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HIGH ISOLATION SPDT NON-REFLECTIVE SWITCH, 9 kHz - 13 GHz

Typical Applications

The HMC1118LP3DE is ideal for:

- Test Instrumentation
- Microwave Radio & VSAT
- Military Radios, Radar & ECM
- Fiberoptics & Broadband Telecom

Features

- Non-Reflective 50 Ohm Design
- Positive Control: 0/+3.3V
- Low Insertion Loss: 0.68 dB @ 8 GHz
- High Isolation: 50 dB @ 8 GHz
- High Power Handling: 35.5 dBm Through Path
27 dBm Terminated Path
- High Linearity: P1dB: +37 dBm typical
IIP3: +61 dBm typical

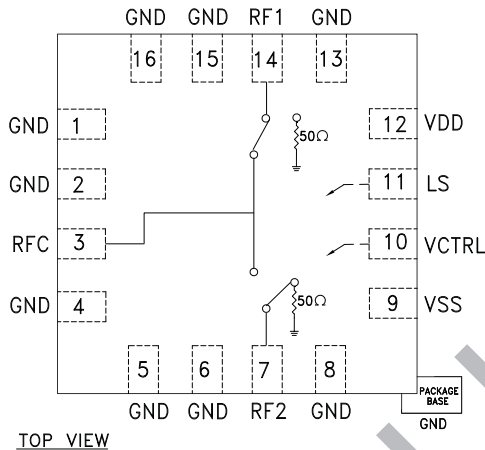
ESD Rating: 2kV HBM

3 x 3 mm 16-Lead QFN SMT Package

No Low Frequency Spurious

Settling Time (0.05 dB Final RF OUT): 7.5 us

Functional Diagram



General Description

The HMC1118LP3DE is a general purpose broadband high isolation, non-reflective SPDT switch in a low cost leadless QFN surface mount package. Covering 9 kHz to 13 GHz, the switch offers high isolation and low insertion loss. The switch features > 47 dB isolation, and 0.6 dB insertion loss up to 8 GHz with 6 us 0.1 dB settling time. The switch operates using positive control voltage logic lines of +3.3/0 V and requires +3.3 V and -2.5 V supplies. The HMC1118LP3DE is packaged in a leadless QFN 3 x 3 mm surface mount package.

Electrical Specifications, $T_A = +25^\circ\text{C}$, $V_{ctl} = 0/+3.3\text{ Vdc}$, $V_{dd} = LS = +3.3\text{ Vdc}$, $V_{ss} = -2.5\text{ Vdc}$, 50 Ohm System

Parameter	Frequency	Min.	Typ.	Max.	Units
Insertion Loss	9 kHz - 3.0 GHz		0.5	1.0	dB
	9 kHz - 8.0 GHz		0.6	1.1	dB
	9 kHz - 10.0 GHz		0.7	1.3	dB
	9 kHz - 13.0 GHz		1.3	2.0	dB
Isolation (RFC to RF1/RF2)	9 kHz - 3.0 GHz	40	50		dB
	9 kHz - 8.0 GHz	40	48		dB
	9 kHz - 10.0 GHz	25	35		dB
	9 kHz - 13.0 GHz	18	25		dB
Return Loss (On State)	9 kHz - 3.0 GHz		26		dB
	9 kHz - 8.0 GHz		22		dB
	9 kHz - 13.0 GHz		9		dB
Return Loss (Off State)	9 kHz - 3.0 GHz		26		dB
	9 kHz - 8.0 GHz		14		dB
	9 kHz - 13.0 GHz		5		dB

