

GaAs MMIC SP8T NON-REFLECTIVE SWITCH, DC - 10 GHz

Typical Applications

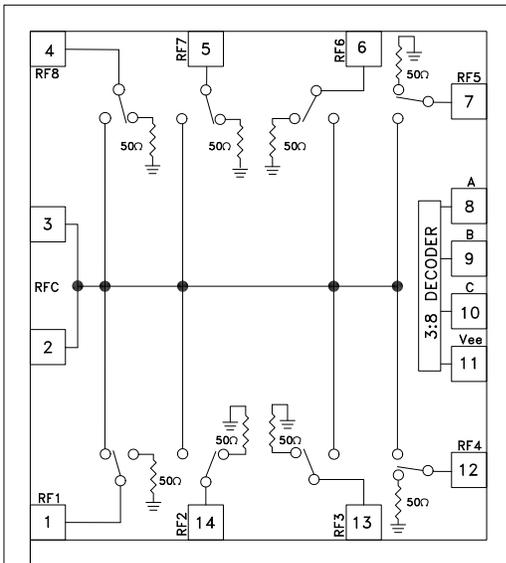
The HMC322 is ideal for:

- Telecom Infrastructure
- Microwave Radio & VSAT
- Military & Space
- Test Instrumentation

Features

- Broadband Performance: DC - 10.0 GHz
- High Isolation: >38 dB@ 4 GHz
- Low Insertion Loss: 2.0 dB@ 4 GHz
- Integrated 3:8 TTL Decoder
- Small Size: 1.45 x 1.6 x 0.10 mm

Functional Diagram



General Description

The HMC322 is a broadband non-reflective GaAs MESFET SP8T switch chip. Covering DC to 10 GHz, this switch offers high isolation and low insertion loss and extends the frequency coverage of Hittite's SP8T switch product line. This switch also includes an on board binary decoder circuit which reduces the required logic control lines to three. The switch operates using a negative control voltage of 0/-5V, and requires a fixed bias of -5V. All data is tested with the chip in a 50 Ohm test fixture connected via 0.025 mm (1 mil) diameter wire bonds of 0.5 mm (20 mils) length.

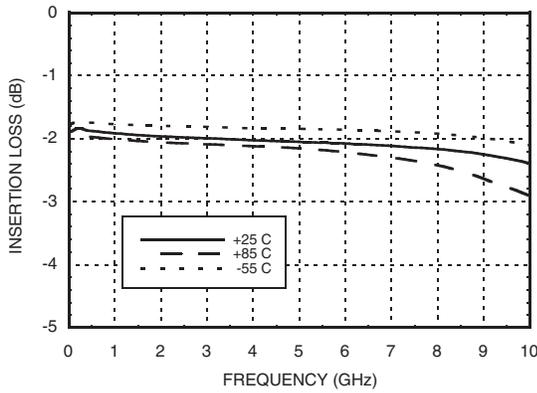
Electrical Specifications, $T_A = +25^\circ C$, With 0/-5V Control, Vee= -5V, 50 Ohm System

| Parameter | Frequency | Min. | Typ. | Max. | Units |
|--|----------------|--|------|------|-------|
| Insertion Loss | DC - 2.0 GHz | | 1.9 | 2.3 | dB |
| | DC - 4.0 GHz | | 2.0 | 2.4 | dB |
| | DC - 6.0 GHz | | 2.1 | 2.5 | dB |
| | DC - 8 GHz | | 2.2 | 2.6 | dB |
| | DC - 10.0 GHz | | 2.4 | 2.8 | dB |
| Isolation (RFC to RF1 - 8) | DC - 2.0 GHz | 40 | 46 | | dB |
| | DC - 4.0 GHz | 32 | 38 | | dB |
| | DC - 6.0 GHz | 27 | 32 | | dB |
| | DC - 8 GHz | 20 | 26 | | dB |
| | DC - 10.0 GHz | 18 | 24 | | dB |
| Return Loss | "On State" | | 14 | | dB |
| Return Loss | "Off State" | | 11 | | dB |
| Input Power for 1 dB Compression | 0.5 - 10.0 GHz | 19 | 23 | | dBm |
| Input Third Order Intercept (Two-Tone Input Power = +7 dBm Each Tone) | 0.5 - 10.0 GHz | 34 | 38 | | dBm |
| Switching Characteristics | DC - 10.0 GHz | | 50 | | ns |
| | | tRISE, tFALL (10/90% RF) tON, tOFF (50% CTL to 10/90% RF) | | 150 | |

