

PRELIMINARY DATA SHEET

SKY13443-11: 0.4-2.7 GHz SP10T Switch with GPIO Interface

Applications

- 2G/3G multimode cellular handsets (UMTS, CDMA2000, EDGE, GSM)
- Embedded data cards

Features

- Broadband frequency range: 0.4 to 2.7 GHz
- Single, positive DC power supply (2.5 to 3.3 V)
- Excellent Band 13 2nd harmonic rejection
- Integrated, low-pass harmonic filter for GSM transmit paths
- Integrated GPIO interface
- Any of eight TRX ports can be used for WCDMA transmit/receive or GSM receive functions
- Small MCM (20-pin, 3.2 x 3.2 mm) package (MSL3, 260 °C per JEDEC J-STD-020)



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Description

The SKY13443-11 is a Single Pole, Ten-Throw (SP10T) antenna switch with an integrated General Purpose Input/Output (GPIO) interface and dual low-pass harmonic filters. The switch has eight transmit/receive ports, any of which can be used for WCDMA transmit/receive or GSM receive functions.

Using advance switching technologies, the SKY13443-11 maintains low insertion loss and high isolation for both transmit and receive switching paths. The switch also exhibits an excellent triple beat ratio and 2nd/3rd order modulation distortion performance.

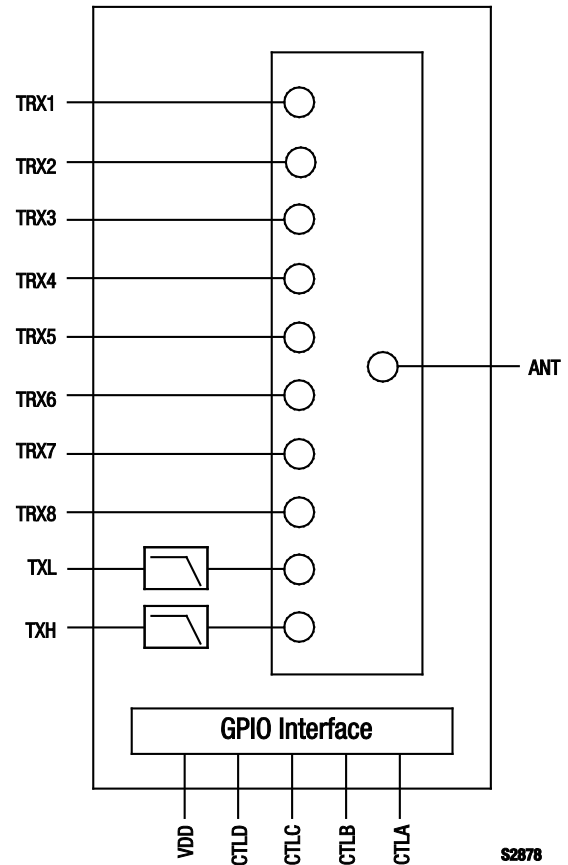


Figure 1. SKY13443-11 Block Diagram

Switching is controlled by an integrated GPIO interface. Depending on the logic applied to the decoder, the antenna pin is connected to one of ten 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.

The SKY13443-11 is manufactured in a compact, 3.2 x 3.2 mm, 20-pin Multi-Chip Module (MCM) 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.

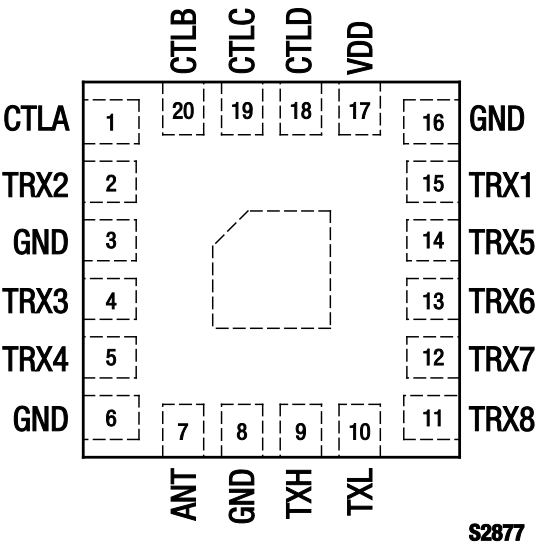


Figure 2. SKY13443-11 Pinout – 20-Pin MCM (Top View)

