PRODUCT DATASHEET

CGY2177AUH/C1

6-bit C-Band Phase Shifter

DESCRIPTION

The CGY2177AUH/C1 is a high performance GaAs MMIC 6–bit Phase Shifter operating in C-band. It 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 variation.

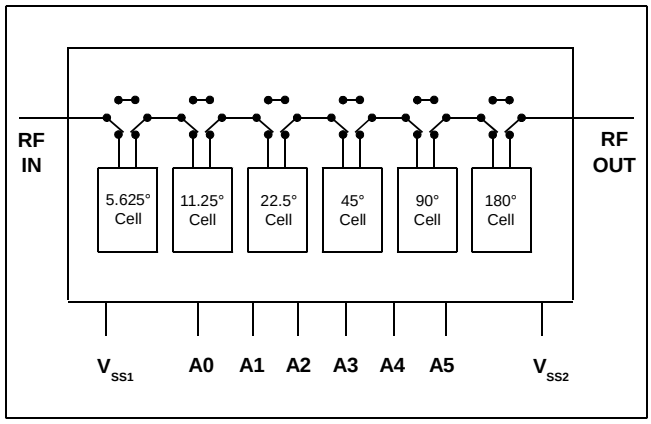
This die is manufactured using OMMIC's 0.18 µm gate length PHEMT Technology. The MMIC uses gold bonding pads and backside metallization and is fully protected with Silicon Nitride passivation to obtain the highest level of reliability. This technology has been evaluated for Space applications and is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

FEATURES

- Operating Range : 4.8GHz to 6.8GHz
- Insertion Loss : 5 dB @ 5.4GHz
- Phase Shift Range = 360°
- RMS Phase Error ≈ 2°@ 5.4GHz
- RMS Amplitude Variation ≈ 0.25 dB @ 5.4GHz
- S_{11} & S_{22} < -13 dB @ 5.4 GHz (All states)
- 0 / +5V Control Lines
- Chip size = 3470 x 2220 µm ± 5 µm
- Tested, Inspected Known Good Die (KGD)
- Samples Available
- Demonstration Boards Available
- Space and MIL-STD Available

APPLICATIONS

- Radar
- Telecommunication
- Instrumentation



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

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LIMITING VALUES

T_{amb} = 25 ℃ unless otherwise noted

Symbol	Parameter	Conditions	MIN.	MAX.	UNIT
A_N	Phase Control Inputs		0	+6	V
V_{S1}	Source supply voltage	When V_{S2} pad is not used	-5	0,5	V
V_{S2}	Source supply voltage	When V_{S1} pad is not used	-6	0,5	V
P_{IN}	Input power	At RF_{IN}		25	dBm
T_{amb}	Ambient temperature		-40	+85	°C
T_j	Junction temperature			+150	°C
T_{stg}	Storage temperature		-55	+150	°C

THERMAL CHARACTERISTICS

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

CHARACTERISTICS

Conditions : V_{SS2}= -4.5 V; I_{SS2}= 8 mA; T_{amb} = 25 ℃

Symbol	Parameter	Conditions	MIN.	TYP.	MAX.	UNIT
Supplies						
V_{SS2}	Source supply voltage	V_{S1} pad is open	-6	-4,5	-4	V
I_{SS2}	Source supply current			8		mA
V_{SS1}	Source supply voltage	V_{S2} pad is open	-5	-3,5	-3	V
I_{SS1}	Source supply current			8		mA
RF Performance 4.8 GHz to 6.8 GHz unless otherwise stated						
BW	Bandwidth		4.8		6.8	GHz
IL	Insertion Loss	Reference state		5		dB
PH_{range}	Phase range			360		°
$PH_{error\ (max)}$	RMS Phase Error [5GHz – 6.5GHz]			2		°
$ATT_{error\ (RMS)}$	RMS Attenuation Error [5GHz – 6.5GHz]			0.25		dB
S_{11}	Input reflection coefficient, All States	50 Ω source		-15		dB
S_{22}	Output reflection coefficient, All States	50 Ω load		-15		dB
P_{1dB}	Input Power at 1dB Compression Point			20		dBm

Note1 : The RMS value is the root mean square of the error defined as below

$$x_{\mathrm{rms}} = \sqrt{\frac{1}{N}\sum_{i=1}^{N} x_i^2} = \sqrt{\frac{x_1^2 + x_2^2 + \cdots + x_N^2}{N}}$$

Where x_i is the difference between the measured value and the expected value.

LOGIC TRUTH TABLE

	A0	A1	A2	A3	A4	A5
Nominal Phase Shift	-5.6°	-11.25°	-22.5°	-45°	-90°	-180°
Reference State	0	0	0	0	0	0
Phase Shift Activated	1	1	1	1	1	1

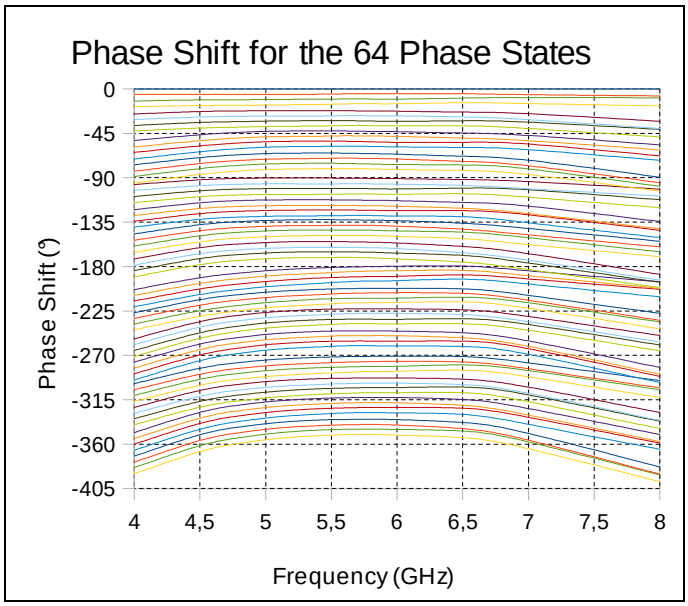
	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Phase Shift (°)	**-180°**	**-90°**	**-45°**	**-22.5°**	**-11.25°**	**-5.6°**
0	0	0	0	0	0	0
-5.6	0	0	0	0	0	1
-11.25	0	0	0	0	1	0
-22.5	0	0	0	1	0	0
-45	0	0	1	0	0	0
-62	0	0	1	0	1	1
-90	0	1	0	0	0	0
-118	0	1	0	1	0	1
-180	1	0	0	0	0	0
-270	1	1	0	0	0	0
-354	1	1	1	1	1	1

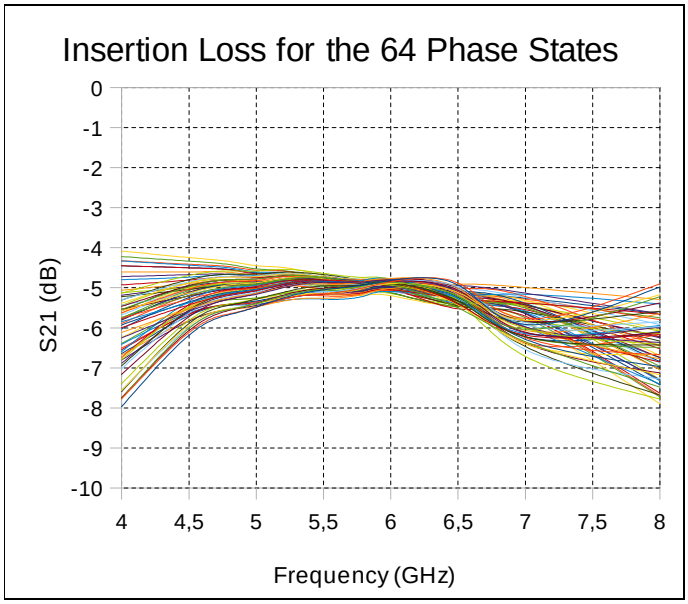
CONTROL VOLTAGE

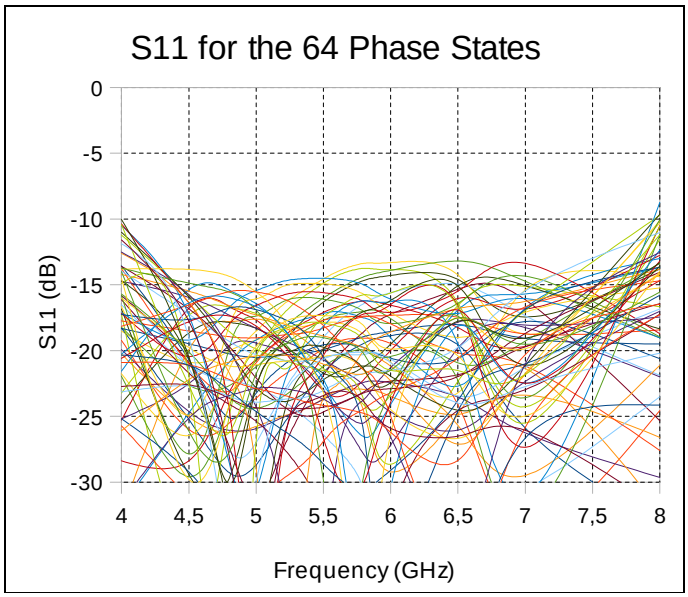
State	MIN.	MAX.	UNIT
Low (0)	0	1	V
High (1)	4	6	V

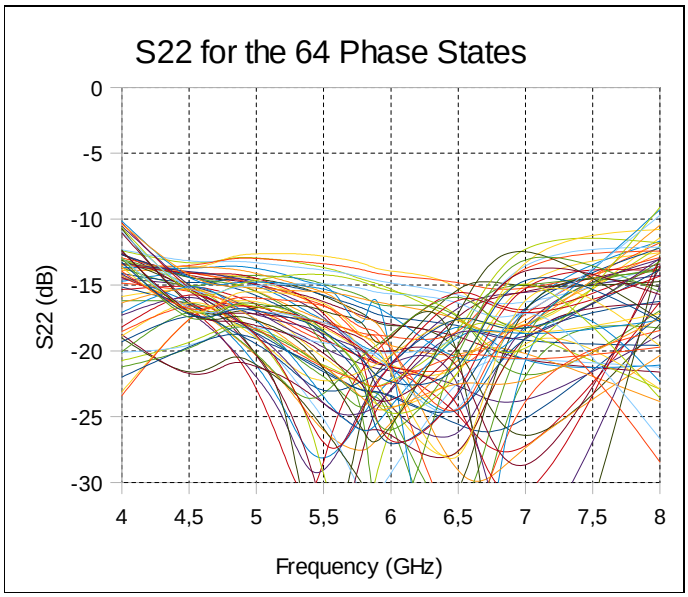
ON WAFER MEASUREMENTS – S PARAMETERS

Supply voltage : V_{SS2}= -4.5 V, Calculated with Input/Output Inductance of 0.5 nH



