# SKY13473–569LF: 0.4 to 2.7 GHz SP10T LTE Transmit/Receive Switch with MIPI RFFE Interface

## Applications

- 3G/4G multimode cellular tablets and handsets (LTE, UMTS, CDMA2000)
- Embedded data cards

## Features

- Broadband frequency range: 0.4 to 2.7 GHz
- Low insertion loss
- High isolation and linearity
- Integrated, programmable MIPI interface
- Default USID = 1011
- Ten linear TRX ports with isolation greater than 20 dB @ 2.7 GHz
- Small QFN (20-pin, 2.4 x 2.4 x 0.75 mm) package (MSL1, 260 °C per JEDEC J-STD–020)

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## Description

The SKY13473–569LF is a Single Pole, Ten Throw (SP10T) antenna switch with a Mobile Industry Processor Interface (MIPI) and is part of a two-switch family:

- SKY13473-569LF SP10T Antenna Switch with default USID = 1011 (this Data Sheet)

- SKY13473-12-569LF SP10T Antenna Switch with default USID = 1010 (Data Sheet #202983)

Using advanced switching technologies, the SKY13473–569LF maintains low insertion loss and high isolation for both transmit and receive switching paths. The high linearity performance and low insertion loss achieved by the SKY13473–569LF makes it an ideal choice for UMTS, CDMA2000, and LTE applications.

The switch also exhibits an excellent triple beat ratio and 2nd/3rd order Intermodulation Distortion (IMD) performance. Switching is controlled by an integrated MIPI interface. Depending on the logic applied to the decoder, the antenna pin is connected to one of 10 switched RF ports using a low insertion loss path, while the paths between the antenna pin and the other RF pins are in a high isolation state. No external DC blocking capacitors are required on the RF paths.
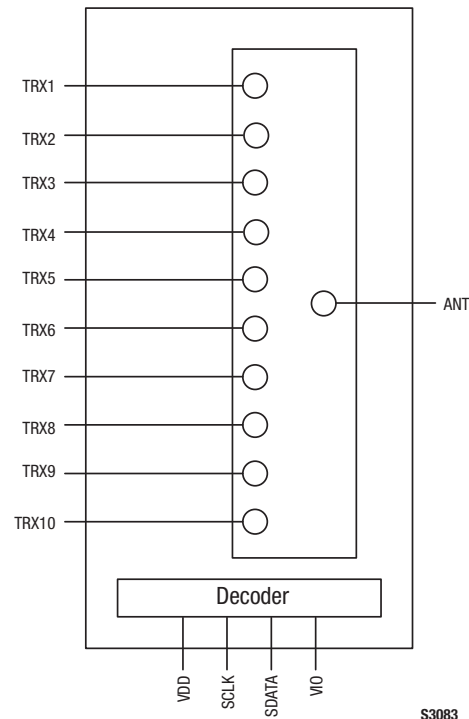


**Figure 1. SKY13473–569LF Block Diagram**

The SKY13473–569LF is manufactured in a compact, 2.4 x 2.4 x 0.75 mm, 20-pin surface mount 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.
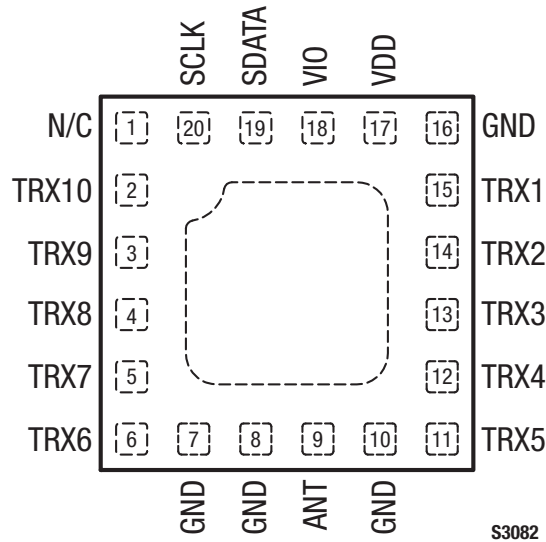
**Figure 2. SKY13473–569LF Pinout – 20-Pin QFN**
**(Top View)**

**Table 1. SKY13473–569LF Signal Descriptions**

| Pin # | Name | Description | Pin # | Name | Description |
|---|---|---|---|---|---|
| 1 | N/C | No connection. Can be grounded or left floating. | 11 | TRX5 | Multi-band, multi-mode transmit/receive port #5. This pin is either connected directly to or is disconnected from pin 9, depending on the control data applied to pin 19. |
| 2 | TRX10 | Multi-band, multi-mode transmit/receive port #10. This pin is either connected directly to or is disconnected from pin 9, depending on the control data applied to pin 19. | 12 | TRX4 | Multi-band, multi-mode transmit/receive port #4. This pin is either connected directly to or is disconnected from pin 9, depending on the control data applied to pin 19. |
| 3 | TRX9 | Multi-band, multi-mode transmit/receive port #9. This pin is either connected directly to or is disconnected from pin 9, depending on the control data applied to pin 19. | 13 | TRX3 | Multi-band, multi-mode transmit/receive port #3. This pin is either connected directly to or is disconnected from pin 9, depending on the control data applied to pin 19. |
| 4 | TRX8 | Multi-band, multi-mode transmit/receive port #8. This pin is either connected directly to or is disconnected from pin 9, depending on the control data applied to pin 19. | 14 | TRX2 | Multi-band, multi-mode transmit/receive port #2. This pin is either connected directly to or is disconnected from pin 9, depending on the control data applied to pin 19. |
| 5 | TRX7 | Multi-band, multi-mode transmit/receive port #7. This pin is either connected directly to or is disconnected from pin 9, depending on the control data applied to pin 19. | 15 | TRX1 | Multi-band, multi-mode transmit/receive port #1. This pin is either connected directly to or is disconnected from pin 9, depending on the control data applied to pin 19. |
| 6 | TRX6 | Multi-band, multi-mode transmit/receive port #6. This pin is either connected directly to or is disconnected from pin 9, depending on the control data applied to pin 19. | 16 | GND | Ground |
| 7 | GND | Ground | 17 | VDD | DC power supply |
| 8 | GND | Ground | 18 | VIO | MIPI decoder Interface/reference voltage |
| 9 | ANT | Antenna input/output | 19 | SDATA | Data input/output |
| 10 | GND | Ground | 20 | SCLK | Clock signal |

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**Table 2. SKY13473–569LF Absolute Maximum Ratings**

| Parameter | Symbol | Minimum | Maximum | Units |
|---|---|---|---|---|
| Power supply | $V_{DD}$ | 2.5 | 5.0 | V |
| Digital control signal | VIO | | 2 | V |
| RF input power | $P_{IN}$ | | +33 | dBm |
| Storage temperature | $T_{STG}$ | −55 | +150 | °C |
| Operating temperature | $T_{OP}$ | −40 | +90 | °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 SKY13473–569LF are provided in Table 2. Electrical specifications are provided in Tables 3 through 6. Figure 3 provides the timing diagram for turn-on time and switching time.