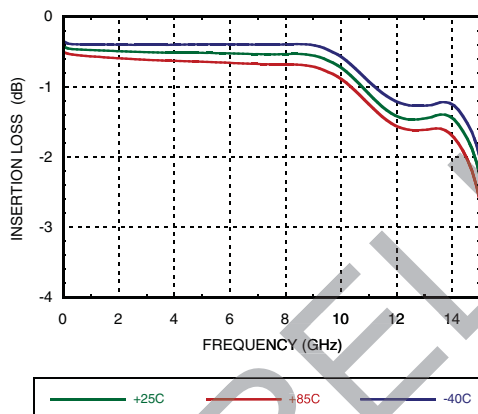


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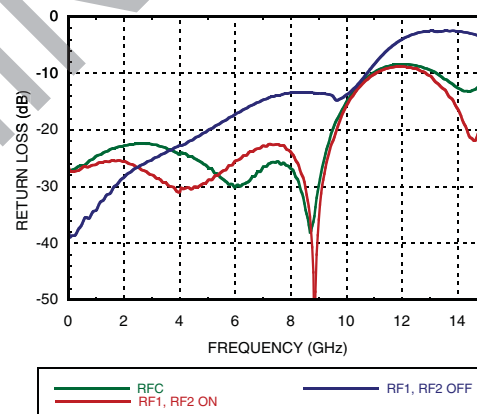
**Electrical Specifications, $T_A = +25^\circ\text{C}$, $V_{ctl} = 0/+3.3\text{ Vdc}$, $V_{dd} = LS = +3.3\text{ Vdc}$,
 $V_{ss} = -2.5\text{ Vdc}$, 50 Ohm System (continued)**

Parameter	Frequency	Min.	Typ.	Max.	Units
Input Power for 1 dB Compression	1 MHz - 13.0 GHz	35	37		dBm
Input Third Order Intercept (Two-Tone Input Power = +14 dBm Each Tone)	1 MHz - 13.0 GHz		62		dBm
RF Settling Time 50% CTL to 0.05 dB Margin to Final RF OUT 50% CTL to 0.1 dB Margin to Final RF OUT			7.5 6		us us
Switching Speed tRISE, tFALL (10/90% RF) tON, tOFF (50% CTL to 10/90% RF)			0.85 2.7		us us

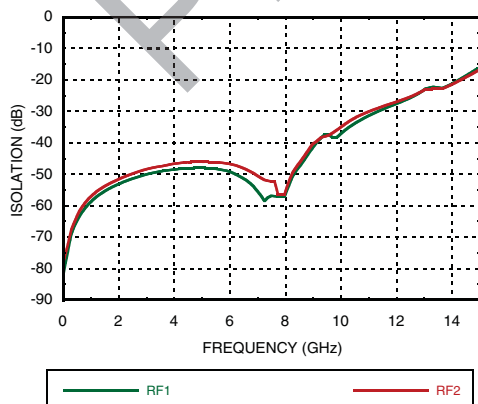
Insertion Loss



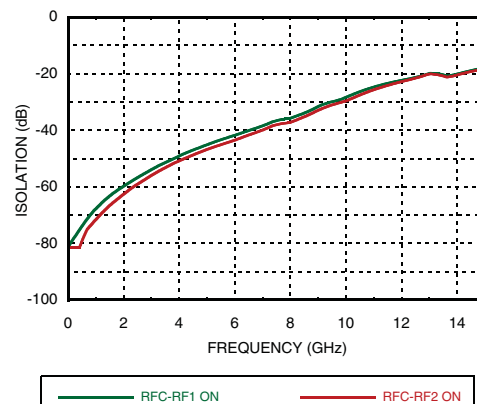
Return Loss



Isolation Between Ports RFC and RF1 / RF2



Isolation Between Ports RF1 and RF2

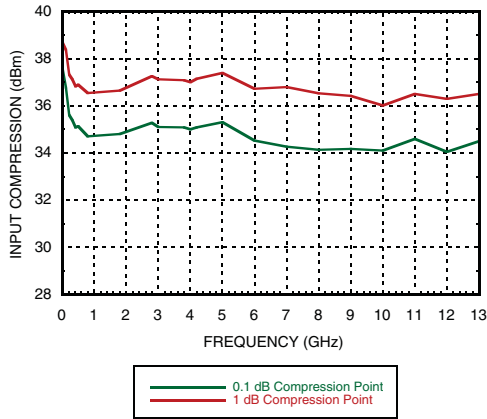




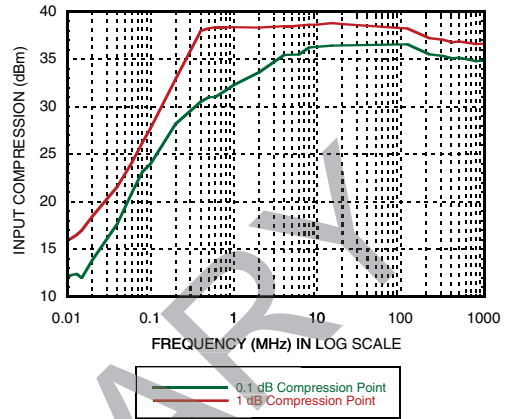
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SWITCHES - SPDT - SMT

