DATA SHEET

SKY13327-365LF: 0.25-2.15 GHz 4x2 Switch Matrix with Tone/Voltage Detector

Applications

- DBS switching systems
- cable TV/modems

Features

- Broadband frequency range: 0.25 to 2.15 GHz
- Tone and voltage control switching
- High isolation: 40 dB @ 900 MHz
- Four RF inputs, two RF outputs
- Low current consumption: 2.5 mA @ 5 V
- Alternate truth Table logic using Skyworks SKY13369-365LF
- Miniature QFN (20-pin, 4 x 4 mm) package (MSL1, 260 °C per JEDEC J-STD-020)

NEW

Skyworks Green™ products are RoHS (Restriction of Hazardous Substances)-compliant, conform to the EIA/EICTA/JEITA Joint Industry Guide (JIG) Level A guidelines, are halogen free according to IEC-61249-2-21, and contain <1,000 ppm antimony trioxide in polymeric materials.

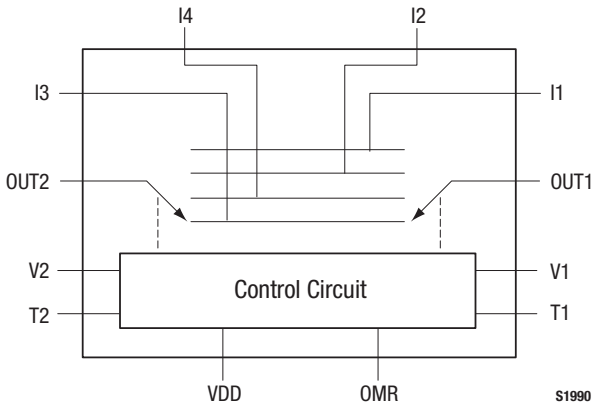


Figure 1. SKY13327-365LF Block Diagram

Description

The SKY13327-365LF is a four-input to two-output switch matrix intended for Direct Broadcast Satellite (DBS) switching and cable TV/modem applications. The SKY13327-365LF enables any of the four inputs to either of the two outputs. Switch states can be selected using tone and voltage signals together with vertical-horizontal mirror control inputs. The load detection and Digital Satellite Equipment Control (DiSEqC) rejection are integrated on the switch.

The SKY13327-365LF rejects DiSEqC signals and responds only to continuous-tone and voltage signals or vertical-horizontal mirror control inputs. The switch on/off states are not changed by DiSEqC signals, and only changed by continuous-tone and voltage signals or vertical-horizontal mirror control inputs.

One of the two switch outputs can be deactivated when no-tone and no-voltage are applied to one of the tone/voltage detectors. Another Skyworks switch, the SKY13369-365LF, can be used to reverse the I1, I2, I3, and I4 truth Table logic.

The SKY13327-365LF 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.

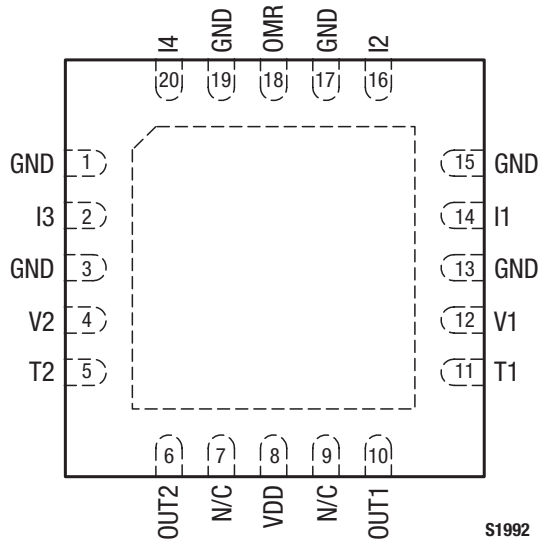


Figure 2. SKY13327-365LF Pinout – 20-Pin QFN (Top View)

Table 1. SKY13327-365LF Signal Descriptions

Pin #	Name	Description	Pin #	Name	Description
1	GND	Ground	11	T1	Stereo right tone detector input
2	I3	RF input 3	12	V1	Stereo right voltage detector input
3	GND	Ground	13	GND	Ground
4	V2	Stereo left voltage detector input	14	I1	RF input 1
5	T2	Stereo left tone detector input	15	GND	Ground
6	OUT2	RF output 2	16	I2	RF input 2
7	N/C	No connection. Pin may be grounded with no change in performance.	17	GND	Ground
8	VDD	Power supply voltage	18	OMR	Vertical/horizontal mirror (see Table 4)
9	N/C	No connection. Pin may be grounded with no change in performance.	19	GND	Ground
10	OUT1	RF output 1	20	I4	RF input 4

Electrical and Mechanical Specifications

The absolute maximum ratings of the SKY13327-365LF are provided in Table 2. Electrical specifications are provided in Table 3.

