

DATA SHEET

SKY12207-306LF: 0.9 to 4.0 GHz 50 W High-Power Silicon PIN Diode SPDT Switch

Applications

- Transmit/receive switching and failsafe switching in TD-SCDMA, WiMAX, and LTE base stations
- Transmit/receive switching in land mobile radios and military communication systems

Features

- High-power handling: 50 W CW, 300 W peak
- Low insertion loss: 0.4 dB typical
- Controlled with positive power supply
- Bias driver circuit available on request
- Small, QFN (16-pin, 4 x 4 mm) Pb-free package (MSL1, 260 °C per JEDEC J-STD-020)
- For RoHS and other product compliance information, see the [Skyworks Certificate of Conformance](#)

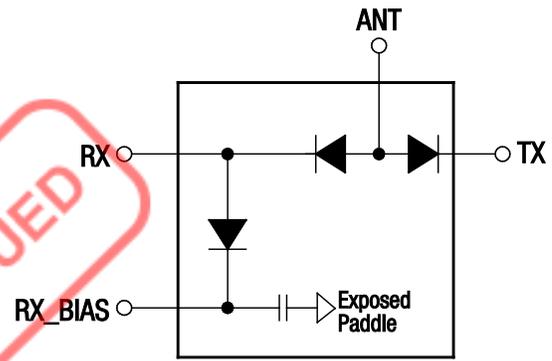
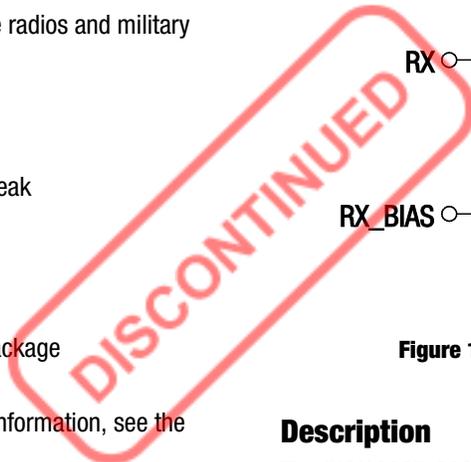


Figure 1. SKY12207-306LF Block Diagram

Description

The SKY12207-306LF is a high-power handling, single-pole, double-throw (SPDT) silicon PIN diode switch. The device operates over the 900 MHz to 4 GHz band. It features low insertion loss, excellent power handling, and superb linearity with low DC power consumption.

The SKY12207-306LF is well-suited for use as a high power transmit/receive switch in a variety of telecommunication systems such as WiMAX, TD-SCDMA, or LTE base stations.

The device is provided in a 4 x 4 mm, 16-pin Quad Flat No-Lead (QFN) 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.

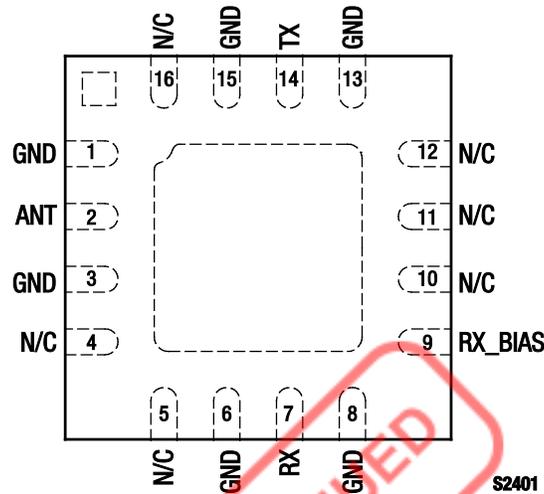


Figure 2. SKY12207-306LF Pinout (Top View)

Table 1. SKY12207-306LF Signal Descriptions

| Pin | Name | Description | Pin | Name | Description |
|-----|------|--|-----|---------|--|
| 1 | GND | Ground. Must be connected to ground using lowest possible impedance. | 9 | RX_BIAS | RF ground port and DC bias input port |
| 2 | ANT | Antenna RF port and DC bias input port | 10 | N/C | No connection |
| 3 | GND | Ground. Must be connected to ground using lowest possible impedance. | 11 | N/C | No connection |
| 4 | N/C | No connection | 12 | N/C | No connection |
| 5 | N/C | No connection | 13 | GND | Ground. Must be connected to ground using lowest possible impedance. |
| 6 | GND | Ground. Must be connected to ground using lowest possible impedance. | 14 | TX | Transmit RF input port and DC bias input port |
| 7 | RX | Receive output port and DC bias input port | 15 | GND | Ground. Must be connected to ground using lowest possible impedance. |
| 8 | GND | Ground. Must be connected to ground using lowest possible impedance. | 16 | N/C | No connection |

Electrical and Mechanical Specifications

The absolute maximum ratings of the SKY12207-306LF are provided in Table 2. Recommended operating conditions are specified in Table 3 and electrical specifications are provided in Table 4.

Typical performance characteristics of the SKY12207-306LF are illustrated in Figures 3 through 16.

The state of the SKY12207-306LF is determined by the logic provided in Table 6. Table 7 provides the logic for use with the SKY12207-306LF Evaluation Board.

Power derating data is plotted against temperature in Figures 17 and 18. Equivalent circuit diagrams for transmit and receive are shown in Figure 19.

Table 2. SKY12207-306LF Absolute Maximum Ratings¹

| Parameter | Symbol | Minimum | Maximum | Units |
|---|------------------|---------|---------|-------|
| RF CW input power, TX and ANT ports (T _{SUBSTRATE} = 25 °C) | P _{IN} | | 75 | W |
| RF peak input power, TX and ANT ports (T _{SUBSTRATE} = 25 °C, RF burst width = 10 μs, RF burst repetition rate = 25 kHz) | P _{IN} | | 300 | W |
| RF CW input power, RX port (T _{SUBSTRATE} = 25 °C) | P _{IN} | | 60 | W |
| RF peak input power, RX port (T _{SUBSTRATE} = 25 °C, RF burst width = 10 μs, RF burst repetition rate = 25 kHz) | P _{IN} | | 240 | W |
| Control port reverse voltage | V _{CTL} | | 200 | V |
| Control port forward current | I _{CTL} | | 200 | mA |
| Operating temperature | T _{OP} | -55 | +175 | °C |
| Storage temperature | T _{STG} | -55 | +200 | °C |
| Electrostatic discharge: | ESD | | | |
| Charged Device Model (CDM), Class 4 | | | 1000 | V |
| Human Body Model (HBM), Class 1A | | | 250 | V |
| Machine Model (MM), Class B | | | 150 | 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 (Per ANT, TX, RX, and RX_BIAS Inputs)

| Parameter | Symbol | Min | Typ | Max | Units |
|------------------------------|------------------|-----|-----|-----|-------|
| Control port reverse voltage | V _{CTL} | 5 | 28 | 100 | V |
| Control port forward current | I _{CTL} | 20 | 50 | 100 | mA |