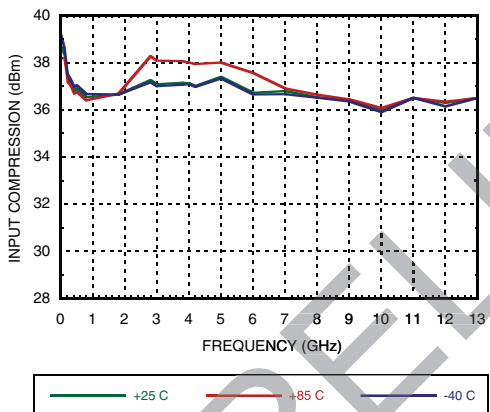
0.1 and 1 dB Input Compression Point



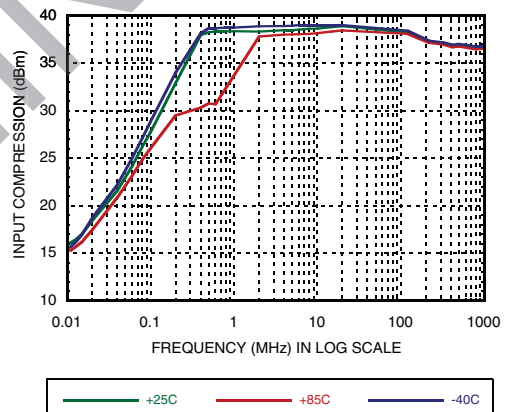
0.1 and 1 dB Input Compression Point (Low Frequency Detail)



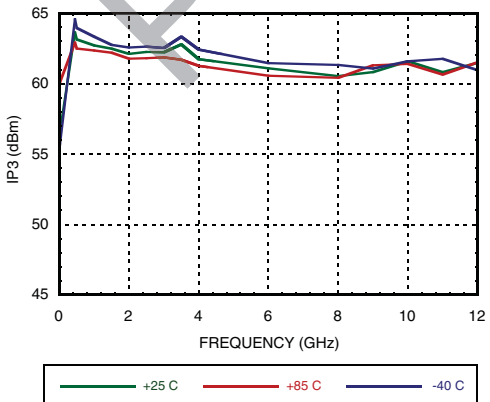
1 dB Input Compression Point over Temp.



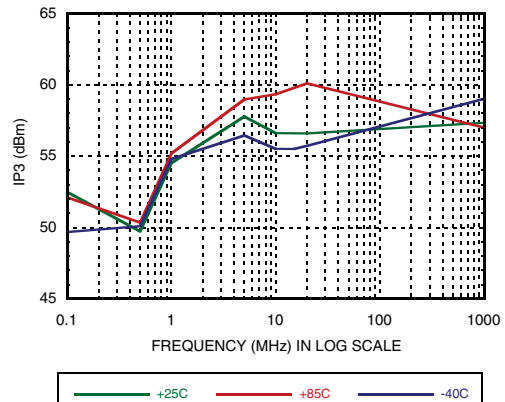
1 dB Input Compression Point over Temp. (Low Frequency Detail)



Input Third Order Intercept Point over Temp.



