DATA SHEET

SKY13442-553LF: 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 QFN (20-pin, 2.5 x 2.5 mm) package (MSL1, 260 °C per JEDEC J-STD-020)

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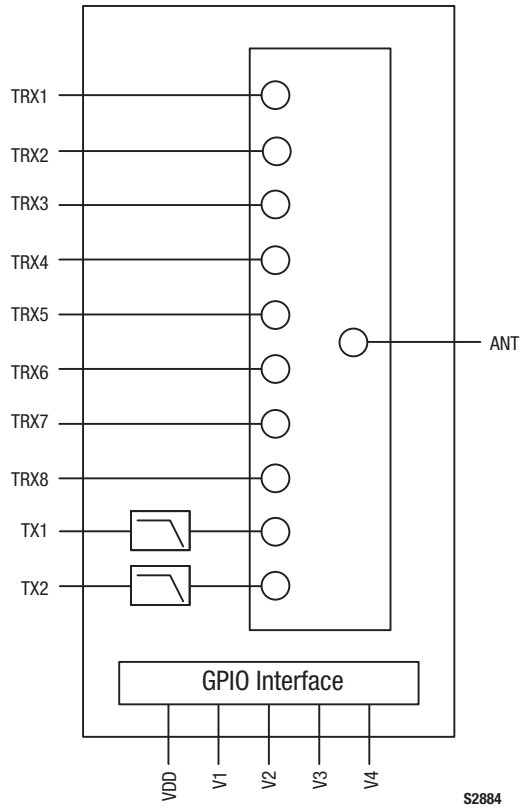


Figure 1. SKY13442-553LF Block Diagram

Description

The SKY13442-553LF 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 SKY13442-553LF 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.

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 SKY13442-553LF is manufactured in a compact, 2.5 x 2.5 mm, 20-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.

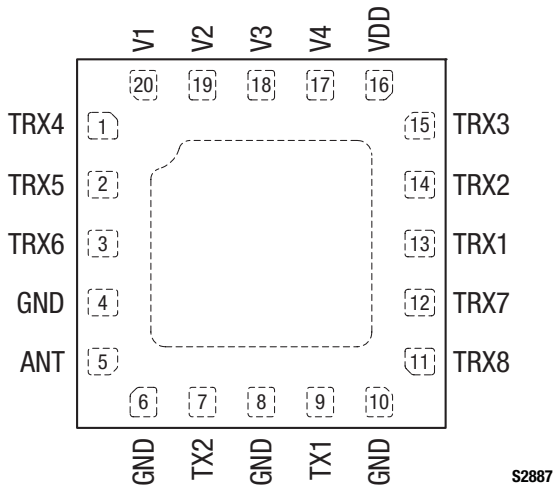


Figure 2. SKY13442-553LF Pinout – 20-Pin QFN (Top View)

Table 1. SKY13442-553LF Signal Descriptions

Pin #	Name	Description	Pin #	Name	Description
1	TRX4	RF input/output port 4	11	TRX8	RF input/output port 8
2	TRX5	RF input/output port 5	12	TRX7	RF input/output port 7
3	TRX6	RF input/output port 6	13	TRX1	RF input/output port 1
4	GND	Ground	14	TRX2	RF input/output port 2
5	ANT	Antenna RF port	15	TRX3	RF input/output port 3
6	GND	Ground	16	VDD	DC power supply
7	TX2	GSM high band transmit RF input port with integrated harmonic filter	17	V4	DC input control voltage 4
8	GND	Ground	18	V3	DC input control voltage 3
9	TX1	GSM low band transmit RF input port with integrated harmonic filter	19	V2	DC input control voltage 2
10	GND	Ground	20	V1	DC input control voltage 1

Note: Bottom ground paddles must be connected to ground.

Table 2. SKY13442-553LF 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 SKY13442-553LF are provided in Table 2. Electrical specifications are provided in Table 3. Table 4 provides the control logic for the SKY13442-553LF.

Typical performance characteristics of the SKY13442-553LF 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 SKY13442-553LF exhibits exceptional performance for all TRX ports.

Table 3. SKY13442-553LF Electrical Specifications (Note 1) (1 of 2)
(V_{DD} = 2.85 V, CTLA = CTLB = CTLC = CTLD = 0/1.8 V, T_{OP} = +25 °C, P_{IN} = 0 dBm, Characteristic Impedance [Z_O] = 50 Ω, Unless Otherwise Noted)