Table 4. SKY12207-306LF Electrical Specifications, Bias Voltage = 28 V¹ (1 of 3)
 (T_{OP} = +25 °C, Characteristic Impedance [Z₀] = 50 Ω, EVB Optimized for 2.6 GHz Operation, Unless Otherwise Noted)

| Parameter | Symbol | Test Condition | Min | Typ | Max | Units | | | | | |
|---------------------------------|-----------------------|---|-----|-----|-----|-------|----------------|------|------|--|----|
| Insertion loss, TX to ANT ports | IL _{TX-ANT} | V _{PIN_2} = 1 V, I _{PIN_14} = -50 mA, I _{PIN_9} = -50 mA, V _{PIN_7} = 28 V, TX port P _{IN} @ pin 14 = 0 dBm: | | | | | | | | | |
| | | | | | | | 900 MHz | 0.60 | | | dB |
| | | | | | | | 1.80 GHz | 0.31 | | | dB |
| | | | | | | | 2.01 GHz | 0.32 | 0.45 | | dB |
| | | | | | | | 2.3 to 2.7 GHz | 0.40 | 0.55 | | dB |
| 3.3 to 3.8 GHz | 0.54 | | | dB | | | | | | | |
| Insertion loss, ANT to RX ports | IL _{ANT-RX} | V _{PIN_2} = 1 V, V _{PIN_14} = 28 V, I _{PIN_7} = -50 mA, V _{PIN_9} = 28 V, ANT port P _{IN} @ pin 2 = 0 dBm: | | | | | | | | | |
| | | | | | | | 900 MHz | 0.58 | | | dB |
| | | | | | | | 1.80 GHz | 0.35 | | | dB |
| | | | | | | | 2.01 GHz | 0.37 | 0.50 | | dB |
| | | | | | | | 2.3 to 2.7 GHz | 0.45 | 0.60 | | dB |
| 3.3 to 3.8 GHz | 0.67 | | | dB | | | | | | | |
| Isolation, TX to RX ports | ISO _{TX-RX} | V _{PIN_2} = 1 V, I _{PIN_14} = -50 mA, I _{PIN_9} = -50 mA, V _{PIN_7} = 28 V, TX port P _{IN} @ pin 14 = 0 dBm: | | | | | | | | | |
| | | | | | | | 900 MHz | | 38.0 | | dB |
| | | | | | | | 1.80 GHz | | 44.0 | | dB |
| | | | | | | | 2.01 GHz | 42.5 | 45.0 | | dB |
| | | | | | | | 2.3 to 2.7 GHz | 37.0 | 39.0 | | dB |
| 3.3 to 3.8 GHz | | 29.0 | | dB | | | | | | | |
| Isolation, ANT to TX ports | ISO _{ANT-TX} | V _{PIN_2} = 1 V, V _{PIN_14} = 28 V, I _{PIN_7} = -50 mA, V _{PIN_9} = 28 V, ANT port P _{IN} @ pin 2 = 0 dBm: | | | | | | | | | |
| | | | | | | | 900 MHz | | 26.0 | | dB |
| | | | | | | | 1.80 GHz | | 22.0 | | dB |
| | | | | | | | 2.01 GHz | 17.5 | 21.0 | | dB |
| | | | | | | | 2.3 to 2.7 GHz | 17.0 | 20.0 | | dB |
| 3.3 to 3.8 GHz | | 16.0 | | dB | | | | | | | |
| Isolation, ANT to RX ports | ISO _{ANT-RX} | V _{PIN_2} = 1 V, I _{PIN_14} = -50 mA, I _{PIN_9} = -50 mA, V _{PIN_7} = 28 V, ANT port P _{IN} @ pin 2 = 0 dBm: | | | | | | | | | |
| | | | | | | | 900 MHz | | 37 | | dB |
| | | | | | | | 1.80 GHz | | 41 | | dB |
| | | | | | | | 2.01 GHz | 39 | 41 | | dB |
| | | | | | | | 2.3 to 2.7 GHz | 36 | 37 | | dB |
| 3.3 to 3.8 GHz | | 28 | | dB | | | | | | | |

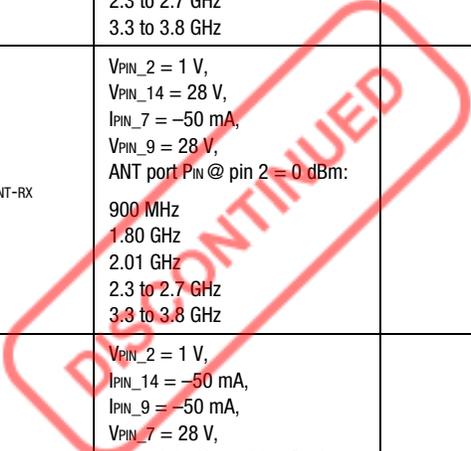


Table 4. SKY12207-306LF Electrical Specifications, Bias Voltage = 28 V¹ (2 of 3)
(T_{OP} = +25 °C, Characteristic Impedance [Z₀] = 50 Ω, EVB Optimized for 2.6 GHz Operation, Unless Otherwise Noted)

| Parameter | Symbol | Test Condition | Min | Typ | Max | Units |
|--|---------|--|-----|------|-----|-------|
| Input return loss | | 1.8 to 2.5 GHz: RX insertion loss state, ANT port (@ pin 2) | | 28 | | dB |
| | | TX insertion loss state, TX port (@ pin 14) | | 26 | | dB |
| Transmit 2 nd harmonic | 2fo | TX insertion loss state, TX port P _{IN} @ pin 14 = +30 dBm: | | | | |
| | | 900 MHz | | -88 | | dBc |
| | | 1.80 GHz | | -85 | | dBc |
| | | 2.01 GHz | | -95 | | dBc |
| | | 2.50 GHz | | -95 | | dBc |
| 3.55 GHz | | -89 | | dBc | | |
| Transmit 3 rd harmonic | 3fo | TX insertion loss state, TX port P _{IN} @ pin 14 = +30 dBm: | | | | |
| | | 900 MHz | | -99 | | dBc |
| | | 1.80 GHz | | -97 | | dBc |
| | | 2.01 GHz | | -105 | | dBc |
| | | 2.50 GHz | | -97 | | dBc |
| 3.55 GHz | | -90 | | dBc | | |
| Transmit third order input intercept point | IIP3 | V _{PIN_2} = 1 V, I _{PIN_14} = -50 mA, I _{PIN_9} = -50 mA, V _{PIN_7} = 28 V, TX port P _{IN} @ pin 14 = +30 dBm/tone, tone spacing = 1 MHz, 2.01 GHz | | +78 | | dBm |
| Transmit 0.1 dB compression point | IPO.1dB | V _{PIN_2} = 1 V, I _{PIN_14} = -50 mA, I _{PIN_9} = -50 mA, V _{PIN_7} = 28 V, 0.9 to 3.55 GHz | | +45 | | dBm |
| Receive 0.1 dB compression point | IPO.1dB | V _{PIN_2} = 1 V, V _{PIN_14} = 28 V, I _{PIN_7} = -50 mA, V _{PIN_9} = 28 V, 0.9 to 3.55 GHz | | +46 | | dBm |

Table 4. SKY12207-306LF Electrical Specifications, Bias Voltage = 28 V¹ (3 of 3)
(T_{OP} = +25 °C, Characteristic Impedance [Z₀] = 50 Ω, EVB Optimized for 2.6 GHz Operation, Unless Otherwise Noted)

| Parameter | Symbol | Test Condition | Min | Typ | Max | Units |
|---|-------------------------|--|-----|-----|-----|-------|
| Maximum transmit CW input power | P _{IN_CW} | V _{PIN_2} = 1 V, I _{PIN_14} = -50 mA, I _{PIN_9} = -50 mA, V _{PIN_7} = 28 V, 0.9 to 3.55 GHz | | 50 | | W |
| Maximum transmit TDD LTE input power ² | P _{IN_TDD LTE} | V _{PIN_2} = 1 V, I _{pin_14} = -50 mA I _{pin_9} = -50 mA V _{pin_7} = 28 V PAR = 8 dB 3.6 GHz | | | 46 | dBm |
| Maximum receive CW input power | P _{IN_CW} | V _{PIN_2} = 1 V, V _{PIN_14} = 28 V, I _{PIN_7} = -50 mA, V _{PIN_9} = 28 V, 0.9 to 3.55 GHz | | 40 | | W |
| Transmit RF switching time | t _{sw} | 10% to 90% RF on, repetition rate = 0.5 MHz, @ 2.60 GHz | | 85 | | ns |

