

DATA SHEET

SKY13293-340LF: 0.25-2.15 GHz 4 x 2 Matrix Switch

Applications

- DBS switching, cable modems, cable TV

Features

- Broadband frequency range: 0.25 to 2.15 GHz
- High isolation: 57 dB typical @ 0.9 GHz
- Four RF inputs, two RF outputs
- Low current consumption: 500 μ A typical @ 5 V
- 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.

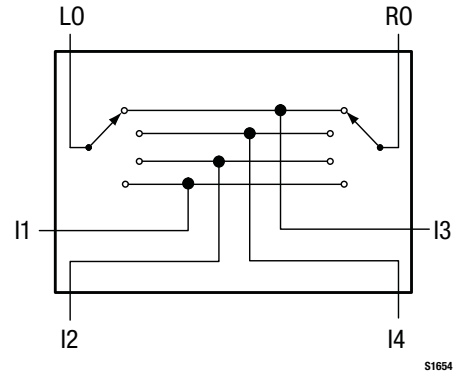


Figure 1. SKY13293-340LF Block Diagram

Description

The SKY13293-340LF is a four-input to two-output switch in a low-cost Quad Flat No-Lead (QFN) 4 x 4 mm package. The switch can control signals from 0.25 to 2.15 GHz. The SKY13293-340LF enables 16 states, directing any of the four inputs to either of the two outputs. Switch states are selected by four voltage inputs.

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.

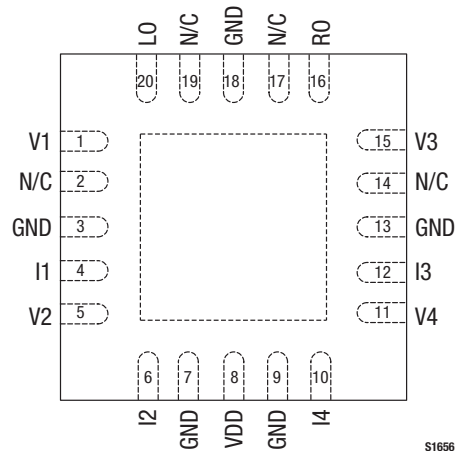


Figure 2. SKY13293-340LF Pinout – 20-Pin QFN (Top View)

Table 1. SKY13293-340LF Signal Descriptions

Pin #	Name	Type	I/O	Description	Pin #	Name	Type	I/O	Description
1	V1	DC	I	Control voltage input #1	11	V4	DC	I	Control voltage input #4
2	N/C	–	–	No connection	12	I3	RF	I	RF input #3 (250-2150 MHz)
3	GND	–	GND	RF/DC Ground	13	GND	–	GND	RF/DC Ground
4	I1	RF	I	RF input #1 (250-2150 MHz)	14	N/C	–	–	No connection
5	V2	DC	I	Control voltage input #2	15	V3	DC	I	Control voltage input #3
6	I2	RF	I	RF input #2 (250-2150 MHz)	16	RO	RF	O	RF channel right output (250-2150 MHz)
7	GND	–	GND	RF/DC Ground	17	N/C	–	–	No connection
8	VDD	DC	I	Supply voltage input	18	GND	–	GND	RF/DC Ground
9	GND	–	GND	RF/DC Ground	19	N/C	–	–	No connection
10	I4	RF	I	RF input #4 (250-2150 MHz)	20	LO	RF	O	RF channel left output (250-2150 MHz)

Table 2. SKY13293-340LF Absolute Maximum Ratings

Parameter	Symbol	Minimum	Typical	Maximum	Units
Input power	P _{IN}			+15	dBm
Logic control input voltage				5.5	V
Control voltage				5.5	V
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.

Electrical and Mechanical Specifications

The absolute maximum ratings of the SKY13293-340LF are provided in Table 2. The electrical specifications are provided in Table 3.

Typical performance characteristics of the SKY13293-340LF are illustrated in Figures 3 through 11.

The state of the SKY13293-340LF is determined by the logic provided in Table 4.