Parameter	Symbol	Test Condition	Min	Typical	Max	Units
RF Specifications						
Insertion Loss	IL	704 to 787 MHz, ANT to TRX		0.45	0.60	dB
Insertion Loss (TRX1-3)	IL	824 to 960 MHz, ANT to TRX		0.55	0.70	dB
		1710 to 2170 MHz, ANT to TRX		0.70	0.85	dB
		2300 to 2690 MHz, ANT to TRX		0.85	1.05	dB
Insertion Loss (TRX4-6)	IL	824 to 960 MHz, ANT to TRX		0.55	0.70	dB
		1710 to 2170 MHz, ANT to TRX		0.70	0.85	dB
		2300 to 2690 MHz, ANT to TRX		0.85	1.00	dB
Insertion Loss (TRX7-8)	IL	824 to 960 MHz, ANT to TRX		0.55	0.70	dB
		1710 to 2170 MHz, ANT to TRX		0.70	0.85	dB
		2300 to 2690 MHz, ANT to TRX		0.95	1.10	dB
Insertion loss: ANT to TX1 port	IL	824 to 915 MHz		1.15	1.35	dB
Insertion loss: ANT to TX2 port	IL	1710 to 1910 MHz		1.15	1.35	dB
Isolation (TRX1/2/3/7/8 to TRX4/5/6 ports)	ISO	824 to 1910 MHz	42	45		dB
Isolation (TX1 to TRX1 through TRX8[RX2] ports)	ISO	824 to 915 MHz	40	43		dB
Isolation (TX2 to TRX1 through TRX8[RX2] ports)	ISO	1710 to 1910 MHz	40	43		dB
Isolation (TRx4 to TRx6)	ISO	824 to 1910MHz	27	30		dBm
Adjacent port isolation	ISO_{ADJ}	824 to 1990 MHz	21	24		dB
Band 13 2nd harmonic	B13 2fo	P_{IN} = +25 dBm, f = 787 MHz, TRX1 to TRX8		–80	–78	dBm
Harmonics		UMTS, P_{IN} = +27 dBm:		–67	–45	dBm
		TX1 port, P_{IN} = +35 dBm		–49	–36	dBm
		TX2 port, P_{IN} = +33 dBm		–52	–36	dBm
Attenuation (TX1 port)		GSM850:				
		2f	21	24		dB
		3f	25	28		dB
		>4f		20		dB
		EGSM900:				
		2f	25	28		dB
		3f	25	28		dB
		>4f		20		dB
Attenuation (TX2 port)		DCS1800:				
		2f	25	28		dB
		3f	25	28		dB
		>4f		20		dB
		PCS1900:				
		2f	24	27		dB
		3f	25	28		dB
		>4f		15		dB

Table 3. SKY13442-553LF Electrical Specifications (Note 1) (2 of 2)
(V_{DD} = 2.85 V, CTLA = CTLB = CTLC = CTLD = 0/1.8 V, T_{OP} = +25 °C, P_{IN} = 0 dBm, Characteristic Impedance [Z_O] = 50 Ω, Unless Otherwise Noted)

Parameter	Symbol	Test Condition	Min	Typical	Max	Units
RF Specifications (continued)						
Return loss	|S11|	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		–110	–105	dBm
3rd Order Intermodulation Distortion	IMD3	UMTS mode		–110	–105	dBm
Triple Beat Ratio	TBR	650 to 900 MHz 1710 to 2155 MHz	81 81	91 91		dBc dBc
Switching speed		10/90% RF		3	5	µs
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				 3 3	 5 5	 µA µA

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

Table 4. SKY13442-553LF Mode Control Logic

Insertion Loss State	V1 (Pin 20)	V2 (Pin 19)	V3 (Pin 18)	V4 (Pin 17)
Standby (all ports in isolation state)	0	0	0	0
ANT to TX1	1	1	0	0
ANT to TX2	1	0	0	0
ANT to TRX7	0	1	1	0
ANT to TRX8	0	1	0	0
ANT to TRX1	0	0	1	0
ANT to TRX2	1	0	1	0
ANT to TRX3	1	1	1	0
ANT to TRX4	1	0	1	1
ANT to TRX5	1	1	1	1
ANT to TRX6	1	0	0	1

Typical Performance Characteristics

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

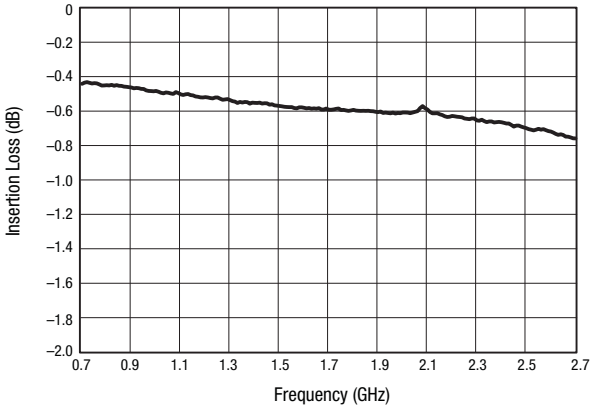


Figure 3. Insertion Loss vs Frequency (ANT to All TRX Ports)

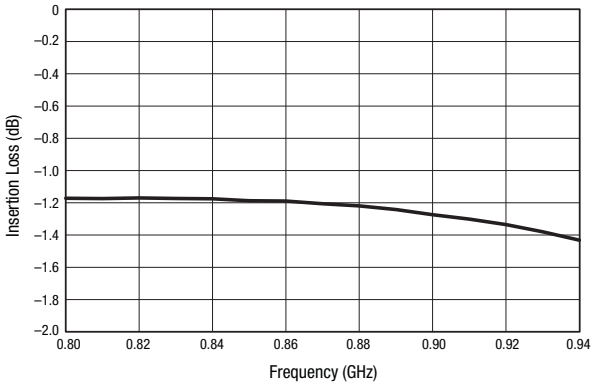


Figure 4. Insertion Loss vs Frequency (ANT to TX1 Port)

