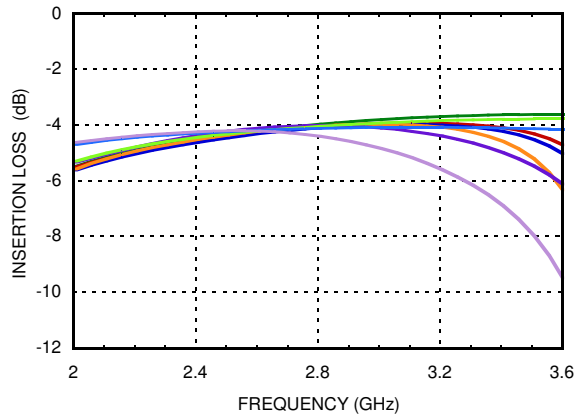
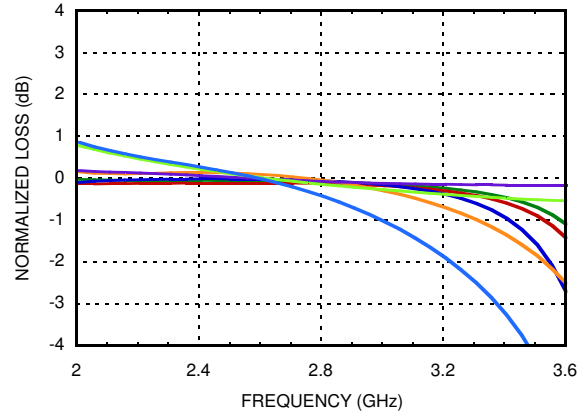


**GaAs MMIC 6-BIT DIGITAL  
PHASE SHIFTER, 2.5 - 3.1 GHz**

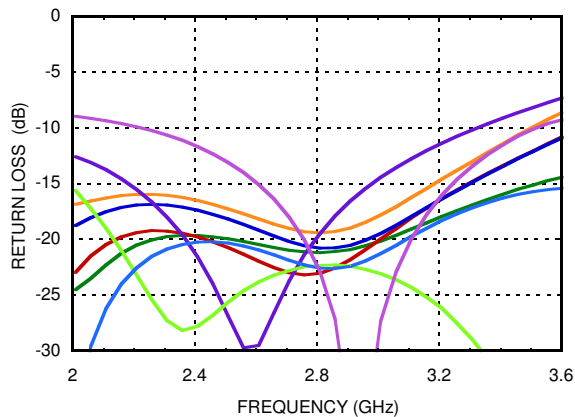
**Insertion Loss, Major States Only**



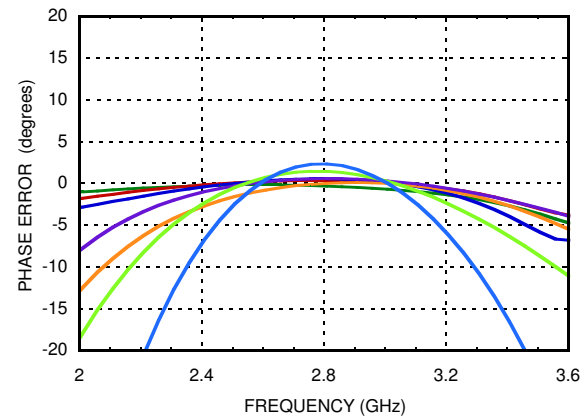
**Normalized Loss, Major States Only**



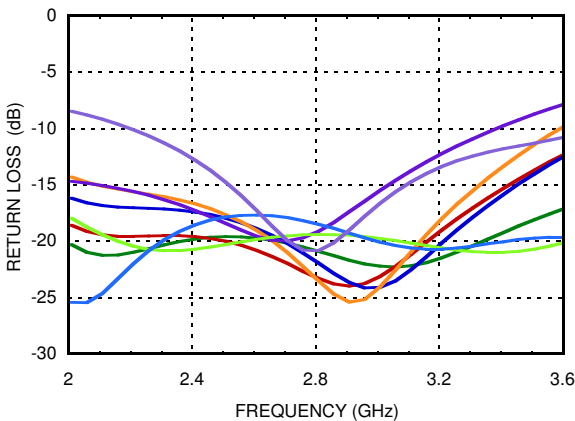
**Input Return Loss, Major States Only**



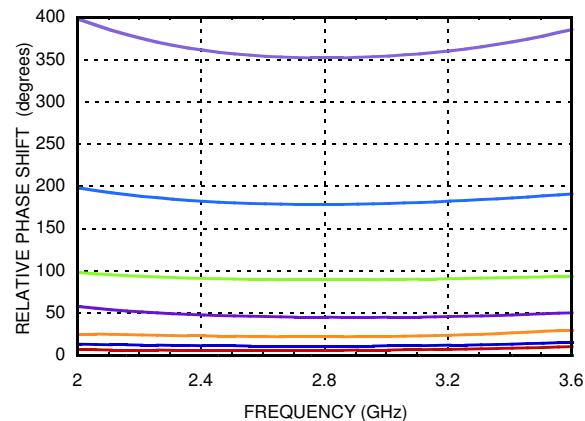
**Phase Error, Major States Only**



**Output Return Loss, Major States Only**

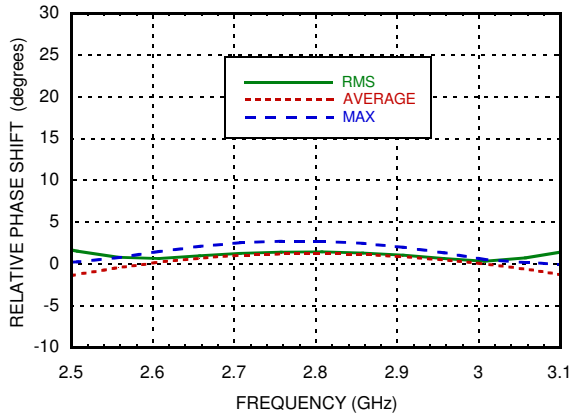


**Relative Phase Shift  
Major States Including All Bits**

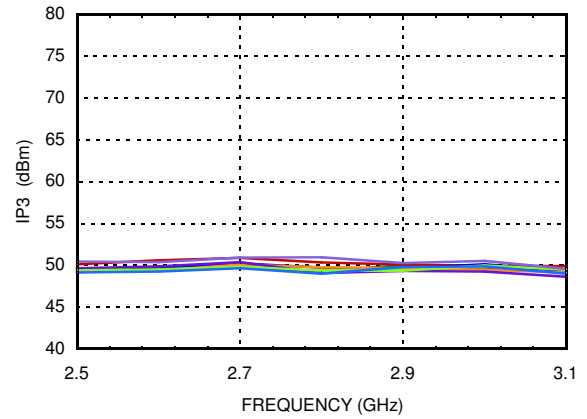


**GaAs MMIC 6-BIT DIGITAL PHASE SHIFTER, 2.5 - 3.1 GHz**

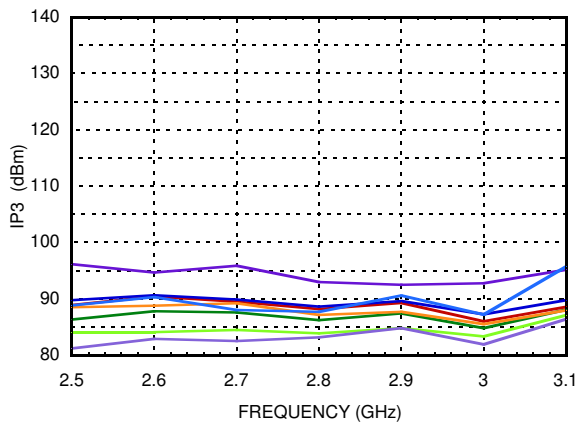
**Relative Phase Shift, RMS, Average, Max, All States**