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

² Not 100% tested in production. Guaranteed by design

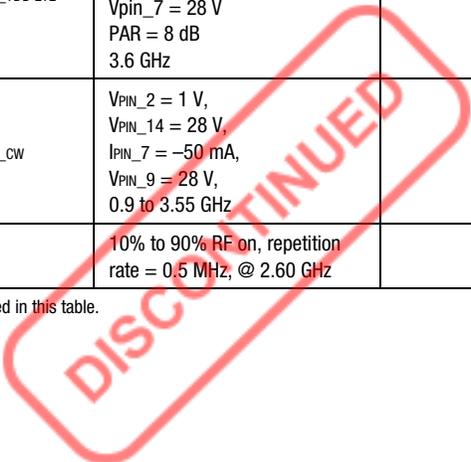


Table 5. SKY12207-306LF Electrical Specifications, Bias Voltage = 5 V¹ (1 of 3)
(T_{OP} = +25 °C, Characteristic Impedance [Z₀] = 50 Ω, EVB Optimized for 2.6 GHz Operation, Unless Otherwise Noted)

| Parameter | Symbol | Test Condition | Min | Typ | Max | Units | |
|---------------------------------|-----------------------|---|------|------|------|-------|--|
| Insertion loss, TX to ANT ports | IL _{TX-ANT} | V _{PIN_2} = 1 V, I _{PIN_14} = -50 mA, I _{PIN_9} = -50 mA, V _{PIN_7} = 5 V, TX port P _{IN} @ pin 14 = 0 dBm: 900 MHz 1.80 GHz 2.01 GHz 2.3 to 2.7 GHz 3.3 to 3.8 GHz | | 0.63 | | | |
| | | | | | 0.34 | | |
| | | | | | 0.36 | 0.45 | |
| | | | | | 0.44 | 0.55 | |
| | | | | | 0.61 | | |
| Insertion loss, ANT to RX ports | IL _{ANT-RX} | V _{PIN_2} = 1 V, V _{PIN_14} = 5 V, I _{PIN_7} = -50 mA, V _{PIN_9} = 5 V, ANT port P _{IN} @ pin 2 = 0 dBm: 900 MHz 1.80 GHz 2.01 GHz 2.3 to 2.7 GHz 3.3 to 3.8 GHz | | 0.60 | | | |
| | | | | | 0.36 | | |
| | | | | | 0.38 | 0.50 | |
| | | | | | 0.47 | 0.60 | |
| | | | | | 0.72 | | |
| Isolation, TX to RX ports | ISO _{TX-RX} | V _{PIN_2} = 1 V, I _{PIN_14} = -50 mA, I _{PIN_9} = -50 mA, V _{PIN_7} = 5 V, TX port P _{IN} @ pin 14 = 0 dBm: 900 MHz 1.80 GHz 2.01 GHz 2.3 to 2.7 GHz 3.3 to 3.8 GHz | | | | | |
| | | | | | 37.0 | | |
| | | | | | 44.0 | | |
| | | | 42.5 | | 45.0 | | |
| | | | 37.0 | | 39.0 | | |
| Isolation, ANT to TX ports | ISO _{ANT-TX} | V _{PIN_2} = 1 V, V _{PIN_14} = 5 V, I _{PIN_7} = -50 mA, V _{PIN_9} = 5 V, ANT port P _{IN} @ pin 2 = 0 dBm: 900 MHz 1.80 GHz 2.01 GHz 2.3 to 2.7 GHz 3.3 to 3.8 GHz | | | | | |
| | | | | | 26.0 | | |
| | | | | | 22.0 | | |
| | | | 17.5 | | 21.0 | | |
| | | | 17.0 | | 19.0 | | |
| Isolation, ANT to RX ports | ISO _{ANT-RX} | V _{PIN_2} = 1 V, I _{PIN_14} = -50 mA, I _{PIN_9} = -50 mA, V _{PIN_7} = 5 V, ANT port P _{IN} @ pin 2 = 0 dBm: 900 MHz 1.80 GHz 2.01 GHz 2.3 to 2.7 GHz 3.3 to 3.8 GHz | | | | | |
| | | | | | 36 | | |
| | | | | | 41 | | |
| | | | 39 | | 41 | | |
| | | | 35 | | 36 | | |
| | | | | 27 | | | |

Table 5. SKY12207-306LF Electrical Specifications, Bias Voltage = 5 V¹ (2 of 3)
(T_{OP} = +25 °C, Characteristic Impedance [Z₀] = 50 Ω, EVB Optimized for 2.6 GHz Operation, Unless Otherwise Noted)

| Parameter | Symbol | Test Condition | Min | Typ | Max | Units |
|--|---------|---|-----|-----|-----|-------|
| Input return loss | | 1.8 to 2.5 GHz: RX insertion loss state, ANT port (@ pin 2) | | 23 | | dB |
| | | TX insertion loss state, TX port (@ pin 14) | | 23 | | dB |
| Transmit 2 nd harmonic | 2fo | TX insertion loss state, TX port P _{IN} @ pin 14 = +30 dBm: | | | | |
| | | 900 MHz | | -46 | | dBc |
| | | 1.80 GHz | | -50 | | dBc |
| | | 2.01 GHz | | -52 | | dBc |
| | | 2.50 GHz | | -54 | | dBc |
| 3.55 GHz | | -68 | | dBc | | |
| Transmit 3 rd harmonic | 3fo | TX insertion loss state, TX port P _{IN} @ pin 14 = +30 dBm: | | | | |
| | | 900 MHz | | -57 | | dBc |
| | | 1.80 GHz | | -70 | | dBc |
| | | 2.01 GHz | | -72 | | dBc |
| | | 2.50 GHz | | -71 | | dBc |
| 3.55 GHz | | -62 | | dBc | | |
| Transmit third order input intercept point | IIP3 | V _{PIN_2} = 1 V, I _{PIN_14} = -50 mA, I _{PIN_9} = -50 mA, V _{PIN_7} = 5 V, TX port P _{IN} @ pin 14 = +30 dBm/tone, tone spacing = 1 MHz, @ 2.01 GHz | | +74 | | dBm |
| Transmit 0.1 dB compression point | IPO.1dB | V _{PIN_2} = 1 V, I _{PIN_14} = -50 mA, I _{PIN_9} = -50 mA, V _{PIN_7} = 5 V, 1.8 to 2.5 GHz | | +33 | | dBm |
| Receive 0.1 dB compression point | IPO.1dB | V _{PIN_2} = 1 V, V _{PIN_14} = 5 V, I _{PIN_7} = -50 mA, V _{PIN_9} = 5 V, 0.9 to 3.55 GHz | | +34 | | dBm |

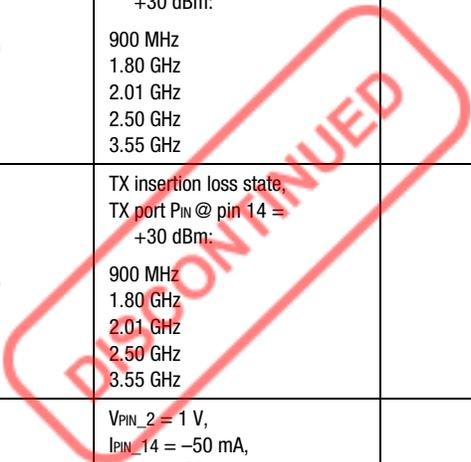
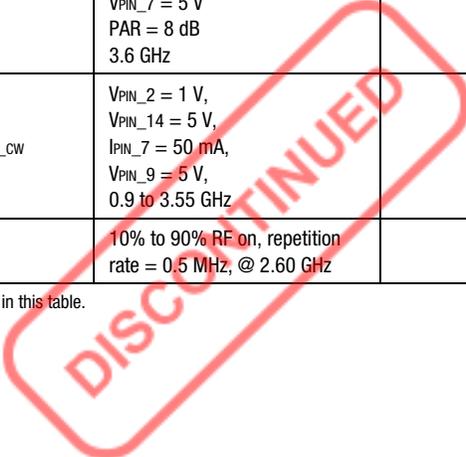


Table 5. SKY12207-306LF Electrical Specifications, Bias Voltage = 5 V¹ (3 of 3)
(T_{OP} = +25 °C, Characteristic Impedance [Z₀] = 50 Ω, EVB Optimized for 2.6 GHz Operation, Unless Otherwise Noted)

| Parameter | Symbol | Test Condition | Min | Typ | Max | Units |
|---|-------------------------|--|-----|-----|-----|-------|
| Maximum transmit CW input power | P _{IN_CW} | V _{PIN_2} = 1 V, I _{PIN_14} = -50 mA, I _{PIN_9} = -50 mA, V _{PIN_7} = 5 V, 0.9 to 3.55 GHz | | 15 | | W |
| Maximum transmit TDD LTE input power ² | P _{IN_TDD LTE} | V _{PIN_2} = 1 V I _{PIN_14} = -50 mA I _{PIN_9} = -50 mA V _{PIN_7} = 5 V PAR = 8 dB 3.6 GHz | | | 39 | dBm |
| Maximum receive CW input power | P _{IN_CW} | V _{PIN_2} = 1 V, V _{PIN_14} = 5 V, I _{PIN_7} = 50 mA, V _{PIN_9} = 5 V, 0.9 to 3.55 GHz | | 10 | | W |
| Transmit RF switching time | t _{sw} | 10% to 90% RF on, repetition rate = 0.5 MHz, @ 2.60 GHz | | 85 | | ns |

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

² Not 100% tested in production. Guaranteed by design.



