**SKYWORKS®**

DATA SHEET

SKY13290-313LF: PHEMT 10 W SPDT Switch 500 MHz–2.5 GHz

Features

- Broadband: 500 MHz–2.5 GHz
- Very low insertion loss: 0.4 dB typ. @ 900 MHz
- High isolation: 26 dB typ. @ 900 MHz
- High input power compression: 0.1 dB at > 40 dBm
- Low current consumption: <100 µA @ 3 V
- Miniature QFN-6 2 x 3 mm package
- Lead (Pb)-free and RoHS-compliant MSL-1 @ 260 °C per JEDEC J-STD-020

Functional Block Diagram
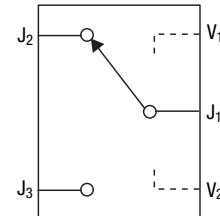
Description

The SKY13290-313LF is a PHEMT IC high-power SPDT switch. This high-power switch has been designed for use from 500 MHz–2.5 GHz, where low loss, high isolation, low control voltage and ultraminiature package size are required. It can be controlled with positive, negative or a combination of both voltages. The RF signal paths within the SKY13290-313LF are fully bilateral.

Some standard implementations include T/R switching for telematic applications at elevated power levels.

Switching is controlled via two control voltage inputs. Depending upon the voltage level applied to the control voltage pins, the common RF port (J_1) is connected to one of two RF ports (J_2 or J_3) via a low insertion loss path, while the path between J_1 and the other RF port is in its isolation state. When the control voltages are toggled, the states between J_1 and J_2, as well as J_1 and J3, are also toggled.

The SKY13290-313LF is available in a lead (Pb)-free, RoHS-compliant, QFN-6 2 x 3 mm plastic package.

An evaluation board is available upon request.

NEW Skyworks offers lead (Pb)-free, RoHS (Restriction of Hazardous Substances)-compliant packaging.

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Electrical Specifications at 25 °C

V_{CTRL} = 0/3 V, T = 25°C, P_{INPUT} = 0 dbm, Z_0 = 50 Ω, unless otherwise noted

Parameter	Frequency	Min.	Typ.	Max.	Unit
Insertion loss	0.5–1.0 GHz		0.40	0.5	dB
	1.0–2.0 GHz		0.45	0.6	dB
	2.0–2.5 GHz		0.55	0.7	dB
Isolation	0.5–1.0 GHz	23	26		dB
	1.0–2.0 GHz	17	20		dB
	2.0–2.5 GHz	15	18		dB
Return loss[1]	0.5–1.0 GHz		20		dB
	1.0–2.5 GHz		20		dB

1. Return loss state. Lower frequency return loss is dependent on value of the DC blocks.

Operating Characteristics at 25 °C

V_{CTRL} = 0/3 V, T = 25°C, P_{INPUT} = 0 dbm, Z_0 = 50 Ω, unless otherwise noted

Parameter	Condition	Frequency	Min.	Typ.	Max.	Unit
Switching characteristics:						
Rise/fall time	10/90% or 90/10% RF			650		ns
On/off time	50% V_{CTL} to 90/10% RF			800		ns
Input power for 0.1 dB compression		900 MHz		40.5		dBm
Thermal resistance				45		°C/W
Control voltage	V_{LOW} = 0 V @ 20 µA maximum					
	V_{HIGH} = 2.7 V @ 100 µA maximum to 10 V @ 200 µA maximum					