An application circuit diagram is presented in Figure 12.

Table 4. SKY13293-340LF Electrical Specifications (Note 1)**($V_{DD} = 5\text{ V}$, $T_{OP} = +25\text{ }^{\circ}\text{C}$, $P_{IN} = -20\text{ dBm}$, Characteristic Impedance [Z_0] = $50\text{ }\Omega$, Unless Otherwise Noted)**

Parameter	Symbol	Test Condition	Min	Typical	Max	Units
RF Switch Performance						
Insertion loss		0.25-0.95 GHz		8.0	8.2	dB
		0.95-2.15 GHz		9.0	9.7	dB
Insertion loss flatness		0.25-0.95 GHz		0.75	1.00	dB
		0.95-2.15 GHz		1.50	2.50	dB
Isolation (normalized to insertion loss)		0.25-0.95 GHz	43.0	57.0		dB
		0.95-1.45 GHz	38.5	52.0		dB
		1.45-2.15 GHz		45.0		dB
Return loss (input selected)		0.25-0.95 GHz	15	20		dB
		0.95-2.15 GHz	11	21		dB
Return loss (input deselected)		0.25-0.95 GHz	15	20		dB
		0.95-2.15 GHz	11	21		dB
1 dB input compression point	IP1dB	0.25-2.15 GHz		+15		dBm
3 rd Order Input Intercept Point	IIP3	$P_{IN} = -12\text{ dBm/ tone}$, 1 MHz spacing, 2.15 GHz		+27		dBm
Switching characteristics: Rise/fall time		10/90% or 90/10% RF		10		ns
		50% V_{CTL} to 90/10% RF		29		ns
Logic Controls						
Control input current	I_{DIG}	$0\text{ V} \leq V_{CTL} \leq V_{DD}$		5		μA
Control input low logic level	V_{IL}				0.7	V
Control input high logic level	V_{IH}		2.2			V
Power Supply						
Supply voltage	V_{DD}		3.0	5.0	5.5	V
Supply current	I_{DD}			500		μA

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

Typical Performance Characteristics

(T_{OP} = +25 °C, Characteristic Impedance [Z₀] = 50 Ω, Unless Otherwise Noted)

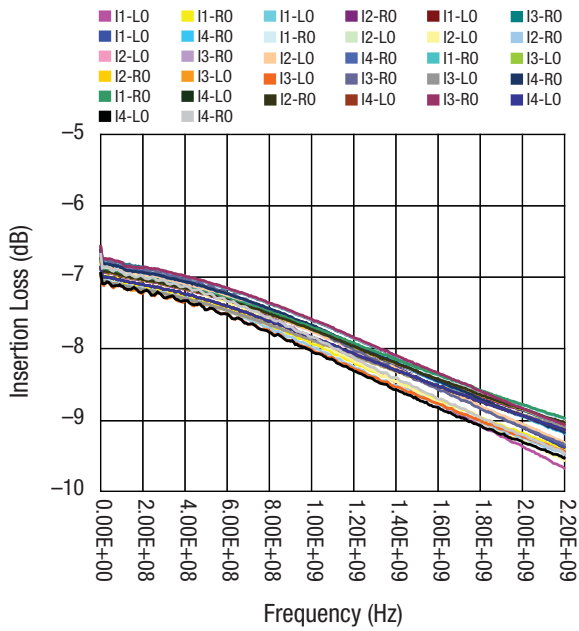
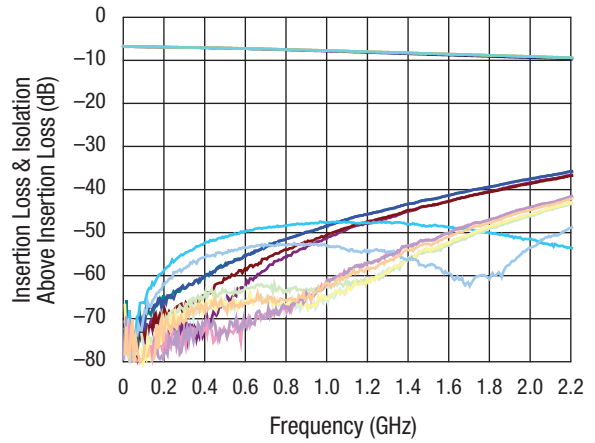
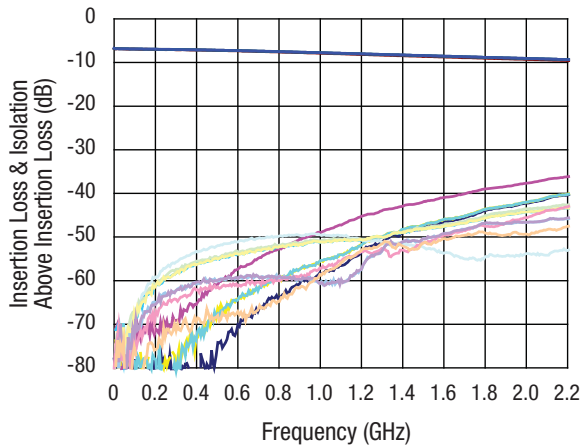


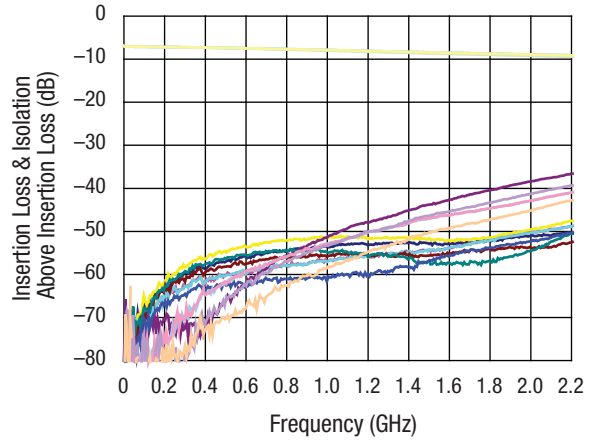
Figure 3. Insertion Loss, All States



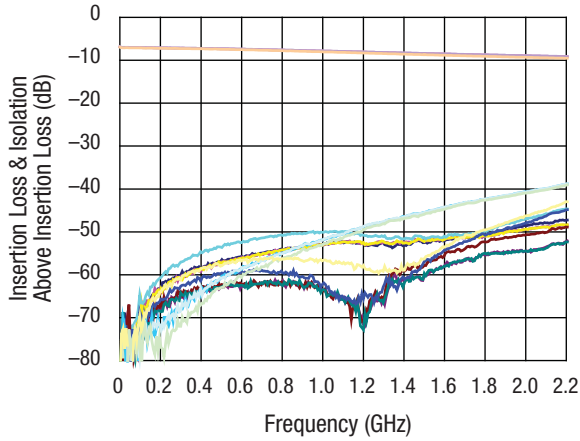
**Figure 4. I1 to LO Path, All States
(Isolation is Normalized to Insertion Loss)**



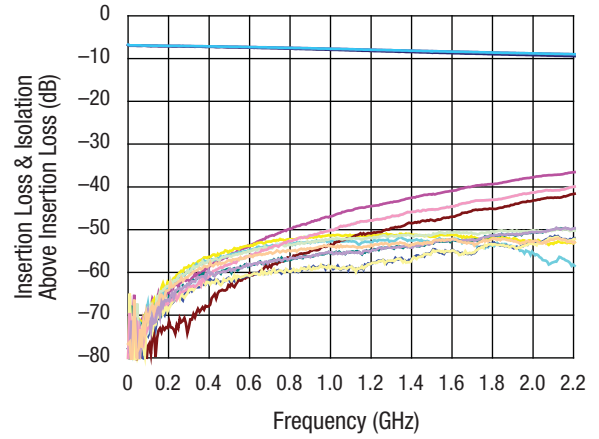
**Figure 5. I2 to LO Path, All States
(Isolation is Normalized to Insertion Loss)**