Typical Performance Characteristics

($T_{OP} = +25\text{ }^{\circ}\text{C}$, Characteristic Impedance [Z_0] = 50 Ω , EVB Optimized for 2.6 GHz Operation, Unless Otherwise Noted)

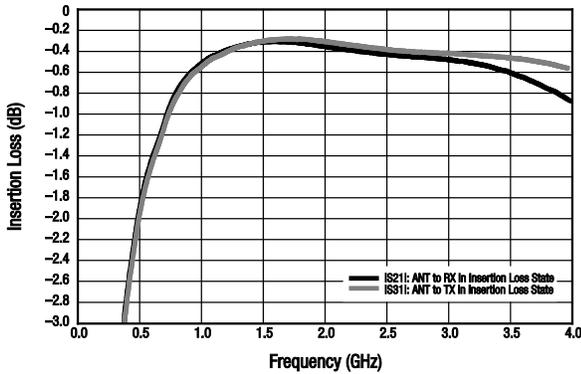


Figure 3. Insertion Loss vs Frequency
(ANT to RX and ANT to TX Ports; $V_{CTL} = 28\text{ V}$, $I_{CTL} = -50\text{ mA}$)

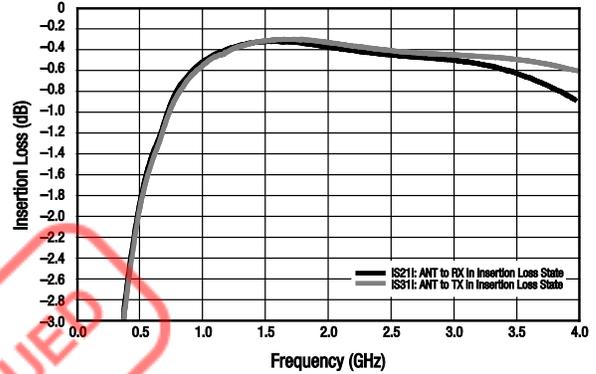


Figure 4. Insertion Loss vs Frequency
(ANT to RX and ANT to TX Ports; $V_{CTL} = 5\text{ V}$, $I_{CTL} = -50\text{ mA}$)

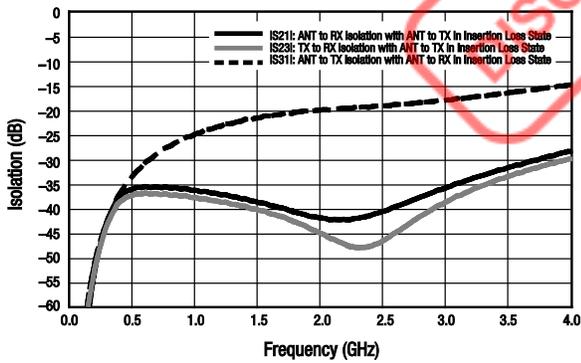


Figure 5. Isolation vs Frequency
(ANT to RX, TX to RX, and ANT to TX Ports;
 $V_{CTL} = 28\text{ V}$, $I_{CTL} = -50\text{ mA}$)

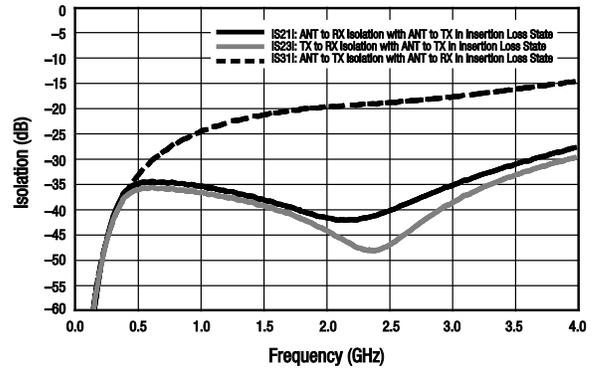


Figure 6. Isolation vs Frequency
(ANT to RX, TX to RX, and ANT to TX Ports;
 $V_{CTL} = 5\text{ V}$, $I_{CTL} = -50\text{ mA}$)

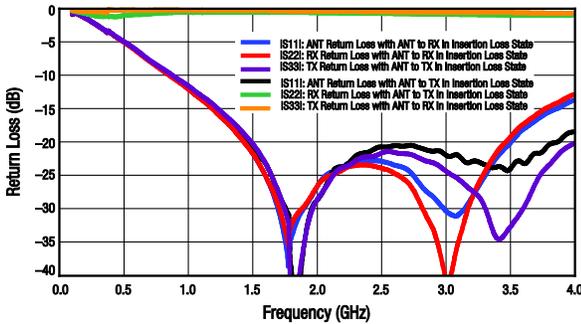


Figure 7. Return Loss vs Frequency
(ANT, TX, and RX Ports; $V_{CTL} = 28\text{ V}$, $I_{CTL} = -50\text{ mA}$)

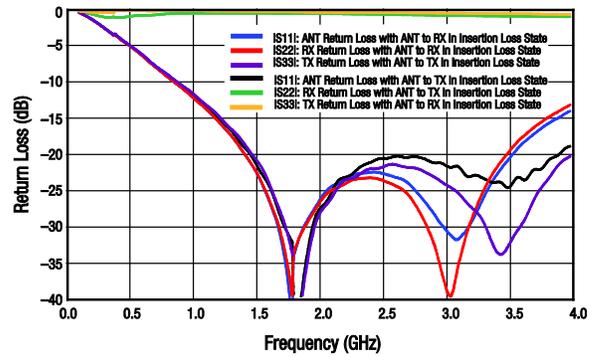


Figure 8. Return Loss vs Frequency
(ANT, TX, and RX Ports; $V_{CTL} = 5\text{ V}$, $I_{CTL} = -50\text{ mA}$)

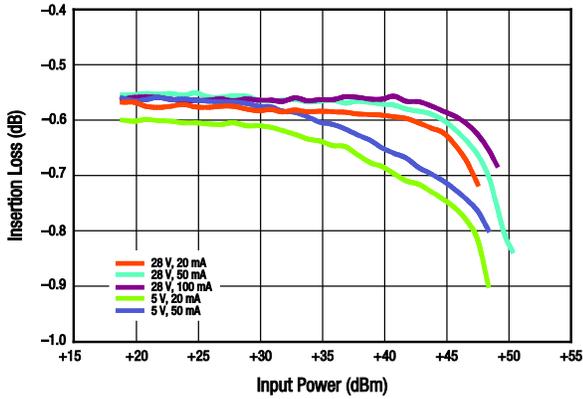


Figure 9. Insertion Loss vs CW Input Power (ANT to RX Port, $f = 2.6$ GHz)

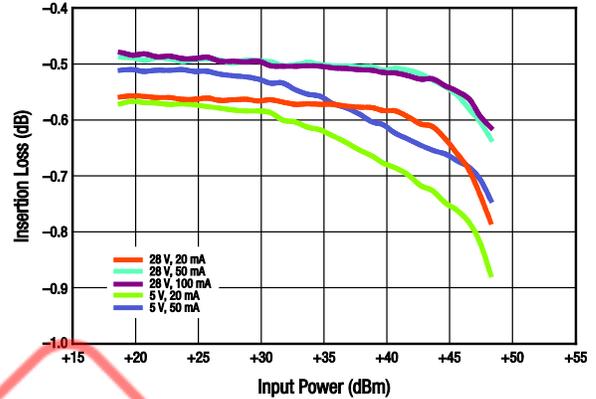


Figure 10. Insertion Loss vs CW Input Power (TX to ANT Port, $f = 2.6$ GHz)