Table 1. SKY13443-11 Signal Descriptions

| Pin # | Name | Description | Pin # | Name | Description |
|-------|------|--|-------|------|----------------------------|
| 1 | CTLA | DC input control voltage 1 | 11 | TRX8 | RF input/output port 8 |
| 2 | TRX2 | RF input/output port 2 | 12 | TRX7 | RF input/output port 7 |
| 3 | GND | Ground | 13 | TRX6 | RF input/output port 6 |
| 4 | TRX3 | RF input/output port 3 | 14 | TRX5 | RF input/output port 5 |
| 5 | TRX4 | RF input/output port 4 | 15 | TRX1 | RF input/output port 1 |
| 6 | GND | Ground | 16 | GND | Ground |
| 7 | ANT | Antenna RF port | 17 | VDD | DC power supply |
| 8 | GND | Ground | 18 | CTLD | DC input control voltage 4 |
| 9 | TXH | GSM high band transmit RF input port with integrated harmonic filter | 19 | CTLC | DC input control voltage 3 |
| 10 | TXL | GSM low band transmit RF input port with integrated harmonic filter | 20 | CTLB | DC input control voltage 2 |

Note: Bottom ground paddles must be connected to ground.

Table 2. SKY13443-11 Absolute Maximum Ratings

| Parameter | Symbol | Minimum | Maximum | Units |
|-----------------------|------------|---------|---------|-------|
| RF input power | P_{IN} | | +36 | dBm |
| Power supply | | | 5 | V |
| DC control voltage | V_{CTRL} | | 2.7 | V |
| Storage temperature | T_{STG} | −40 | +125 | °C |
| Operating temperature | T_{OP} | −30 | +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 SKY13443-11 are provided in Table 2. Electrical specifications are provided in Table 3. Table 4 provides the control logic for the SKY13443-11.

Typical performance characteristics of the SKY13443-11 are illustrated in Figures 3 to 12.

Figure 13 illustrates the test setup used to measure data for Figure 10. 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 TRX8 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 SKY13443-11 exhibits exceptional performance for all TRX ports.

Table 3. SKY13443-11 Electrical Specifications (Note 1) (1 of 2)

($V_{DD} = 2.85\text{ V}$, $CTLA = CTLB = CTLC = CTLD = 0/1.8\text{ V}$, $T_{OP} = +25\text{ }^{\circ}\text{C}$, $P_{IN} = 0\text{ dBm}$, Characteristic Impedance [Z_0] = $50\text{ }\Omega$, Unless Otherwise Noted)

| Parameter | Symbol | Test Condition | Min | Typical | Max | Units |
|--|---------|---|-------|---------|------|---------------|
| RF Specifications | | | | | | |
| Insertion loss: ANT to TRX1 through TRX8 ports | IL | 824 to 960 MHz | | 0.5 | 0.7 | dB |
| | | 1710 to 2170 MHz | | 0.6 | 0.8 | dB |
| | | 2300 to 2690 MHz | | 0.9 | 1.1 | dB |
| Insertion loss: ANT to TXL port | IL | 824 to 915 MHz | | 1.35 | 1.55 | dB |
| Insertion loss: ANT to TXH port | IL | 1710 to 1910 MHz | | 1.2 | 1.4 | dB |
| Isolation (TRX1/5/6/7/8 to TRX2/3/4 ports) | ISO | 824 to 1910 MHz | 40 | 45 | | dB |
| Isolation (TXL to TRX1 through TRX8 ports) | ISO | 824 to 915 MHz | 40 | 44 | | dB |
| Isolation (TXH to TRX1 through TRX8 ports) | ISO | 1710 to 1910 MHz | 32 | 39 | | dB |
| Isolation (ANT to TRX3 [TRX2 “on”]) | ISO | 1805 to 1990 MHz | 33 | 36 | | dB |
| Isolation (ANT to TRX2 [TRX3 “on”]) | ISO | 1805 to 1990 MHz | 33 | 36 | | dB |
| Band 13 2 nd harmonic | B13 2fo | $P_{IN} = +25\text{ dBm}$, $f = 787\text{ MHz}$, TRX1 to TRX8 | | -85 | | dBm |
| Harmonics | | UMTS, $P_{IN} = +27\text{ dBm}$: | | -48 | -36 | dBm |
| | | TXL port, $P_{IN} = +35\text{ dBm}$ | | -45 | -36 | dBm |
| | | TXH port, $P_{IN} = +33\text{ dBm}$ | | -44 | -36 | dBm |
| Attenuation (TXL port) | | GSM850: | | | | |
| | | 2f | 25 | 28 | | dB |
| | | 3f | 25 | 28 | | dB |
| | | >4f | | 20 | | dB |
| | | EGSM900: | | | | |
| | | 2f | 25 | 28 | | dB |
| Attenuation (TXH port) | | DCS1800: | | | | |
| | | 2f | 25 | 28 | | dB |
| | | 3f | 25 | 28 | | dB |
| | | >4f | | 20 | | dB |
| | | PCS1900: | | | | |
| | | 2f | 25 | 28 | | dB |
| Return loss | IS111 | 0.4 to 2.2 GHz | 14 | 18 | | dB |
| | | | | | | |
| | | | | | | |
| 2nd Order Input Intercept Point | IIP2 | AWS, PCS, IMT to CDMA2000 modes | +95.5 | | | dBm |
| 2nd Order Intermodulation Distortion | IMD2 | UMTS mode | | | -105 | dBm |
| 3rd Order Intermodulation Distortion | IMD3 | UMTS mode | | -110 | | dBm |
| Triple Beat Ratio | TBR | 650 to 900 MHz | 81 | | | dBc |
| | | 1710 to 2155 MHz | 81 | | | dBc |
| 1 dB Input Compression Point | IP1dB | TXL port, 824 to 915 MHz | +40 | | | dBm |
| | | TXH port, 1710 to 1910 MHz | +39 | | | dBm |
| Switching speed | | 10/90% RF | | 3 | 5 | μs |

Table 3. SKY13443-11 Electrical Specifications (Note 1) (2 of 2)

($V_{DD} = 2.85\text{ V}$, $CTLA = CTLB = CTLC = CTLD = 0/1.8\text{ V}$, $T_{OP} = +25\text{ }^{\circ}\text{C}$, $P_{IN} = 0\text{ dBm}$, Characteristic Impedance [Z_0] = $50\text{ }\Omega$, Unless Otherwise Noted)

| Parameter | Symbol | Test Condition | Min | Typical | Max | Units |
|---------------------------------|---------------------------|----------------|-----------|---------|--------------|--------------------------------|
| DC Specifications | | | | | | |
| Supply voltage | V_{DD} | | 2.50 | 2.85 | 3.30 | V |
| Supply current | I_{DD} | | | 50 | 100 | μA |
| Control voltage: High Low | CTLA, CTLB, CTLC, CTLD | | 1.35 0 | 1.80 | 2.50 0.45 | V V |
| Control current: High Low | | | | 5 | 10 | μA μA |

