

## GAAS MMIC SP8T NON-REFLECTIVE SWITCH, DC - 8 GHz

### Typical Applications

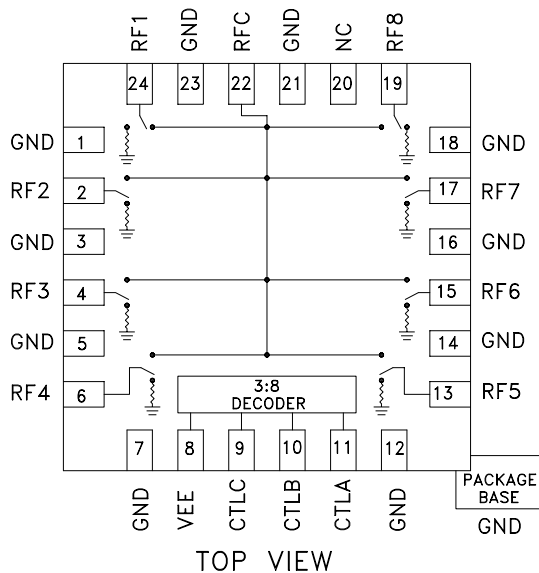
This switch is suitable for usage in DC - 8.0 GHz 50-Ohm or 75-Ohm systems:

- Broadband
- Fiber Optics
- Switched Filter Banks
- Wireless below 8 GHz

### Features

- Broadband Performance: DC - 8.0 GHz
- High Isolation: >30 dB@ 6 GHz
- Low Insertion Loss: 2.4 dB@ 6 GHz
- Integrated 3:8 TTL Decoder
- 24 Lead 4x4mm QFN Package: 9 mm<sup>2</sup>

### Functional Diagram



### General Description

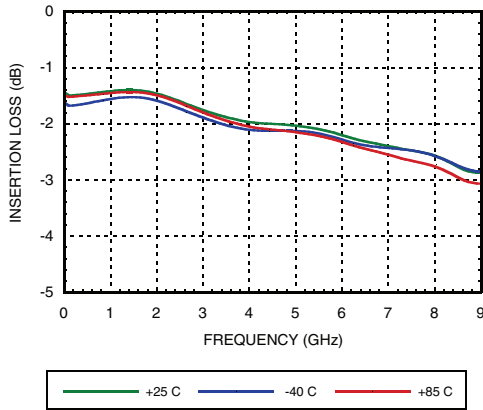
The HMC322ALP4E is a broadband non-reflective GaAs MESFET SP8T switch in a low cost leadless surface mount package. Covering DC to 8 GHz, this switch offers high isolation and low insertion loss. This switch also includes an on board binary decoder circuit which reduces the required logic control lines to three. The switch operates using a negative control voltage of 0/-5 volts, and requires a fixed bias of -5V. This switch is suitable for usage in 50-Ohm or 75-Ohm systems.

### Electrical Specifications, $T_A = +25^\circ \text{C}$ , With 0/-5V Control, 50 Ohm System

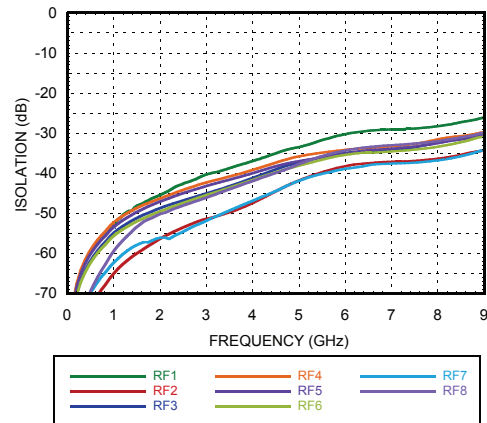
Parameter	Frequency	Min.	Typ.	Max.	Units
Insertion Loss	DC - 2.0 GHz		1.8	2.5	dB
	DC - 4.0 GHz		2.0	2.7	dB
	DC - 8.0 GHz		2.5	2.9	dB
Isolation	DC - 2.0 GHz	35	50		dB
	DC - 4.0 GHz	30	45		dB
	DC - 6.0 GHz	25	40		dB
	DC - 8.0 GHz	20	35		dB
Return Loss	"On State"	DC - 2.0 GHz	9	17	dB
		DC - 8.0 GHz	6	15	dB
Return Loss	"Off State"	DC - 8.0 GHz	7	20	dB
Input Power for 1 dB Compression	0.5 - 8.0 GHz	19	26		dBm
Input Third Order Intercept (Two-Tone Input Power = +7 dBm Each Tone)	0.5 - 8.0 GHz	36	40		dBm
Switching Characteristics tRISE, tFALL (10/90% RF)	DC - 8.0 GHz		25		ns
		tON, tOFF (50% CTL to 10/90% RF)		150	

