HMC922LP4E

v02.0213

GaAs MMIC NON-REFLECTIVE DIFFERENTIAL SPDT SWITCH, DC - 4 GHz

Typical Applications

The HMC922LP4E is ideal for:

- Test & Measurement Equipment
- Antenna Diversity & Selector Selection
- Broadband Switch Matrices
- Military, EW & ECM
- SATCOM & Space

Features

Differential SPDT Functionality

Low Insertion Loss: 0.8 dB

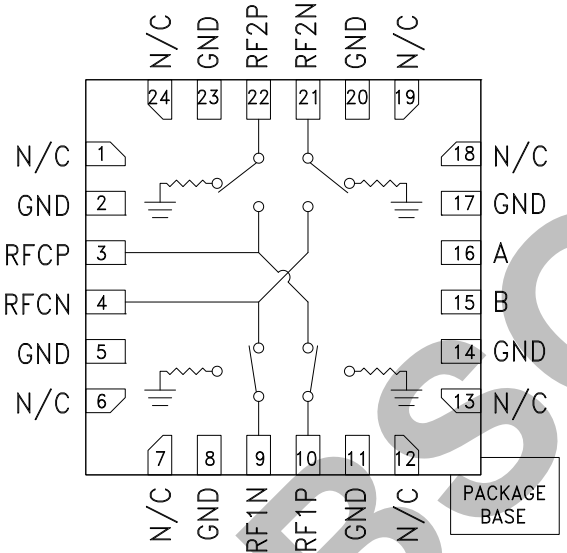
High IP3: +50 dBm

High Input P1dB: +35 dBm

Positive Control: 0/+3V to 0/+5V

24 Lead 4x4 mm QFN Package: 16 mm²

Functional Diagram



General Description

The HMC922LP4E is a DC to 4 GHz high isolation GaAs MMIC non-reflective Differential SPDT switch in a low cost leadless surface mount package. The switch is ideal for antenna diversity & selector selection, broadband switch matrices, test & measurement equipment, military and space applications yielding up to 60 dB isolation, low 0.8 dB insertion loss and +50 dBm input IP3. Power handling is excellent with the switch offering a P1dB compression point of +35 dBm. On-chip circuitry allows two positive voltage controls of 0/+3V to 0/+5V at very low DC currents.

Electrical Specifications, T_A = +25° C, Vctl = 0/+3 Vdc (Unless Otherwise Stated), 50 Ohm System

Parameter		Frequency	Min.	Typ.	Max.	Units
Insertion Loss		DC - 2.0 GHz 2.0 - 4.0 GHz		0.8 1.2	1.2 1.5	dB dB
Isolation:	State 1: RFCN-RF2P, RFCN-RF2N, RFCP-RF2N, RFCP-RF2P State 2: RFCN-RF1P, RFCN-RF1N, RFCP-RF1N, RFCP-RF1P	DC - 2.0 GHz 2.0 - 4.0 GHz	45 40	60 45		dB dB
Isolation	State 1: RFCN-RF1P, RFCP-RF1N State 2: RFCN-RF2P, RFCP-RF2N	DC - 2.0 GHz 2.0 - 4.0 GHz	30 20	40 30		dB dB
Return Loss (On State, Any Port)		DC - 2.0 GHz 2.0 - 4.0 GHz		20 15		dB dB
Input Power for 1 dB Compression	Vctl= 0/+3V Vctl= 0/+5V	0.5 - 4.0 GHz		30 35		dBm dBm
Input Power for 0.1 dB Compression	Vctl= 0/+3V Vctl= 0/+5V	0.5 - 4.0 GHz		27 32		dBm dBm
Input Third Order Intercept (Two-Tone Input Power= +7 dBm Each Tone)	Vctl= 0/+3V Vctl= 0/+5V	0.5 - 4.0 GHz		50 50		dBm dBm
Switching Characteristics		DC - 4.0 GHz				
	tRISE / tFALL (10/90% RF)			15		ns
	tON / tOFF (50% CTL to 10/90% RF)			40		ns