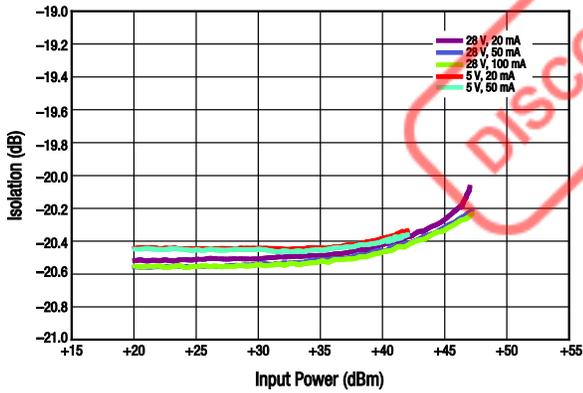


Figure 11. Isolation vs CW Input Power (ANT to RX Port, $f = 2.6$ GHz)

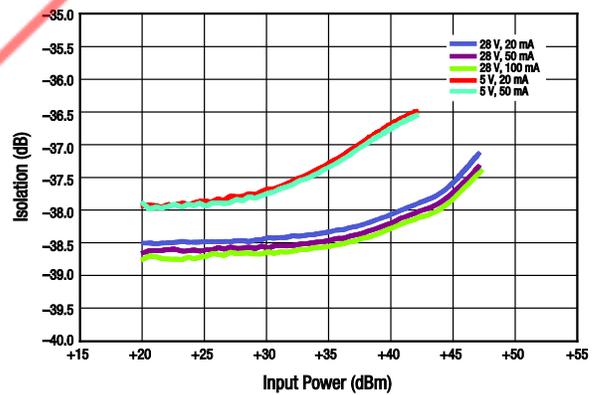


Figure 12. Isolation vs CW Input Power (TX to ANT Port, $f = 2.6$ GHz)

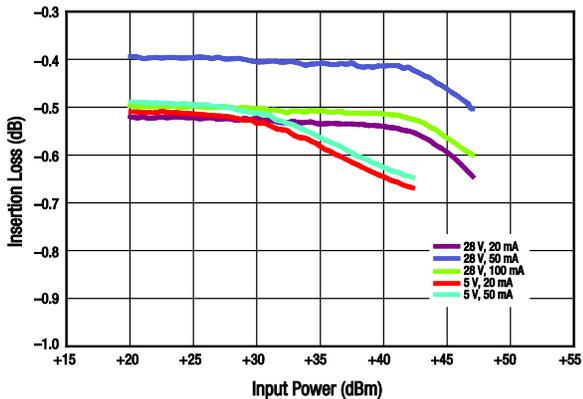


Figure 13. Insertion Loss vs CW Input Power (ANT to RX Port, $f = 2.3$ GHz)

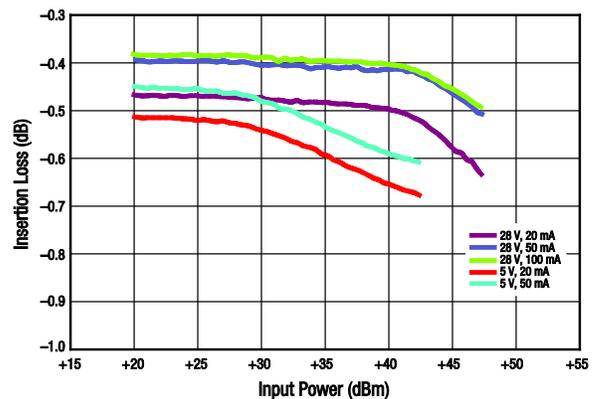


Figure 14. Insertion Loss vs CW Input Power (TX to ANT Port, $f = 2.3$ GHz)

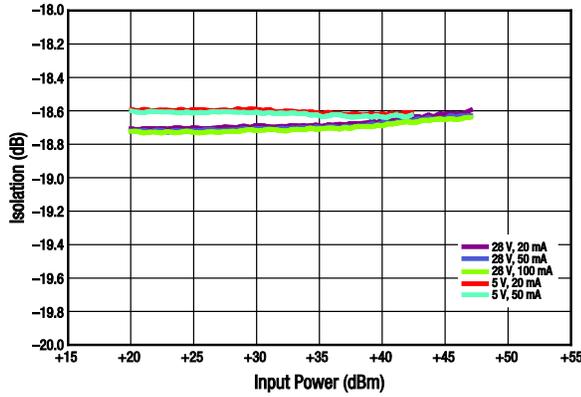


Figure 15. Isolation vs CW Input Power (ANT to RX Port, f = 2.3 GHz)

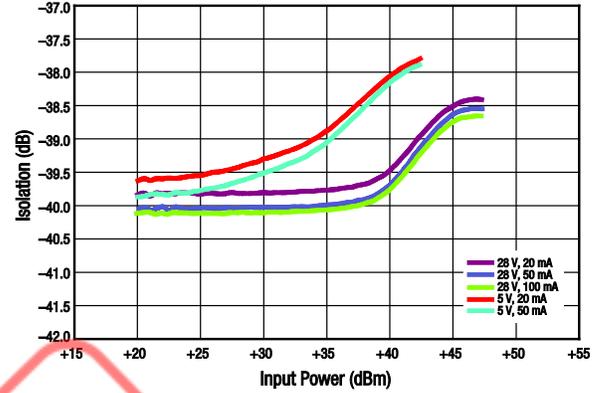


Figure 16. Isolation vs CW Input Power (TX to ANT Port, f = 2.3 GHz)

Table 6. SKY12207-306LF Truth Table

| Switch State | Path | | Control Conditions | | | |
|--------------------------|---|---|---------------------------------|--------------------------------------|--|-----------------------|
| | Antenna-to-Receiver Port (Pin 2 to Pin 7) | Transmitter-to-Antenna Port (Pin 14 to Pin 2) | Antenna Port Bias Input (Pin 2) | Nominal Receiver Output Port (Pin 7) | Nominal Transmitter Port Bias Input (Pin 14) | RX_BIAS Input (Pin 9) |
| Receive (see Figure 12) | Low insertion loss | High isolation | 1 V | -50 mA | 28 V | 28 V |
| Transmit (see Figure 12) | High isolation | Low insertion loss | 1 V | 28 V | -50 mA | -50 mA |

Table 7. SKY12207-306LF Evaluation Board Truth Table

| Switch State | Path | | Control Conditions | | | |
|--------------------------|--------------------------|-----------------------------|-------------------------|----------------------|-----------------------------|---------------|
| | Antenna-to-Receiver Port | Transmitter-to-Antenna Port | Antenna Port Bias Input | Receiver Output Port | Transmitter Port Bias Input | RX_BIAS Input |
| Receive (see Figure 12) | Low insertion loss | High isolation | 28 V | 0 V (ground) | 28 V | 28 V |
| Transmit (see Figure 12) | High isolation | Low insertion loss | 28 V | 28 V | 0 V (ground) | 0 V (ground) |

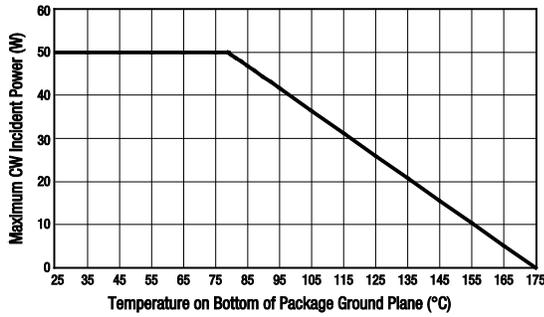


Figure 17. Transmit Power Derating, Maximum CW Incident Power (Insertion Loss = 0.3 dB) vs Temperature on Bottom of Package Ground Plane

