

SKYWORKS®

DATA SHEET

SKY13309-370LF: 0.1 – 3.0 GHz pHEMT GaAs SP3T Switch

Applications

- 802.11 a/b/g/n WLAN networks
- Bluetooth® systems

Features

- Positive low voltage control: 0/3 V
- Low insertion loss: 0.5 dB @ 2.5 GHz
- High isolation: 25 dB @ 2.5 GHz
- Excellent linearity performance: P1dB = +29 dBm
- Advanced pHEMT process
- Miniature, ultra-thin DFN (8-pin, 2 x 2 mm) package (MSL1, 260 °C per JEDEC J-STD-020)



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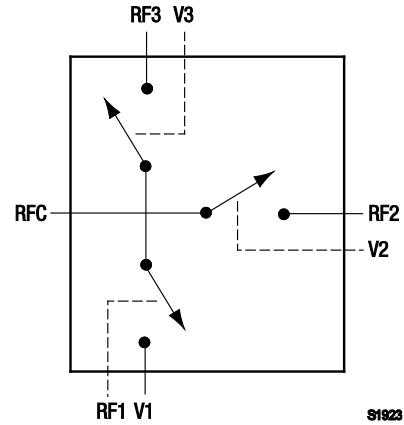


Figure 1. SKY13309-370LF Block Diagram

Description

The SKY13309-370LF is a GaAs pHEMT 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, small size, and low cost 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.

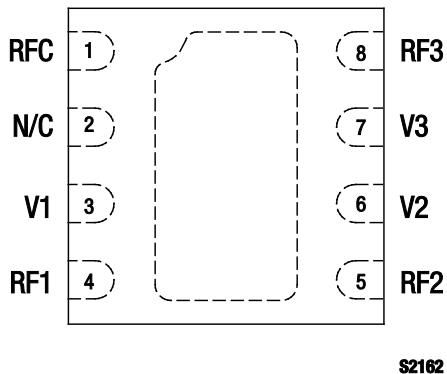


Figure 2. SKY13309-370LF Pinout – 8-Pin DFN (Top View)

Table 1. SKY13309-370LF 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. SKY13309-370LF 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 SKY13309-370LF are provided in Table 2. Electrical specifications are provided in Table 3.

Typical performance characteristics of the SKY13309-370LF are illustrated in Figures 3 through 20.

The state of the SKY13309-370LF is determined by the logic provided in Table 4.

Table 3. SKY13309-370LF 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		0.60	0.75	dB
		2.4 to 2.5 GHz		0.50	0.65	dB
Return loss (insertion loss state)	IS11I	RFC to RF1, RF2, RF3				
		0.1 to 3.0 GHz		20		dB
		2.4 to 2.5 GHz		20		dB
Isolation	ISO	RFC to RF1, RF2, RF3				
		0.1 to 3.0 GHz	22	25		dB
		2.4 to 2.5 GHz	22	25		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		+37		dBm
		V _{LOW} = 0 V, V _{HIGH} = 3.3 V		+45		dBm
Control voltage		V _{LOW} = 0 to 0.25 V @ 5 μA typical		0		V
		V _{HIGH} = 2.1 to 5.0 V @ 10 μA typical		3.3		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)