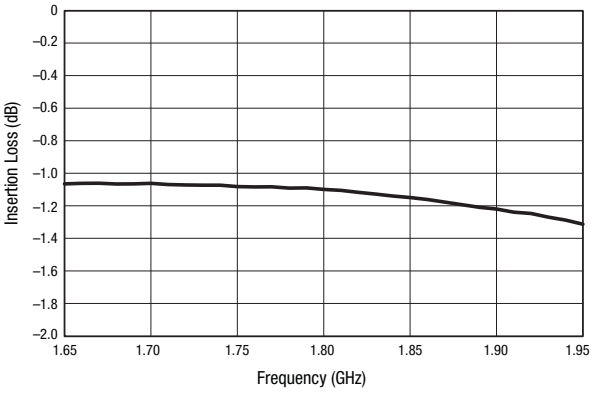


Figure 5. Insertion Loss vs Frequency (ANT to TX2 Port)

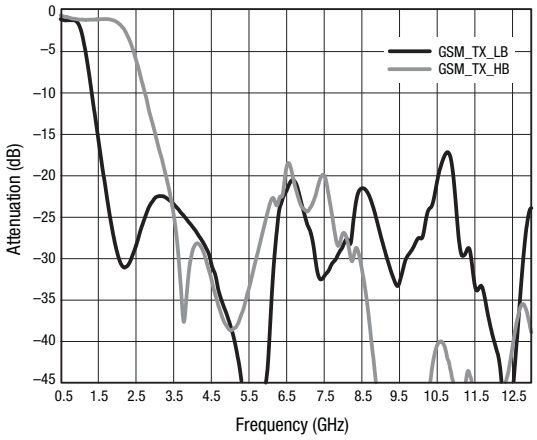


Figure 6. Attenuation vs Frequency (ANT to TX1/2 Ports)

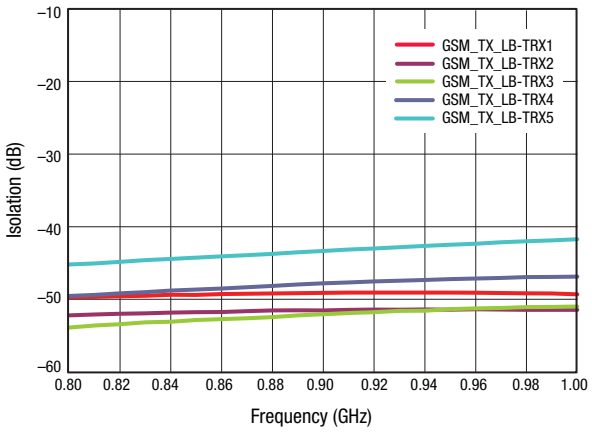


Figure 7. Isolation vs Frequency (TX1 to TRX Ports)

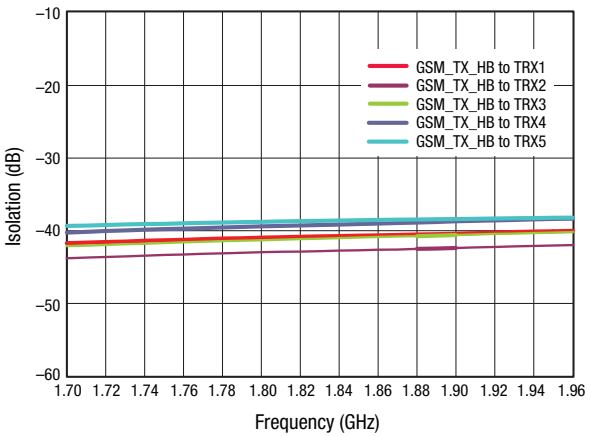


Figure 8. Isolation vs Frequency (TX2 to TRX Ports)

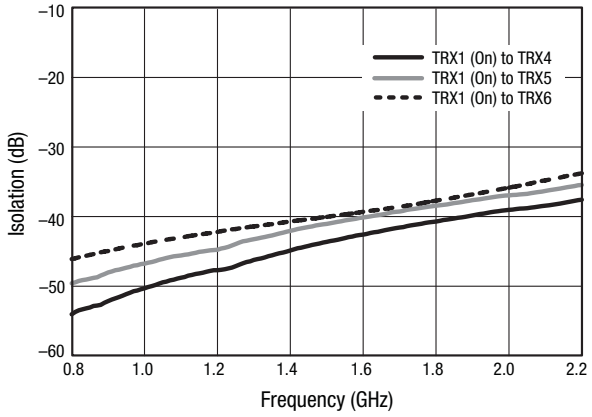


Figure 9. Isolation vs Frequency (TRX1 to TRX4/5/6 Ports)

