SKYWORKS®

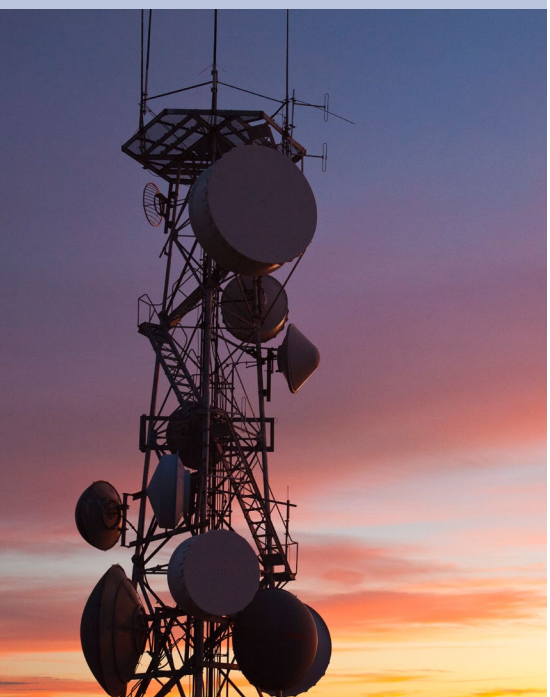
Product Brief

Applications

- Internet of Things (IoT)
- Tx/Rx and diversity
  - WLAN/Bluetooth®
  - Energy management
  - RFID
  - UHF/VHF: public safety bands
  - 800/900 MHz land mobile radios (LMR)
- Smartphones and data cards
- 3G/4G wireless networks
- Microwave applications up to 8 GHz
- Multi-antenna switching/swapping
- Automotive

Features

- Low insertion loss
- High isolation
- High linearity and low distortion
- High power (up to 100 W) handling
- Broad frequency range: 20 MHz to 8 GHz
- Low bias and control-logic voltage
- Low current operation



General Purpose RF Switches

Select RF switches available from stock for prototype or high-volume production

Skyworks Solutions offers a select group of radio frequency (RF) switches from our diverse switch offering that are in stock and ready for immediate design. The devices cover applications including aerospace and defense, automotive, computing, connected home, consumer electronics, media, medical, military (COTS), mobile devices, networking, smart energy, wearables and wireless infrastructure.

Our select switches portfolio includes the most popular, broad-market SPST, SPDT (SP2T), SP3T, SP4T, DPDT and up to SP8T products readily available to ship from stock. These devices provide excellent performance and value while utilizing proven technologies for high reliability. The select switches are used in a wide variety of systems, including cellular smartphones, feature phones and base stations, WLAN front-end modules, and RF/microwave test instruments. All SOI (Silicon on Insulator), GaAs (Gallium Arsenide) pHEMT and PIN diode-based switches are broadband by design and can be utilized throughout all Internet of Things (IoT) applications. Select switches have been fully characterized for low frequency applications, covering the UHF and VHF ranges utilized within land mobile radios.

Performance characteristics include broadband operation (VHF to 8 GHz), high power handling (up to 100 W), high isolation, low insertion loss, and reflective or absorptive ports when they are placed into their high isolation states. Products are tested and shipped from our high volume facility. All switches are packaged in industry-standard, plastic surface-mount packages and leverage Skyworks' extensive design knowledge, technical leadership, manufacturing expertise, and superior quality.

An application engineering team is available to assist you with your design efforts. Application notes and block diagrams are accessible on Skyworks' website at www.skyworksinc.com.

Join Our Customer Email Program Today
Skyworks is continually releasing new products. Join our customer email program instantly by scanning the QR code with your smartphone.

Skyworks Green™ products are compliant to all applicable materials legislation and are halogen-free. For additional information, please refer to Skyworks Definition of Green™, document number SQ04-0074.

