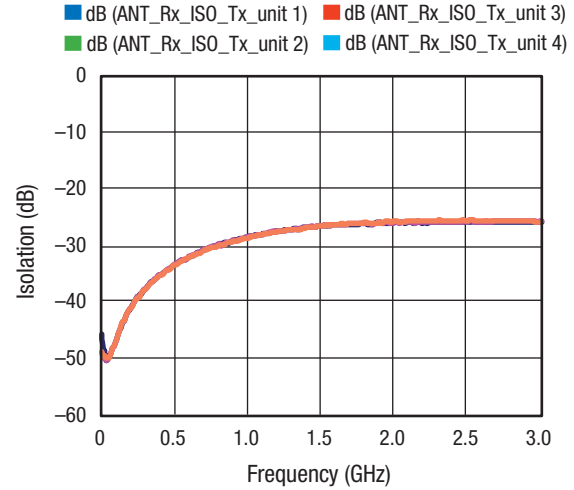


Figure 8. RF1 to RF3 Isolation

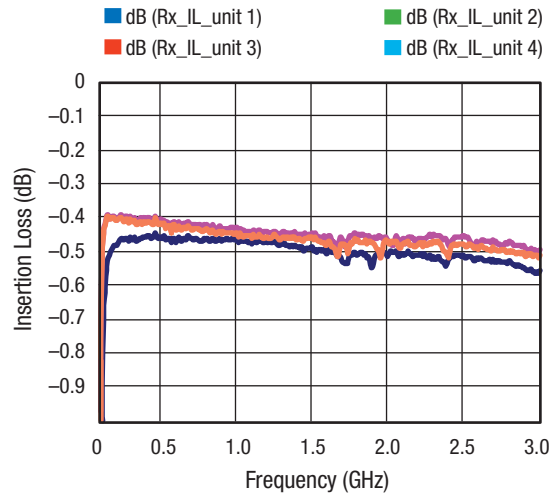


Figure 9. RFC to RF2 Insertion Loss

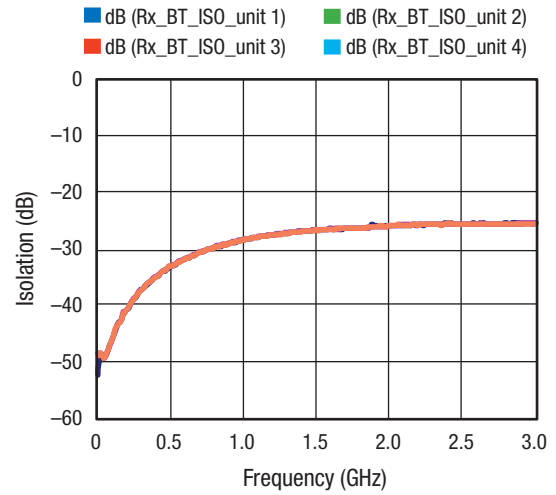


Figure 10. RFC to RF2 Isolation

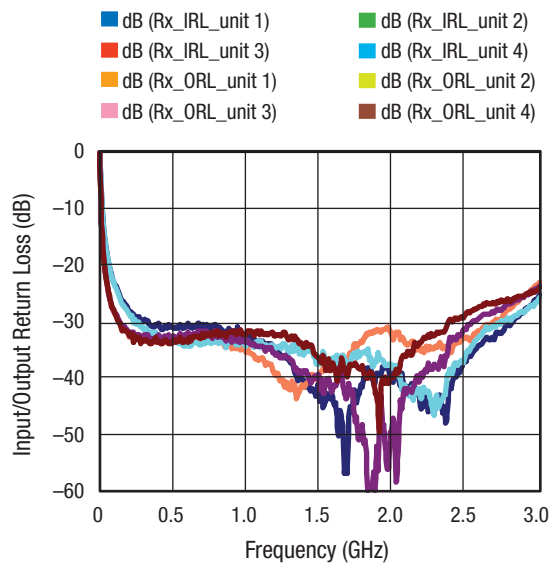


Figure 11. RFC to RF2 Return Loss

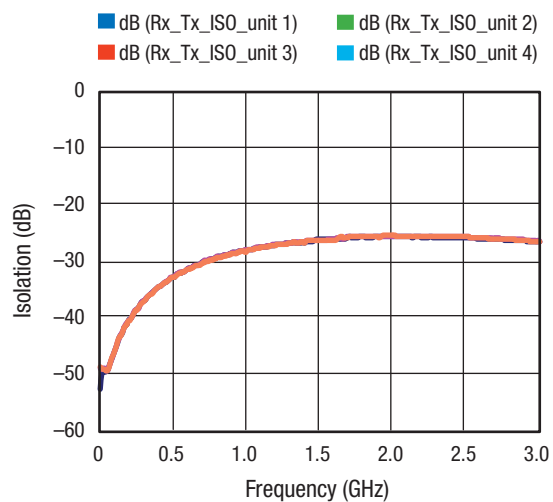


Figure 12. RFC to RF3 Isolation

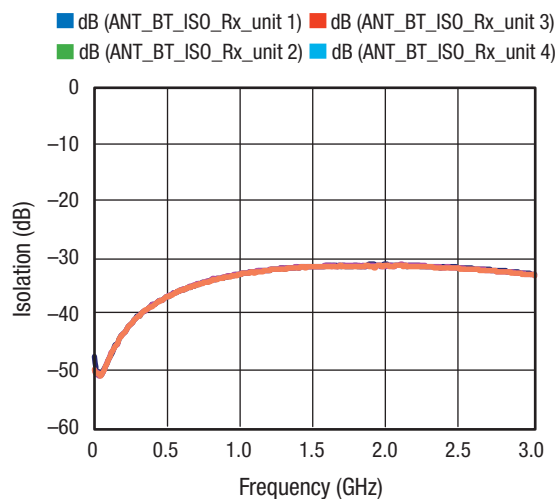


Figure 13. RF2 to RF3 Isolation

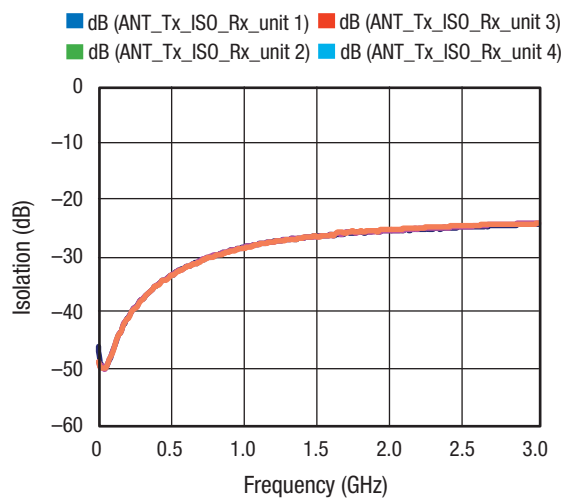


Figure 14. RF2 to RF1 Isolation

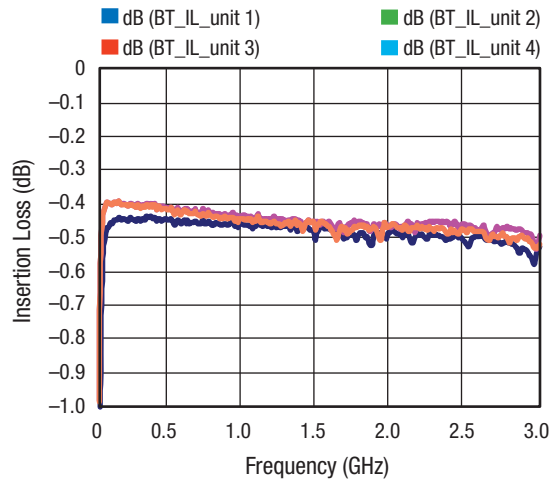


Figure 15. RFC to RF3 Insertion Loss

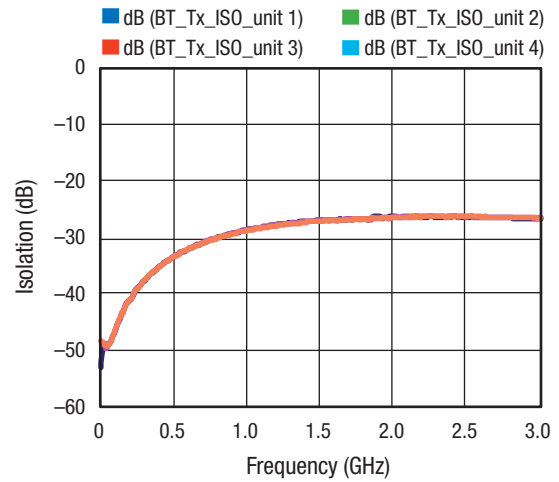


Figure 16. RFC to RF1 Isolation

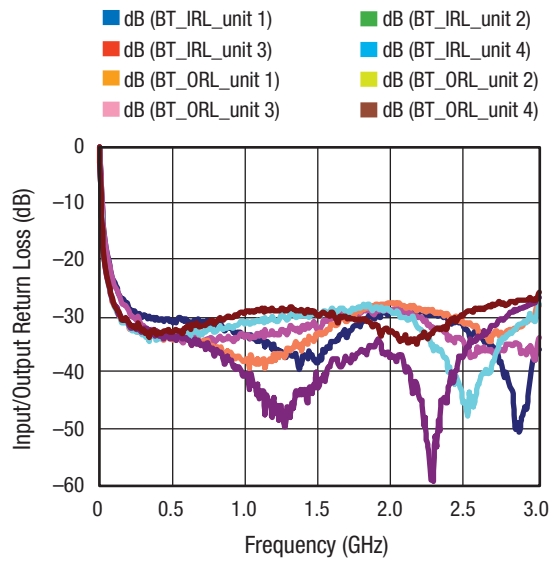


Figure 17. RFC to RF3 Return Loss

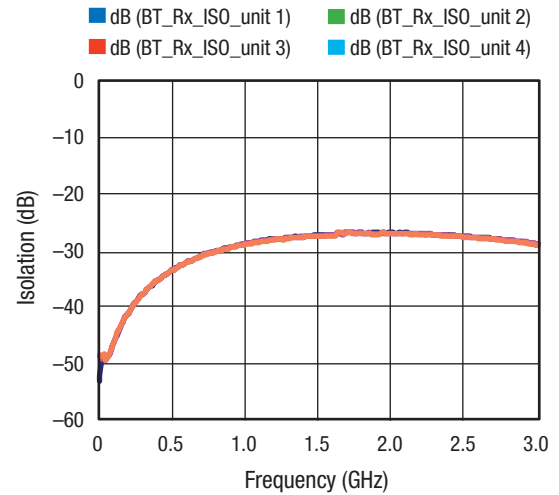


Figure 18. RFC to RF2 Isolation

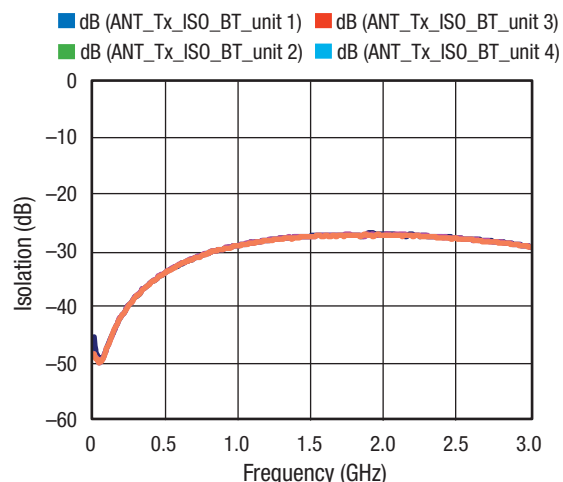


Figure 19. RF3 to RF1 Isolation

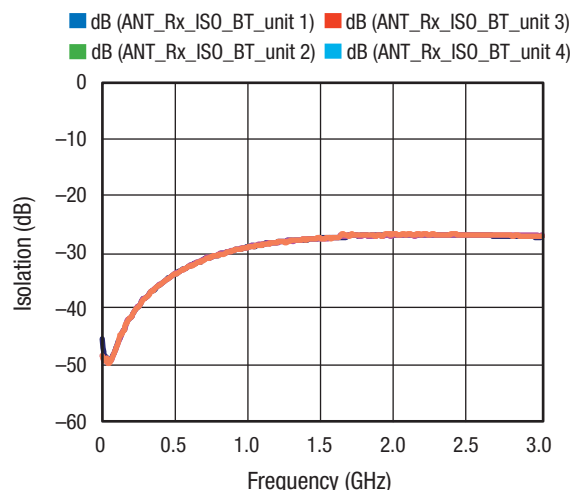


Figure 20. RF3 to RF2 Isolation

Table 4. SKYA21002 Truth Table

| V1 (Pin 3) | V2 (Pin 6) | V3 (Pin 7) | Low Insertion Loss Path |
|------------|------------|------------|-------------------------|
| High | Low | Low | RFC to RF1 |
| Low | High | Low | RFC to RF2 |
| Low | Low | High | RFC to RF3 |

Note: High = 2.1 V to 5.0 V. Low = 0 V to 0.25 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 SKYA21002 Evaluation Board is used to test the performance of the SKYA21002 SPDT Switch. An Evaluation Board schematic diagram is provided in Figure 21. An assembly drawing for the Evaluation Board is shown in Figure 22.

Package Dimensions

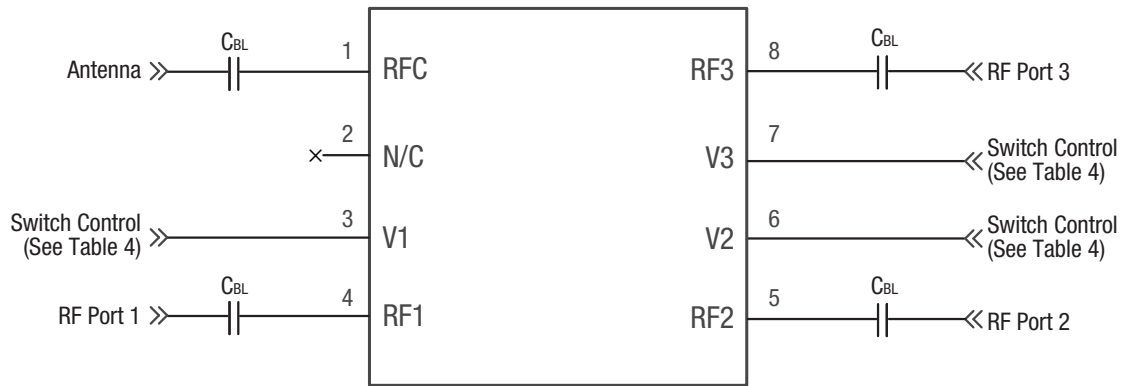
The PCB layout footprint for the SKYA21002 is provided in Figure 23. Typical case markings are shown in Figure 24. Package dimensions for the 8-pin DFN are shown in Figure 25, and tape and reel dimensions are provided in Figure 26.

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 SKYA21002 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.

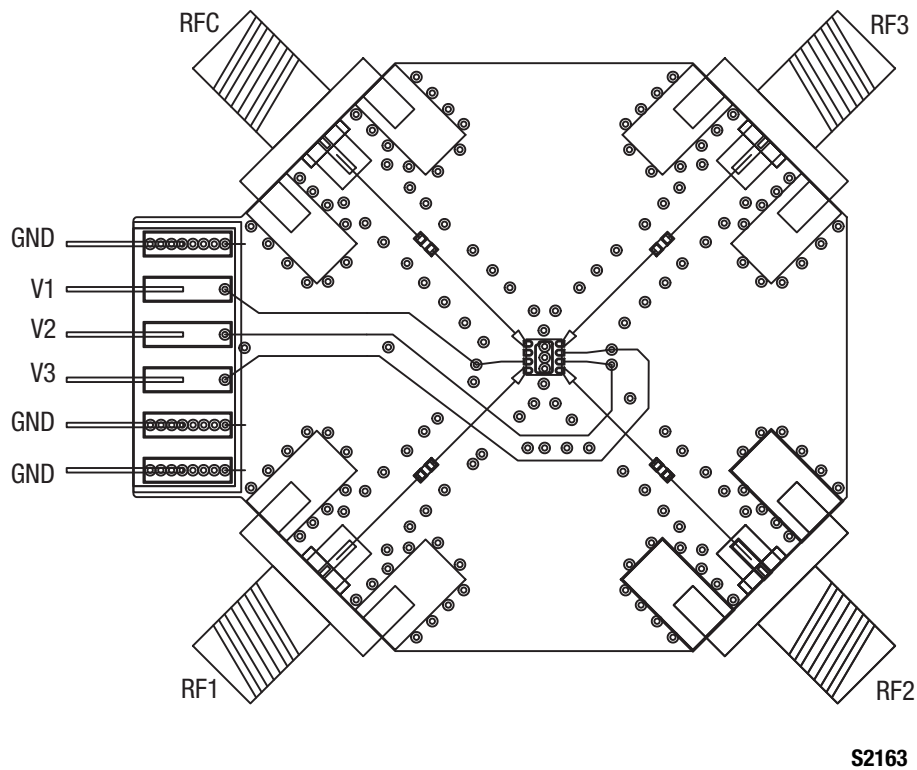
Care must be taken when attaching this product, whether it is done manually or in a production solder reflow environment. Production quantities of this product are shipped in a standard tape and reel format.



Note: $C_{BL} = 47 \text{ pF}$ for $>500 \text{ MHz}$ operation; 220 pF for operation down to 50 MHz .
Higher values recommended for lower frequency operation.
Exposed paddle must be grounded.

S1925a

Figure 21. SKYA21002 Evaluation Board Schematic



S2163

Figure 22. SKYA21002 Evaluation Board Assembly Diagram

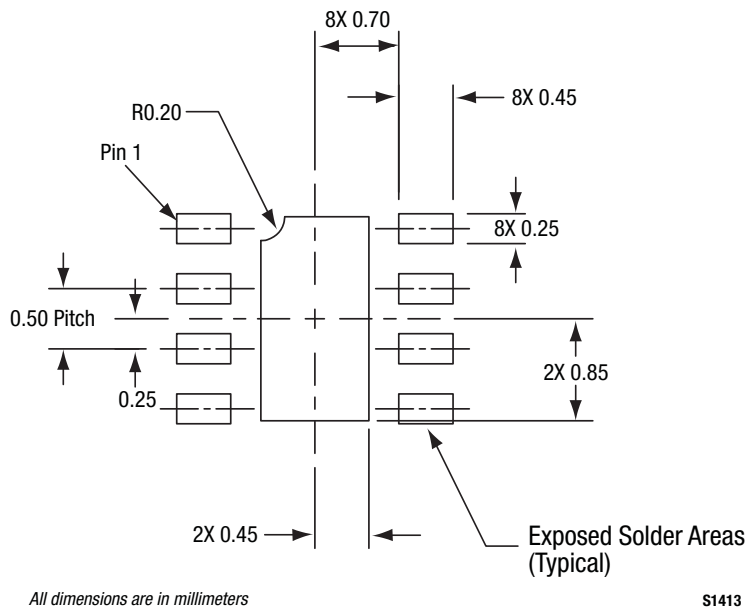


Figure 23. SKYA21002 PCB Layout Footprint (Top View)

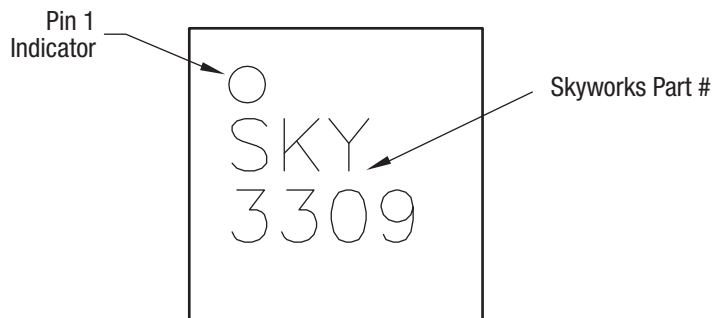
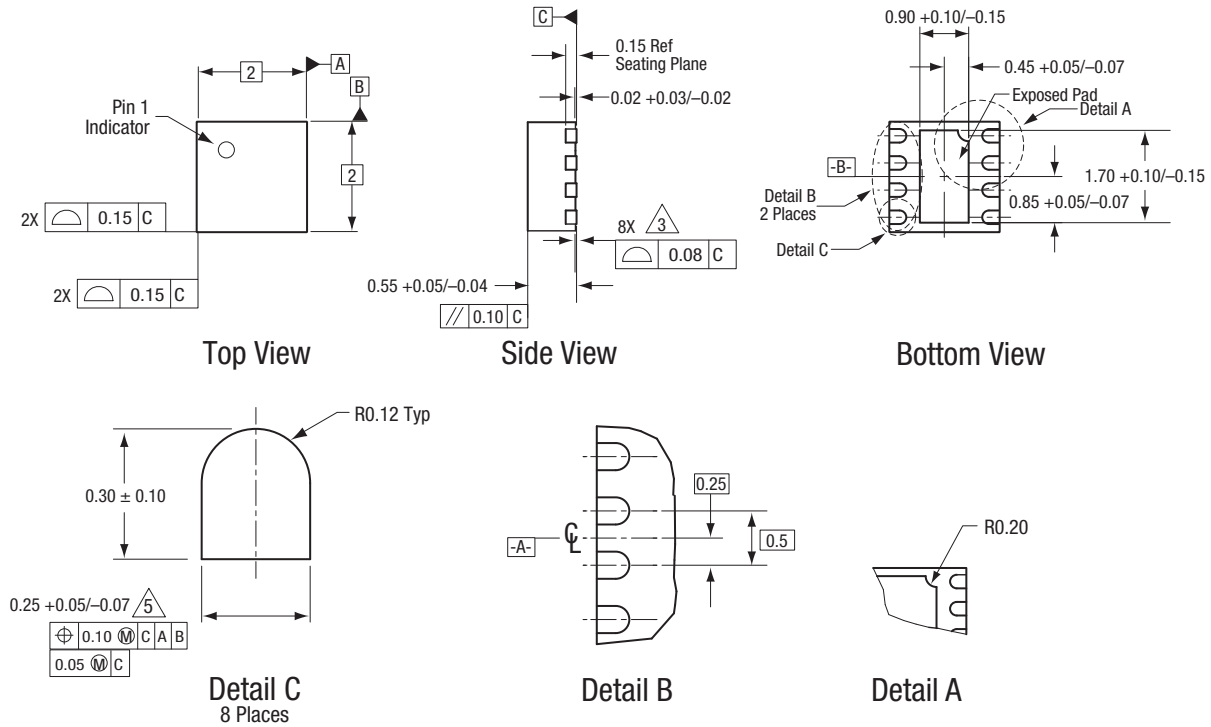


