DATA SHEET

SKY13410-365LF: 0.25 - 2.15 GHz 4x2 Switch Matrix with Tone/Voltage Decoder

Applications

- DBS switching systems
- Cable TV/modems

Features

- Broadband frequency range: 0.25 to 2.15 GHz
- Tone and voltage, or mode control switching
- High isolation: 40 dB typical @ 900 MHz
- Four RF inputs, two RF outputs
- Low current consumption: 1.5 mA typical @ 5 V
- Miniature QFN (20-pin, 4 x 4 mm) package (MSL1, 260 °C per JEDEC J-STD-020)

Skyworks Pb-free products are compliant with all applicable legislation. For additional information, refer to *Skyworks Definition of Lead (Pb)-Free*, document number SQ04-0073.

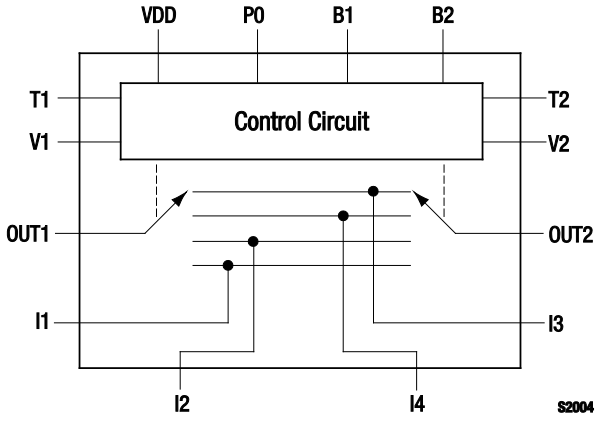


Figure 1. SKY13410-365LF Block Diagram

Description

The SKY13410-365LF is a four-input to two-output switch matrix intended for Direct Broadcast Satellite (DBS) switching and cable TV/modem applications. The SKY13410-365LF enables 16 states, directing any of the four inputs to either of the two outputs. Switch states are selected using tone and voltage signals together with logic levels applied to mode control inputs. The switch can operate over a temperature range of –40 °C to +85 °C.

The SKY13410-365LF is manufactured in a compact, 4 x 4 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.

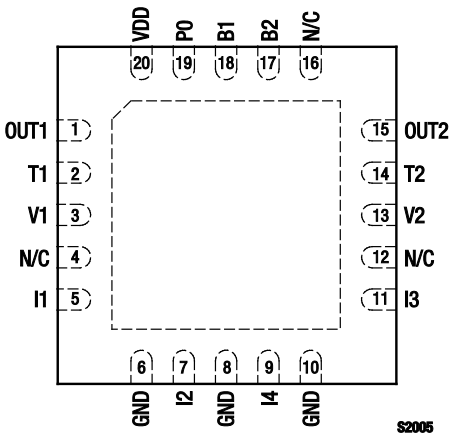


Figure 2. SKY13410-365LF Pinout – 20-Pin QFN (Top View)

Table 1. SKY13410-365LF Signal Descriptions

Pin #	Name	Description	Signal Type	I/O	Pin #	Name	Description	Signal Type	I/O
1	OUT1	RF channel output #1, 250 to 2150 MHz	RF	O	11	I3	RF input #3, 250 to 2150 MHz	RF	I
2	T1	Tone detector input #1	AC	I	12	N/C	No connection	–	–
3	V1	Voltage detector input #1	DC	I	13	V2	Voltage detector input #2	DC	I
4	N/C	No connection	–	–	14	T2	Tone detector input #2	AC	I
5	I1	RF input #1, 250 to 2150 MHz	RF	I	15	OUT2	RF channel output #2, 250 to 2150 MHz	RF	O
6	GND	Ground	GND	–	16	N/C	No connection. This pin must be left open.	DC	–
7	I2	RF input #2, 250 to 2150 MHz	RF	I	17	B2	Mode control input #2	DC	I
8	GND	Ground	GND	–	18	B1	Mode control input #1	DC	I
9	I4	RF input #4, 250 to 2150 MHz	RF	I	19	P0	Mode control input #0		
10	GND	Ground	GND	–	20	VDD	Supply voltage, +3.3 to +5.0 V	DC	I

Technical Description

The SKY13410-365LF is controlled by a pair of DC voltage levels applied to V1 (pin 3) and V2 (pin 13) combined with 22 kHz signal levels applied to T1 (pin 2) and T2 (pin 14). These signals are supplied from a set top box, receiver, etc., that is controlled by the user.

The configuration of the switch, itself, is controlled by the logic levels applied to P0 (pin 19), B1 (pin 18), and B2 (pin 17).

A pair of SKY13410-365LF 4x2 switches can be used to form a 4x4 switch. Figure 3 shows a suggested implementation in which one of the 4x2 switches is mounted on the top side of a printed circuit board, with the second 4x2 switch mounted on the back side of the printed circuit board.

The four RF input signals, which may come from a variety of sources but are shown here coming from four separate low-noise block converters, are split and routed directly to the inputs of the top-side switch and through vias to the inputs of the back-side switch.

