

Typical Applications

The HMC174MS8(E) is ideal for:

- Infrastructure & Repeaters
- Cellular/3G & WiMAX
- Portable Wireless
- LNA Protection
- Automotive Telematics
- Test Equipment

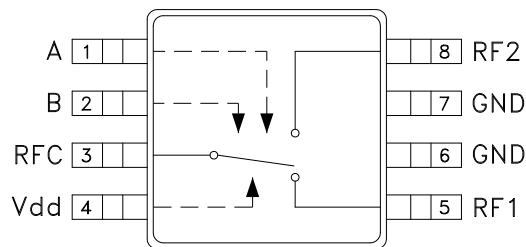
Features

- Low Insertion Loss: 0.5 dB
- High Input IP3: +60 dBm
- Positive Control: 0/+3V to 0 /+8V
- High RF power Capability
- MSOP - 8 SMT package, 14.8 mm²

General Description

The HMC174MS8 & HMC174MS8E are low-cost SPDT switches in 8-lead MSOP packages for use in transmit-receive applications which require very low distortion at high signal power levels. The device can control signals from DC to 3 GHz and is especially suited for cellular/3G and WiMAX applications with only 0.5 dB loss. The design provides exceptional intermodulation performance; providing a +60 dBm third order intercept at 8 Volt bias. RF1 and RF2 are reflective shorts 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.

Functional Diagram

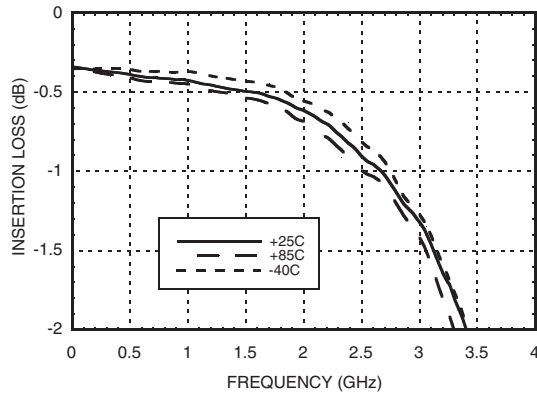


Electrical Specifications, $T_A = +25^\circ \text{C}$, $V_{dd} = +5 \text{Vdc}$, 50 Ohm System

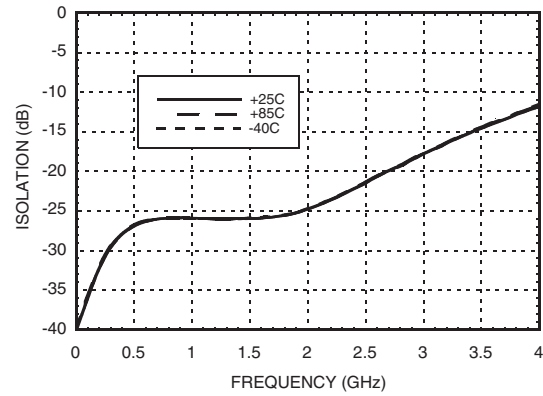
| Parameter | Frequency | Min. | Typ. | Max. | Units |
|----------------------------------|----------------------------------|--------------------------|------|------|-------|
| Insertion Loss | DC - 1.0 GHz | | 0.4 | 0.7 | dB |
| | DC - 2.0 GHz | | 0.5 | 0.8 | dB |
| | DC - 2.5 GHz | | 0.8 | 1.1 | dB |
| | DC - 3.0 GHz | | 1.3 | 1.8 | dB |
| Isolation | DC - 1.0 GHz | 21 | 26 | | dB |
| | DC - 2.0 GHz | 21 | 26 | | dB |
| | DC - 2.5 GHz | 18 | 23 | | dB |
| | DC - 3.0 GHz | 15 | 20 | | dB |
| Return Loss | DC - 1.0 GHz | | 25 | | dB |
| | DC - 2.0 GHz | | 20 | | dB |
| | DC - 2.5 GHz | | 15 | | dB |
| | DC - 3.0 GHz | | 12 | | dB |
| Input Power for 1 dB Compression | 0.5 - 1.0 GHz | 32 | 36 | | dBm |
| | 0.5 - 3.0 GHz | 32 | 36 | | dBm |
| Input Third Order Intercept | 0.5 - 1.0 GHz | 55 | 60 | | dBm |
| | 0.5 - 3.0 GHz | 49 | 56 | | dBm |
| Switching Characteristics | DC - 3.0 GHz | | | | |
| | | tRISE, tFALL (10/90% RF) | | 10 | ns |
| | tON, tOFF (50% CTL to 10/90% RF) | | 24 | ns | |



