

Analog Devices Welcomes Hittite Microwave Corporation

NO CONTENT ON THE ATTACHED DOCUMENT HAS CHANGED



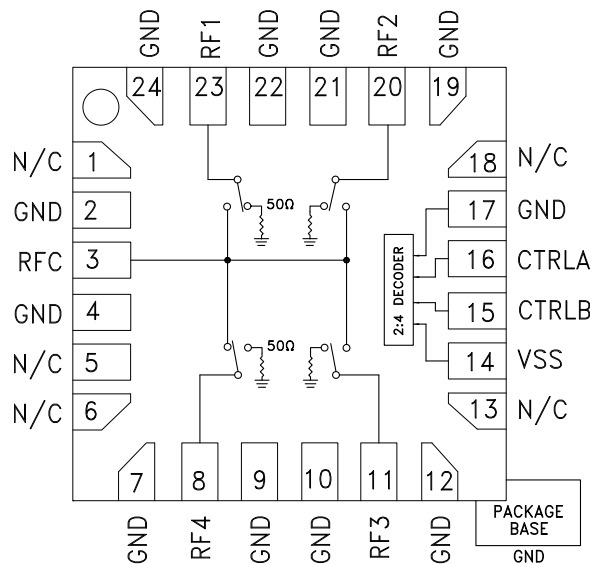
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Typical Applications

The HMC641ALP4E is ideal for:

- Telecom Infrastructure
- Microwave Radio & VSAT
- Military & Space Hybrids
- Test Instrumentation
- SATCOM & Sensors

Functional Diagram



Features

- Broadband Performance: DC - 20 GHz
- High Isolation: 45 dB @ 10 GHz
- Low Insertion Loss: 2.3 dB @ 10 GHz
- Integrated 2:4 TTL Decoder
- 24 Lead 4x4 mm SMT Package: 16 mm²

General Description

The HMC641ALP4E is a broadband non-reflective GaAs pHEMT SP4T switch in a compact 4x4 mm plastic package. Covering DC to 20 GHz, this switch offers high isolation, low insertion loss and on-chip termination of isolated ports. This switch also includes an on board binary decoder circuit which reduces the number of required logic control lines from four to two. The HMC641ALP4E is controlled with 0/ -5V logic, exhibits fast switching speed and consumes much less DC current than pin diode based solutions.

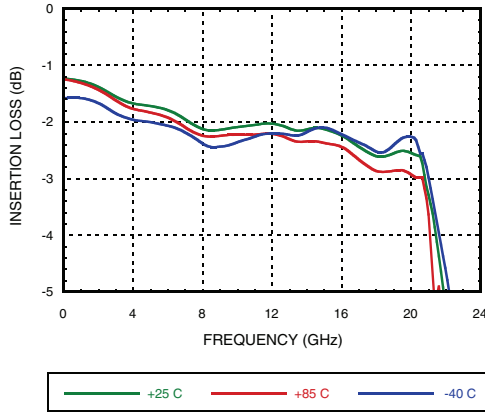
Electrical Specifications, $T_A = +25^\circ\text{C}$, With 0/-5V Control, $V_{SS} = -5\text{V}$, 50 Ohm System

| Parameter | Frequency | Min. | Typ. | Max. | Units |
|---|-----------------|-------------|------|------|-------|
| Insertion Loss | DC - 12 GHz | | 2.0 | 3.2 | dB |
| | DC - 20 GHz | | 3.0 | 4.2 | dB |
| Isolation (RFC to RF1 - RF4) | DC - 12 GHz | 30 | 42 | | dB |
| | DC - 20 GHz | 30 | 40 | | dB |
| Return Loss | "On State" | DC - 12 GHz | 18 | | dB |
| | | DC - 20 GHz | 17 | | dB |
| Return Loss | "Off State" | DC - 20 GHz | 13 | | dB |
| Input Power for 1 dB Compression | 0.05 - 0.25 GHz | 15 | 20 | | dBm |
| | 0.25 - 20 GHz | 20 | 24 | | dBm |
| Input Third Order Intercept (Two-Tone Input Power= +10 dBm Each Tone) | 0.05 - 0.25 GHz | | 30 | | dBm |
| | 0.25 - 20 GHz | | 41 | | dBm |
| Switching Characteristics tRISE, tFALL (10/90% RF) tON, tOFF (50% CTL to 10/90% RF) | DC - 20 GHz | | 30 | | ns |
| | | | 100 | | ns |

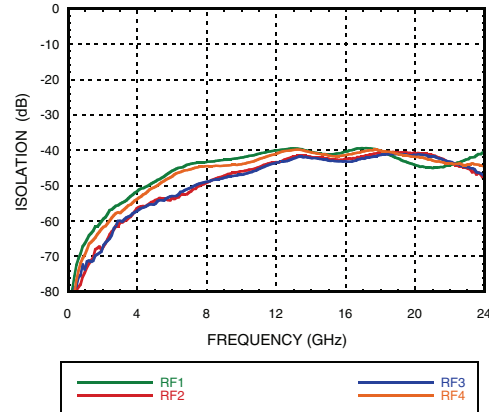


GaAs MMIC SP4T NON-REFLECTIVE SWITCH, DC - 20 GHz

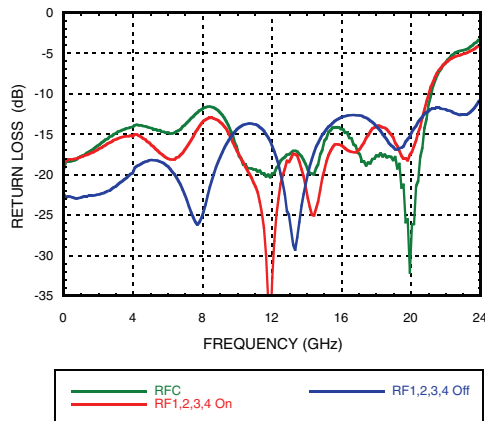
Insertion Loss vs. Temperature



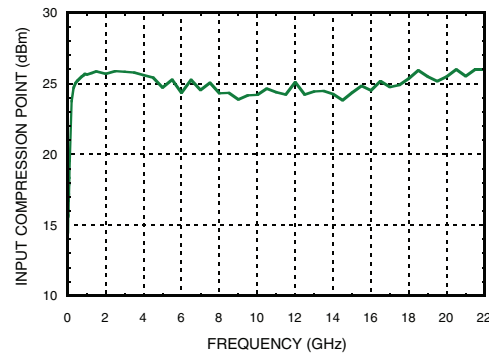
Isolation



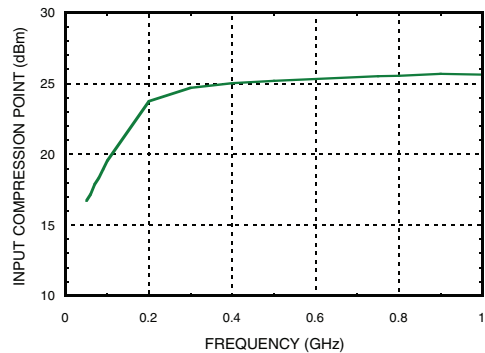
Return Loss



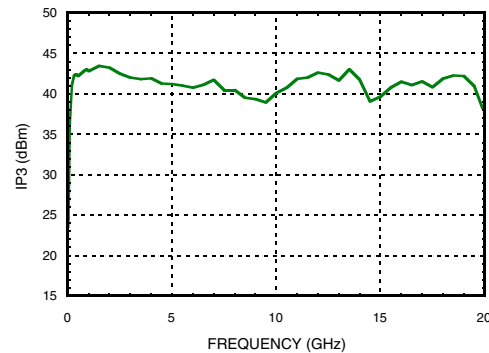
1 dB Input Compression Point



1 dB Input Compression Point (Low Frequency Detail)



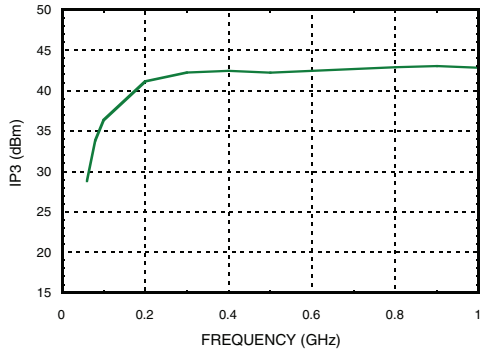
Input Third Order Intercept Point





GaAs MMIC SP4T NON-REFLECTIVE SWITCH, DC - 20 GHz

Input Third Order Intercept (Low Frequency Detail)



Absolute Maximum Ratings

| | | |
|---|---------------------|-----------|
| Bias Voltage (Vss) | -7V | |
| Control Voltage Range (CTRLA & CTRLB) | Vss -0.5V to +1V | |
| Maximum Input Power | Insertion Loss Path | +26.5 dBm |
| | Terminated Path | +23 dBm |
| Channel Temperature | 150 °C | |
| Thermal Resistance Channel to ground paddle | Insertion Loss Path | 201 °C/W |
| | Terminated Path | 321 °C/W |
| Storage Temperature | -65 to +150 °C | |
| Operating Temperature | -40 to +85 °C | |
| ESD Sensitivity (HBM) | Class 1A | |

Truth Table

| Control Input | | Signal Path State |
|---------------|-------|-------------------|
| CTRLA | CTRLB | RFC to: |
| High | High | RF1 |
| Low | High | RF2 |
| High | Low | RF3 |
| Low | Low | RF4 |



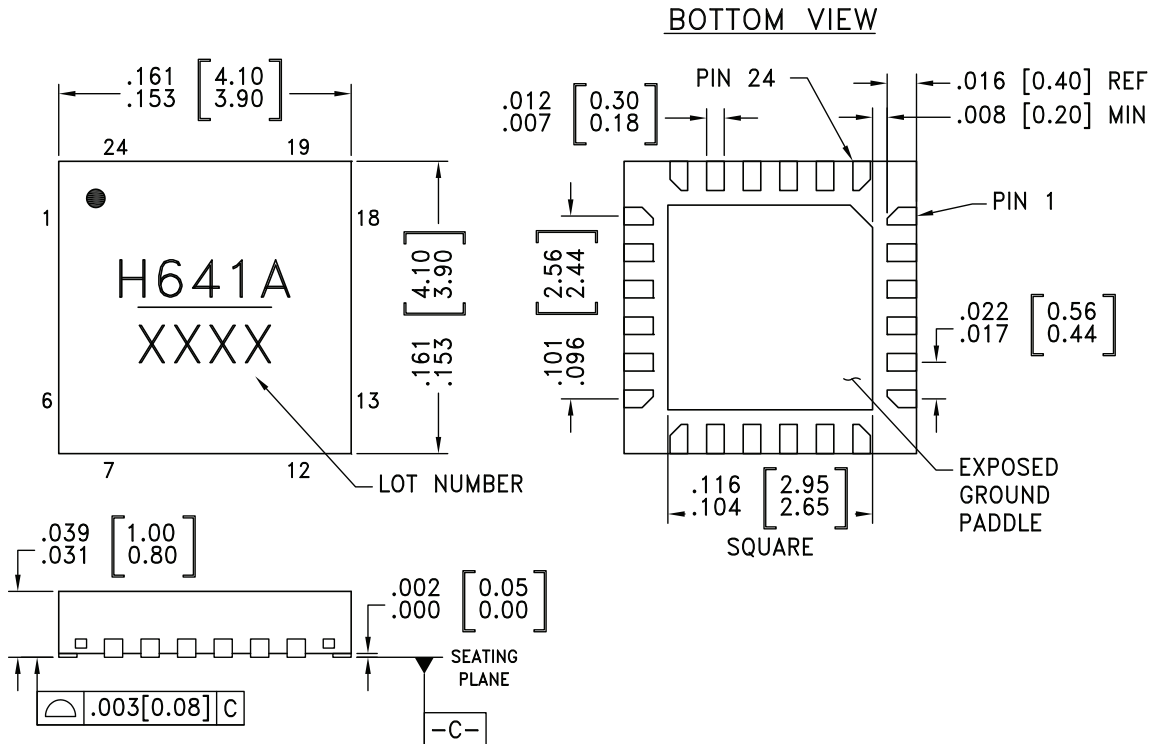
ELECTROSTATIC SENSITIVE DEVICE
OBSERVE HANDLING PRECAUTIONS

Bias Voltage & Current

| Vss Range = -5 Vdc ±10% | | |
|-------------------------|----------------|----------------|
| Vss (Vdc) | Iss (Typ) (mA) | Iss (Max) (mA) |
| -5 | 1.7 | 5.0 |

TTL/CMOS Control Voltages

| State | Bias Condition |
|-------|----------------------------|
| Low | -2.5V to 0V @ 30 µA Typ. |
| High | -5V to -3.8V @ 0.5 µA Typ. |

Outline Drawing

NOTES:

1. LEADFRAME MATERIAL: COPPER ALLOY
2. DIMENSIONS ARE IN INCHES [MILLIMETERS]
3. LEAD SPACING TOLERANCE IS NON-CUMULATIVE
4. PAD BURR LENGTH SHALL BE 0.15 mm MAXIMUM.
PAD BURR HEIGHT SHALL BE 0.05 mm MAXIMUM.
5. PACKAGE WARP SHALL NOT EXCEED 0.05 mm.
6. ALL GROUND LEADS AND GROUND PADDLE MUST BE SOLDERED TO PCB RF GROUND.
7. REFER TO HITTITE APPLICATION NOTE FOR SUGGESTED LAND PATTERN.


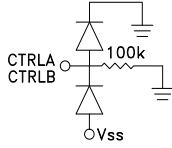
Package Information

| Part Number | Package Body Material | Lead Finish | MSL Rating | Package Marking ^[1] |
|-------------|--|---------------|---------------------|--------------------------------|
| HMC641ALP4E | RoHS-compliant Low Stress Injection Molded Plastic | 100% matte Sn | MSL1 ^[2] | H641A XXXX |

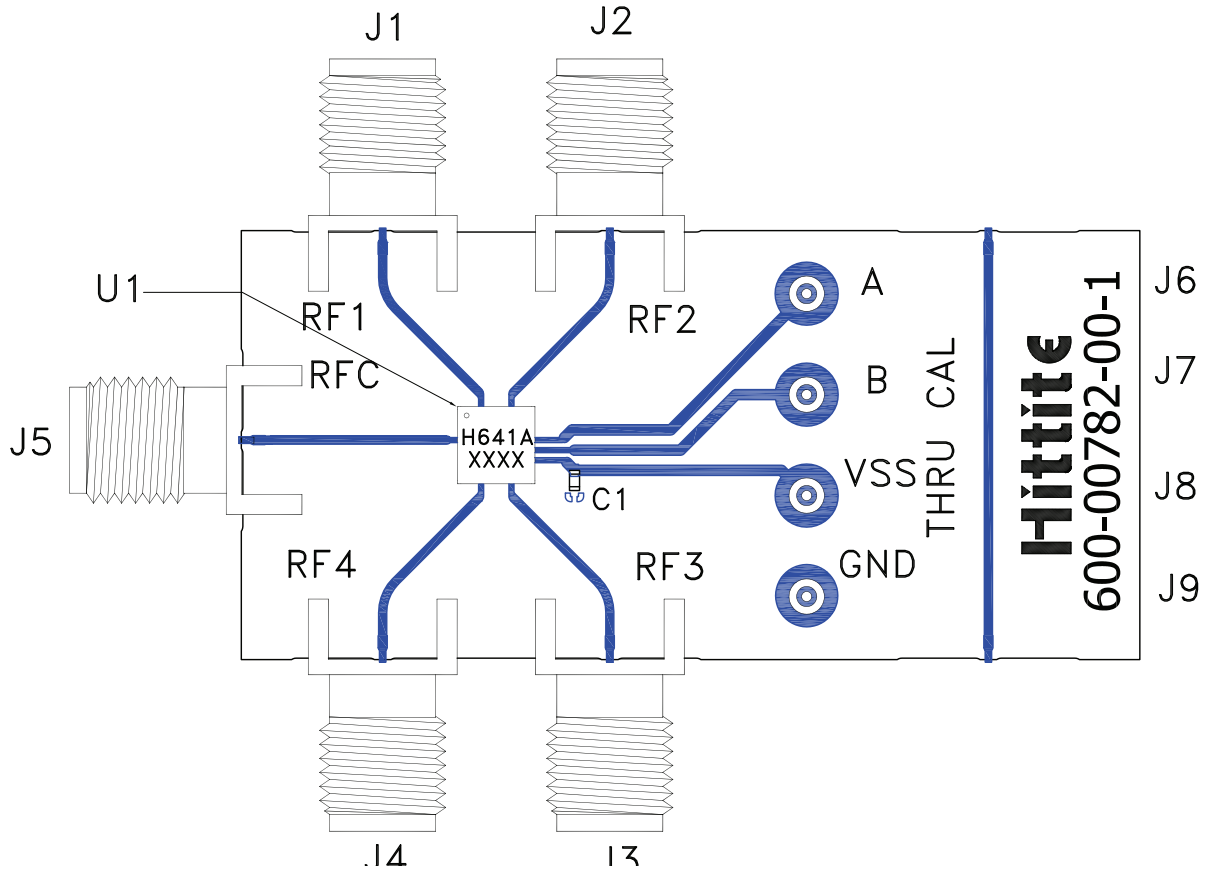
[1] 4-Digit lot number XXXX

[2] Max peak reflow temperature of 260 °C


GaAs MMIC SP4T NON-REFLECTIVE SWITCH, DC - 20 GHz
Pin Descriptions

| Pin Number | Function | Description | Interface Schematic |
|---|----------|--|---|
| 1, 5, 6, 13, 18 | N/C | These pins are not connected internally; however, all data shown herein was measured with these pins connected to RF/DC ground externally. | |
| 2, 4, 7, 9, 10, 12, 17, 19, 21, 22, 24 Ground Paddle | GND | These pins and the exposed ground paddle must be connected to RF/DC ground. |  |
| 3 | RFC | This pin is DC coupled and matched to 50 Ohms. A blocking capacitor is required if RF line potential is not equal to 0V. | |
| 8 | RF4 | This pin is DC coupled and matched to 50 Ohms. A blocking capacitor is required if RF line potential is not equal to 0V. | |
| 11 | RF3 | This pin is DC coupled and matched to 50 Ohms. A blocking capacitor is required if RF line potential is not equal to 0V. | |
| 14 | Vss | Supply Voltage -5 Vdc ± 10%. | |
| 15 | CTRLB | See Truth Table and Control Voltage Table. |  |
| 16 | CTRLA | See Truth Table and Control Voltage Table. | |
| 20 | RF2 | This pin is DC coupled and matched to 50 Ohms. A blocking capacitor is required if RF line potential is not equal to 0V. | |
| 23 | RF1 | This pin is DC coupled and matched to 50 Ohms. A blocking capacitor is required if RF line potential is not equal to 0V. | |

Evaluation PCB



List of Materials for Evaluation PCB EVAL01-HMC641ALP4 [1]

| Item | Description |
|---------|-------------------------------|
| J1 - J5 | PCB Mount SMA Connector |
| J6 - J9 | DC Pin |
| C1 | 1000 pF Capacitor, 0402 Pkg. |
| U1 | HMC641ALP4E Switch |
| PCB [2] | 600-00782-00-1 Evaluation PCB |

[1] Reference this number when ordering complete evaluation PCB

[2] Circuit Board Material: Rogers 4350 or Arlon FR4

The circuit board used in the application should use RF circuit design techniques. Signal lines should have 50 Ohm impedance while the package ground leads and exposed paddle should be connected directly to the ground plane similar to that shown. A sufficient number of via holes should be used to connect the top and bottom ground planes. The evaluation board should be mounted to an appropriate heat sink. The evaluation circuit board shown is available from Hittite upon request.