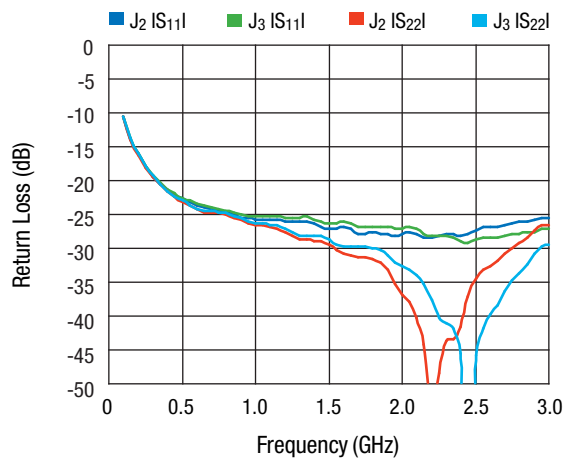## Typical Performance Data

$Z_0 = 50\ \Omega$, $V_{CTRL} = 0/3$ V, unless otherwise noted
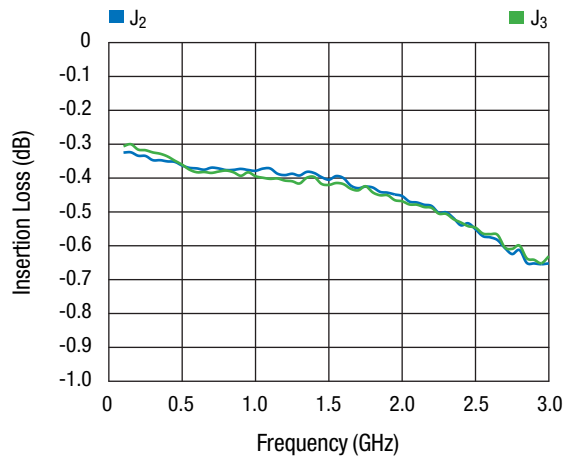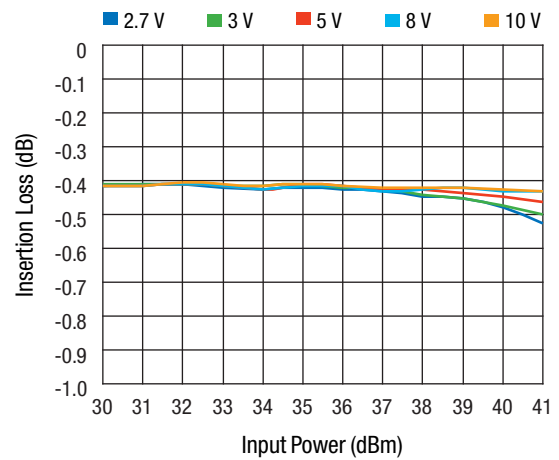

Insertion Loss vs. Frequency
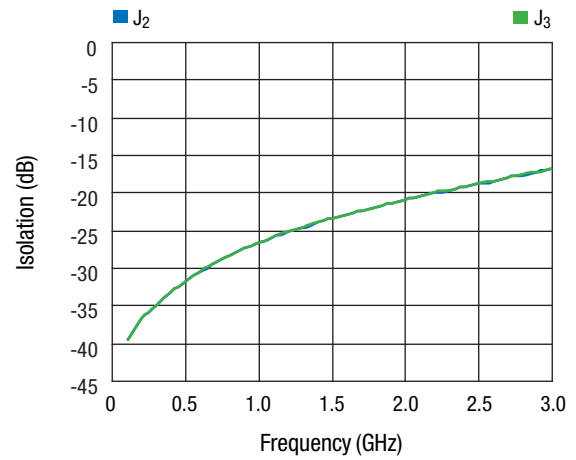
Isolation vs. Frequency

**Return Loss vs. Frequency
(Insertion Loss State)**

**Insertion Loss vs. Input Power
F = 900 MHz**

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Absolute Maximum Ratings

Characteristic	Value
Control voltage range	$0 \leq V_C \leq 10$ V
RF input power	43.5 dBm, f > 900 MHz
Operating temperature	-40 °C to +85 °C
Storage temperature	-65 °C to +150 °C

Performance is guaranteed only under the conditions listed in the specifications table and is not guaranteed under the full range(s) described by the Absolute Maximum specifications. Exceeding any of the absolute maximum/minimum specifications may result in permanent damage to the device and will void the warranty.

CAUTION: Although this device is designed to be as robust as possible, ESD (Electrostatic Discharge) 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 must be employed at all times.

Recommended Solder Reflow Profiles

Refer to the *"Recommended Solder Reflow Profile"* Application Note.

Tape and Reel Information

Refer to the *"Discrete Devices and IC Switch/Attenuators Tape and Reel Package Orientation"* Application Note.
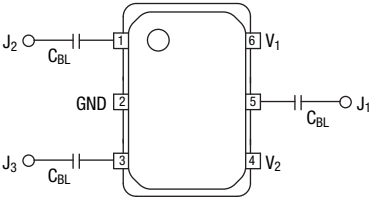
QFN-6
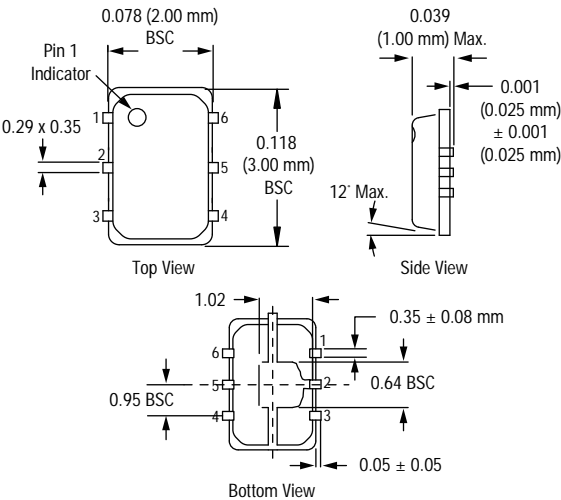
Truth Table

V_1	V_2	$J_1–J_2$	$J_1–J_3$
V_{LOW}	V_{HIGH}	Isolation	Insertion loss
V_{HIGH}	V_{LOW}	Insertion loss	Isolation
V_{LOW}	V_{LOW}	Not recommended[1]	
V_{HIGH}	V_{HIGH}	Not recommended[1]	

2.7 V $< V_{HIGH} < 10$ V, $0 < V_{LOW} < 0.2$ V.
1. Switch in undefined state.

Pin Out (Top View)

DC blocking capacitors (C_{BL}) must be supplied externally.

