

GaAS MMIC SOT26 T/R SWITCH DC - 2.5 GHz

FEBRUARY 2001

v01.0700

Features

LOW INSERTION LOSS: 0.4 dB

ULTRA SMALL PACKAGE: SOT26

HIGH INPUT IP3: +62 dBm

POSITIVE CONTROL: 0/+3V to 0/+8V



General Description

The HMC195 is a low-cost SPDT switch in a 6-lead SOT26 package for use in transmit-receive applications which require very low distortion at high signal power levels. The device can control signals from DC to 2.5 GHz and is especially suited for 900 MHz, 1.8-2.2GHz applications with less than 1dB loss. The design provides exceptional intermodulation performance; a +62dBm third order intercept at 8 Volt bias. RF1 or RF2 is a reflective short when "Off". On-chip circuitry allows single positive supply operation at very low DC current with control inputs compatible with CMOS and most TTL logic families. Applications include PCMCIA wireless cards and cellular phones.

Guaranteed Performance $V_{ctl} = 0/+5 V_{dc}$, 50 Ohm System, -40 to +85 deg C

Parameter	Frequency	Min.	Typ.	Max.	Units
Insertion Loss	DC - 1.0 GHz		0.4	0.7	dB
	DC - 2.0 GHz		0.6	0.9	dB
	DC - 2.5 GHz		1.1	1.4	dB
Isolation	DC - 1.0 GHz	22	25		dB
	DC - 2.0 GHz	19	23		dB
	DC - 2.5 GHz	15	18		dB
Return Loss	DC - 1.0 GHz	20	26		dB
	DC - 2.0 GHz	12	15		dB
	DC - 2.5 GHz	9	11		dB
Input Power for 1dB Compression 0/8V Control	0.5 - 1.0 GHz	30	36		dBm
	0.5 - 2.5 GHz	29	35		dBm
Input Third Order Intercept 0/8V Control	0.5 - 1.0 GHz	58	62		dBm
	0.5 - 2.5 GHz	55	59		dBm
Switching Characteristics tRISE, tFALL (10/90% RF) tON, tOFF (50% CTL to 10/90% RF)	DC - 2.5 GHz		10 24		nS nS