IMD2 and IMD3 test conditions for various frequencies are listed in Tables 7 and 8, respectively.

Triple Beat Ratio (TBR) test conditions for bands 2 and 5 are listed in Table 9.

Figure 4 illustrates the test setup used to measure intermodulation products. This industry standardized test is used to simulate the WCDMA Band 1 linearity of the antenna switch. A +20 dBm Continuous Wave (CW) signal, $f_{FUND}$, is sequentially applied to the TRX1 through TRX10 ports, while a −15 dBm CW blocker signal, $f_{BLK}$, is applied to the ANT port.

The resulting 3rd Order Intermodulation Distortion (IMD3), $f_{RX}$, is measured over all phases of $f_{FUND}$. The SKY13473–569LF exhibits exceptional performance for all TRXx ports.

Table 10 describes the register content and programming read/write sequences. Refer to the *MIPI Alliance Specification for RF Front-End Control Interface (RFFE)*, v1.10 (26 July 2011) for additional information on MIPI programming sequences and MIPI bus specifications.

Figures 5 and 6 provide the timing diagrams for register write commands and read commands, respectively.

Table 11 provides the Register_0 logic. Table 12 describes the register parameters and bit values.

**Table 3. SKY13473–569LF General Electrical Specifications (Note 1)**
**($V_{DD}$ = 2.85 V, VIO = 1.8 V, $T_{OP}$ = +25 °C, Characteristic Impedance [$Z_0$] = 50 Ω, Unless Otherwise Noted)**

| Parameter | Symbol | Test Condition | Min | Typical | Max | Units |
|---|---|---|---|---|---|---|
| Supply voltage | $V_{DD}$ | | 2.50 | 2.85 | 4.80 | V |
| Supply current, active mode | $I_{DD}$ | | | 35 | 80 | μA |
| Supply current, low power mode | $I_{DD}$ | | | 10 | | μA |
| Interface supply | VIO | | 1.65 | 1.80 | 1.95 | V |
| Interface signal:<br>    High<br>    Low | | | 0.8 x VIO | | 0.2 x VIO | V<br>V |
| Control current:<br>    High<br>    Low | $I_{CTL}$ | | | | 10<br>5 | μA<br>μA |
| Turn-on time (Note 2) | $t_{ON}$ | Measured from 50% of final $V_{DD}$ supply voltage to 90% of RF power | | 20 | | μs |
| Switching time (Note 2) | $t_{SW}$ | Measured from the rising edge of last clock signal to 90% RF power | | 2 | 5 | μs |

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

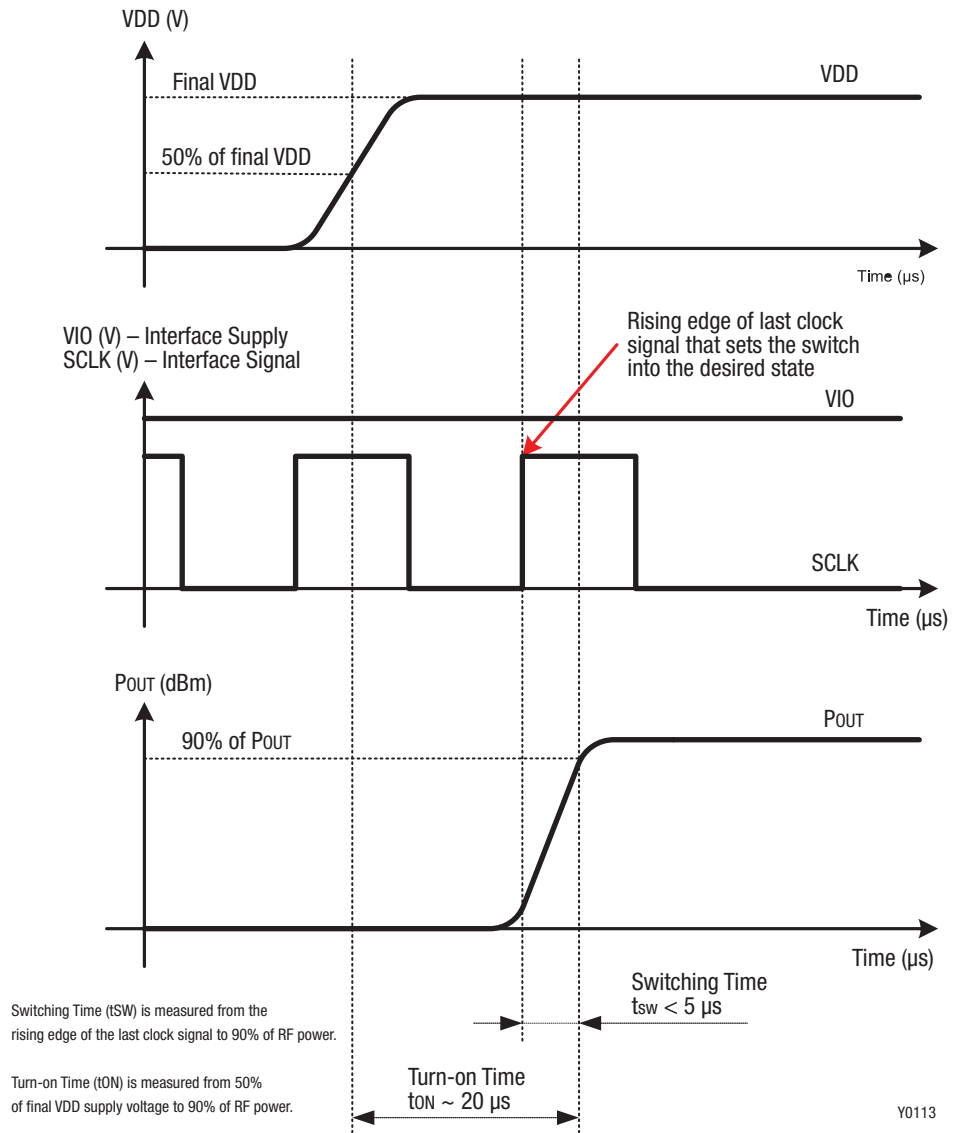**Note 2:** PIN = +27 dBm, TA = –40 to +90 °C. See Figure 3.

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VDD (V)

Final VDD

50% of final VDD

VDD

Time (µs)

VIO (V) – Interface Supply
SCLK (V) – Interface Signal

Rising edge of last clock
signal that sets the switch
into the desired state

VIO

SCLK

Time (µs)

$P_{OUT}$ (dBm)

90% of $P_{OUT}$

$P_{OUT}$

Time (µs)

Switching Time
$t_{SW} < 5$ µs

Switching Time (tSW) is measured from the
rising edge of the last clock signal to 90% of RF power.