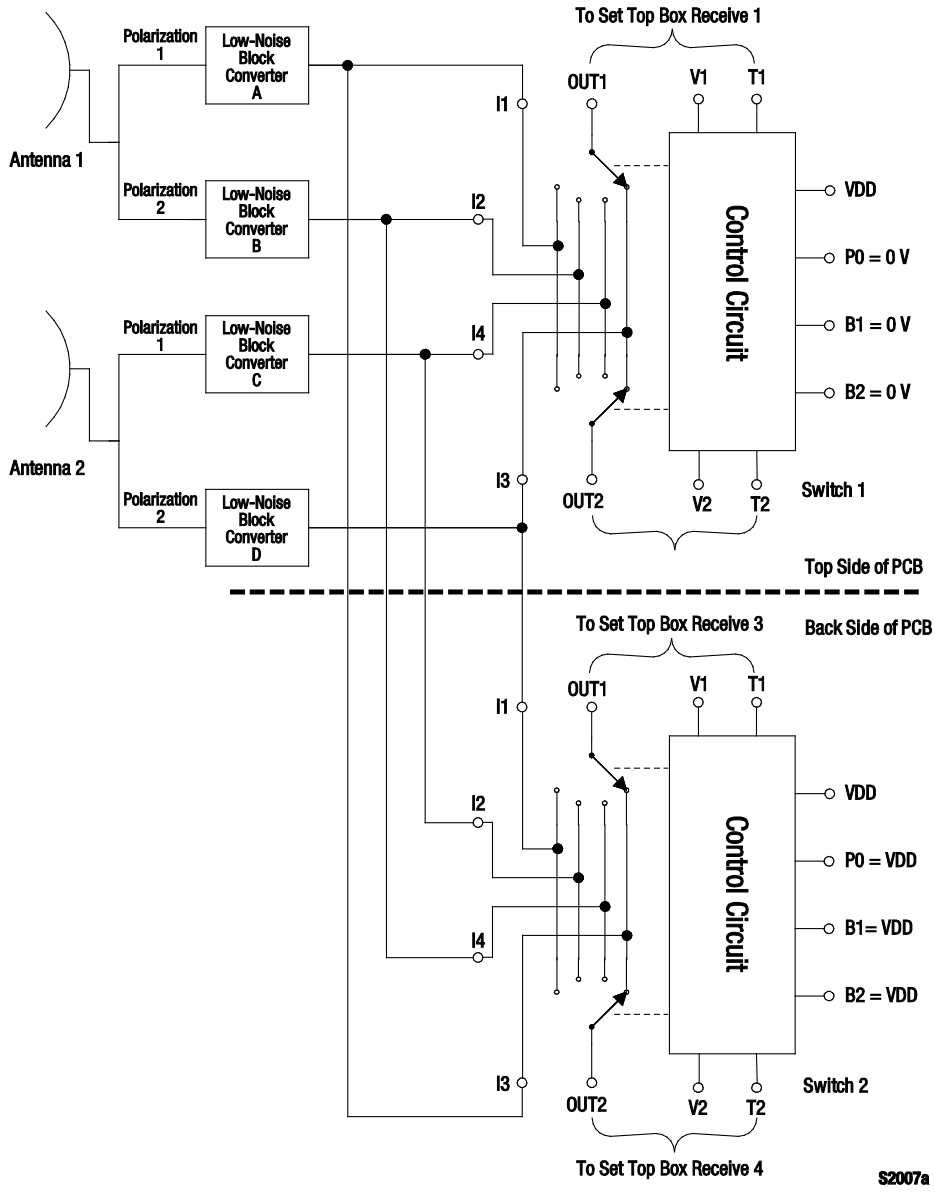


Figure 3. Suggested Implementation of Two 4x2 Switches

With each of the configuration inputs (P0, B1, and B2) of the top-side switch held at 0 V, and each of the configuration inputs of the back-side switch held at VDD, the same logic controls from each of the four receivers selects any specific input signal.

For example, if the user of receiver 1 wants to receive the signal from antenna 1, polarization 1, through low-noise block A, that receiver must send a 22 kHz tone and a control voltage greater than the threshold voltage to switch 1. If the user of receiver 3 also wants to receive the signal from antenna 1, polarization 1, through low-noise block A, that receiver must also send a 22 kHz tone and a control voltage greater than the threshold voltage to switch 2.

Other logic configurations are possible. Refer to the truth Tables in this Data Sheet.

Electrical and Mechanical Specifications

The absolute maximum ratings of the SKY13410-365LF are provided in Table 2. Electrical specifications are provided in Table 3.

Typical performance characteristics of the SKY13410-365LF are illustrated in Figures 4 through 9.

The state of the SKY13410-365LF is determined by the logic provided in Tables 4 through 13.

Table 2. SKY13410-365LF Absolute Maximum Ratings

Parameter	Symbol	Minimum	Typical	Maximum	Units
Supply voltage	V_{DD}			5.5	V
Mode select input voltage (must not exceed VDD)				5.5	V
Polarization input control voltage				21	V
RF input power	P_{IN}			+15	dBm
Storage temperature	T_{STG}	–65		+150	°C
Operating temperature	T_{OP}	–40		+85	°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.*

Table 3. SKY13410-365LF Electrical Specifications (Note 1) (1 of 2)
(V_{DD} = 0 and +3.3 to +5.0 V, T_{OP} = +25 °C, Characteristic Impedance [Z_0] = 50 Ω, Unless Otherwise Noted)

Parameter	Symbol	Test Condition	Min	Typical	Max	Units
RF Switch Specifications						
Insertion loss	IL	0.25 to 0.95 GHz 0.95 to 2.15 GHz		7.5 9.0	8.0 10.0	dB dB
Insertion loss flatness		0.25 to 0.95 GHz 0.95 to 2.15 GHz		0.7 2.0	1.0 3.0	dB dB
Isolation	Iso	Normalized to insertion loss 0.25 to 0.95 GHz 0.95 to 2.15 GHz	 38 28	 40 30		 dB dB
Input return loss		0.25 to 0.95 GHz I1, I2, I3, I4 OUT1, OUT2	 10 8	 15 10		 dB dB
1 dB Input Compression Point	IP1dB	0.25 to 0.95 GHz		+12		dBm
Tone/Voltage Detector Specifications						
Polarization select input current	I_{PT1}, I_{PT2}	V_{P1} and V_{P2} = 21 V		200		µA
Polarization select threshold voltage	V_{TP1}, V_{TP2}		14	15	16	V
Polarization switching time	T_{SPOL}			0.9		µs
Tone frequency	T_{F1}, T_{F2}	@ 500 mVp-p	7	22	800	kHz
Tone threshold voltage	T_{T1}, T_{T2}	@ 22 kHz with 10 nF external DC blocking capacitor	100	170	900	mVp-p
Tone input impedance	T_{ZIN1}, T_{ZIN2}	@ 22 kHz including external 10 nF series blocking capacitor		2		kΩ

Table 3. SKY13410-365LF Electrical Specifications (Note 1) (2 of 2)
(V_{DD} = 0 and +3.3 to +5.0, T_{OP} = +25 °C, Characteristic Impedance [Z_O] = 50 Ω, Unless Otherwise Noted)

Parameter	Symbol	Test Condition	Min	Typical	Max	Units
Mode Control Specifications						
Control input current	I_{DIG}	0 V ≤ V_{CTRL} ≤ V_{DD}		1		µA
Control input low logic level	V_{LOW}		0		1	V
Control input high logic level	V_{HIGH}		V_{DD} – 1	V_{DD}	V_{DD} + 0.5	V
Power Supply						
Supply voltage	V_{DD}		3.3	4.2	5.0	V
Supply current	I_{DD}			1.5		mA

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

Note 2: The SKY13410-365LF detects 22 kHz signaling amplitudes across the full specified range of the DiSEqC bus functional specification.

Anticipated Performance Characteristics

(V_{DD} = +3.3 to +5.0, T_{OP} = +25 °C, P_{IN} = 0 dBm, Characteristic Impedance [Zo] = 50 Ω, Unless Otherwise Noted)