Pin Descriptions

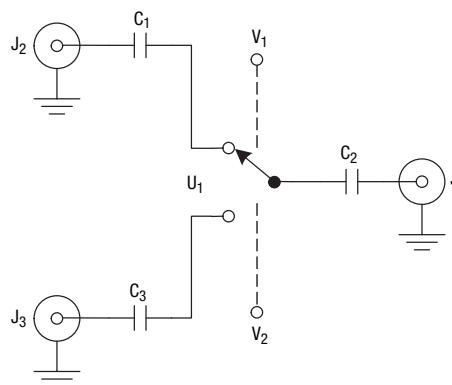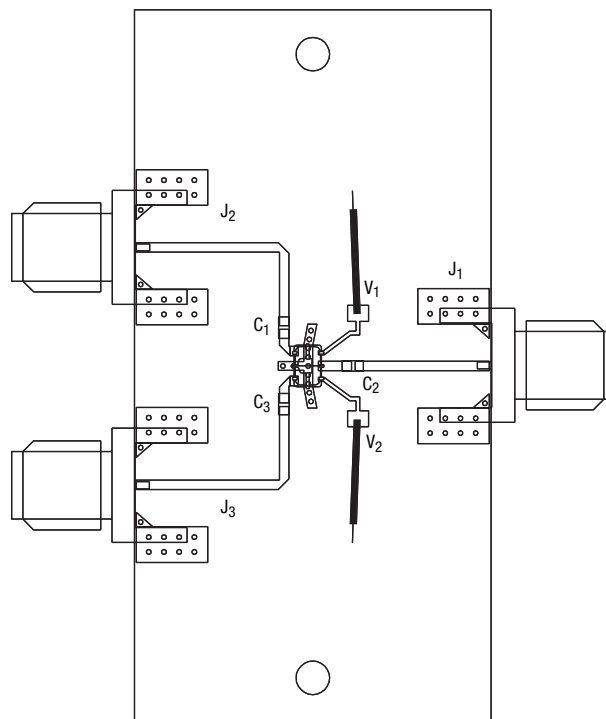| Pin Number	Pin Name	Description
1	J_2	RF Input/Output – RF input/output port which is either connected to J_1 via a low insertion loss path or isolated from J_1, according to the logic voltage levels applied to V_1 and V_2.
2	GND	Equipotential Point – Internal circuit common, which must be connected to the pcb ground or common via the lowest possible impedance.
3	J_3	RF Input/Output – RF input/output port which is either connected to J_1 via a low insertion loss path or isolated from J_1, according to the logic voltage levels applied to V_1 and V_2.
4	V_2	Control Voltage 2 – Control voltage input #2. The logic voltage level applied to this pin, along with the voltage level applied to V_1 (pin 6), determines the states of the RF paths between $J_1–J_2$ and $J_1–J_3$.
5	J_1	RF Common Input/Output – RF common input/output port which is either connected to J_2 or to J_3 via a low insertion loss and isolated from the other RF port, according to the logic voltage levels applied to V_1 and V_2.
6	V_1	Control Voltage 1 – Control voltage input #1. The logic voltage level applied to this pin, along with the voltage level applied to V_2 (pin 4), determines the states of the RF paths between $J_1–J_2$ and $J_1–J_3$.

Evaluation Board

The evaluation board for the SKY13290-313 allows the switch to be fully exercised. The RF common port is marked "J_1", and the two switched RF ports are marked "J_2" and "J_3". All of the RF ports have SMA connectors mounted. The control voltage inputs are marked "V_1" and "V_2".

The printed circuit board material is Rogers 4003. The RF dielectric layer is 0.012 inches thick, ½ oz. copper. The RF transmission lines are each 50 Ω (nominal) microstrip.

There are three DC blocking capacitors on the board, C_1, C_2 and C_3, each of which is in series with one of the RF ports. These capacitors are 47 pF. For improved insertion loss at signal frequencies below approximately 500 MHz these capacitors should be replaced with larger capacitance capacitors, such as 1000 pF.

Item	Description	Comments
C_1, C_2, C_3	DC Blocking Capacitor, 47 pF	0402
J_1, J_2, J_3	SMA Connector, Edge Mount	
U1	SKY13290-313	
Printed Circuit Board	Skyworks SK39990	

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