The state of the SKY13327-365LF is determined by the logic provided in Table 4.

Typical performance characteristics of the SKY13327-365LF are illustrated in Figures 3 through 10.

Table 2. SKY13327-365LF Absolute Maximum Ratings

Parameter	Symbol	Minimum	Typical	Maximum	Units
Supply voltage	V_{DD}			6	V
RF input power	P_{IN}			+18	dBm
Storage temperature	T_{STG}	–40		+125	°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 4. SKY13327-365LF Electrical Specifications (Note 1)
(V_{DD} = 5 V, T_{OP} = +25 °C, P_{IN} = 0 dBm, Characteristic Impedance [Z_0] = 50 Ω, Unless Otherwise Noted)

Parameter	Symbol	Test Condition	Min	Typical	Max	Units
RF Specifications						
Insertion loss	IL	All states 0.25 to 0.95 GHz 0.95 to 2.15 GHz		 8 9	 9 10	 dB dB
Insertion loss flatness		All states 0.25 to 0.95 GHz 0.95 to 2.15 GHz		 1.0 1.0	 1.5 1.5	 dB dB
Isolation	Iso	Normalized to insertion loss, all states 0.25 to 0.95 GHz 0.95 to 2.15 GHz	 35 25	 37 31		 dB dB
Input return loss		0.25 to 0.95 GHz, I1, I2, I3, I4, all states	12	15		dB
Output return loss		0.25 to 2.15 GHz, OUT1, OUT2, all states	7	12		dB
1 dB Input Compression Point	IP1dB	@ 2.15 Ghz	+13	+15		dBm
3rd Order Input Intercept Point	IIP3	@ 2.15 Ghz, 1 MHz spacing, P_{IN} = –12 dBm/tone		+25		dBm
Tone/Voltage Detector Specifications						
Polarization select threshold voltage		With external 10 nF series capacitor	14.9	15.0	15.2	V
Switching time			1.3	1.5	6.2	ms
Tone frequency			14	22	442	kHz
Tone threshold voltage				90		mVp-p
Power Supply						
Supply voltage			3.3	5.0	5.5	V
Supply current	I_{CC}			2.5		mA

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

Table 4. SKY13327-365LF Truth Table

State	V1 (Pin 12)	T1 (Pin 11)	V2 (Pin 4)	T2 (Pin 5)	Signal Path	
					Pin 18 (OMR) Open	Pin 18 (OMR) Connected to Ground
1	V_{LOW}	No Tone	V_{LOW}	No Tone	I1 to OUT2, I1 to OUT1	I3 to OUT2, I3 to OUT1
2	V_{LOW}	No Tone	V_{LOW}	22 kHz Tone	I2 to OUT2, I1 to OUT1	I4 to OUT2, I3 to OUT1
3	V_{LOW}	No Tone	V_{HIGH}	No Tone	I3 to OUT2, I1 to OUT1	I1 to OUT2, I3 to OUT1
4	V_{LOW}	No Tone	V_{HIGH}	22 kHz Tone	I4 to OUT2, I1 to OUT1	I2 to OUT2, I3 to OUT1
5	V_{LOW}	22 kHz Tone	V_{LOW}	No Tone	I1 to OUT2, I2 to OUT1	I3 to OUT2, I4 to OUT1
6	V_{LOW}	22 kHz Tone	V_{LOW}	22 kHz Tone	I2 to OUT2, I2 to OUT1	I4 to OUT2, I4 to OUT1
7	V_{LOW}	22 kHz Tone	V_{HIGH}	No Tone	I3 to OUT2, I2 to OUT1	I1 to OUT2, I4 to OUT1
8	V_{LOW}	22 kHz Tone	V_{HIGH}	22 kHz Tone	I4 to OUT2, I2 to OUT1	I2 to OUT2, I4 to OUT1
9	V_{HIGH}	No Tone	V_{LOW}	No Tone	I1 to OUT2, I3 to OUT1	I3 to OUT2, I1 to OUT1
10	V_{HIGH}	No Tone	V_{LOW}	22 kHz Tone	I2 to OUT2, I3 to OUT1	I4 to OUT2, I1 to OUT1
11	V_{HIGH}	No Tone	V_{HIGH}	No Tone	I3 to OUT2, I3 to OUT1	I1 to OUT2, I1 to OUT1
12	V_{HIGH}	No Tone	V_{HIGH}	22 kHz Tone	I4 to OUT2, I3 to OUT1	I2 to OUT2, I1 to OUT1
13	V_{HIGH}	22 kHz Tone	V_{LOW}	No Tone	I1 to OUT2, I4 to OUT1	I3 to OUT2, I2 to OUT1
14	V_{HIGH}	22 kHz Tone	V_{LOW}	22 kHz Tone	I2 to OUT2, I4 to OUT1	I4 to OUT2, I2 to OUT1
15	V_{HIGH}	22 kHz Tone	V_{HIGH}	No Tone	I3 to OUT2, I4 to OUT1	I1 to OUT2, I2 to OUT1
16	V_{HIGH}	22 kHz Tone	V_{HIGH}	22 kHz Tone	I4 to OUT2, I4 to OUT1	I2 to OUT2, I2 to OUT1
17	No Voltage	No Tone	V_{LOW}	No Tone	I1 to OUT2	I3 to OUT2
18	No Voltage	No Tone	V_{LOW}	22 kHz Tone	I2 to OUT2	I4 to OUT2
19	No Voltage	No Tone	V_{HIGH}	No Tone	I3 to OUT2	I1 to OUT2
20	No Voltage	No Tone	V_{HIGH}	22 kHz Tone	I4 to OUT2	I2 to OUT2
21	V_{LOW}	No Tone	No Voltage	No Tone	I1 to OUT1	I3 to OUT1
22	V_{LOW}	22 kHz Tone	No Voltage	No Tone	I2 to OUT1	I4 to OUT1
23	V_{HIGH}	No Tone	No Voltage	No Tone	I3 to OUT1	I1 to OUT1
24	V_{HIGH}	22 kHz Tone	No Voltage	No Tone	I4 to OUT1	I2 to OUT1