Turn-on Time (tON) is measured from 50%
of final VDD supply voltage to 90% of RF power.

Turn-on Time
$t_{ON} \sim 20$ µs

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**Figure 3. SKY13473-569LF Timing Diagram**

**Table 4. SKY13473–569LF RF Electrical Specifications (1 of 2) (Note 1)**
**($V_{DD}$ = 2.85 V, $T_{OP}$ = +25 °C, Characteristic Impedance [$Z_0$] = 50 $\Omega$, Unless Otherwise Noted)**

| Parameter | Symbol | Test Condition | Min | Typical | Max | Units |
|---|---|---|---|---|---|---|
| Operating frequency | f | | 0.4 | | 2.7 | GHz |
| Insertion loss | IL | Up to 1.0 GHz<br>Up to 2.0 GHz<br>Up to 2.7 GHz | | 0.45<br>0.60<br>0.80 | 0.65<br>0.80<br>0.95 | dB<br>dB<br>dB |
| Isolation (ANT port to any receive port) (see Table 5) | Iso | Up to 1.0 GHz<br>Up to 2.0 GHz<br>Up to 2.7 GHz | 30<br>25<br>20 | 37<br>30<br>27 | | dB<br>dB<br>dB |
| Return loss | RL | All ports, up to 1.0 GHz<br>All ports, up to 2.0 GHz<br>All ports, up to 2.7 GHz | 20<br>20 | 25<br>25<br>14 | | dB<br>dB<br>dB |
| Triple Beat Ratio | TBR | 650 to 900 MHz | +81 | +93 | | dBc |
| | | 1710 to 2155 MHz | +81 | +94 | | dBc |
| | | (also see Table 9) | | | | |
| 2nd Order Intermodulation | IMD2 | See Table 7 | | −110 | −105 | dBm |
| 3rd Order Intermodulation | IMD3 | See Table 8 | | −110 | −105 | dBm |
| Band 13 2nd harmonic | 2fo | TRX1 to TRX10,<br>$P_{IN}$ = +25 dBm,<br>fo = 782 MHz | | −80 | −78 | dBm |
| Band 17 3rd harmonic | 3fo | TRX1 to TRX10,<br>$P_{IN}$ = +25 dBm,<br>fo = 707 MHz | | −80 | −78 | dBm |
| Low band 2nd harmonic | 2fo | TRX1 to TRX10,<br>$P_{IN}$ = +27 dBm,<br>fo = 900 MHz | | −80 | −72 | dBm |
| Low band 3rd harmonic | 3fo | TRX1 to TRX10,<br>$P_{IN}$ = +27 dBm,<br>fo = 900 MHz | | −74 | −66 | dBm |

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**Table 4. SKY13473–569LF RF Electrical Specifications (2 of 2) (Note 1)**
**(V$_{DD}$ = 2.85 V, T$_{OP}$ = +25 °C, Characteristic Impedance [Z$_0$] = 50 Ω, Unless Otherwise Noted)**

| Parameter | Symbol | Test Condition | Min | Typical | Max | Units |
|---|---|---|---|---|---|---|
| High band 2$^{nd}$ harmonic | 2fo | TRX1 to TRX10, P$_{IN}$ = +27 dBm, fo = 2690 MHz | | −70 | −62 | dBm |
| High band 3$^{rd}$ harmonic | 3fo | TRX1 to TRX10, P$_{IN}$ = +27 dBm, fo = 2690 MHz | | −68 | −60 | dBm |

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

**Table 5. SKY13473–569LF RF Electrical Specifications: Isolation, ANT to TRX Ports (1 of 2) (Note 1)**
**(V$_{DD}$ = 2.85 V, T$_{OP}$ = +25 °C, Characteristic Impedance [Z$_0$] = 50 Ω, Unless Otherwise Noted)**

| Closed Path | Frequency (MHz) | Isolation (dB) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | TRX1 | TRX2 | TRX3 | TRX4 | TRX5 | TRX6 | TRX7 | TRX8 | TRX9 | TRX10 |
| TRX1 | 915 | – | −39 | −43 | −43 | −38 | −45 | −49 | −49 | −52 | −54 |
| TRX1 | 1910 | – | −31 | −32 | −36 | −32 | −39 | −43 | −41 | −44 | −46 |
| TRX1 | 2690 | – | −29 | −28 | −32 | −28 | −36 | −39 | −37 | −40 | −42 |
| TRX2 | 915 | −46 | – | −48 | −48 | −39 | −45 | −49 | −49 | −52 | −53 |
| TRX2 | 1910 | −35 | – | −35 | −37 | −32 | −39 | −43 | −41 | −44 | −46 |
| TRX2 | 2690 | −32 | – | −30 | −33 | −28 | −36 | −39 | −37 | −40 | −42 |
| TRX3 | 915 | −50 | −44 | – | −42 | −41 | −46 | −49 | −49 | −52 | −52 |
| TRX3 | 1910 | −38 | −35 | – | −34 | −32 | −40 | −43 | −42 | −44 | −45 |
| TRX3 | 2690 | −34 | −32 | – | −31 | −28 | −36 | −39 | −37 | −40 | −41 |
| TRX4 | 915 | −46 | −47 | −39 | – | −46 | −46 | −49 | −49 | −51 | −52 |
| TRX4 | 1910 | −37 | −34 | −31 | – | −33 | −40 | −43 | −42 | −44 | −45 |
| TRX4 | 2690 | −33 | −29 | −27 | – | −29 | −36 | −39 | −37 | −39 | −41 |
| TRX5 | 915 | −45 | −45 | −48 | −43 | – | −47 | −50 | −49 | −52 | −52 |
| TRX5 | 1910 | −37 | −35 | −35 | −34 | – | −40 | −43 | −42 | −44 | −45 |
| TRX5 | 2690 | −33 | −31 | −30 | −32 | – | −36 | −39 | −37 | −39 | −41 |
| TRX6 | 915 | −52 | −51 | −48 | −47 | −42 | – | −43 | −48 | −44 | −45 |
| TRX6 | 1910 | −45 | −44 | −40 | −41 | −36 | – | −35 | −35 | −35 | −37 |
| TRX6 | 2690 | −41 | −40 | −36 | −37 | −33 | – | −32 | −29 | −30 | −32 |
| TRX7 | 915 | −52 | −51 | −47 | −47 | −42 | −46 | – | −39 | −46 | −46 |
| TRX7 | 1910 | −45 | −44 | −40 | −41 | −36 | −35 | – | −31 | −34 | −37 |
| TRX7 | 2690 | −42 | −40 | −36 | −37 | −33 | −31 | – | −27 | −29 | −33 |
| TRX8 | 915 | −53 | −51 | −47 | −46 | −42 | −43 | −42 | – | −43 | −50 |
| TRX8 | 1910 | −45 | −44 | −40 | −40 | −36 | −34 | −34 | – | −34 | −38 |
| TRX8 | 2690 | −42 | −40 | −36 | −37 | −32 | −30 | −31 | – | −31 | −33 |

