v02.0911

HMC221A / 221AE

GaAs MMIC SOT26 SPDT SWITCH, DC - 3 GHz

Typical Applications

The HMC221A(E) is ideal for:

- ISM Applications
- PCMCIA Wireless Cards
- Cellular Applications

Features

RoHS-Compliant Product

Low Insertion Loss: 0.4 dB

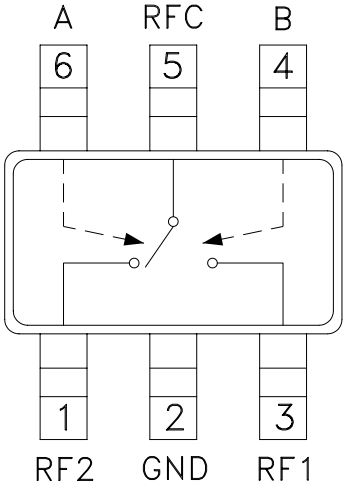
Ultra Small Package: SOT26

Input IP3: +45 dBm

Positive Control: 0/+3V @ 3 µA

Included in the HMC-DK005 Designer's Kits

Functional Diagram



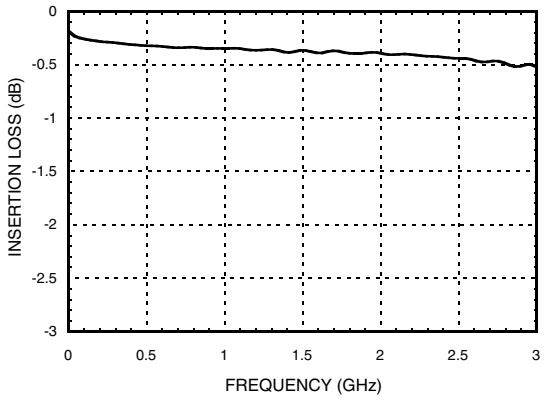
General Description

The HMC221A(E) is a low-cost SPDT switch in a 6-lead SOT26 plastic package for use in general switching applications which require very low insertion loss and very small size. This device can control signals from DC to 3 GHz and is especially suited for 900 MHz, 1.8 - 2.2 GHz, and 2.4 GHz ISM applications with less than 1 dB loss. The design provides exceptional insertion loss performance, ideal for filter and receiver switching. RF1 and RF2 are reflective shorts when "Off". The two control voltages require a minimal amount of DC current and offer compatibility with most CMOS & TTL logic families. See HMC197A(E) for same performance in an alternate SOT26 pin-out.

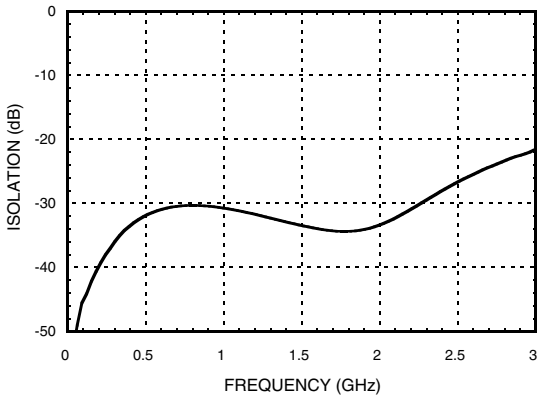
Electrical Specifications, T_A = +25° C, Vctl = 0/+3 to +8 Vdc

Parameter	Frequency	Min.	Typ.	Max.	Units
Insertion Loss	DC - 1.0 GHz DC - 2.0 GHz DC - 2.5 GHz DC - 3.0 GHz		0.4 0.45 0.6 0.8	0.7 0.8 0.9 1.1	dB dB dB dB
Isolation	DC - 1.0 GHz DC - 2.0 GHz DC - 2.5 GHz DC - 3.0 GHz	24 24 21 14	28 28 25 18		dB dB dB dB
Return Loss	DC - 1.0 GHz DC - 2.0 GHz DC - 2.5 GHz DC - 3.0 GHz	20 17 16 11	23 22 20 15		dB dB dB dB
Input Power for 1 dB Compression (Vctl = 0/+5V)	0.5 - 1.0 GHz 0.5 - 3.0 GHz	25 23	30 29		dBm dBm
Input Third Order Intercept (Vctl = 0/+5V) (Two-tone Input Power = +7 dBm Each Tone)	0.5 - 1.0 GHz 0.5 - 3.0 GHz	40 38	45 43		dBm dBm
Switching Characteristics tRISE, tFALL (10/90% RF) tON, tOFF (50% CTL to 10/90% RF)	DC - 3.0 GHz		 3 10		 ns ns