Note: V_{LOW} = 10 V ~ 14 V
V_{HIGH} = 16 V ~ 21 V
No Tone = No 22 kHz tone present
22 kHz Tone = 22 kHz tone present with amplitude greater than 100 mVp-p
No Voltage = < 5 V
Any state other than described in this Table places the switch into an undefined state. An undefined state will not damage the device.

Typical Performance Characteristics

(V_{DD} = 5 V, T_{OP} = +25 °C, P_{IN} = 0 dBm, Characteristic Impedance [Z_O] = 50 Ω, Unless Otherwise Noted)

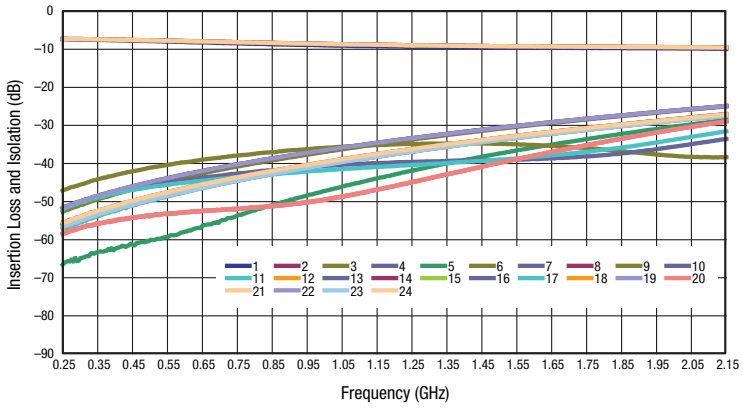


Figure 3. I1 to OUT1 for States 1 to 24

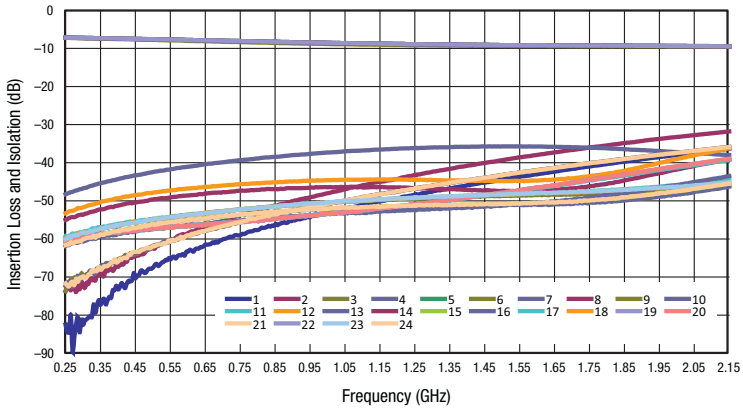


Figure 4. I2 to OUT1 for States 1 to 24

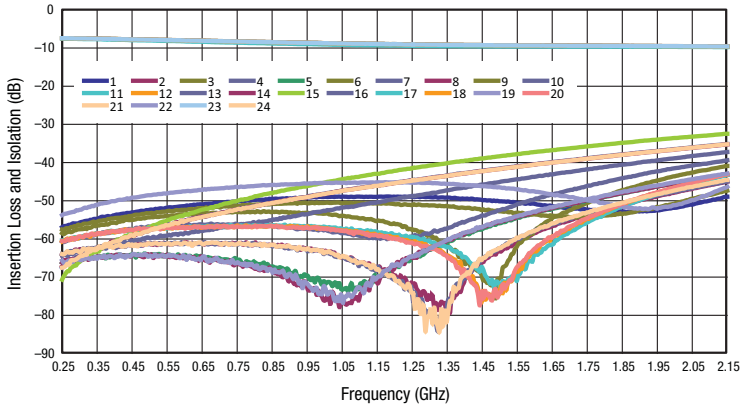


Figure 5. I3 to OUT1 for States 1 to 24

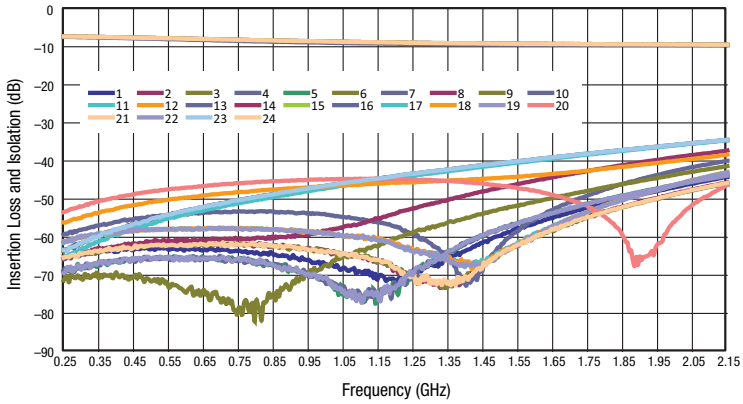


Figure 6. I4 to OUT1 for States 1 to 24

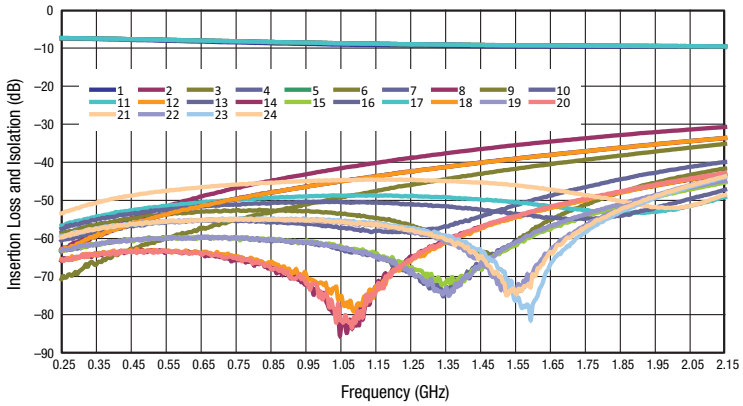


Figure 7. I1 to OUT2 for States 1 to 24

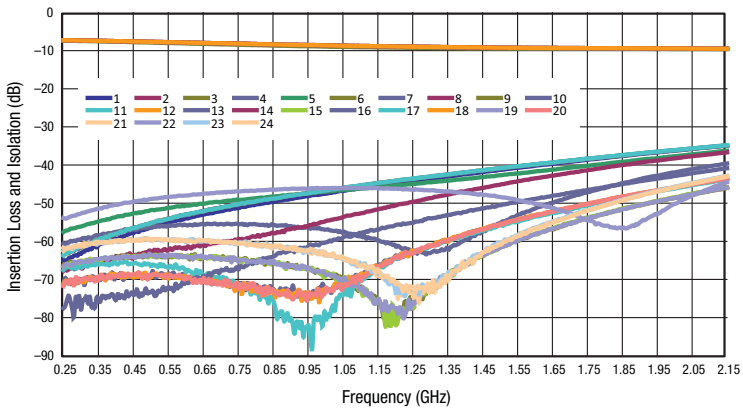


Figure 8. I2 to OUT2 for States 1 to 24

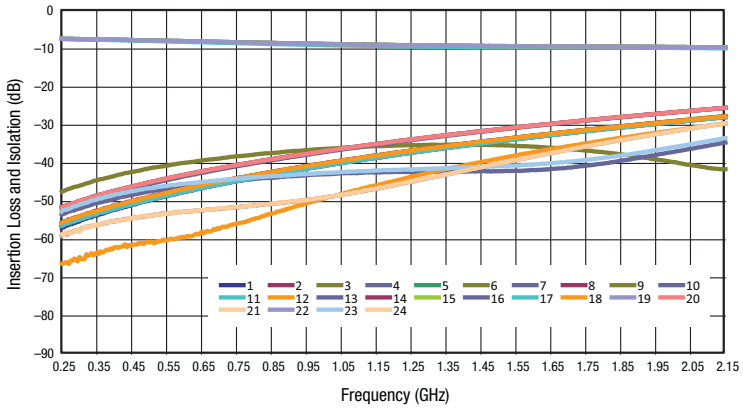


Figure 9. I3 to OUT2 for States 1 to 24