Internet of Things (IoT)

Aerospace and defense, automotive, computing, connected home, consumer electronics, media, medical, military (COTS), mobile devices, networking, smart energy, wearables and wireless infrastructure

Part Number	Description	Frequency (GHz)	Insertion Loss (dB)	Isolation (dB)	Input IP3 (dBm)	Input $P_{1\,dB}$ (dBm)
SKYA21001*	SPDT (R)	0.02–3.0	0.30-0.40	23-25	50	34
SKY13453-385LF	SPDT (R)	0.01–6.0	0.40–0.70	27–15	57	33
SKY13446-374LF	SPDT (R)	0.10–6.0	0.50–0.80	38–30	–	32
SKY13418-485LF	SP8T (R)	0.10–3.0	0.45–0.85	35–20	66	38
SKY13417-485LF	SP7T (R)	0.10–3.0	0.45–0.85	35–20	66	38
SKY13416-485LF	SP6T (R)	0.10–3.0	0.40–0.45	42–31	69	38
SKY13415-485LF	SP5T (R)	0.10–3.0	0.40–0.45	42–31	69	38
SKY13414-485LF	SP4T (R)	0.10–3.0	0.40–0.45	42–31	69	38
SKY13384-350LF	SP4T (A)	0.20–4.0	0.60–1.20	50–36	51	30
SKY13381-374LF	DPDT (R)	0.10–6.0	0.50–1.50	31–14	62	38
SKY13373-460LF	SP3T (R)	0.10–6.0	0.35–0.80	40–22	55	39
SKY13370-374LF	SPDT (A)	0.50–6.0	0.70–1.15	31–24	55	39
SKY13355-374LF	DPDT (R)	0.10–6.0	0.50–0.90	31–15	55	33
SKY13351-378LF	SPDT (R)	0.02–6.0	0.35	24	50	30 (0.5 dB)
SKY13348-374LF	SPDT (A)	0.50–6.0	0.60–1.00	27–24	57	37
SKY13347-360LF	SPST (A)	0.50–3.0	0.60–0.80	45–30	40	31
SKY13330-397LF	SPDT (R)	0.10–6.0	0.30–0.60	42–21	–	39
SKY13323-378LF	SPDT (R)	0.10–3.0	0.20–0.35	27–24	50	27
SKY13322-375LF	SP4T (R)	0.02–6.0	0.6	26	51	30
SKY13317-373LF	SP3T (R)	0.02–6.0	0.6	25	50	29
SKY13299-321LF	SPDT (R)	0.02–5.0	0.30–0.75	29–22	57	38.5
SKY13298-360LF	SPDT (R)	3.00–8.0	0.70–0.90	25–22	47	26
SKY13290-313LF	SPDT (R)	0.02–2.5	0.40–0.55	26–18	–	39.8
SKY13286-359LF	SPDT (A)	0.10–6.0	0.80–1.50	62–42	46	30
SKY13270-92LF	SPDT (R)	0.02–2.7	0.40–0.60	30–19	–	37
SKY12212-478LF	SPDT (R)	0.05–2.7	0.20–0.50	29–50	67	50
AS213-92LF	SPDT (R)	0.10–3.0	0.30–0.50	27–19	40	27
AS193-73LF	SPDT (R)	0.10–3.0	0.35–0.70	19	–	37
AS179-92LF	SPDT (R)	0.02–3.0	0.4	23	43	30
AS169-73LF	SPDT (R)	30 kHz–2.5 GHz	0.30–0.40	25–24	43	30

*AEQ-Q100 qualified

Tx/Rx WLAN (802.11a/b/g/n/ac)

Part Number	Description	Frequency (GHz)	Insertion Loss (dB)	Isolation (dB)	Input IP3 (dBm)	Input $P_{1\,dB}$ (dBm)
SKY13446-374LF	SPDT (R)	0.10–6.0	0.5–0.8	38–30	–	32
SKY13381-374LF	DPDT (R)	0.10–6.0	0.60	22.0	62	38
SKY13370-374LF	SPDT (A)	0.50–6.0	0.7–1.15	31–24	55	39
SKY13355-374LF	DPDT (R)	0.10–6.0	0.60	23.5	55	33
SKY13351-378LF	SPDT (R)	0.02–6.0	0.35	24.0	50	30 (0.5 dB)
SKY13348-374LF	SPDT (A)	0.50–6.0	0.6–1.0	27–24	57	37
SKY13323-378LF	SPDT (R)	0.10–3.0	0.20–0.35	27–24	50	27
SKY13322-375LF	SP4T (R)	0.02–6.0	0.60	26.0	51	30
SKY13317-373LF	SP3T (R)	0.02–6.0	0.60	25.0	50	29
AS179-92LF	SPDT (R)	0.02–3.0	0.40	23.0	43	30

Mobile Devices

Part Number	Description	Frequency (GHz)	Insertion Loss (dB)	Isolation (dB)	Input IP3 (dBm)	Input $P_{1\,dB}$ (dBm)
SKY13453-385LF	SPDT (R)	0.10–6.0	0.4–0.7	27–15	57	33
SKY13417-485LF	SP7T (R)	0.10–3.0	0.45–0.85	35–20	66	38
SKY13418-485LF	SP8T (R)	0.10–3.0	0.45–0.85	35–20	66	38
SKY13317-373LF	SP3T (R)	0.02–6.0	0.6	25	50	29
SKY13416-485LF	SP6T (R)	0.10–3.0	0.4–0.45	42–31	69	38
SKY13415-485LF	SP5T (R)	0.10–3.0	0.4–0.45	42–31	69	38
SKY13414-485LF	SP4T (R)	0.10–3.0	0.4–0.45	42–31	69	38
SKY13373-460LF	SP3T (R)	0.10–3.0	0.35–0.8	40–22	55	39
SKY13330-397LF	SPDT (R)	0.10–6.0	0.3–0.6	42–21	–	39
AS179-92LF	SPDT (R)	0.02–3.0	0.4	23	43	30

UHF/VHF (48–1000 MHz)

Part Number	Description	Frequency (GHz)	Insertion Loss (dB)	Isolation (dB)	Input IP3 (dBm)	Input $P_{1\,dB}$ (dBm)
SKY13351-378LF	SPDT (R)	0.02–6.0	0.35	24	50	30 (0.5 dB)
SKY13322-375LF	SP4T (R)	0.02–6.0	0.6	26	51	30
SKY13317-373LF	SP3T (R)	0.02–6.0	0.6	25	50	29
SKY13299-321LF	SPDT (R)	0.02–5.0	0.30–0.75	29–22	57	28.5
SKY13290-313LF	SPDT (R)	0.02–2.5	0.40–0.55	26–18	–	39.8
SKY12212-478LF	SPDT (R)	0.05–2.7	0.20–0.50	29–50	67	50
AS213-92LF	SPDT (R)	0.10–3.0	0.30–0.50	27–19	40	27
AS193-73LF	SPDT (R)	0.10–3.0	0.35–0.70	19	–	37
AS179-92LF	SPDT (R)	0.02–3.0	0.4	23	43	30

SPDT = Single pole double throw
SP2T = Single pole two throw
SP3T = Single pole three throw
SP4T = Single pole four throw
SP5T = Single pole five throw
SP6T = Single pole six throw
SP7T = Single pole seven throw
SP8T = Single pole eight throw

DPDT = Double pole double throw
R = Reflective
A = Absorptive (terminated)

GaAs RF Switch Fundamentals

A switching field effect transistor (FET) functions as a three port device, where the source and drain ports form a conduction path or channel for the RF signal and the gate port controls whether the channel is opened or closed. A DC control voltage applied to the gate is required to create this function. Most switching FETs use a depletion mode configuration, which means that the channel is normally in its low resistance state with no voltage applied and in its high resistance state when a negative voltage is applied to the gate with respect to the drain and source. For positive control voltage operation, RF ground connections must be floated by inserting a DC block between the FET and ground. Also, DC blocks are required on the RF ports (see Figure 1).

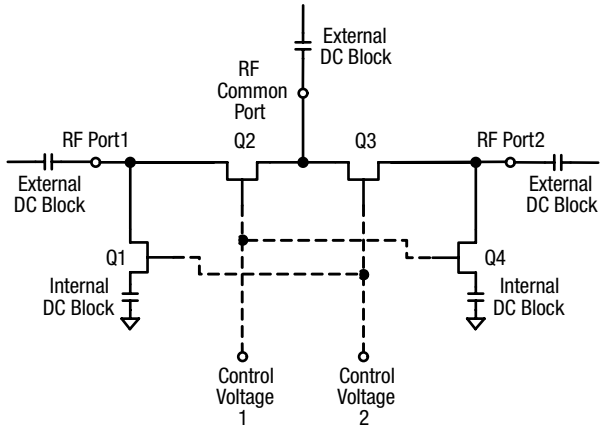


Figure 1. Typical SP2T with Series-Shunt Configuration

A complete switch can be fabricated by arranging FETs in various configurations depending upon the performance requirements of the end application. Figure 1 shows a typical single pole two-throw (SP2T) switch comprised of series and shunt FETs. In the isolation state, the shunt FET (e.g., Q1) is biased to produce a very low resistance, thus its input impedance is a reflective short. The series FET (e.g., Q2) in the same arm is biased to produce a very high resistance. In the low insertion loss state, the converse is true: the shunt FET is biased to produce a very large resistance, while its series FET is biased to produce very low resistance. Please refer to the "Published Articles" section available on Skyworks' website (www.skyworksinc.com/Press_Published_Articles.aspx) for more information about FET switch topologies and properties:

- Ultra-miniature High Linearity SPDT Switch for WLAN Applications
- Top Considerations When Buying or Specifying an RF Switch
- RF/Microwave Solid State Switches: Part 1
- Solid State RF/Microwave Switch Technology: Part 2

Skyworks also offers switches with a 50 Ω absorptive termination connected between the shunt FET(s) and AC ground. Skyworks switches are designated with "R" for reflective and "A" for absorptive in product specification tables.

Figure 2 illustrates the error vector magnitude (EVM) performance of low, medium, and high power switches. EVM is a typical specification to measure the amplitude and phase distortion with modulated signals such as WLAN 802.11a/b/g/n with a 10 dB peak to average ratio.

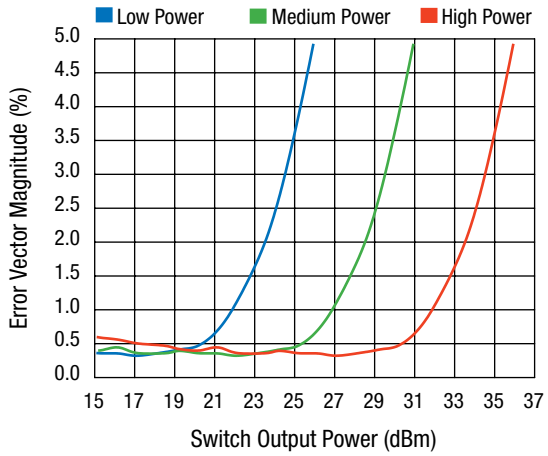


Figure 2. Typical GaAs Switch Performance. Error Vector Magnitude of Typical Low, Medium and High Power Switches

SOI Switch Fundamentals

SOI (silicon on insulator) switch transistors operate in a similar manner to GaAs devices. The channel between the drain and source can be either a low resistance or a high resistance based on the voltage on the gate. The SOI transistor requires a positive voltage on the gate to turn the FET "on" and requires a negative bias to turn the FET "off". To make it easy for the user of the switch, a negative voltage is generated on chip and distributed to the proper FETs based on a logic decode function that is also integrated on die. Since the gates are on an insulator, the switch does not need to be floated above ground potential for positive voltage operation. This also prevents a voltage from being developed on the RF line and therefore the switch does not require DC blocking capacitors. However, voltages from other portions of a circuit should be blocked from the SOI switch. To achieve higher power handling, SOI FETs are stacked to divide the RF voltage across them. The periphery is adjusted accordingly to maintain low insertion loss. FETs are configured in series and shunt orientation the same way they are for GaAs switches. By configuring elements in this manner, the optimum insertion loss and isolation can be achieved as a function of frequency. By designing with the proper number of stacked FETs and the correct periphery, SOI switches have excellent linearity. An example of harmonics performance is shown in Figure 3.

