HMC595 / 595E

GaAs MMIC 3 WATT T/R SWITCH, DC - 3 GHz

Typical Applications

The HMC595 / HMC595E is ideal for:

- Cellular/3G Infrastructure
- Private Mobile Radio Handsets
- WLAN, WiMAX & WiBro
- Automotive Telematics
- Test Equipment

Features

Low Insertion Loss: 0.3 dB

High Input IP3: +65 dBm

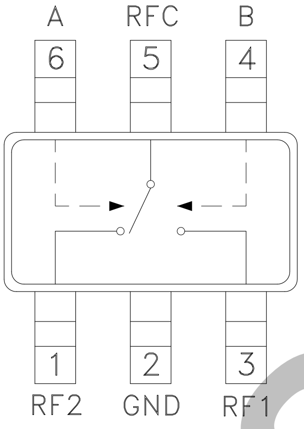
Isolation: 30 dB

Positive Control: 0/+3V to 0/+10V

Ultra Small Package: SOT26

Included in the HMC-DK005 Designer's Kit

Functional Diagram



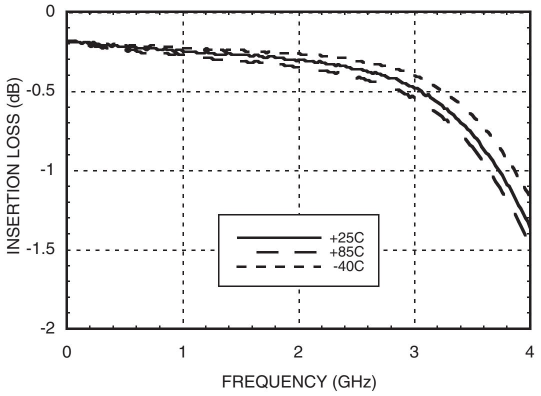
General Description

The HMC595 & HMC595E are low-cost SPDT switches in 6-lead SOT26 packages for use in transmit/receive applications which require very low distortion at high incident power levels. The device can control signals from DC to 3 GHz and is especially suited for Cellular/3G infrastructure, WiMAX and WiBro applications with only 0.3 dB typical insertion loss. The design provides a 3 watt power handling and +65 dBm third order intercept at +8 Volt bias. RF1 and RF2 are reflective shorts when "Off". Control inputs A & B are compatible with CMOS and some TTL logic families. These products are form, fit and function replacements for HMC195 & HMC195E while offering superior electrical performance.

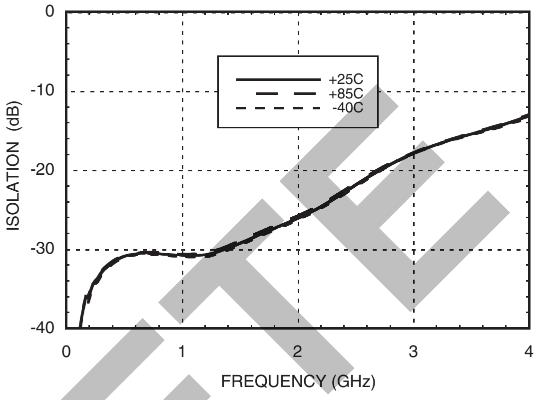
Electrical Specifications, T_A = +25° C, Vctl = 0/+5 Vdc (Unless Otherwise Stated), 50 Ohm System

Parameter		Frequency	Min.	Typ.	Max.	Units
Insertion Loss		DC - 1.0 GHz		0.25	0.5	dB
		DC - 2.0 GHz		0.3	0.6	dB
		DC - 2.5 GHz		0.4	0.7	dB
		DC - 3.0 GHz		0.5	0.8	dB
Isolation		DC - 1.0 GHz	26	30		dB
		DC - 2.0 GHz	22	26		dB
		DC - 2.5 GHz	18	24		dB
		DC - 3.0 GHz	14	18		dB
Return Loss		DC - 1.0 GHz		30		dB
		DC - 2.0 GHz		25		dB
		DC - 2.5 GHz		22		dB
		DC - 3.0 GHz		20		dB
Input Power for 1dB Compression	Vctl = 0/+3V	0.5 - 3.0 GHz	32	35		dBm
	Vctl = 0/+5V		35	38		dBm
	Vctl = 0/+8V		37	39		dBm
Input Third Order Intercept (Two-tone Input Power = +27 dBm Each Tone)	Vctl = 0/+3V	0.5 - 3.0 GHz		47		dBm
	Vctl = 0/+5V			64		dBm
	Vctl = 0/+8V			65		dBm
Switching Characteristics		DC - 3.0 GHz				
	tRISE, tFALL (10/90% RF)			80		ns
	tON, tOFF (50% CTL to 10/90% RF)			120		ns