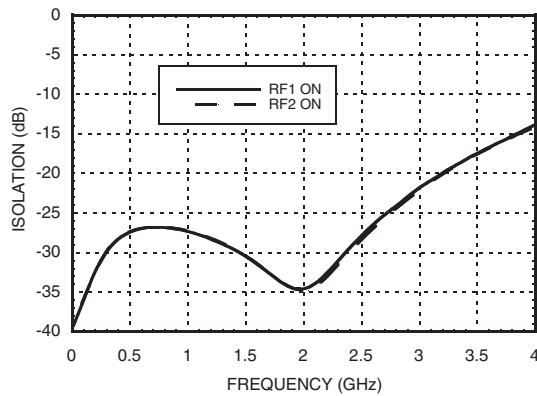
Insertion Loss



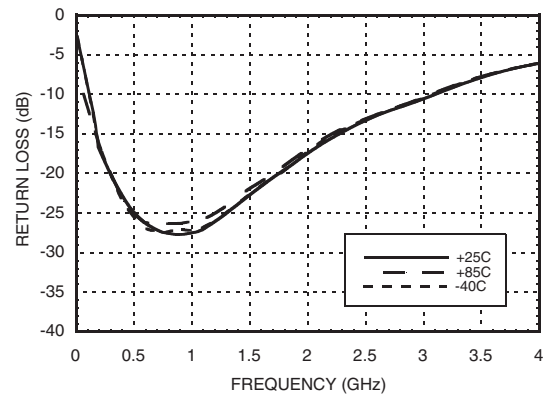
Isolation Between RFC & RF1/RF2



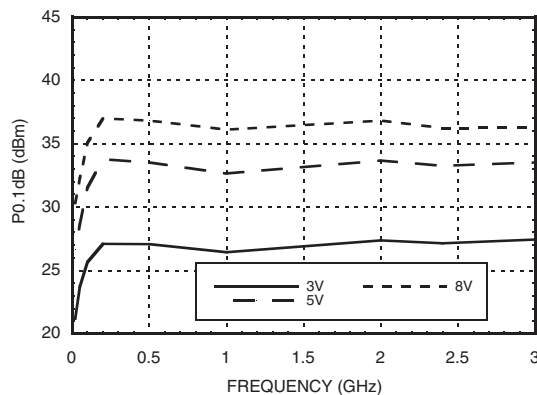
RF1 to RF2 Isolation



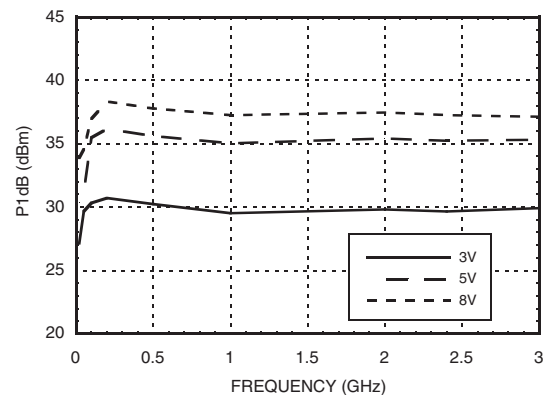
Return Loss



Input P0.1dB vs. Vdd

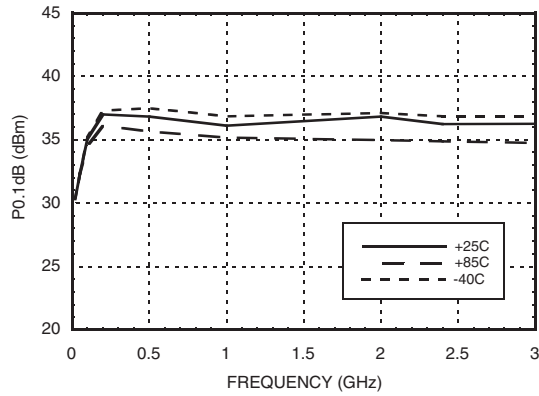


Input P1dB vs. Vdd

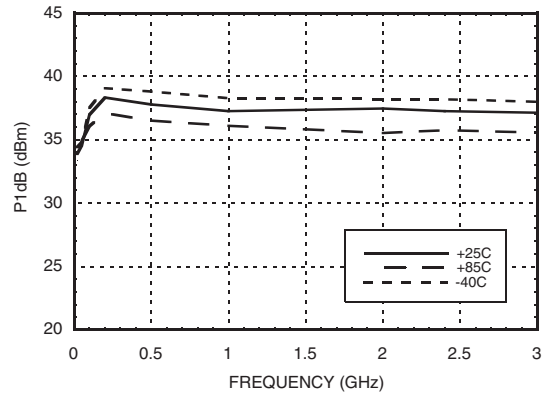




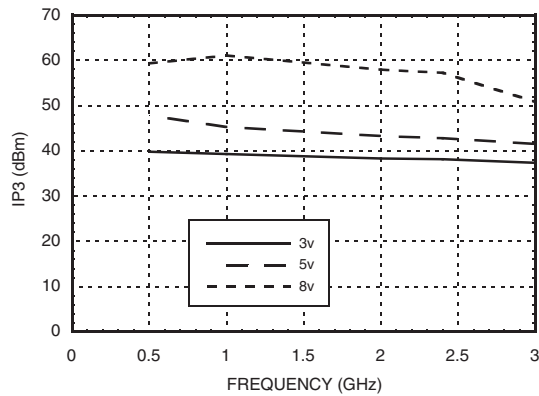
Input P0.1dB vs. Temperature



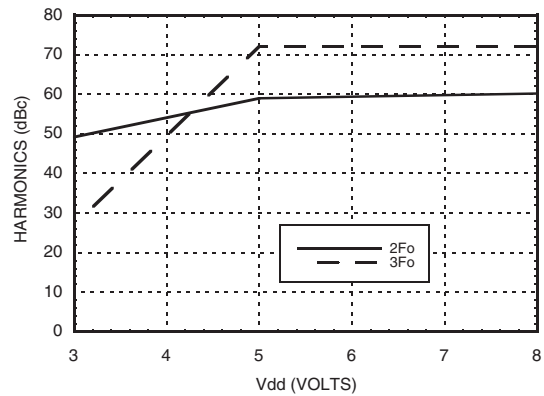
Input P1dB vs. Temperature



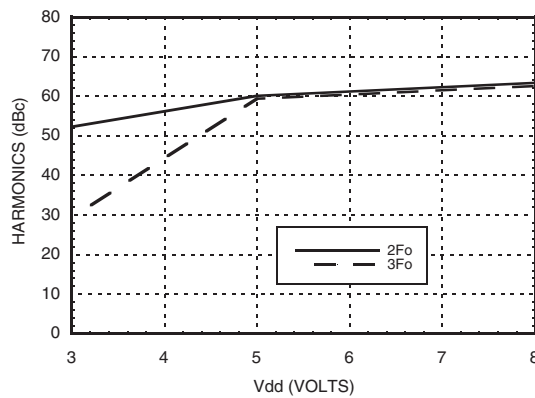
Input Third Order Intercept



