SKY13296-340LF: GaAs SP4T Absorptive Switch 20 MHz–2.5 GHz

Features

- Positive voltage control (0/3 V to 0/5 V)
- High isolation 35 dB at 1 GHz
- Integrated silicon CMOS driver
- Isolated ports are absorptive
- Use of external DC blocks to allow good return loss to low frequency
- Available lead (Pb)-free and RoHS-compliant MSL-1 @ 260 °C per JEDEC J-STD-020

Description

The SKY13296-340LF is a pHEMT GaAs FET IC high isolation, absorptive single-pole four-throw switch packaged in a lead (Pb)-free, 4 x 4 mm, 20-lead exposed-pad plastic package for low-cost commercial applications. The use of external DC blocking capacitors on the RF ports and in series with the internal RF terminations enables the user to extend the range of good return loss to arbitrarily low frequency. This switch is an ideal building block for filter bank switching.

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

Functional Diagram
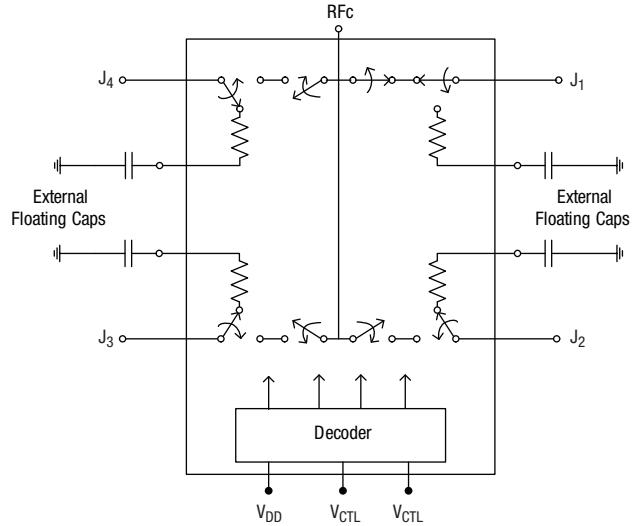
Electrical Specifications

V_{CTL} = 0 V/3V, T = 25 °C, P_{INPUT} = 0 dBm, Z_O = 50 Ω, C_{BLOCK} = 1000 pF, C_{BYPASS} = 1000 pF, unless otherwise noted

Parameter	Frequency	Min.	Typ.	Max.	Unit
Insertion loss	0.02–1.00 GHz		0.4	0.6	dB
	1.00–2.00 GHz		0.6	0.8	dB
	2.00–2.50 GHz		0.7	1.1	dB
Isolation	0.02–1.00 GHz	35	40		dB
	1.00–2.00 GHz	25	30		dB
	2.00–2.50 GHz	21	26		dB
Return loss (Insertion loss state) Lower freq. return loss is dependent on DC blocks	0.02–1.00 GHz	12	18		dB
	1.00–2.00 GHz	9	13		dB
	2.00–2.50 GHz	7	13		dB
Return loss (Isolation state) Lower freq. return loss is dependent on DC blocks and floating caps	0.02–1.00 GHz	9.5	14		dB
	1.00–2.00 GHz	8.0	11		dB
	2.00–2.50 GHz	7.0	9		dB

Operating Characteristics

V_{CTL} = 0 V/3V, T = 25 °C, P_{INPUT} = 0 dBm, Z_0 = 50 Ω, C_{BLOCK} = 1000 pF, C_{BYPASS} = 1000 pF, unless otherwise noted

| Parameter	Condition	Frequency	Min.	Typ.	Max.	Unit
Switching characteristics Rise/fall time On/Off time	10/90% or 90/10% RF 50% V_{CTL} to 90/10% RF			25 50		ns ns
Input power for 0.1 dB compression	V_{DD} = 3 V	870 MHz	13	16		dBm
Intermodulation intercept point (IP3)	For two tone input power 8 dbm/tone 1 MHz spacing, V_{DD} = 3 V	900 MHz		40		dBm
Control voltages[1]	$V_{CTL\ LOW}$ $V_{CTL\ HIGH}$		0 2.75		0.2 V_{DD}	V V
Supply voltage (V_{DD})			3		5.5	V
Supply currents	V_{DD} = 3 V $V_{CTL\ LOW}$, $V_{CTL\ HIGH}$			5 5		uA uA

1. Control voltages switch the V_{DD} voltage to the GaAs switch.
V_{DD} must be powered on prior to a V_{CTL} high signal. A latch up condition may occur if a logic
high signal is applied prior to the V_{DD} voltage.