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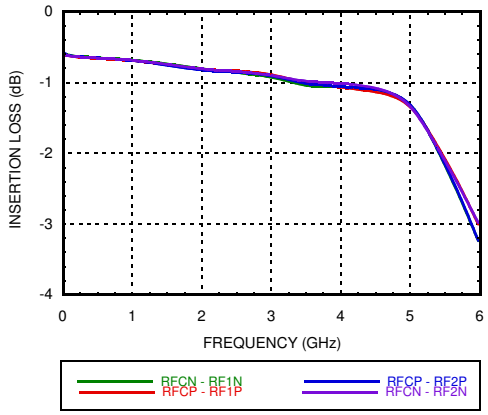
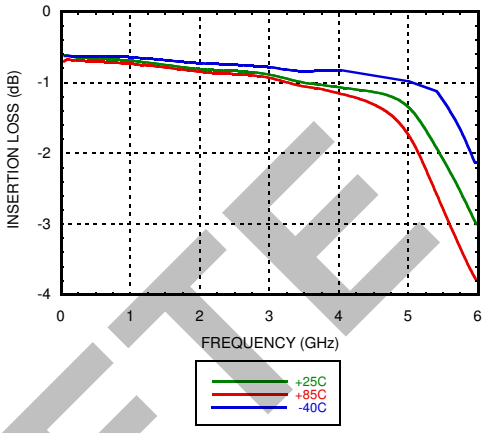
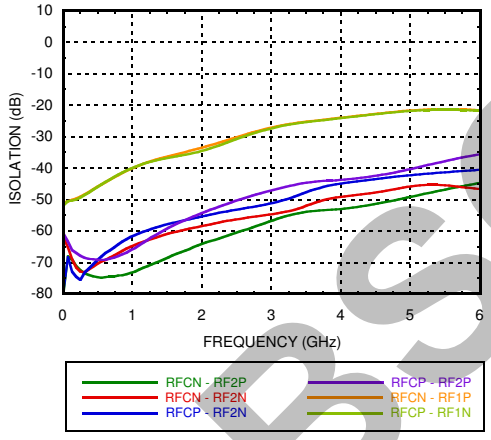
Insertion Loss