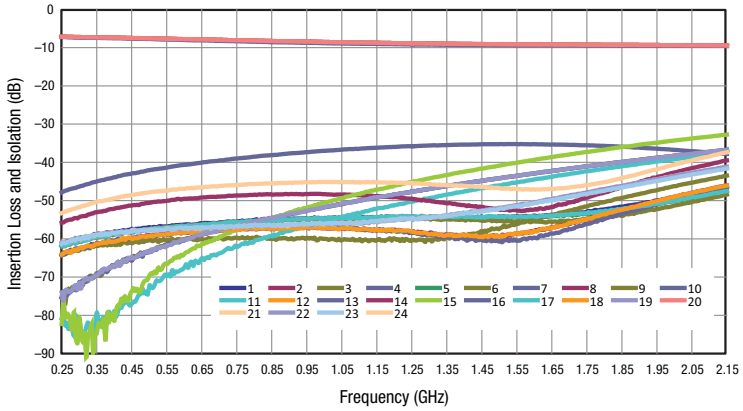


Figure 10. I4 to OUT2 for States 1 to 24

Evaluation Board Description

The SKY13327-365LF Evaluation Board is used to test the performance of the SKY13327-365LF 4x2 Switch Matrix. An Evaluation Board schematic diagram is provided in Figure 11. A recommended application circuit is shown in Figure 12 An assembly drawing for the Evaluation Board is shown in Figure 13.

Package Dimensions

The PCB layout footprint for the SKY13327-365LF is provided in Figure 14. Typical case markings are shown in Figure 15. Package dimensions for the 20-pin QFN are shown in Figure 16, and tape and reel dimensions are provided in Figure 17.

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 SKY13327-365LF is rated to Moisture Sensitivity Level 1 (MSL1) at 260 °C. It can be used for lead or lead-free soldering.

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. For packaging details, refer to the Skyworks Application Note, *Discrete Devices and IC Switch/Attenuators Tape and Reel Package Orientation*, document number 200083.