2nd & 3rd Harmonics @ 900 MHz



2nd & 3rd Harmonics @ 1900 MHz



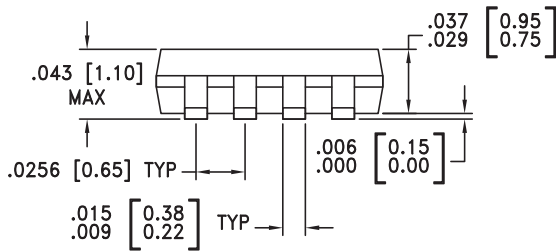
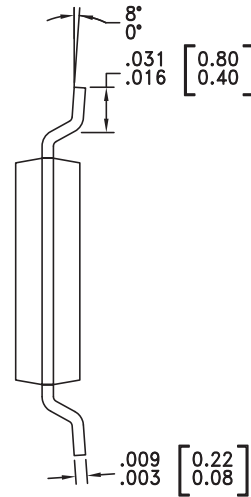
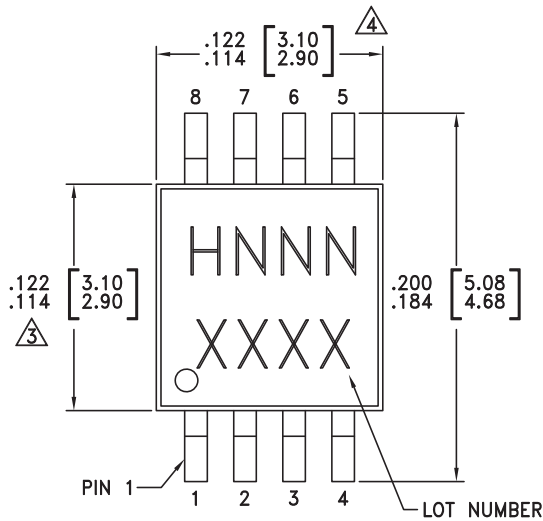

Truth Table *Control Input Voltage Tolerances are ± 0.2 Vdc

| Bias Vdd (Vdc) | Control Input* | | Bias Current Idd (μ A) | Control Current | | Signal Path State | |
|----------------------|----------------|------------|-----------------------------------|------------------|------------------|-------------------|-----------|
| | A (Vdc) | B (Vdc) | | Ia (μ A) | Ib (μ A) | 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 +10 Vdc |
| Control Voltage Range (A & B) | -0.2 to +Vdd Vdc |
| Storage Temperature | -65 to +150 °C |
| Operating Temperature | -40 to +85 °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 ^[3] |
|-------------|----------------------------------------------------|---------------|---------------------|--------------------------------|
| HMC174MS8 | Low Stress Injection Molded Plastic | Sn/Pb Solder | MSL1 ^[1] | H174 XXXX |
| HMC174MS8E | RoHS-compliant Low Stress Injection Molded Plastic | 100% matte Sn | MSL1 ^[2] | H174 XXXX |