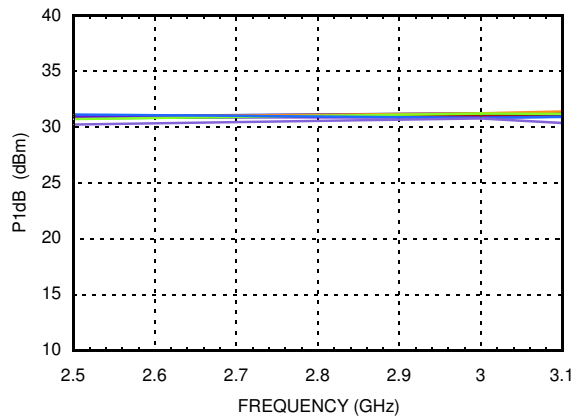
**Input IP3, Major States Only**



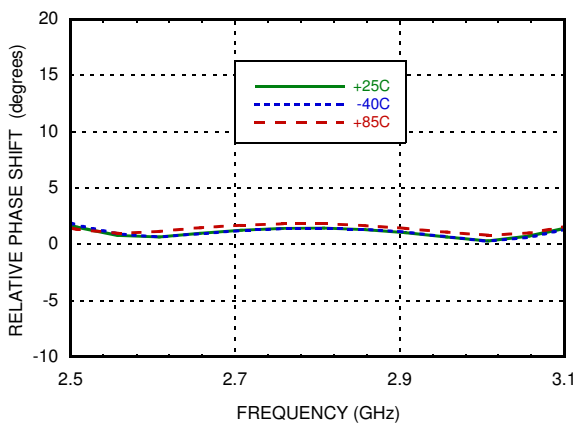
**Input IP2, Major States Only**



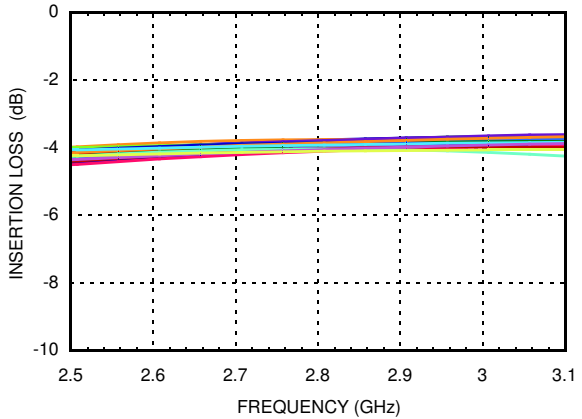
**Input P1dB, Major States Only**



**RMS Phase Error vs. Temperature**

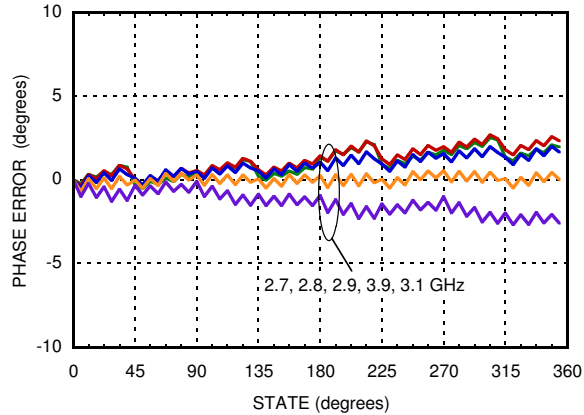


**Insertion Loss vs. Temperature, Major States Only**



## GaAs MMIC 6-BIT DIGITAL PHASE SHIFTER, 2.5 - 3.1 GHz

### Phase Error vs. State



### Bias Voltage & Current

Vdd	Idd
5.0	5.3mA
Vss	Iss
-5.0	5.3mA

### Control Voltage

State	Bias Condition
Low (0)	0 to 0.2 Vdc
High (1)	Vdd ±0.2 Vdc @ 35 µA Typ.

### Absolute Maximum Ratings

Input Power (RFIN)	33 dBm (T= +85 °C)
Bias Voltage Range (Vdd)	-0.2 to +12V
Bias Voltage Range (Vss)	+0.2 to -12V
Channel Temperature (Tc)	150 °C
Thermal Resistance (channel to ground paddle)	128 °C/W
Storage Temperature	-65 to +150 °C
Operating Temperature	-40 to +85 °C
ESD Sensitivity (HBM)	Class1A Passed 250V



ELECTROSTATIC SENSITIVE DEVICE  
OBSERVE HANDLING PRECAUTIONS

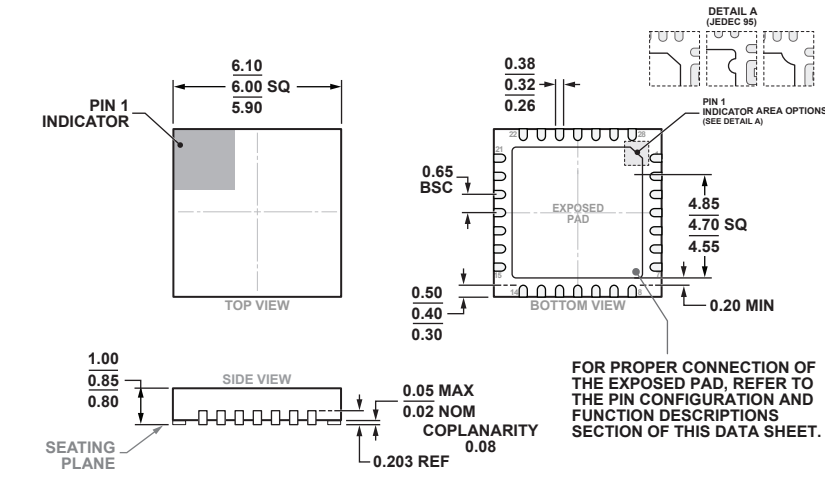
### Truth Table

Control Voltage Input						Phase Shift (Degrees) RFIN - RFOUT
Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	
0	0	0	0	0	0	Reference*
1	0	0	0	0	0	5.625
0	1	0	0	0	0	11.25
0	0	1	0	0	0	22.5
0	0	0	1	0	0	45.0
0	0	0	0	1	0	90.0
0	0	0	0	0	1	180.0
1	1	1	1	1	1	354.375

Any combination of the above states will provide a phase shift approximately equal to the sum of the bits selected.  
\*Reference corresponds to monotonic setting

**GaAs MMIC 6-BIT DIGITAL PHASE SHIFTER, 2.5 - 3.1 GHz**

**Outline Drawing**



COMPLIANT TO JEDEC STANDARDS MO-220-VJJC-3.

28-Lead Lead Frame Chip Scale Package [LFCSP]  
6 mm x 6 mm Body and 0.85 mm Package Height  
(CP-28-13)

Dimensions shown in millimeters

**Package Information**

Part Number	Package Body Material	Lead Finish	MSL Rating	Package Marking <sup>[2]</sup>
HMC647ALP6E	RoHS-compliant Low Stress Injection Molded Plastic	100% matte Sn	MSL3 <sup>[1]</sup>	H647A XXXX