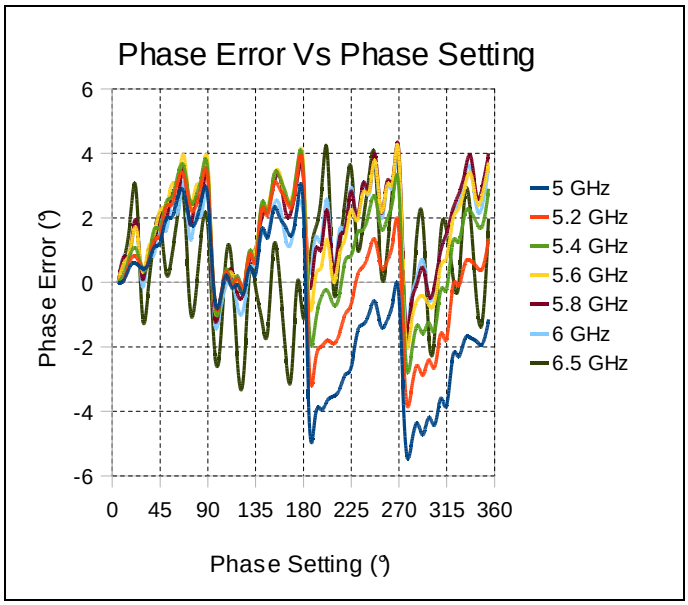


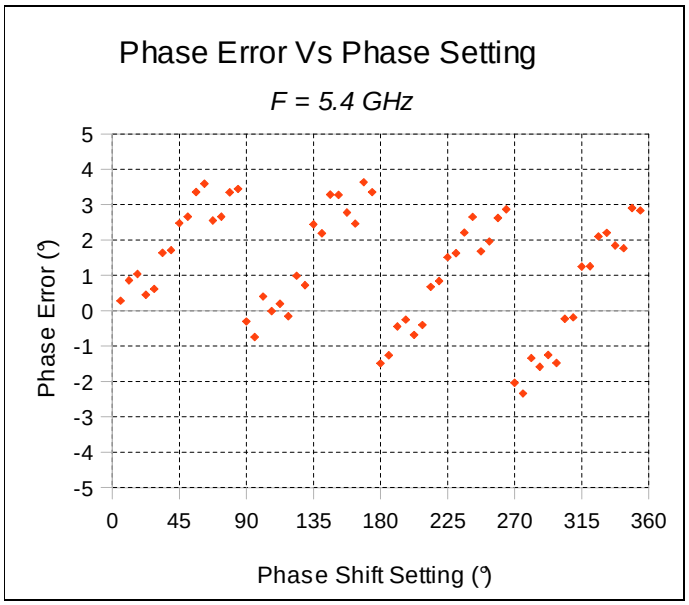


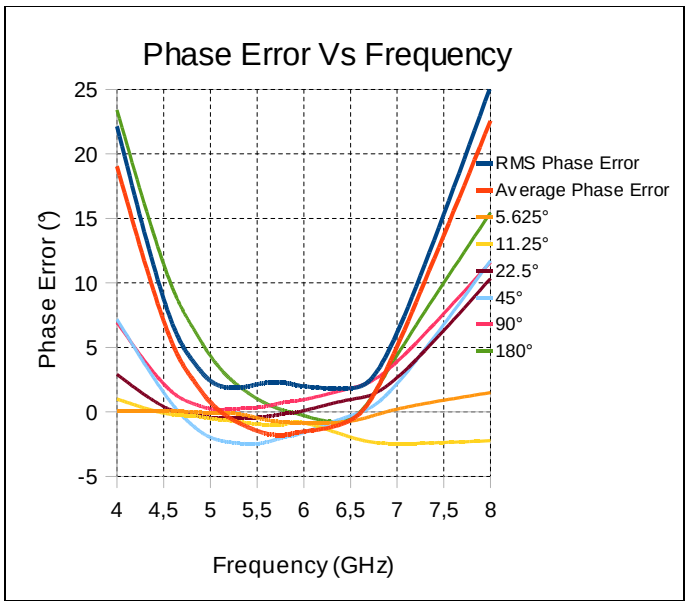


ON WAFER MEASUREMENTS – PHASE SHIFTING ERRORS

Supply voltage : VSS2= -4.5 V, Calculated with Input/Output Inductance of 0.5 nH

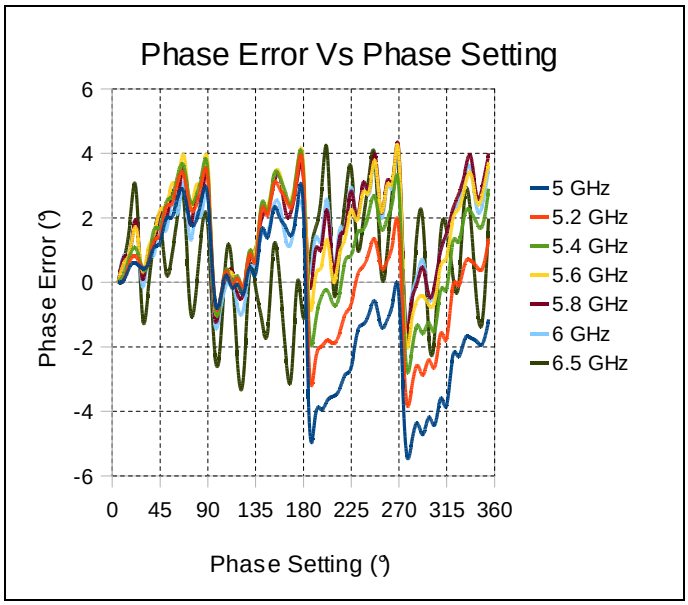


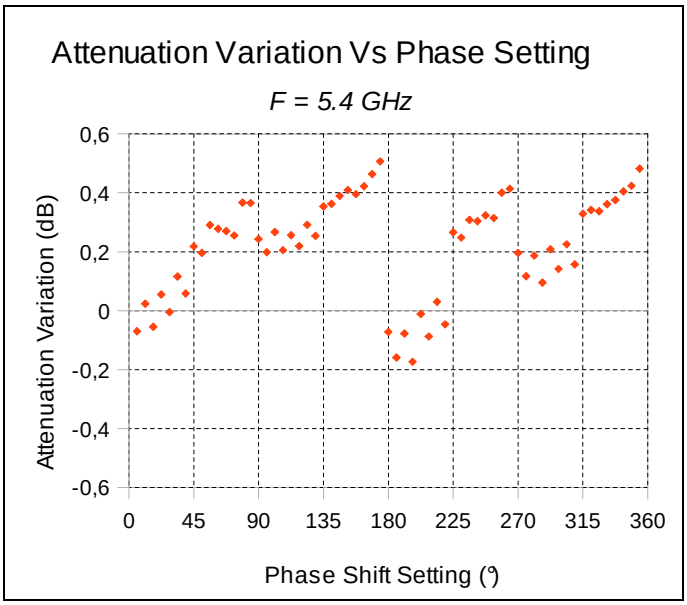


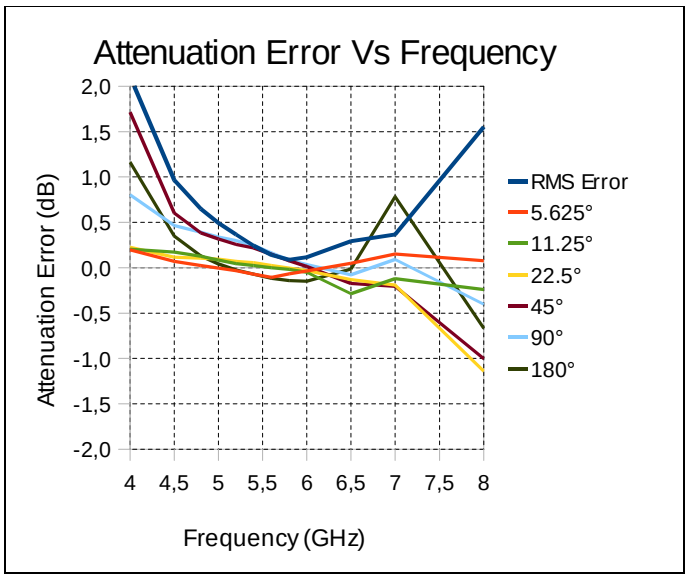


ON WAFER MEASUREMENTS – ATTENUATION ERRORS

Supply voltage : VSS2= -4.5 V, Calculated with Input/Output Inductance of 0.5 nH



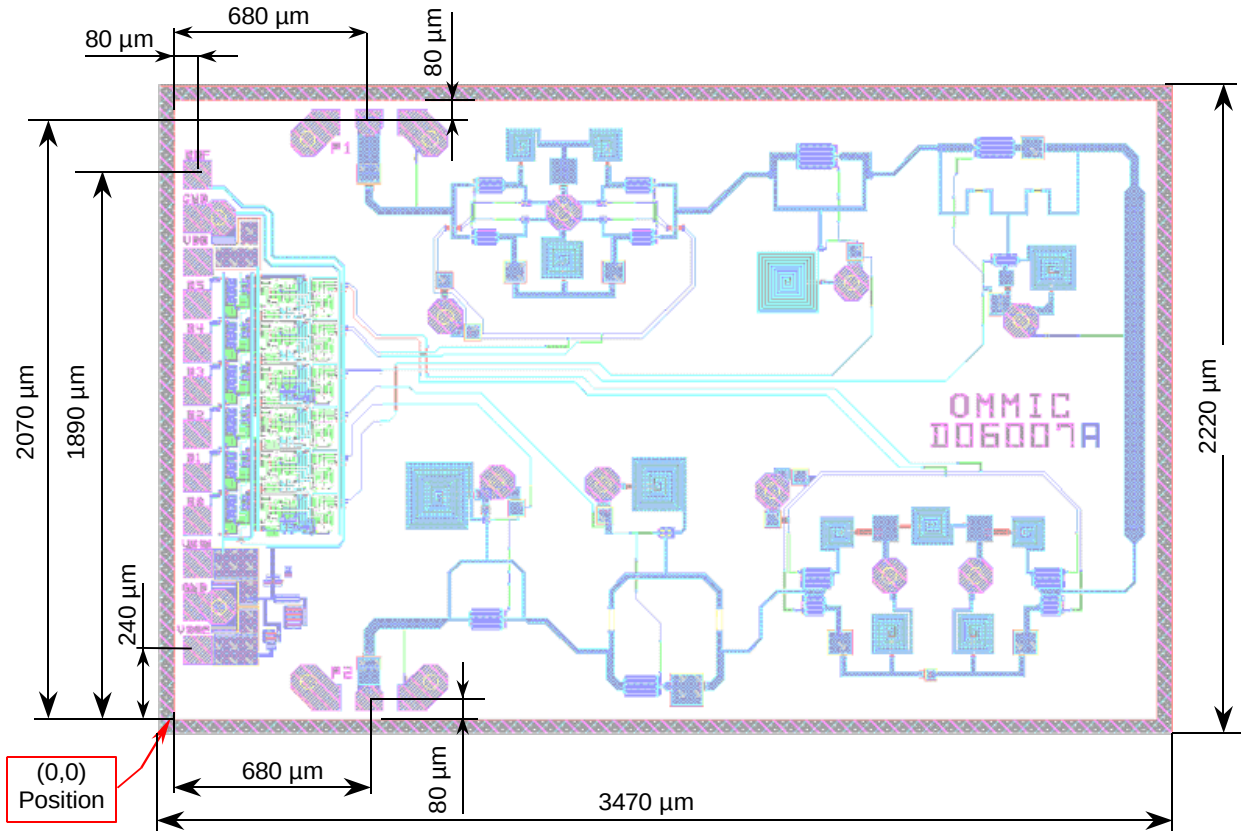




MECHANICAL INFORMATION

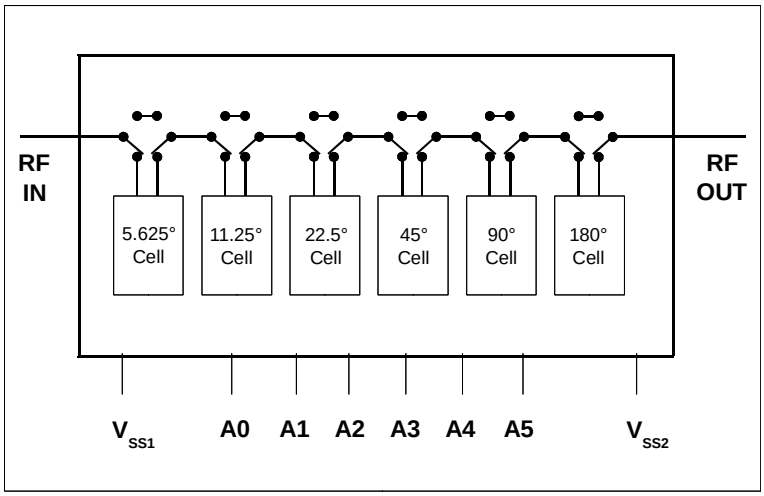
Chip size = 3470 x 2220 µm including the dicing street

- DC Pads = 100 x 100 µm, spacing = 150 µm, Top metal=Au
