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RF1140

BROADBAND HIGH POWER SP4T SWITCH

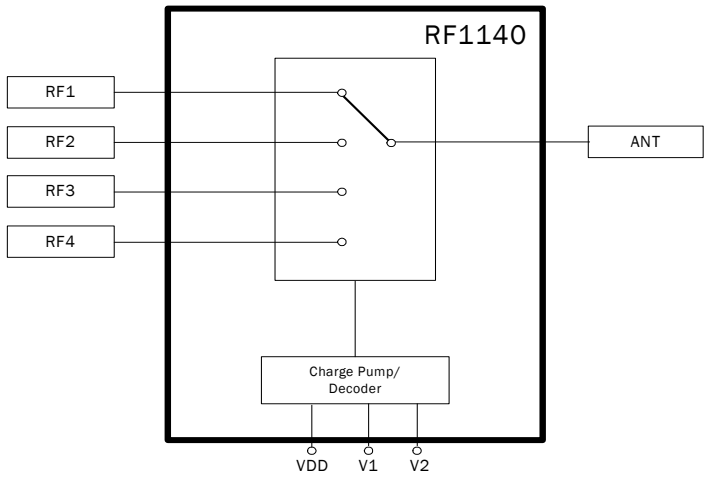
Package Style: QFN, 16-pin, 3mmx3mm

Features

- Low Frequency - 2.5GHz
- Very Low Insertion Loss:
  Cell Band: 0.3dB (Typ.)
  PCS Band: 0.5dB (Typ.)
- High Isolation
  Cell Band: 28dB (Typ.)
  PCS Band: 21dB (Typ.)
- Compatible With Low Voltage Logic: V_{HIGH}=1.8V
- Excellent Linearity Performance (IIP2):
  Cell Band: 114dBm (Typ.)
  PCS Band: 115dBm (Typ.)
- Lowest BOM Cost and Small Solution Size

Applications

- Antenna Tuning Applications
- IEEE802.11b/g WLAN Applications
- Multi-Mode GSM/WCDMA Handsets
- CDMA Primary Path Handsets



Functional Block Diagram

Product Description

The RF1140 is a single-pole four-throw (SP4T) switch designed for general purpose switching applications which require very low insertion loss and high power handling capability. The RF1140 is ideally suited for battery operated applications requiring high performance switching with very low DC power consumption. The RF1140 features low insertion loss, low control voltage, high linearity, and very good harmonic characteristics. Additionally, RF1140 integrates decoding logic, which allows just two control lines needed for switch control. This part is based off RFMD's GaAs pHEMT and is packaged in a very compact 3.0mmx3.0mmx0.55mm, 16-pin, leadless QFN package. No DC-blocking capacitors are required on RF paths, when no DC is applied external to the device ports.

Ordering Information

RF1140	Broadband High Power SP3T Switch
RF1140PCBA-410	Fully Assembled Evaluation Board

Optimum Technology Matching® Applied

☐ GaAs HBT	☐ SiGe BiCMOS	☑ GaAs pHEMT	☐ GaN HEMT
☐ GaAs MESFET	☐ Si BiCMOS	☑ Si CMOS	☐ RF MEMS
☐ InGaP HBT	☐ SiGe HBT	☐ Si BJT	☐ LDMOS

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Absolute Maximum Ratings

Parameter	Rating	Unit
VDD, V1, V2	6.0	V
Maximum Input Power (0.6GHz to 2.5GHz), RF2, RF3, RF4	+38	dBm
Operating Temperature	-30 to +85	°C
Storage Temperature	-65 to +100	°C

Caution! ESD sensitive device.

Exceeding any one or a combination of the Absolute Maximum Rating conditions may cause permanent damage to the device. Extended application of Absolute Maximum Rating conditions to the device may reduce device reliability. Specified typical performance or functional operation of the device under Absolute Maximum Rating conditions is not implied.

RoHS status based on EUDirective2002/95/EC (at time of this document revision).

Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
					VDD=2.6V, V1, V2=High=1.8V, V1, V2=Low=0V, Temp=25°C
Operating Frequency	450		2500	MHz	
Insertion Loss					
RF1-ANT, RF2-ANT, RF3-ANT, RF4 - ANT		0.25	0.40	dB	RF ON, 50MHz to 450MHz
		0.30	0.45	dB	RF ON, 824MHz to 960MHz
		0.50	0.65	dB	RF ON, 1850MHz to 1990MHz
		0.70	0.75	dB	RF ON, 2170MHz to 2500MHz
Isolation					
RF1-ANT, RF2-ANT, RF3-ANT, RF4 - ANT	26	28		dB	RF ON, 824MHz to 960MHz
	19	21		dB	RF ON, 1850MHz to 1990MHz
	18	20		dB	RF ON, 2170MHz to 2500MHz
880MHz Harmonics					
Harmonic (2fo)		-90	-80	dBc	P_{IN}=+35dBm, 880MHz
Third Harmonic (3fo)		-97	-80	dBc	P_{IN}=+35dBm, 880MHz
1800MHz Harmonics					
Harmonic (2fo)		-86	-80	dBc	P_{IN}=+32dBm, 1800MHz
Third Harmonic (3fo)		-81	--75	dBc	P_{IN}=+32dBm, 1800MHz
2500MHz Harmonics					
Harmonic (2fo)		-99	-80	dBc	P_{IN}=+32dBm, 2500MHz
Third Harmonic (3fo)		--94	-80	dBc	P_{IN}=+32dBm, 2500MHz
IIP2					
IIP2 (IMT, PCS, AWS)	105	112		dBm	Tone 1: +26dBm, Tone 2: -20dBm
IIP2 (Cell)	105	110		dBm	Tone 1: +26dBm, Tone 2: -20dBm
RF Port Return Loss					
VSWR			1.5:1		

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Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
Input Power at 0.1dB Compression Point					
	37	38		dBm	
Switching Speed					
		1	5	us	10% to 90% RF, 90% to 10% RF
Triple Beat Ratio					
TBR	85	88		dBc	650MHz to 900MHz[1, 2]
TBR	95	100		dBc	AWS[1, 2]
TBR	83	87		dBc	PCS[1, 2]
DC Supply					
V_{DD} (Switch Supply)	2.5	2.6	3.3	V	
V1 and V2 (H)	1.3	1.8	2.9	V	
V1 and V2 (L)	0		0.4	V	
Control Current			1.5	µA	
Supply Current			0.8	mA	P_{IN}=26dBm

Notes: Parameters hold at 25°C and VDD=2.6V
1. Tested under load with VSWR of 2:1 at all phases
2. Temp= +15°C to +60°C

Switch Control Settings

The switch is operable in four states (see truth table below). The switch is designed for two modes: Active and Stand-by. These modes are controlled by the VDD signal. When VDD is high, the switch is active.

Signal Paths	Control Signals					
Mode	**V1**	**V2**	**S1**	**S2**	**S3**	**S4**
ANT - RF1	Low	Low	ON	OFF	OFF	OFF
ANT - RF2	High	Low	OFF	ON	OFF	OFF
ANT - RF3	Low	High	OFF	OFF	ON	OFF
ANT - RF4	High	High	OFF	OFF	OFF	ON

Electrical Test Methods:
The electrical parameters for the switch were measured on the test evaluation board provided by the switch supplier. The test evaluation board includes means for decoupling RF signals from the control signal port (shunt capacitor at control signal ports).

All measurements were done with the calibration plane at switch pins. The effect of the test board losses and phase delay has been removed from the results.

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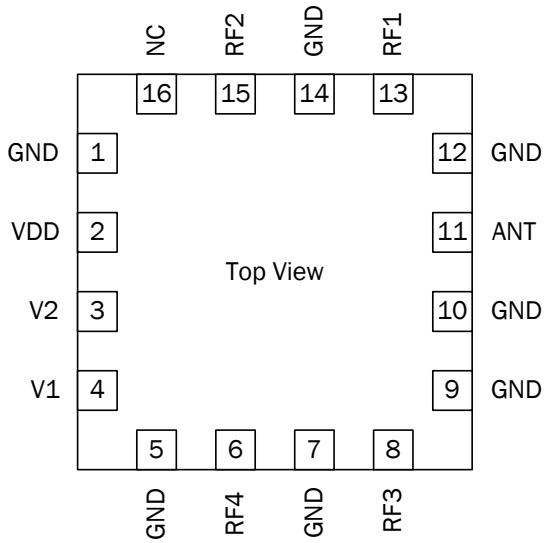
Pin	Function	Description
1	GND	Ground.
2	VDD	DC Voltage Supply.
3	V2	Voltage Control 2.
4	V1	Voltage Control 1.
5	GND	Ground.
6	RF4	RF Output 4.
7	GND	Ground.
8	RF3	RF Output 3.
9	GND	Ground.
10	GND	Ground.
11	ANT	RF Input. Connected to antenna.
12	GND	Ground.
13	RF1	RF Output 1.
14	GND	Ground.
15	RF2	RF Output 2.
16	NC	Can be left floating or grounded.

Pin Configuration



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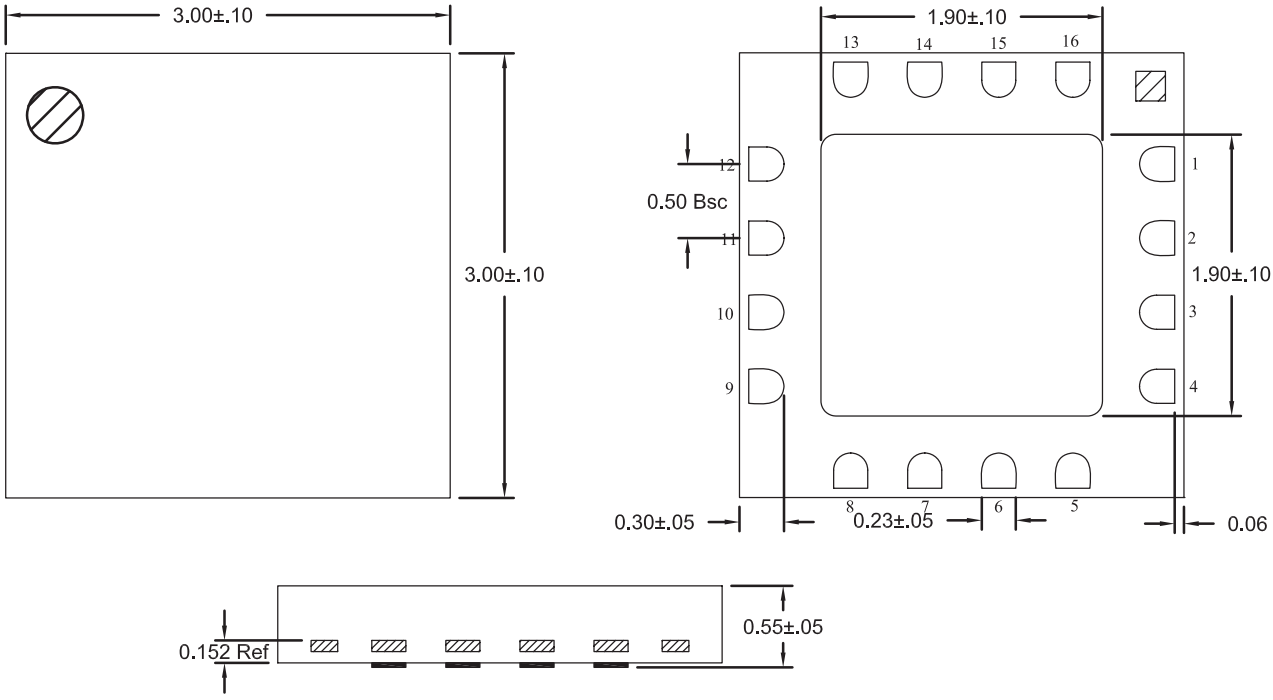
Package Outline



NOTES:
1) PIN 1 SHADED AREA

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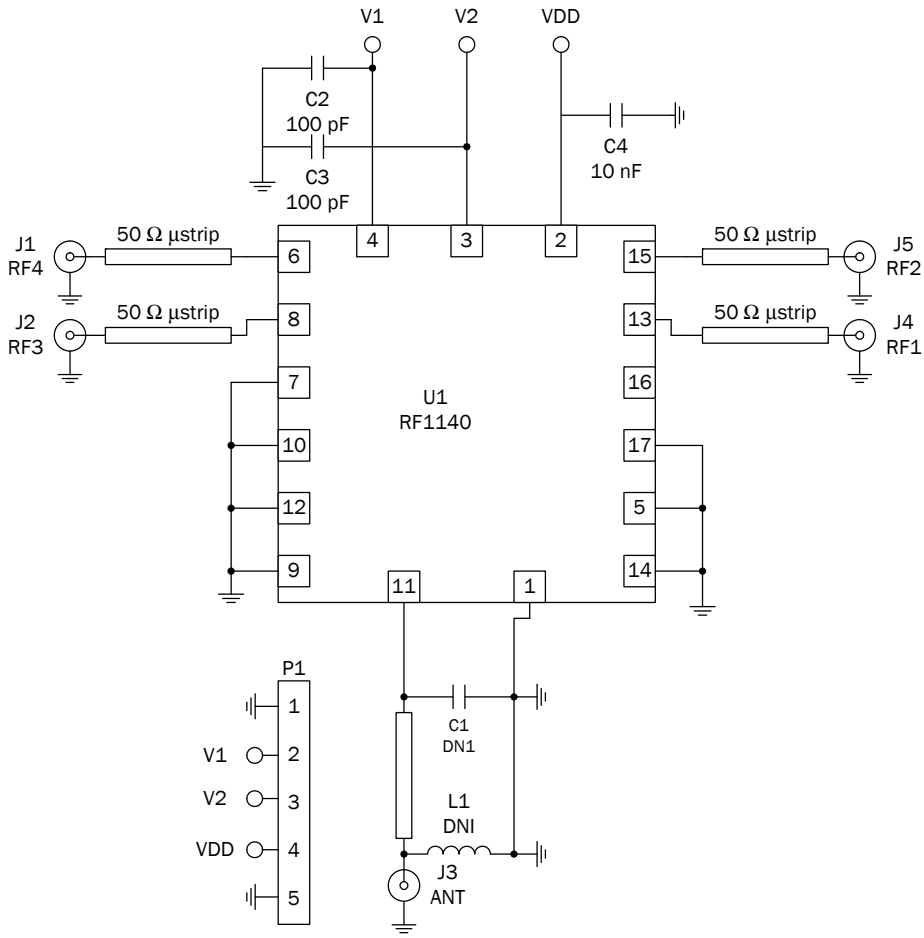
Evaluation Board Schematic



Application Diagram and Guidelines:

The decoupling capacitors are an optional taken and, if necessary, may be used for noise reduction. Decoupling capacitors on the control pins protect the control circuitry from possible RF leakage. DC-blocking capacitors are not needed on the RF paths, as there is no DC on the RF path, however, care should be taken to ensure that DC is not injected in the switch from external circuitry. An ESD filter is needed to protect the switch from antenna ESD events. The filter is formed by LESD inductor and CESD capacitor. The switch has a supply input to feed the built-in logic decoding.

LESD value will depend on the level of ESD protection and the loss acceptable in a given application.

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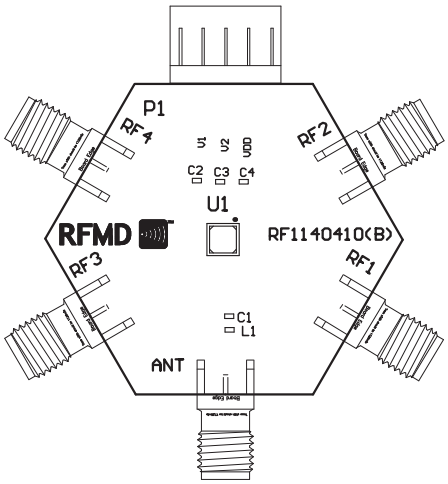
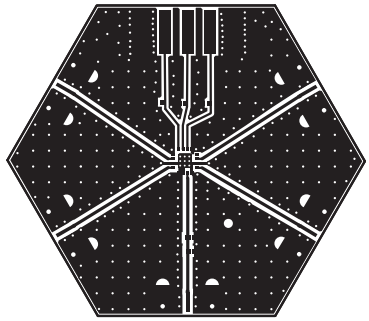
Evaluation Board Layout

Board Thickness 0.0658”, Board Material FR-4

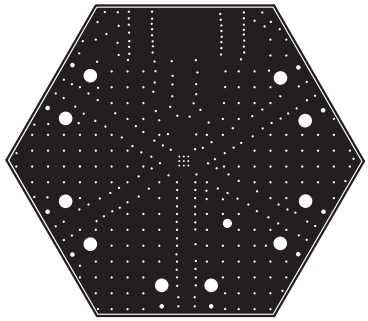
Component Layer



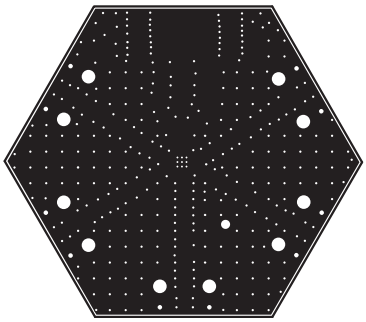
Topside RF Layer



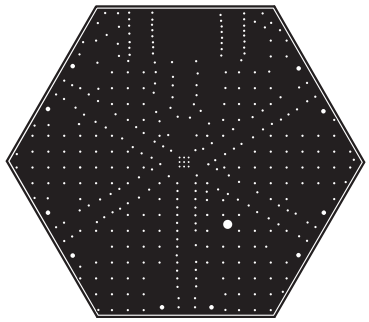
Inner Layer 1



Inner Layer 2



Ground Plane Layer



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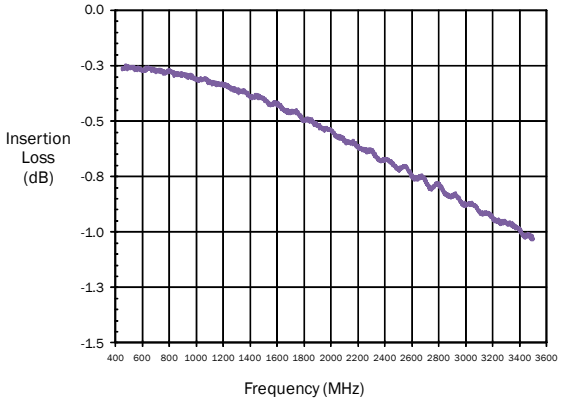
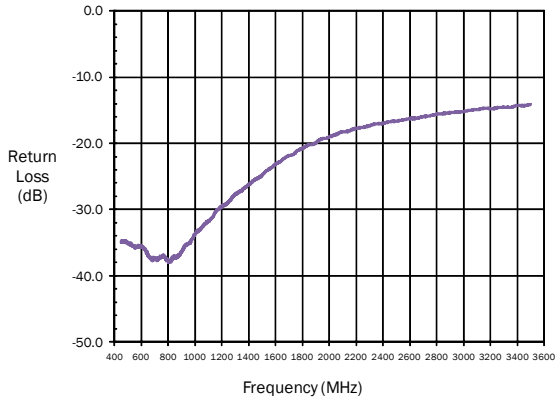
Typical Performance Data on Evaluation Board:

Fixture losses have de-embedded (Temp=25°C, VDD=2.75V, V1 =V2=High=1.8V, V1=V2=Low=0V)

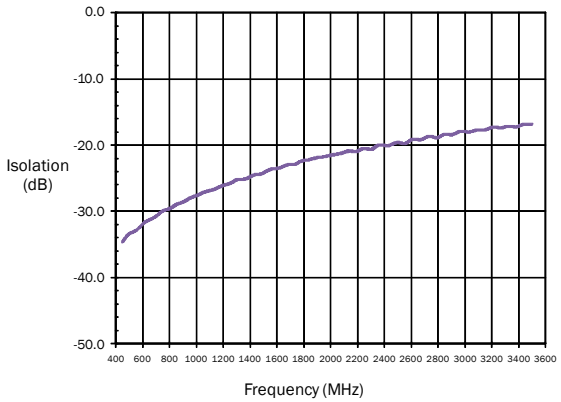
Insertion Loss



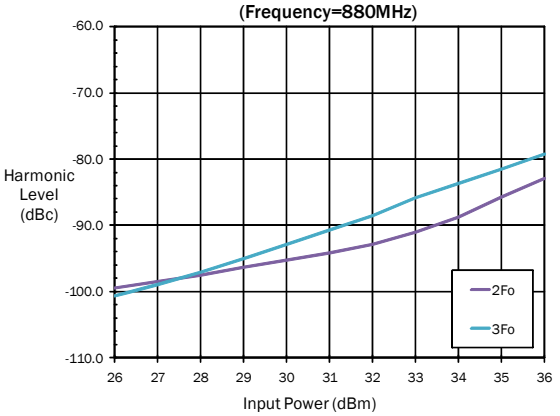
Ant Port Return Loss



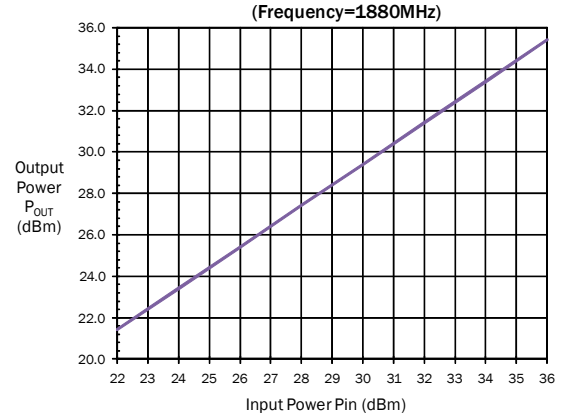
Antenna to Port Isolation



Harmonics (Frequency=880MHz)



Output Power versus Input Power (Frequency=1880MHz)



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