GaAS MMIC SMT LOW DISTORTION T/R SWITCH DC - 2.5 GHZ

FEBRUARY 2000

Features

HIGH THIRD ORDER INTERCEPT: +60 dBm

SINGLE POSITIVE SUPPLY: +3 TO +10V

HIGH RF POWER CAPABILITY

TTL/CMOS CONTROL

General Description

The HMC154S8 is a low-cost SPDT switch in an 8-lead SOIC 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 900MHz and 1.8-2.2 GHz applications. The design provides exceptional intermodulation performance; providing a +60dBm 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.

Guaranteed Performance, *Vdd = +5 Vdc, 50 Ohm System, -40 to +85 deg C*

Parameter	Frequency	Min.	Typ.	Max.	Units
Insertion Loss	DC - 1.0GHz DC - 2.0GHz DC - 2.5GHz		0.5 0.7 1.0	0.7 0.9 1.3	dB dB dB
Isolation	DC - 1.0GHz DC - 2.0GHz DC - 2.5GHz	22 19 15	25 22 18		dB dB dB
Return Loss	DC - 1.0GHz DC - 2.0GHz DC - 2.5GHz	20 14 10	30 18 13		dB dB dB
Input Power for 1dB Compression 0/8V Control	0.5 - 1.0GHz 0.5 - 2.0GHz	35 34	39 38		dBm
Input Third Order Intercept 0/8V Control	0.5 - 1.0GHz 0.5 - 2.0GHz	55 54	60 60		dBm
Switching Characteristics tRISE, tFALL (10/90% RF) tON, tOFF (50% CTL to 10/90% RF)	DC - 2.5GHz		 10 24		 ns ns

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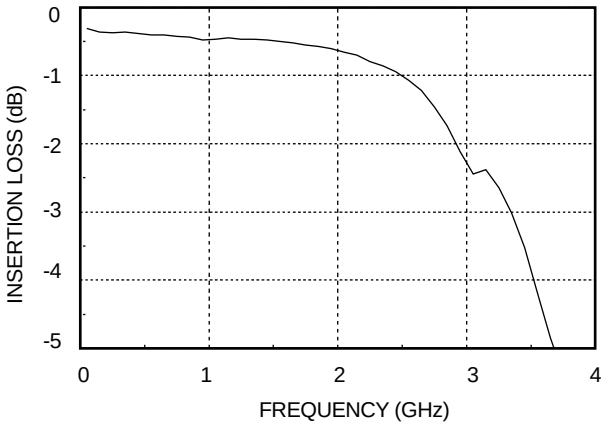
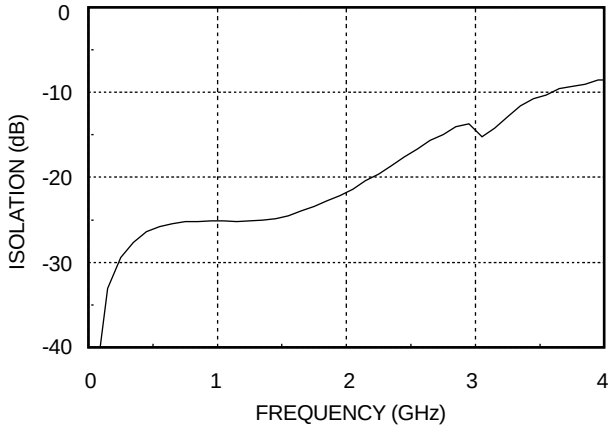
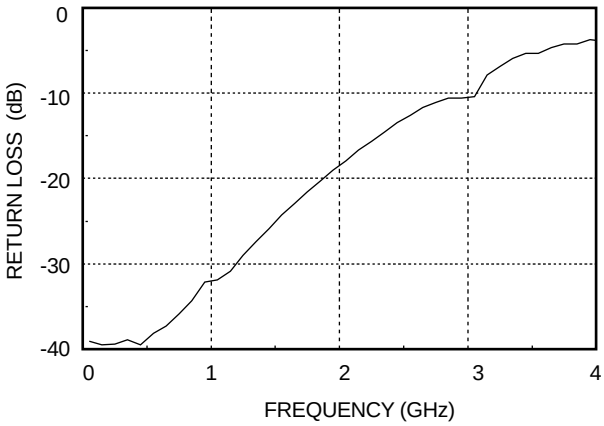
Insertion Loss



Isolation



Return Loss



S - Parameter data is available On-Line at ***www.hittite.com***

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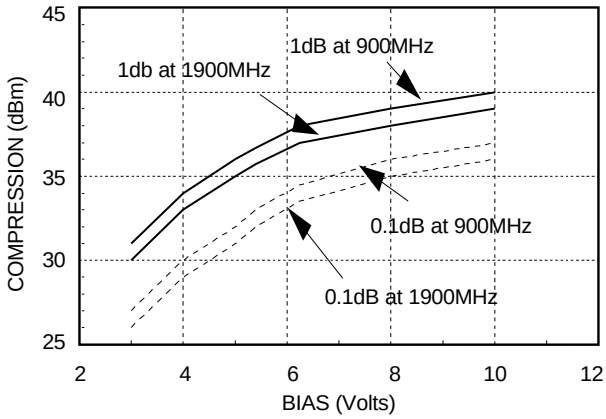
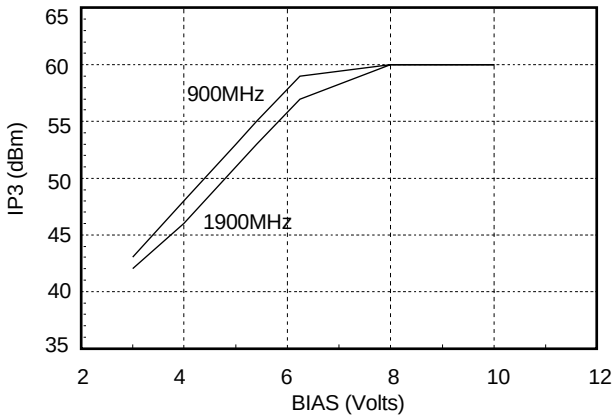
Input Power for 0.1 and 1.0 dB Compression vs Bias Voltage



Input Third Order Intercept vs Bias Voltage



Compression vs Bias Voltage

	Carrier at 900MHz		Carrier at 1900MHz	
Bias Vdd	Input Power for 0.1dB Compression	Input Power for 1dB Compression	Input Power for 0.1dB Compression	Input Power for 1dB Compression
(Volts)	(dBm)	(dBm)	(dBm)	(dBm)
3	27	31	26	30
4	30	34	29	33
5	32	36	31	35
8	36	39	35	38
10	37	40	36	39

Caution: Do not operate in 1dB compression at power levels above +35dBm and do not "hot switch" power levels greater than +23 dBm (Vdd = +5V).

Distortion vs Bias Voltage

	1 Watt Carrier at 900MHz			1 Watt Carrier at 1900MHz		
Bias Vdd	Third Order Intercept	Second Order Intercept	Second Harmoni-c	Third Order Intercept	Second Order Interce-pt	Second Harmonic
(Volts)	(dBm)	(dBm)	(dBc)	(dBm)	(dBm)	(dBc)
3	43	71	45	42	78	55
4	48	85	55	46	88	65
5	53	90	56	51	87	58
8	60	90	58	60	90	59
10	60	90	59	60	90	60

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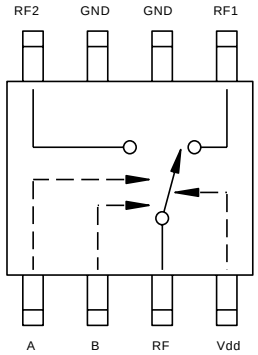
Functional Diagram



Truth Table

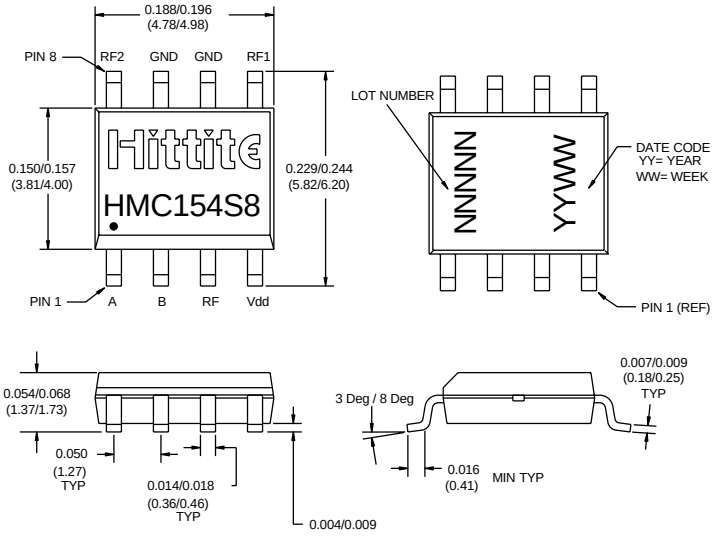
Control Input Voltage Tolerances are ± 0.2 Vdc

Bias	Control Input*		Bias Current	Control Current	Control Current	Signal Path State	
Vdd (Vdc)	A (Vdc)	B (Vdc)	Ivdd (uA)	Ia (uA)	Ib (uA)	RF to RF1	RF to RF2
3	0	0	30	-15	-15	OFF	OFF
3	0	Vdd	25	-25	0	ON	OFF
3	Vdd	0	25	0	-25	OFF	ON
5	0	0	110	-55	-55	OFF	OFF
5	0	Vdd	115	-100	-15	ON	OFF
5	Vdd	0	115	-15	-100	OFF	ON
10	0	0	380	-190	-190	OFF	OFF
10	0	Vdd	495	-275	-220	ON	OFF
10	Vdd	0	495	-220	-275	OFF	ON
5	-Vdd	Vdd	600	-600	225	ON	OFF
5	Vdd	-Vdd	600	225	-600	OFF	ON

Absolute Maximum Ratings

Bias Voltage Range (Vdd)	-0.2 to +12 Vdc
Control Voltage Range (A & B)	-0.2 to +Vdd Vdc
Storage Temperature	-65 to +150 deg C
Operating Temperature	-40 to +85 deg C

Outline



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

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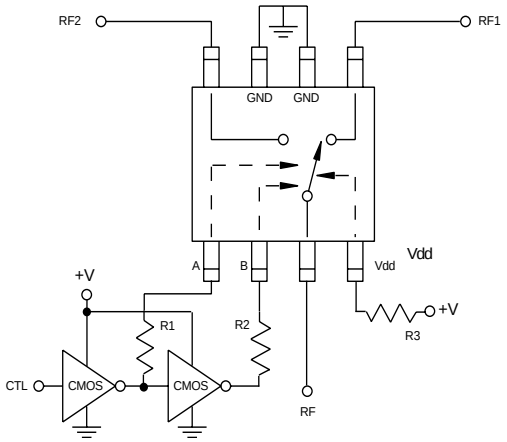
Typical Application Circuit for HMC154S8



Notes:

1. Control inputs A and B can be driven directly with CMOS logic (HC) with V of 3 to 8 Volts applied to the CMOS logic gates and to pin 4 of the RF switch.
2. DC Blocking capacitors are required for each RF port as shown. Capacitor value determines lowest frequency of operation.
3. Highest RF signal power capability is achieved with V set to +10V. However, the switch will operate properly (but at lower RF power capability) at bias voltages down to +3V.
4. Set V to 5 Volts and use HCT series logic to provide a TTL driver interface.

MICROWAVE CORPORATION

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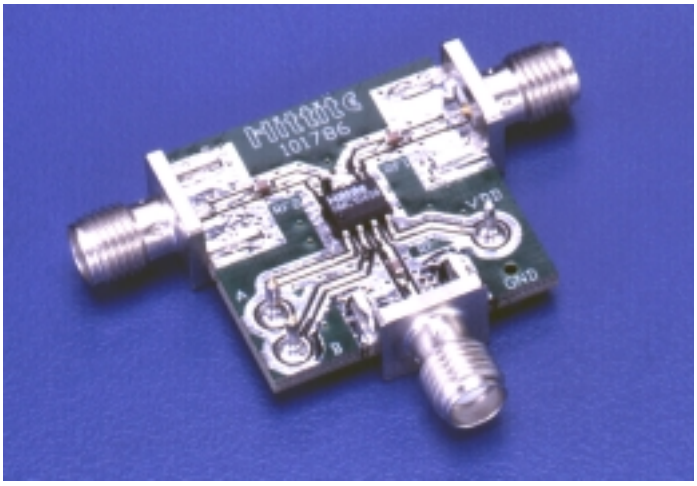
Evaluation Circuit Board



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)