[1] Max peak reflow temperature of 260 °C

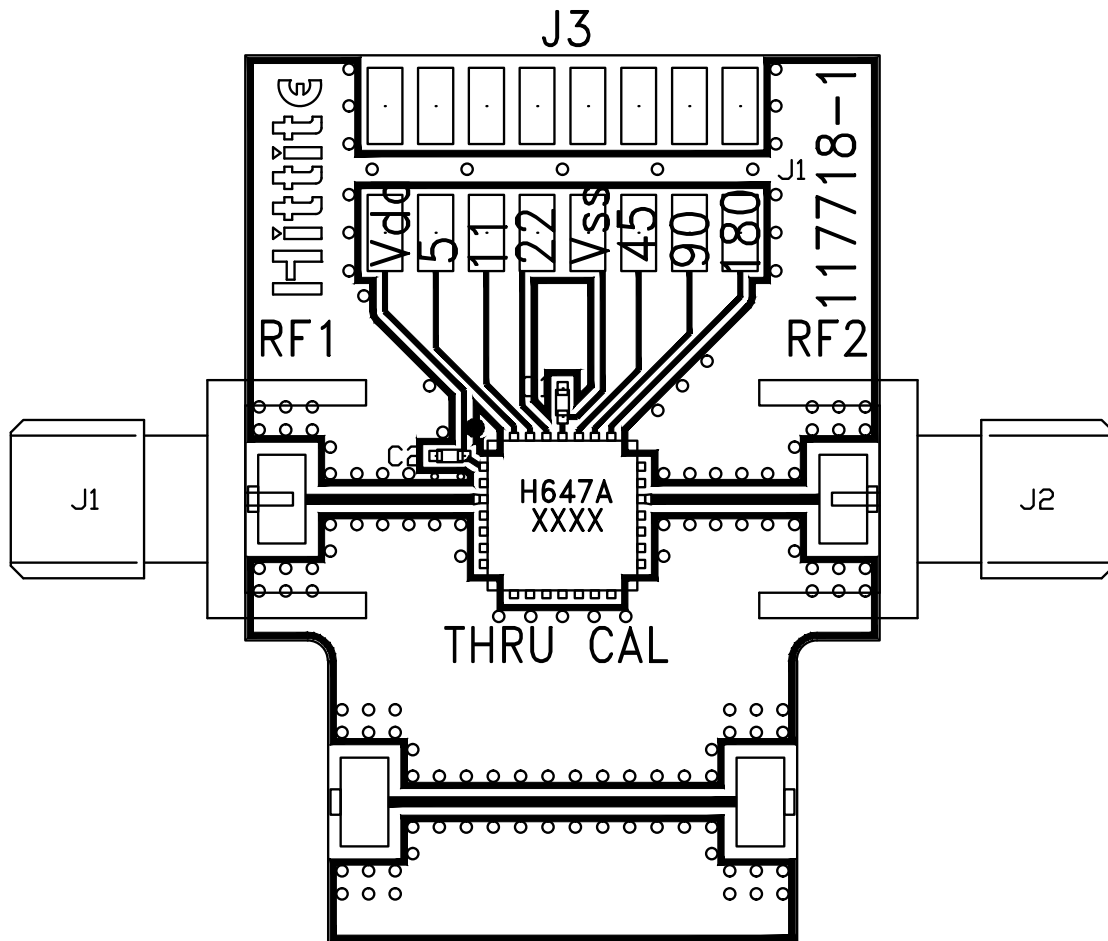
[2] 4-Digit lot number XXXX

**Pin Descriptions**

Pin Number	Function	Description	Interface Schematic
1	Vdd	Voltage Supply	
2, 20	GND	These pins and exposed ground paddle must be connected to RF/DC ground.	
3	RFIN	This port is DC coupled and matched to 50 Ohms.	
4 - 18, 21	N/C	No connection required. These pins may be connected to RF/DC ground without affecting performance.	
19	RFOUT	This port is DC coupled and matched to 50 Ohms.	
22 - 24 26 - 28	BIT6, BIT5, BIT4, BIT3, BIT2, BIT1	Control Input. See truth table and control voltage tables.	
25	Vss	Voltage Supply	

## GaAs MMIC 6-BIT DIGITAL PHASE SHIFTER, 2.5 - 3.1 GHz

### Evaluation PCB



### List of Materials for Evaluation EV1HMC647ALP6 <sup>[1][3]</sup>

Item	Description
J1 - J2	PCB Mount SMA RF Connector
J3	Header 2mm, 16 pins
C1, C2	1000pF, 0402 pkg
U1	HMC647ALP6E 6-Bit Digital Phase Shifter
PCB <sup>[2]</sup>	117718 Evaluation PCB

[1] Reference this number when ordering complete evaluation PCB

[2] Circuit Board Material: Rogers 4350

[3] Please refer to part's pin description and functional diagram for pin out assignments on evaluation board.

The circuit board used in the final 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 Analog Devices, Inc. upon request.

# Mouser Electronics

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[EV1HMC647ALP6](#) [HMC647ALP6ETR](#) [HMC647ALP6E](#)