

# PRELIMINARY DATASHEET

## CGY2171XAUH

### 6-bit 1-15 GHz Attenuator

#### DESCRIPTION

The CGY2171XAUH is a high performance GaAs MMIC 6-bit Attenuator operating in L, S, C, and X-band.

The CGY2171XAUH has a nominal attenuation range of 31.5 dB in 0.5 dB steps. It covers the frequency range of 1 to 15 GHz and can be used in Radar, Telecommunication and Instrumentation applications.

The die is manufactured using OMMIC's 0.18  $\mu\text{m}$  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.

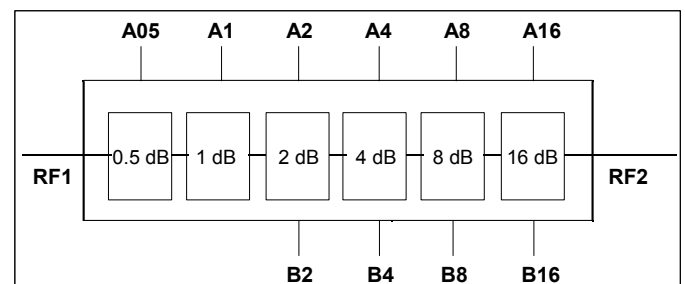
#### APPLICATIONS

- ▶ Radar
- ▶ Telecommunication
- ▶ Instrumentation



#### FEATURES

- ▶ Operating Range : 1 GHz to 15 GHz
- ▶ Insertion Loss : 5 dB at 10 GHz
- ▶ Attenuation Range = 31.5 dB
- ▶ RMS Attenuation Error  $\approx 0.25$  dB @ 10GHz
- ▶ Input P1dB  $\approx +20$  dBm
- ▶  $S_{11}$  &  $S_{22} < -13$  dB @ 10 GHz (All states)
- ▶ 0 / -3V Control Lines
- ▶ Chip size = 2600 x 1200  $\mu\text{m} \pm 5 \mu\text{m}$
- ▶ Tested, Inspected Known Good Die (KGD)
- ▶ Samples Available
- ▶ Demonstration Boards Available
- ▶ Space and MIL-STD Available



Block Diagram of the 6-Bit X-Band Attenuator

## LIMITING VALUES

T<sub>amb</sub> = 25 °C unless otherwise noted

Symbol	Parameter	Conditions	MIN.	MAX.	UNIT
A <sub>N</sub> , B <sub>N</sub>	Attenuation control inputs		-4	0	V
P <sub>IN</sub>	Input power	P <sub>RF</sub> at RF1		TBD	dBm
T <sub>amb</sub>	Ambient temperature		-40	+85	° C
T <sub>j</sub>	Junction temperature			+150	° C
T <sub>stg</sub>	Storage temperature		-55	+150	° C

## THERMAL CHARACTERISTICS

Symbol	Parameter	Value	UNIT
R <sub>th(j-a)</sub>	Thermal resistance from junction to ambient (T <sub>a</sub> = 25 °C)	TBD	° C/W

## CHARACTERISTICS

T<sub>amb</sub> = 25 °C – RF Performance measured on wafer.

Symbol	Parameter	Conditions	MIN.	TYP.	MAX.	UNIT
BW	Bandwidth		1		15	GHz
<i>RF Performance at 10 GHz unless specified</i>						
IL	Insertion Loss			5		dB
NF	Noise Figure at reference state			5		dB
ATT <sub>range</sub>	Attenuation range			31.5		dB
S <sub>11</sub> , S <sub>22</sub>	Input & Output reflection coefficients	At RF1 & RF2		-15		dB
ATT <sub>variation (RMS)</sub>	RMS Attenuation error with attenuation setting (see Note 1)			0.25		dB
ATT <sub>variation (MAX)</sub>	Maximum Attenuation error with attenuation setting			+/- 1		dB
PH <sub>error (RMS)</sub>	RMS Phase variation with attenuation setting (see Note 1)			5		°
PH <sub>error (MAX)</sub>	Maximum Phase variation with attenuation setting			+/- 8		°
P <sub>1dB</sub>	Input 1 dB compression point			20		dBm

Note 1 : The RMS value is the root mean square of the error defined as below

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

Where x<sub>i</sub> is the difference between the measured value and the expected value.