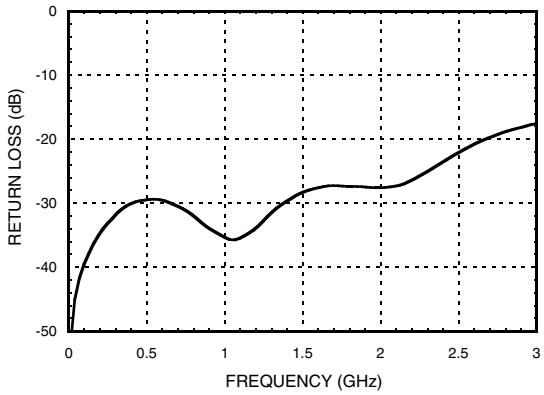
Insertion Loss



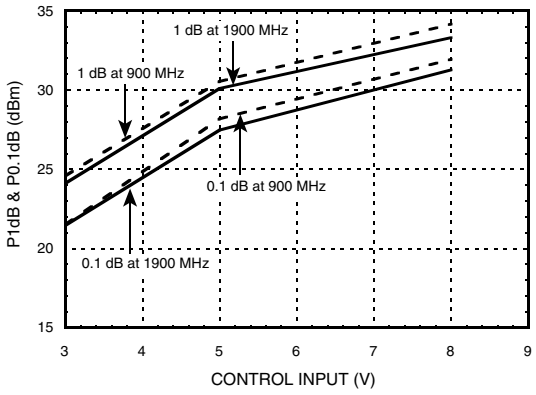
Isolation



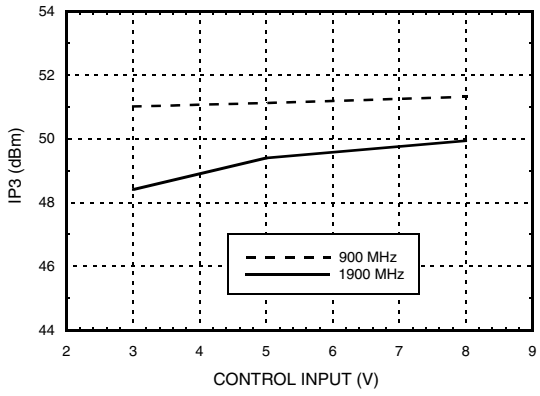
Return Loss



Input 0.1 and 1.0 dB Compression vs. Control Voltage



Input Third Order Intercept Point vs. Control Voltage



Distortion vs. Control Voltage

Control Input	Third Order Intercept (dBm) +7 dBm Each Tone	
(Vdc)	900 MHz	1900 MHz
+3	51	48
+5	51	49
+8	51	50

Truth Table

***Control Input Voltage Tolerances are ± 0.2 Vdc.**

Control Input*		Control Current		Signal Path State	
A (Vdc)	B (Vdc)	Ia (µA)	Ib (µA)	RF to RF1	RF to RF2
0	+3	-3	3	ON	OFF
+3	0	3	-3	OFF	ON
0	+5	-5	5	ON	OFF
+5	0	5	-5	OFF	ON
0	+8	-32	32	ON	OFF
+8	0	32	-32	OFF	ON

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Compression vs. Control Voltage

Control Input	Carrier at 900 MHz		Carrier at 1900 MHz	
	Input Power for 0.1 dB Compression	Input Power for 1 dB Compression	Input Power for 0.1 dB Compression	Input Power for 1.0 dB Compression
(Vdc)	(dBm)	(dBm)	(dBm)	(dBm)
+3	21	24	21	24
+5	28	30	27	30
+8	32	34	31	33

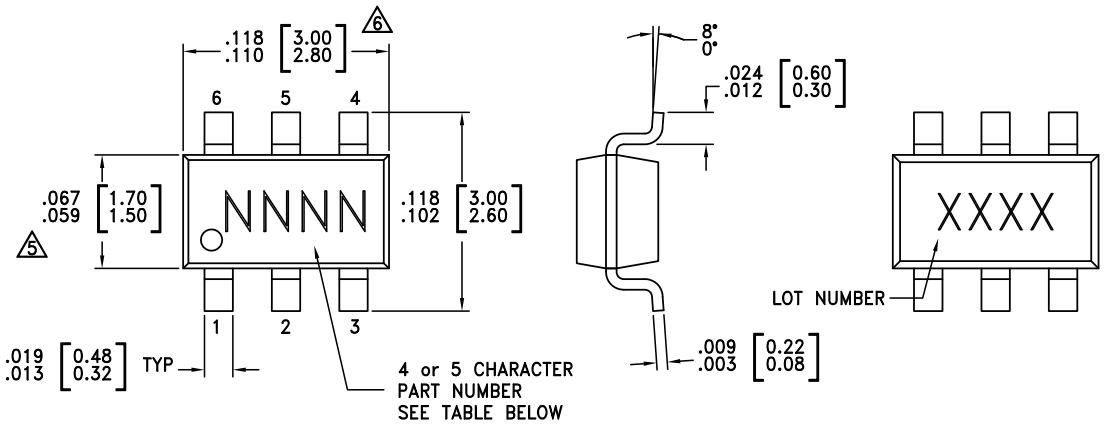
Caution: Do not operate in 1dB compression at power levels above +31 dBm (Vctl = +5 Vdc) and do not "hot switch" power levels greater than +20 dBm (Vctl = +5Vdc). DC blocks are required at ports RFC, RF1 and RF2.