Input Third Order Intercept Point (Low Frequency Detail)





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Absolute Maximum Ratings

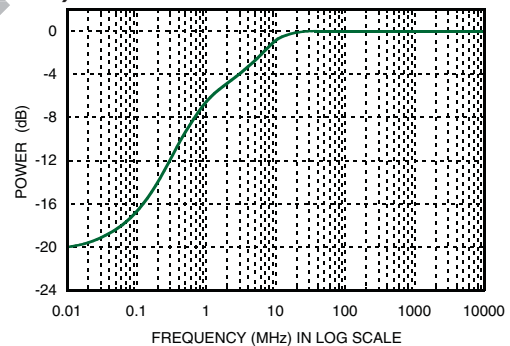
RF Input Power (Vdd/Vctl = +3.3V, Vss = -2.5V) (T = 85 °C) (Freq = 2GHz)	
Through Path	38 dBm
Termination Path	28 dBm
Positive Supply Voltage Range (Vdd)	-0.3 V to +3.7 Vdc
Negative Supply Voltage Range (Vss)	-2.8 V to 0.3 V
Control Voltage Range (Vctl)	-0.3 V to Vdd + 0.3 V
Logic Select Voltage Range (LS)	-0.3 V to Vdd + 0.3 V
Hot Switch Power Level (Vdd = +3.3V) (T = 85 °C) (Freq = 2GHz)	30 dBm
Storage Temperature	-65 to +150 °C
Thermal Resistance	
Through Path	111 °C/W
Termination Path	106 °C/W
Maximum Junction Temperature	125 °C
ESD Sensitivity (HBM)	Class 2

Operating Range

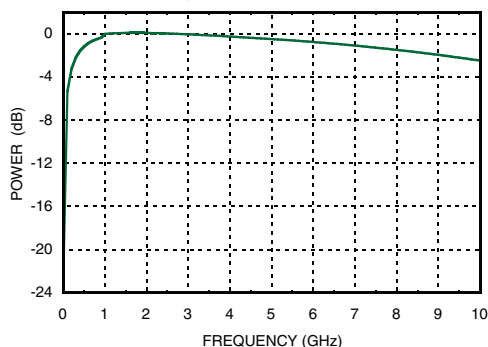
RF Input Power (Vdd/Vctl = +3.3V, Vss = -2.5V) (T = 85 °C) (Freq = 2GHz)	
Through Path	35.5 dBm
Termination Path	27 dBm
Positive Supply Voltage Range (Vdd)	+3.0 V to +3.6 Vdc
Negative Supply Voltage Range (Vss)	-2.75 V to -2.25 V
Control Voltage Range (Vctl)	0 V to Vdd
Logic Select Voltage Range (LS)	0 V to Vdd
Hot Switch Power Level (Vdd = +3.3V) (Freq = 2GHz)	27 dBm
Operating Temperature ^[1]	-40 to +85 °C

[1] At maximum input power. Value will vary with power based on derating.

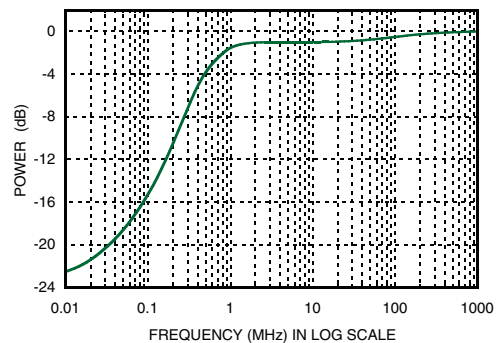
Power Derating (for Hot Switching Power)



Power Derating (Through Path)



Power Derating (Through Path) (Low Frequency Detail)



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Bias Voltage & Current

Vdd Range = +3.3 Vdc ± 10% Vss Range = -2.5 Vdc ± 10%					
Vdd (Vdc)	Vss (Vdc)	Idd (Typ.) (uA)	Iss (Typ.) (uA)	Idd (Max.) (uA)	Iss (Max.) (uA)
+3.3	-2.5	20	0.5	200	10