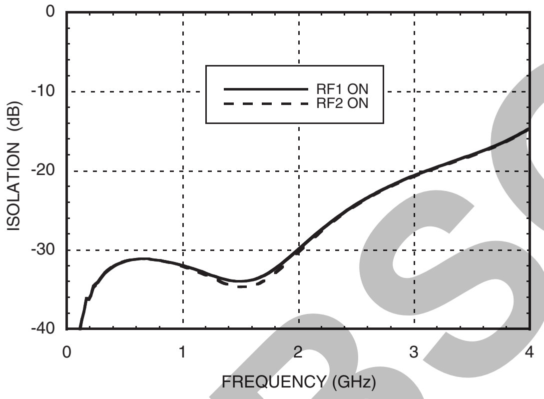
Insertion Loss



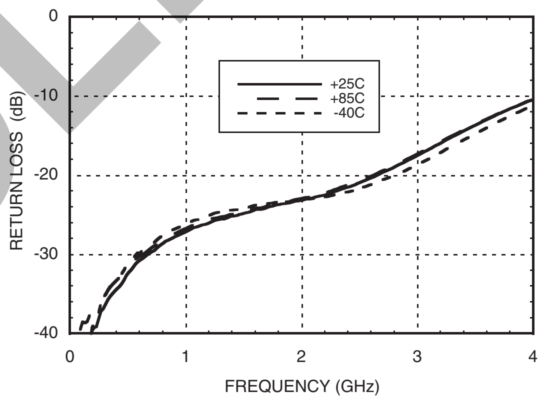
Isolation Between RFC and RF1/RF2



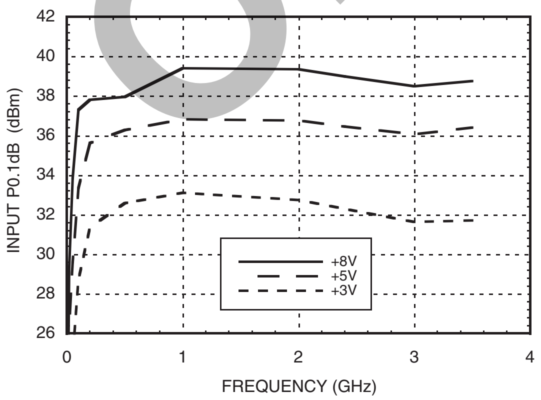
RF1 to RF2 Isolations



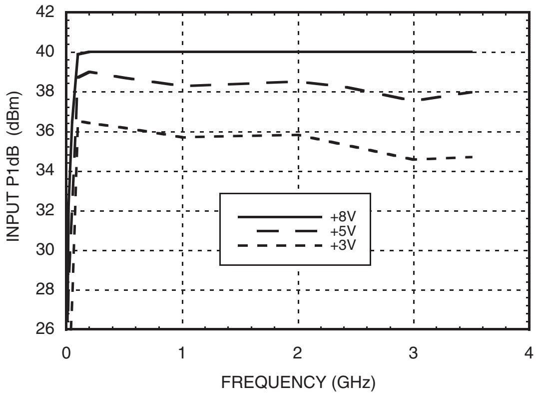
Return Loss



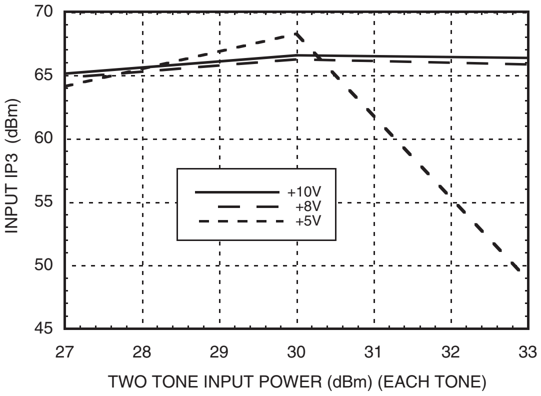
Input P0.1dB vs. Vctl



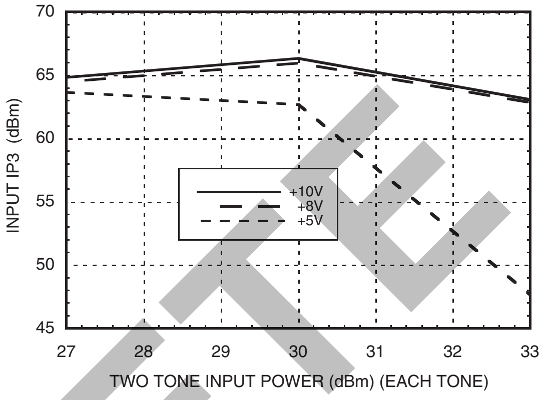
Input P1dB vs. Vctl



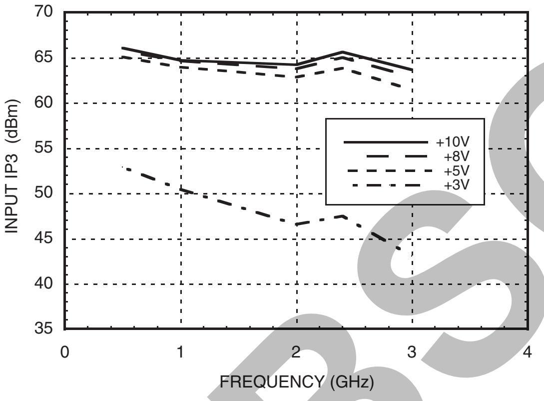
Input IP3 vs. Input Power @ 900 MHz



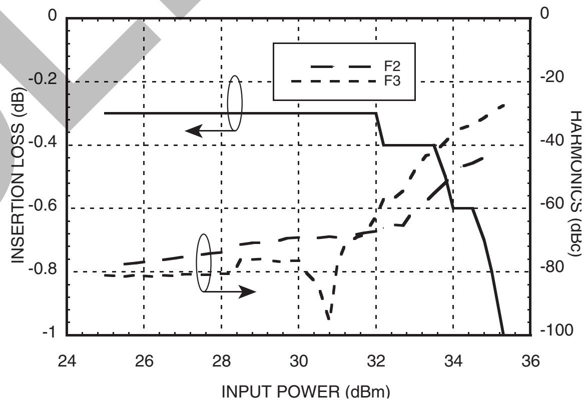
Input IP3 vs. Input Power @ 1900 MHz



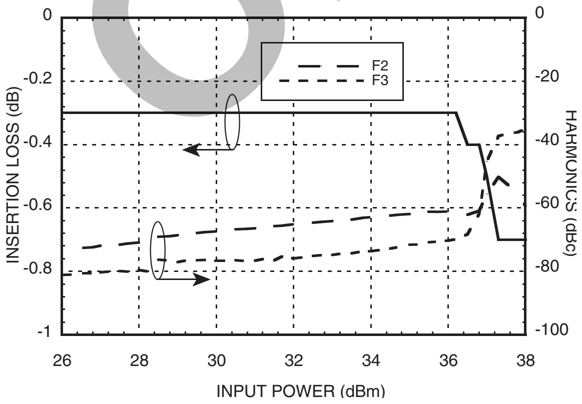
Input Third Order Intercept Point



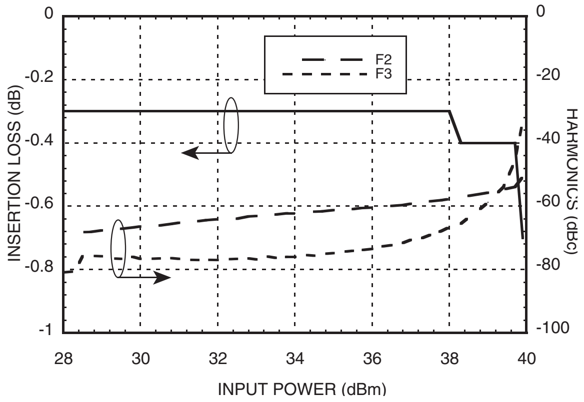
2nd & 3rd Harmonics @ 900 MHz Vctl = +3 Volts



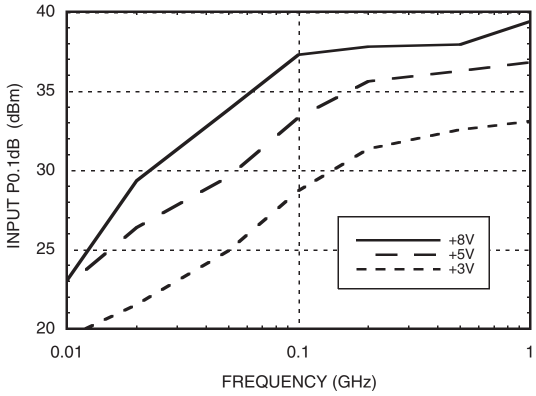
2nd & 3rd Harmonics @ 900 MHz Vctl = +5 Volts



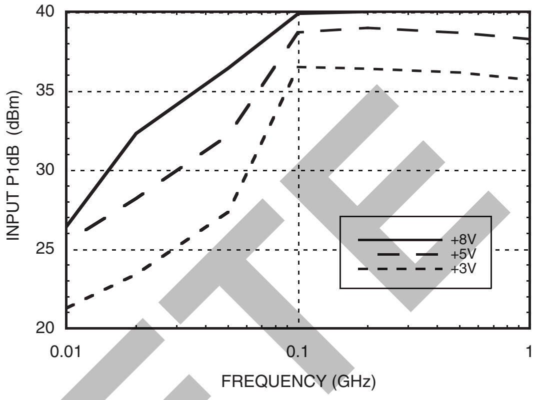
2nd & 3rd Harmonics @ 900 MHz Vctl = +8 Volts



Input P0.1dB vs. Vctl



Input P1dB vs. Vctl



Absolute Maximum Ratings

Max. Input Power V_{ctl} = 0/+8V	0.5 - 2.5 GHz	39 dBm
Control Voltage Range (A & B)		-0.2 to +12 Vdc
Hot Switching Power Level V_{ctl} = 0/+8V		39 dBm
Channel Temperature		150 °C
Continuous Pdiss (T= + 85 °C) (derate 6 mW/°C above 85 °C)		0.38W
Thermal Resistance		173 °C/W
Storage Temperature		-65 to +150 °C
Operating Temperature		-40 to +85 °C
ESD Sensitivity		Class 1A

DC Blocks are required at ports RFC, RF1 and RF2

Control Voltages

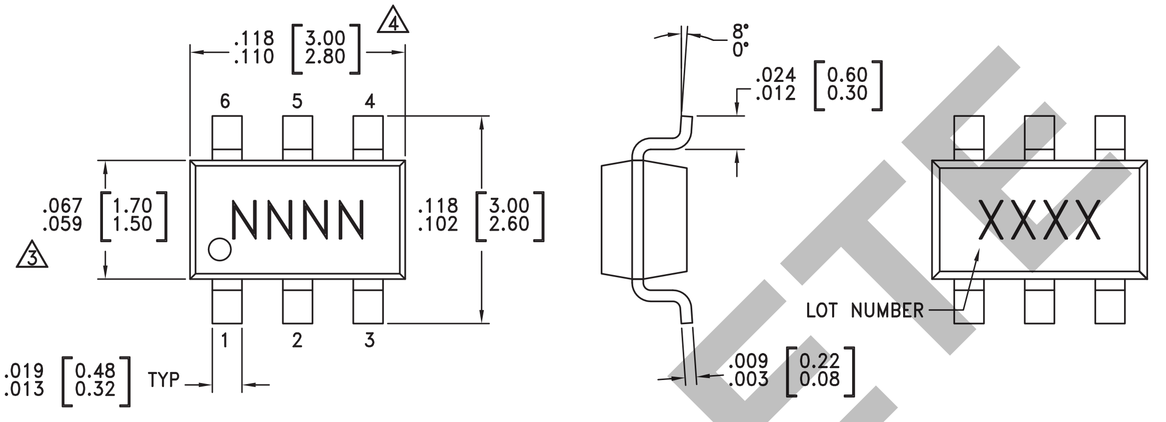
State	Bias Condition
Low	0 to +0.2 Vdc @ 10 µA Typical
High	+3 Vdc @ 2µA Typical to +8 Vdc @ 40 µA Typical (± 0.2 Vdc)

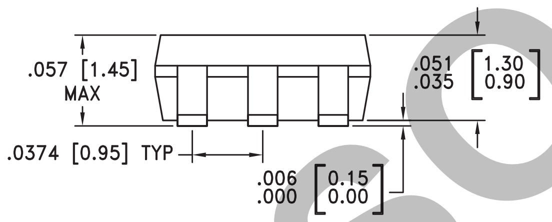
Truth Table

Control Input (Vctl)		Signal Path State	
A	B	RFC to RF1	RFC to RF2
High	Low	Off	On
Low	High	On	Off

ELECTROSTATIC SENSITIVE DEVICE
OBSERVE HANDLING PRECAUTIONS

Outline Drawing





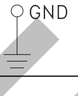
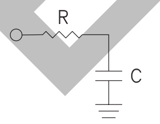
NOTES:
1. LEADFRAME MATERIAL: COPPER ALLOY
2. DIMENSIONS ARE IN INCHES [MILLIMETERS]
3. DIMENSION DOES NOT INCLUDE MOLDFLASH OF 0.15mm PER SIDE.
4. DIMENSION DOES NOT INCLUDE MOLDFLASH OF 0.25mm PER SIDE.
5. ALL GROUND LEADS MUST BE SOLDERED TO PCB RF GROUND

Package Information

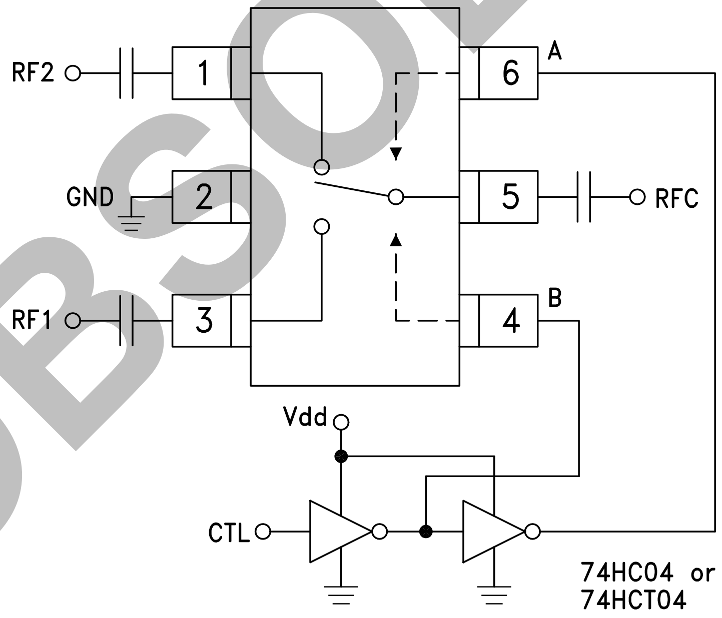
Part Number	Package Body Material	Lead Finish	MSL Rating	Package Marking [3]
HMC595	Low Stress Injection Molded Plastic	Sn/Pb Solder	MSL1 [1]	H595 XXXX
HMC595E	RoHS-compliant Low Stress Injection Molded Plastic	100% matte Sn	MSL1 [2]	595E XXXX

[1] Max peak reflow temperature of 235 °C
[2] Max peak reflow temperature of 260 °C
[3] 4-Digit lot number XXXX

Pin Descriptions

Pin Number	Function	Description	Interface Schematic
1, 3, 5	RF2, RF1, RFC	This pin is DC coupled and matched to 50 Ohm. Blocking capacitors are required.	
2	GND	This pin must be connected to RF/DC ground.	
4	B	See truth table and control voltage table.	
6	A	See truth table and control voltage table.	

Typical Application Circuit

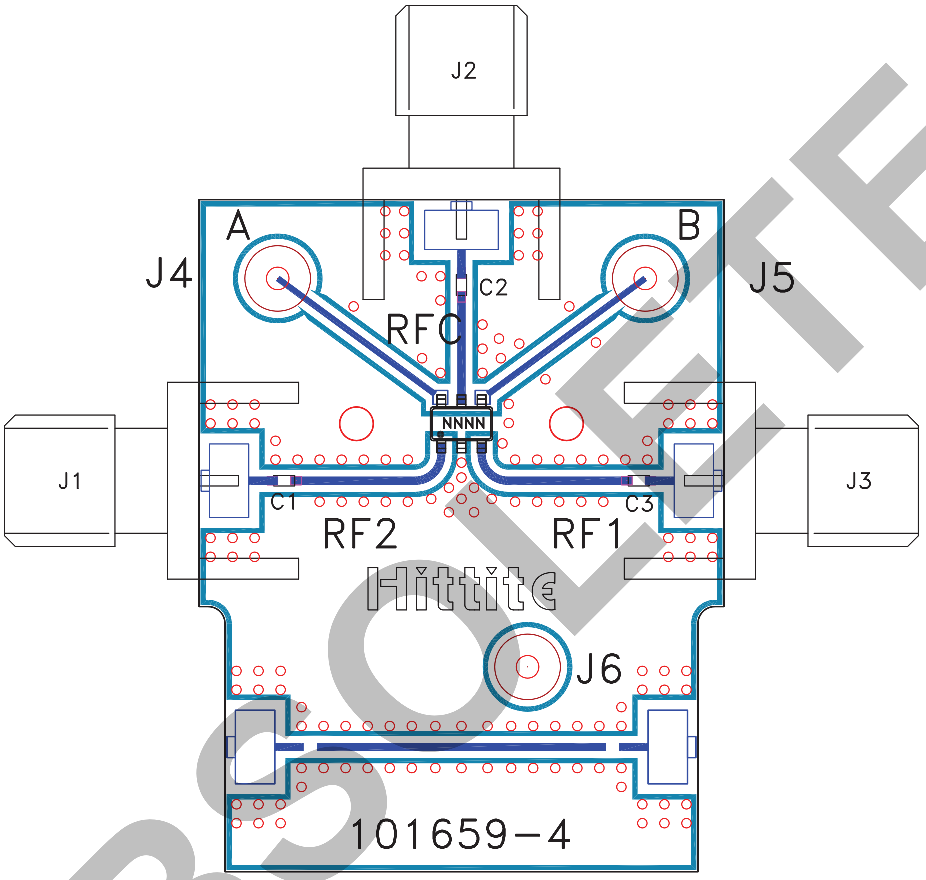


Notes:

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.
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.

GaAs MMIC 3 WATT T/R SWITCH, DC - 3 GHz

Evaluation Circuit Board



List of Materials for Evaluation PCB 101675 [1]

Item	Description
J1 - J3	PCB Mount SMA RF Connector
J4 - J6	DC Pin
C1 - C3	330 pF capacitor, 0402 Pkg.
U1	HMC595 / HMC595E T/R 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 final 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.

Notes: