Phase Shifter, Ku-Band, 6-Bit
14 - 16 GHz

CGY2174UH/C1
Rev. V1

Features

- Insertion Loss: 8 dB @ 15 GHz
- Phase Shift Range: 360°
- RMS Phase Error: 6° @ 15 GHz
- Input P1dB: 20 dBm
- Return Loss: 10 dB @ 15 GHz (All states)
- 0 / -3.3 V Control Lines
- Chip Size: 2800 x 1100 µm
- Tested, Inspected Known Good Die (KGD)
- Samples Available
- Demonstration Boards Available
- Space and MIL-STD Available
- RoHS* Compliant

Applications

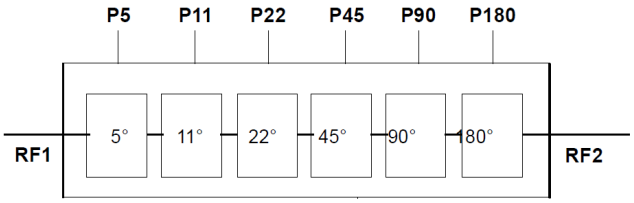
- Radar
- Telecommunication
- Instrumentation

Description

The CGY2174UH/C1 is a high performance GaAs MMIC 6-bit Phase Shifter operating in Ku-band. This device has a nominal phase shifting range of 0 - 360° in 5.625° steps and uses an optimum combination of switched line and high pass/low pass filters to obtain very low phase error and insertion loss variations. It covers the frequency range of 14 to 16 GHz.

The die is manufactured using 0.18 µm gate length pHEMT technology. The MMIC uses gold bond pads and backside metallization and is fully protected with Silicon Nitride passivation to obtain the highest level of reliability. This technology has been evaluated for Space applications and is on the European Preferred Parts List of the European Space Agency.

Block Diagram



Ordering Information

Part Number	Package
CGY2174UH/C1	DIE

* Restrictions on Hazardous Substances, compliant to current RoHS EU directive.

Electrical Specifications: Measured On Wafer, Freq. = 15 GHz, T_A = +25°C

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Insertion Loss	—	dB	—	8	—
Noise Figure	@ Reference State	dB	—	8	—
Phase Range	—	°	—	360	—
Input Return Loss	@ RFIN	dB	—	15	—
Output Return Loss	@ RFOUT	dB	—	15	—
RMS Phase Error vs. Phase Setting[1]	—	°	—	6	—
Maximum Phase Error vs. Phase Setting	—	dB	—	15	—
RMS Attenuation variation with Phase setting[1]	—	dB	—	1	—
Maximum Attenuation Variation with Phase Setting	—	dB	—	2	—
P1dB	—	dBm	—	20	—

1. The RMS value is the root mean square of the error defined as below:
Where xi is the difference between the measured value and the theoretical value (xi is the error), xi is the mean value of the N xi, and σxi is the standard deviation of xi.

$$x_{RMS} = \sqrt{\frac{1}{N}\sum_{i=1}^{N} x_i^2} = \sqrt{\bar{x}_i^{\,2} + \sigma_{x_i}^2}$$

Absolute Maximum Ratings[2,3]

Parameter	Absolute Maximum
Phase Control Inputs	-4 to +0 V
Input Power	28 dBm
Junction Temperature	+150°C
Storage Temperature	-55°C to +150°C

2. Exceeding any one or combination of these limits may cause permanent damage to this device.
3. MACOM does not recommend sustained operation near these survivability limits.

Maximum Operating Ratings

Parameter	Absolute Maximum
Phase Control Inputs	-3.6 to +0 V
Input Power	25 dBm
Operating Temperature	-40°C to +85°C

Handling Procedures

Please observe the following precautions to avoid damage:

Static Sensitivity

These electronic devices are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these devices.

