



## DUAL SPDT SWITCH DC - 2.5 GHz

### Typical Applications

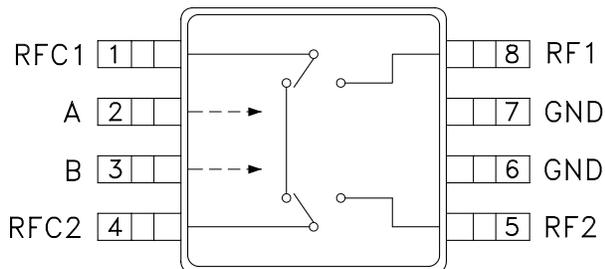
The HMC199AMS8 / 199AMS8E is ideal for:

- Cellular
- ISM Basestations
- PCS

### Features

- RoHS-Compliant Product
- Integrated Dual SPDTs
- Low Insertion Loss: <math><0.5\text{ dB}</math> @ 2 GHz
- Positive Control: 0/+5V, 0/+3V
- Ultra Small MSOP8 Package: 14.8 mm<sup>2</sup>

### Functional Diagram



### General Description

The HMC199AMS8 & HMC199AMS8E are low-cost general purpose dual SPDT GaAs “bypass” switches in 8-lead MSOP packages covering DC to 2.5 GHz. These four-RF-port components integrate two SPDT switches and a through line onto a single IC. The designs provide low insertion loss of less than 0.5 dB while switching passive or active external circuit components in and out of the signal path. Port to port isolations are typically 25 to 30 dB. On-chip circuitry enables positive voltage control operation at very low DC currents with control inputs compatible with CMOS and most TTL logic families. Applications include LNA or filter bypass switching and single bit attenuator switching. The HMC199AMS8E is a RoHS-compliant product.

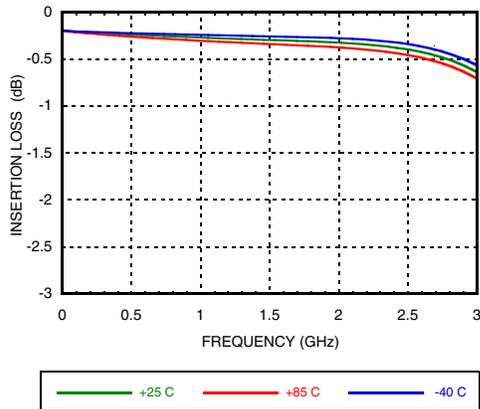
### Electrical Specifications, $T_A = +25^\circ\text{C}$ , $V_{ctl} = 0/+5\text{ Vdc}$ , 50 Ohm System

Parameter	Frequency	Min.	Typ.	Max.	Units
Insertion Loss	DC - 1.0 GHz		0.3	0.6	dB
	DC - 2.0 GHz		0.4	0.8	dB
	DC - 2.5 GHz		0.6	1.0	dB
Isolation (Between Ports RFC1 and RFC2 / RF1 / RF2)	DC - 2.0 GHz	22	25		dB
	DC - 2.5 GHz	17	22		dB
Return Loss (On State, Any Port)	DC - 2.0 GHz	20	30		dB
	DC - 2.5 GHz	20	30		dB
Input Power for 1 dB Compression	0.5 - 2.0 GHz	25	28		dBm
Input Third Order Intercept (Two-tone Input Power = 13 dBm Each Tone)	0.5 - 2.0 GHz	40	55		dBm
Switching Characteristics	DC - 2.5 GHz				
		tRISE, tFALL (10/90% RF)		20	ns
		tON, tOFF (50% CTL to 10/90% RF)		40	ns