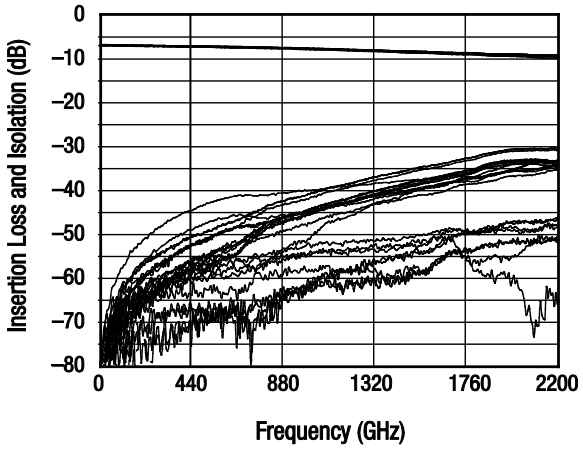


Figure 4. I1 to OUT1 and I1 to OUT2 Paths for States 0 to 15

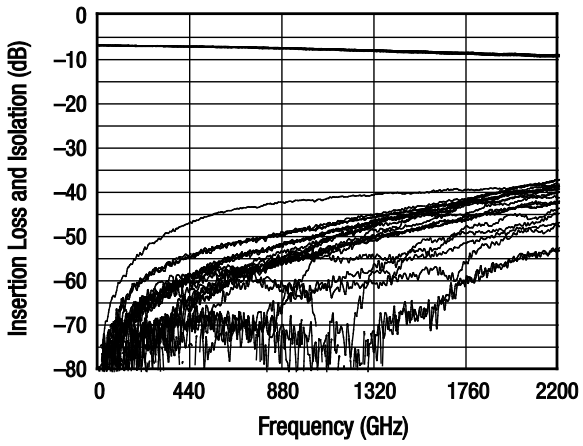


Figure 5. I2 to OUT1 and I2 to OUT2 Paths for States 0 to 15

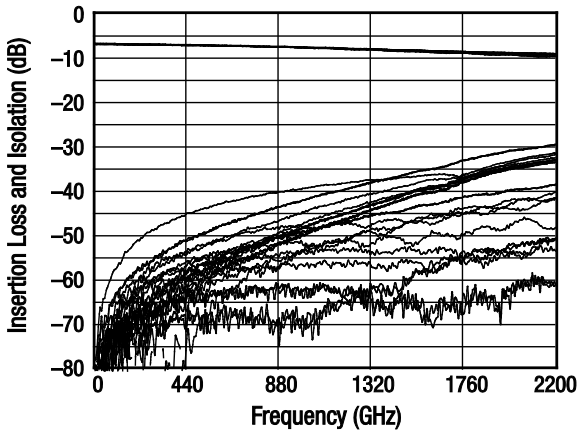


Figure 6. I3 to OUT1 and I3 to OUT2 Paths for States 0 to 15

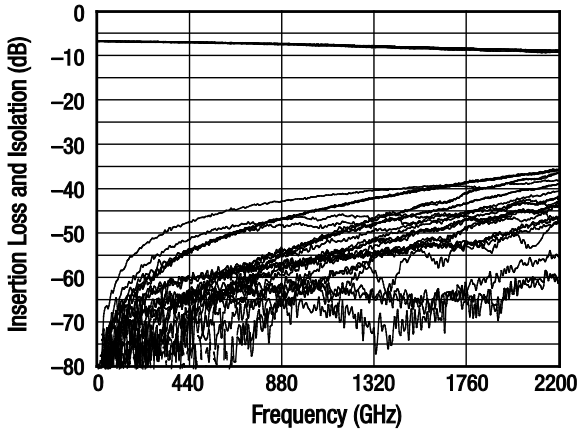


Figure 7. I4 to OUT1 and I4 to OUT2 Paths for States 0 to 15

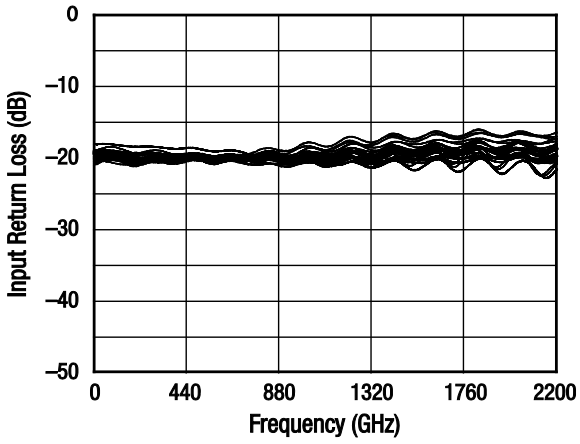


Figure 8. I1, I2, I3, and I4 for States 0 to 15

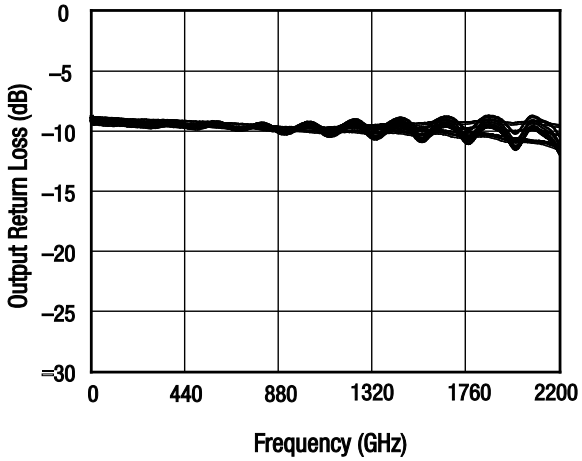


Figure 9. OUT1 and I2 to OUT2 Paths for States 0 to 15

Table 4. SKY13410-365LF Truth Table: Mode Control Summary (1 of 2)

Mode Paths	Mode	P0 (Pin 19)	B1 (Pin 18)	B2 (Pin 17)	I1 (Pin 5)	I2 (Pin 7)	I4 (Pin 9)	I3 (Pin 11)
I_3 I_1 I_2 I_4 **Mode 0 (000): P_0 = 0 V, B_1 = 0 V, B_2 = 0 V (Default Mode)**	0	0	0	0	A	B	C	D
I_3 I_1 I_2 I_4 **Mode 1 (001): P_0 = 0 V, B_1 = 0 V, B_2 = VDD**	1	0	0	1	A	B	D	C
I_3 I_1 I_2 I_4 **Mode 2 (010): P_0 = 0 V, B_1 = VDD, B_2 = 0 V**	2	0	1	0	B	A	C	D
I_3 I_1 I_2 I_4 **Mode 3 (011): P_0 = 0 V, B_1 = VDD, B_2 = VDD**	3	0	1	1	B	A	D	C

Table 4. SKY13410-365LF Truth Table: Mode Control Summary (2 of 2)

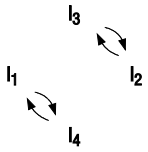
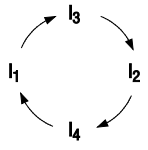
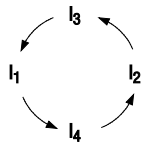
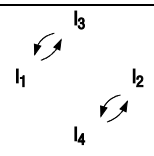
Mode Paths	Mode	P0 (Pin 19)	B1 (Pin 18)	B2 (Pin 17)	I1 (Pin 5)	I2 (Pin 7)	I4 (Pin 9)	I3 (Pin 11)
 Mode 4 (100): P_0 = VDD, B_1 = 0 V, B_2 = 0 V	4	1	0	0	C	D	A	B
 Mode 5 (101): P_0 = VDD, B_1 = 0 V, B_2 = VDD	5	1	0	1	C	D	B	A
 Mode 6 (110): P_0 = VDD, B_1 = VDD, B_2 = 0 V	6	1	1	0	D	C	A	B
 Mode 7 (111): P_0 = VDD, B_1 = VDD, B_2 = VDD	7	1	1	1	D	C	B	A

Table 5. SKY13410-365LF Truth Table: General

State	Tone and Voltage Inputs (Note 1)				Signal Paths
	T1 (Pin 2)	V1 (Pin 3)	T2 (Pin 14)	V2 (Pin 13)	
1	No Tone	V_{LOW}	No Tone	V_{LOW}	D → OUT1, D → OUT2
2	No Tone	V_{LOW}	No Tone	V_{HIGH}	D → OUT1, B → OUT2
3	No Tone	V_{LOW}	22 kHz Tone	V_{LOW}	D → OUT1, C → OUT2
4	No Tone	V_{LOW}	22 kHz Tone	V_{HIGH}	D → OUT1, A → OUT2
5	No Tone	V_{HIGH}	No Tone	V_{LOW}	B → OUT1, D → OUT2
6	No Tone	V_{HIGH}	No Tone	V_{HIGH}	B → OUT1, B → OUT2
7	No Tone	V_{HIGH}	22 kHz Tone	V_{LOW}	B → OUT1, C → OUT2
8	No Tone	V_{HIGH}	22 kHz Tone	V_{HIGH}	B → OUT1, A → OUT2
9	22 kHz Tone	V_{LOW}	No Tone	V_{LOW}	C → OUT1, D → OUT2
10	22 kHz Tone	V_{LOW}	No Tone	V_{HIGH}	C → OUT1, B → OUT2
11	22 kHz Tone	V_{LOW}	22 kHz Tone	V_{LOW}	C → OUT1, C → OUT2
12	22 kHz Tone	V_{LOW}	22 kHz Tone	V_{HIGH}	C → OUT1, A → OUT2
13	22 kHz Tone	V_{HIGH}	No Tone	V_{LOW}	A → OUT1, D → OUT2
14	22 kHz Tone	V_{HIGH}	No Tone	V_{HIGH}	A → OUT1, B → OUT2
15	22 kHz Tone	V_{HIGH}	22 kHz Tone	V_{LOW}	A → OUT1, C → OUT2
16	22 kHz Tone	V_{HIGH}	22 kHz Tone	V_{HIGH}	A → OUT1, A → OUT2

Note 1: "No Tone" = no 22 kHz tone present
"22 kHz Tone" = 22 kHz tone present with amplitude > 100 mVp-p
$V_{LOW} \leq 14$ V
$V_{HIGH} \geq 16$ V

Table 6. SKY13410-365LF Truth Table: Tone and Voltage Controls
Mode 0 (000): P0 = B1 = B2 = 0 V (Default State)

State	Tone and Voltage Inputs (Note 1)				Signal Paths
	T1 (Pin 2)	V1 (Pin 3)	T2 (Pin 14)	V2 (Pin 13)	
1	No Tone	V_{LOW}	No Tone	V_{LOW}	I3 → OUT1, I3 → OUT2
2	No Tone	V_{LOW}	No Tone	V_{HIGH}	I3 → OUT1, I2 → OUT2
3	No Tone	V_{LOW}	22 kHz Tone	V_{LOW}	I3 → OUT1, I4 → OUT2
4	No Tone	V_{LOW}	22 kHz Tone	V_{HIGH}	I3 → OUT1, I1 → OUT2
5	No Tone	V_{HIGH}	No Tone	V_{LOW}	I2 → OUT1, I3 → OUT2
6	No Tone	V_{HIGH}	No Tone	V_{HIGH}	I2 → OUT1, I2 → OUT2
7	No Tone	V_{HIGH}	22 kHz Tone	V_{LOW}	I2 → OUT1, I4 → OUT2
8	No Tone	V_{HIGH}	22 kHz Tone	V_{HIGH}	I2 → OUT1, I1 → OUT2
9	22 kHz Tone	V_{LOW}	No Tone	V_{LOW}	I4 → OUT1, I3 → OUT2
10	22 kHz Tone	V_{LOW}	No Tone	V_{HIGH}	I4 → OUT1, I2 → OUT2
11	22 kHz Tone	V_{LOW}	22 kHz Tone	V_{LOW}	I4 → OUT1, I4 → OUT2
12	22 kHz Tone	V_{LOW}	22 kHz Tone	V_{HIGH}	I4 → OUT1, I1 → OUT2
13	22 kHz Tone	V_{HIGH}	No Tone	V_{LOW}	I1 → OUT1, I3 → OUT2
14	22 kHz Tone	V_{HIGH}	No Tone	V_{HIGH}	I1 → OUT1, I2 → OUT2
15	22 kHz Tone	V_{HIGH}	22 kHz Tone	V_{LOW}	I1 → OUT1, I4 → OUT2
16	22 kHz Tone	V_{HIGH}	22 kHz Tone	V_{HIGH}	I1 → OUT1, I1 → OUT2

Note 1: "No Tone" = no 22 kHz tone present
"22 kHz Tone" = 22 kHz tone present with amplitude > 100 mVp-p
$V_{LOW} \leq 14$ V
$V_{HIGH} \geq 16$ V

Table 7. SKY13410-365LF Truth Table: Tone and Voltage Controls
Mode 1 (001): P0 = B1 = 0 V, B2 = VDD

State	Tone and Voltage Inputs (Note 1)				Signal Paths
	T1 (Pin 2)	V1 (Pin 3)	T2 (Pin 14)	V2 (Pin 13)	
1	No Tone	V_{LOW}	No Tone	V_{LOW}	I4 → OUT1, I4 → OUT2
2	No Tone	V_{LOW}	No Tone	V_{HIGH}	I4 → OUT1, I2 → OUT2
3	No Tone	V_{LOW}	22 kHz Tone	V_{LOW}	I4 → OUT1, I3 → OUT2
4	No Tone	V_{LOW}	22 kHz Tone	V_{HIGH}	I4 → OUT1, I1 → OUT2
5	No Tone	V_{HIGH}	No Tone	V_{LOW}	I2 → OUT1, I4 → OUT2
6	No Tone	V_{HIGH}	No Tone	V_{HIGH}	I2 → OUT1, I2 → OUT2
7	No Tone	V_{HIGH}	22 kHz Tone	V_{LOW}	I2 → OUT1, I3 → OUT2
8	No Tone	V_{HIGH}	22 kHz Tone	V_{HIGH}	I2 → OUT1, I1 → OUT2
9	22 kHz Tone	V_{LOW}	No Tone	V_{LOW}	I3 → OUT1, I4 → OUT2
10	22 kHz Tone	V_{LOW}	No Tone	V_{HIGH}	I3 → OUT1, I2 → OUT2
11	22 kHz Tone	V_{LOW}	22 kHz Tone	V_{LOW}	I3 → OUT1, I3 → OUT2
12	22 kHz Tone	V_{LOW}	22 kHz Tone	V_{HIGH}	I3 → OUT1, I1 → OUT2
13	22 kHz Tone	V_{HIGH}	No Tone	V_{LOW}	I1 → OUT1, I4 → OUT2
14	22 kHz Tone	V_{HIGH}	No Tone	V_{HIGH}	I1 → OUT1, I2 → OUT2
15	22 kHz Tone	V_{HIGH}	22 kHz Tone	V_{LOW}	I1 → OUT1, I3 → OUT2
16	22 kHz Tone	V_{HIGH}	22 kHz Tone	V_{HIGH}	I1 → OUT1, I1 → OUT2

Note 1: "No Tone" = no 22 kHz tone present
"22 kHz Tone" = 22 kHz tone present with amplitude > 100 mVp-p
$V_{LOW} \leq 14$ V
$V_{HIGH} \geq 16$ V

Table 8. SKY13410-365LF Truth Table: Tone and Voltage Controls
Mode 2 (010): P0 = 0 V, B1 = VDD, B2 = 0 V

