

Phase Shifter, 6-Bit

6 - 18 GHz



CGY2173UH/C2

Rev. V1

Features

- Insertion Loss: 13 dB @ 12 GHz
- Phase Shift Range: 360°
- RMS Phase Error: 4° @ 12 GHz
- Input P1dB: 27 dBm @ 12 GHz
- Return Loss: 20 dB @ 12 GHz (All states)
- 0 / -3 V Control Lines
- Chip Size: 3250 x 3500 μm
- Tested, Inspected Known Good Die (KGD)
- Space and MIL-STD Available
- Developed & Evaluated for Space in the frame of ESA European Component Initiative
- RoHS* Compliant

Applications

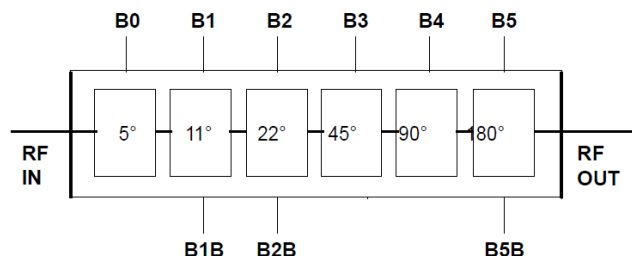
- Radar
- Telecommunication
- Instrumentation

Description

The CGY2173UH/C2 is a high performance GaAs MMIC 6-bit Phase Shifter operating from 6 GHz up to 18 GHz. 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.

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. It has been developed and evaluated for Space in the frame of ESA European Component Initiative.

Block Diagram



Ordering Information

Part Number	Package
CGY2173UH/C2	DIE

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

Electrical Specifications: Measured On Wafer, Freq. = 12 GHz, T_A = +25°C

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Insertion Loss	—	dB	—	13	—
Noise Figure	@ Reference State	dB	—	13	—
Phase Range	—	°	—	360	—
Input Return Loss	@ RFIN	dB	—	20	—
Output Return Loss	@ RFOUT	dB	—	20	—
RMS Phase Error vs. Phase Setting ¹	—	°	—	4	—
Maximum Phase Error vs. Phase Setting	—	dB	—	10	—
RMS Attenuation Variation with Phase Setting ¹	—	dB	—	0.6	—
Maximum Attenuation Variation with Phase Setting	—	dB	—	1	—
P1dB	—	dBm	—	27	—

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 σ_{xi} 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 +0.5 V
Input Power	33 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 to +0 V
Input Power	30 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.

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Logic Truth Table

	B0	B1	B1B	B2	B2B	B3	B4	B5	B5B
Nominal Phase Shift	-5.625°	-11.25°	-11.25°	-22.5°	-22.5°	-45°	-90°	-180°	-180°
Pad	B0	B1	B1B	B2	B2B	B3	B4	B5	B5B
Phase Shift Activated	1	1	0	1	0	1	1	1	0
Reference State	0	0	1	0	1	0	0	0	1

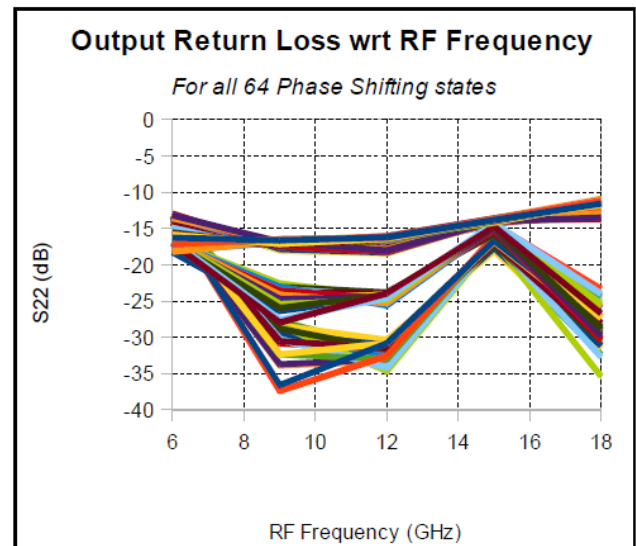
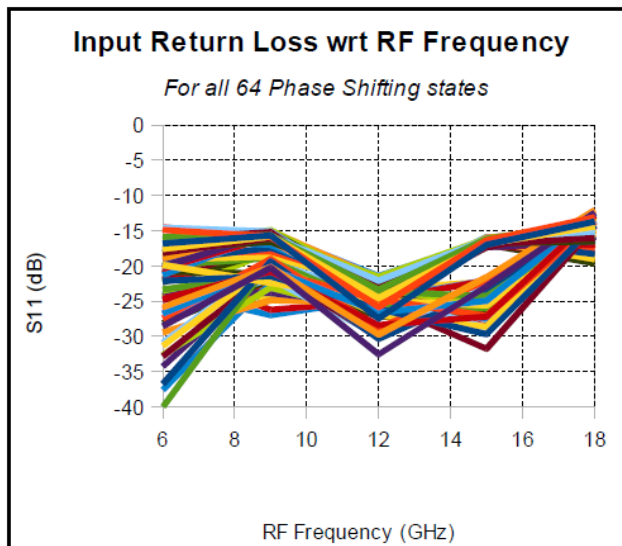
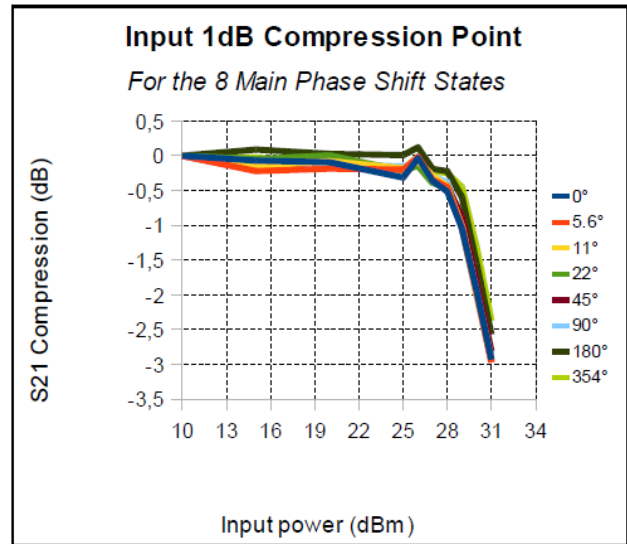
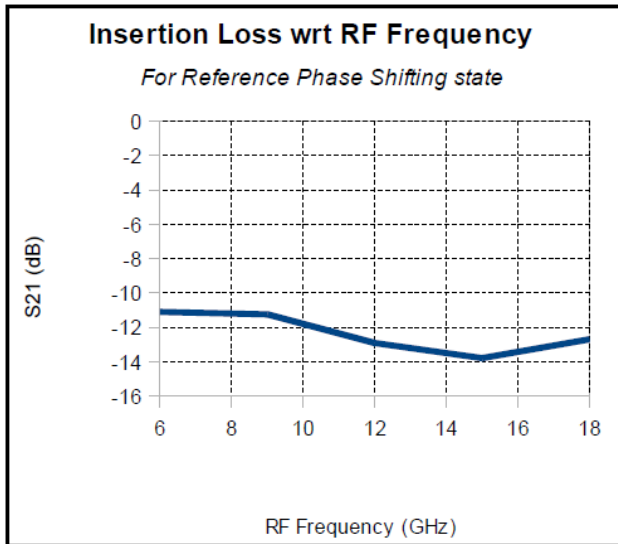
Logic Truth Table (V)

	B0	B1	B1B	B2	B2B	B3	B4	B5	B5B
Phase Shift (°)	-5.625°	-11.25°	-11.25°	-22.5°	-22.5°	-45°	-90°	-180°	-180°
0	0	0	1	0	1	0	0	0	1
-5.625	1	0	1	0	1	0	0	0	1
-11.25	0	1	0	0	1	0	0	0	1
-22.5	0	0	1	1	0	0	0	0	1
-45	0	0	1	0	1	1	0	0	1
-90	0	0	1	0	1	0	1	0	1
-180	0	0	1	0	1	0	0	1	1
-354.375	1	1	0	1	0	1	1	1	0

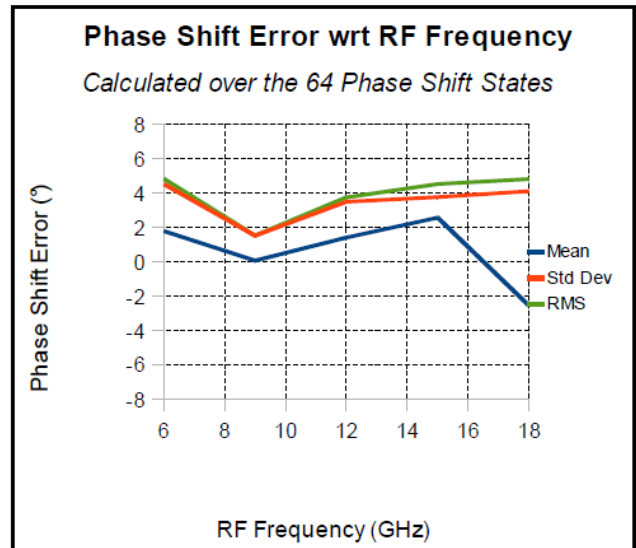
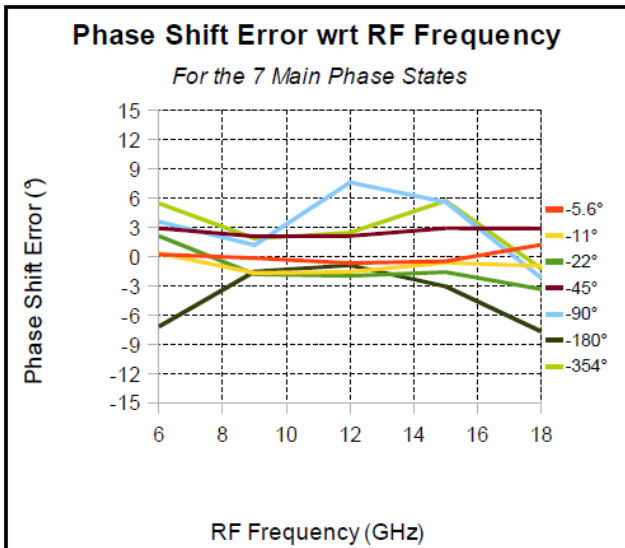
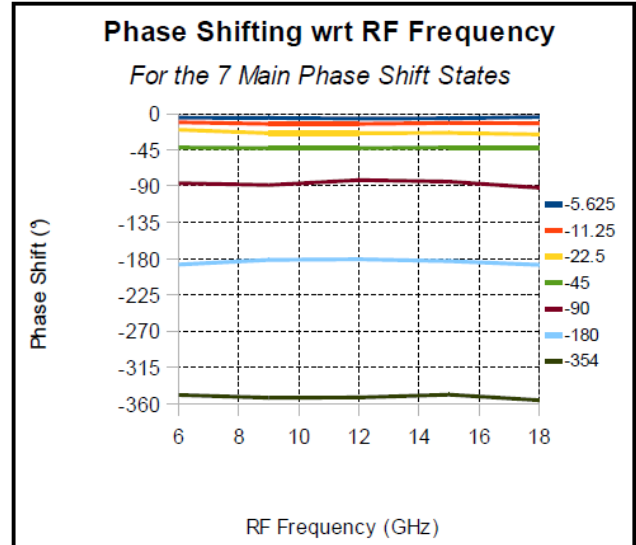
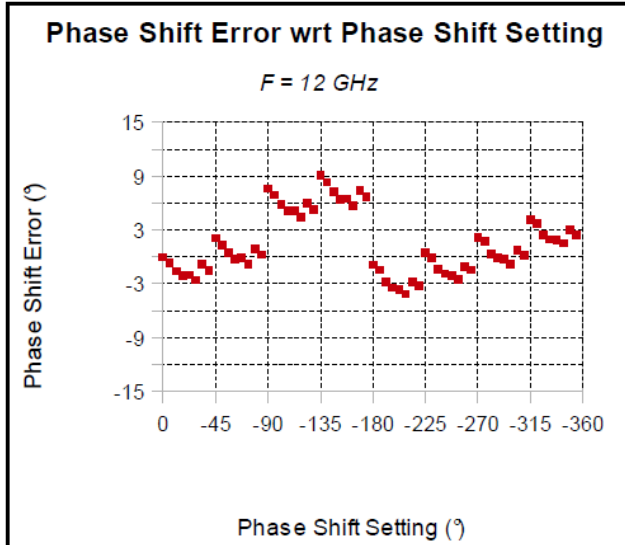
Control Voltage

State	Min.	Typ.	Max.	Unit
Low (0)	-3.5	-3.0	-2.5	V
High (1)	-0.1	0	+0.1	V

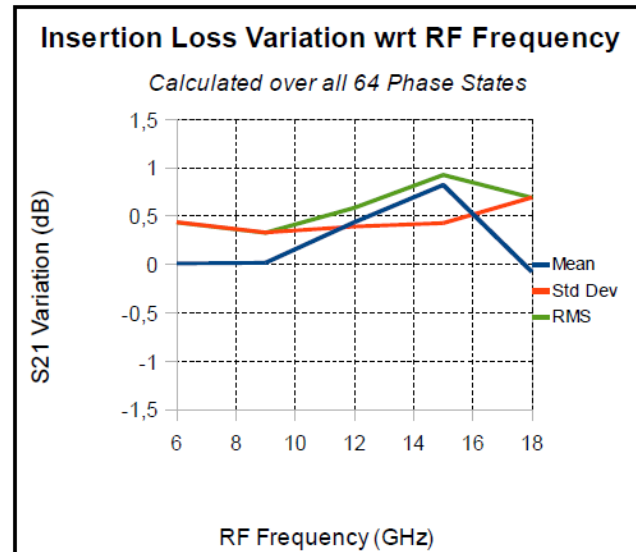
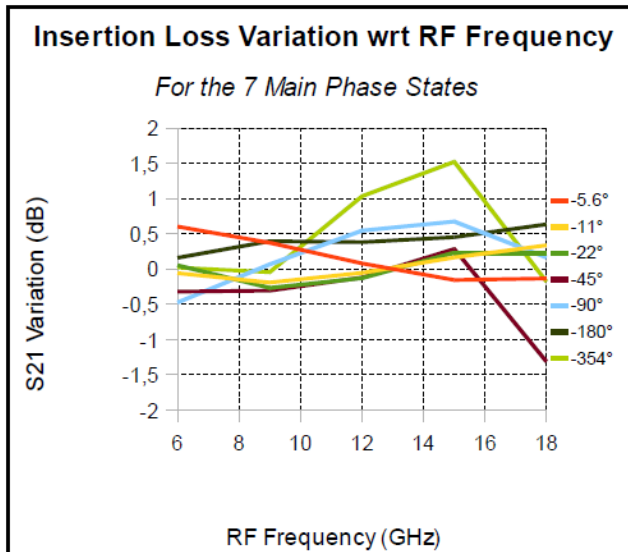
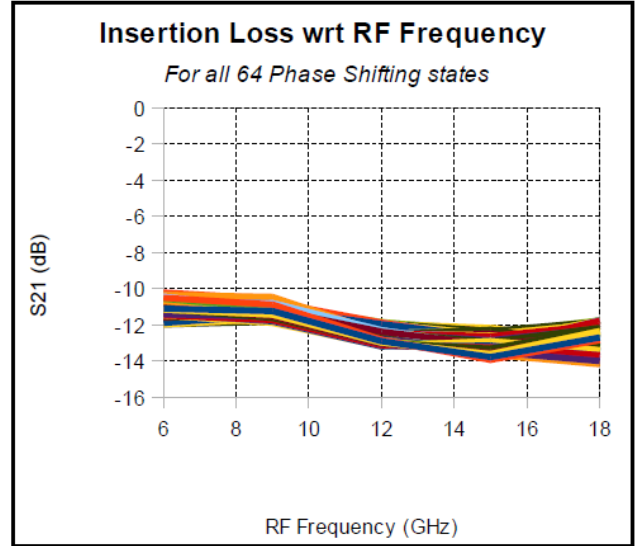
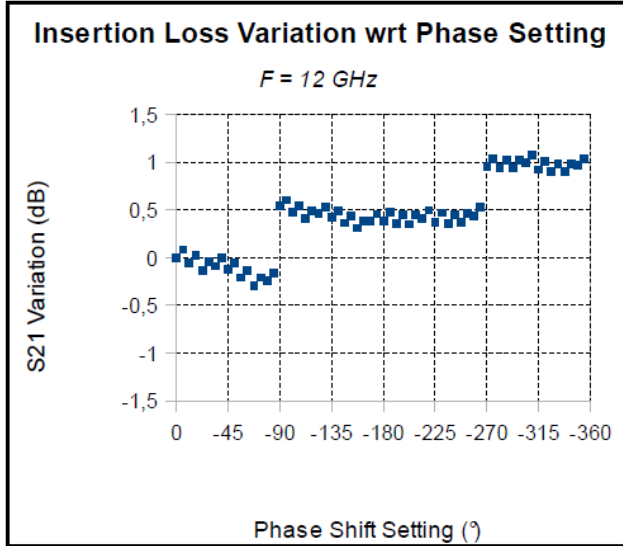
Typical Performance Curves:



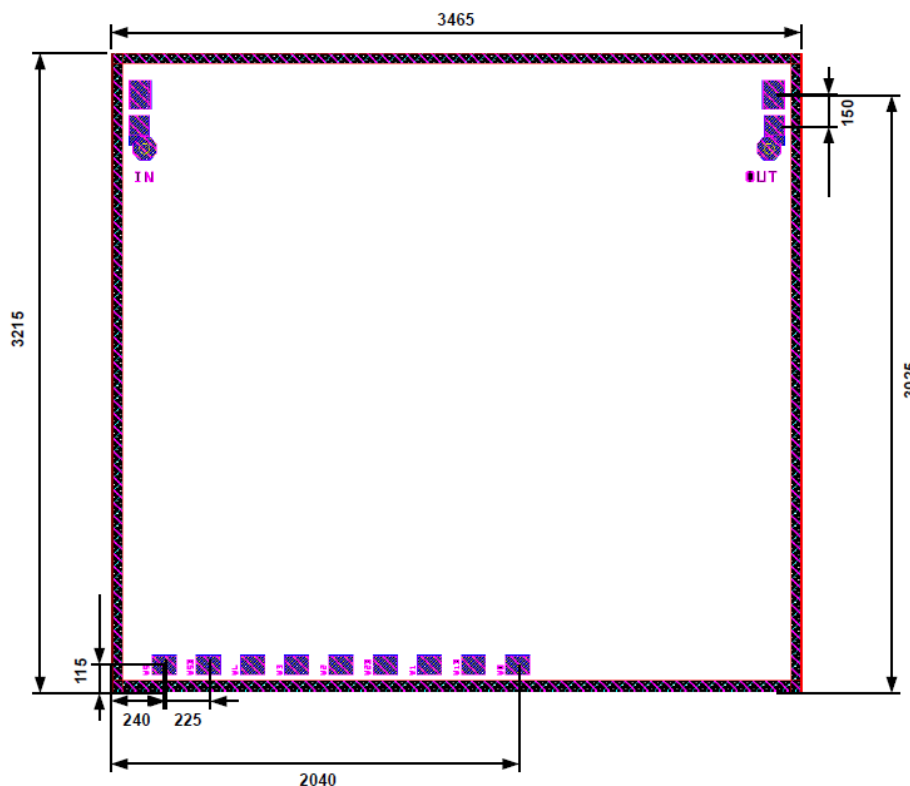
Typical Performance Curves:



Typical Performance Curves:



Mechanical Information:



Chip Size = 3250 x 3500 μm (± 5 μm after dicing)
 DC Pads = 100 x 125 μm, spacing = 100 μm, top metal = Au
 RF Pads = 110 x 150 μm, top metal = Au
 Chip Thickness = 100 μm

Pad Position⁴

Pad Name	Symbol	Coordinate		Description
		X	Y	
IN	RFIN	120	3025	RF Input Port
OUT	RFOUT	3345	3025	RF Output Port
V5	B5	240	115	180° cell control
V5B	B5B	465	115	180° complementary cell control
V4	B4	690	115	90° complementary cell control
V3	B3	915	115	45° cell control
V2	B2	1140	115	22° cell control
V2B	B2B	1365	115	22° complementary cell control
V1	B1	1590	115	11° cell control
V1B	B1B	1815	115	11° complementary cell control
V0	B0	2040	115	5° cell control

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

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