Logic Truth Table

	P5	P11	P22	P45	P90	P180
Nominal Phase Shift	-5.625°	-11.25°	-22.5°	-45°	-90°	-180°
Pad	B0	B1	B1B	B2	B2B	B3
Phase Shift Activated	1	1	0	1	0	1
Reference State	0	0	1	0	1	0

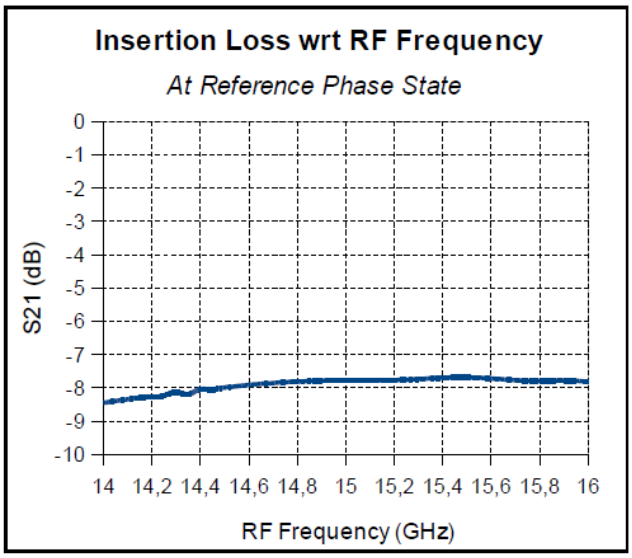
Logic Truth Table (V)

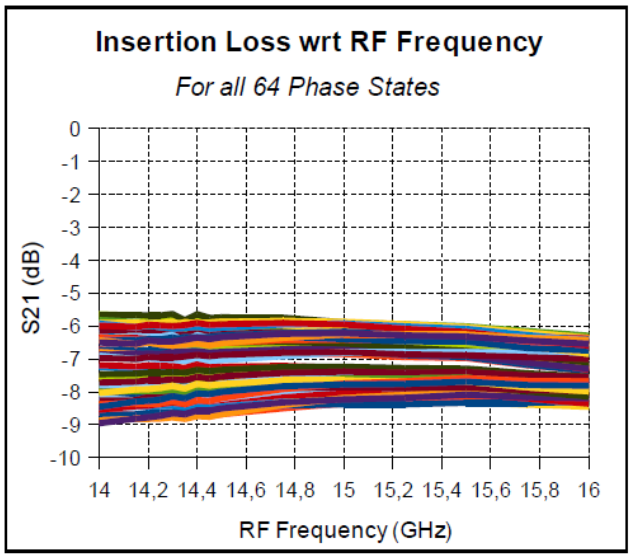
	P5	P11	P22	P45	P90	P180
Phase Shift (°)	-5.625°	-11.25°	-22.5°	-45°	-90°	-180°
0	0	0	0	0	0	0
-5.625	1	0	0	0	0	0
-11.25	0	1	0	0	0	0
-22.5	0	0	1	0	0	0
-45	0	0	0	1	0	0
-90	0	0	0	0	1	0
-180	0	0	0	0	0	1
-354.375	1	1	1	1	1	1

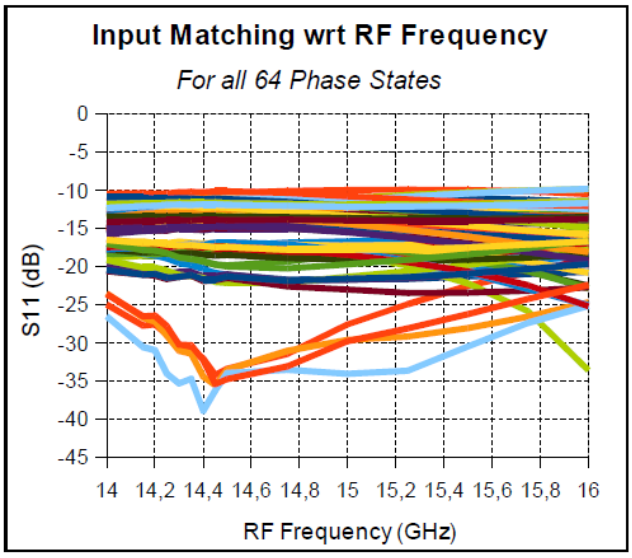
Control Voltage

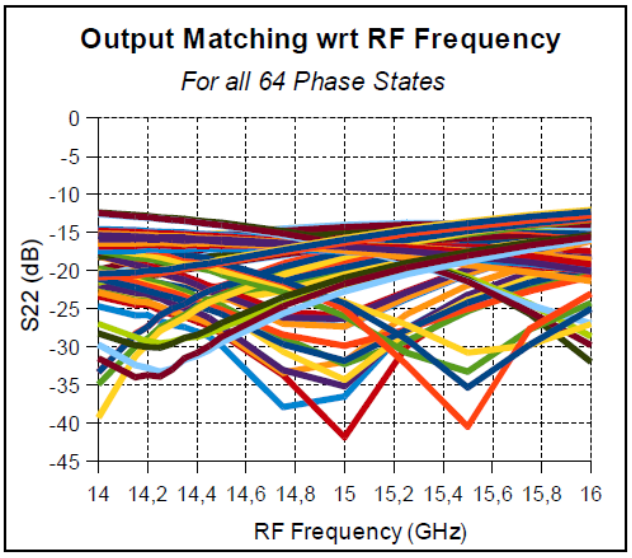
State	Min.	Typ.	Max.	Unit
Low (1)	-3.6	-3.3	-3.0	V
High (0)	-0.1	0	+0.1	V

Typical Performance Curves:









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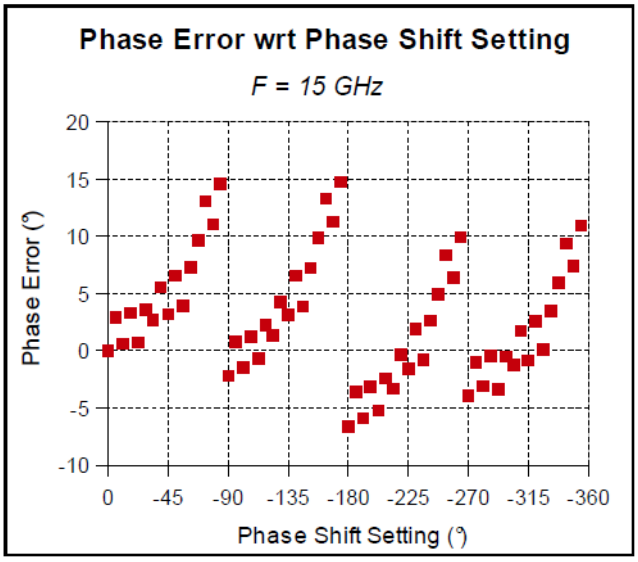

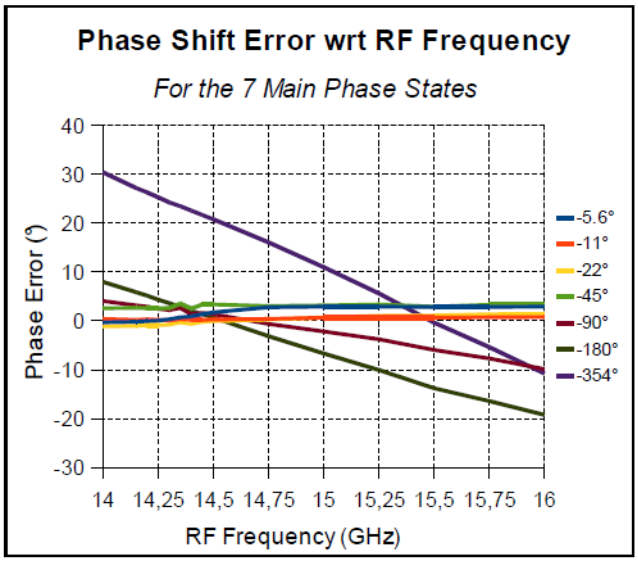

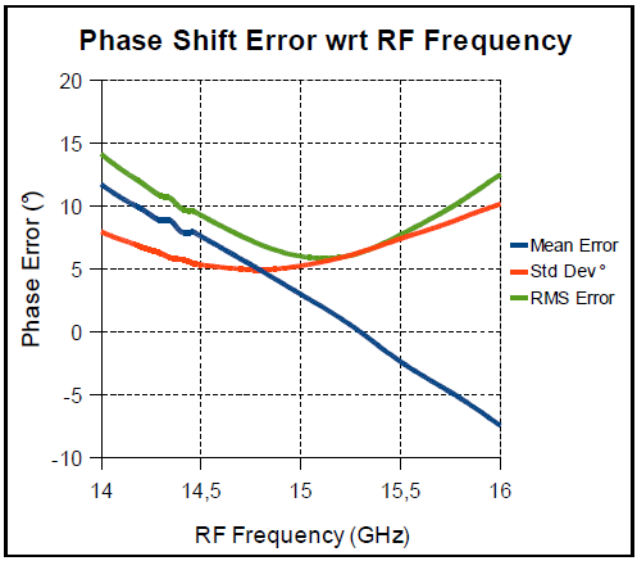

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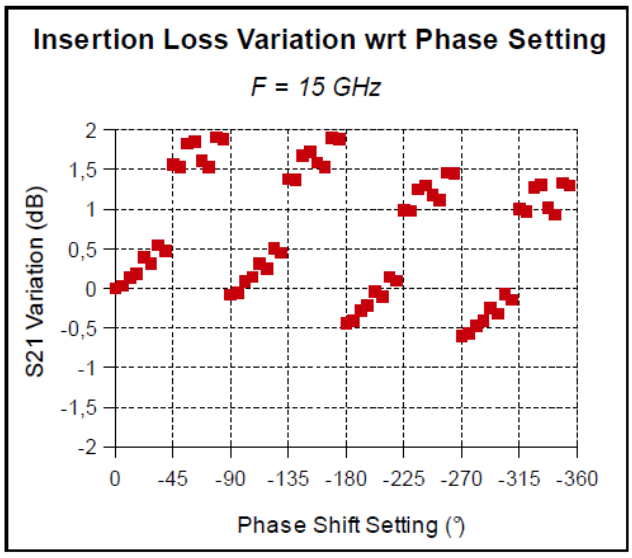
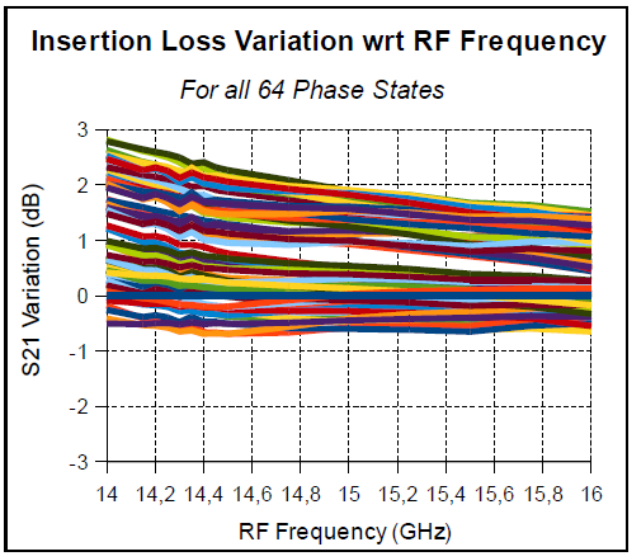
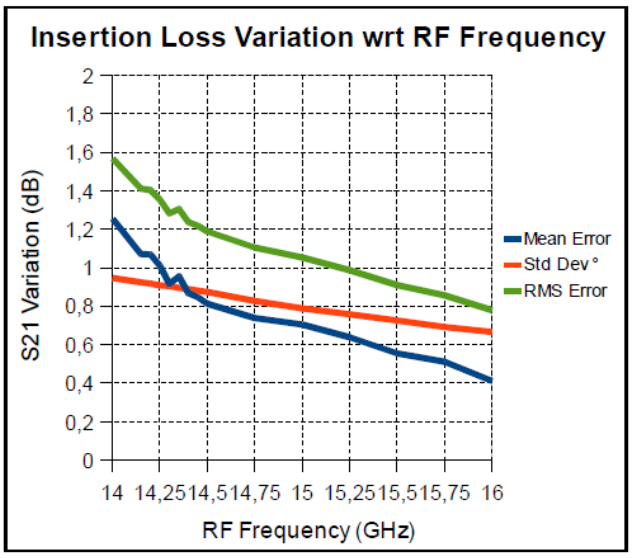
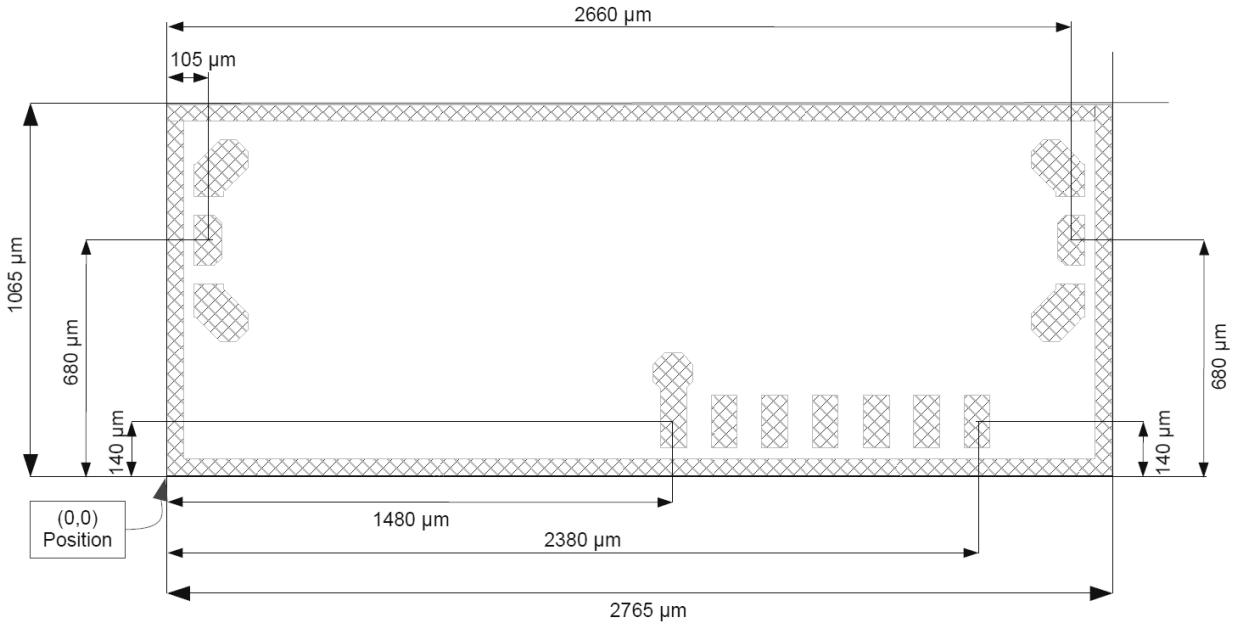






Mechanical Information:



Chip Size = 2800 x 1100 µm (± 5 µm after dicing)
DC Pads = 80 x 160 µm, spacing = 70 µm, top metal = Au
RF Pads = 85 x 150 µm, top metal = Au
Chip Thickness = 100 µm

Pad Position[4]

Pad Name	Symbol	Coordinate		Description
		X	Y	
IN	RFIN	120	3025	RF Port 1
OUT	RFOUT	3345	3025	RF Port 2
2GND	GND	240	115	Ground (back side)
C5	P5	465	115	5° cell control
C11	P11	690	115	11° cell control
C22	P22	915	115	22° cell control
C45	P45	1140	115	45° cell control
C90	P90	1365	115	90° cell control
C180	P180	1590	115	180° cell control

4. X=0, Y=0 at bottom left corner. See Mechanical Information for more details.