State	Tone and Voltage Inputs (Note 1)				Signal Paths
	T1 (Pin 2)	V1 (Pin 3)	T2 (Pin 14)	V2 (Pin 13)	
1	No Tone	V_{LOW}	No Tone	V_{LOW}	I3 → OUT1, I3 → OUT2
2	No Tone	V_{LOW}	No Tone	V_{HIGH}	I3 → OUT1, I1 → OUT2
3	No Tone	V_{LOW}	22 kHz Tone	V_{LOW}	I3 → OUT1, I4 → OUT2
4	No Tone	V_{LOW}	22 kHz Tone	V_{HIGH}	I3 → OUT1, I2 → OUT2
5	No Tone	V_{HIGH}	No Tone	V_{LOW}	I1 → OUT1, I3 → OUT2
6	No Tone	V_{HIGH}	No Tone	V_{HIGH}	I1 → OUT1, I1 → OUT2
7	No Tone	V_{HIGH}	22 kHz Tone	V_{LOW}	I1 → OUT1, I4 → OUT2
8	No Tone	V_{HIGH}	22 kHz Tone	V_{HIGH}	I1 → OUT1, I2 → OUT2
9	22 kHz Tone	V_{LOW}	No Tone	V_{LOW}	I4 → OUT1, I3 → OUT2
10	22 kHz Tone	V_{LOW}	No Tone	V_{HIGH}	I4 → OUT1, I1 → OUT2
11	22 kHz Tone	V_{LOW}	22 kHz Tone	V_{LOW}	I4 → OUT1, I4 → OUT2
12	22 kHz Tone	V_{LOW}	22 kHz Tone	V_{HIGH}	I4 → OUT1, I2 → OUT2
13	22 kHz Tone	V_{HIGH}	No Tone	V_{LOW}	I2 → OUT1, I3 → OUT2
14	22 kHz Tone	V_{HIGH}	No Tone	V_{HIGH}	I2 → OUT1, I1 → OUT2
15	22 kHz Tone	V_{HIGH}	22 kHz Tone	V_{LOW}	I2 → OUT1, I4 → OUT2
16	22 kHz Tone	V_{HIGH}	22 kHz Tone	V_{HIGH}	I2 → OUT1, I2 → OUT2

Note 1: "No Tone" = no 22 kHz tone present
"22 kHz Tone" = 22 kHz tone present with amplitude > 100 mVp-p
$V_{LOW} \leq 14$ V
$V_{HIGH} \geq 16$ V

Table 9. SKY13410-365LF Truth Table: Tone and Voltage Controls
Mode 3 (011): P0 = 0 V, B1 = B2 = VDD

State	Tone and Voltage Inputs (Note 1)				Signal Paths
	T1 (Pin 2)	V1 (Pin 3)	T2 (Pin 14)	V2 (Pin 13)	
1	No Tone	V_{LOW}	No Tone	V_{LOW}	I4 → OUT1, I4 → OUT2
2	No Tone	V_{LOW}	No Tone	V_{HIGH}	I4 → OUT1, I1 → OUT2
3	No Tone	V_{LOW}	22 kHz Tone	V_{LOW}	I4 → OUT1, I3 → OUT2
4	No Tone	V_{LOW}	22 kHz Tone	V_{HIGH}	I4 → OUT1, I2 → OUT2
5	No Tone	V_{HIGH}	No Tone	V_{LOW}	I1 → OUT1, I4 → OUT2
6	No Tone	V_{HIGH}	No Tone	V_{HIGH}	I1 → OUT1, I1 → OUT2
7	No Tone	V_{HIGH}	22 kHz Tone	V_{LOW}	I1 → OUT1, I3 → OUT2
8	No Tone	V_{HIGH}	22 kHz Tone	V_{HIGH}	I1 → OUT1, I2 → OUT2
9	22 kHz Tone	V_{LOW}	No Tone	V_{LOW}	I3 → OUT1, I4 → OUT2
10	22 kHz Tone	V_{LOW}	No Tone	V_{HIGH}	I3 → OUT1, I1 → OUT2
11	22 kHz Tone	V_{LOW}	22 kHz Tone	V_{LOW}	I3 → OUT1, I3 → OUT2
12	22 kHz Tone	V_{LOW}	22 kHz Tone	V_{HIGH}	I3 → OUT1, I2 → OUT2
13	22 kHz Tone	V_{HIGH}	No Tone	V_{LOW}	I2 → OUT1, I4 → OUT2
14	22 kHz Tone	V_{HIGH}	No Tone	V_{HIGH}	I2 → OUT1, I1 → OUT2
15	22 kHz Tone	V_{HIGH}	22 kHz Tone	V_{LOW}	I2 → OUT1, I3 → OUT2
16	22 kHz Tone	V_{HIGH}	22 kHz Tone	V_{HIGH}	I2 → OUT1, I2 → OUT2

Note 1: "No Tone" = no 22 kHz tone present
"22 kHz Tone" = 22 kHz tone present with amplitude > 100 mVp-p
$V_{LOW} \leq 14$ V
$V_{HIGH} \geq 16$ V

Table 10. SKY13410-365LF Truth Table: Tone and Voltage Controls
Mode 4 (100): P0 = VDD, B1 = B2 = 0 V

State	Tone and Voltage Inputs (Note 1)				Signal Paths
	T1 (Pin 2)	V1 (Pin 3)	T2 (Pin 14)	V2 (Pin 13)	
1	No Tone	V_{LOW}	No Tone	V_{LOW}	I2 → OUT1, I2 → OUT2
2	No Tone	V_{LOW}	No Tone	V_{HIGH}	I2 → OUT1, I3 → OUT2
3	No Tone	V_{LOW}	22 kHz Tone	V_{LOW}	I2 → OUT1, I1 → OUT2
4	No Tone	V_{LOW}	22 kHz Tone	V_{HIGH}	I2 → OUT1, I4 → OUT2
5	No Tone	V_{HIGH}	No Tone	V_{LOW}	I3 → OUT1, I2 → OUT2
6	No Tone	V_{HIGH}	No Tone	V_{HIGH}	I3 → OUT1, I3 → OUT2
7	No Tone	V_{HIGH}	22 kHz Tone	V_{LOW}	I3 → OUT1, I1 → OUT2
8	No Tone	V_{HIGH}	22 kHz Tone	V_{HIGH}	I3 → OUT1, I4 → OUT2
9	22 kHz Tone	V_{LOW}	No Tone	V_{LOW}	I1 → OUT1, I2 → OUT2
10	22 kHz Tone	V_{LOW}	No Tone	V_{HIGH}	I1 → OUT1, I3 → OUT2
11	22 kHz Tone	V_{LOW}	22 kHz Tone	V_{LOW}	I1 → OUT1, I1 → OUT2
12	22 kHz Tone	V_{LOW}	22 kHz Tone	V_{HIGH}	I1 → OUT1, I4 → OUT2
13	22 kHz Tone	V_{HIGH}	No Tone	V_{LOW}	I4 → OUT1, I2 → OUT2
14	22 kHz Tone	V_{HIGH}	No Tone	V_{HIGH}	I4 → OUT1, I3 → OUT2
15	22 kHz Tone	V_{HIGH}	22 kHz Tone	V_{LOW}	I4 → OUT1, I1 → OUT2
16	22 kHz Tone	V_{HIGH}	22 kHz Tone	V_{HIGH}	I4 → OUT1, I4 → OUT2

Note 1: "No Tone" = no 22 kHz tone present
"22 kHz Tone" = 22 kHz tone present with amplitude > 100 mVp-p
$V_{LOW} \leq 14$ V
$V_{HIGH} \geq 16$ V

Table 11. SKY13410-365LF Truth Table: Tone and Voltage Controls
Mode 5 (101): P0 = VDD, B1 = 0 V, B2 = VDD

State	Tone and Voltage Inputs (Note 1)				Signal Paths
	T1 (Pin 2)	V1 (Pin 3)	T2 (Pin 14)	V2 (Pin 13)	
1	No Tone	V_{LOW}	No Tone	V_{LOW}	I2 → OUT1, I2 → OUT2
2	No Tone	V_{LOW}	No Tone	V_{HIGH}	I2 → OUT1, I4 → OUT2
3	No Tone	V_{LOW}	22 kHz Tone	V_{LOW}	I2 → OUT1, I1 → OUT2
4	No Tone	V_{LOW}	22 kHz Tone	V_{HIGH}	I2 → OUT1, I3 → OUT2
5	No Tone	V_{HIGH}	No Tone	V_{LOW}	I4 → OUT1, I2 → OUT2
6	No Tone	V_{HIGH}	No Tone	V_{HIGH}	I4 → OUT1, I4 → OUT2
7	No Tone	V_{HIGH}	22 kHz Tone	V_{LOW}	I4 → OUT1, I1 → OUT2
8	No Tone	V_{HIGH}	22 kHz Tone	V_{HIGH}	I4 → OUT1, I3 → OUT2
9	22 kHz Tone	V_{LOW}	No Tone	V_{LOW}	I1 → OUT1, I2 → OUT2
10	22 kHz Tone	V_{LOW}	No Tone	V_{HIGH}	I1 → OUT1, I4 → OUT2
11	22 kHz Tone	V_{LOW}	22 kHz Tone	V_{LOW}	I1 → OUT1, I1 → OUT2
12	22 kHz Tone	V_{LOW}	22 kHz Tone	V_{HIGH}	I1 → OUT1, I3 → OUT2
13	22 kHz Tone	V_{HIGH}	No Tone	V_{LOW}	I3 → OUT1, I2 → OUT2
14	22 kHz Tone	V_{HIGH}	No Tone	V_{HIGH}	I3 → OUT1, I4 → OUT2
15	22 kHz Tone	V_{HIGH}	22 kHz Tone	V_{LOW}	I3 → OUT1, I1 → OUT2
16	22 kHz Tone	V_{HIGH}	22 kHz Tone	V_{HIGH}	I3 → OUT1, I3 → OUT2

Note 1: "No Tone" = no 22 kHz tone present
"22 kHz Tone" = 22 kHz tone present with amplitude > 100 mVp-p
$V_{LOW} \leq 14$ V
$V_{HIGH} \geq 16$ V

Table 12. SKY13410-365LF Truth Table: Tone and Voltage Controls
Mode 6 (110): P0 = B1 = VDD, B2 = 0 V

State	Tone and Voltage Inputs (Note 1)				Signal Paths
	T1 (Pin 2)	V1 (Pin 3)	T2 (Pin 14)	V2 (Pin 13)	
1	No Tone	V_{LOW}	No Tone	V_{LOW}	I1 → OUT1, I1 → OUT2
2	No Tone	V_{LOW}	No Tone	V_{HIGH}	I1 → OUT1, I3 → OUT2
3	No Tone	V_{LOW}	22 kHz Tone	V_{LOW}	I1 → OUT1, I2 → OUT2
4	No Tone	V_{LOW}	22 kHz Tone	V_{HIGH}	I1 → OUT1, I4 → OUT2
5	No Tone	V_{HIGH}	No Tone	V_{LOW}	I3 → OUT1, I1 → OUT2
6	No Tone	V_{HIGH}	No Tone	V_{HIGH}	I3 → OUT1, I3 → OUT2
7	No Tone	V_{HIGH}	22 kHz Tone	V_{LOW}	I3 → OUT1, I2 → OUT2
8	No Tone	V_{HIGH}	22 kHz Tone	V_{HIGH}	I3 → OUT1, I4 → OUT2
9	22 kHz Tone	V_{LOW}	No Tone	V_{LOW}	I2 → OUT1, I1 → OUT2
10	22 kHz Tone	V_{LOW}	No Tone	V_{HIGH}	I2 → OUT1, I3 → OUT2
11	22 kHz Tone	V_{LOW}	22 kHz Tone	V_{LOW}	I2 → OUT1, I2 → OUT2
12	22 kHz Tone	V_{LOW}	22 kHz Tone	V_{HIGH}	I2 → OUT1, I4 → OUT2
13	22 kHz Tone	V_{HIGH}	No Tone	V_{LOW}	I4 → OUT1, I1 → OUT2
14	22 kHz Tone	V_{HIGH}	No Tone	V_{HIGH}	I4 → OUT1, I3 → OUT2
15	22 kHz Tone	V_{HIGH}	22 kHz Tone	V_{LOW}	I4 → OUT1, I2 → OUT2
16	22 kHz Tone	V_{HIGH}	22 kHz Tone	V_{HIGH}	I4 → OUT1, I4 → OUT2

Note 1: "No Tone" = no 22 kHz tone present
"22 kHz Tone" = 22 kHz tone present with amplitude > 100 mVp-p
$V_{LOW} \leq 14$ V
$V_{HIGH} \geq 16$ V

Table 13. SKY13410-365LF Truth Table: Tone and Voltage Controls
Mode 7 (111): P0 = B1 = B2 = VDD

State	Tone and Voltage Inputs (Note 1)				Signal Paths
	T1 (Pin 2)	V1 (Pin 3)	T2 (Pin 14)	V2 (Pin 13)	
1	No Tone	V_{LOW}	No Tone	V_{LOW}	I1 → OUT1, I1 → OUT2
2	No Tone	V_{LOW}	No Tone	V_{HIGH}	I1 → OUT1, I4 → OUT2
3	No Tone	V_{LOW}	22 kHz Tone	V_{LOW}	I1 → OUT1, I2 → OUT2
4	No Tone	V_{LOW}	22 kHz Tone	V_{HIGH}	I1 → OUT1, I3 → OUT2
5	No Tone	V_{HIGH}	No Tone	V_{LOW}	I4 → OUT1, I1 → OUT2
6	No Tone	V_{HIGH}	No Tone	V_{HIGH}	I4 → OUT1, I4 → OUT2
7	No Tone	V_{HIGH}	22 kHz Tone	V_{LOW}	I4 → OUT1, I2 → OUT2
8	No Tone	V_{HIGH}	22 kHz Tone	V_{HIGH}	I4 → OUT1, I3 → OUT2
9	22 kHz Tone	V_{LOW}	No Tone	V_{LOW}	I2 → OUT1, I1 → OUT2
10	22 kHz Tone	V_{LOW}	No Tone	V_{HIGH}	I2 → OUT1, I4 → OUT2
11	22 kHz Tone	V_{LOW}	22 kHz Tone	V_{LOW}	I2 → OUT1, I2 → OUT2
12	22 kHz Tone	V_{LOW}	22 kHz Tone	V_{HIGH}	I2 → OUT1, I3 → OUT2
13	22 kHz Tone	V_{HIGH}	No Tone	V_{LOW}	I3 → OUT1, I1 → OUT2
14	22 kHz Tone	V_{HIGH}	No Tone	V_{HIGH}	I3 → OUT1, I4 → OUT2
15	22 kHz Tone	V_{HIGH}	22 kHz Tone	V_{LOW}	I3 → OUT1, I2 → OUT2
16	22 kHz Tone	V_{HIGH}	22 kHz Tone	V_{HIGH}	I3 → OUT1, I3 → OUT2

Note 1: "No Tone" = no 22 kHz tone present
"22 kHz Tone" = 22 kHz tone present with amplitude > 100 mVp-p
$V_{LOW} \leq 14$ V
$V_{HIGH} \geq 16$ V

Evaluation Board Description

The SKY13410-365LF Evaluation Board is used to test the performance of the SKY13410-365LF 4x2 Switch Matrix. A recommended application schematic is provided in Figure 10. An assembly drawing for the Evaluation Board is shown in Figure 11.