Absolute Maximum Ratings

Control Voltage Range (A & B)	-0.2 to +12 Vdc
Channel Temperature	150 °C
Continuous Pdiss (T = 85 °C) (derate 5.6 mW/°C above 85 °C)	0.36 W
Thermal Resistance	178 °C/W
Storage Temperature	-65 to +150 °C
Operating Temperature	-40 to +105 °C
ESD Sensitivity (HBM)	Class 1A

ELECTROSTATIC SENSITIVE DEVICE
OBSERVE HANDLING PRECAUTIONS

Outline Drawing



NOTES:

1. LEADFRAME MATERIAL: COPPER ALLOY
2. DIMENSIONS ARE IN INCHES [MILLIMETERS].
3. DIMENSION DOES NOT INCLUDE MOLDFLASH OF 0.15mm PER SIDE.
4. DIMENSION DOES NOT INCLUDE MOLDFLASH OF 0.25mm PER SIDE.
5. ALL GROUND LEADS MUST BE SOLDERED TO PCB RF GROUND.

Package Information

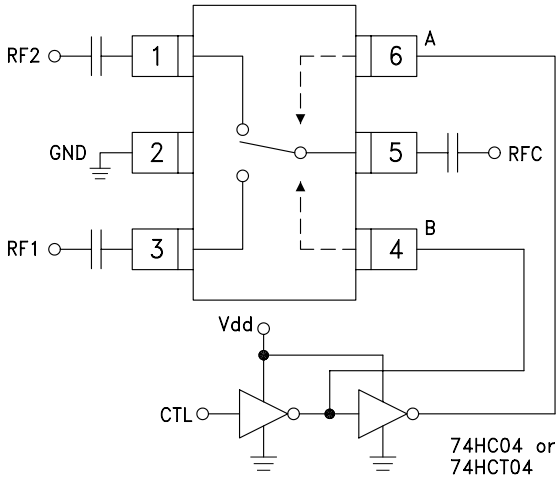
Part Number	Package Body Material	Lead Finish	MSL Rating	Package Marking
HMC221A	Low Stress Injection Molded Plastic	Sn/Pb Solder	MSL1 [1]	221A XXXX
HMC221AE	RoHS-compliant Low Stress Injection Molded Plastic	100% matte Sn	MSL1 [2]	221AE XXXX

[1] Max peak reflow temperature of 235 °C
[2] Max peak reflow temperature of 260 °C

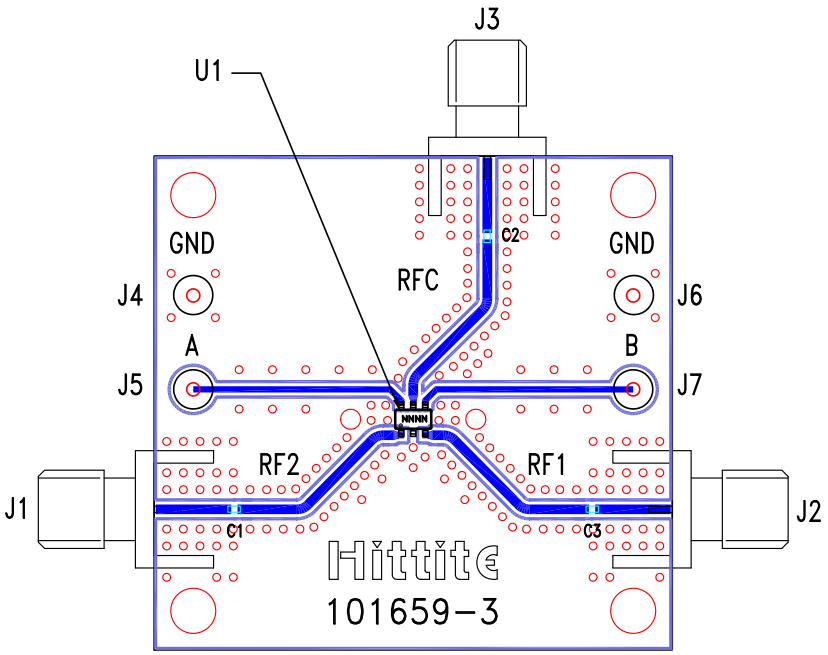
Typical Application Circuit

Notes:

1. Set logic gate and switch Vdd = +3V to +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 of 5 to 8 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 = +8V and A/B set to 0/+8V.



Evaluation Circuit Board



List of Materials for Evaluation PCB 101675 [1]

Item	Description
J1 - J3	PCB Mount SMA RF Connector
J4 - J7	DC Pin
C1 - C3	330 pF Capacitor, 0402 Pkg.
U1	HMC221A / HMC221AE SPDT Switch
PCB [2]	101659 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 package bottom 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.