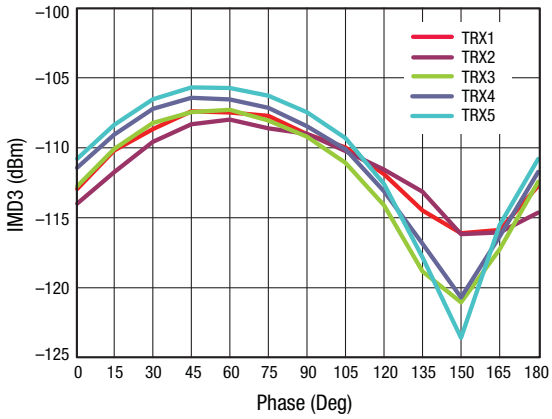


Figure 10. 3rd Order Intermodulation Distortion vs Phase, TRX Ports (f_{FUND} = 1.95 GHz, f_{BLK} = 1.76 GHz, f_{RX} = 2.14 GHz)

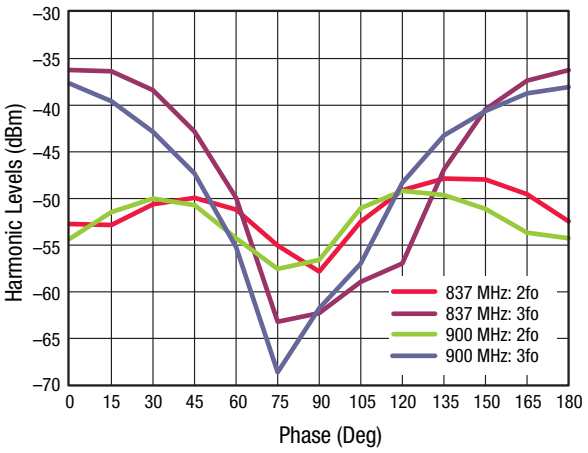


Figure 11. Harmonics vs Phase (ANT to TX1, P_{IN} = +35 dBm, 5:1 VSWR Mismatch)

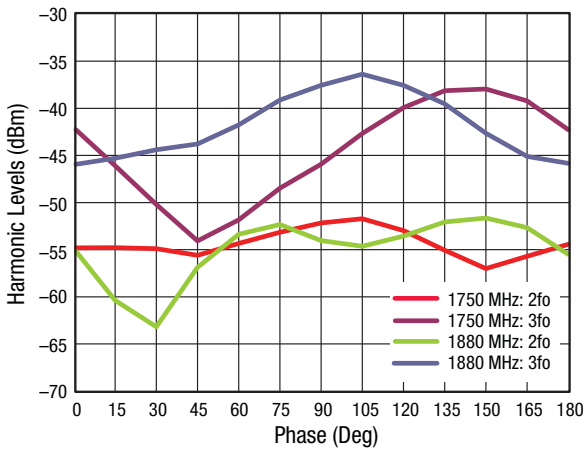


Figure 12. Harmonics vs Phase (ANT to TX2, P_{IN} = +33 dBm, 5:1 VSWR Mismatch)

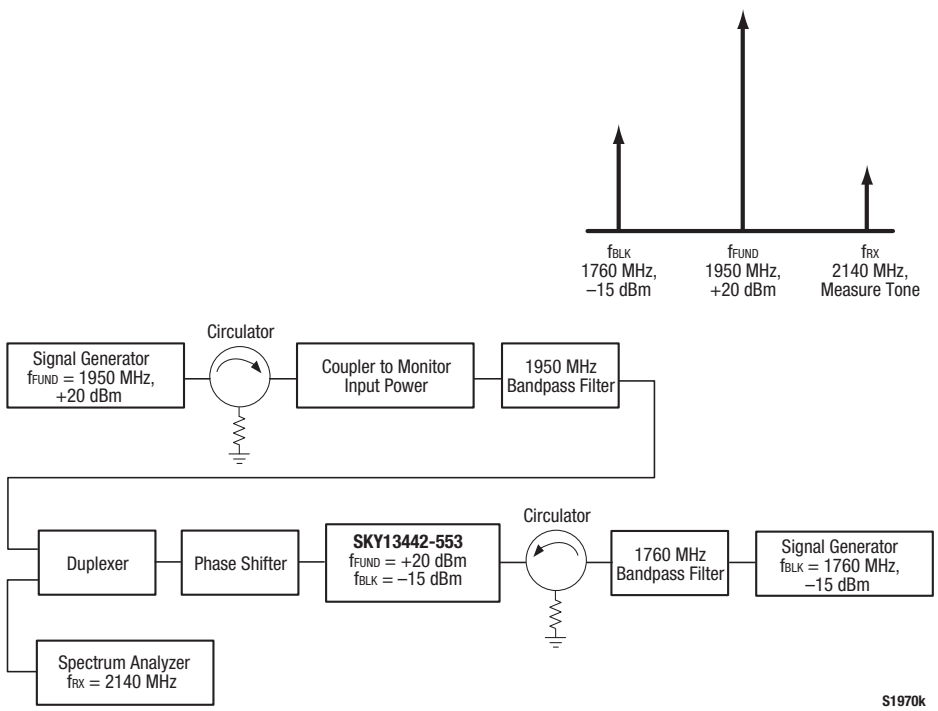


Figure 13. 3rd Order Intermodulation Test Setup

Evaluation Board Description

The SKY13442-553LF Evaluation Board is used to test the performance of the SKY13442-553LF 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 SKY13442-553LF is provided in Figure 17. Typical case markings are shown in Figure 18. Package dimensions for the 20-pin QFN are shown in Figure 19, and tape and reel dimensions are provided in Figure 20.

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 SKY13442-553LF 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.

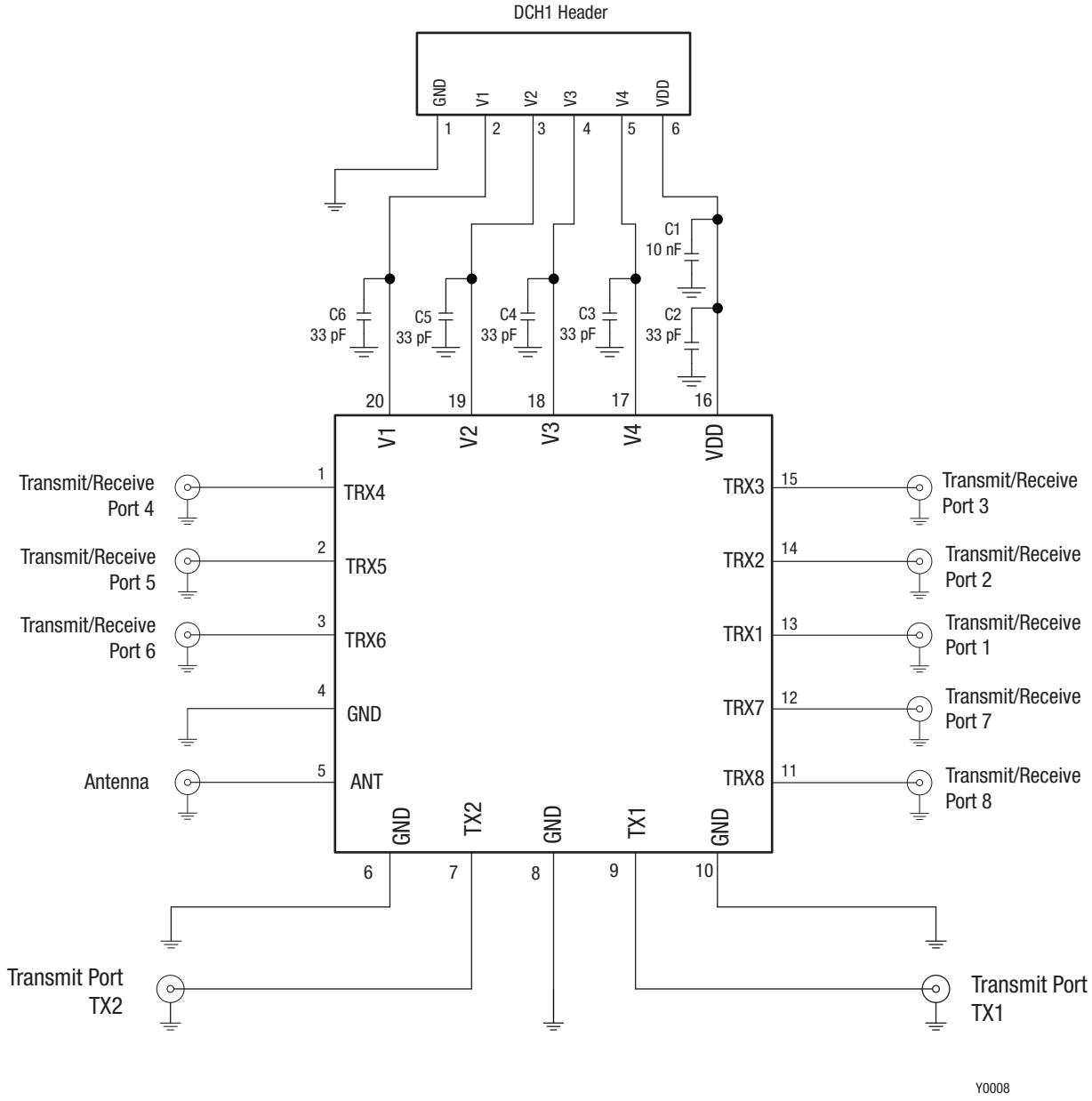
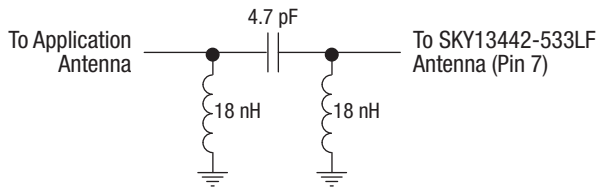
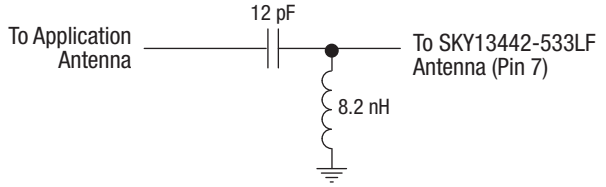