- RF Pads = 100 x 100 µm, pitch = 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.

BLOCK DIAGRAM AND PAD CONFIGURATION



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

PAD POSITION

PAD NAME	SYMBOL	COORDINATES		DESCRIPTION
		X	Y	
P2	RF_{OUT}	680	80	RF Port 2
P1	RF_{IN}	680	2070	RF Port 1
VSS2	V_{SS2}	80	240	V_{SS2} power supply
GND	GND	80	390	Ground (connected to MMIC back side metal)
VSS1	V_{SS1}	80	540	V_{SS1} power supply
B0	A0	80	690	5.625° cell control
B1	A1	80	840	11.25° cell control
B2	A2	80	990	22.5° cell control
B3	A3	80	1140	45° cell control
B4	A4	80	1290	90° cell control
B5	A5	80	1440	180° cell control
VDD	V_D	80	1590	Do not use
GND	GND	80	1740	Ground (connected to MMIC back side metal)
REF	V_{REF}	80	1890	Internal negative voltage : to be decoupled to ground

X=0, Y=0 at bottom left corner : see Mechanical Information for more details.

NOTES

1- Only V_{SS1} or V_{SS2} is to be connected. For example: if V_{SS2} is used, V_{SS1} must be left open.
2- The power supply (V_{SS1} or V_{SS2}) and V_{REF} must be decoupled to the ground with 100nF capacitors as close as possible to the chip.

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
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ORDERING INFORMATION

Generic type	Package type	Version	Sort Type	Description
CGY2177A	UH	C1		6-bit C-band Phase Shifter
CGY2177A	UH	C1	EK	Reference Board with RF Connectors

RoHS Compliant

Document History : Version 1.0, Last Update 21/09/2011

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