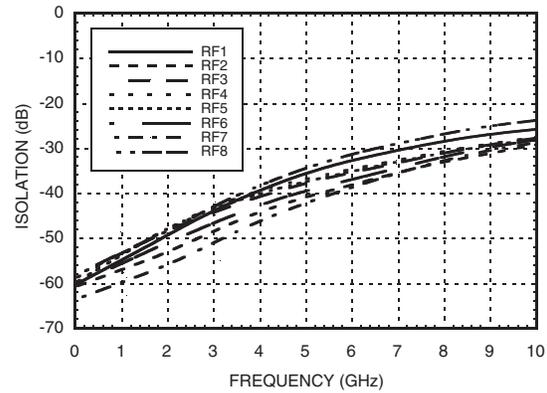
For price, delivery, and to place orders, please contact Hittite Microwave Corporation:
 20 Alpha Road, Chelmsford, MA 01824 Phone: 978-250-3343 Fax: 978-250-3373
 Order On-line at www.hittite.com

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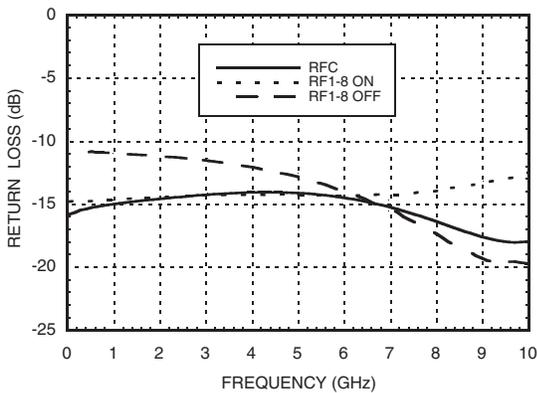
Insertion Loss vs. Temperature



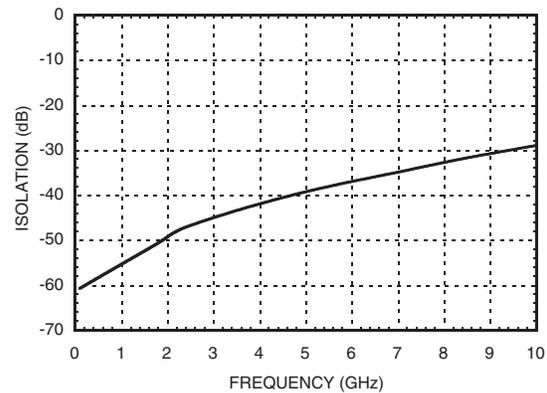
Isolation Between RFC and Output Ports



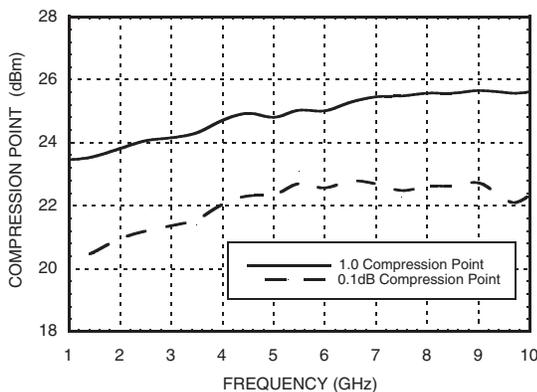
Return Loss



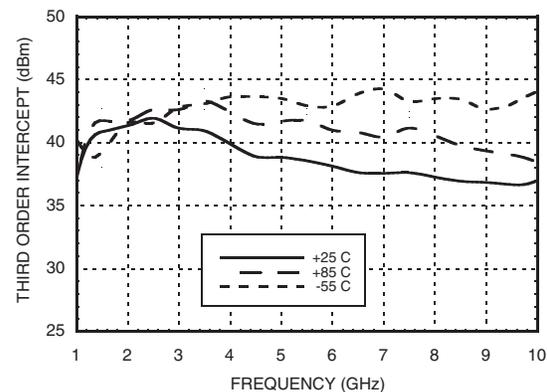
Isolation Between Output Ports



0.1 and 1 dB Input Compression Point



Input Third Order Intercept Point



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Absolute Maximum Ratings

| | |
|-----------------------------------|---------------------|
| Bias Voltage Range (Vee) | -7 Vdc |
| Control Voltage Range (A, B, & C) | Vee -0.5V to +1 Vdc |
| Storage Temperature | -65 to +150 °C |
| Operating Temperature | -40 to +85 °C |
| RF Input Power, 0.5 - 10 GHz | +26 dBm |

Control Voltages

| State | Bias Condition |
|-------|-------------------------------|
| Low | -3V to 0 Vdc @ 25 uA Typical |
| High | -5 to -4.2 Vdc @ 5 uA Typical |

4



**ELECTROSTATIC SENSITIVE DEVICE
OBSERVE HANDLING PRECAUTIONS**

Truth Table

| Control Input | | | Signal Path State |
|---------------|------|------|-------------------|
| A | B | C | RFCOM to: |
| High | High | High | RF1 |
| Low | High | High | RF2 |
| High | Low | High | RF3 |
| Low | Low | High | RF4 |
| High | High | Low | RF5 |
| Low | High | Low | RF6 |
| High | Low | Low | RF7 |
| Low | Low | Low | RF8 |

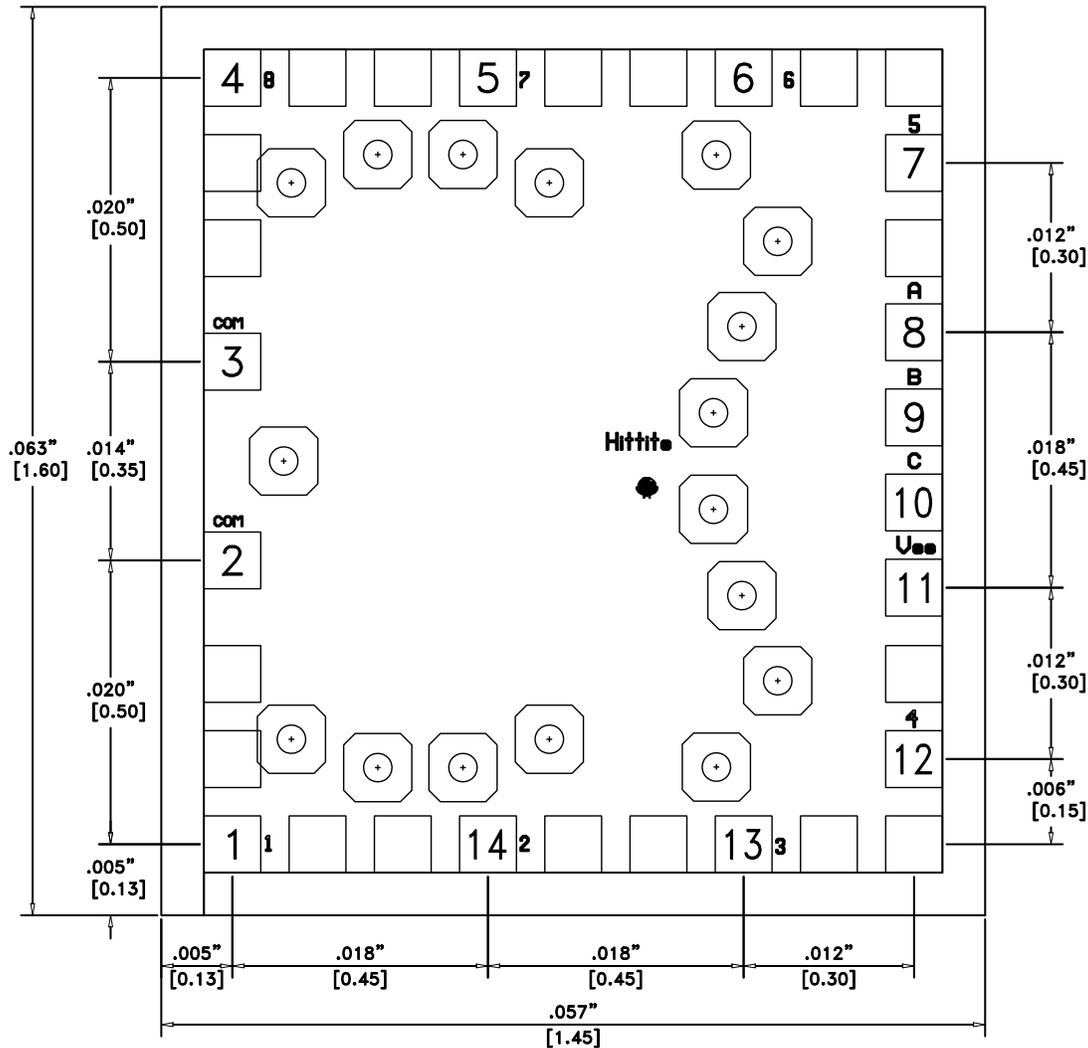
Bias Voltage & Current

| Vee Range = -5 Vdc ± 10% | | |
|--------------------------|-----------------------------|-----------------------------|
| Vee (Vdc) | I _{ee} (Typ.) (mA) | I _{ee} (Max.) (mA) |
| -5.0 | 5.0 | 9.0 |

SWITCHES - CHIP

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Outline Drawing



Die Packaging Information ^[1]

| Standard | Alternate |
|--------------------|-----------|
| WP-3 (Waffle Pack) | [2] |

[1] Refer to the "Packaging Information" section for die packaging dimensions.

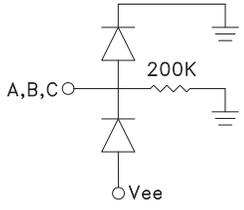
[2] For alternate packaging information contact Hittite Microwave Corporation.

NOTES:

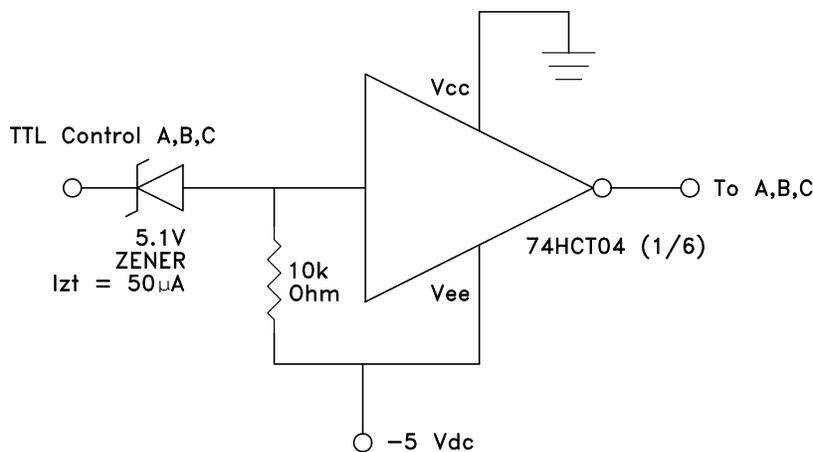
1. DIMENSIONS IN INCHES [MILLIMETERS].
2. DIE THICKNESS IS 0.004".
3. TYPICAL BOND PAD IS 0.004" SQUARE.
4. TYPICAL BOND PAD SPACING IS 0.006" CENTER TO CENTER.
5. BOND PAD METALLIZATION: GOLD.
6. BACKSIDE METALLIZATION: GOLD.
7. BACKSIDE METAL IS GROUND.
8. NO CONNECTION REQUIRED FOR UNLABELED GROUND BOND PADS.

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Pad Descriptions

| Pad Number | Function | Description | Interface Schematic |
|-------------------|------------------------|---|---|
| 1 - 7, 12 - 14 | RF1, RFC, RF8 - RF2 | These pads are DC coupled and matched to 50 Ohms. Blocking capacitors are required if RF line potential is not equal to 0V. | |
| 8 | A | See truth table and control voltage table. |  |
| 9 | B | See truth table and control voltage table. | |
| 10 | C | See truth table and control voltage table. | |
| 11 | Vee | Supply Voltage = -5Vdc ± 10% | |
| Die Bottom | GND | Die bottom must be connected to RF / DC ground. |  |

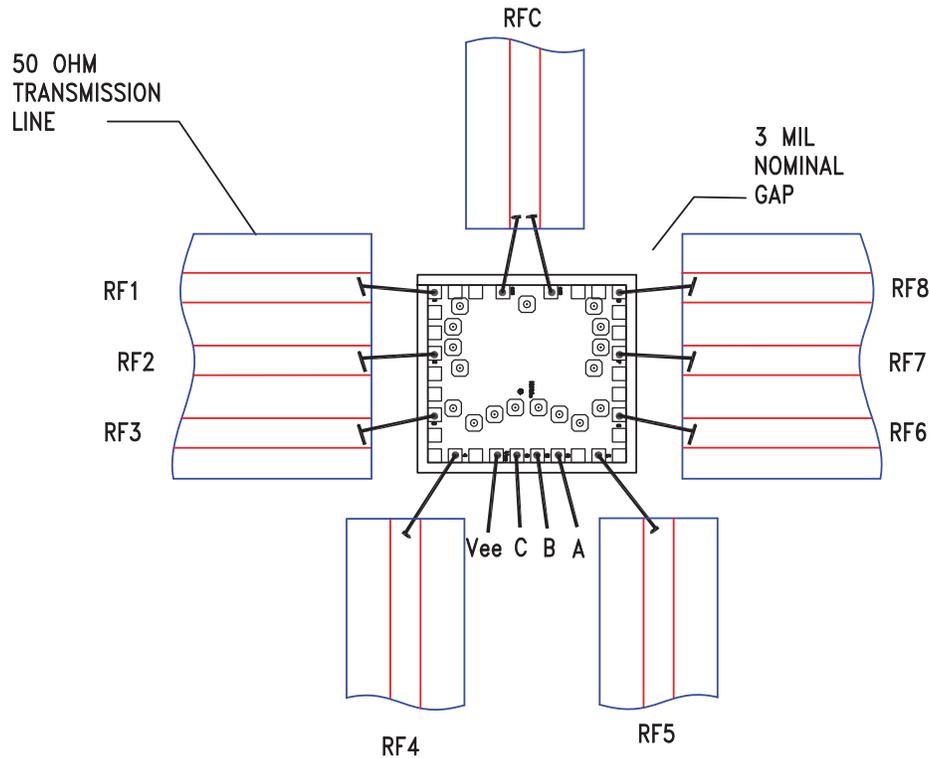
TTL Interface Circuit (Required for Each Control Input A, B and C)



Note:
Control inputs A, B, and C can be driven directly with TTL logic with -5 Volts applied to the HCT logic gates Vee pin and to the Vee pad of the RF Switch.

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Assembly Diagram



Handling Precautions

Follow these precautions to avoid permanent damage.

Storage: All bare die are placed in either Waffle or Gel based ESD protective containers, and then sealed in an ESD protective bag for shipment. Once the sealed ESD protective bag has been opened, all die should be stored in a dry nitrogen environment.

Cleanliness: Handle the chips in a clean environment. DO NOT attempt to clean the chip using liquid cleaning systems.

Static Sensitivity: Follow ESD precautions to protect against ESD strikes.

Transients: Suppress instrument and bias supply transients while bias is applied. Use shielded signal and bias cables to minimize inductive pick-up.

General Handling: Handle the chip along the edges with a vacuum collet or with a sharp pair of bent tweezers. The surface of the chip has fragile air bridges and should not be touched with vacuum collet, tweezers, or fingers.

Mounting

The chip is back-metallized and can be die mounted with electrically conductive epoxy. The mounting surface should be clean and flat.

Epoxy Die Attach: Apply a minimum amount of epoxy to the mounting surface so that a thin epoxy fillet is observed around the perimeter of the chip once it is placed into position. Cure epoxy per the manufacturer's schedule.

Wire Bonding

Ball or wedge bond with 0.025mm (1 mil) diameter pure gold wire. Thermo-sonic wirebonding with a nominal stage temperature of 150 deg. C and a ball bonding force of 40 to 50 grams or wedge bonding force of 18 to 22 grams is recommended. Use the minimum level of ultrasonic energy to achieve reliable wirebonds. Wirebonds should be started on the chip and terminated on the package or substrate. All bonds should be as short as possible <0.31mm (12 mils).