Figure 14. SKY13442-553LF Evaluation Board Schematic



ESD Circuit 1



ESD Circuit 2

Y0012

Figure 15. SKY13442-553LF Recommended ESD Protection Circuits

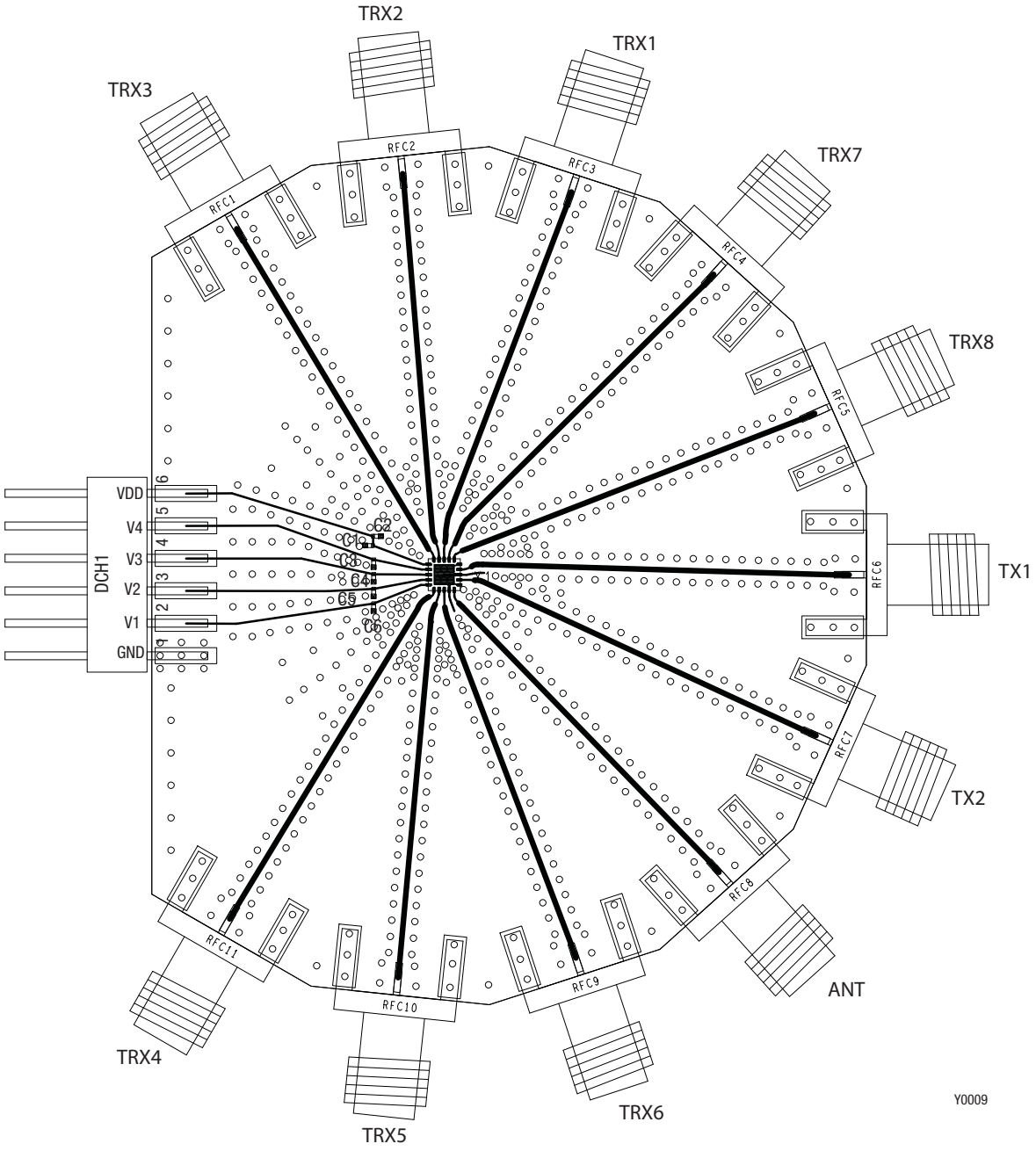