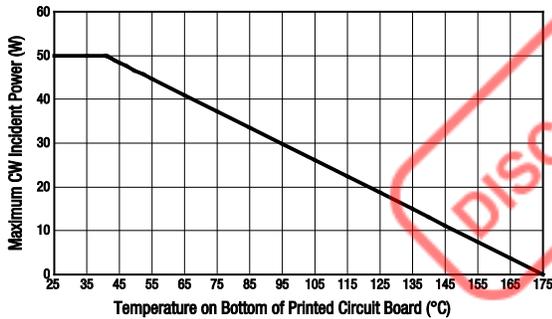


Figure 18. Transmit Power Derating, Maximum CW Incident Power (Insertion Loss = 0.3 dB) vs Temperature on Bottom of Printed Circuit Board

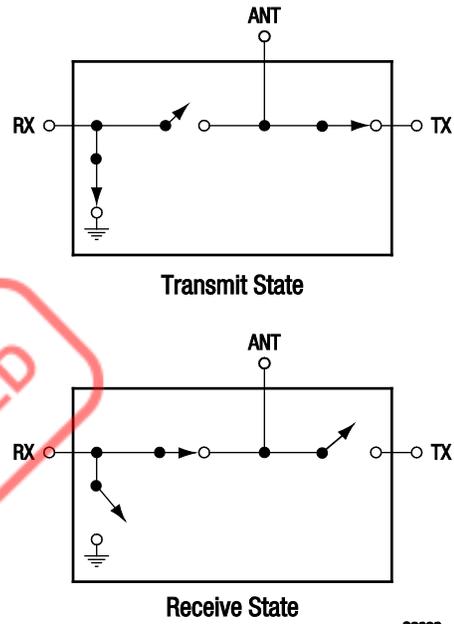


Figure 19. SKY12207-306LF Equivalent Circuit Diagrams

Evaluation Board Description

The SKY12207-306LF Evaluation Board is used to test the performance of the SKY12207-306LF PIN Diode SPDT switch. An assembly drawing for the Evaluation Board is shown in Figure 20. The layer detail is provided in Figure 21.

The SKY12207-306LF is designed to handle very large signals. Sufficient power may be dissipated by this switch to cause heating of the PIN diodes contained in the switch. It is very important to use a printed circuit board design that provides adequate cooling capability to keep the junction temperature of the PIN diodes below their maximum rated operating temperature.

As indicated in Figure 17, the x-axis temperature is referenced to the bottom of the QFN package. A printed circuit board with a very low thermal resistance and external heat sink design must be used to achieve the results shown in this Figure. The power derating curve with the x-axis temperature referenced to the bottom of the printed circuit board is provided in Figure 18.

The evaluation circuit is designed to facilitate control of the SKY12207-306LF transmit/receive switch with bias signals derived from positive voltages.

The state of the PIN diodes within the SKY12207-306LF is controlled with 5 V applied to the ANT port and bias voltages of either 28 V or 0 V applied to the remaining bias inputs (RX and TX ports). The switch state circuit diagrams are shown in Figure 19.

The value of resistor R1, 80 Ω, is selected to provide 50 mA of forward current through the "on" series diode with 5 V applied to the ANT port bias pin. The R2 resistance value of 540 Ω is selected to produce approximately 50 mA of forward bias current in the RX shunt diode with a source voltage of 28 V.

The magnitudes of the voltages applied to the TX and RX ports determine which of the RX or TX series diodes is biased into forward conduction. For example, to place the SKY12207-306LF into the transmit state, 0 V is applied to the TX port (which forward biases the diode between pins 2 and 14), 28 V is applied to the RX port (which reverse biases the diode between pins 2 and 7), and 0 V is applied to the RX_BIAS port (which applies a forward bias through R2 to the diode connected between pins 7 and 9).

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The component values shown in the Evaluation Board circuit diagram (Figure 22) were selected to optimize performance in the 2.0 to 3.5 GHz band.

Refer to Table 8 for the Evaluation Board Bill of Materials. Table 9 provides voltage, current, and resistor values for bias adjustments.

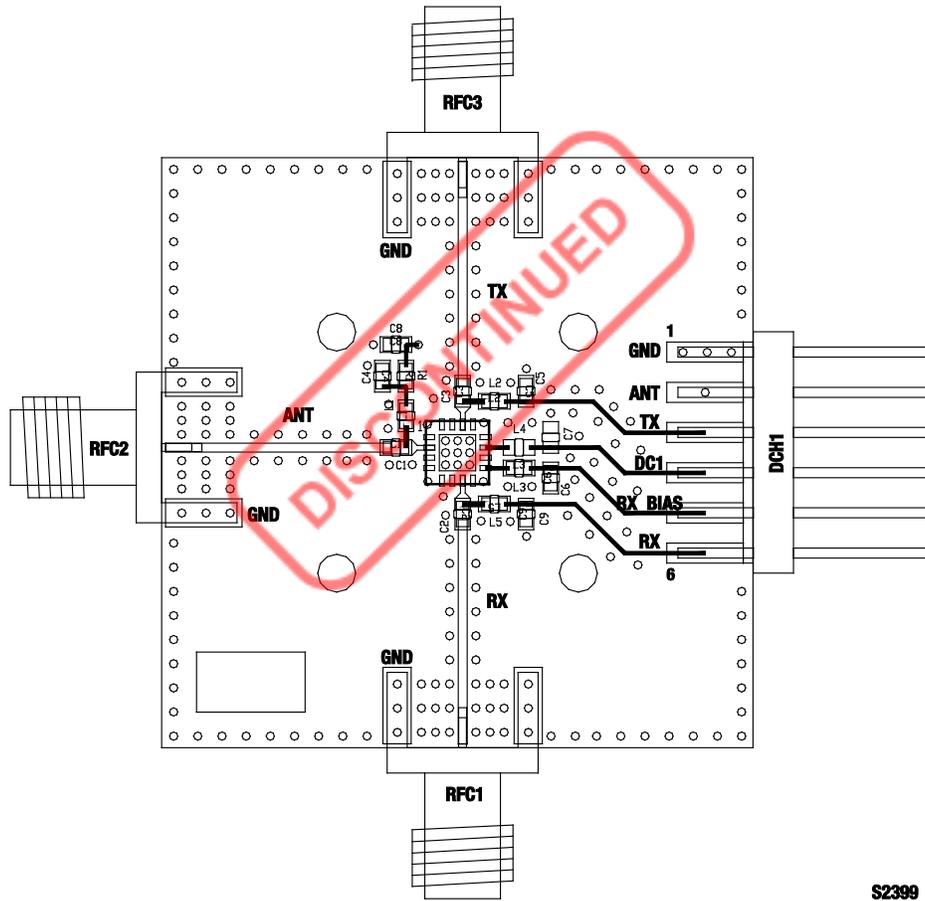


Figure 20. SKY12207-306LF Evaluation Board Assembly Diagram

S2399

| Cross Section | Name | Thickness (in) | Material |
|---|-------------------|----------------|---------------------|
|  | Top Soldermask | | |
|  | L1 | (0.0028) | Cu foil |
|  | Laminate | 0.012 ± 0.0006 | Rogers R04003C Core |
|  | L2 | (0.0014) | Cu foil |
|  | Laminate | (Note 1) | FR4 Prepreg |
|  | L3 | (0.0014) | Cu foil |
|  | Laminate | 0.010 ± 0.0006 | FR4 Core |
|  | L4 | (0.0028) | Cu foil |
|  | Bottom Soldermask | | |

Note 1: Adjust this thickness to meet total thickness goal of 0.062 ± 0.005 inches.