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

Table 4. SKY13443-11 Mode Control Logic

| Insertion Loss State | CTLA (Pin 1) | CTLB (Pin 20) | CTLC (Pin 19) | CTLD (Pin 18) |
|--|-----------------|------------------|------------------|------------------|
| Standby (all ports in isolation state) | 0 | 0 | 0 | 0 |
| ANT to TXL | 1 | 1 | 0 | 0 |
| ANT to TXH | 1 | 0 | 0 | 0 |
| ANT to TRX7 | 0 | 1 | 1 | 0 |
| ANT to TRX8 | 0 | 1 | 0 | 0 |
| ANT to TRX3 | 1 | 1 | 1 | 1 |
| ANT to TRX4 | 1 | 0 | 0 | 1 |
| ANT to TRX5 | 1 | 0 | 1 | 0 |
| ANT to TRX6 | 0 | 0 | 1 | 0 |
| ANT to TRX2 | 1 | 0 | 1 | 1 |
| ANT to TRX1 | 1 | 1 | 1 | 0 |

Typical Performance Characteristics

($V_{DD} = 2.85$ V, $V_1 = V_2 = V_3 = V_4 = 0/1.8$ V, $T_{OP} = +25$ °C, $P_{IN} = 0$ dBm, Characteristic Impedance $[Z_0] = 50$ Ω , Unless Otherwise Noted)

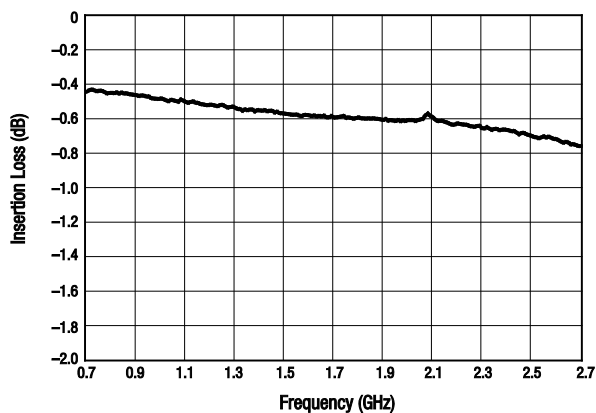


Figure 3. Insertion Loss vs Frequency
(ANT to All TRX Ports)

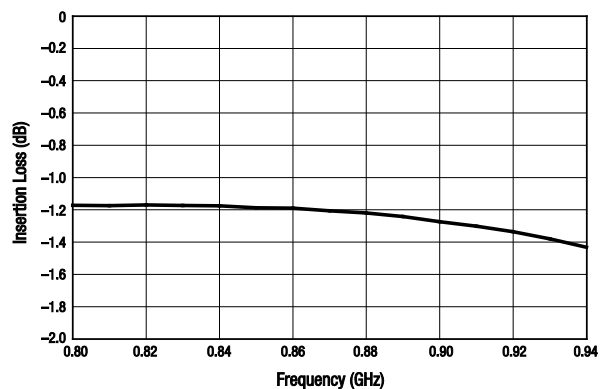


Figure 4. Insertion Loss vs Frequency
(ANT to TXL Port)

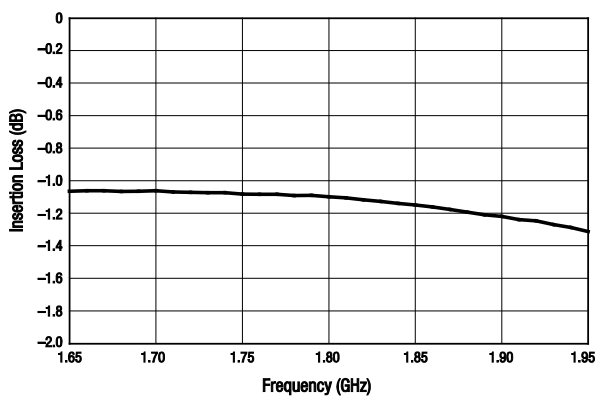


Figure 5. Insertion Loss vs Frequency
(ANT to TXH Port)

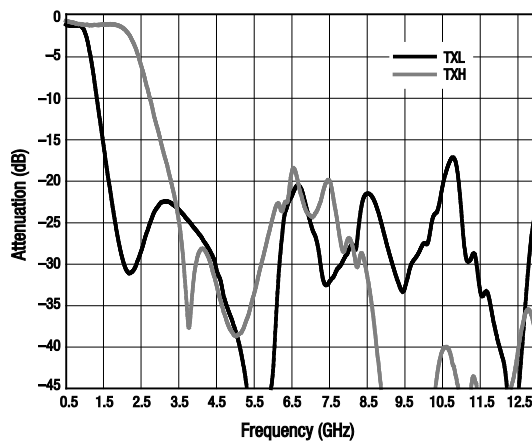
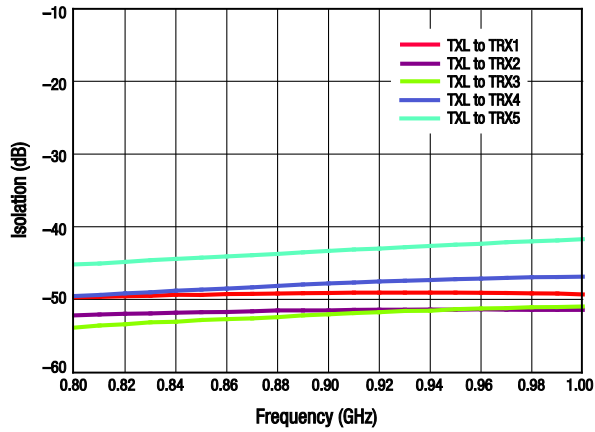
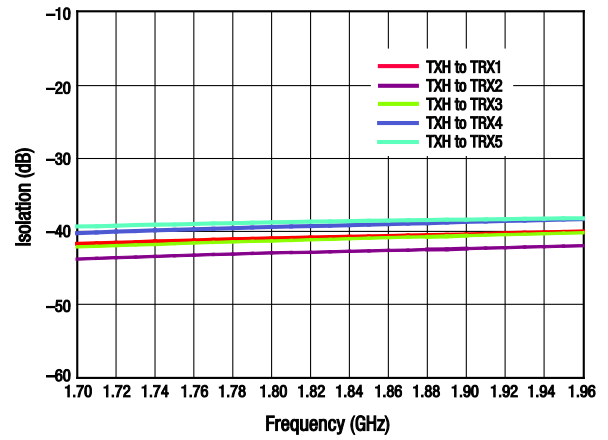


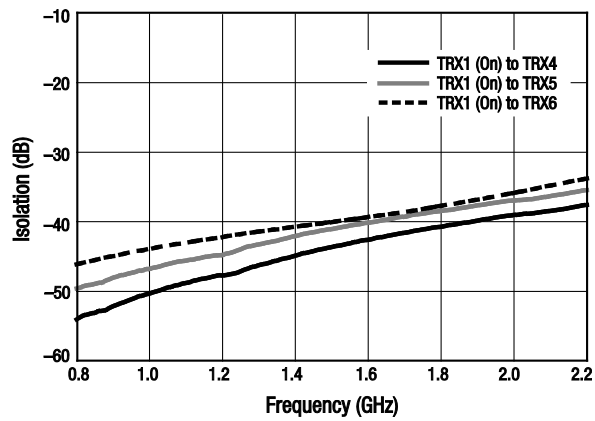
Figure 6. Attenuation vs Frequency
(ANT to TXL/H Ports)



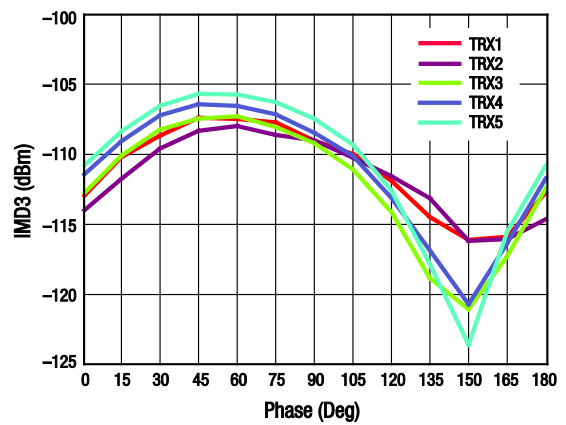
**Figure 7. Isolation vs Frequency
(TXL to TRX Ports)**