**LOGIC TRUTH TABLE**

	A05	A1	A2	B2	A4	B4	A8	B8	A16	B16
Nominal Attenuation	0.5 dB	1 dB	2 dB	2 dB	4 dB	4 dB	8 dB	8 dB	16 dB	16 dB
Pad	A05	A1	A2	A2B	A4	A4B	A8	A8B	A16	A16B
Attenuation activated	-3V	-3V	-3V	0V	-3V	0V	-3V	0V	-3V	0V
Reference state	0V	0V	0V	-3V	0V	-3V	0V	-3V	0V	-3V

	A05	A1	A2	B2	A4	B4	A8	B8	A16	B16
<b>Attenuation (dB)</b>	<b>0.5</b>	<b>1</b>	<b>2</b>	<b>2</b>	<b>4</b>	<b>4</b>	<b>8</b>	<b>8</b>	<b>16</b>	<b>16</b>
0	0	0	0	1	0	1	0	1	0	1
0.5	1	0	0	1	0	1	0	1	0	1
1	0	1	0	1	0	1	0	1	0	1
2	0	0	1	0	0	1	0	1	0	1
3	0	1	1	0	0	1	0	1	0	1
4	0	0	0	1	1	0	0	1	0	1
5	0	1	0	1	1	0	0	1	0	1
6	0	0	1	0	1	0	0	1	0	1
8	0	0	0	1	0	1	1	0	0	1
10	0	0	1	0	0	1	1	0	0	1
15	0	1	1	0	1	0	1	0	0	1
16	0	0	0	1	0	1	0	1	1	0
20	0	0	0	1	1	0	0	1	1	0
25	0	1	0	1	0	1	1	0	1	0
30	0	0	1	0	1	0	1	0	1	0
31.5	1	1	1	0	1	0	1	0	1	0