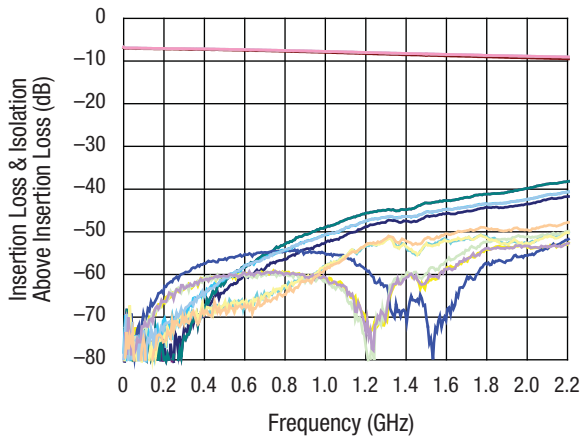
**Figure 6. I3 to LO Path, All States
(Isolation is Normalized to Insertion Loss)**



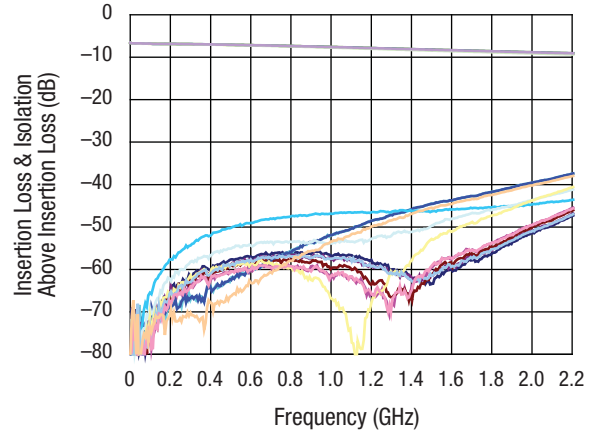
**Figure 7. I4 to LO Path, All States
(Isolation is Normalized to Insertion Loss)**



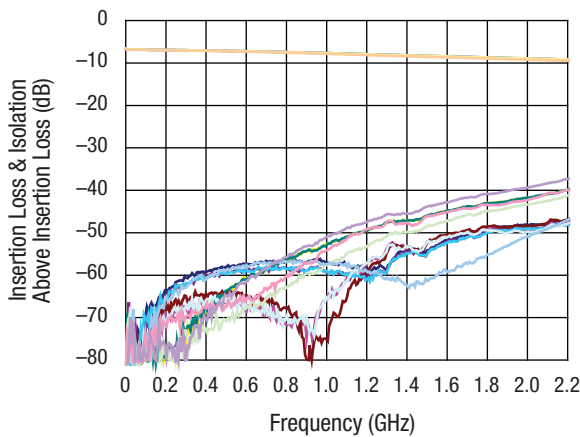
**Figure 8. R0 Path, All States
(Isolation is Normalized to Insertion Loss)**



**Figure 9. R0 Path, All States
(Isolation is Normalized to Insertion Loss)**



**Figure 10. I3 to R0 Path, All States
(Isolation is Normalized to Insertion Loss)**



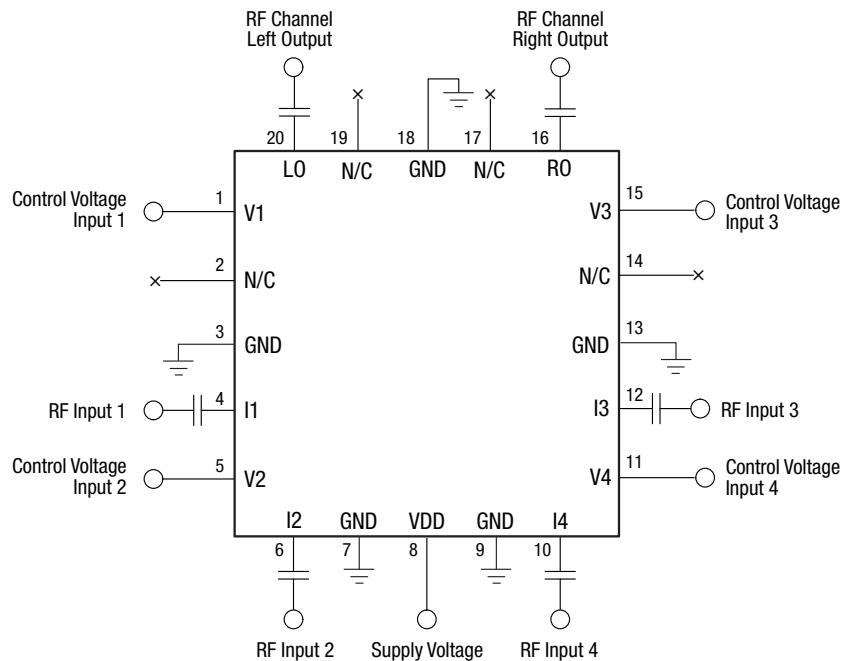
**Figure 11. I4 to R0 Path, All States
(Isolation is Normalized to Insertion Loss)**

Table 5. SKY13293-340LF Truth Table

State	Control Voltage Inputs (Note 1)				Signal Path (Note 2)
	V1	V2	V3	V4	
0	0	0	0	0	I1 → LO, I1 → RO
1	0	0	0	1	I1 → LO, I2 → RO
2	0	0	1	0	I1 → LO, I3 → RO
3	0	0	1	1	I1 → LO, I4 → RO
4	0	1	0	0	I2 → LO, I1 → RO
5	0	1	0	1	I2 → LO, I2 → RO
6	0	1	1	0	I2 → LO, I3 → RO
7	0	1	1	1	I2 → LO, I4 → RO
8	1	0	0	0	I3 → LO, I1 → RO
9	1	0	0	1	I3 → LO, I2 → RO
10	1	0	1	0	I3 → LO, I3 → RO
11	1	0	1	1	I3 → LO, I4 → RO
12	1	1	0	0	I4 → LO, I1 → RO
13	1	1	0	1	I4 → LO, I2 → RO
14	1	1	1	0	I4 → LO, I3 → RO
15	1	1	1	1	I4 → LO, I4 → RO

Note 1: "1" = VIH. "0" = VIL. Any state other than described in this Table places the switch into an undefined state. An undefined state will not damage the device.

Note 2: All other paths in isolation state.



Blocking capacitors present on pins 4, 6, 10, 12, 16, and 20 are 330 pF.

S1640

Figure 12. Application Circuit

Package Dimensions

The PCB layout footprint for the SKY13293-340LF is provided in Figure 13. Typical case markings are shown in Figure 14. Package dimensions for the 20-pin QFN are shown in Figure 15, and tape and reel dimensions are provided in Figure 16.

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 SKY13293-340LF 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. For packaging details, refer to the Skyworks Application Note, *Discrete Devices and IC Switch/Attenuators Tape and Reel Package Orientation*, document number 200083.

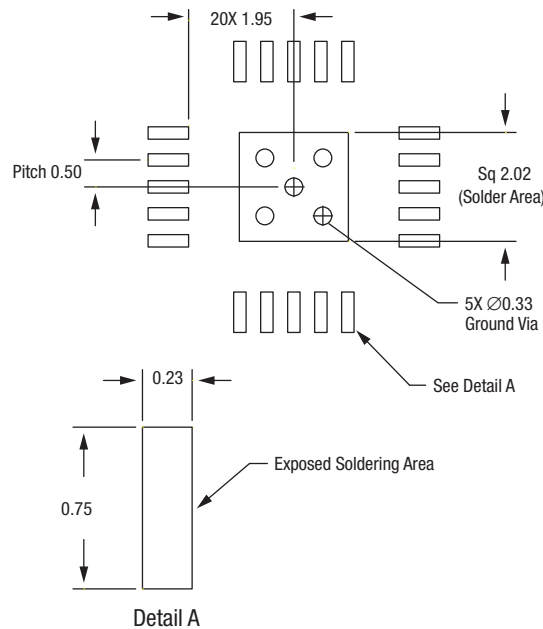


Figure 13. SKY13293-340LF PCB Layout Footprint (Top View)

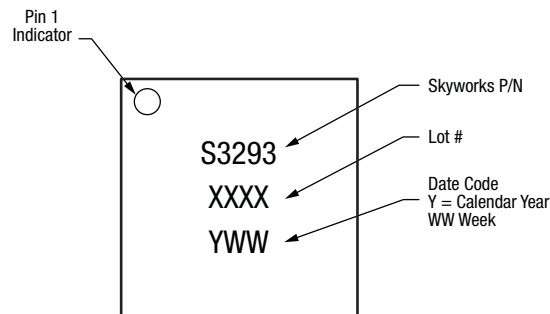
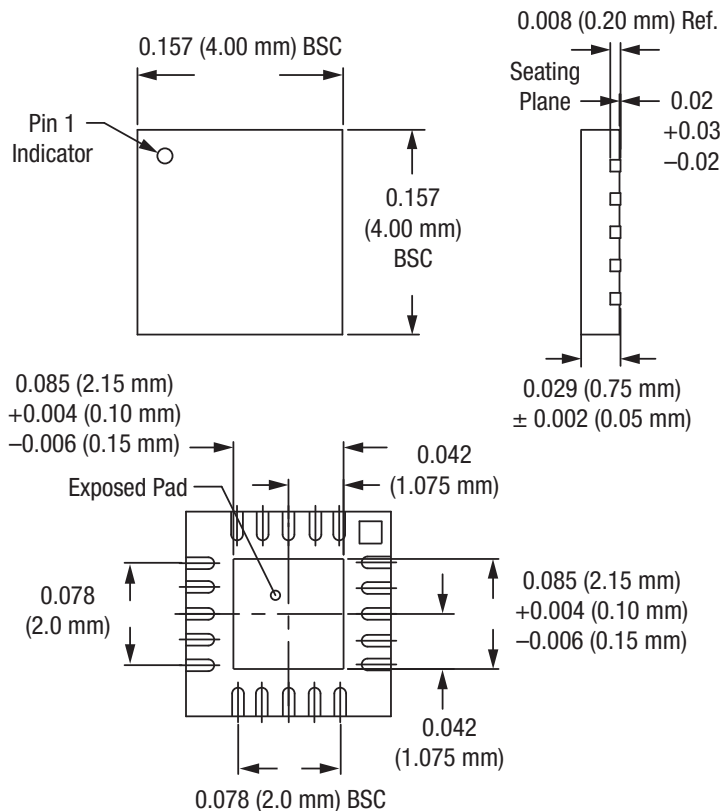


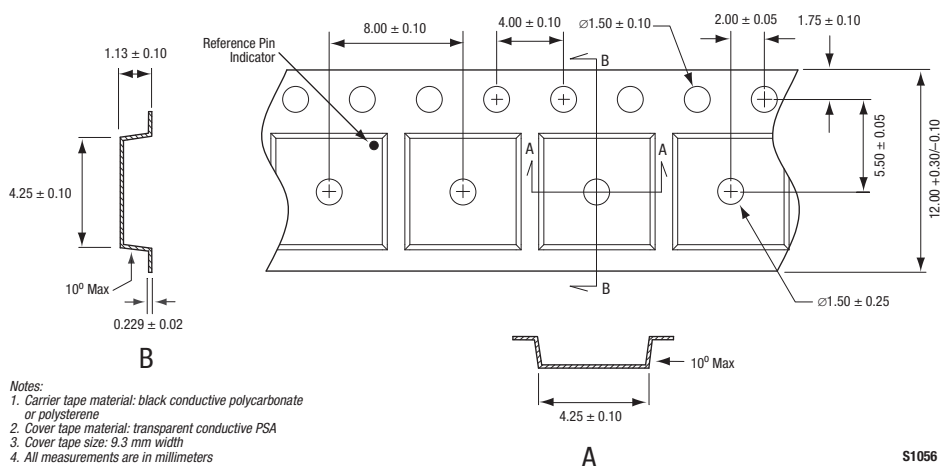
Figure 14. Typical Case Markings (Top View)