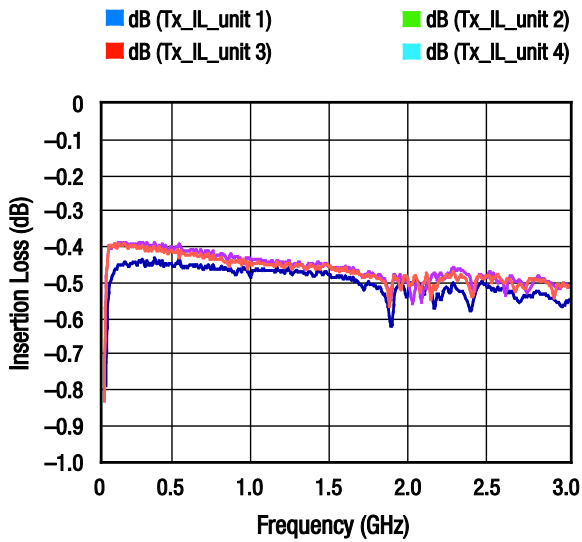


Figure 3. RFC to RF1 Insertion Loss

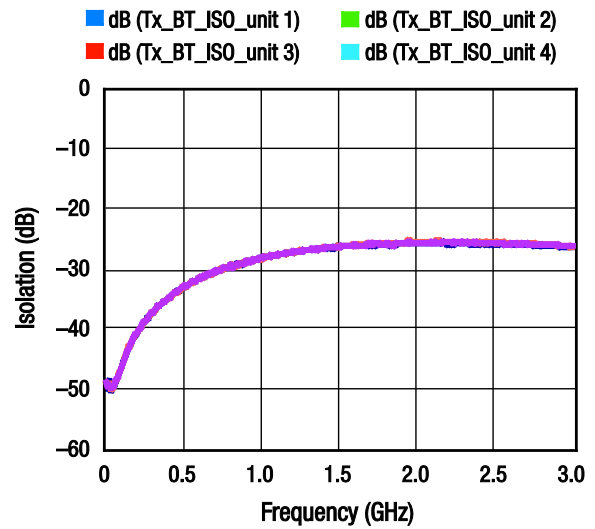


Figure 4. RFC to RF3 Isolation

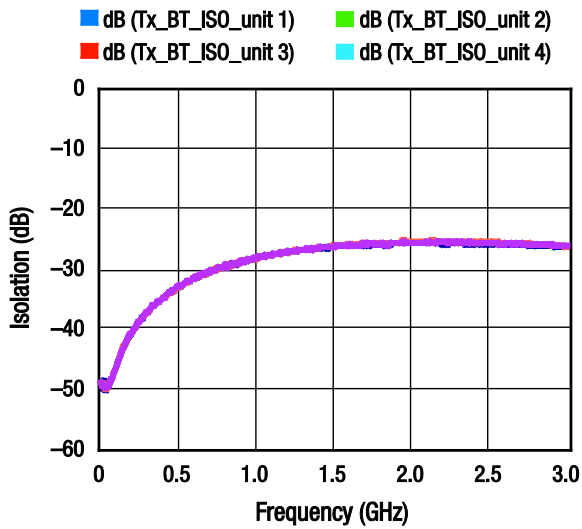


Figure 5. RFC to RF1 Return Loss

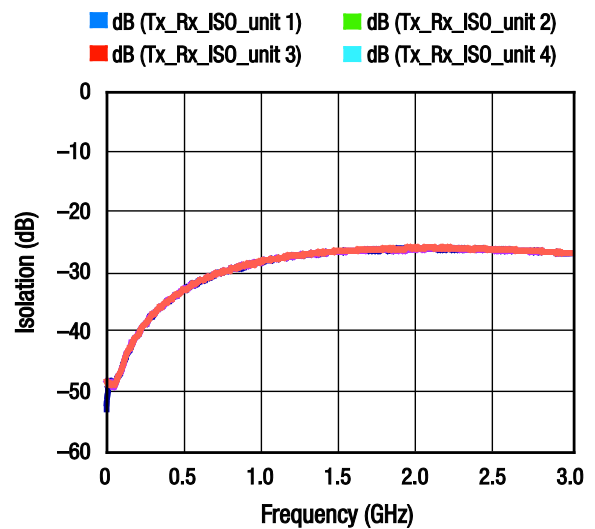


Figure 6. RFC to RF2 Isolation

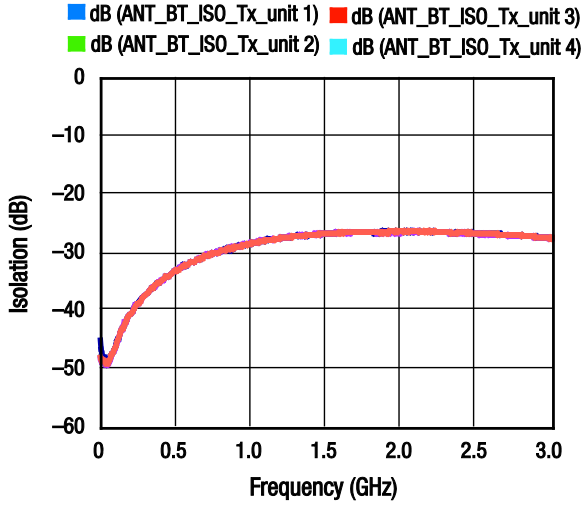


Figure 7. RF1 to RF2 Isolation

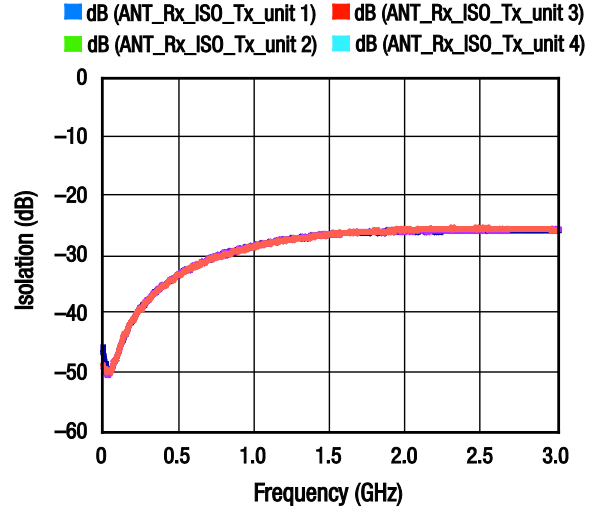


Figure 8. RF1 to RF3 Isolation

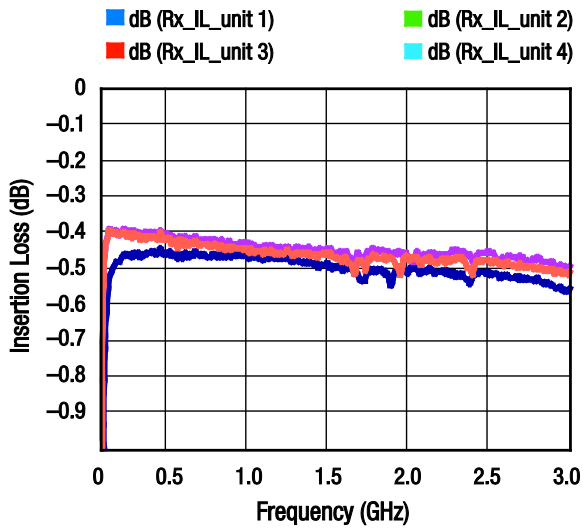


Figure 9. RFC to RF2 Insertion Loss

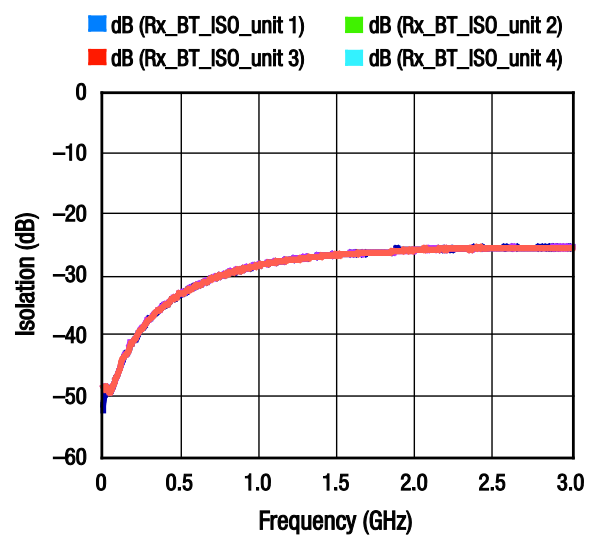


Figure 10. RFC to RF2 Isolation

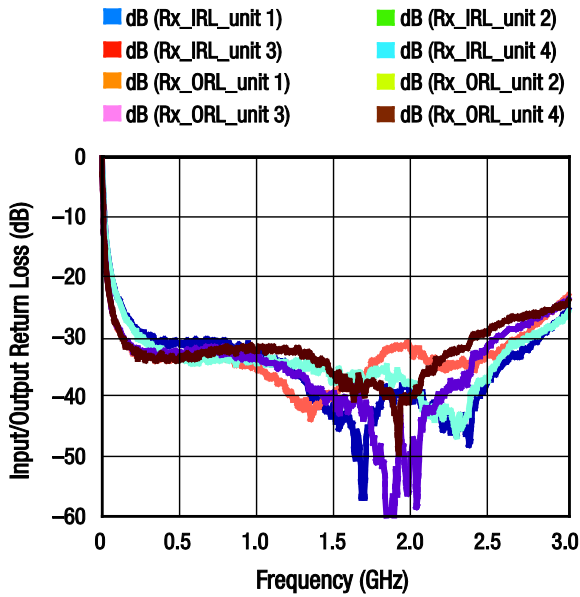


Figure 11. RFC to RF2 Return Loss

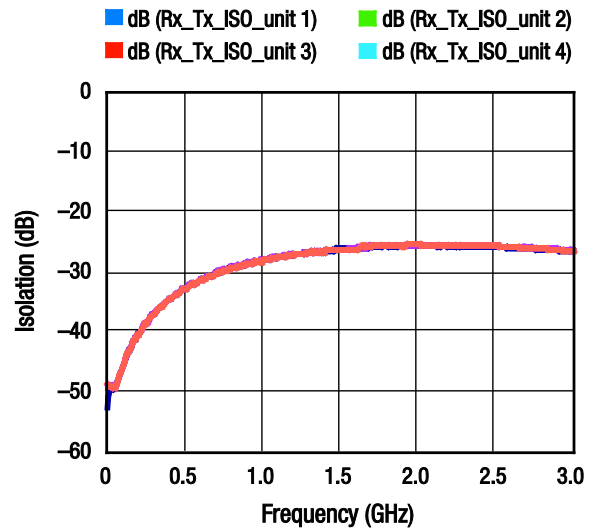


Figure 12. RFC to RF3 Isolation

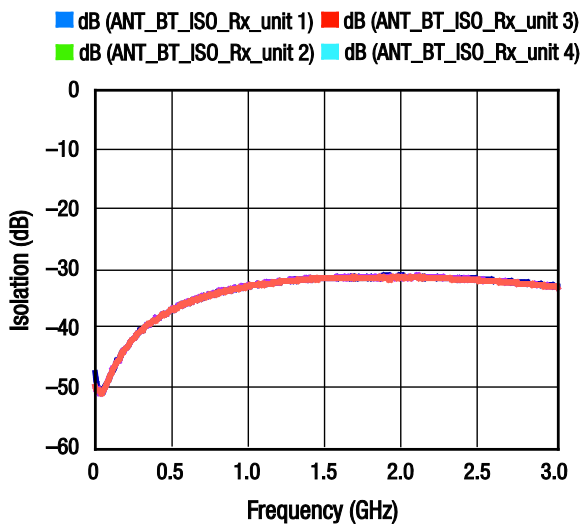


Figure 13. RF2 to RF3 Isolation

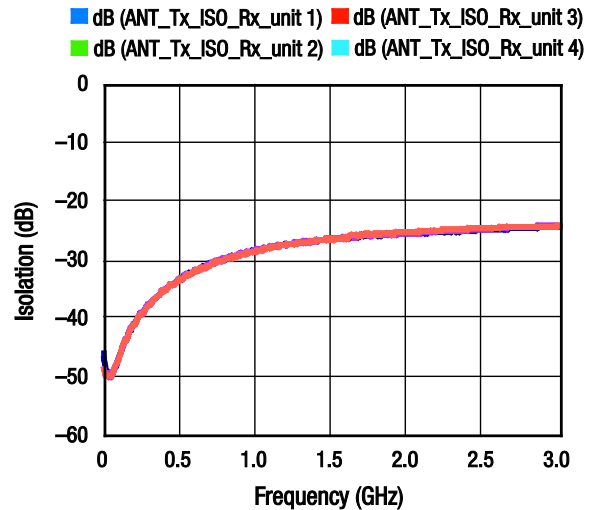


Figure 14. RF2 to RF1 Isolation

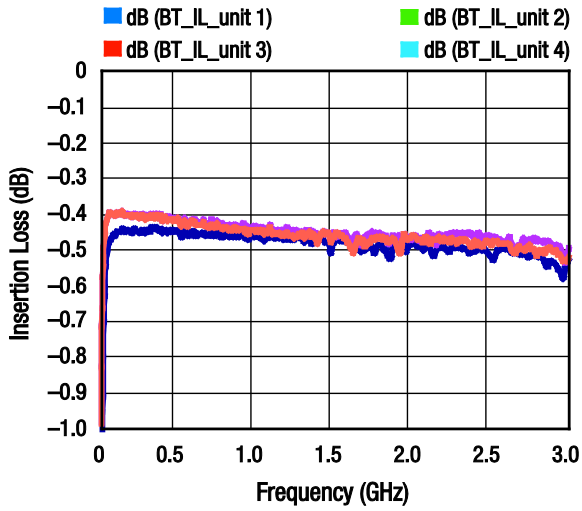


Figure 15. RFC to RF3 Insertion Loss

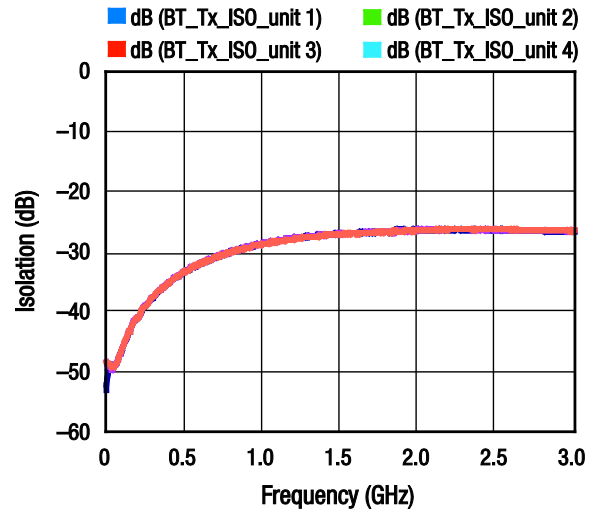


Figure 16. RFC to RF1 Isolation

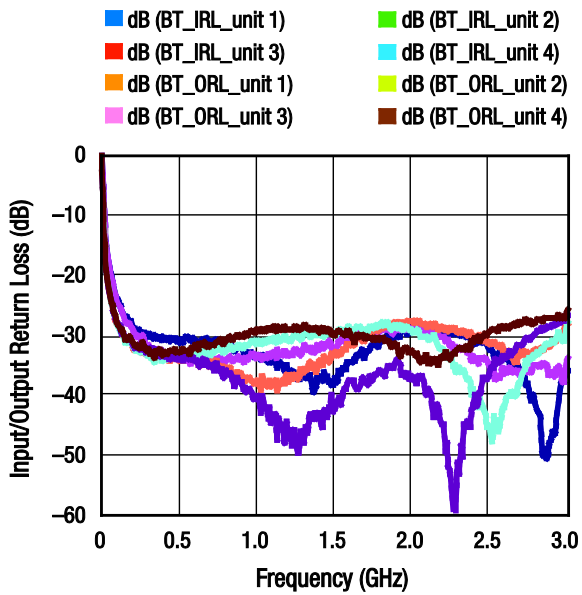


Figure 17. RFC to RF3 Return Loss

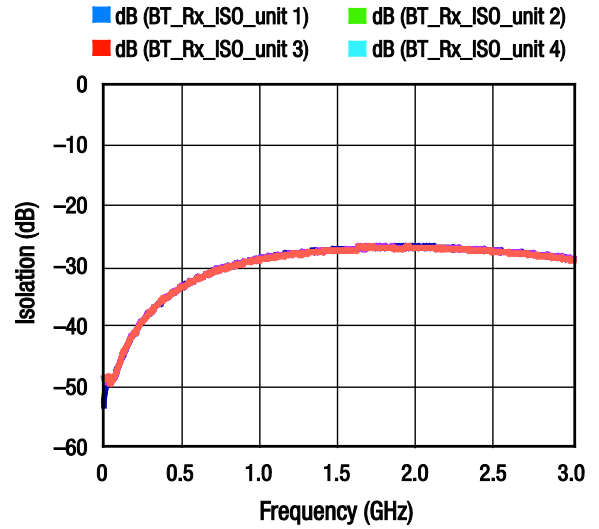


Figure 18. RFC to RF2 Isolation

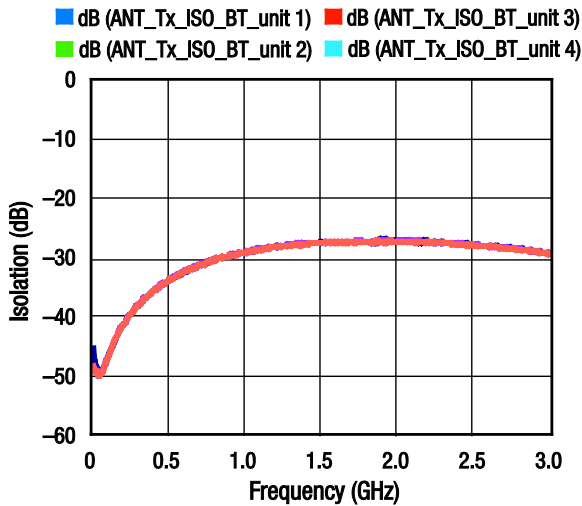


Figure 19. RF3 to RF1 Isolation

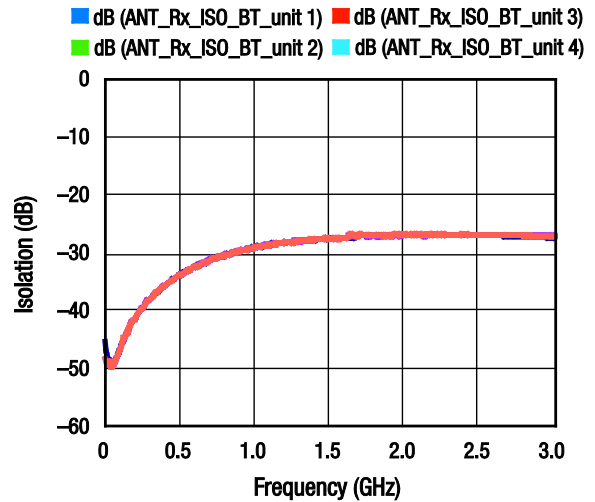


Figure 20. RF3 to RF2 Isolation

Table 4. SKY13309-370LF 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 SKY13309-370LF Evaluation Board is used to test the performance of the SKY13309-370LF 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

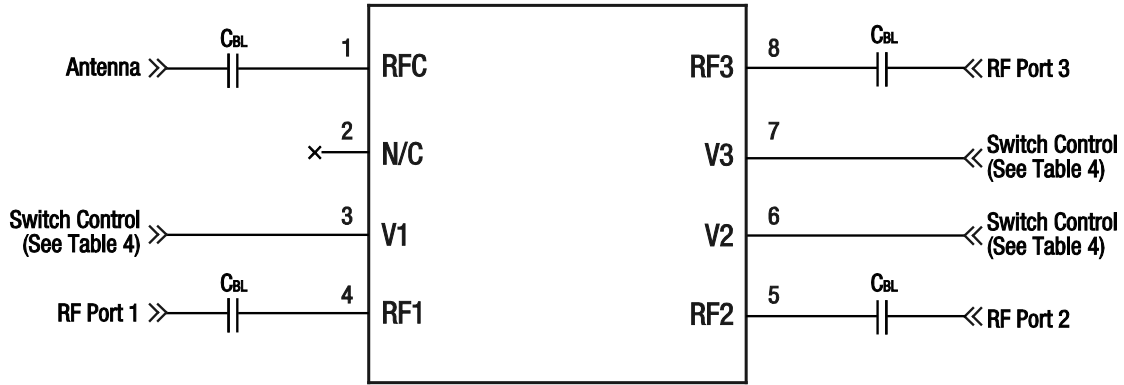
The PCB layout footprint for the SKY13309-370LF is provided in Figure 23. Typical case markings are shown in Figure 24. Package dimensions for the 8-pin DFN are shown in Figure 25, and tape and reel dimensions are provided in Figure 26.

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 SKY13309-370LF 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 pF for >500 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. SKY13309-370LF Evaluation Board Schematic

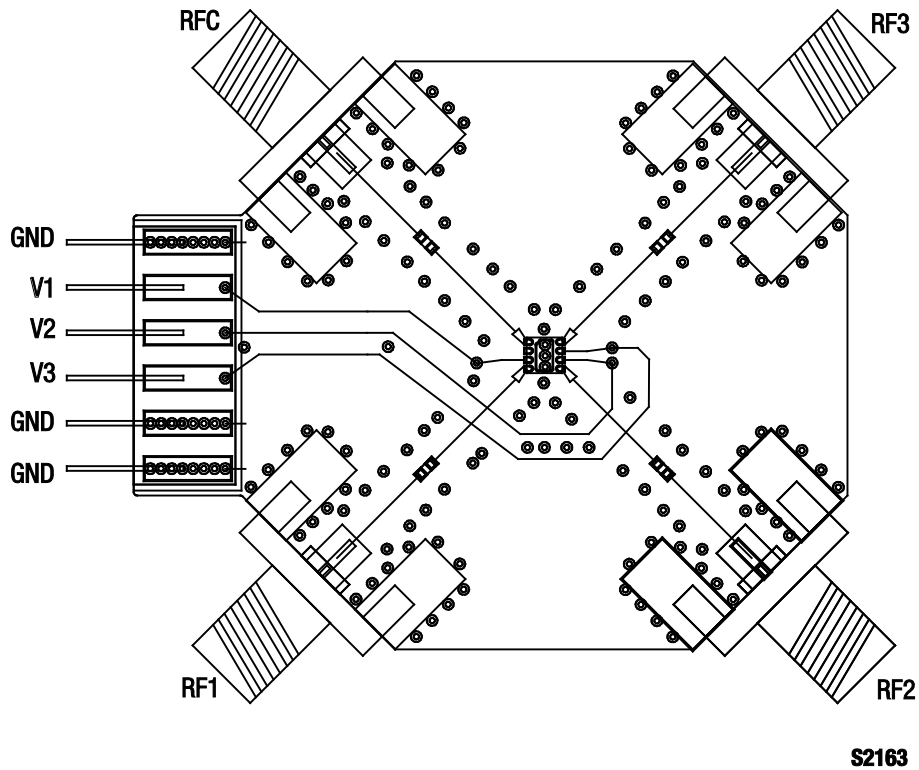


Figure 22. SKY13309-370LF Evaluation Board Assembly Diagram

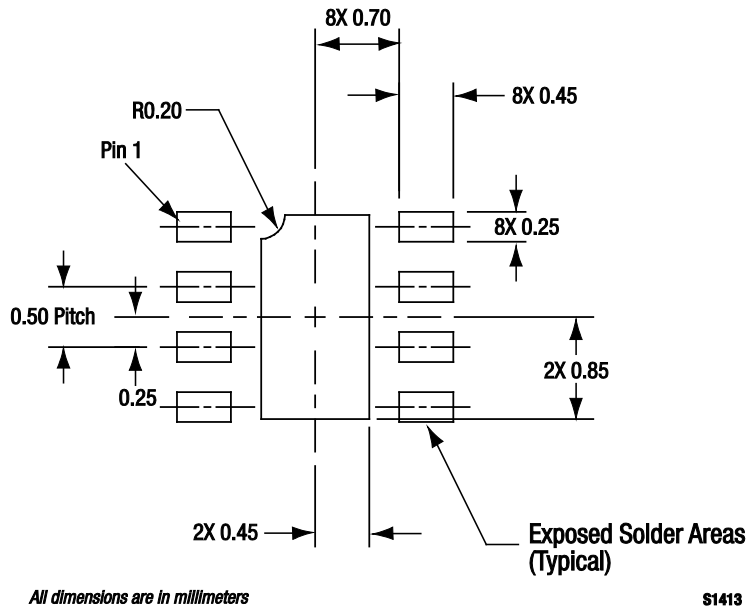


Figure 23. SKY13309-370LF PCB Layout Footprint (Top View)

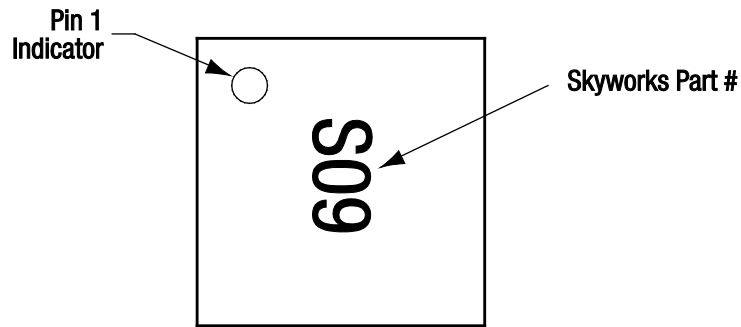
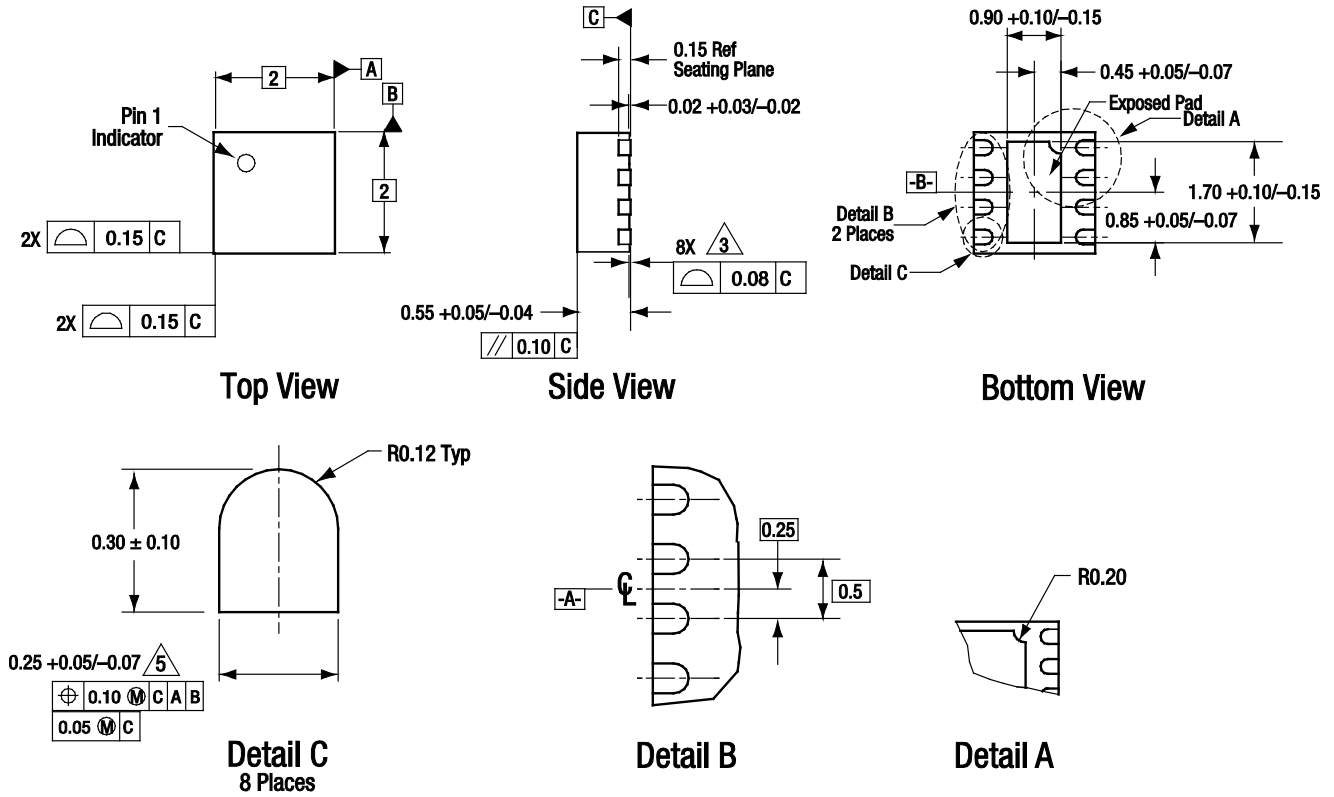