**Table 5. SKY13473–569LF RF Electrical Specifications: Isolation, ANT to TRX Ports (2 of 2) (Note 1)**
**(V_DD = 2.85 V, T_OP = +25 °C, Characteristic Impedance [Z_0] = 50 Ω, Unless Otherwise Noted)**

| Closed Path | Frequency (MHz) | Isolation (dB) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | TRX1 | TRX2 | TRX3 | TRX4 | TRX5 | TRX6 | TRX7 | TRX8 | TRX9 | TRX10 |
| TRX9 | 915 | –53 | –52 | –47 | –46 | –41 | –42 | –50 | –47 | – | –43 |
| TRX9 | 1910 | –46 | –44 | –40 | –40 | –36 | –34 | –38 | –34 | – | –34 |
| TRX9 | 2690 | –42 | –40 | –36 | –37 | –32 | –30 | –34 | –30 | – | –31 |
| TRX10 | 915 | –54 | –53 | –47 | –46 | –41 | –41 | –45 | –43 | –38 | – |
| TRX10 | 1910 | –46 | –45 | –40 | –40 | –36 | –34 | –37 | –32 | –31 | – |
| TRX10 | 2690 | –42 | –40 | –36 | –37 | –32 | –30 | –33 | –27 | –28 | – |

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

**Table 6. SKY13473–569LF RF Electrical Specifications: Isolation, TRX to TRX Ports (1 of 2) (Note 1)**
**(V_DD = 2.85 V, T_OP = +25 °C, Characteristic Impedance [Z_0] = 50 Ω, Unless Otherwise Noted)**

| Closed Path | Frequency (MHz) | Isolation (dB) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | TRX1 | TRX2 | TRX3 | TRX4 | TRX5 | TRX6 | TRX7 | TRX8 | TRX9 | TRX10 |
| TRX1 | 915 | – | –31 | –41 | –43 | –52 | –57 | –59 | –57 | –53 | –53 |
| TRX1 | 1910 | – | –25 | –34 | –35 | –39 | –47 | –48 | –46 | –44 | –46 |
| TRX1 | 2690 | – | –21 | –29 | –32 | –35 | –44 | –44 | –41 | –40 | –42 |
| TRX2 | 915 | –33 | – | –34 | –39 | –49 | –57 | –59 | –57 | –53 | –54 |
| TRX2 | 1910 | –27 | – | –28 | –32 | –38 | –47 | –48 | –46 | –45 | –46 |
| TRX2 | 2690 | –24 | – | –24 | –29 | –34 | –44 | –44 | –41 | –40 | –42 |
| TRX3 | 915 | –39 | –33 | – | –32 | –44 | –58 | –59 | –57 | –54 | –55 |
| TRX3 | 1910 | –33 | –27 | – | –26 | –35 | –47 | –48 | –45 | –45 | –47 |
| TRX3 | 2690 | –29 | –23 | – | –22 | –31 | –43 | –44 | –41 | –40 | –43 |
| TRX4 | 915 | –42 | –38 | –31 | – | –34 | –58 | –58 | –56 | –54 | –55 |
| TRX4 | 1910 | –35 | –32 | –25 | – | –27 | –46 | –47 | –45 | –45 | –47 |
| TRX4 | 2690 | –31 | –27 | –21 | – | –23 | –42 | –43 | –40 | –40 | –43 |
| TRX5 | 915 | –43 | –41 | –37 | –32 | – | –58 | –56 | –55 | –54 | –55 |
| TRX5 | 1910 | –36 | –34 | –30 | –26 | – | –45 | –47 | –45 | –45 | –47 |
| TRX5 | 2690 | –32 | –29 | –26 | –23 | – | –41 | –42 | –40 | –40 | –43 |
| TRX6 | 915 | –55 | –54 | –58 | –60 | –51 | – | –32 | –37 | –41 | –43 |
| TRX6 | 1910 | –47 | –45 | –45 | –47 | –43 | – | –26 | –30 | –34 | –36 |
| TRX6 | 2690 | –43 | –40 | –40 | –43 | –40 | – | –23 | –26 | –30 | –32 |
| TRX7 | 915 | –55 | –54 | –58 | –60 | –50 | –34 | – | –31 | –38 | –41 |
| TRX7 | 1910 | –47 | –45 | –46 | –48 | –43 | –27 | – | –25 | –32 | –35 |
| TRX7 | 2690 | –43 | –41 | –41 | –44 | –40 | –24 | – | –21 | –28 | –31 |

**Table 6. SKY13473–569LF RF Electrical Specifications: Isolation, TRX to TRX Ports (2 of 2) (Note 1)**
**(V$_{DD}$ = 2.85 V, T$_{OP}$ = +25 °C, Characteristic Impedance [Z$_0$] = 50 Ω, Unless Otherwise Noted)**

| Closed Path | Frequency (MHz) | Isolation (dB) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | TRX1 | TRX2 | TRX3 | TRX4 | TRX5 | TRX6 | TRX7 | TRX8 | TRX9 | TRX10 |
| TRX8 | 915 | −55 | −54 | −59 | −61 | −49 | −42 | −32 | – | −32 | −39 |
| TRX8 | 1910 | −47 | −45 | −46 | −48 | −42 | −35 | −26 | – | −26 | −33 |
| TRX8 | 2690 | −43 | −40 | −41 | −44 | −40 | −31 | −22 | – | −23 | −29 |
| TRX9 | 915 | −54 | −54 | −59 | −60 | −49 | −45 | −39 | −34 | – | −32 |
| TRX9 | 1910 | −46 | −45 | −46 | −48 | −42 | −37 | −32 | −28 | – | −26 |
| TRX9 | 2690 | −42 | −40 | −41 | −44 | −41 | −33 | −28 | −24 | – | −23 |
| TRX10 | 915 | −53 | −53 | −59 | −60 | −49 | −47 | −41 | −40 | −30 | – |
| TRX10 | 1910 | −46 | −44 | −46 | −48 | −42 | −38 | −35 | −33 | −24 | – |
| TRX10 | 2690 | −42 | −40 | −42 | −44 | −41 | −34 | −31 | −29 | −21 | – |

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

**Table 7. IMD2 Test Conditions**

| Band | Transmit Frequency (MHz) | Transmit Power (dBm) | Frequency Blocker, Low (MHz) | Frequency Blocker, High (MHz) | Power Blocker (dBm) | Receive Frequency (MHz) |
|---|---|---|---|---|---|---|
| 1 | 1950.0 | +20 | 190 | 4090 | −15 | 2140.0 |
| 2 | 1880.0 | | 80 | 3840 | | 1960.0 |
| 4 | 1732.0 | | 400 | 3864 | | 2132.0 |
| 5 | 836.5 | | 45 | 1718 | | 881.5 |
| 7 | 2535.0 | | 120 | 5187 | | 2655.0 |
| 8 | 897.0 | | 45 | 1839 | | 942.0 |