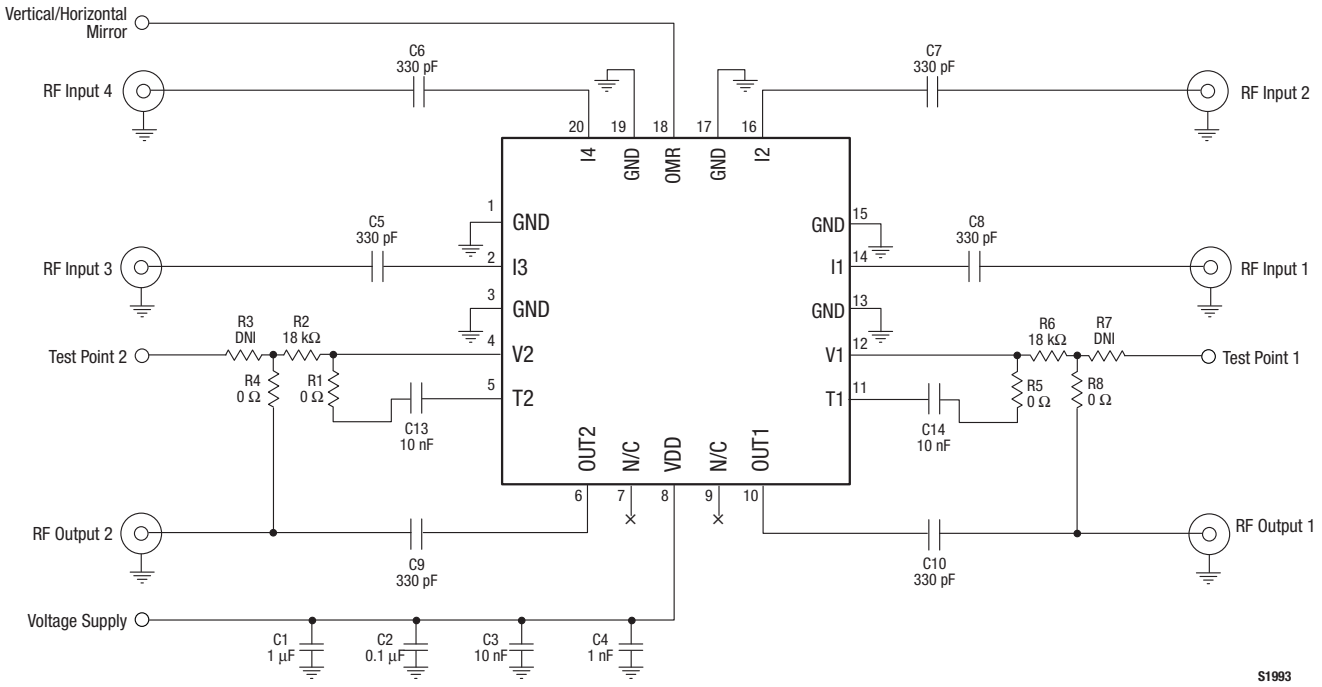


Figure 11. SKY13327-365LF Evaluation Board Schematic

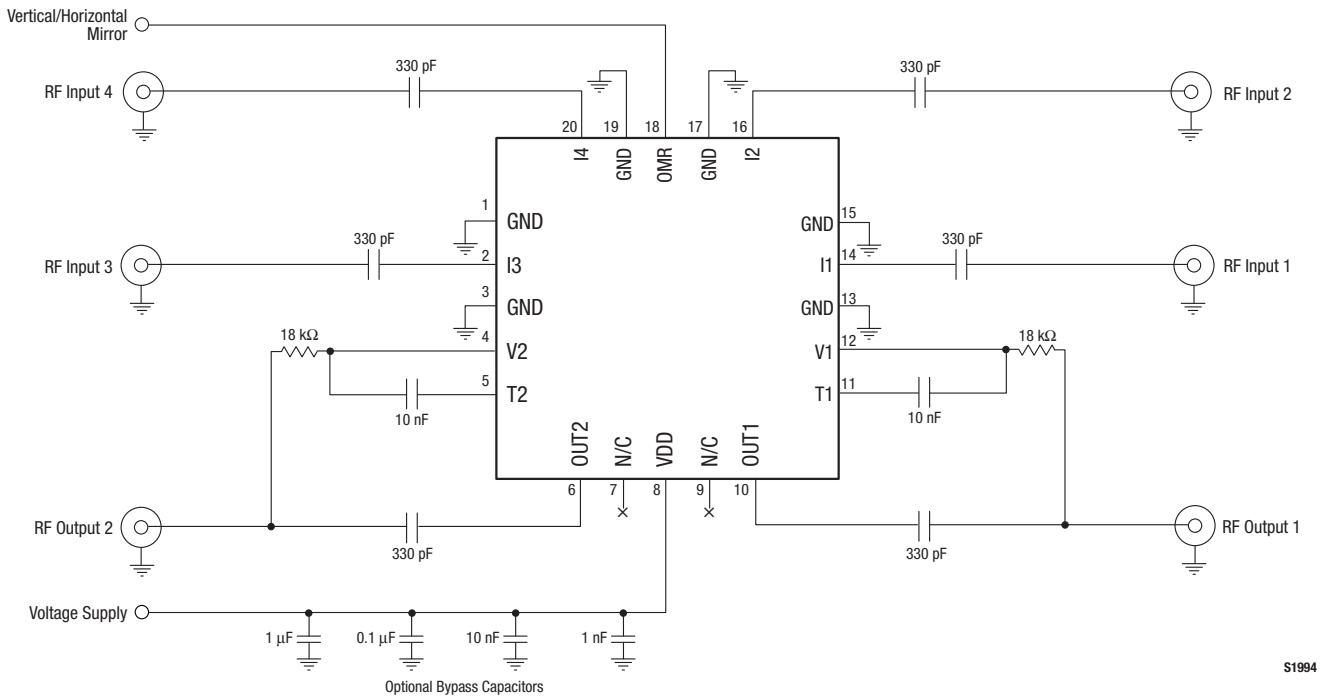


Figure 12. SKY13327-365LF Recommended Application Circuit

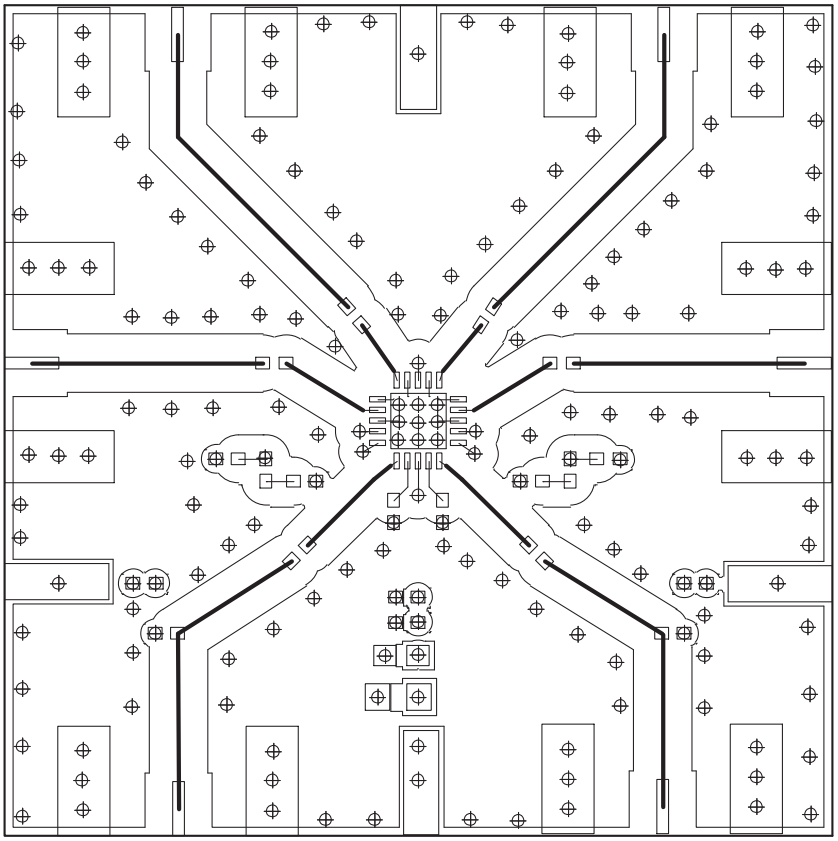


Figure 13. SKY13327-365LF Evaluation Board Assembly Diagram

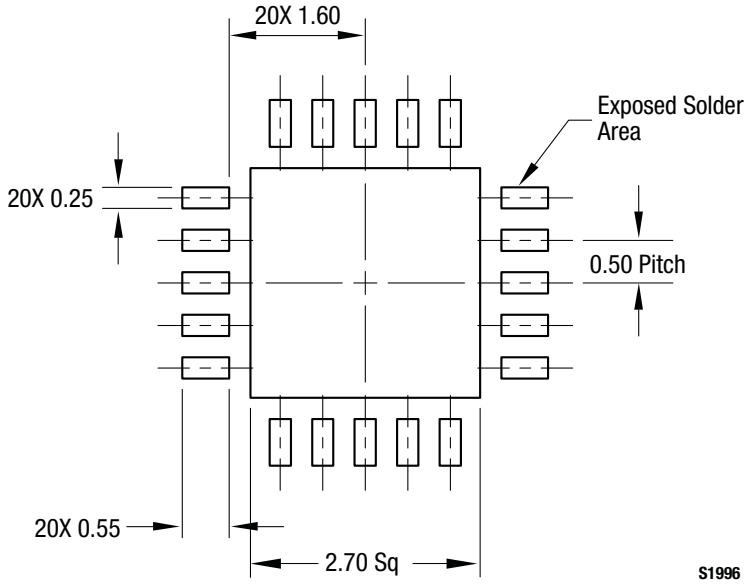