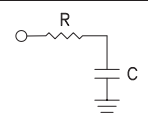

[1] Max peak reflow temperature of 235 °C

[2] Max peak reflow temperature of 260 °C

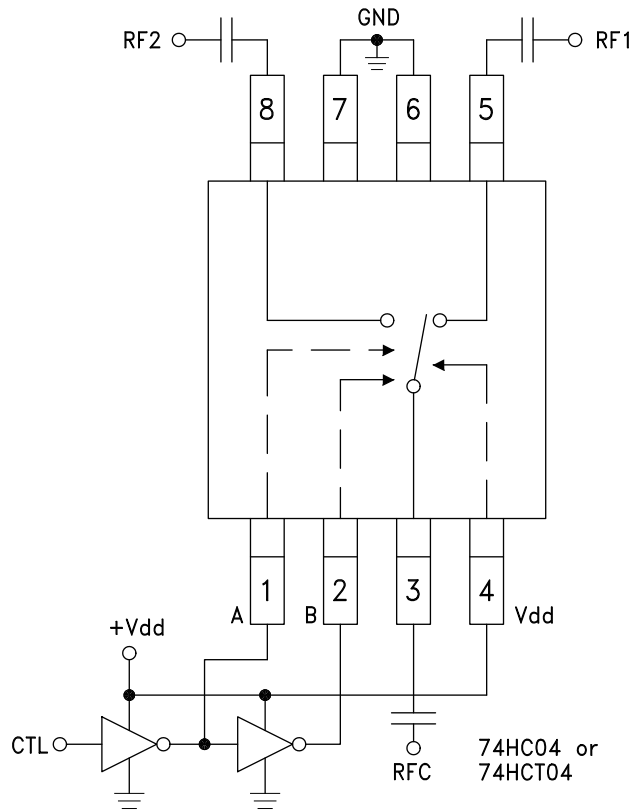
[3] 4-Digit lot number XXXX



Pin Descriptions

| Pin Number | Function | Description | Interface Schematic |
|------------|---------------|---------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| 1 | A | See truth table and control voltage table. |  |
| 2 | B | See truth table and control voltage table. | |
| 3, 5, 8 | RFC, RF1, RF2 | This pin is DC coupled and matched to 50 Ohm. Blocking capacitors are required. | |
| 4 | Vdd | Supply Voltage. | |
| 6, 7 | GND | This pin must be connected to RF/DC ground. |  |

Typical Application Circuit



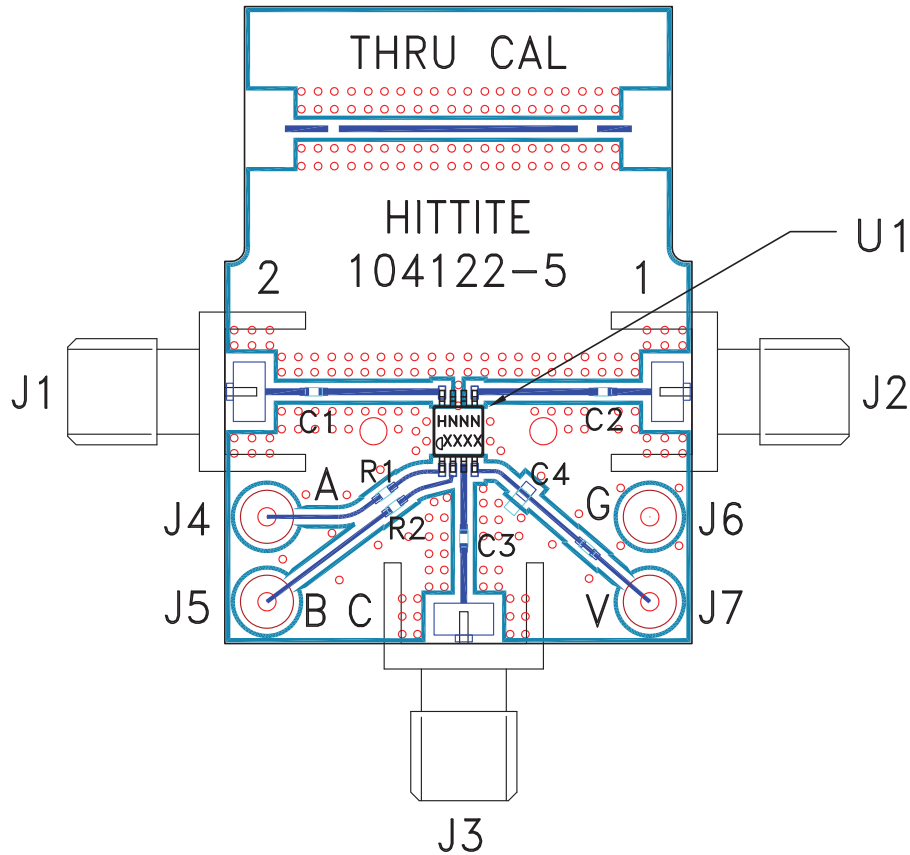
Notes:

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 +8V. The switch will operate properly (but at lower RF power capability) at bias voltages down to +3V.

*For price, delivery, and to place orders, please contact Hittite Microwave Corporation:
20 Alpha Road, Chelmsford, MA 01824 Phone: 978-250-3343 Fax: 978-250-3373
Order On-line at www.hittite.com*



Evaluation Circuit Board



List of Materials for Evaluation PCB 104124 [1]

| Item | Description |
|---------|--------------------------------|
| J1 - J3 | PCB Mount SMA RF Connector |
| J4 - J7 | DC Pin |
| C1 - C3 | 100 pF capacitor, 0402 Pkg. |
| C4 | 10,000 pF capacitor, 0603 Pkg. |
| U1 | HMC174MS8(E) T/R Switch |
| PCB [2] | 104122 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: