



Product Brief

Applications

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

Features

- High power handling
- Low insertion loss
- High antenna to receive isolation
- Broad frequency range: 20 MHz to 6 GHz
- Controlled with positive power supply
- Bias driver circuit available on request

High Power (40 to 150 Watt) SPST and SPDT PIN Diode Switches

Skyworks' family of broadband, high power handling, high linearity, single-pole single-throw (SPST) and single-pole double-throw (SPDT) transmit and receive (T/R) switches deliver low insertion loss and high isolation and are ideal for use in up to 150 W RF input power applications. These silicon-based PIN diode switches are broadband by design, can operate with positive voltages and have been fully characterized for low-frequency applications such as UHF and VHF, as well as popular cell phone communication bands.

Performance characteristics include high power handling, high isolation, superb linearity and low insertion loss with reflective ports. The entire suite of solutions (shown in Table 1) provides excellent performance and value, and leverages Skyworks' extensive design knowledge, technical leadership, manufacturing expertise and superior quality.

Our lead (Pb)-free, RoHS-compliant and Green™ products are fabricated in our high volume silicon wafer facility and all switches are packaged in industry-standard, plastic, surface-mount QFN packages. Parts are in stock and available for immediate use in transmit/receive switching and failsafe switching in TD-SCDMA and LTE base stations, land mobile radios, public safety radios, and military communication systems.

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

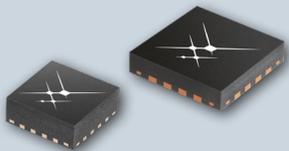


Table 1. High Power PIN Diode Switches

	Description (Absorptive / Reflective)	Frequency (GHz)	Typical Ant-Rx Insertion Loss (dB)	Typical Ant-Rx Isolation Loss (dB)	Max. Power (W)	Package (mm)
SKY12207-306LF	SPDT (R)	0.9-4.0	0.3-0.6	27-41	50	QFN 16L 4 x 4 x 0.9
SKY12207-478LF	SPDT (R)	0.9-4.0	0.3-0.6	30-42	50	QFN 16L 4 x 4 x 1.5
SKY12208-306LF	SPDT (R)	0.02-2.7	0.1-0.4	33-49	50	QFN 16L 4 x 4 x 0.9
SKY12208-478LF	SPDT (R)	0.02-2.7	0.2-0.5	35-50	50	QFN 16L 4 x 4 x 1.5
SKY12209-478LF	SPDT (R)	0.9-4.0	0.4-0.6	35-46	40	QFN 16L 4 x 4 x 1.5
SKY12210-478LF	SPDT (R)	0.9-4.0	0.3-0.6	33-44	100	QFN 16L 4 x 4 x 1.5
SKY12211-478LF	SPDT (R)	0.05-2.7	0.2-0.5	32-49	40	QFN 16L 4 x 4 x 1.5
SKY12212-478LF	SPDT (R)	0.05-2.7	0.3-0.4	24-47	100	QFN 16L 4 x 4 x 1.5
SKY12213-478LF	SPST (R)	0.05-6.0	0.3-0.6	20-34	150	QFN 16L 4 x 4 x 1.5

High Power PIN Diode Switch Fundamentals

A PIN diode is a current controlled resistor at radio and microwave frequencies. It is a silicon semiconductor diode in which a high-resistivity intrinsic I-region is sandwiched between a P-type and N-type region. When the PIN diode is forward biased, holes and electrons are injected into the I-region. These charges do not immediately annihilate each other; instead they stay alive for an average time. This results in an average stored charge which lowers the effective resistance of the I-region. When the PIN diode is at zero or reverse bias, there is no stored charge in the I-region and the diode appears as a capacitor shunted by a parallel resistance.

A PIN diode based T/R switch is a practical design for base station and infrastructure applications. Figure 1 illustrates how a SPDT switch can be used to connect a transmitter and a receiver to a common single antenna in a single duplex system.

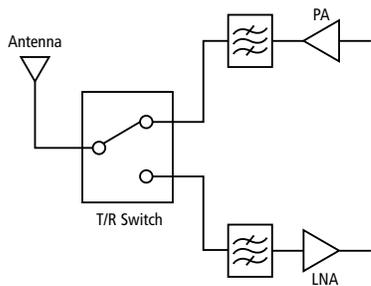


Figure 1. Simplified T/R Switch

The SKY12207-478LF, SKY12208-478LF, SKY12210-478LF and SKY12212-478LF SPDT T/R switch designs consist of a series-connected PIN diode placed between the transmitter power amplifier and antenna, and a series and shunt-connected PIN diode connected at the receiver port, as shown in Figure 2.

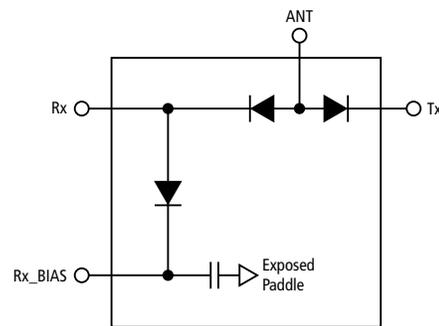


Figure 2. Typical SPDT with Series-Shunt Configuration

As shown in Figures 3a and 3b, when the transmitter is on, forward current is applied to the transmit series diode (low impedance state), allowing low insertion loss between transmitter and antenna. The high impedance of the receiver series diode protects it from the transmitter power, and the forward biased shunt diode on the receiver side improves the ANT to receive isolation by shunting the RF signal to ground that is not blocked by the receiver series diode. When the receiver is on, forward current is applied to the receive series diode (low impedance state), allowing low insertion loss between receiver and antenna. The series transmit and shunt receive PIN diodes are at zero bias (high impedance state). This results in low loss between the antenna and the receiver and isolates the off transmitter.

The SKY12209-478LF and SKY12211-478LF switches operate similarly to the designs described above, but incorporate an additional shunt diode on the transmit side to create a symmetrical series-shunt SPDT switch as shown in Figure 4. These switches are very useful for high power T/R and RF path switching applications.

For ultra high power applications (up to 150 W) the SKY12213-478LF can be configured as an SPST or combined with other

Skyworks' discrete series diodes like the SMP1322-040LF and shunt diodes like the SMP1302-085LF to create a variety of switch configurations. Figure 5 represents a T/R SPDT switch using the SKY12213-478LF packaged diode and other Skyworks packaged diodes.

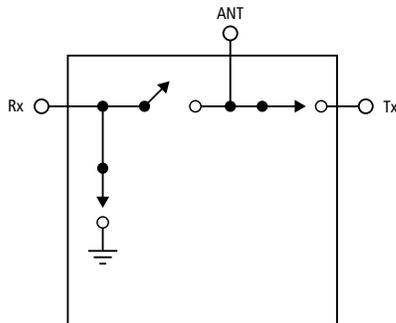


Figure 3a. Typical SPDT Transmit State

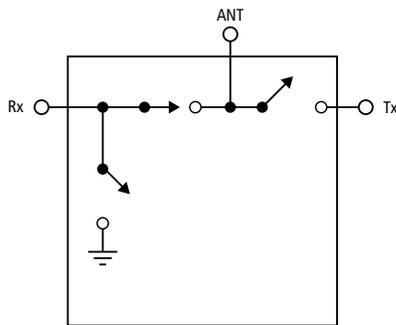


Figure 3b. Typical SPDT Receive State

The SKY12209-478LF and SKY12211-478LF switches operate similarly to the designs described above, but incorporate an additional shunt diode on the transmit side to create a symmetrical series-shunt SPDT switch as shown in Figure 4. These switches are very useful for high power T/R and RF path switching applications.

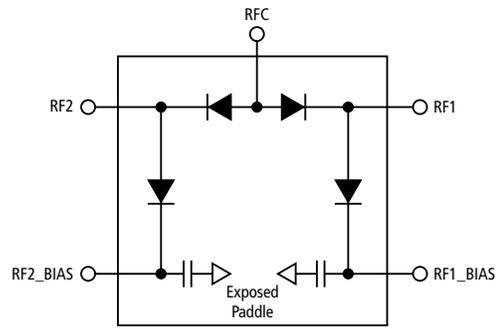


Figure 4. Typical Symmetrical SPDT Switch States

For ultra high power applications (up to 150 W) the SKY12213-478LF can be configured as an SPST or combined with other Skyworks' discrete series diodes like the SMP1322-040LF and shunt diodes like the SMP1302-085LF to create a variety of switch configurations. Figure 5 represents a T/R SPDT switch using the SKY12213-478LF packaged diode and other Skyworks packaged diodes.

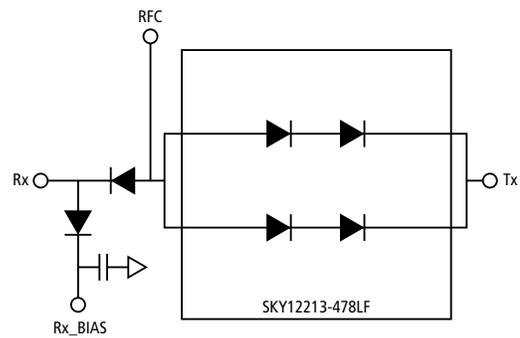


Figure 5. Typical T/R SPDT Configuration with SKY12213-478LF

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