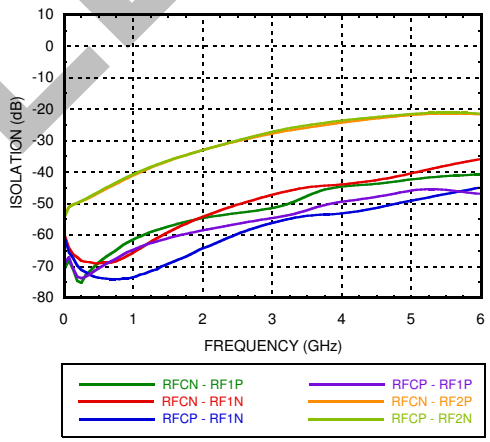
Insertion Loss vs. Temperature



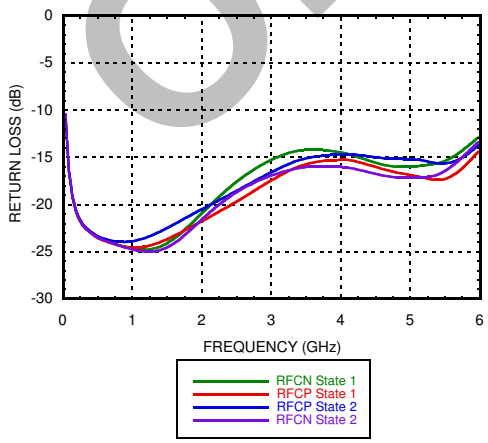
Isolation State 1



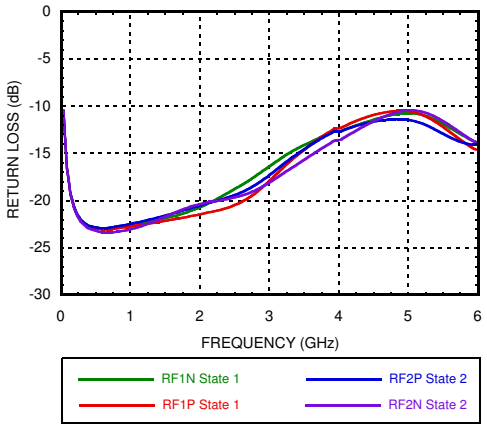
Isolation State 2



Return Loss RFC



Return Loss RF1, 2



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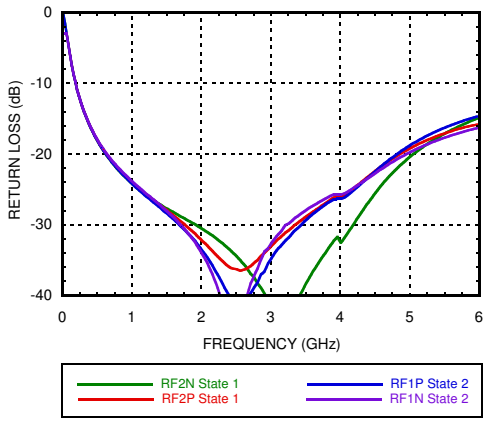
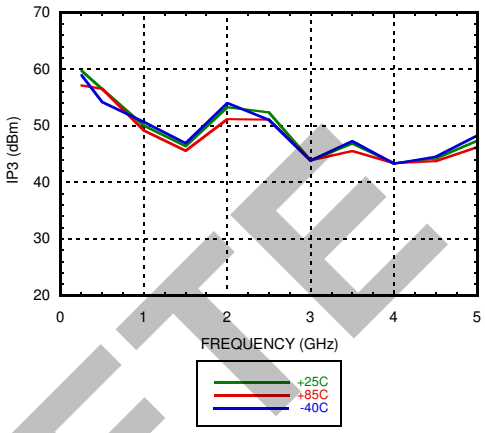
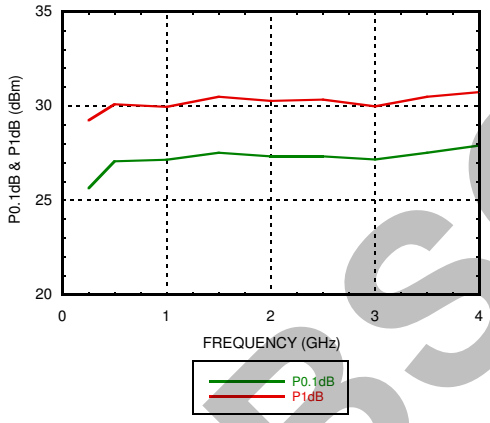
Off State Return Loss



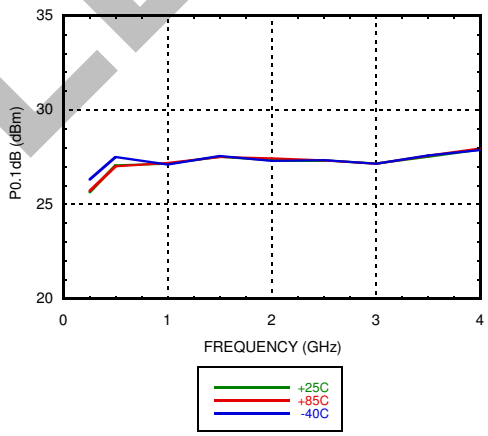
Input IP3* @ 3V



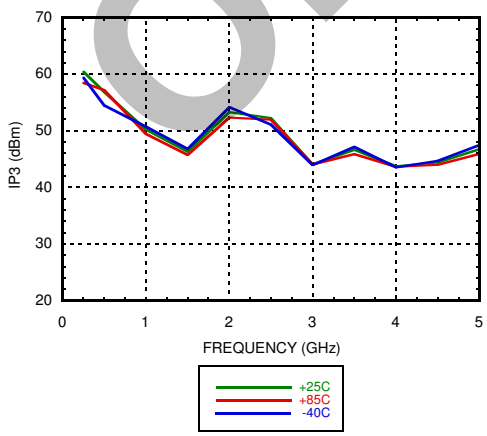
Input 0.1dB & 1 dB Compression Point @ 3V



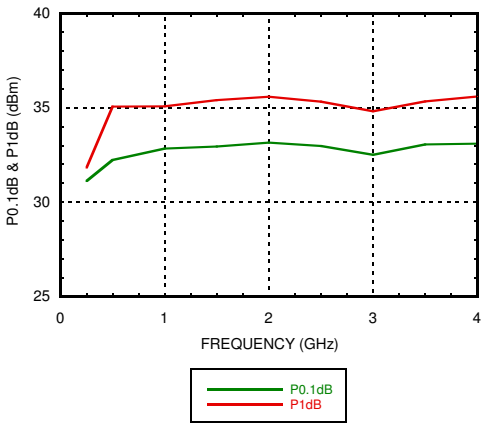
Input 0.1dB Compression Point vs. Temperature @ 3V