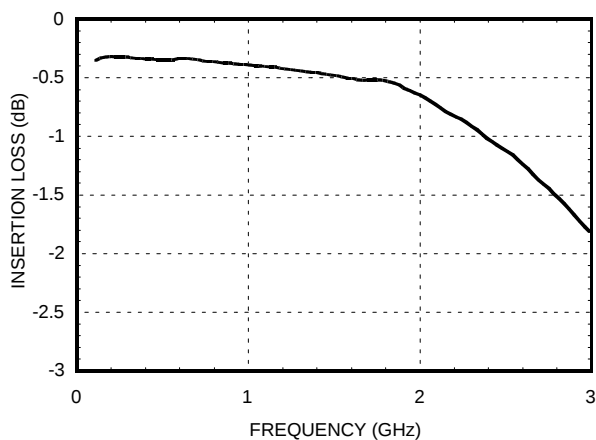


HMC195 SOT26 T/R SWITCH DC - 2.5 GHz

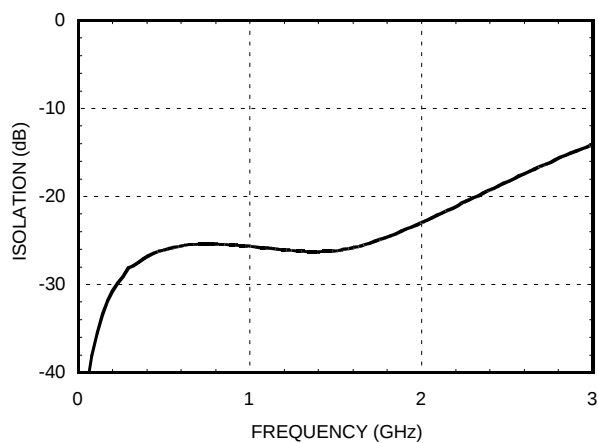
v01.0700

FEBRUARY 2001

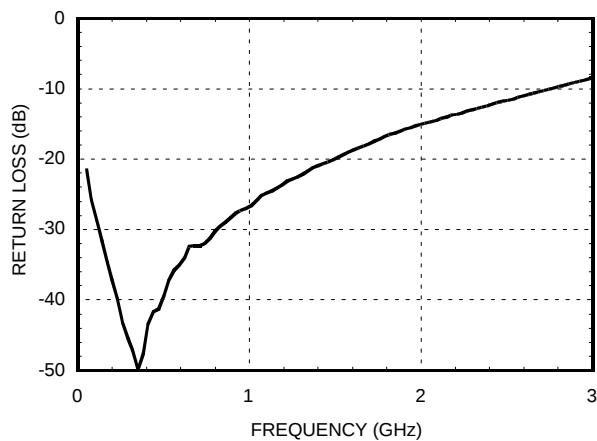
Insertion Loss



Isolation



Return Loss



7

SMT SPDT SWITCHES

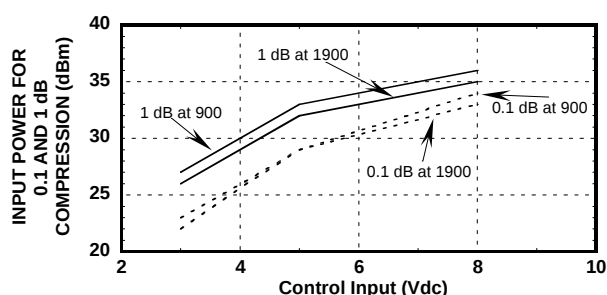


HMC195 SOT26 T/R SWITCH DC - 2.5 GHz

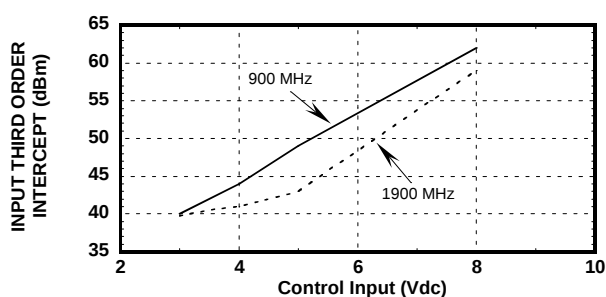
FEBRUARY 2001

v01.0700

Input 0.1 and 1.0 dB Compression vs Control Voltage



Input Third Order Intercept vs Control Voltage



Compression vs Bias Voltage

Control Input	Carrier at 900MHz		Carrier at 1900MHz	
	Input Power for 0.1dB Compression	Input Power for 1dB Compression	Input Power for 0.1dB Compression	Input Power for 1dB Compression
	(dBm)	(dBm)	(dBm)	(dBm)
(Vdc)				
+3	23	27	22	26
+5	29	33	29	32
+8	34	36	33	35

Distortion vs Bias Voltage

Control Input	1 Watt Carrier at 900MHz		1 Watt Carrier at 1900MHz	
	Third Order Intercept	Second Order Intercept	Third Order Intercept	Second Order Intercept
	(dBm)	(dBm)	(dBm)	(dBm)
(Vdc)				
+3	40	87	39	79
+4	44	88	41	85
+5	49	90	43	91
+8	62	90	59	99

Caution: Do not operate in 1dB compression at power levels above +33 dBm and do not 'hot switch' power levels greater than +23dBm ($V_{CTL} = +5Vdc$). DC blocks are required at ports RFC, RF1 and RF2.

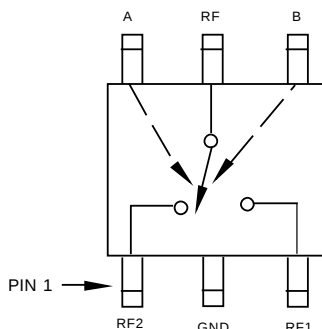


HMC195 SOT26 T/R SWITCH DC - 2.5 GHz

v01.0700

FEBRUARY 2001

Functional Diagram



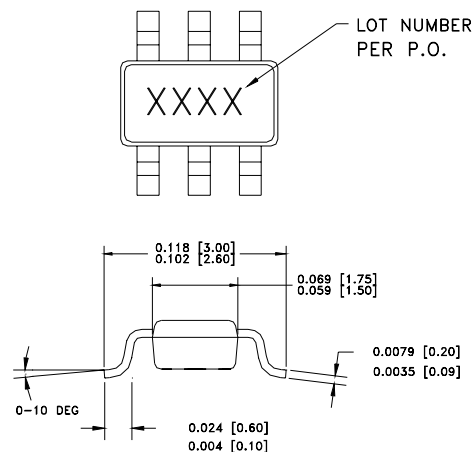
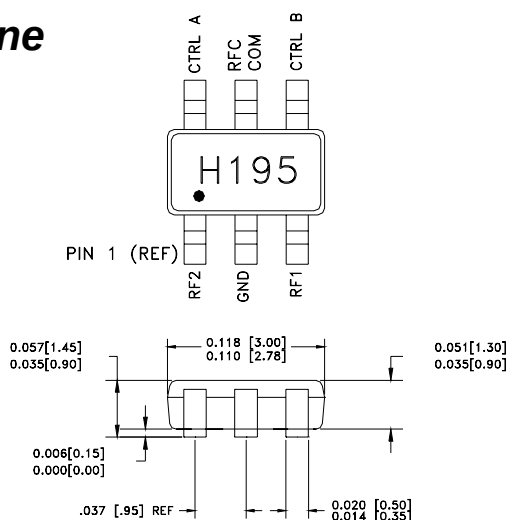
Truth Table *Control Input Tolerances are +/- 0.2 Vdc

Control Input *		Control Current		Signal Path	
A (Vdc)	B (Vdc)	Ia (uA)	Ib (uA)	RF to RF1	RF to RF2
0	+3	-25	25	On	Off
+3	0	25	-25	Off	On
0	+5	-120	120	On	Off
+5	0	120	-120	Off	On
0	+8	-120	200	On	Off
+8	0	200	-200	Off	On

Absolute Maximum Ratings

Max. Input Power ($V_{CTL} = 0/+8V$)	0.05 GHz 0.5 - 2.5 GHz	+27 dBm +34 dBm
Control Voltage Range (A & B)	-0.2 to +12Vdc	
Storage Temperature	-65 to +150 deg. C	
Operating Temperature	-40 to +85 deg. C	

Outline



- MATERIAL:
A) PACKAGE BODY: LOW STRESS INJECTION MOLDED PLASTIC, SILICA & SILICONE IMPREGNATED
B) LEADFRAME MATERIAL: COPPER ALLOY
- PLATING: LEAD-TIN SOLDER PLATE
- DIMENSIONS ARE IN INCHES (MILLIMETERS)
UNLESS OTHERWISE SPECIFIED TOL. ARE $\pm 0.005(\pm 0.13)$

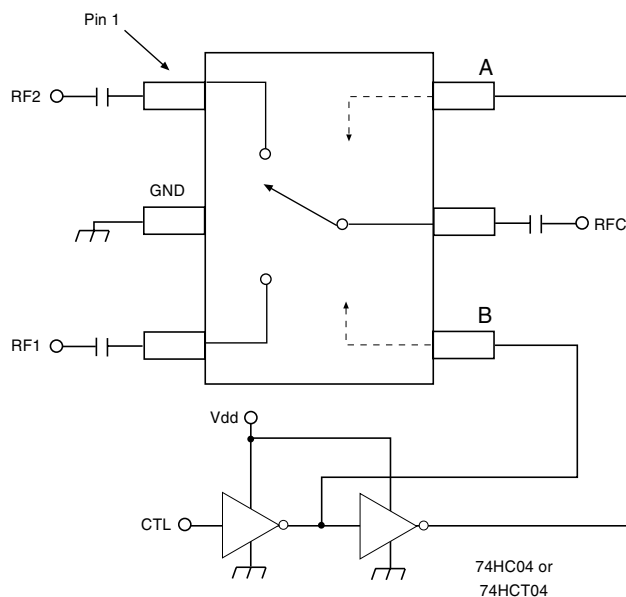


HMC195 DC - 2.5 GHz SOT26 T/R SWITCH

FEBRUARY 2001

v01.0700

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 3 to 8 Volts applied to the CMOS logic gates and to pin 4 of the RF switch.
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 V set to +10V. The switch will operate properly (but at lower RF power capability) at bias voltages down to +3V.

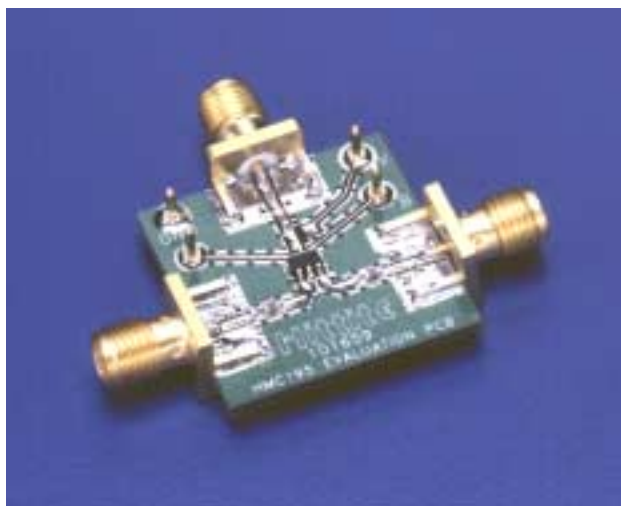


HMC195 DC - 2.5 GHz SOT26 T/R SWITCH

v01.0700

FEBRUARY 2001

Evaluation Circuit Board



The circuit board used in the final application should use RF circuit design techniques. Signal lines should have 50 ohm impedance while the package ground leads should be connected directly to the ground plane similar to that shown below. A sufficient number of VIA holes should be used to connect the top and bottom ground planes. The evaluation circuit board as shown is available from Hittite upon request.

Evaluation Circuit Board Layout Design Details

Layout Technique	Grounded Co-Planar Waveguide (GCPW)
Material	FR4
Dielectric Thickness	0.028" (0.71 mm)
50 Ohm Line Width	0.037" (0.94 mm)
Gap to Ground Edge	0.010" (0.25 mm)
Ground VIA Hole Diameter	0.014" (0.36 mm)
Connectors	SMA-F (EF - Johnson P/N 142-0701-806)

7

SPDT SWITCHES

SMT