Dimensions are in inches (millimeters shown in parentheses)

S1655

Figure 14. SKY13293-340LF 20-Pin QFN Package Dimensions



S1056

Figure 15. SKY13293-340LF Tape and Reel Dimensions

Ordering Information

Model Name	Manufacturing Part Number
SKY13293-340LF 0.25-2.15 GHz 4 x 2 Matrix Switch	SKY13293-340LF

Copyright © 2008, 2009, 2010 Skyworks Solutions, Inc. All Rights Reserved.

Information in this document is provided in connection with Skyworks Solutions, Inc. ("Skyworks") products or services. These materials, including the information contained herein, are provided by Skyworks as a service to its customers and may be used for informational purposes only by the customer. Skyworks assumes no responsibility for errors or omissions in these materials or the information contained herein. Skyworks may change its documentation, products, services, specifications or product descriptions at any time, without notice. Skyworks makes no commitment to update the materials or information and shall have no responsibility whatsoever for conflicts, incompatibilities, or other difficulties arising from any future changes.

No license, whether express, implied, by estoppel or otherwise, is granted to any intellectual property rights by this document. Skyworks assumes no liability for any materials, products or information provided hereunder, including the sale, distribution, reproduction or use of Skyworks products, information or materials, except as may be provided in Skyworks Terms and Conditions of Sale.

THE MATERIALS, PRODUCTS AND INFORMATION ARE PROVIDED "AS IS" WITHOUT WARRANTY OF ANY KIND, WHETHER EXPRESS, IMPLIED, STATUTORY, OR OTHERWISE, INCLUDING FITNESS FOR A PARTICULAR PURPOSE OR USE, MERCHANTABILITY, PERFORMANCE, QUALITY OR NON-INFRINGEMENT OF ANY INTELLECTUAL PROPERTY RIGHT; ALL SUCH WARRANTIES ARE HEREBY EXPRESSLY DISCLAIMED. SKYWORKS DOES NOT WARRANT THE ACCURACY OR COMPLETENESS OF THE INFORMATION, TEXT, GRAPHICS OR OTHER ITEMS CONTAINED WITHIN THESE MATERIALS. SKYWORKS SHALL NOT BE LIABLE FOR ANY DAMAGES, INCLUDING BUT NOT LIMITED TO ANY SPECIAL, INDIRECT, INCIDENTAL, STATUTORY, OR CONSEQUENTIAL DAMAGES, INCLUDING WITHOUT LIMITATION, LOST REVENUES OR LOST PROFITS THAT MAY RESULT FROM THE USE OF THE MATERIALS OR INFORMATION, WHETHER OR NOT THE RECIPIENT OF MATERIALS HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

Skyworks products are not intended for use in medical, lifesaving or life-sustaining applications, or other equipment in which the failure of the Skyworks products could lead to personal injury, death, physical or environmental damage. Skyworks customers using or selling Skyworks products for use in such applications do so at their own risk and agree to fully indemnify Skyworks for any damages resulting from such improper use or sale.

Customers are responsible for their products and applications using Skyworks products, which may deviate from published specifications as a result of design defects, errors, or operation of products outside of published parameters or design specifications. Customers should include design and operating safeguards to minimize these and other risks. Skyworks assumes no liability for applications assistance, customer product design, or damage to any equipment resulting from the use of Skyworks products outside of stated published specifications or parameters.

Skyworks, the Skyworks symbol, and "Breakthrough Simplicity" are trademarks or registered trademarks of Skyworks Solutions, Inc., in the United States and other countries. Third-party brands and names are for identification purposes only, and are the property of their respective owners. Additional information, including relevant terms and conditions, posted at www.skyworksinc.com, are incorporated by reference.