

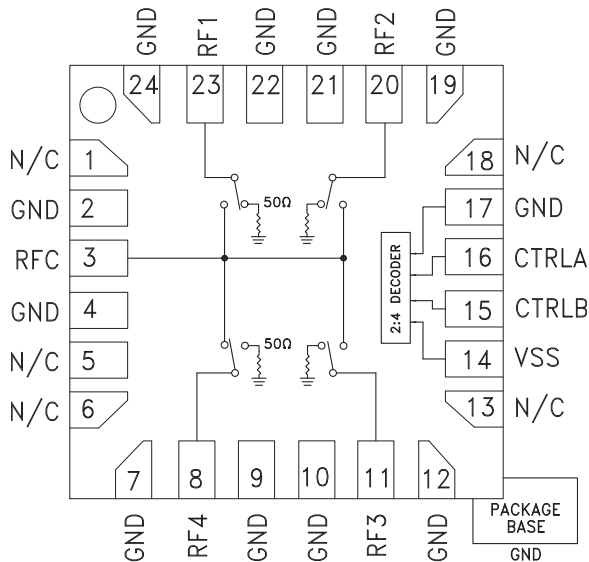
## GaAs MMIC SP4T NON-REFLECTIVE SWITCH, DC - 20 GHz

### Typical Applications

The HMC641LP4E 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 mm<sup>2</sup>

### General Description

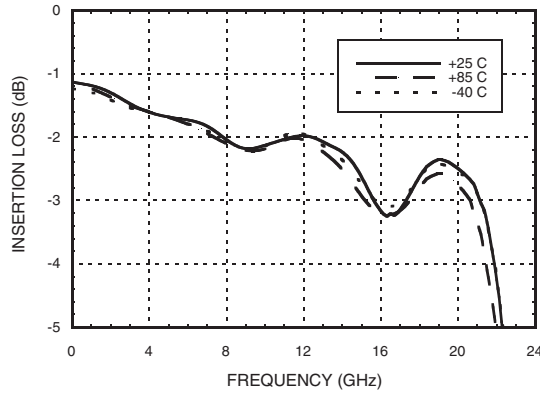
The HMC641LP4E is a broadband non-reflective GaAs pHEMT SP4T switch in a compact 4x4 mm plastic package. Covering DC to 20 GHz, this switch offers high isolation, low insertion loss and on-chip termination of isolated ports. This switch also includes an on board binary decoder circuit which reduces the number of required logic control lines from four to two. The HMC641LP4E is controlled with 0/-5V logic, exhibits fast switching speed and consumes much less DC current than pin diode based solutions. The HMC641LP4E is also available in die form as the HMC641.

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

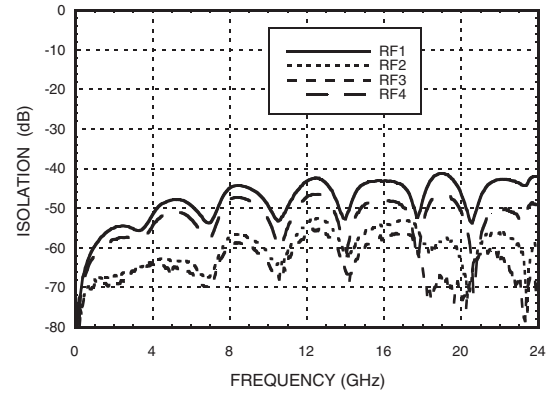
Parameter	Frequency	Min.	Typ.	Max.	Units
Insertion Loss	DC - 12 GHz		2.0	3.2	dB
	DC - 20 GHz		3.0	4.2	dB
Isolation (RFC to RF1 - RF4)	DC - 12 GHz	30	42		dB
	DC - 20 GHz	30	40		dB
Return Loss	DC - 12 GHz		18		dB
	DC - 20 GHz		17		dB
Return Loss	DC - 20 GHz		13		dB
Input Power for 1 dB Compression	0.05 - 0.25 GHz	10	15		dBm
	0.25 - 20 GHz	20	22		dBm
Input Third Order Intercept (Two-Tone Input Power= +14 dBm Each Tone)	0.05 - 0.25 GHz		30		dBm
	0.25 - 20 GHz		38		dBm
Switching Characteristics tRISE, tFALL (10/90% RF) tON, tOFF (50% CTL to 10/90% RF)	DC - 20 GHz		15		ns
			88		ns

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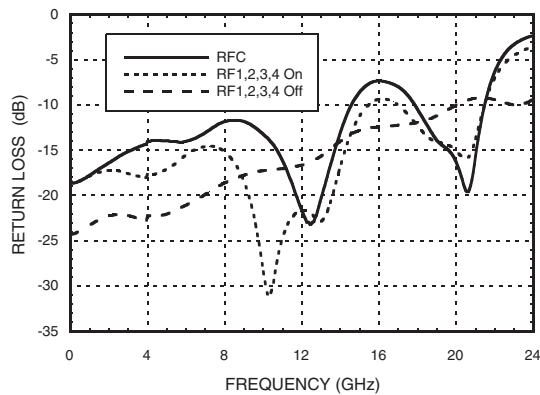
**Insertion Loss vs. Temperature**



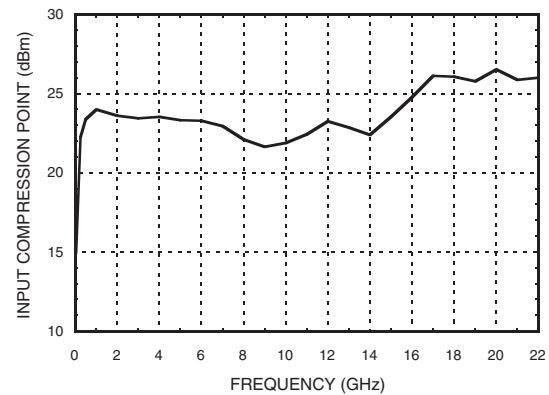
**Isolation**



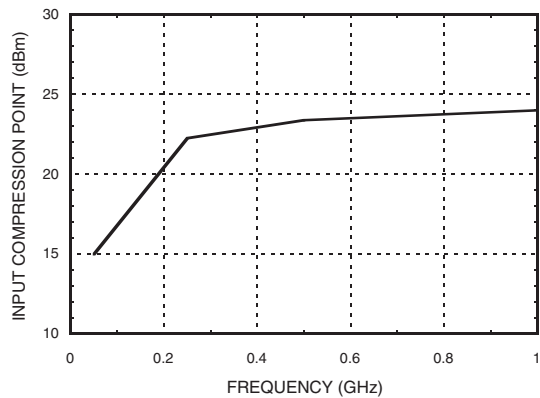
**Return Loss**



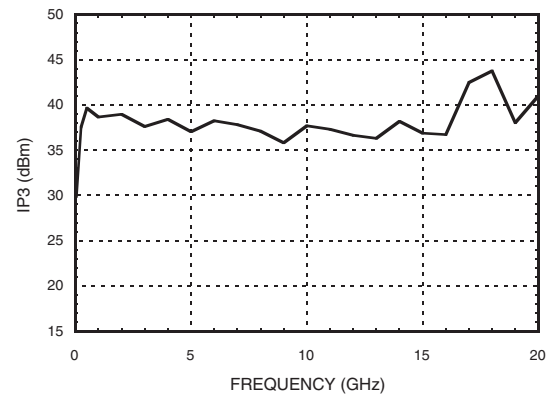
**1 dB Input Compression Point**



**1 dB Input Compression Point (Low Frequency Detail)**

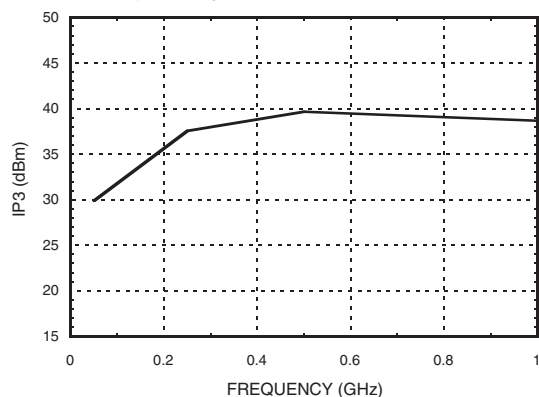


**Input Third Order Intercept Point @ 0 dBm Tone Power**



## 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 (A & B)	Vss -1V to +1V
Maximum Input Power	+24 dBm
Channel Temperature	150 °C
Thermal Resistance Channel to ground paddle (Insertion Loss Path)	199 °C/W
Thermal Resistance Channel to ground paddle (Terminated Path)	219 °C/W
Storage Temperature	-65 to +150 °C
Operating Temperature	-40 to +85 °C
ESD Sensitivity (HBM)	Class 1A



ELECTROSTATIC SENSITIVE DEVICE  
OBSERVE HANDLING PRECAUTIONS

### Truth Table

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

### Bias Voltage & Current

Vss Range = -5 Vdc $\pm$ 10%		
Vss (Vdc)	Iss (Typ) (mA)	Iss (Max) (mA)
-5	1.7	5.0


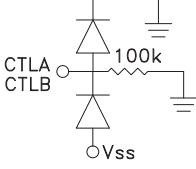
### TTL/CMOS Control Voltages

State	Bias Condition
Low	-2.5V to 0V @ 30 $\mu$ A Typ.
High	-5V to -3.8V @ 1.7 $\mu$ A Typ.



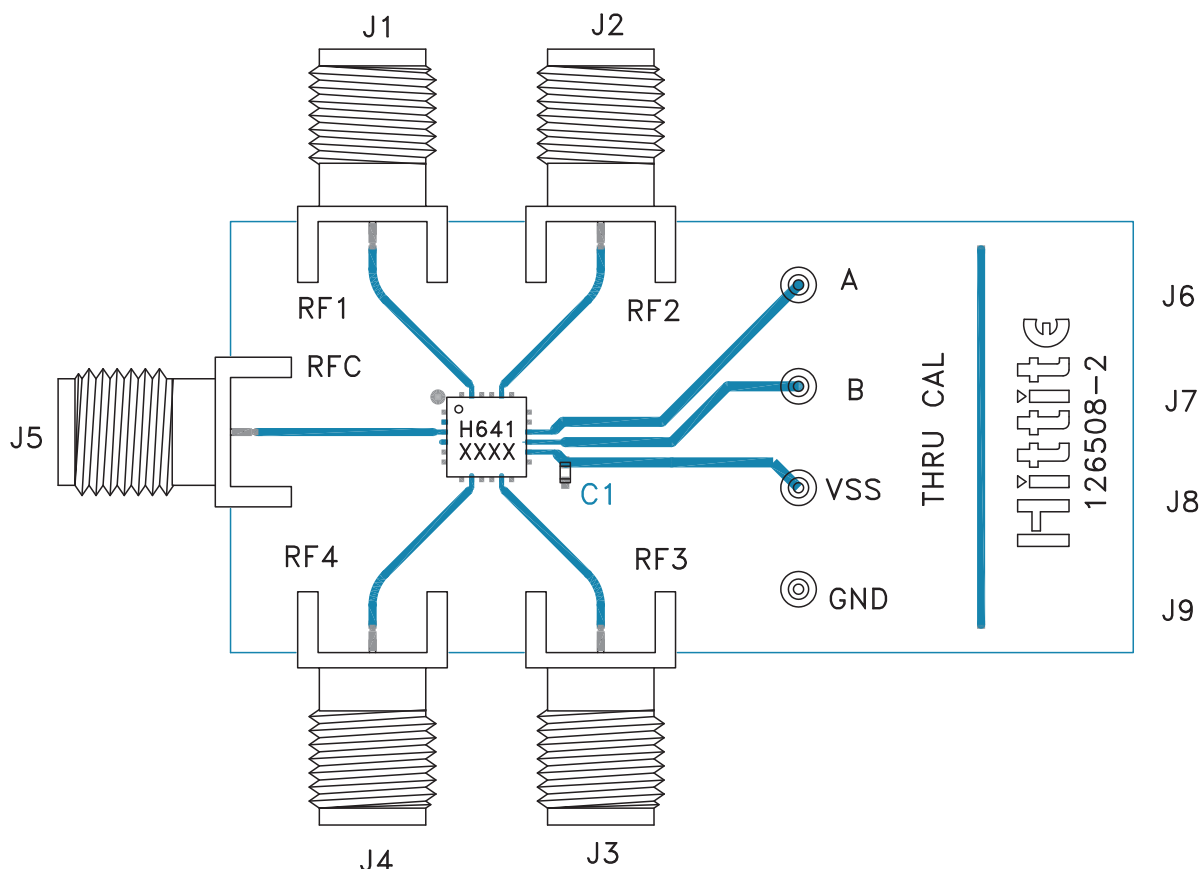
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**Pin Descriptions**

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, 8, 11, 20, 23	RFC, RF1, RF2, RF3, RF4	These pads are DC coupled and matched to 50 Ohms. Blocking capacitors are required if RF line potential is not equal to 0V.	
14	Vss	Supply Voltage -5 Vdc $\pm$ 10%.	
15	CTLB	See Truth Table and Control Voltage Table.	
16	CTLA	See Truth Table and Control Voltage Table.	

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**Evaluation PCB**



**List of Materials for Evaluation PCB 126511 <sup>[1]</sup>**

Item	Description
J1 - J5	PCB Mount SMA Connector
J6 - J9	DC Pin
C1	1000 pF Capacitor, 0402 Pkg.
U1	HMC641LP4E Switch
PCB <sup>[2]</sup>	126508 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.