**Table 8. IMD3 Test Conditions**

| Band | Transmit Frequency (MHz) | Transmit Power (dBm) | Frequency Blocker (MHz) | Power Blocker (dBm) | Receive Frequency (MHz) |
|---|---|---|---|---|---|
| 1 | 1950.0 | +20 | 1760.0 | −15 | 2140.0 |
| 2 | 1880.0 | | 1800.0 | | 1960.0 |
| 4 | 1732.0 | | 1332.0 | | 2132.0 |
| 5 | 836.5 | | 791.5 | | 881.5 |
| 7 | 2535.0 | | 2415.0 | | 2655.0 |
| 8 | 897.0 | | 852.0 | | 942.0 |

**Table 9. Triple Beat Ratio Test Conditions**

| Band | Transmit Frequency 1 (MHz) | Transmit Power 1 (dBm) | Transmit Frequency 2 (MHz) | Transmit Power 2 (dBm) | Frequency Blocker @ ANT (MHz) | Power Blocker (dBm) | TBR Product Frequency (MHz) |
|---|---|---|---|---|---|---|---|
| 2 | 1880.0 | +21.5 | 1881.0 | +21.5 | 1960.0 | −30 | 1960.0 ± 1 |
| 5 | 835.5 | | 836.5 | | 881.5 | | 881.5 ± 1 |
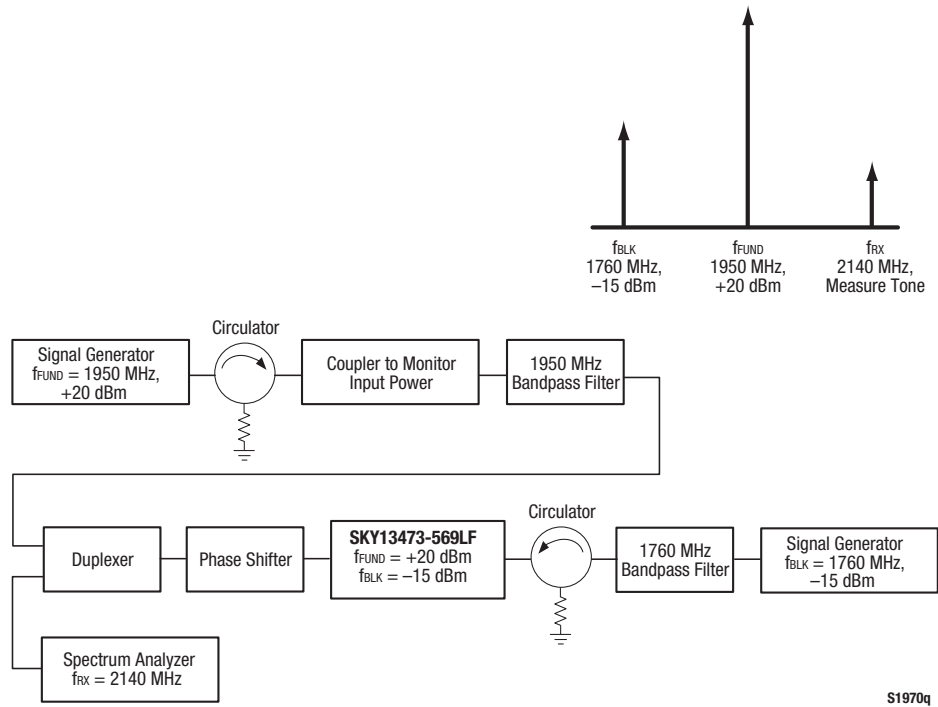
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Figure 4. 3rd Order Intermodulation Test Setup

**Table 10. Command Sequence Bit Definitions**

| Type | SSC | C11-C8 | C7 | C6-C5 | C4 | C3-C0 | Parity Bits | BPC | Extended Operation | | | | | |
| | | | | | | | | | DA7(1)-DA0(1) | Parity Bits | BPC | DA7(n)-DA0(n) | Parity Bits | BPC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Reg0 Write | Y | SA[3:0] | 1 | Data[6:5] | Data[4] | Data{3:0] | Y | Y | – | – | – | – | – | – |
| Reg Write | Y | SA[3:0] | 0 | 10 | Addr[4] | Addr[3:0] | Y | – | Data[7:0] | – | – | – | Y | Y |
| Reg Read | Y | SA[3:0] | 0 | 11 | Addr[4] | Addr[3:0] | Y | Y | Data[7:0] | – | – | – | Y | Y |

**Legend**:
SSC = Sequence start command    DA = Data/address frame bits    BC = Byte count (# of consecutive addresses)
C = Command frame bits    BPC = Bus park cycle
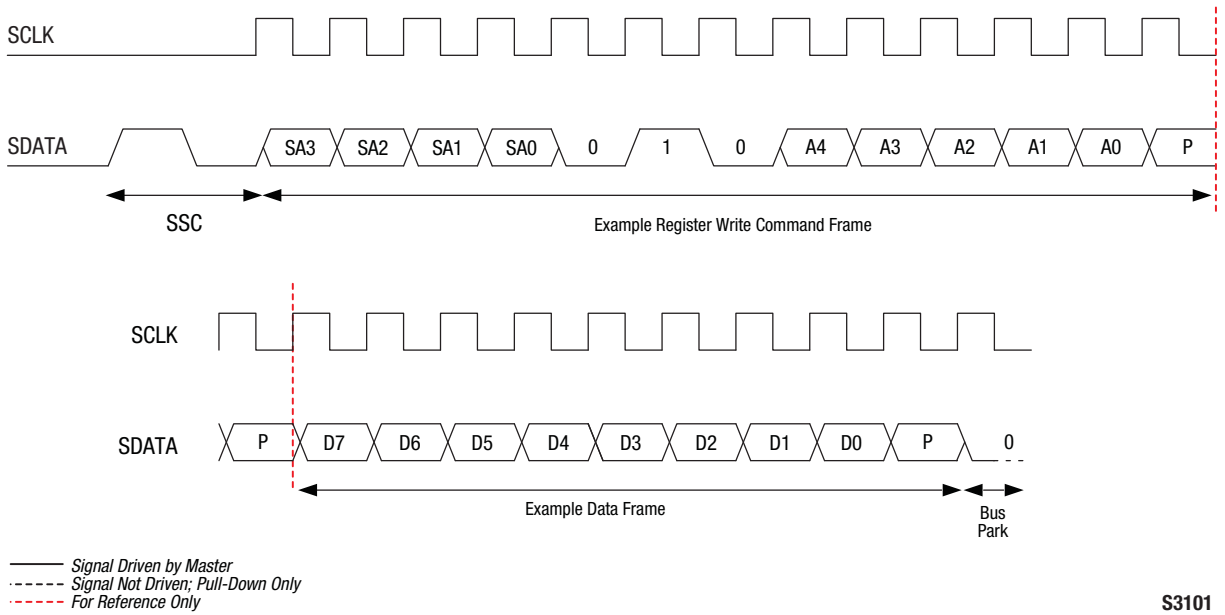
**Figure 5. Register Write Command Timing Diagram**
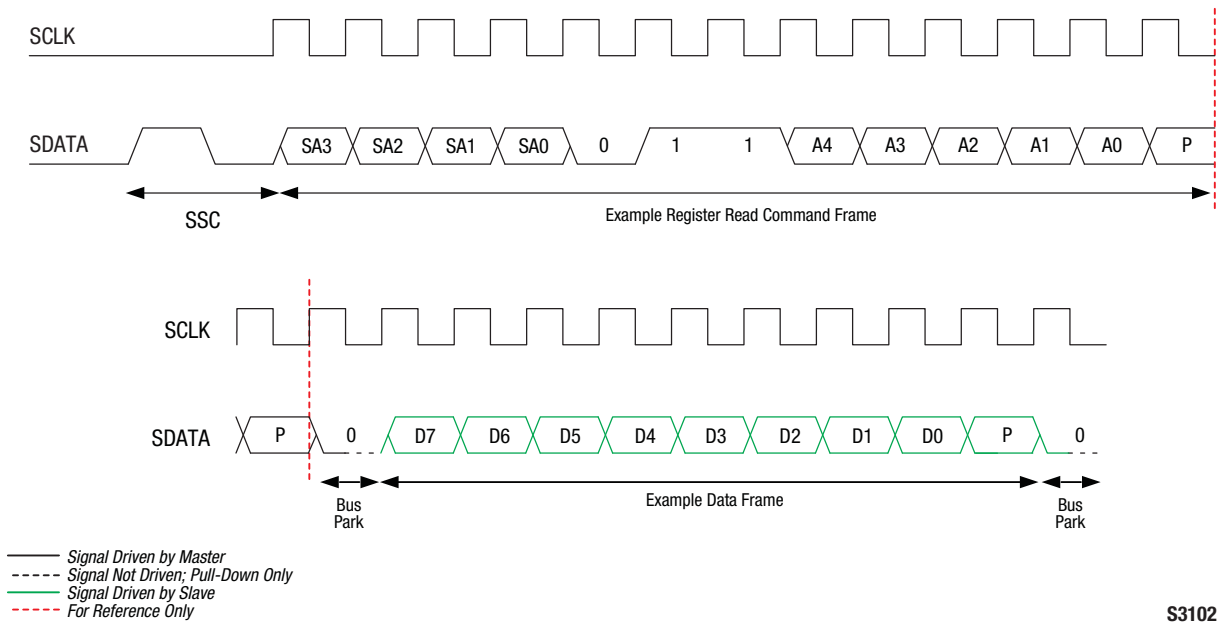


**Figure 6. Register Read Command Timing Diagram**

**Table 11. Register_0 Truth Table**

| State | Mode | Register_0 Bits | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
| 1 | Isolation (default) | x | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | TRX1 | x | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| 3 | TRX2 | x | 0 | 0 | 0 | 1 | 0 | 1 | 0 |
| 4 | TRX3 | x | 0 | 0 | 0 | 1 | 1 | 1 | 0 |
| 5 | TRX4 | x | 0 | 0 | 0 | 1 | 0 | 1 | 1 |
| 6 | TRX5 | x | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 7 | TRX6 | x | 0 | 0 | 0 | 1 | 0 | 0 | 1 |
| 8 | TRX7 | x | 0 | 0 | 0 | 0 | 1 | 1 | 0 |
| 9 | TRX8 | x | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 10 | TRX9 | x | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| 11 | TRX10 | x | 0 | 0 | 0 | 1 | 0 | 0 | 0 |

**Table 12. Register Description and Programming (1 of 2)**

| Register | | Parameter | Description | Default (Binary) |
|---|---|---|---|---|
| Name | Address (Hex) | | | |
| Register_0 | 0000 | MODE_CTRL | Bits[7:0]: Switch control. See Table 10 for logic | – |
| RFFE_STATUS | 001A | SOFTWARE RESET | Bit[7]: Resets all data to default values except for USID, GSID, or the contents of the PM_TRIG Register. 0 = Normal operation 1 = Software reset | 0 |
| | | COMMAND_FRAME_PARITY_ERR | Bit[6]: Command sequence received with parity error – discard command. | 0 |
| | | COMMAND_LENGTH_ERR | Bit[5]: Command length error. | 0 |
| | | ADDRESS_FRAME_PARITY_ERR | Bit[4]: Address frame parity error =1. | 0 |
| | | DATA_FRAME_PARITY_ERR | Bit[3]: Data frame with parity error. | 0 |
| | | READ_UNUSED_REG | Bit[2]: Read command to an invalid address. | 0 |
| | | WRITE_UNUSED_REG | Bit[1]: Write command to an invalid address. | 0 |
| | | BID_GID_ERR | Bit[0]: Read command with a BROADCAST_ID (refer to the *MIPI Alliance Specification*) or GSID. | 0 |
| GROUP_SID | 001B | Reserved | Bits[7:4]: Reserved | 0000 |
| | | GSID | Bits[3:0]: Group slave ID | 0000 |

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**Table 12. Register Description and Programming (2 of 2)**