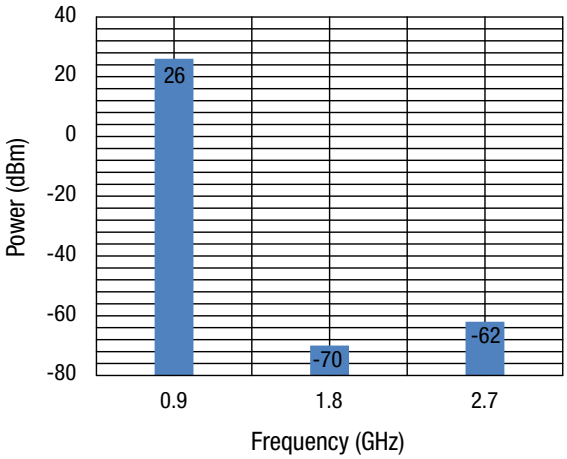


Figure 3. SKY13414-485LF SOI SP4T Switch Harmonics Performance at 900 MHz Signal

Transmit-Receive Switch

A SPDT switch can be used as a transmit-receive (Tx/Rx) switch, to alternately connect a transmitter and a receiver to a common single antenna in a single duplex system, as shown in Figure 4.

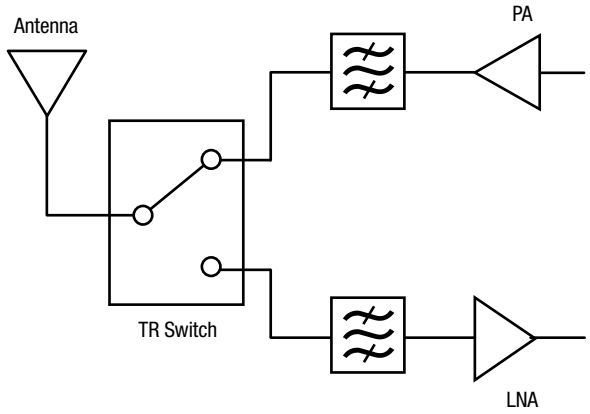


Figure 4. Simplified TR Switching Block Diagram

Antenna Swap

A DPDT switch can be used as an antenna swap switch, to selectively connect Antenna A and Antenna B in order to enhance RF over-the-air (OTA) performance with a multiple antenna system, as shown in Figure 5.

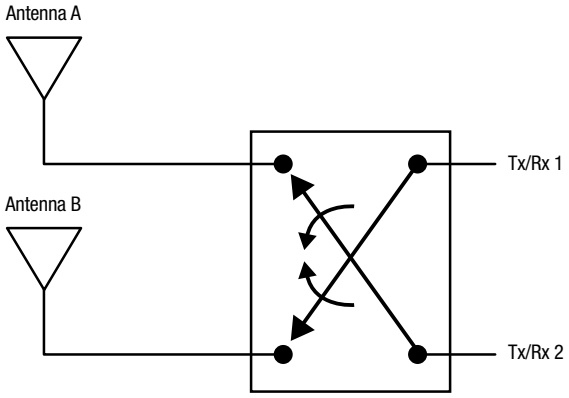


Figure 5. Simplified Antenna Swap Block Diagram

Switches for 100 Watt Applications

The SKY12212-478LF broadband, high power handling, high linearity, single-pole double-throw (SPDT) silicon, PIN diode, T/R switch is one of a series of innovative products. The SKY12212-478LF is well-suited for use as a high power transmit/receive or fail safe switch in a variety of telecommunication systems such as public safety radios, UHF/VHF land mobile radios and military communication systems, or TDD-LTE, TD-SCDMA base stations. The internal circuit of SKY12212-478LF is shown in Figure 6.

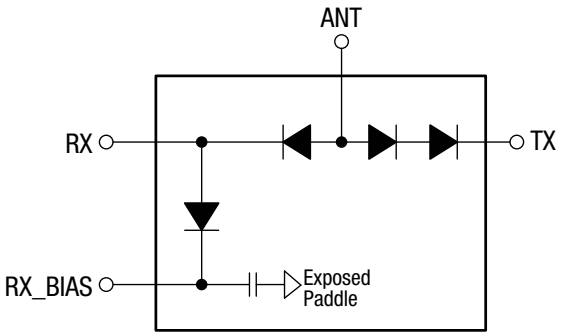


Figure 6. SKY12212-478LF Silicon PIN Diode SPDT Switch Circuit

For additional information, please refer to the following Application Notes and Published Articles.

Application Notes

Positive Voltage Operation of GaAs Control ICs

Published Articles

Ultra-Miniature High Linearity SPDT Switch for WLAN Applications

Top Considerations When Buying or Specifying an RF Switch

RF/Microwave Solid State Switches: Part 1

Solid State RF/Microwave Switch Technology: Part 2

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