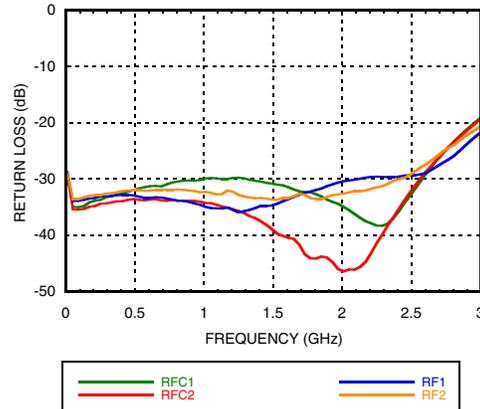


**DUAL SPDT SWITCH  
DC - 2.5 GHz**

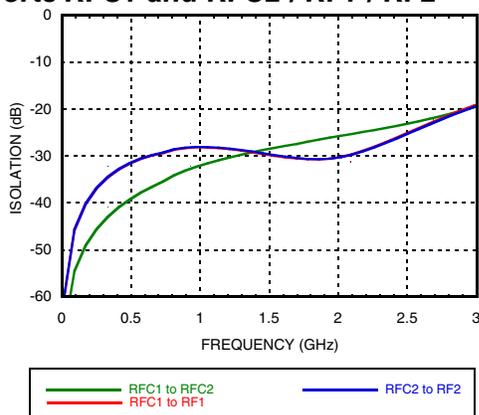
**Insertion Loss**



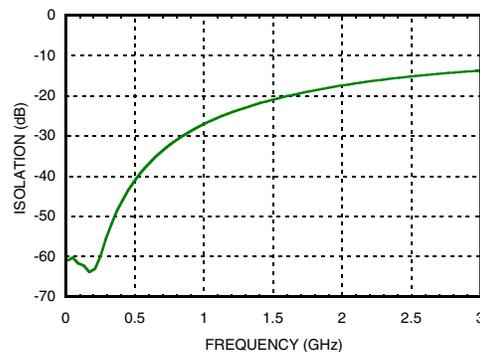
**Return Loss**



**Isolation Between Ports RFC1 and RFC2 / RF1 / RF2**

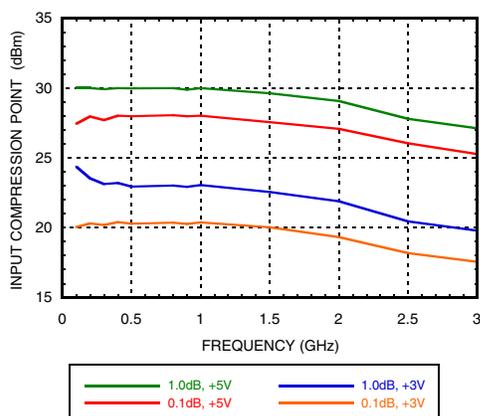


**Isolation Between Ports RF1 and RF2**

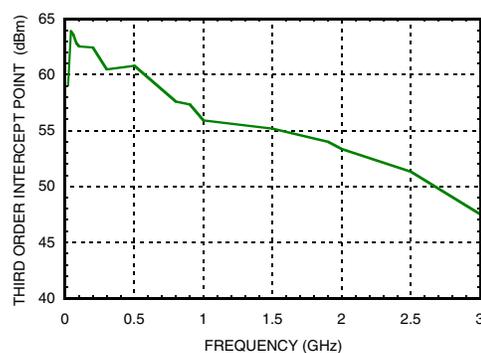


Note: RFC1 - RFC2 is in insertion loss state

**0.1 and 1 dB Compression Point**



**Input Third Order Intercept Point**



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### Absolute Maximum Ratings

RF Input Power $V_{CTL} = 0/+5V$	+29.3 dBm
Control Voltage Range (A & B)	-0.5 to +7.5 Vdc
Channel Temperature	150 °C
Continuous $P_{diss}$ (T = 85 °C) (derate 5.85 mW/°C above 85 °C)	0.38 W
Thermal Resistance	171 °C/W
Storage Temperature	-65 to +150 °C
Operating Temperature	-40 to +85 °C
ESD Sensitivity (HBM)	Class 1A

### Truth Table

\*Control Input Tolerances are  $\pm 0.5$  Vdc

Control Input*		Control Current (Typical)		Signal Path		
A (Vdc)	B (Vdc)	Ia ( $\mu$ A)	Ib ( $\mu$ A)	RFC1 to RFC2	RFC1 to RF1	RFC2 to RF2
0	+5	-1	1	ON	OFF	OFF
+5	0	1	-1	OFF	ON	ON
0	+3	-0.1	0.1	ON	OFF	OFF
+3	0	0.1	-0.1	OFF	ON	ON

DC blocking capacitors are required at ports RFC1, RFC2, RF1, RF2. Choose value for lowest frequency of operation.