<table>
<thead>
<tr><th colspan="2">Register</th><th rowspan="2">Parameter</th><th rowspan="2">Description</th><th rowspan="2">Default (Binary)</th></tr>
<tr><th>Name</th><th>Address (Hex)</th></tr>
</thead>
<tbody>
<tr>
<td rowspan="7">PM_TRIG (Note 1)</td>
<td rowspan="7">001C</td>
<td>PWR_MODE</td>
<td>Bits[7:6]:<br><br>00 = Normal operation (active)<br>01 = Default settings (startup)<br>10 = Low power (low power)<br>11 = Reserved</td>
<td>00</td>
</tr>
<tr>
<td>Trigger_Mask_2</td>
<td>Bit[5]:<br><br>If this bit is set, trigger 2 is disabled. When all triggers are disabled, if writing to a register that is associated with trigger 2, the data goes directly to the destination register.</td>
<td>0</td>
</tr>
<tr>
<td>Trigger_Mask_1</td>
<td>Bit[4]:<br><br>If this bit is set, trigger 1 is disabled. When all triggers are disabled, if writing to a register that is associated with trigger 1, the data goes directly to the destination register.</td>
<td>0</td>
</tr>
<tr>
<td>Trigger_Mask_0</td>
<td>Bit[3]:<br><br>If this bit is set, trigger 0 is disabled. When all triggers are disabled, if writing to a register that is associated with trigger 0, the data goes directly to the destination register.</td>
<td>0</td>
</tr>
<tr>
<td>Trigger_2</td>
<td>Bit[2]:<br><br>If this bit is set, data is loaded into the trigger 2 registers.</td>
<td>0</td>
</tr>
<tr>
<td>Trigger_1</td>
<td>Bit[1]:<br><br>If this bit is set, data is loaded into the trigger 1 registers.</td>
<td>0</td>
</tr>
<tr>
<td>Trigger_0</td>
<td>Bit[0]:<br><br>If this bit is set, data is loaded into the trigger 0 registers.</td>
<td>0</td>
</tr>
<tr>
<td>PRODUCT_ID</td>
<td>001D</td>
<td>PRODUCT_ID</td>
<td>Bits[7:0]:<br><br>This is a read-only register. However, during the programming of the Unique Slave Identifier (USID), a write command sequence is performed on this register but the value is not changed.</td>
<td>01000101</td>
</tr>
<tr>
<td>MANUFACTURER_ID</td>
<td>001E</td>
<td>MANUFACTURER_ID</td>
<td>Bits[7:0]:<br><br>Read-only register</td>
<td>10100101</td>
</tr>
<tr>
<td rowspan="3">MAN_USID</td>
<td rowspan="3">001F</td>
<td>Reserved</td>
<td>Bits[7:6]:<br><br>Reserved</td>
<td>00</td>
</tr>
<tr>
<td>MANUFACTURER_ID</td>
<td>Bits[5:4]:<br><br>Read-only register</td>
<td>01</td>
</tr>
<tr>
<td>USID</td>
<td>Bits[3:0]:<br><br>Programmable USID. A write to these bits programs the USID.</td>
<td>1011</td>
</tr>
</tbody>
</table>

**Note 1**: Unlike the complete independence between triggers 0, 1, and 2, and also between the associated trigger masks 0, 1, and 2, respectively, as described in the MIPI RFFE Specification, this device uses additional interactions between the provided trigger functions.

The delayed application of updated data to all triggerable registers in this device may be accomplished using any of the three triggers (0, 1, or 2), provided that the particular trigger used is not currently masked off. If multiple triggers are enabled, any or all of those are sufficient to cause the data to be transferred from shadow registers to destination registers for all triggerable registers in the device.

It is also necessary to disable all three triggers (i.e., set all three trigger masks) to ensure that data written to any triggerable register will immediately be written to the destination register at the conclusion of the RFFE command sequence where the data is written.

## Evaluation Board Description

The SKY13473–569LF Evaluation Board is used to test the performance of the SKY13473–569LF SP10T Switch. An Evaluation Board schematic diagram is provided in Figure 7. A recommended ESD protection circuit diagram is provided in Figure 8. An assembly drawing for the Evaluation Board is shown in Figure 9.

## Package Dimensions

The PCB layout footprint for the SKY13473–569LF is provided in Figure 10. Typical case markings are shown in Figure 11. Package dimensions for the 20-pin QFN are shown in Figure 12, and tape and reel dimensions are provided in Figure 13.

## 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 SKY13473–569LF 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, *PCB Design and 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.
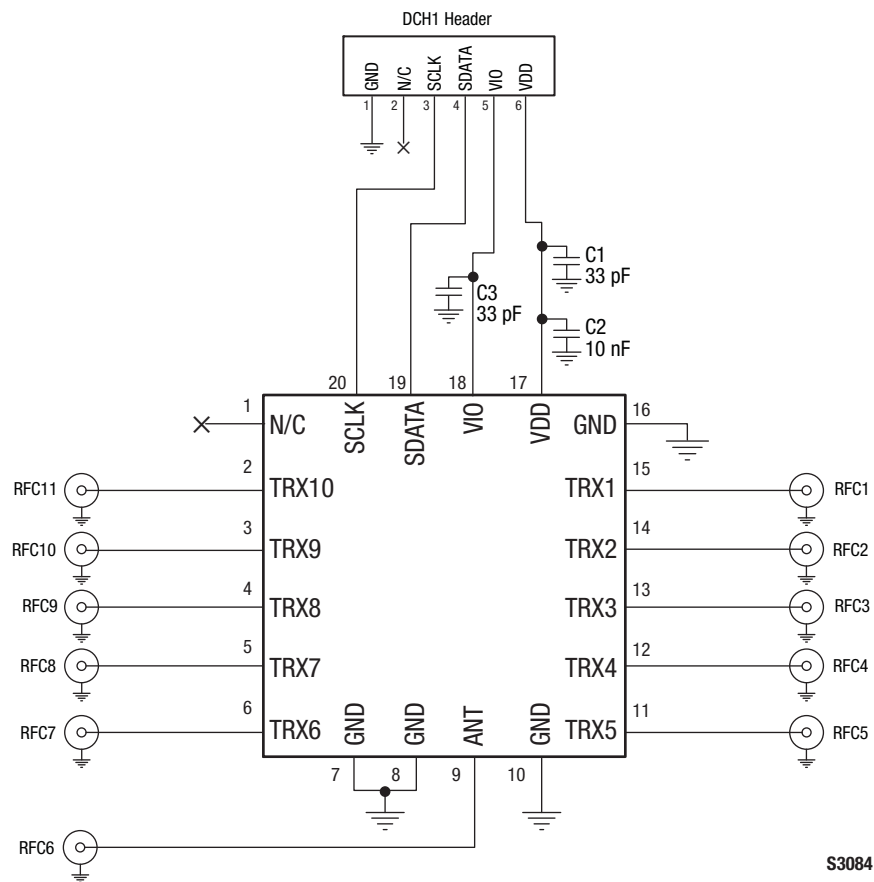


**Figure 7. SKY13473–569LF Evaluation Board Schematic**

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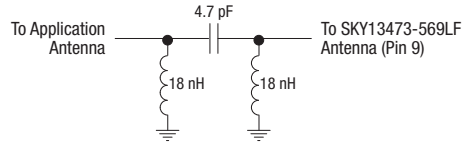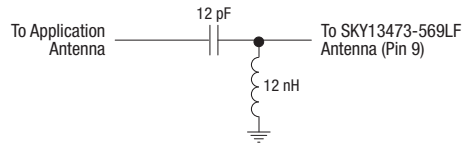
ESD Circuit 1

ESD Circuit 2

S2520k

**Figure 8. SKY13473–569LF Recommended ESD Protection Circuits**
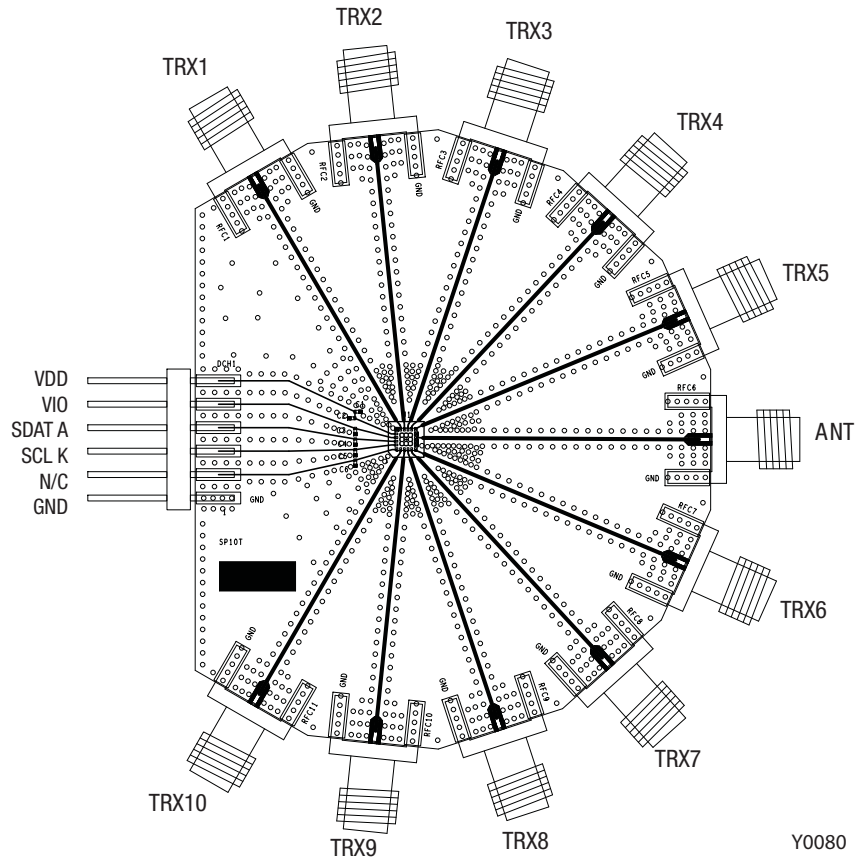
**Figure 9. SKY13473–569LF Evaluation Board Assembly Diagram**
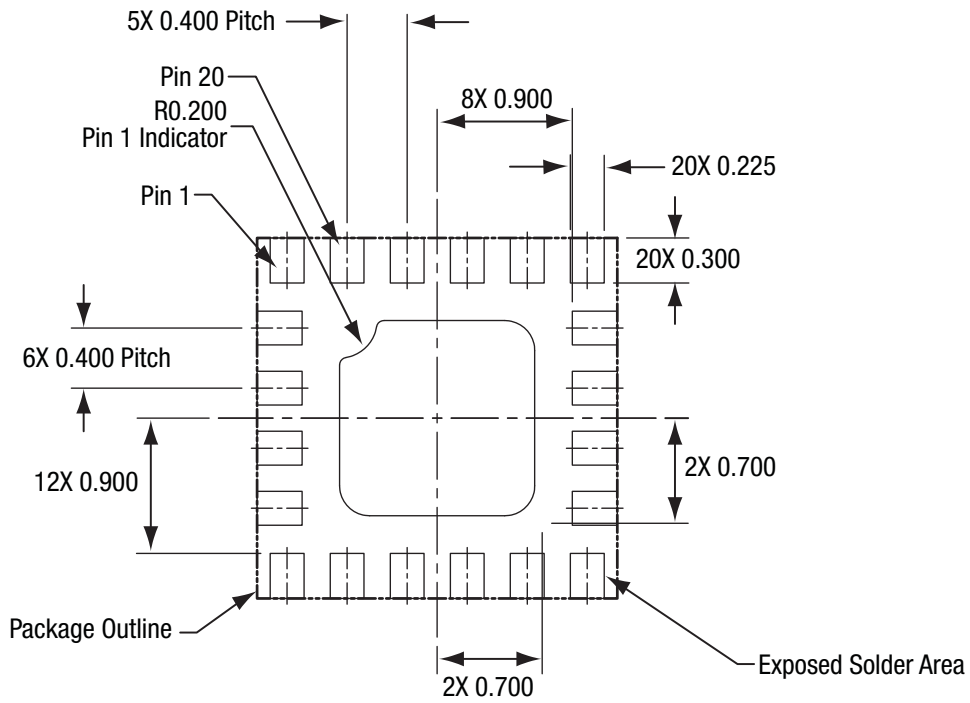
*All dimensions are in millimeters*                                                                S3292

**Figure 10. SKY13473–569LF PCB Layout Footprint**
**(Top View)**
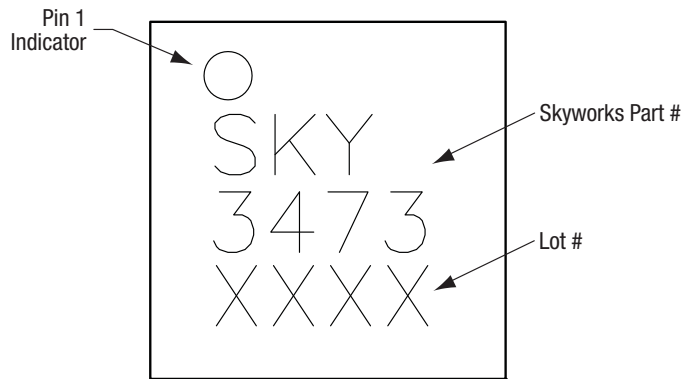


**Figure 11. Typical Part Markings**
**(Top View)**

Top View    Side View    Bottom View

**8X 0.20**

R0.20 Pin 1 Indicator

*All measurements are in millimeters.*
*Dimensioning and tolerancing according to ASME Y14.5M-1994.*
*Coplanarity applies to the terminals and all other bottom surface metalization.*
*Dimension applies to metalized terminal. If the terminal has a radius on its*
*end, the width dimension should not be measured in that radius area.*

**Detail A**
Scale: 80X
4X This Rotation
4X Rotated 180°
6X Rotated 90° CW
6X Rotated 90° CCW

S3080

**Figure 12. SKY13473–569LF 20-Pin QFN Package Dimensions**



Section B

Section A

*Notes:*

*1. Carrier tape material: black conductive polystyrene.*
*2. Cover tape material: transparent conductive material.*
*3. 10 sprocket hole pitch cumulative tolerance: ± 0.20 mm.*
*4. Ao and Bo measured on plane 0.30 mm above the bottom of the pocket.*
*5. All dimensions are in millimeters.*

Y0079

**Figure 13. SKY13473–569LF Tape and Reel Dimensions**

## Ordering Information

| Model Name | Manufacturing Part Number | Evaluation Board Part Number |
|---|---|---|
| SKY13473–569LF 0.4 to 2.7 GHz SP10T LTE Transmit/Receive Switch with MIPI RFFE Interface | SKY13473–569LF | SKY13473–569LF-EVB |

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