Input IP3 * @ 5V



Input 0.1 dB & 1 dB Compression Point @ 5V



** Two-tone input power = +7 dBm each tone, 1 MHz spacing.*

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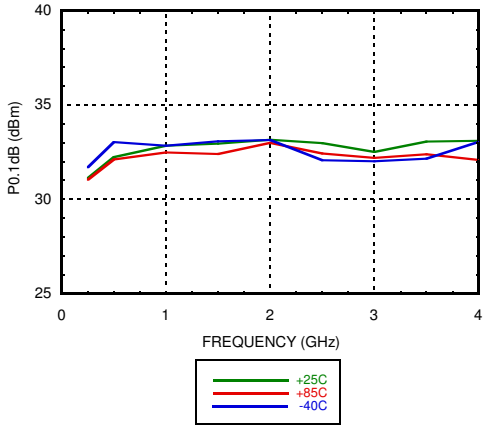
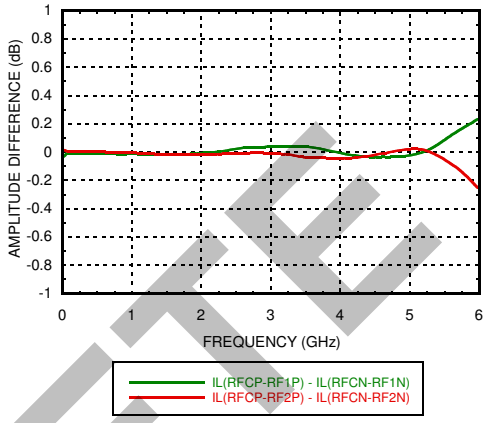
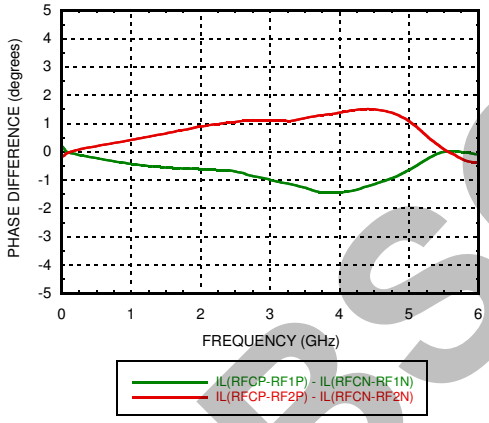
Input 0.1 dB Compression Point vs. Temperature @ 5V



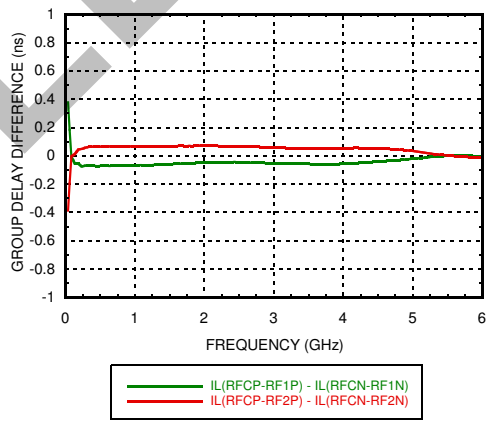
Insertion Loss Amplitude Mismatch



Insertion Loss Phase Mismatch



Group Delay Mismatch



Absolute Maximum Ratings

Control Voltage (A, B)	-0.5V to 8V DC
RF Input Power Through Path 3V/5V Termination Path 3V/5V	 32 / 34 dBm 26 dBm
Channel Temperature	150 °C
Thermal Resistance (channel to package ground paddle) Through Path Termination Path	 30 °C/W 79 °C/W
Storage Temperature	-65 to +150 °C
Operating Temperature	-40 to +85 °C
ESD Sensitivity (HBM)	Class 1A

ELECTROSTATIC SENSITIVE DEVICE
OBSERVE HANDLING PRECAUTIONS

Control Voltages

State	Bias Condition
Low	0 to +0.5 Vdc @ < 1 µA Typ.
High	+3.0 to +5.5 Vdc @ 20 µA Typ.