Typical Performance Data

V_{CTL} = 0 V/3V, T = 25 °C, P_{INPUT} = 0 dBm, Z_0 = 50 Ω, C_{BLOCK} = 1000 pF, C_{BYPASS} = 1000 pF, unless otherwise noted
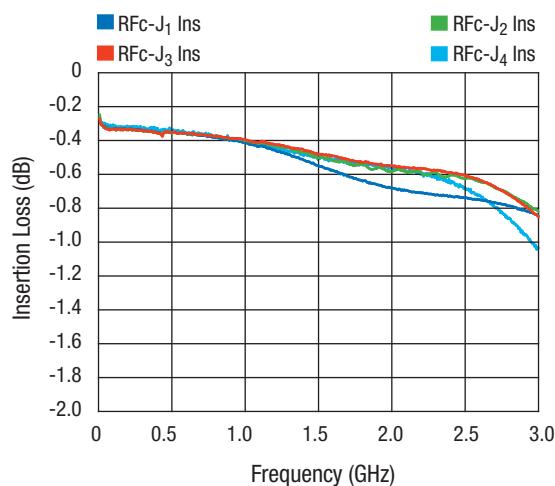
Typical Insertion Loss
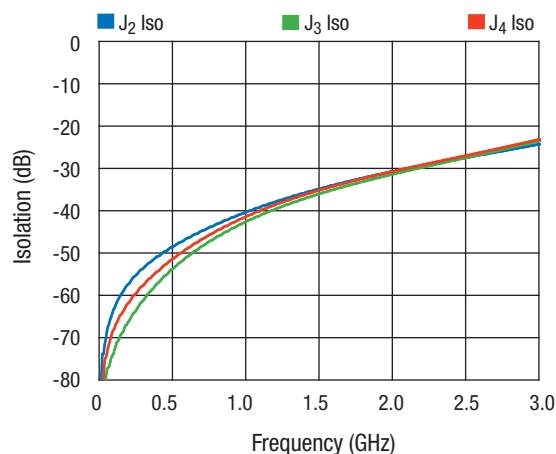


Typical Isolation RFc-J_1 Path On
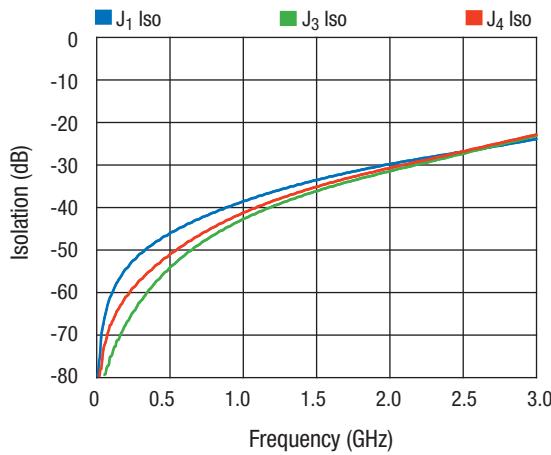
Typical Isolation RFc-J$_2$ Path On
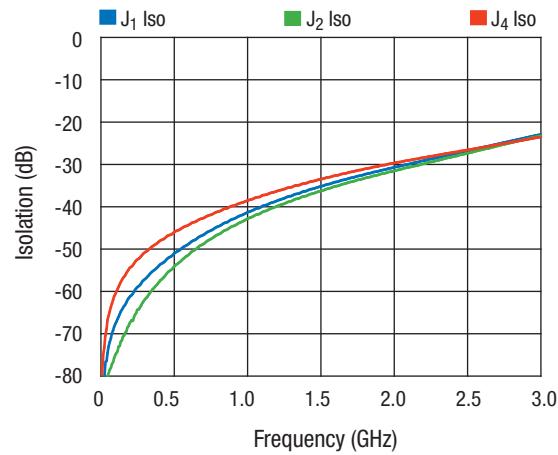
Typical Isolation RFc-J$_3$ Path On
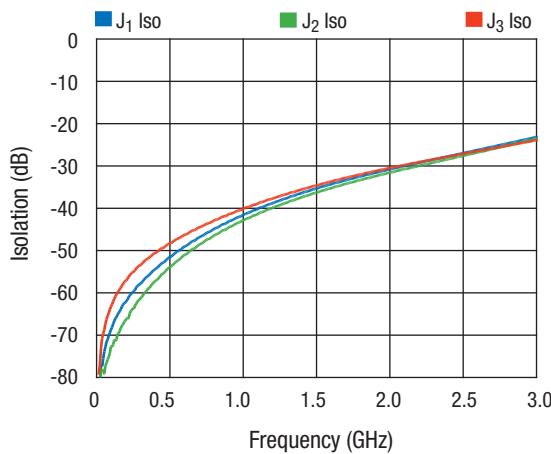
Typical Isolation RFc-J$_4$ Path On
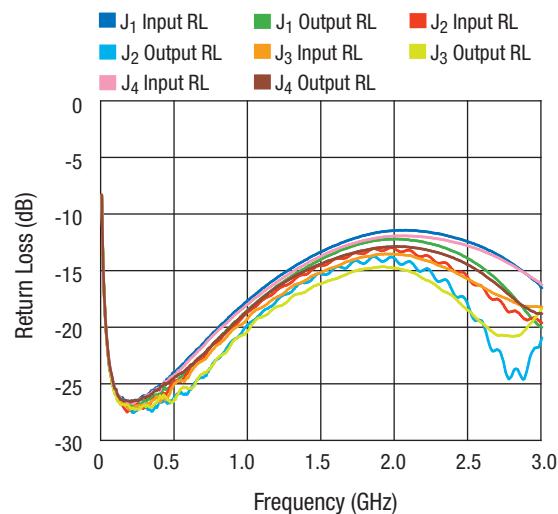
**Typical Return Loss
Insertion Loss States**