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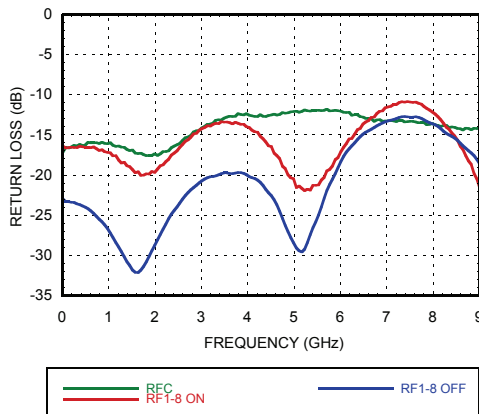
**Insertion Loss vs. Temperature**



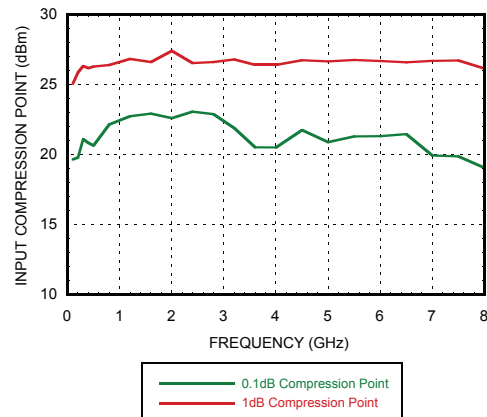
**Isolation**



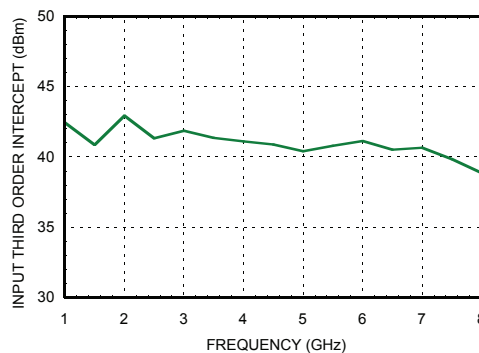
**Return Loss**



**0.1 and 1 dB Input Compression Point**



**Input Third Order Intercept Point**



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### Bias Voltage & Current

Vee Range = -5.0 Vdc $\pm$ 10%		
Vee (Vdc)	I <sub>ee</sub> (Typ.) (mA)	I <sub>ee</sub> (Max.) (mA)
-5.0	5.0	9.0

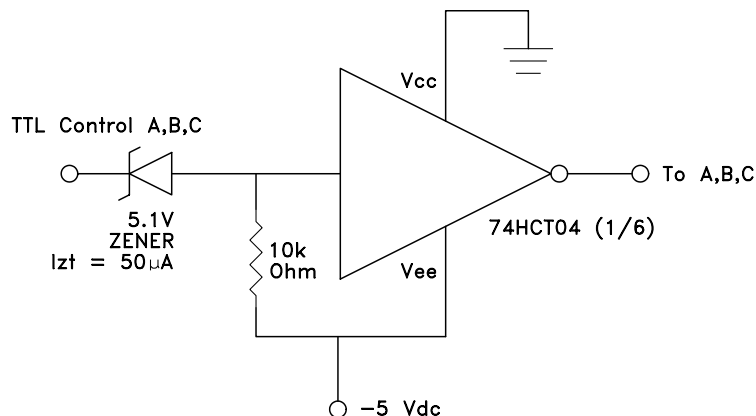
### Control Voltages

State	Bias Condition
Low	-3V to 0 Vdc @ 25 $\mu$ A Typical
High	-5 to -4.2 Vdc @ 5 $\mu$ A Typical

### Truth Table

Control Input			Signal Path State
A	B	C	RFCOM to:
High	High	High	RF1
Low	High	High	RF2
High	Low	High	RF3
Low	Low	High	RF4
High	High	Low	RF5
Low	High	Low	RF6
High	Low	Low	RF7
Low	Low	Low	RF8

### TTL Interface Circuit



#### Note:

Control inputs A, B, and C can be driven directly with TTL logic with -5 Volts applied to the HCT logic gates Vee pin and to Vee (pin 8) of the RF Switch.

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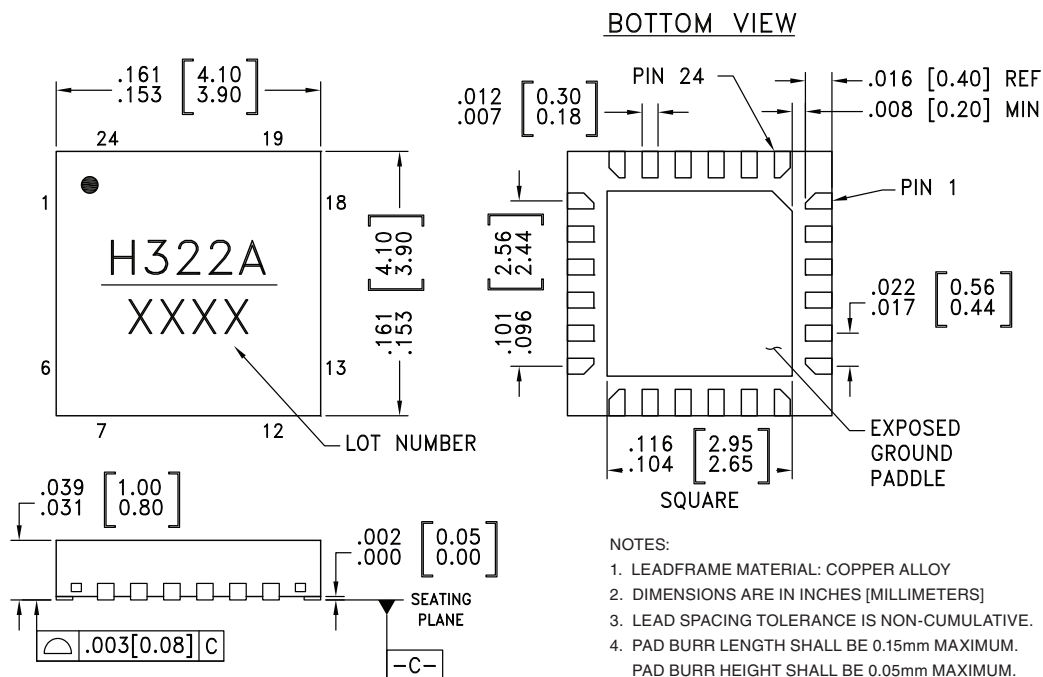
### Absolute Maximum Ratings

Bias Voltage Range (Vee)	-7.0 Vdc
Control Voltage Range (A, B, & C)	Vee -0.5V to +1.0 Vdc
Storage Temperature	-65 to +150 °C
Operating Temperature	-40 to +85 °C
Maximum Input Power	
Insertion Loss Path	26.5 dBm
Terminated Path	24 dBm
Channel Temperature	150 °C
Continuous Pdiss ( T = 85 °C ) ( derate 5.34 mW / °C )	0.348 W
Thermal Resistance	
Insertion Loss Path	184 °C / W
Terminated Path	243 °C / W
ESD Sensitivity (HBM)	Class 1A