Package Dimensions

The PCB layout footprint for the SKY13410-365LF is provided in Figure 12. Typical case markings are shown in Figure 13. Package dimensions for the 20-pin QFN are shown in Figure 14, and tape and reel dimensions are provided in Figure 15.

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 SKY13410-365LF 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.

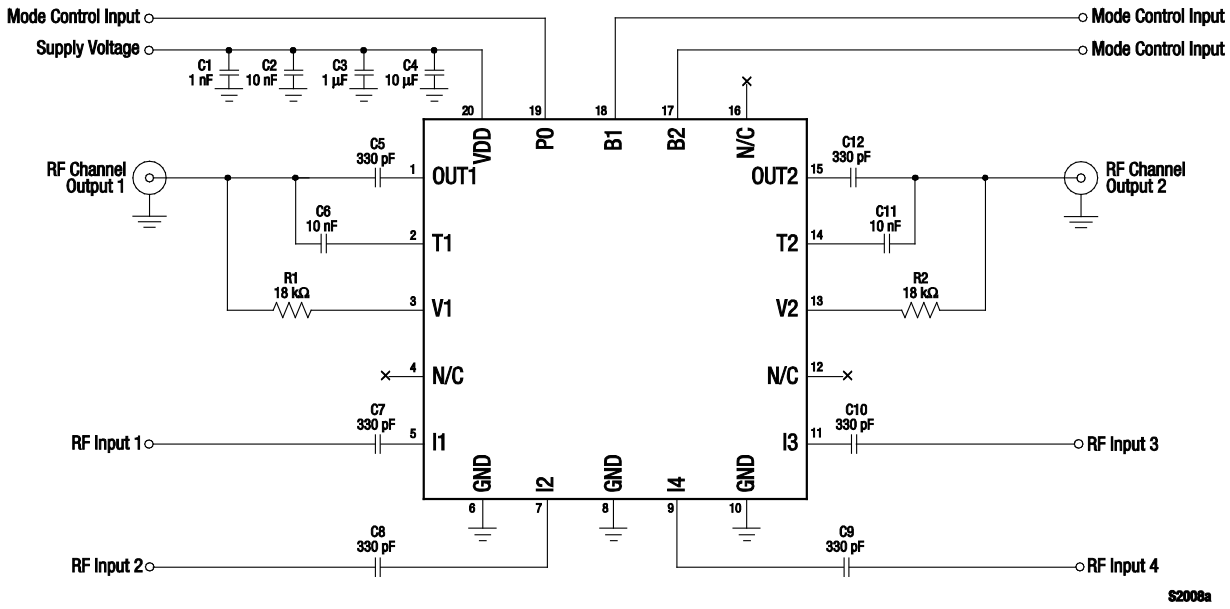


Figure 10. SKY13410-365LF Recommended Application Circuit

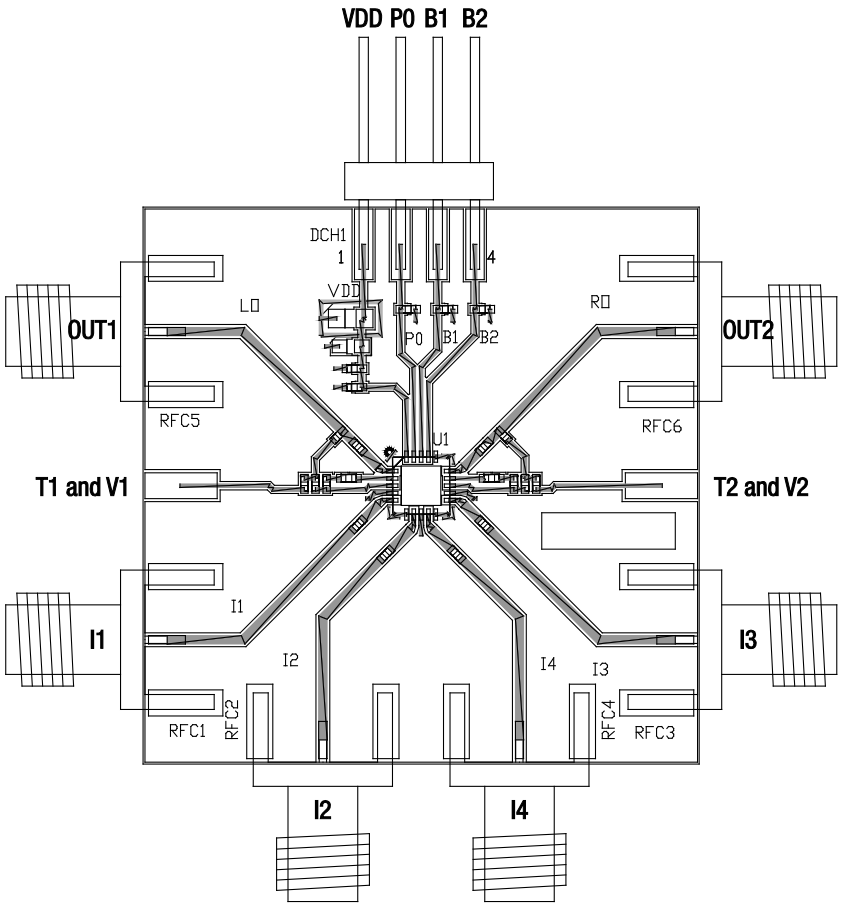


Figure 11. SKY13410-365LF Evaluation Board Assembly Diagram

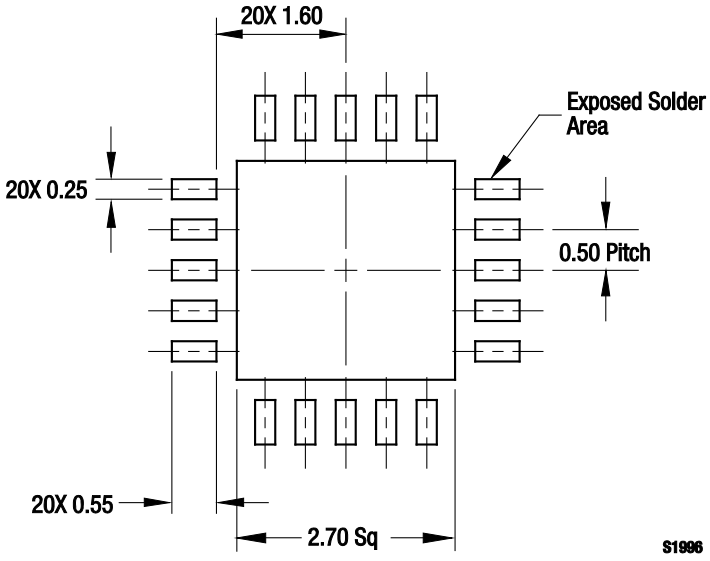


Figure 12. SKY13410-365LF PCB Layout Footprint (Top View)