**Typical Return Loss
Isolation States**

Skyworks Solutions, Inc. • Phone [781] 376-3000 • Fax [781] 376-3100 • sales@skyworksinc.com • www.skyworksinc.com

200613 Rev. B • Skyworks Proprietary Information • Products and Product Information are Subject to Change Without Notice. • September 18, 2007   3
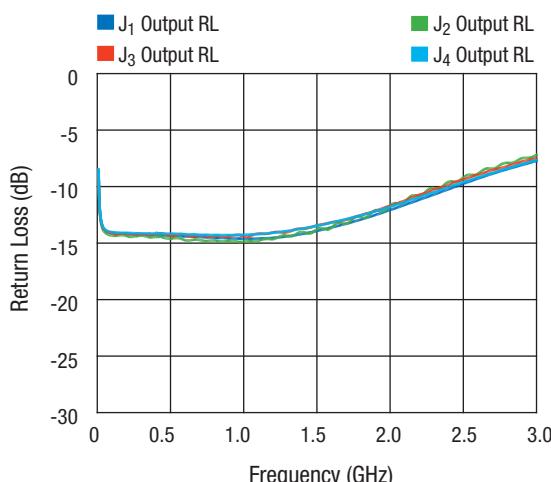
Pin Out
(Top View X-ray of Pads on Bottom of Package)
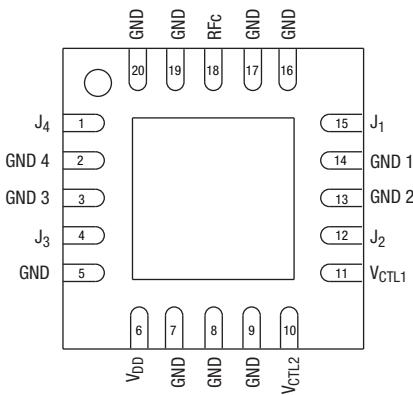
DC blocks are required on RFc, J₁, J₂, J₃, J₄.
Floating caps are required on Gnd 1, Gnd 2, Gnd 3, Gnd 4.

Truth Table

V_{DD}	$V_{CTL\,1}$	$V_{CTL\,2}$	RFc-J_1	RFc-J_2	RFc-J_3	RFc-J_4
1	0	0	Ins. Loss	Isolation	Isolation	Isolation
1	1	0	Isolation	Ins. Loss	Isolation	Isolation
1	0	1	Isolation	Isolation	Ins. Loss	Isolation
1	1	1	Isolation	Isolation	Isolation	Ins. Loss

V_{DD} must be powered on prior to a VCTL hgih signal.
"0" = 0 to 0.2 V.
"1" = 2.75 to V_{DD} V.
V_{DD} = 3 V to 5 V.

Absolute Maximum Ratings

| Characteristic	Value
V_{DD} voltage range	$2.75 \leq V_{DD} \leq 5.5$ V
RF input power @ 5.5 V	1 W, f > 500 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.*

Pin Assignments

Pin	Symbol	Description
1	J_4	RF port. Must be DC blocked with a capacitor appropriate for lowest frequency of operation
2	GND 4	AC Ground for J_4 RF port. Must be DC blocked using a capacitor appropriate for lowest frequency of desired input return loss on J_4 port
3	GND 3	AC Ground for J_3 RF port. Must be DC blocked using a capacitor appropriate for lowest frequency of desired input return loss on J_3 port
4	J_3	RF port. Must be DC blocked with a capacitor appropriate for lowest frequency of operation
5	GND	DC Ground
6	V_{DD}	Supply voltage for decoder
7	GND	DC Ground
8	GND	DC Ground
9	GND	DC Ground
11	$V_{CTL\,1}$	DC control voltage applied to decoder
10	$V_{CTL\,2}$	DC control voltage applied to decoder
12	J_2	RF port. Must be DC blocked with a capacitor appropriate for lowest frequency of operation
13	GND 2	AC Ground for J_2 RF port. Must be DC blocked using a capacitor appropriate for lowest frequency of desired input return loss on J_2 port
14	GND 1	AC Ground for J_1 RF port. Must be DC blocked using a capacitor appropriate for lowest frequency of desired input return loss on J_1 port
15	J_1	RF port. Must be DC blocked with a capacitor appropriate for lowest frequency of operation
16	GND	DC Ground
17	GND	DC Ground
18	RFc	RF common port. Must be DC blocked with a capacitor appropriate for lowest frequency of operation
19	GND	DC Ground
20	GND	DC Ground
Exposed Paddle		DC Ground

Evaluation Board

C_3, C_4 = use cap appropriate for minimum freq. of operation

C_1, C_2 = use cap appropriate for minimum freq. of operation

Use cap value appropriate for minimum freq. of operation C_{BLK} 5 PLACES

Gnd V_{DD} V_{CTL2} V_{CTL1}
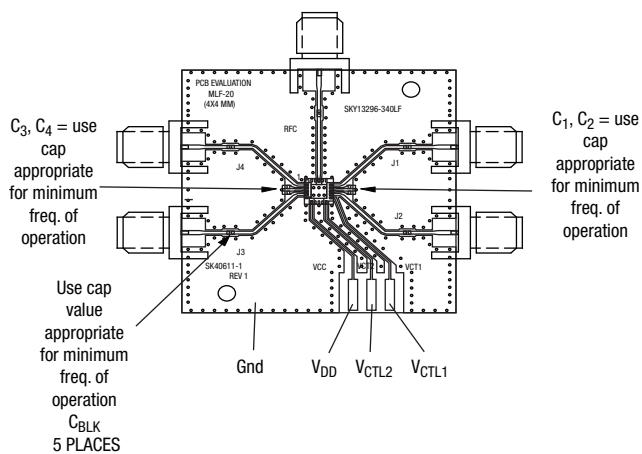
C_{BLOCK} = 1000 pF for operating frequency > 20 MHz.
C_{BYPASS} C_1–C_4 = 1000 pF for operating frequency > 20 MHz.
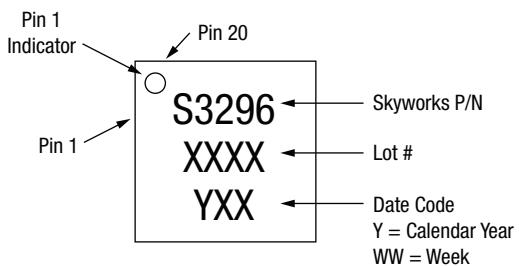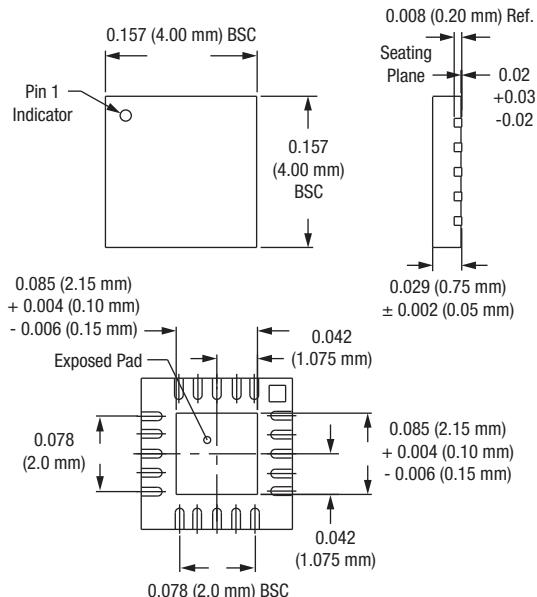
Recommended Solder Reflow Profiles

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.

Part Marking

Pin 1 Indicator

Pin 20

Pin 1

S3296
XXXX
YXX

Skyworks P/N

Lot #

Date Code
Y = Calendar Year
WW = Week

QFN-20 (4 x 4)

0.157 (4.00 mm) BSC

Pin 1 Indicator

0.157 (4.00 mm) BSC

0.085 (2.15 mm) + 0.004 (0.10 mm) - 0.006 (0.15 mm)

Exposed Pad

0.078 (2.0 mm)

0.042 (1.075 mm)

0.042 (1.075 mm)

0.078 (2.0 mm) BSC

0.085 (2.15 mm) + 0.004 (0.10 mm) - 0.006 (0.15 mm)

0.008 (0.20 mm) Ref.

Seating Plane

0.02 +0.03 -0.02

0.029 (0.75 mm) ± 0.002 (0.05 mm)

Skyworks Solutions, Inc. • Phone [781] 376-3000 • Fax [781] 376-3100 • sales@skyworksinc.com • www.skyworksinc.com

6   September 18, 2007 • Skyworks Proprietary Information • Products and Product Information are Subject to Change Without Notice. • 200613 Rev. B