Truth Table

	Control Input		Signal Path State	
	A	B	RFCP to:	RFCN to:
State 1	High	Low	RF1P	RF1N
State 2	Low	High	RF2P	RF2N

Do not operate continuously at RF power input greater than 1 dB compression and do not hot switch power levels grater than +27 dBm for control = 0/+3 Vdc, or +30 dBm for control = 0/+5 Vdc.

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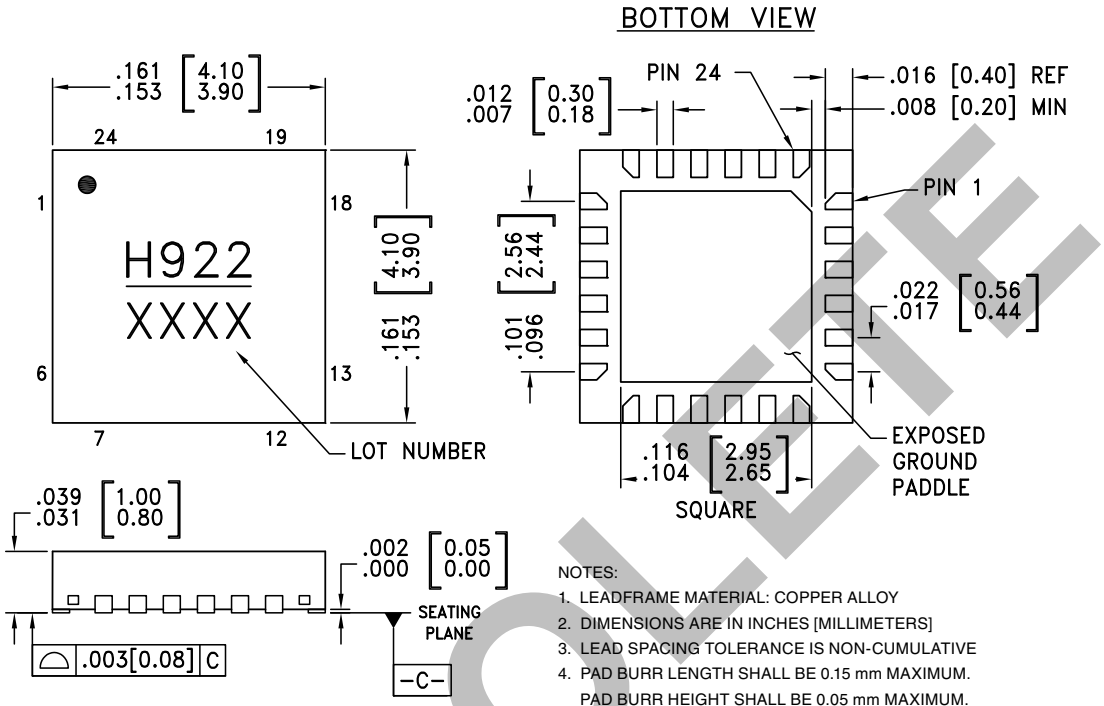
Outline Drawing



NOTES:

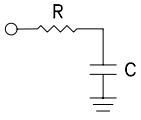
1. LEADFRAME MATERIAL: COPPER ALLOY
2. DIMENSIONS ARE IN INCHES [MILLIMETERS]
3. LEAD SPACING TOLERANCE IS NON-CUMULATIVE
4. PAD BURR LENGTH SHALL BE 0.15 mm MAXIMUM. PAD BURR HEIGHT SHALL BE 0.05 mm MAXIMUM.
5. PACKAGE WARP SHALL NOT EXCEED 0.05 mm.
6. ALL GROUND LEADS AND GROUND PADDLE MUST BE SOLDERED TO PCB RF GROUND.
7. REFER TO HITTITE APPLICATION NOTE FOR SUGGESTED LAND PATTERN.

Package Information

Part Number	Package Body Material	Lead Finish	MSL Rating	Package Marking [1]
HMC922LP4E	RoHS-compliant Low Stress Injection Molded Plastic	100% matte Sn	MSL1 [2]	H922 XXXX

[1] 4-Digit lot number XXXX
[2] Max peak reflow temperature of 260 °C

Pin Descriptions

Pin Number	Function	Description	Interface Schematic
3, 4, 9, 10, 21, 22	RFCP, RFCN, RF1N, RF1P, RF2N, RF2P	These pins are DC coupled and matched to 50 Ohms. Blocking capacitors are required.	
1, 6, 7, 12, 13, 18, 19, 24	N/C	The pins are not connected internally; however, all data shown herein was measured with these pins connected to RF/DC ground externally.	
2, 5, 8, 11, 14, 17, 20, 23	GND	Package bottom has exposed metal paddle that must be connected to PCB RF ground as well.	
16	A	See truth and control voltage tables.	
15	B	See truth and control voltage tables.	

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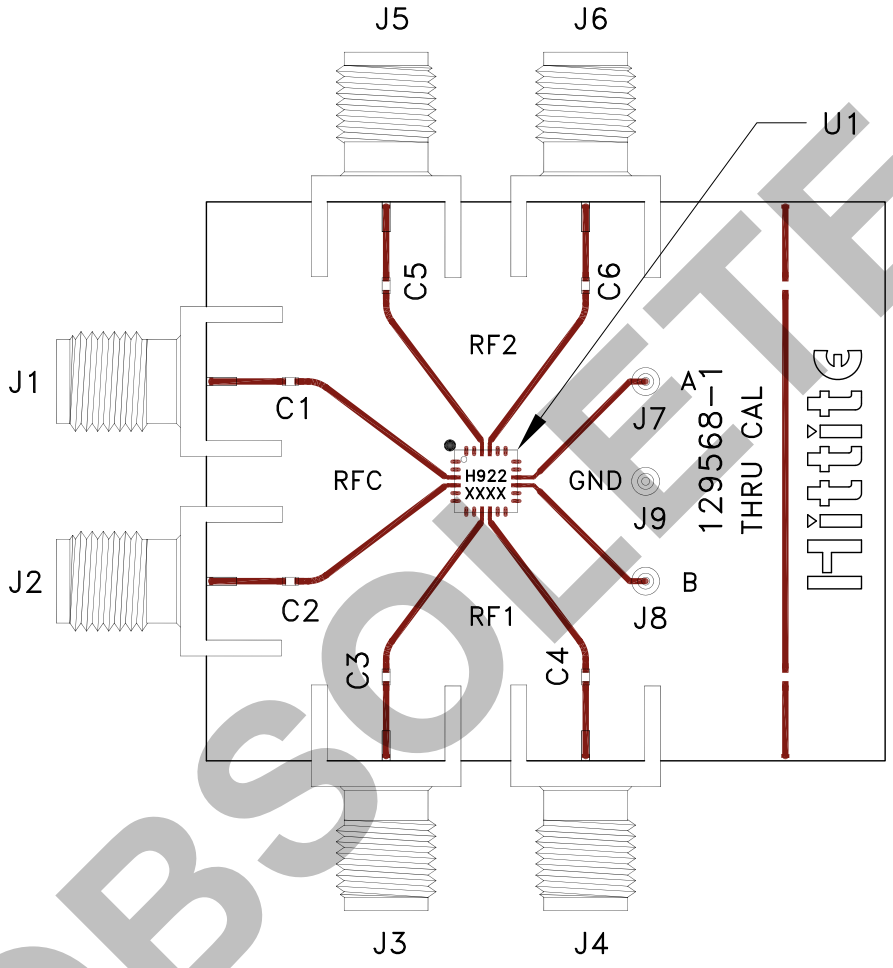
Evaluation PCB



List of Materials for Evaluation PCB 129570 [1]

Item	Description
J1 - J6	PCB Mount SMA RF Connector
J7 - J9	DC Pin
C1 - C6	330 pF Capacitor, 0402 Pkg.
U1	HMC922LP4E SPDT Switch
PCB [2]	129568 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 use RF circuit design techniques. Signal lines should have 50 Ohm impedance while the package ground leads and exposed paddle should be connected directly to the ground plane similar to that shown above. A sufficient number of via holes should be used to connect the top and bottom ground planes. The evaluation circuit board shown above is available from Hittite upon request.

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