### Distortion vs. Frequency

Control Input (Vdc)	Input Third Order Intercept (dBm) 0 dBm Each Tone	
	900 MHz	1900 MHz
+5	56	52
+3	52	47

### Compression vs. Frequency

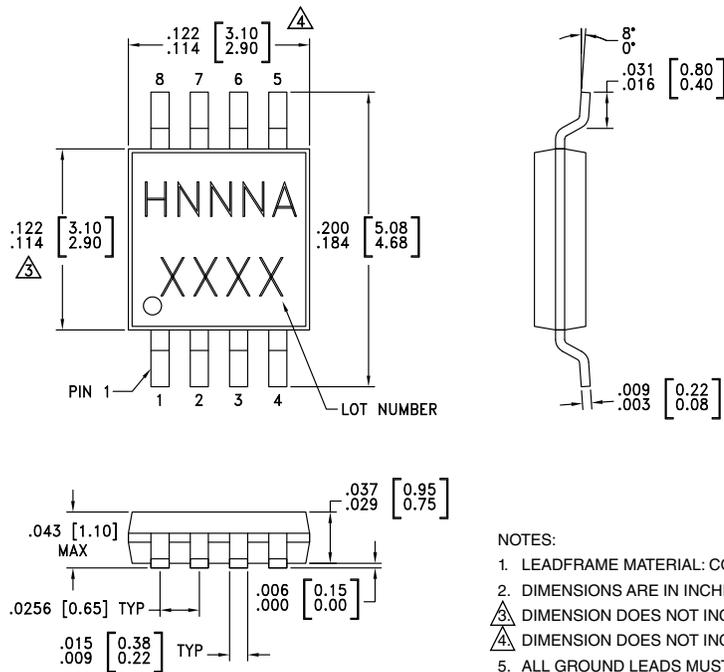
CTL Input (Vdc)	Carrier at 900MHz		Carrier at 1900MHz	
	Input Power for 0.1 dB Compression (dBm)	Input Power for 1.0 dB Compression (dBm)	Input Power for 0.1 dB Compression (dBm)	Input Power for 1.0 dB Compression (dBm)
+5	28	30	27	29
+3	20	23	20	22

Caution: Do not operate continuously at RF power input greater than 1 dB compression and do not "hot switch" power levels greater than +22 dBm (Control = 0/+5Vdc).



**ELECTROSTATIC SENSITIVE DEVICE  
OBSERVE HANDLING PRECAUTIONS**

### Outline Drawing



### Package Information

Part Number	Package Body Material	Lead Finish	MSL Rating	Package Marking <sup>[3]</sup>
HMC199AMS8	Low Stress Injection Molded Plastic	Sn/Pb Solder	MSL1 <sup>[1]</sup>	H199A XXXX
HMC199AMS8E	RoHS-compliant Low Stress Injection Molded Plastic	100% matte Sn	MSL1 <sup>[2]</sup>	H199A XXXX

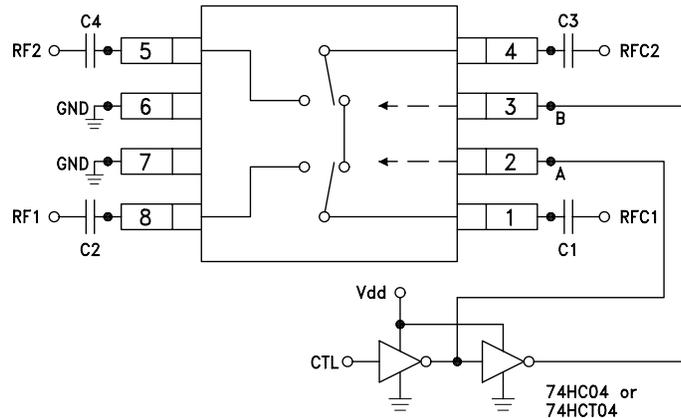
[1] Max peak reflow temperature of 235 °C