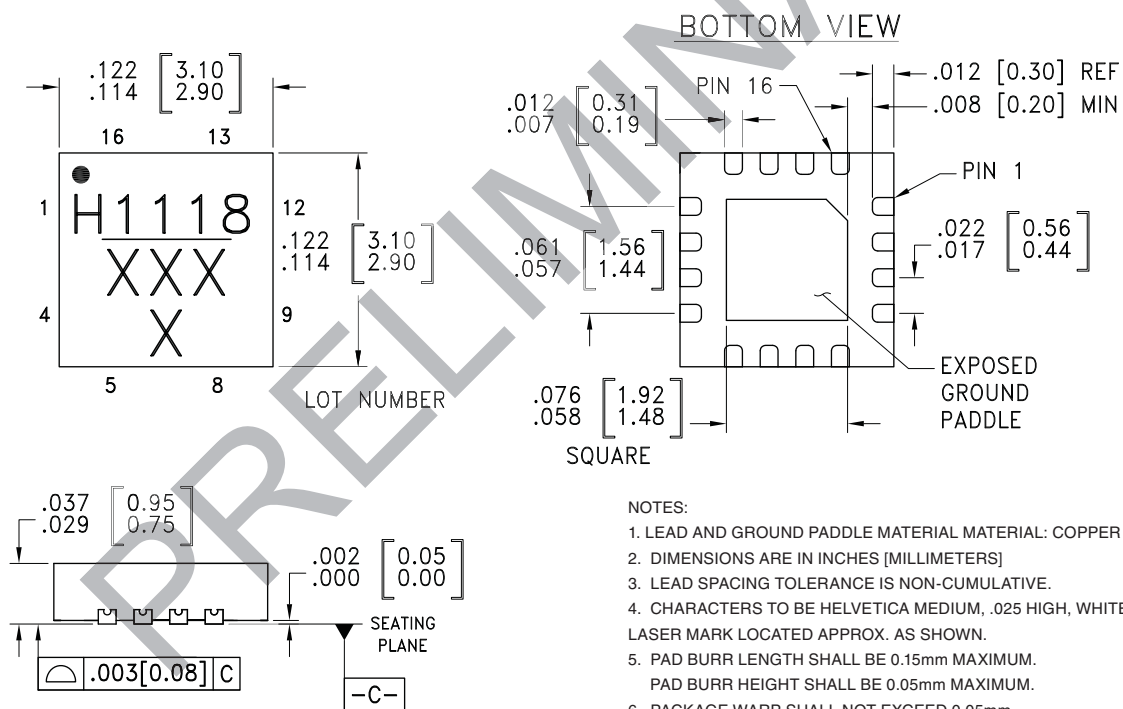
TTL/CMOS Control Voltages

State	Bias Condition
Low	-0.3 to +0.8 Vdc @ <1 μA Typical
High	2.0 to Vdd + 0.3 Vdc @ <1 μA Typical

Truth Table

Control Input		Signal Path State	
LS	Vctl	RFC - RF1	RFC - RF2
High	Low	ON	OFF
High	High	OFF	ON
Low	Low	OFF	ON
Low	High	ON	OFF

Outline Drawing



NOTES:

1. LEAD AND GROUND PADDLE MATERIAL: COPPER ALLOY
2. DIMENSIONS ARE IN INCHES [MILLIMETERS]
3. LEAD SPACING TOLERANCE IS NON-CUMULATIVE.
4. CHARACTERS TO BE HELVETICA MEDIUM, .025 HIGH, WHITE INK, OR LASER MARK LOCATED APPROX. AS SHOWN.
5. PAD BURR LENGTH SHALL BE 0.15mm MAXIMUM.
PAD BURR HEIGHT SHALL BE 0.05mm MAXIMUM.
6. PACKAGE WARP SHALL NOT EXCEED 0.05mm.
7. ALL GROUND LEADS AND GROUND PADDLE MUST BE SOLDERED TO PCB RF GROUND.
8. REFER TO HITTITE APPLICATION NOTE FOR SUGGESTED LAND PATTERN.

Package Information

Part Number	Package Body Material	Lead Finish	MSL Rating	Package Marking ^[1]
HMC1118LP3DE	RoHS-compliant Low Stress Injection Molded Plastic	NiPdAu	MSL1 ^[2]	H1118 XXXX

[1] 4-Digit lot number XXXX

[2] Max peak reflow temperature of 260 °C

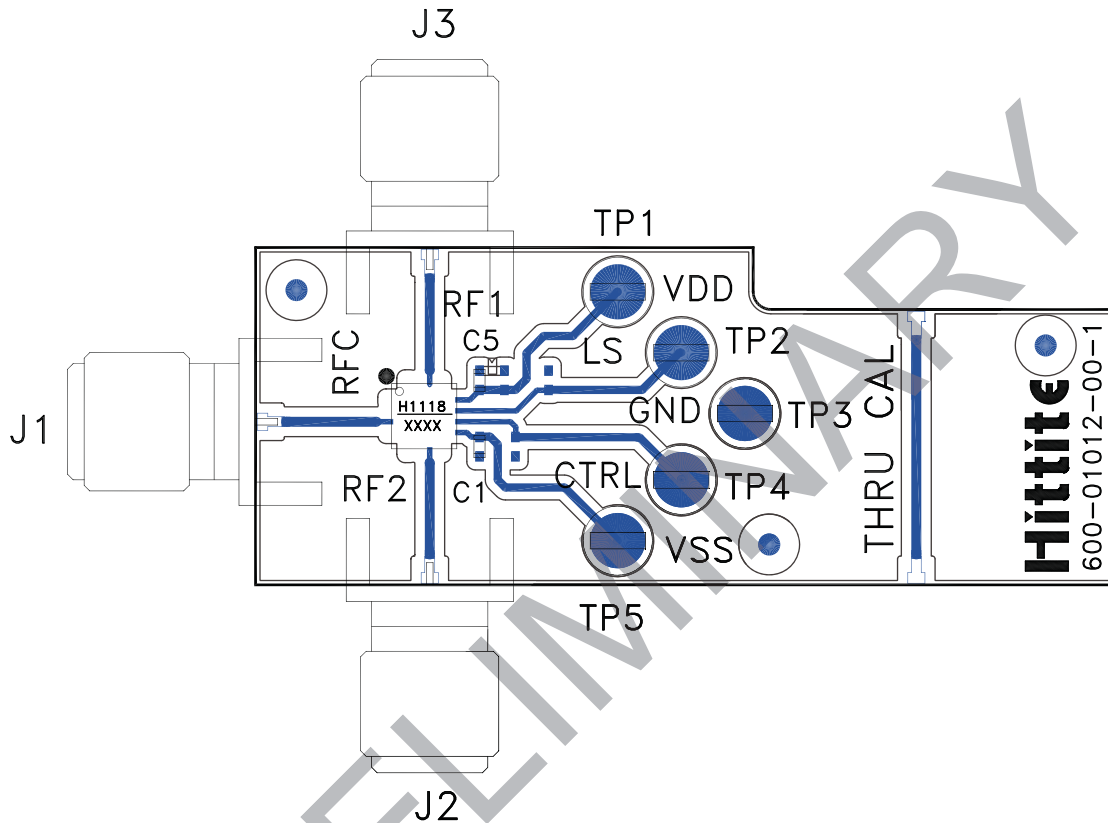


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Pin Descriptions

Pin Number	Function	Description	Interface Schematic
1, 2, 4, 5, 6, 8, 13, 15, 16	GND	Package bottom must also be connected to PCB RF ground.	
3, 7, 14	RFC, RF1, RF2	These pins are DC coupled and matched to 50 Ohms. Blocking capacitors are required if RF line potential is not equal to 0 Vdc.	
9	Vss	Negative supply voltage.	
10	Vctl	Control input. See truth and control voltage tables.	
11	LS	Logic select input. See truth table.	
12	VDD	Positive supply voltage.	

Evaluation PCB



List of Materials for Evaluation PCB EV1HMC1118LP3D [1]

Item	Description
J1 - J3	PC Mount SMA RF Connector
TP1-TP5	Thru Hole Mount Test Point
C1, C5	100 pF Capacitor, 0402 Pkg.
U1	HMC1118LP3DE SPDT Switch
PCB [2]	600-01012-00-1 Evaluation PCB

[1] Reference this number when ordering complete evaluation PCB

[2] Circuit Board Material: Rogers 4350

The circuit board used in the application should be generated with proper RF circuit design techniques. Signal lines at the RF port should have 50 Ohm impedance and the package ground leads and backside ground slug should be connected directly to the ground plane similar to that shown above. The evaluation circuit board shown above is available from Hittite Microwave Corporation upon request.