TriQuint
SEMICONDUCTOR®

Adjusting the TGP1439 5-Bit Phase Shifter to
Perform as 4-Bit or 3-Bit Phase Shifters

Background: The TGP1439 device was originally designed as a 5-bit phase-shifter. This device can also be implemented as a 4-bit and 3-bit phase shifter by adjusting the voltage of Bond Pads 9, 10, and 11 of this device.

Method: Tests were performed to determine which combination of biases applied to Bond Pads 9, 10, and 11 would result in optimal performance of the 4-bit and 3-bit phase-shifters.

4-Bit Phase Shifter: Bond Pad 11 of the TGP1439 is connected to a constant voltage for 4-bit operation. Pad 11 controls the least significant bit (11.25°) of the 5-bit phase-shifter. Tests were performed to determine the Bond Pad 11 bias condition for optimum 4-bit operation. Data was taken to support a control voltage of -2.5V and –5V.

TEST	Pad 11
1	0.0V
2	Vcntl

Test Conditions for the 4-bit Phase Shifter

3-Bit Phase Shifter: Bond Pads 9, 10, and 11 of the TGP1439 are connected to a constant voltage for 3-bit operation. Pads 9 and 10 controls the second least significant bit (22.5°) of the 5-bit phase-shifter. Pads 9 and 10 are complimentary in that when pad 10 is biased, pad 9 must be grounded, and vice versa. The four tests shown in the table below were performed to determine the Bond Pads 9, 10, and 11 bias conditions for optimum 3-bit operation. Data was taken to support a control voltage of -2.5V and –5V.

TEST	Pad 11	Pad 10	Pad 9
1	0.0V	0.0V	Vcntl
2	0.0V	Vcntl	0.0V
3	Vcntl	0.0V	Vcntl
4	Vcntl	Vcntl	0.0V

Test Conditions for the 3-bit Phase Shifter

Recommended Approach: TriQuint recommends that the device be biased in the following way to achieve the optimal 4-bit and 3-bit performance.
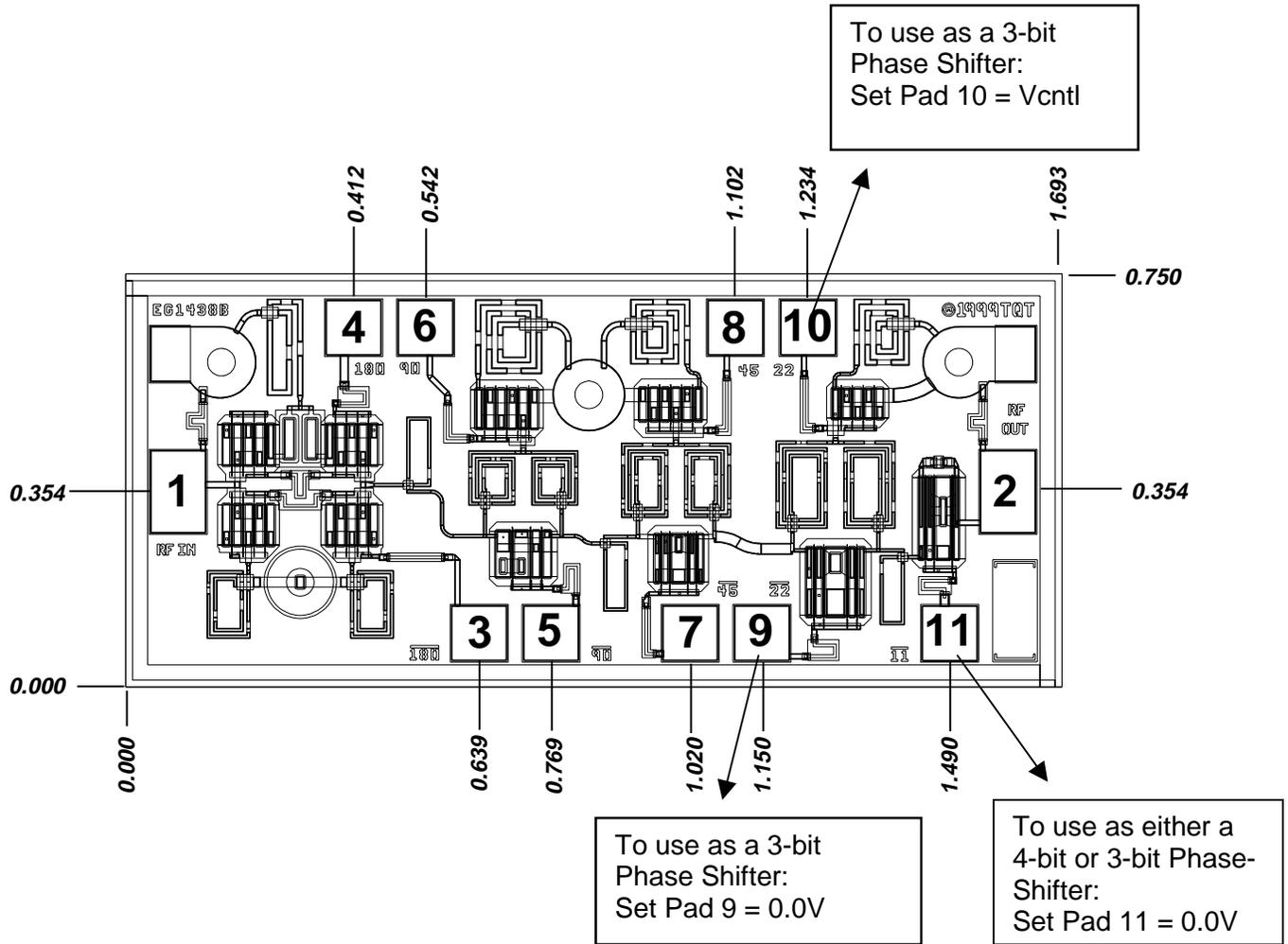
       4-bit Phase Shifter: Ground Bond Pad 11.

       3-bit Phase Shifter: 1. Ground Bond Pad 11.
                                        2. Set Bond Pad 10 to the control voltage (-2.5V to –5V).
                                          3. Ground Bond Pad 9

Refer to the mechanical drawing for further clarification.

Mechanical Drawing

To use as a 3-bit Phase Shifter: Set Pad 10 = Vcntl

To use as a 3-bit Phase Shifter: Set Pad 9 = 0.0V

To use as either a 4-bit or 3-bit Phase-Shifter: Set Pad 11 = 0.0V

To use as a 4-bit phase-shifter, set Bond Pad 11 = 0.0V.

To use as a 3-bit phase-shifter, set Bond Pad 11 = 0.0V, Bond Pad 10= Vcntl (constant voltage), and Bond Pad 9 = 0.0V.

To turn phase bits off, apply the opposite condition. For example: to turn Phase bit 180° OFF, set Bond Pad 3 = 0.0V and Bond Pad 4 = Vcntl