

Phase Shifter, 6-Bit 6 - 18 GHz



CGY2392SHV/C1

Rev. V2

Features

- Insertion Loss: 11.2 dB @ 12 GHz
- Phase Shift Range: 360°
- RMS Phase Error: 1.9° @ 12 GHz
- RMS Amplitude Variation: 0.45 dB @ 12 GHz
- Input Return Loss: 12 dB
- Output Return Loss: 14 dB
- 0 / +5 V Control Lines
- Package Size: 5 x 5 mm
- Tested, Inspected Known Good Die (KGD)
- Space and MIL-STD Available
- RoHS* Compliant

Applications

- Radar
- Telecommunication
- Instrumentation

Description

The CGY2392SHV/C1 is a high performance GaAs MMIC 6-Bit phase shifter operating from 6 - 18 GHz. This device has a nominal phase shifting range of 0 - 360° in 5.625° steps and has a low RMS Phase Error. It is part of a new 6 - 18 GHz chipset that is dedicated to Radar, Telecommunication, and Instrumentation applications.

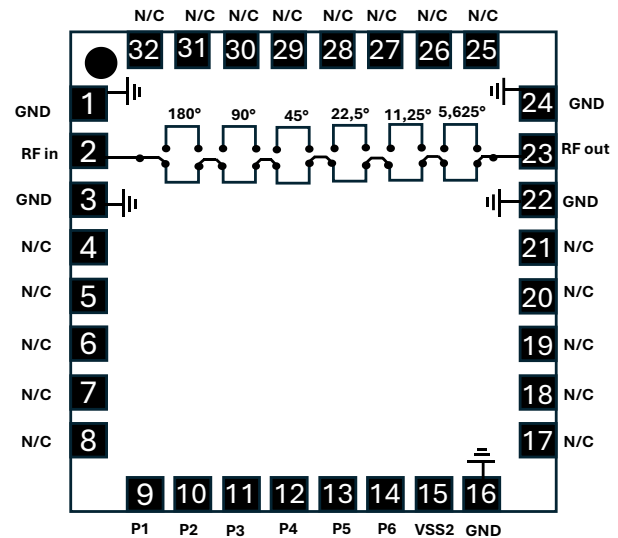
The die is manufactured using 0.18 μm gate length pHEMT process. The MMIC uses gold bonding pads, backside metallization and is fully protected with Silicon Nitride passivation to obtain the highest level of reliability. This technology has been evaluated for Space applications and is on the European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

Available in DIE form part # CGY2392SUH/C1.

Ordering Information

Part Number	Package
CGY2392SHV/C1	Package
CGY2392SHV/C1/EK	Sample Board

Block Diagram



Pin Configuration

Pad #	Name	Function
1,3,16,22,24	GND	Ground
4-8,17-21, 25-32	NC	No Connect
2	RF In	RF Input
9	P1	180°
10	P2	90°
11	P3	45°
12	P4	22.5°
13	P5	11.25°
14	P6	5.625°
15	VSS2	Negative supply
23	RF Out	RF Output
33	Paddle ¹	GND

1. The exposed pad centered on the package bottom must be connected to RF, DC and thermal ground.

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

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Electrical Specifications: Measured On Wafer
Freq. = 6 - 18 GHz, $V_{SS2} = -4.5$ V, $I_{SS2} = 8$ mA, $T_A = +25^\circ\text{C}$

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Insertion Loss	—	dB	—	11.2	—
Phase Range	—	°	—	360	—
Input Return Loss	@ RF_{IN}	dB	—	12	—
Output Return Loss	@ RF_{OUT}	dB	—	12	—
RMS Phase Error	—	°	—	2.7	—
RMS Attenuation Error	—	dB	—	0.5	—

Absolute Maximum Ratings^{2,3}

Parameter	Absolute Maximum
Phase Control Inputs	0 to +5.5 V
Source Supply Voltage When VSS2 pad is not used When VSS1 pad is not used	-5.0 to +0.5 -6.0 to +0.5
Input Power	25 dBm
Junction Temperature	+150°C
Operating Temperature	-40°C to +85°C
Storage Temperature	-55°C to +150°C

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

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 (1/2)

Nominal Phase Shift	P1	P2	P3	P4	P5	P6
	180°	90°	45°	22.5°	11.25°	5.625°
Reference State	0	0	0	0	0	0
Phase Shift Activated	1	1	1	1	1	1

Logic Truth Table (V)

Phase Shift (°)	P1	P2	P3	P4	P5	P6
	180°	90°	45°	22.5°	11.25°	5.625°
0	0	0	0	0	0	0
5.625	0	0	0	0	0	1
11.25	0	0	0	0	1	0
16.875	0	0	0	0	1	1
22.5	0	0	0	1	0	0
28.125	0	0	0	1	0	1
33.75	0	0	0	1	1	0
39.375	0	0	0	1	1	1
45	0	0	1	0	0	0
50.625	0	0	1	0	0	1
56.25	0	0	1	0	1	0
61.875	0	0	1	0	1	1
67.5	0	0	1	1	0	0
73.125	0	0	1	1	0	1
78.75	0	0	1	1	1	0
84.375	0	0	1	1	1	1
90	0	1	0	0	0	0
95.625	0	1	0	0	0	1
101.25	0	1	0	0	1	0
106.875	0	1	0	0	1	1
112.5	0	1	0	1	0	0
118.125	0	1	0	1	0	1
123.75	0	1	0	1	1	0
129.375	0	1	0	1	1	1
135	0	1	1	0	0	0
140.625	0	1	1	0	0	1
146.25	0	1	1	0	1	0
151.875	0	1	1	0	1	1
157.5	0	1	1	1	0	0
163.125	0	1	1	1	0	1
168.75	0	1	1	1	1	0
174.375	0	1	1	1	1	1
180	1	0	0	0	0	0

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Logic Truth Table (2/2)

Phase Shift (°)	P1	P2	P3	P4	P5	P6
	180°	90°	45°	-22.5°	11.25°	5.625°
185.625	1	0	0	0	0	1
191.25	1	0	0	0	1	0
198.875	1	0	0	0	1	1
202.5	1	0	0	1	0	0
208.125	1	0	0	1	0	1
213.75	1	0	0	1	1	0
219.375	1	0	0	1	1	1
225	1	0	1	0	0	0
230.625	1	0	1	0	0	1
236.25	1	0	1	0	1	0
241.875	1	0	1	0	1	1
247.5	1	0	1	1	0	0
253.125	1	0	1	1	0	1
258.75	1	0	1	1	1	0
264.375	1	0	1	1	1	1
270	1	1	0	0	0	0
275.625	1	1	0	0	0	1
281.25	1	1	0	0	1	0
286.875	1	1	0	0	1	1
292.5	1	1	0	1	0	0
298.125	1	1	0	1	0	1
303.75	1	1	0	1	1	0
309.375	1	1	0	1	1	1
315	1	1	1	0	0	0
320.625	1	1	1	0	0	1
326.25	1	1	1	0	1	0
331.875	1	1	1	0	1	1
337.5	1	1	1	1	0	0
343.125	1	1	1	1	0	1
348.75	1	1	1	1	1	0
354.375	1	1	1	1	1	1

Control Voltage

State	Min.	Max.	Unit
Low (0)	0	1	V
High (1)	4	6	V

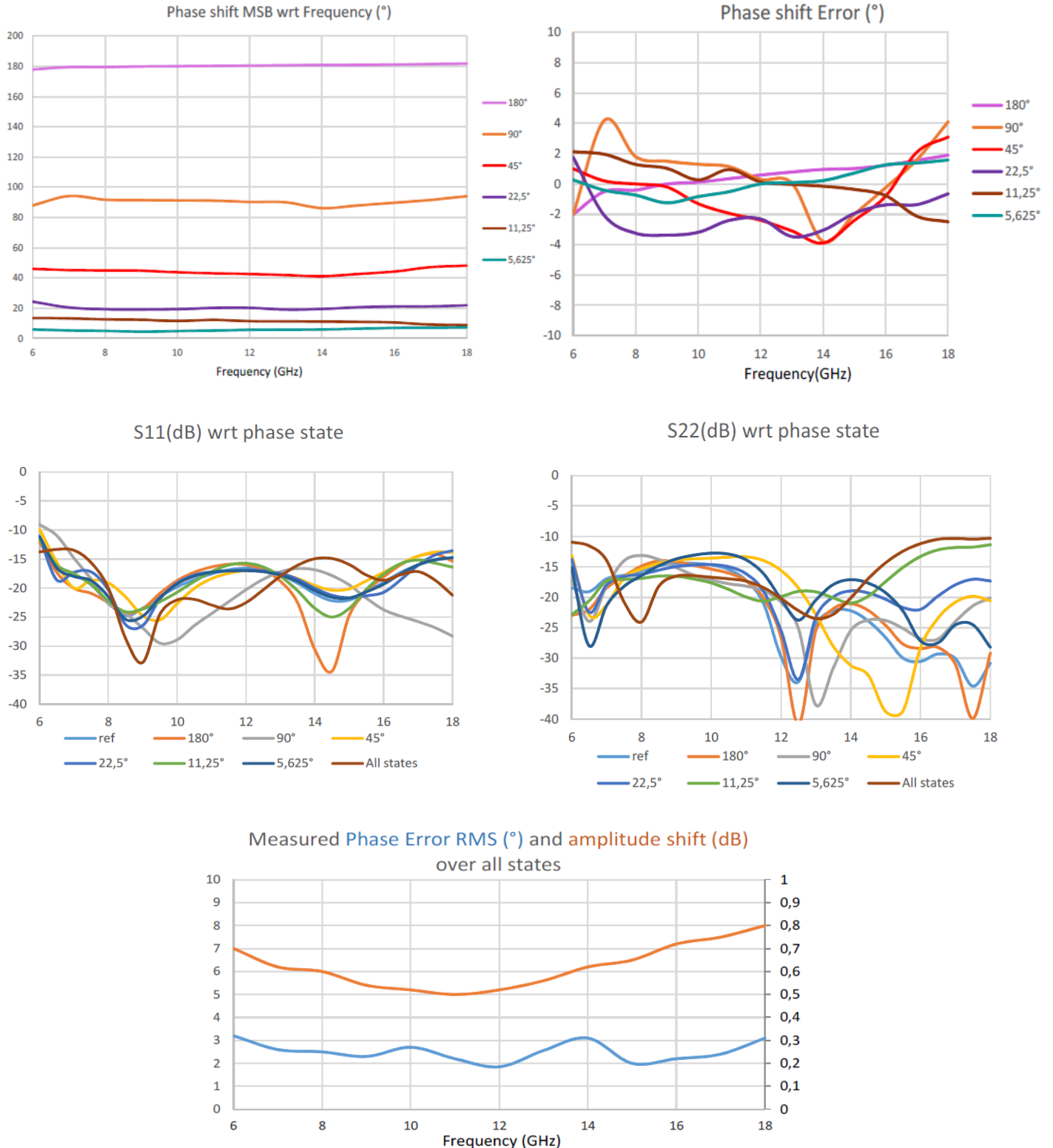
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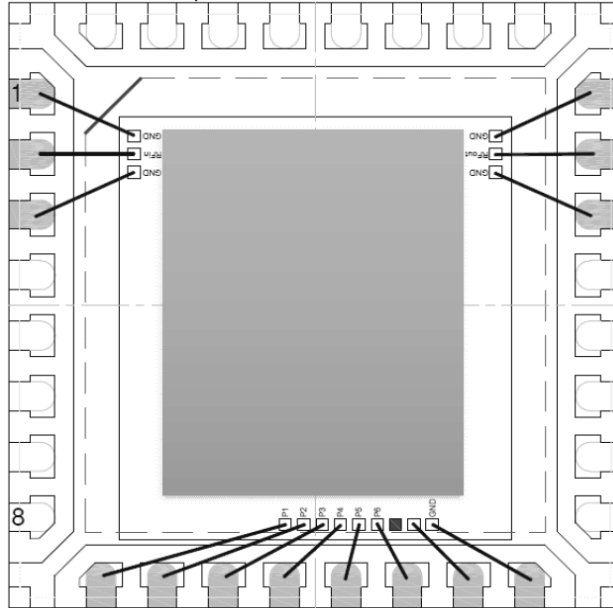
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Typical Performance Curves: $V_{SS2} = -4.5\text{ V}$



Bonding Diagram



Pad Configuration

Pad #	Pad Name
1,3,16,22,24	Ground
4 - 8,17 - 21,25 - 32	No Connection
2	RF Input
9	P1
10	P2
11	P3
12	P4
13	P5
14	P6
15	VSS2
23	RF Output

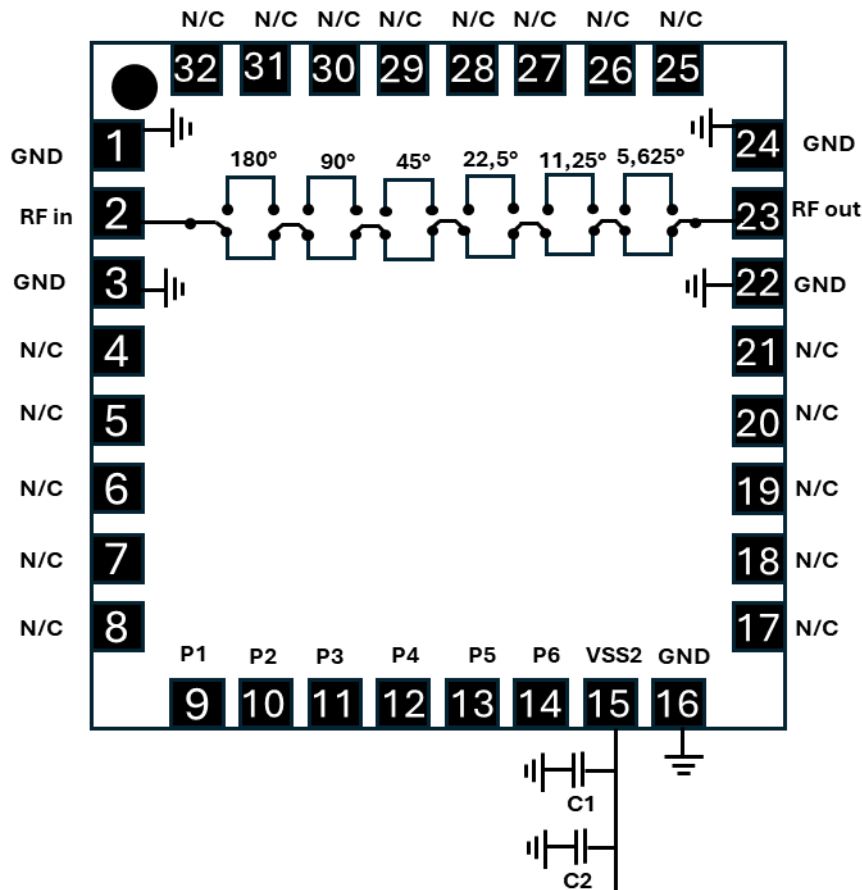
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Functional schematic



Parts List

Part	Value	Case Style	Manufacturer	Manufacturer's Part number
C1	47 pF	0402	Murata	GRT1555C1H470JA02D
C2	100 nF	0402	Murata	GRM155R70J104KA01D

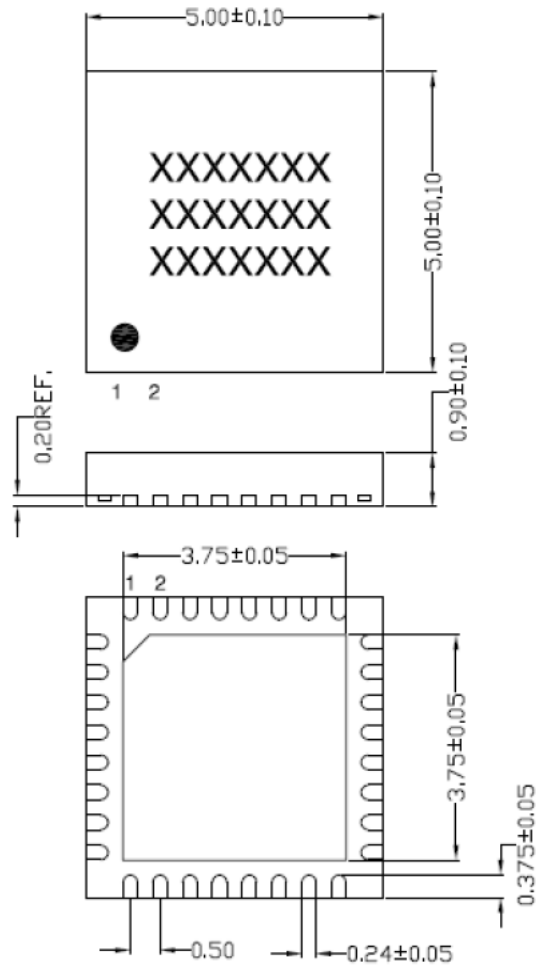
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Outline



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