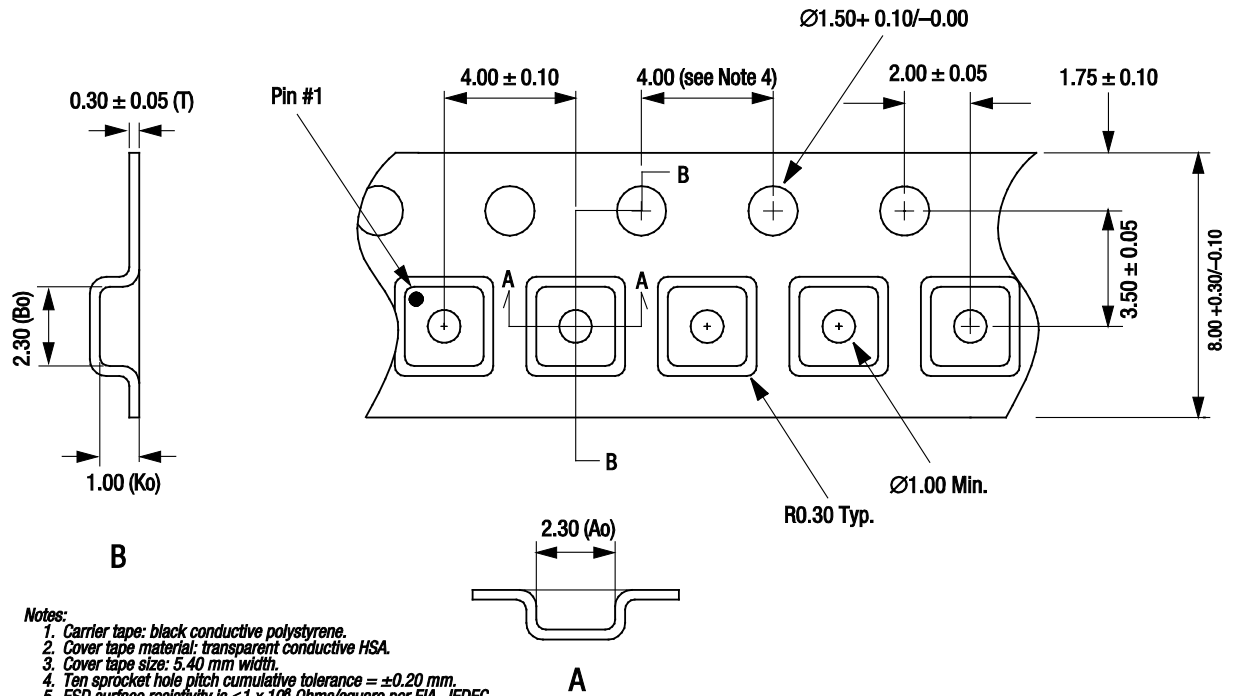
Figure 24. Typical Case Markings (Top View)



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 metallized terminal and is measured between 0.15 mm and 0.30 mm from terminal tip.

S1755

Figure 25. SKY13309-370LF 8-Pin DFN Package Dimensions



- Notes:
1. Carrier tape: black conductive polystyrene.
 2. Cover tape material: transparent conductive HSA.
 3. Cover tape size: 5.40 mm width.
 4. Ten sprocket hole pitch cumulative tolerance = ± 0.20 mm.
 5. ESD surface resistivity is $\leq 1 \times 10^9$ Ohms/square per EIA, JEDEC tape and reel specification.
 6. Ao and Bo measurement point to be 0.30 mm from bottom pocket.
 7. All measurements are in millimeters.

S1601

Figure 26. SKY13309-370LF Tape and Reel Dimensions

Ordering Information

Model Name	Manufacturing Part Number	Evaluation Board Part Number
SKY13309-370LF 0.1-3.0 GHz SP3T Switch	SKY13309-370LF	SKY13309-370LF-EVB

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