S2531

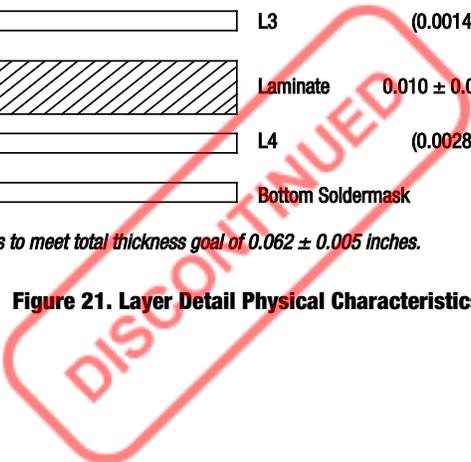
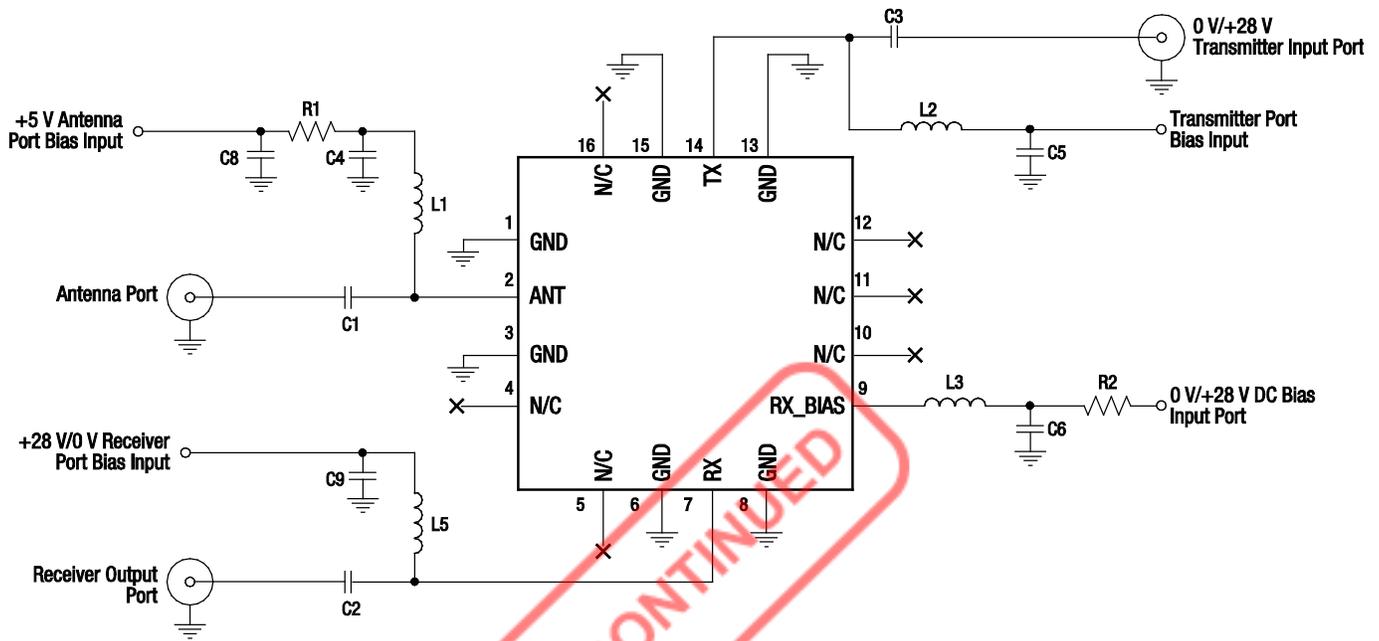


Figure 21. Layer Detail Physical Characteristics



NOTE: The N/C pins (4, 5, 10, 11, 12, and 16) are not internally connected, so they can be left open or grounded.

S2402

Figure 22. Evaluation Board Schematic

Table 8. Evaluation Board Bill of Materials¹

| Component | Value | Size | Product Number | Manufacturer | Mfr Part Number | Characteristics |
|----------------------------|---------|------|----------------|--------------|-----------------|--------------------------|
| C1, C2, C3, C4, C5, C6, C9 | 1000 pF | 0603 | 5404R23-057 | TDK | C1608C0G1H102JT | COG, 50 V, ±5% |
| C8 | 1 μF | 0603 | 5404R29-070 | TDK | C2012X7R1H104K | X7R, 50 V, ±10% |
| L1, L2, L5 | 22 nH | 0603 | 55332R34-028 | Taiyo-Yuden | HK160822NJ-T | SRF, 1600 MHz, ±5% |
| L3 | 560 nH | 0603 | | Coil Craft | 0603LS-561XJLB | SRF, 525 MHz, ±5% |
| R1 (Note 2) | 80 Ω | 0603 | | Panasonic | ERJ-3GEYJ161V | 0.1 W, 5% |
| R2 (Note 3) | 540 Ω | | | | | Axial leaded (off board) |

¹ Component values selected are based on the desired frequency and bias level. Values may be adjusted for a specific response.

² Two 160 Ω resistors are combined in parallel to achieve a minimum power handling requirement and an 80 Ω resistance.

³ Evaluation Board does not include resistor R2. Operating at 28 V and 50 mA requires the R2 resistor with a power dissipation greater than 1.35 W.

Table 9. Component Calculation Values¹

| Vs (V) | V _{DIODE} (V) | V _{RES} (V) | Current (A) | Resistance (Ω) | Power Dissipation (W) |
|--------|------------------------|----------------------|-------------|----------------|-----------------------|
| 28 | 1 | 27 | 0.05 | 540 | 1.35 |
| 28 | 1 | 27 | 0.02 | 1350 | 0.54 |
| 5 | 1 | 4 | 0.05 | 80 | 0.20 |
| 5 | 1 | 4 | 0.02 | 200 | 0.08 |

¹ Vs = supply voltage; V_{DIODE} = voltage drop across the diode; V_{RES} = voltage drop across the resistor.

R1 and R2 values are calculated by $(V_s - V_{DIODE})/I$, where I is the desired bias current.

The power dissipation in R1 or R2 is calculated by $I \times (V_s - V_{DIODE})$. The resistor selected must be safely rated with a power greater than the dissipated power.

Package Dimensions

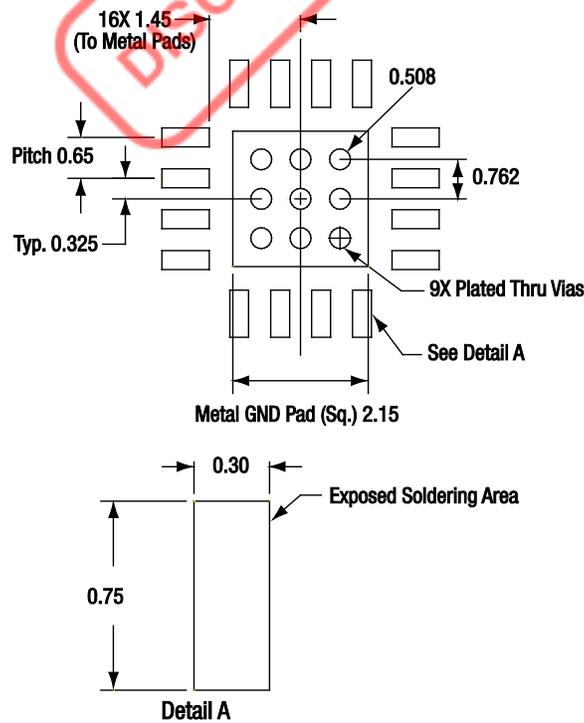
The PCB layout footprint for the SKY12207-306LF is shown in Figure 23. Typical part markings are noted in Figure 24. Package dimensions are shown in Figure 25, and tape and reel dimensions are provided in Figure 26.