[2] Max peak reflow temperature of 260 °C

[3] 4-Digit lot number XXXX



### Typical Application Circuit

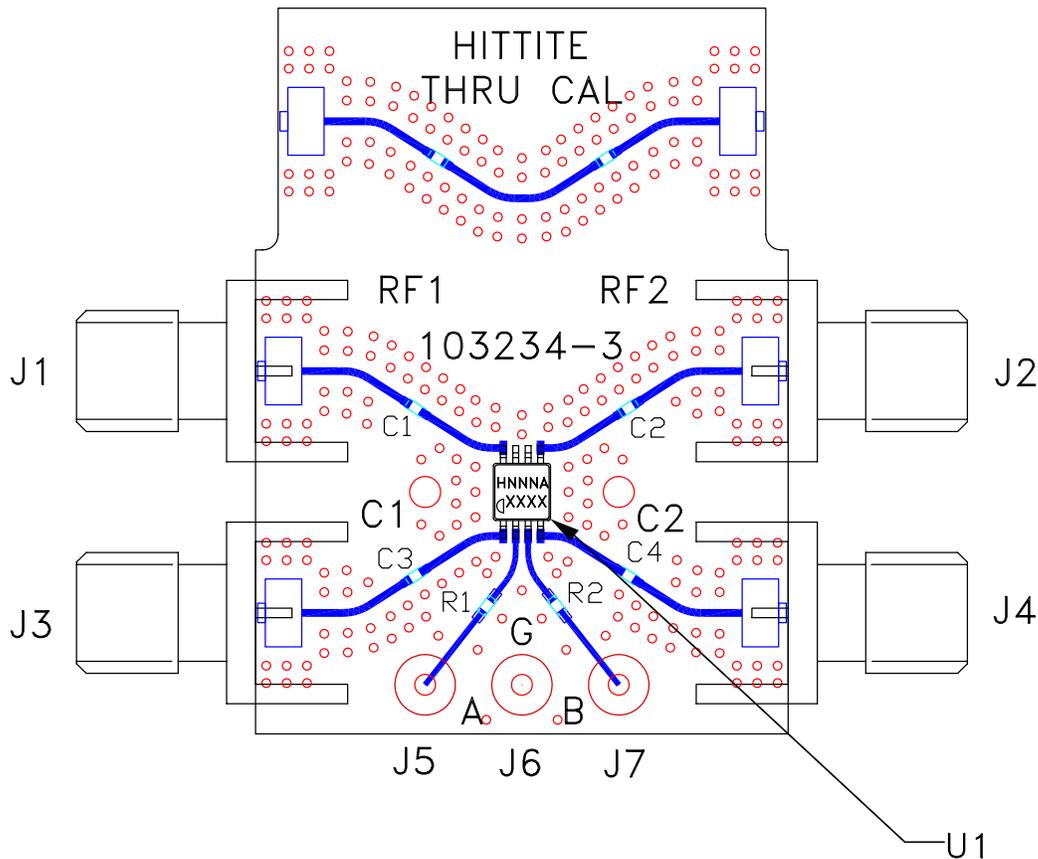


Notes:

1. Set A/B control to 0/+5V, Vdd = +5V and use HCT series logic to provide a TTL driver interface.
2. Control inputs A/B can be driven directly with CMOS logic (HC) with Vdd = 5 to 7 Volts applied to the CMOS logic gates.
3. DC Blocking capacitors are required for each RF port as shown. Capacitor value determines lowest frequency of operation.
4. Highest RF signal power capability is achieved with Vdd = +7V and A/B set to 0/+7V.



### Evaluation PCB



### List of Materials for Evaluation PCB EV1HMC199AMS8 [1]

Item	Description
J1 - J4	PCB Mount SMA RF Connector
J5 - J7	DC Pin
C1 - C4	Chip Capacitor, 0402 Pkg. Choose value for lowest frequency of operation. 330 pF is provided on PCB.
R1 - R2	100 Ohm Resistor, 0402 Pkg.
U1	HMC199AMS8 / 199AMS8E Bypass Switch
PCB [2]	103234 Evaluation PCB 1.5" x 1.5"

[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 ports should have 50 ohm impedance. The evaluation circuit board shown above is available from Hittite Microwave Corporation upon request.

\*R1 & R2 = 100 Ohm.

These optional resistors will provide more RF path to control circuit isolation.