PRELIMINARY DATASHEET

CGY2174UH

6-bit Ku-Band Phase Shifter

DESCRIPTION

The CGY2174UH is a high performance GaAs MMIC 6–bit Phase Shifter operating in Ku-band.

The CGY2174UH 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 and can be used in Radar, Telecommunication and Instrumentation applications.

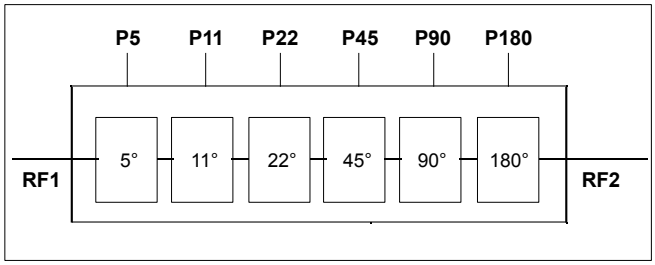
The die is manufactured using OMMIC's 0.18 µm gate length PHEMT Technology. The MMIC uses gold bonding pads and backside metallization and is fully protected with Silicon Nitride passivation to obtain the highest level of reliability. This technology has been evaluated for Space applications and is on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

APPLICATIONS

- Radar
- Telecommunication
- Instrumentation

FEATURES

- Operating Range : 14 GHz to 16 GHz
- Insertion Loss : 8 dB at 15 GHz
- Phase Shift Range = 360°
- RMS Phase Error ≈ 6° @ 15 GHz
- Input P1dB ≈ +20 dBm
- S_{11} & S_{22} < -10 dB @ 15 GHz (All states)
- 0 / -3.3V Control Lines
- Chip size = 2800 x 1100 µm ± 5 µm
- Tested, Inspected Known Good Die (KGD)
- Samples Available
- Demonstration Boards Available
- Space and MIL-STD Available



Block Diagram of the 6-Bit Ku-Band Phase Shifter

RoHS Compliant

Website : www.ommic.com

OMMIC
2, Chemin du Moulin – BP. 11
94 453 Limeil-Brévannes – FRANCE

Email : Information@ommic.com

LIMITING VALUES

T_{amb} = 25 °C unless otherwise noted

Symbol	Parameter	Conditions	MIN.	MAX.	UNIT
P_N	Phase Shift control inputs		-4	0	V
P_{IN}	Input power	P_{RF} at RF1		+28	dBm
T_j	Junction temperature			+150	° C
T_{stg}	Storage temperature		-55	+150	° C

OPERATING CONDITIONS

T_{amb} = 25 °C unless otherwise noted

Symbol	Parameter	Conditions	MIN.	MAX.	UNIT
P_N	Phase Shift control inputs		-3.6	0	V
P_{IN}	Input power	P_{RF} at RF1		+25	dBm
T_{amb}	Ambient temperature		-40	+85	°C

THERMAL CHARACTERISTICS

Symbol	Parameter	Value	UNIT
$R_{th(j-a)}$	Thermal resistance from junction to ambient (T_a = 25 °C)	TBD	° C/W

CHARACTERISTICS

T_{amb} = 25 °C – RF Performance measured on wafer.

Symbol	Parameter	Conditions	MIN.	TYP.	MAX.	UNIT
BW	Bandwidth		14		16	GHz
RF Performance at 15 GHz unless specified						
IL	Insertion Loss			8		dB
NF	Noise Figure at reference state			8		dB
PH_{range}	Phase range			360		°
S_{11}	Input reflection coefficient	At RF1		-15	-10	dB
S_{22}	Output reflection coefficient	At RF2		-15	-10	dB
$PH_{error\ (RMS)}$	RMS Phase error vs phase setting (see Note)			6		°
$PH_{error\ (MAX)}$	Maximum Phase error vs phase setting			15		°
$ATT_{variation\ (RMS)}$	RMS Attenuation variation with phase setting (see Note)			1		dB
$ATT_{variation\ (MAX)}$	Maximum Attenuation variation with phase setting			2		dB
P_{1dB}	Input 1 dB compression point			+20		dBm

Note : The RMS value is the root mean square of the error defined as below :

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

Where x_i is the difference between the measured value and the theoretical value, $\bar{x}_i$ is the mean value of the N x_i, and σ_{xi} is the standard deviation of x_i.

Caution : This device is a high performance RF component and can be damaged by inappropriate handling. Standard ESD precautions should be followed. OMMIC document “OM-CI-MV/ 001/ PG” contains more information on the precautions to take.

LOGIC TRUTH TABLE

	P5	P11	P22	P45	P90	P180
Nominal Phase Shift	-5.625°	-11.25°	-22.5°	-45°	-90°	-180°
Pad	C5	C11	C22	C45	C90	C180
Phase Shift activated	-3.3V	-3.3V	-3.3V	-3.3V	-3.3V	-3.3V
Reference state	0V	0V	0V	0V	0V	0V

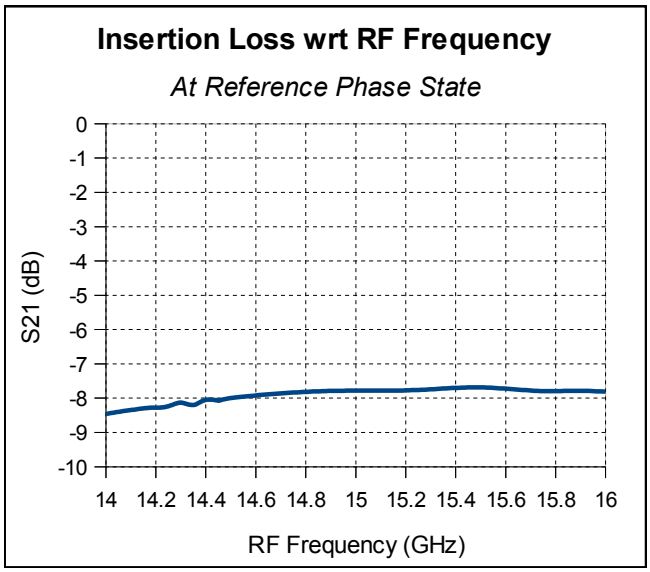
	P5	P11	P22	P45	P90	P180
Phase Shift (°)	-5.625°	-11.25°	-22.5°	-45°	-90°	-180°
0	0V	0V	0V	0V	0V	0V
-5.625	-3.3V	0V	0V	0V	0V	0V
-11.25	0V	-3.3V	0V	0V	0V	0V
-22.5	0V	0V	-3.3V	0V	0V	0V
-45	0V	0V	0V	-3.3V	0V	0V
-90	0V	0V	0V	0V	-3.3V	0V
-180	0V	0V	0V	0V	0V	-3.3V
-354.375	-3.3V	-3.3V	-3.3V	-3.3V	-3.3V	-3.3V

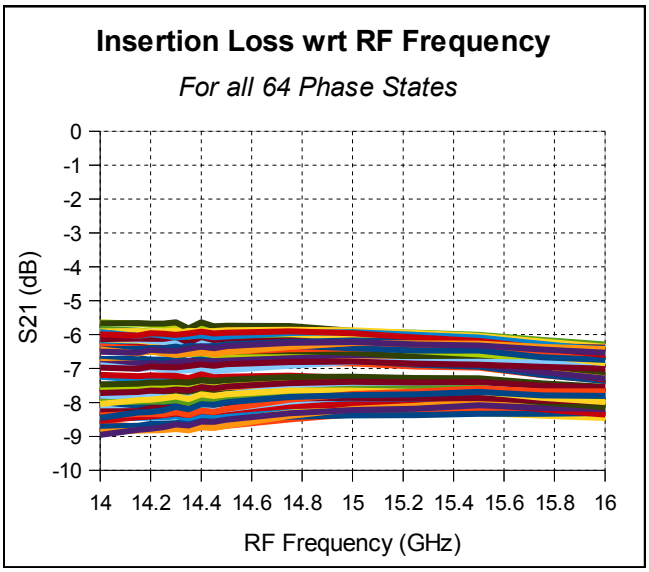
CONTROL VOLTAGE

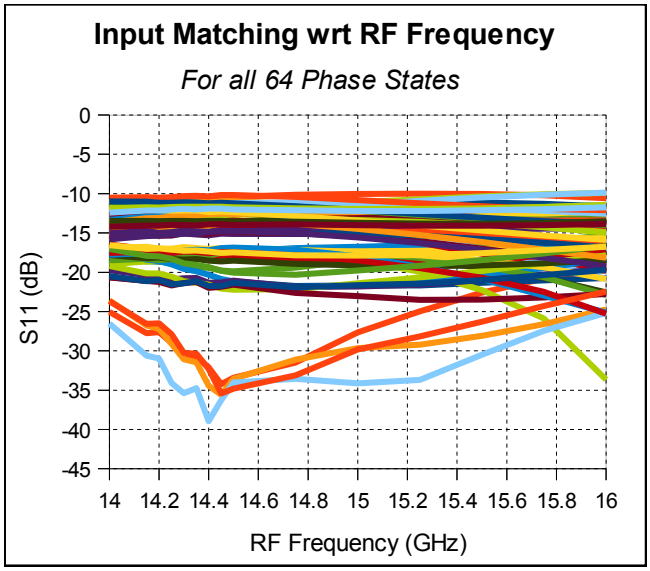
State	MIN.	TYP.	MAX.	UNIT
Low	-3.6	-3.3	-3	V
High	-0.1	0	+0.1	V

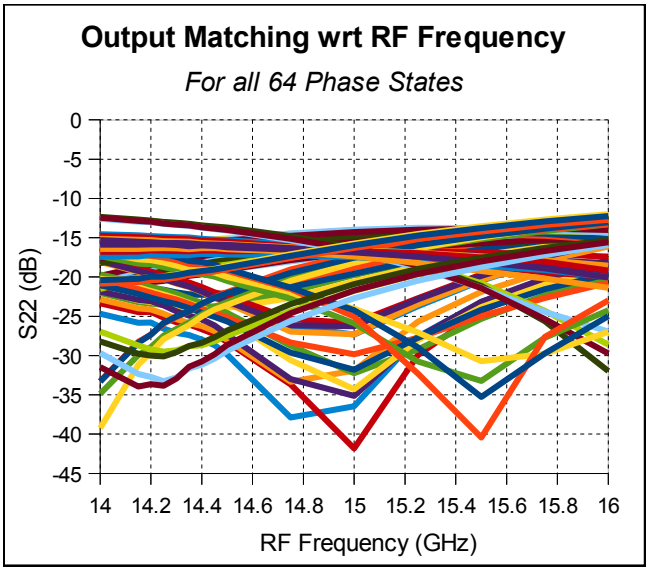
ON WAFER MEASUREMENTS – S PARAMETERS

Measured on wafer @ T = 25 °C
Calculated with input and output inductance of 0.3 nH



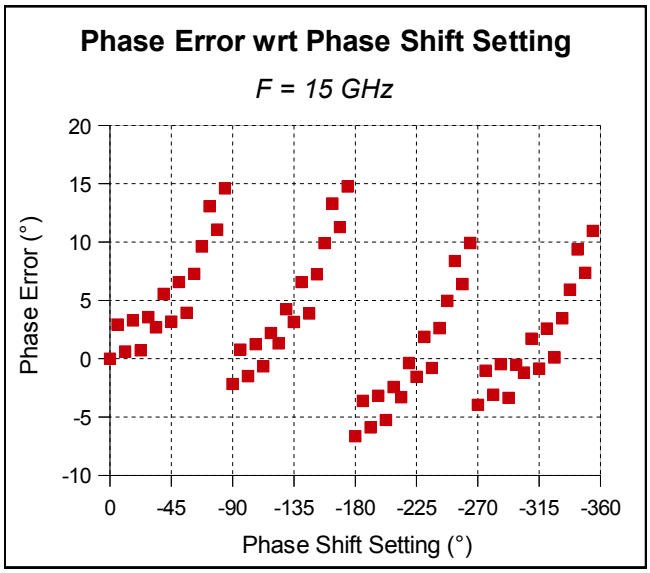


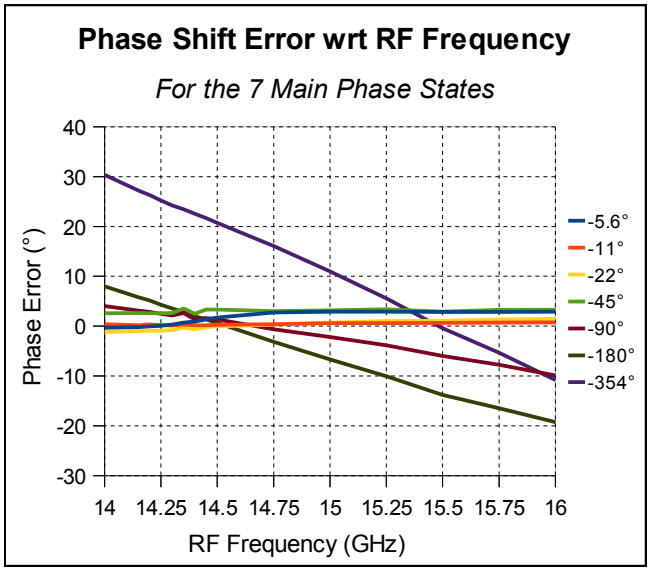


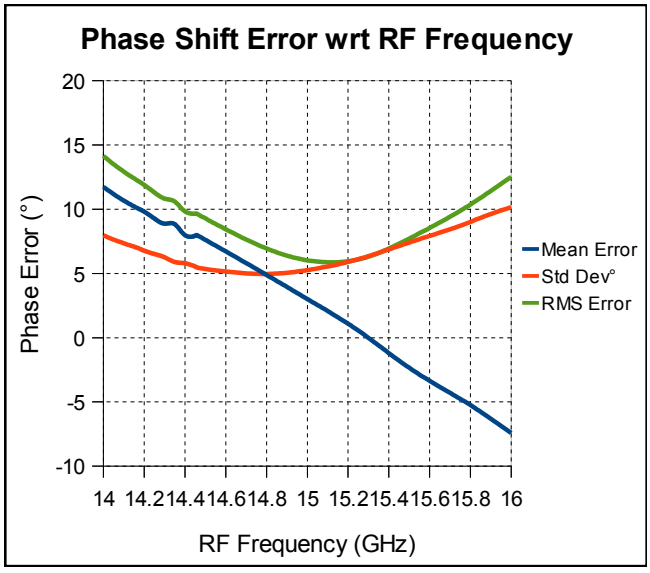


ON WAFER MEASUREMENTS – PHASE SHIFTING ERRORS

Measured on wafer @ T = 25 °C
Calculated with input and output inductance of 0.3 nH







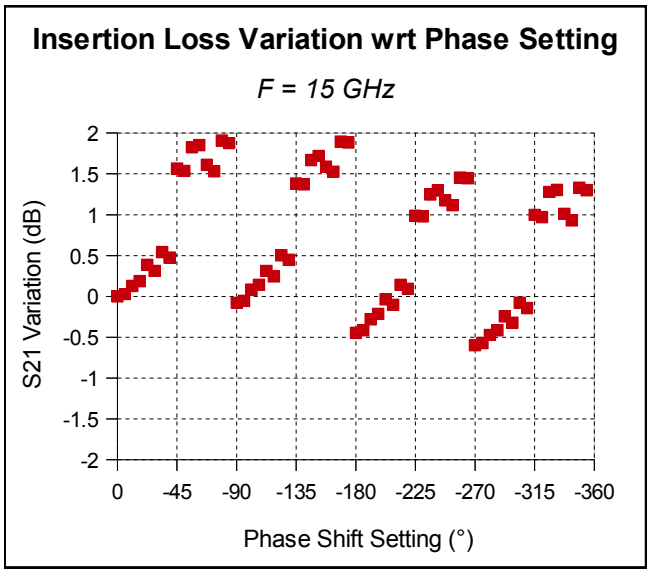
Note : The RMS value is the root mean square of the error defined as below :

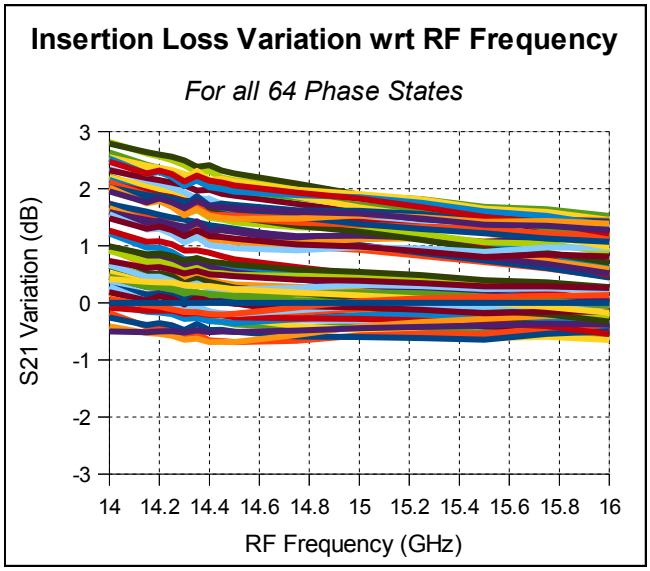
$$x_{RMS} = \sqrt{\frac{1}{N}\sum_{i=1}^{N} x_i^2} = \sqrt{\bar{x}_i^{\,2} + \sigma_{x_i}^2}$$

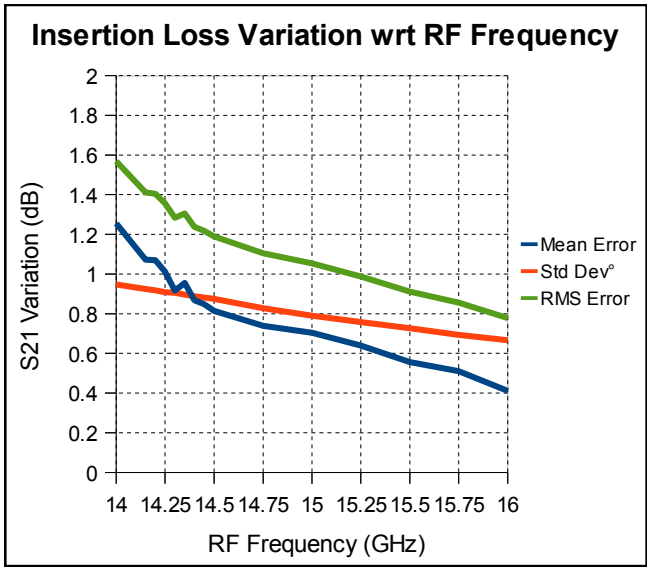
Where x_i is the difference between the measured value and the theoretical value, $\bar{x}_i$ is the mean value of the N x_i, and σ_{xi} is the standard deviation of x_i.

ON WAFER MEASUREMENTS – INSERTION LOSS VARIATIONS

Measured on wafer @ T = 25 °C
Calculated with input and output inductance of 0.3 nH







Note : The RMS value is the root mean square of the error defined as below :

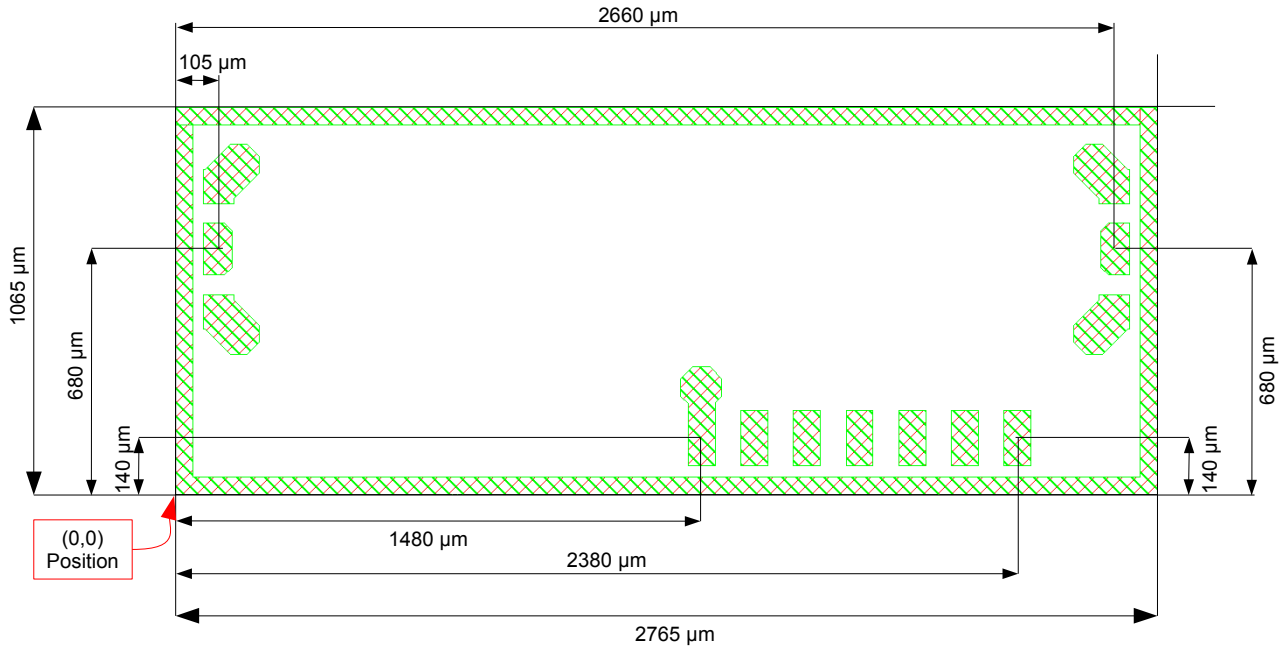
$$x_{RMS} = \sqrt{\frac{1}{N}\sum_{i=1}^{N} x_i^2} = \sqrt{\bar{x}_i^{\,2} + \sigma_{x_i}^2}$$

Where x_i is the difference between the measured value and the theoretical value, $\bar{x}_i$ is the mean value of the N x_i, and σ_{xi} is the standard deviation of x_i.

MECHANICAL INFORMATION

Chip size = 2800 x 1100 µm (2765 x 1065 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



Caution : This device is a high performance RF component and can be damaged by inappropriate handling. Standard ESD precautions should be followed. OMMIC document "OM-CI-MV/ 001/ PG" contains more information on the precautions to take.

PAD POSITION

PAD NAME	SYMBOL	COORDINATES		DESCRIPTION
		X	Y	
IN	RF1	105	680	RF Port 1
OUT	RF2	2660	680	RF Port 2
GND	GND	1480	140	Ground (back side)
C5	P5	1630	140	5° cell control
C11	P11	1780	140	11° cell control
C22	P22	1930	140	22° cell control
C45	P45	2080	140	45° cell control
C90	P90	2230	140	90° cell control
C180	P180	2380	140	180° cell control

X=0, Y=0 at bottom left corner.

DEFINITIONS

Limiting values definition
Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 60134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.

Application information
Applications that are described herein for any of these products are for illustrative purposes only. OMMIC makes no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

DISCLAIMERS

Life support applications
These products are not designed for use in life support appliances, devices, or systems where malfunction of these products can reasonably be expected to result in personal injury. OMMIC's customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify OMMIC for any damages resulting from such application.

Right to make changes
OMMIC reserves the right to make changes, without notice, in the products, including circuits, standard cells, and/or software, described or contained herein in order to improve design and/or performance. OMMIC assumes no responsibility or liability for the use of any of these products, conveys no licence or title under any patent, copyright, or mask work right to these products, and makes no representations or warranties that these products are free from patent, copyright, or mask work right infringement, unless otherwise specified.

ORDERING INFORMATION

Generic type	Package type	Version	Sort type	Description
CGY2174	UH	C1	-	6-bit Ku-Band Phase Shifter

RoHS Compliant

Document History : Version 1.0, Last Update 11/6/2010