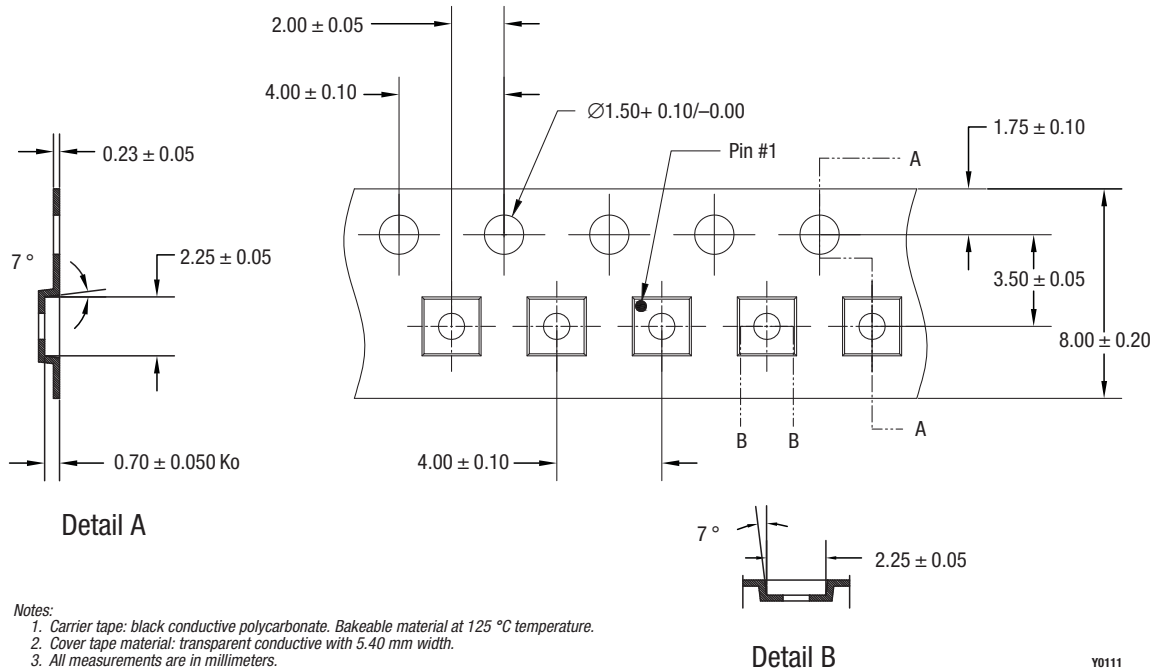
Figure 24. Typical Case Markings (Top View)



All measurements are in millimeters.
 Dimensioning and tolerancing according to ASME Y14.5M-1994.
 Coplanarity applies to the exposed heat sink slug as well as the terminals..
 Plating requirement per source control drawing (SCD) 2504.
 Dimension applies to metalized terminal and is measured between 0.15 mm and 0.30 mm from terminal tip.

S1755

Figure 25. SKYA21002 8-Pin DFN Package Dimensions



Notes:
 1. Carrier tape: black conductive polycarbonate. Bakeable material at 125 °C temperature.
 2. Cover tape material: transparent conductive with 5.40 mm width.
 3. All measurements are in millimeters.

Figure 26. SKYA21002 Tape and Reel Dimensions

Ordering Information

| Model Name | Manufacturing Part Number | Evaluation Board Part Number |
|-----------------------------------|---------------------------|------------------------------|
| SKYA21002 0.1-3.0 GHz SP3T Switch | SKYA21002 | SKYA21002-EVB |

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