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 SKY12207-306LF 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



All measurements in millimeters

S2274

Figure 23. SKY12207-306LF PCB Layout Footprint

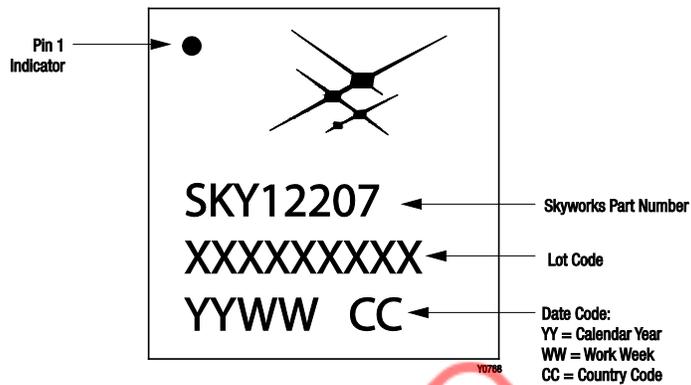
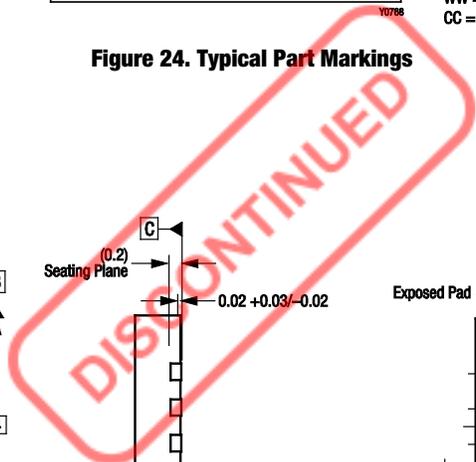
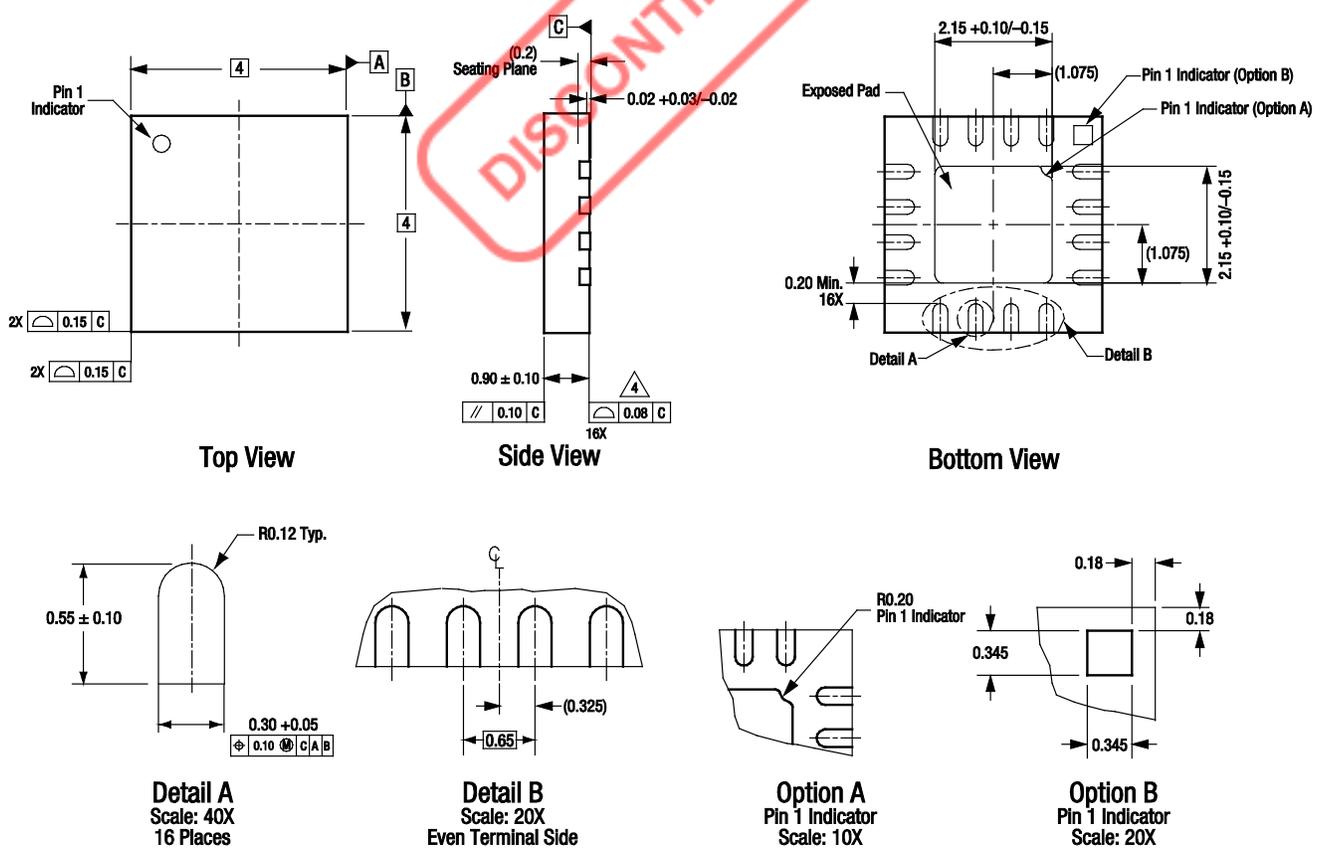


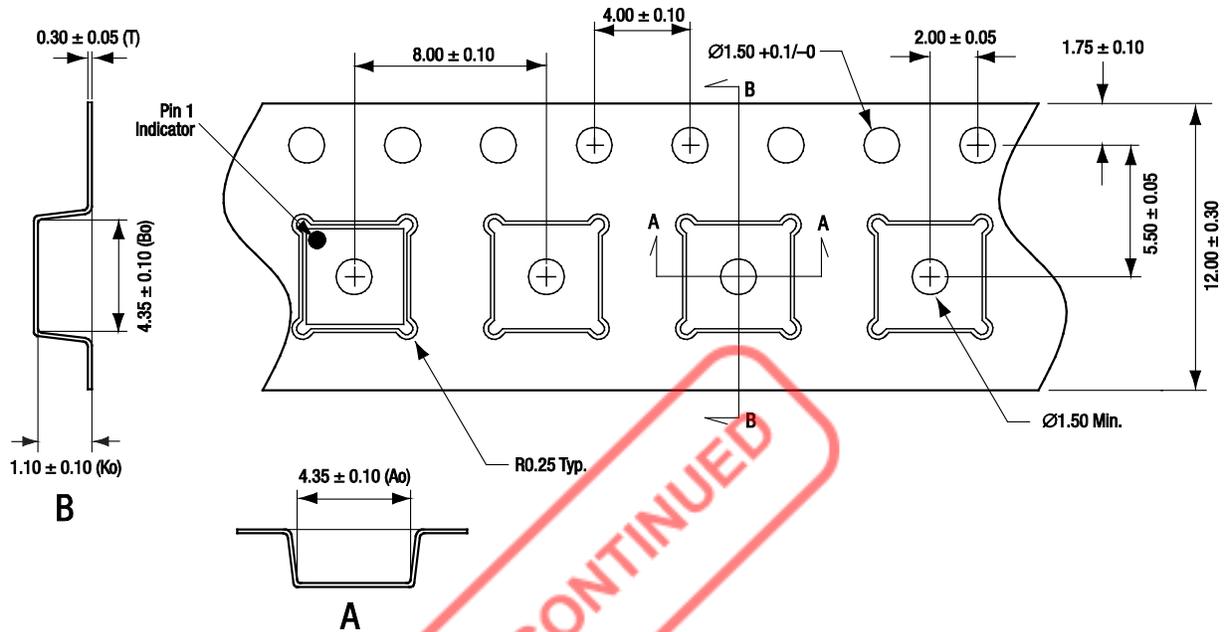
Figure 24. Typical Part Markings



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.
 Package may have option A or option B pin 1 indicator.

S2400

Figure 25. SKY12207-306LF Package Dimensions



- Notes:**
1. Carrier tape material: black conductive polystyrene, non-bakeable
 2. Cover tape material: transparent conductive HSA
 3. Cover tape size: 9.2 mm width
 4. ESD surface resistivity is $\geq 1 \times 10^6 \sim \leq 1 \times 10^{10}$ Ohms/square per EIA, JEDEC TNR Specification.
 5. All measurements are in millimeters

DISCONTINUED

S1846

Figure 26. SKY12207-306LF Tape and Reel Dimensions

Ordering Information

| Part Number | Product Description | Evaluation Board Part Number |
|----------------|--|------------------------------|
| SKY12207-306LF | 0.9 to 4.0 GHz 50 W High-Power Silicon PIN Diode SPDT Switch | SKY12207-306LF-EVB |



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