Figure 16. SKY13442-553LF Evaluation Board Assembly Diagram

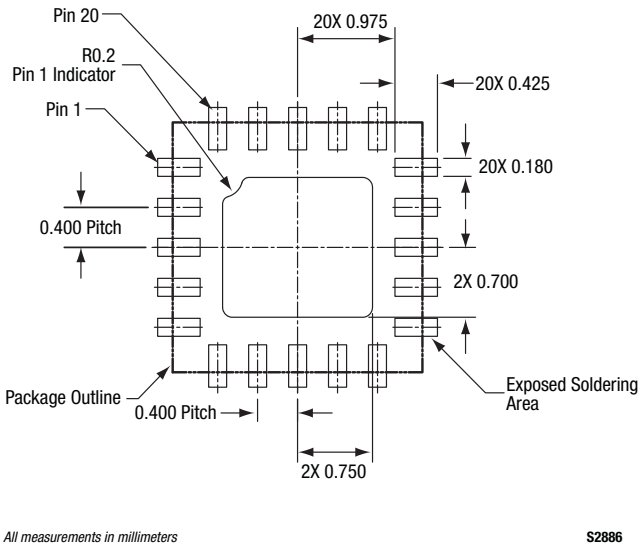


Figure 17. SKY13442-553LF PCB Layout Footprint (Top View)

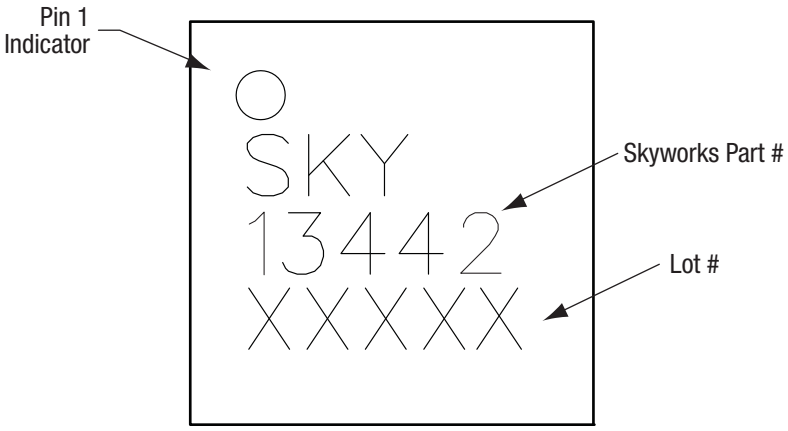
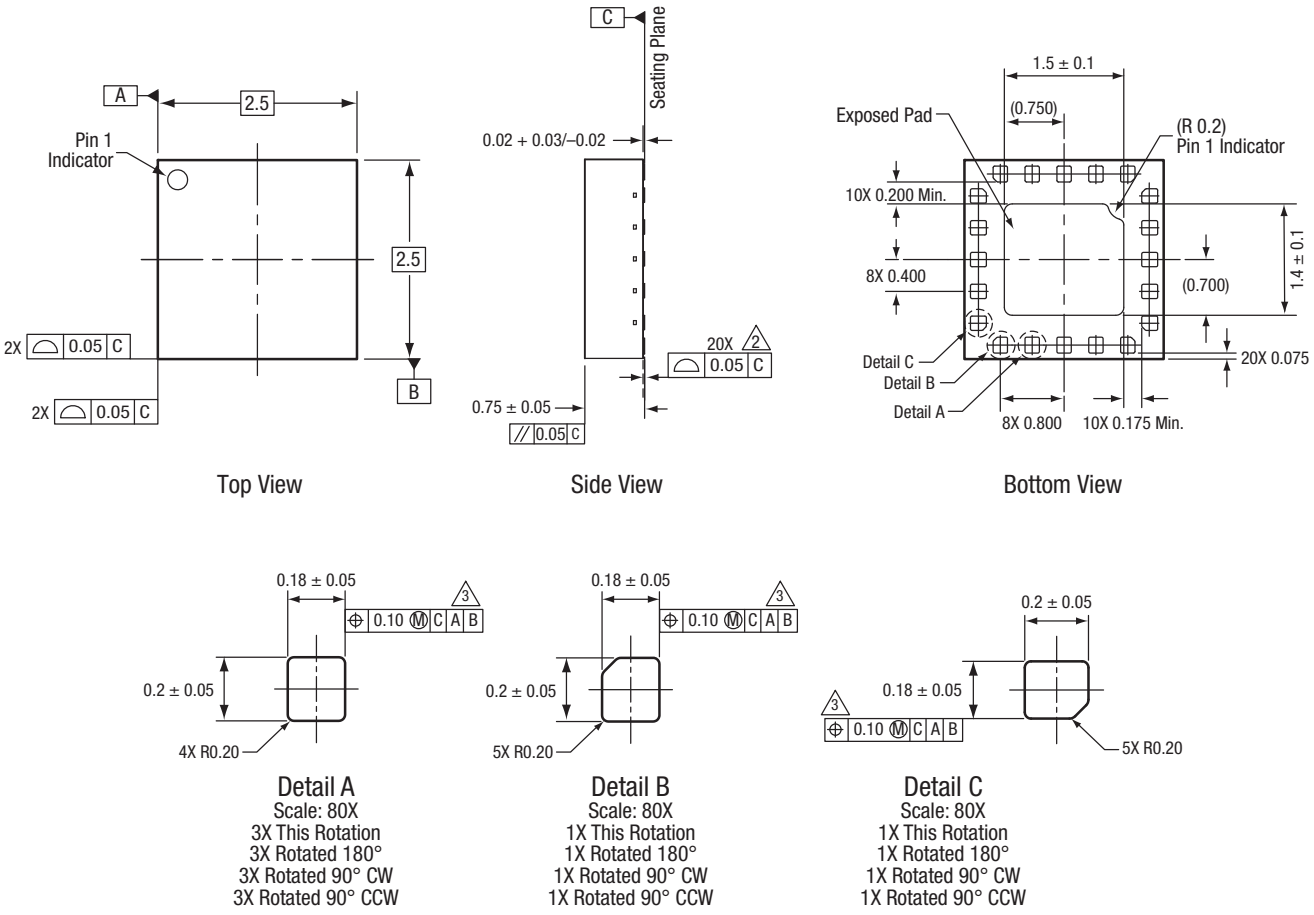