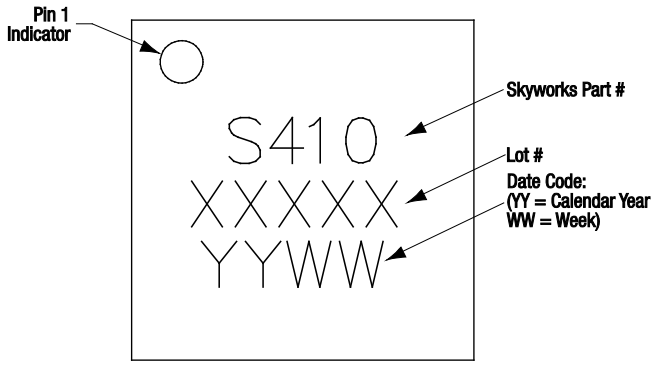
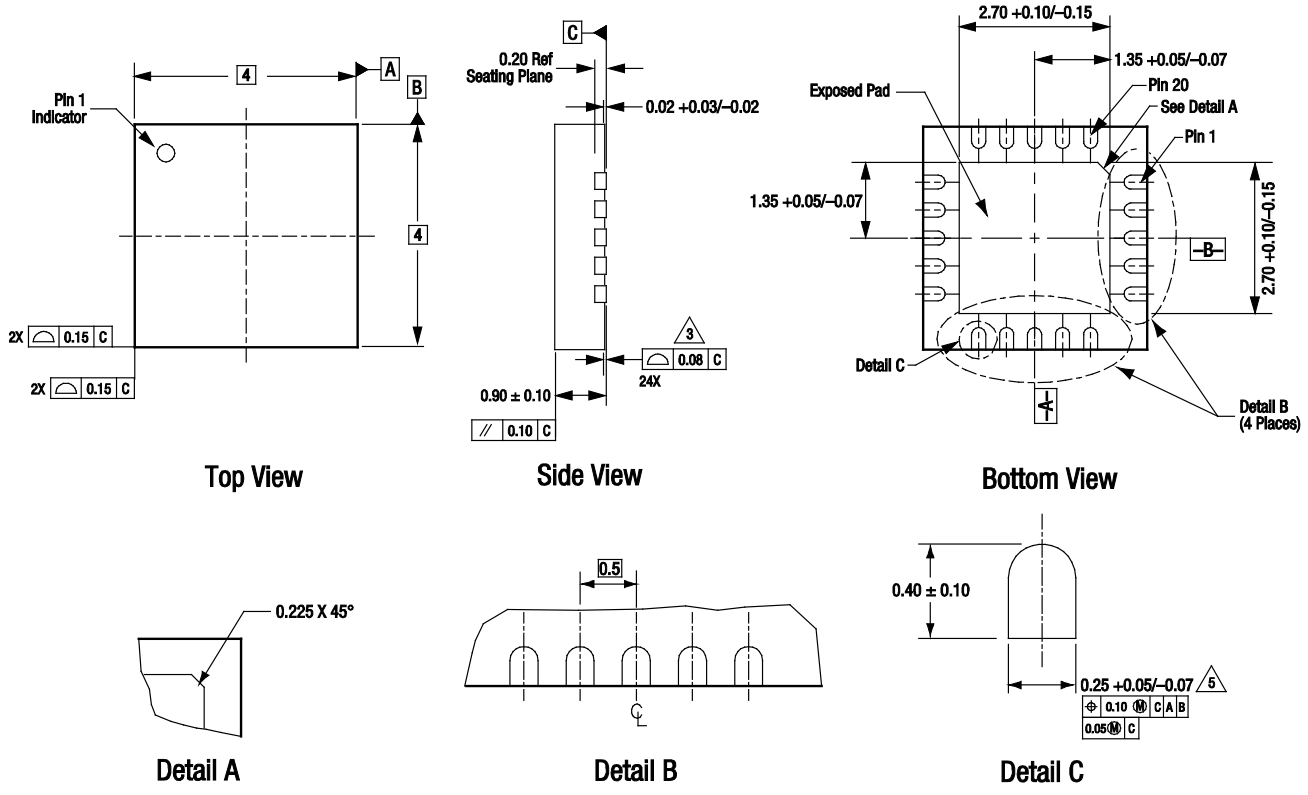


Figure 13. Typical Case Markings (Top View)



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 and is measured between 0.15 mm and 0.30 mm from terminal tip.

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Figure 14. SKY13410-365LF 20-Pin QFN Package Dimensions

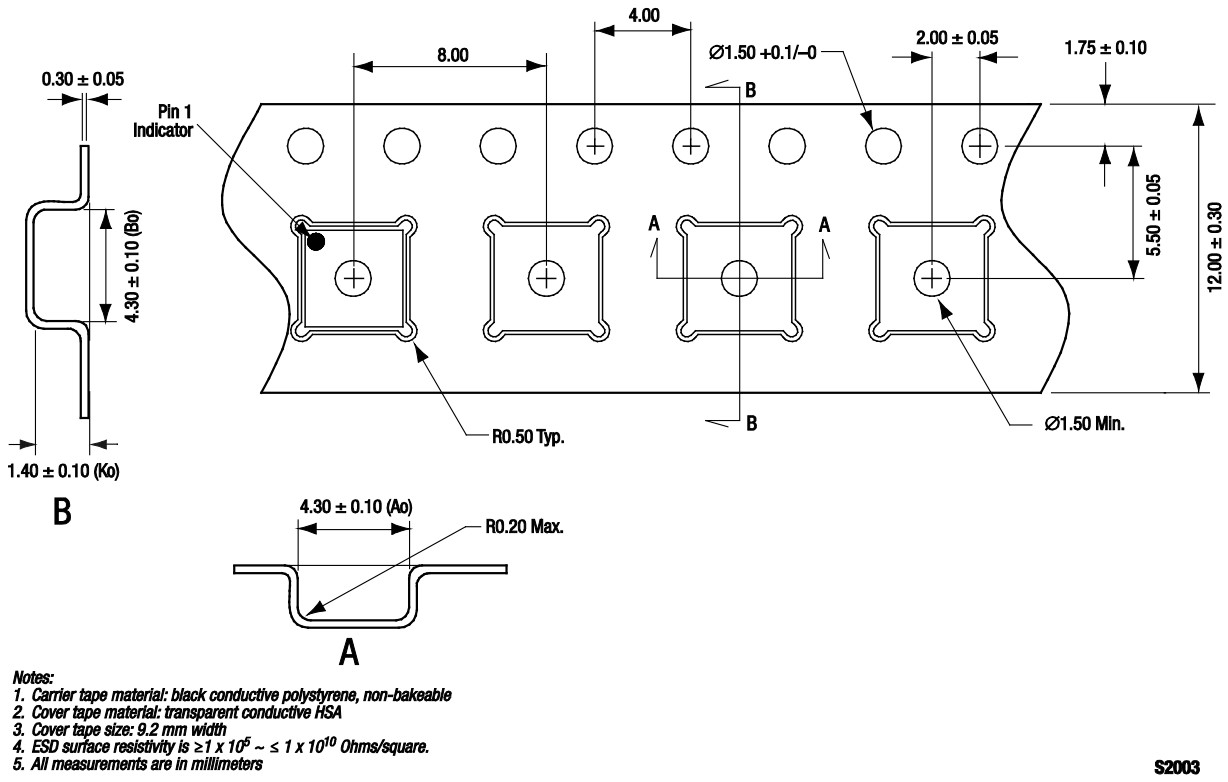

Figure 15. SKY13410-365LF Tape and Reel Dimensions

Ordering Information

Model Name	Manufacturing Part Number	Evaluation Board Part Number
SKY13410-365LF 4x2 Switch Matrix	SKY13410-365LF	SKY13410-365LF-EVB