Figure 14. SKY13327-365LF PCB Layout Footprint (Top View)

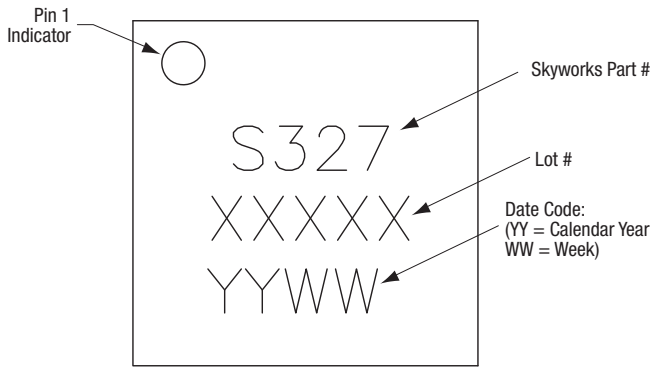
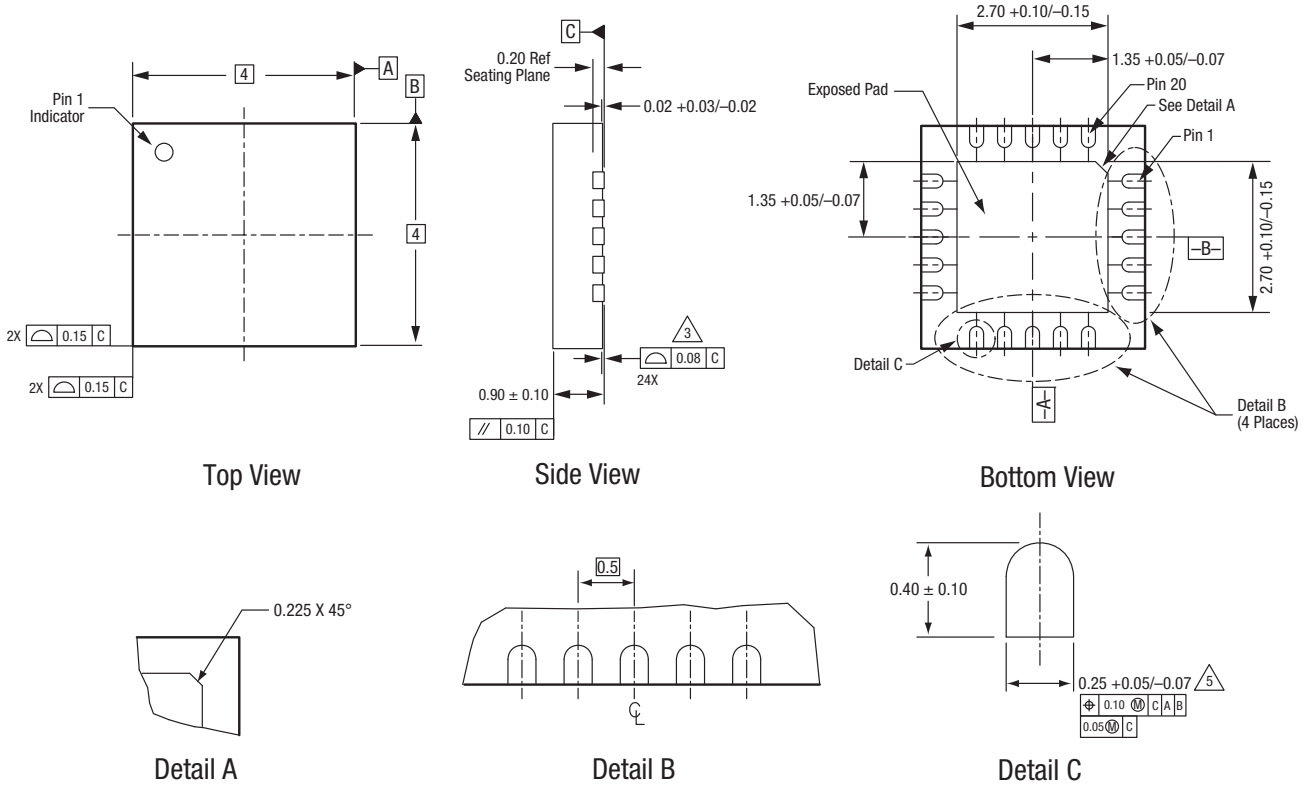