**Figure 8. Isolation vs Frequency
(TXH to TRX Ports)**



**Figure 9. Isolation vs Frequency
(TRX1 to TRX4/5/6 Ports)**



**Figure 10. 3rd Order Intermodulation Distortion vs Phase, TRX
Ports ($f_{\text{FUND}} = 1.95$ GHz, $f_{\text{BLK}} = 1.76$ GHz, $f_{\text{RX}} = 2.14$ GHz)**

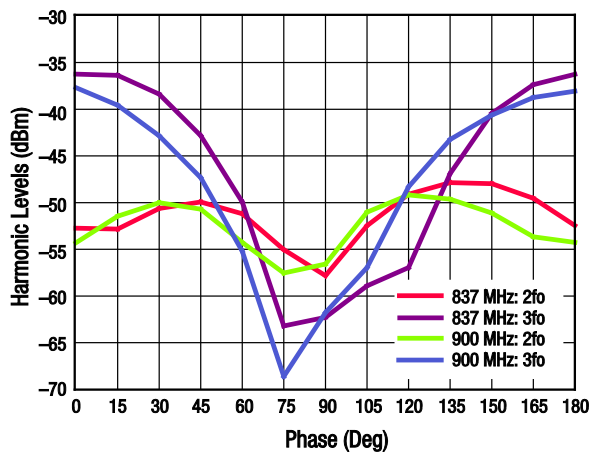


Figure 11. Harmonics vs Phase
(ANT to TXL, $P_{IN} = +35$ dBm, 5:1 VSWR Mismatch)

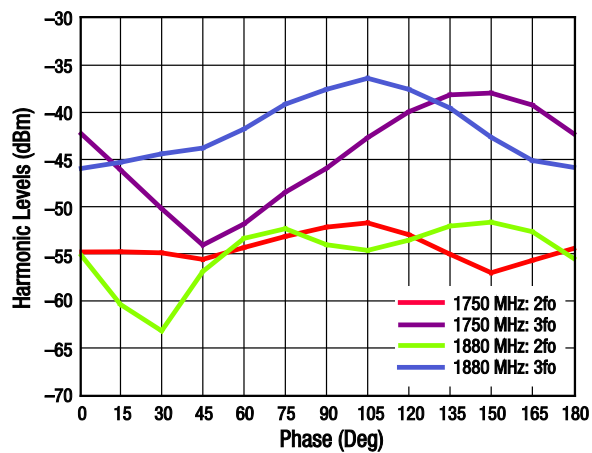


Figure 12. Harmonics vs Phase
(ANT to TXH, $P_{IN} = +33$ dBm, 5:1 VSWR Mismatch)

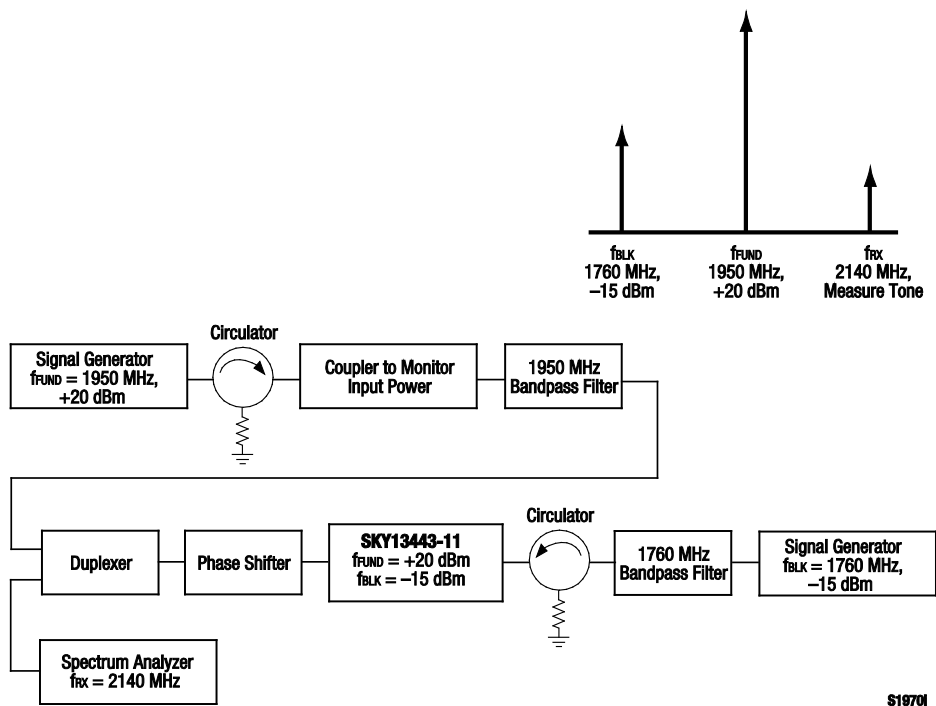


Figure 13. 3rd Order Intermodulation Test Setup

S1970J

Evaluation Board Description

The SKY13443-11 Evaluation Board is used to test the performance of the SKY13443-11 SP10T Switch. An Evaluation Board schematic diagram is provided in Figure 14. A recommended ESD protection circuit diagram is provided in Figure 15. An assembly drawing for the Evaluation Board is shown in Figure 16.

Package Dimensions

The PCB layout footprint for the SKY13443-11 is provided in Figure 17. Typical case markings are shown in Figure 18. Package dimensions for the 20-pin MCM are shown in Figure 19, and tape and reel dimensions are provided in Figure 20.

Package and Handling Information

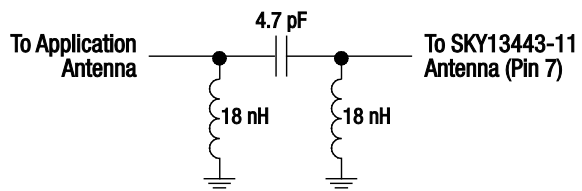
Since the device is sensitive to moisture absorption, it is baked and vacuum packed before shipping. Instructions on the shipping container label regarding exposure to moisture after the container seal is broken must be followed. Otherwise, problems related to moisture absorption may occur when the part is subjected to high temperature during solder assembly.

THE SKY13443-11 is rated to Moisture Sensitivity Level 3 (MSL3) 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.

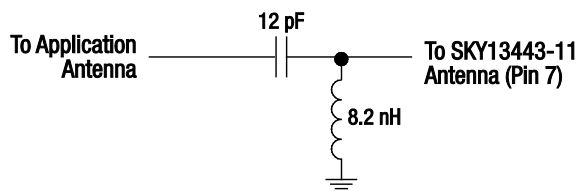
Care must be taken when attaching this product, whether it is done manually or in a production solder reflow environment. Production quantities of this product are shipped in a standard tape and reel format.

*** TBD ***

Figure 14. SKY13443-11 Evaluation Board Schematic



ESD Circuit 1



ESD Circuit 2

S2520e

Figure 15. SKY13443-11 Recommended ESD Protection Circuits

*** TBD ***

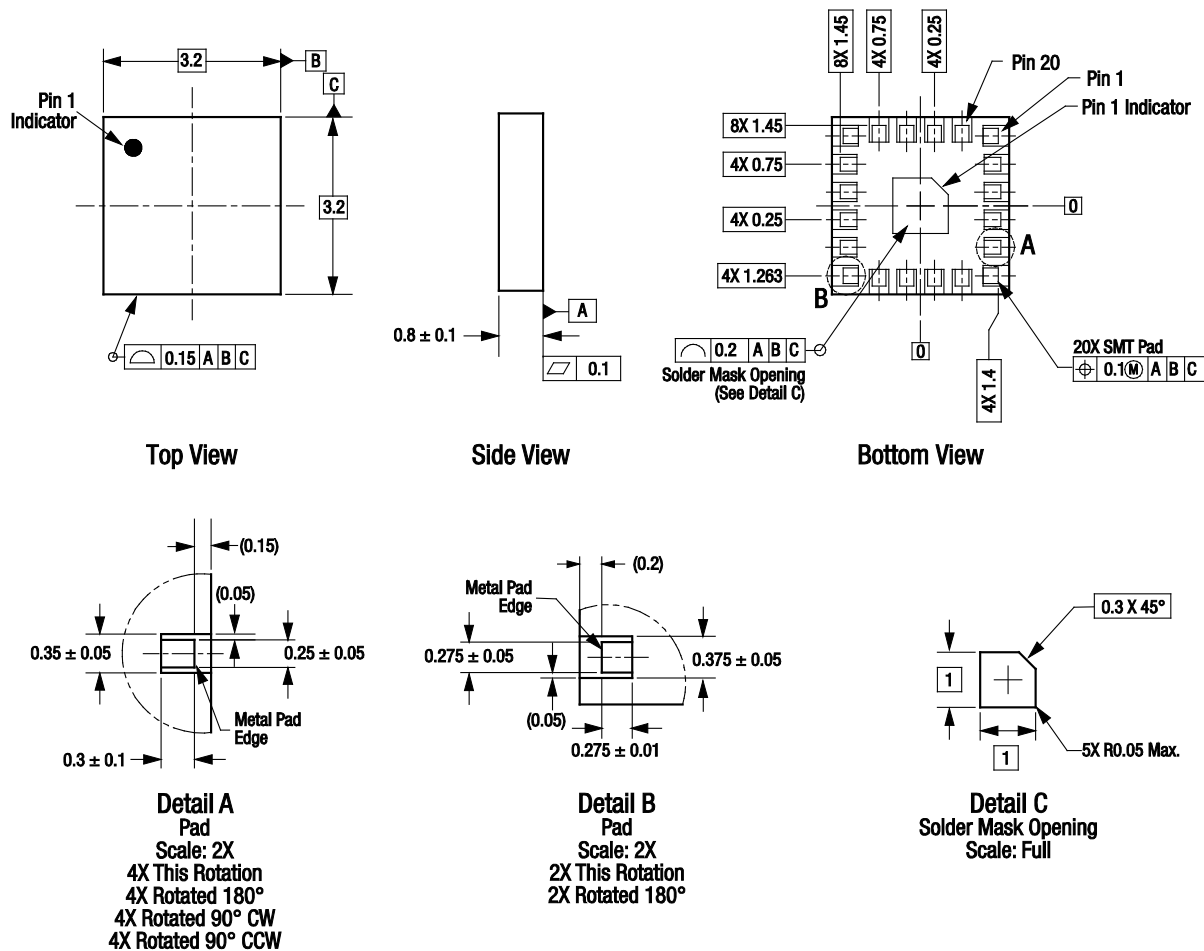
Figure 16. SKY13443-11 Evaluation Board Assembly Diagram

*** TBD ***

**Figure 17. SKY13443-11 PCB Layout Footprint
(Top View)**

*** TBD ***

**Figure 18. Typical Part Markings
(Top View)**



Dimensioning and tolerancing according to ASME Y14.5M-1994.
All measurements are in millimeters

S2917

Figure 19. SKY13443-11 20-Pin MCM Package Dimensions

*** TBD ***

Figure 20. SKY13443-11 Tape and Reel Dimensions

Ordering Information

| Model Name | Manufacturing Part Number | Evaluation Board Part Number |
|---|---------------------------|------------------------------|
| SKY13443-11 0.4-2.7 GHz SP10T Switch w/GPIO Interface | SKY13443-11 | *** TBD *** |

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