ELECTROSTATIC SENSITIVE DEVICE  
OBSERVE HANDLING PRECAUTIONS

### Outline Drawing



#### NOTES:

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


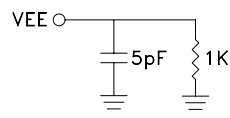
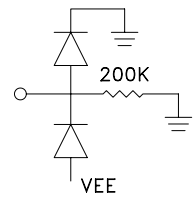
### Package Information

Part Number	Package Body Material	Lead Finish	MSL Rating	Package Marking <sup>[2]</sup>
HMC322ALP4E	RoHS-compliant Low Stress Injection Molded Plastic	100% matte Sn	MSL3 <sup>[1]</sup>	H322A XXXX

[1] Max peak reflow temperature of 260 °C

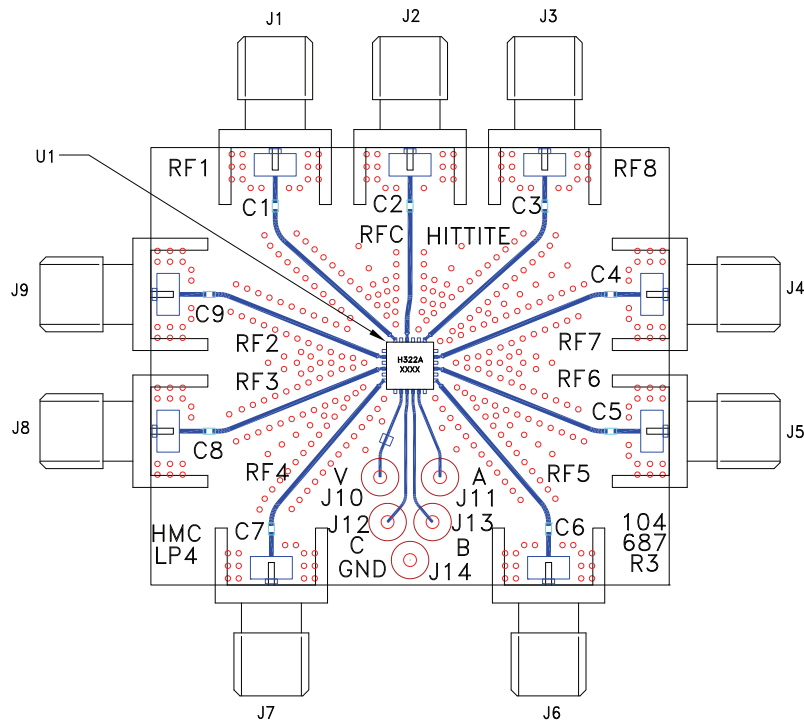
[2] 4-Digit lot number XXXX

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**Pin Descriptions**

Pin Number	Function	Description	Interface Schematic
1, 3, 5, 7, 12, 14, 16, 18, 21, 23	GND	Package bottom has exposed metal paddle that must also be connected to PCB RF ground.	
2, 4, 6, 13, 15, 17, 19, 22, 24	RF1 - RF8 & RFC	This pin is DC coupled and matched to 50 Ohm. Blocking capacitors are required if RF line potential is not equal to 0V.	
8	VEE	Supply Voltage = $-5V \pm 10\%$	
9	CTL C	See truth table and control voltage table.	
10	CTL B	See truth table and control voltage table.	
11	CTL A	See truth table and control voltage table.	
20	N/C	This pin should be connected to PCB RF ground to maximize isolation.	

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### Evaluation PCB



### List of Materials for Evaluation PCB EV1HMC322ALP4 [1]

Item	Description
J1 - J9	PCB Mount SMA RF Connector
J10 - J14	DC Pin
C1 - C9	100 pF Capacitor, 0402 Pkg.
U1	HMC322ALP4E SP8T Switch
PCB [2]	104687 Evaluation PCB 1.73"x1.46"

[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 Analog Devices Inc. upon request.