Figure 15. Typical Case Markings (Top View)



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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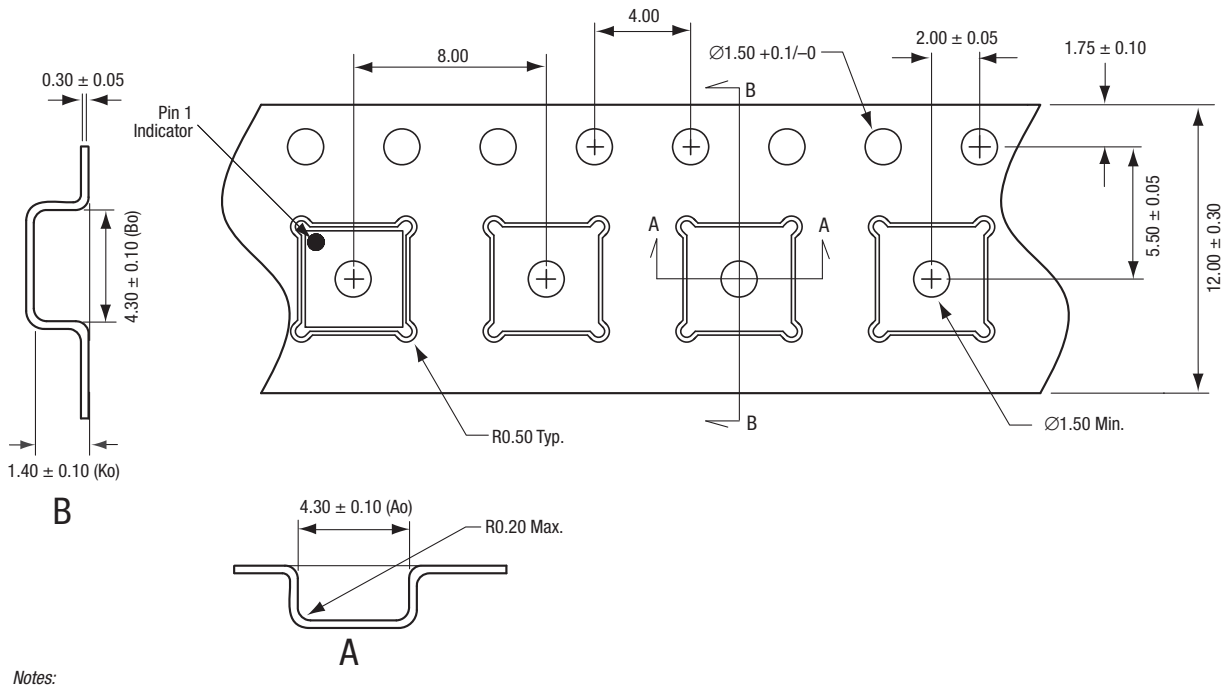
Figure 16. SKY13327-365LF 20-Pin QFN Package Dimensions



Notes:
1. Carrier tape material: black conductive polystyrene, non-bakeable
2. Cover tape material: transparent conductive HSA
3. Cover tape size: 9.2 mm width
4. All measurements are in millimeters

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Figure 17. SKY13327-365LF Tape and Reel Dimensions

Ordering Information

Model Name	Manufacturing Part Number	Evaluation Board Part Number
SKY13327-365LF 4x2 Switch Matrix	SKY13327-365LF	EN30-D925-001