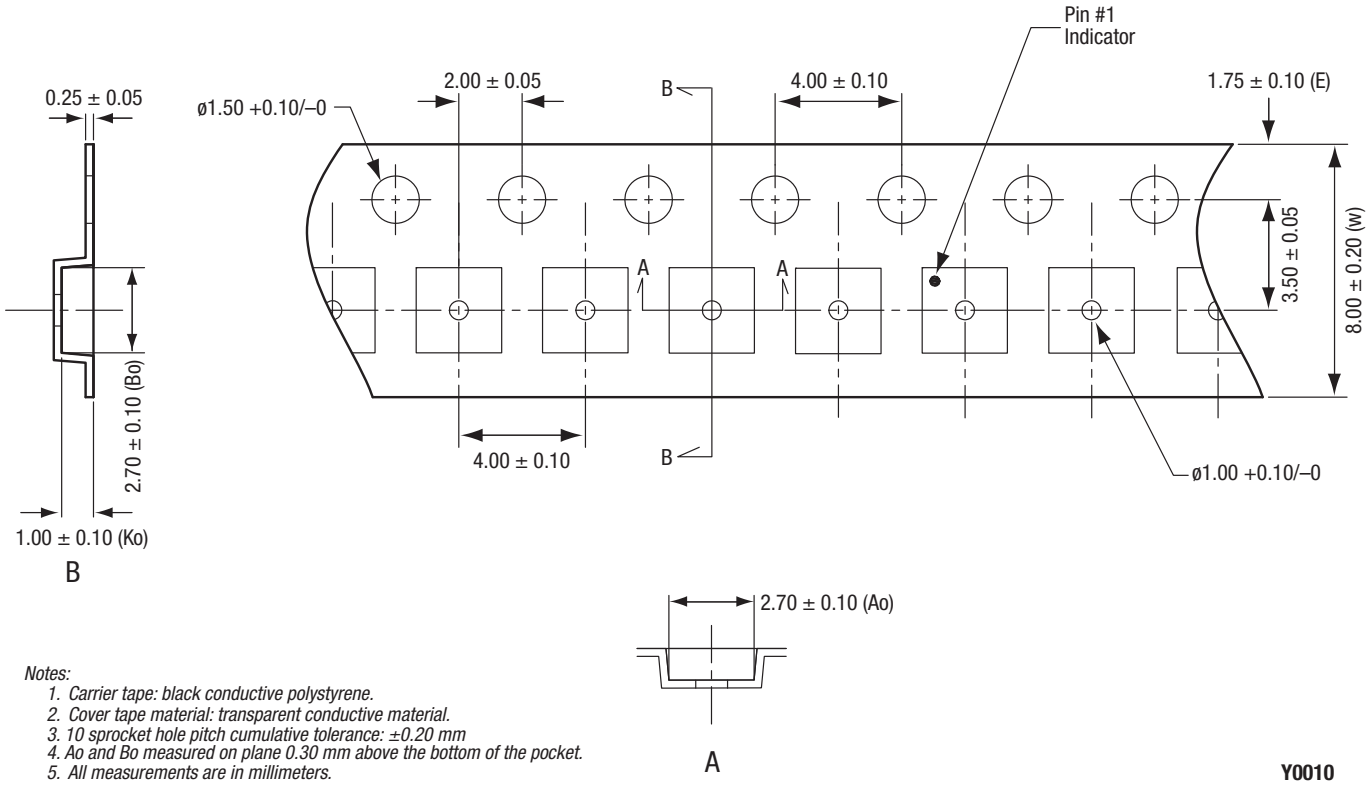
Figure 18. Typical Part Markings (Top View)



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.
Dimension applies to metalized terminal. If the terminal has a radius on its end, the dimension should not be measured in that area.

S2885

Figure 19. SKY13442-553LF 20-Pin QFN Package Dimensions



Notes:
1. *Carrier tape: 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 measurements are in millimeters.*

Y0010

Figure 20. SKY13442-553LF Tape and Reel Dimensions

Ordering Information

Model Name	Manufacturing Part Number	Evaluation Board Part Number
SKY13442-553LF 0.4-2.2 GHz SP10T Switch	SKY13442-553LF	SKY13442-553LF-EVB