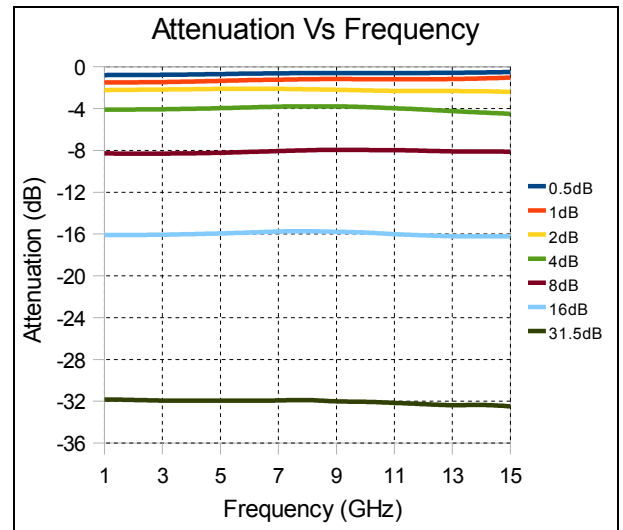
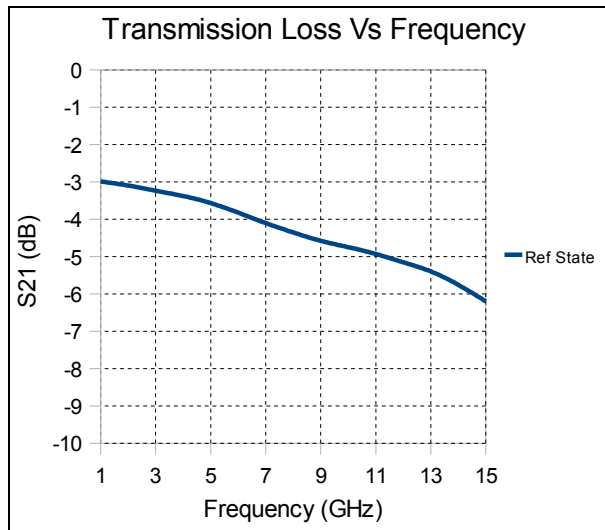
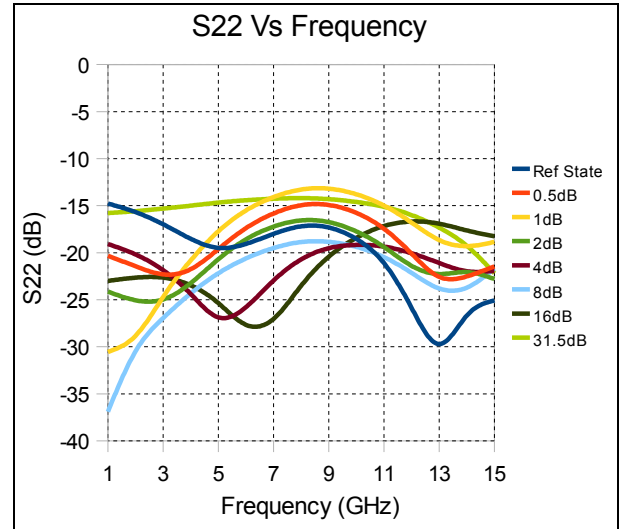
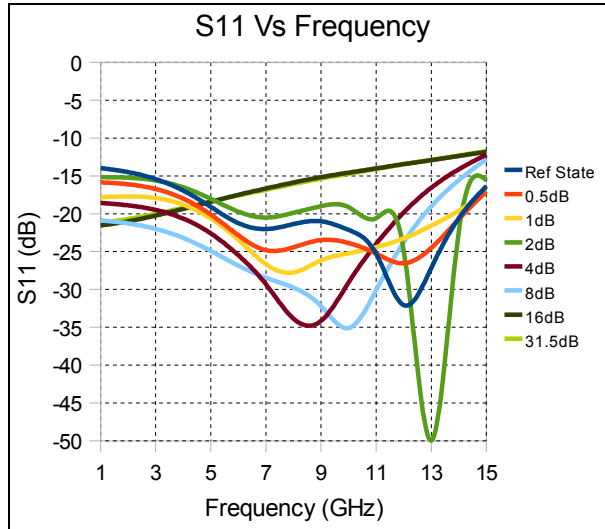
**CONTROL VOLTAGE**

State	MIN.	TYP.	MAX.	UNIT
Low	-3.25	-3	-2.75	V
High	-0.01	0	+0.01	V

**ON WAFER MEASUREMENTS – S PARAMETERS**

Measured on wafer @ T = 25 °C

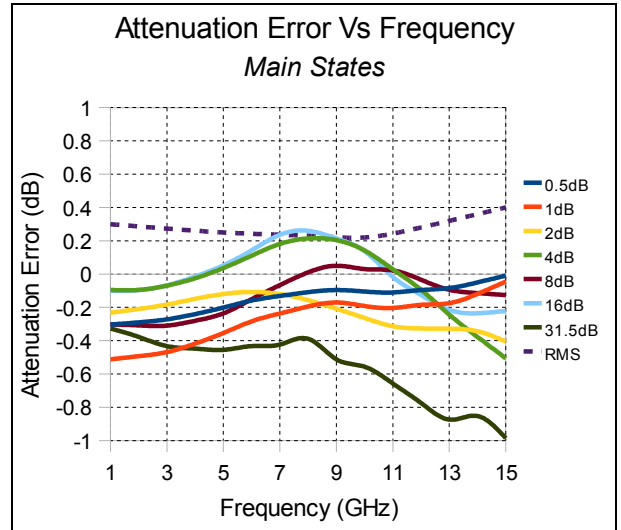
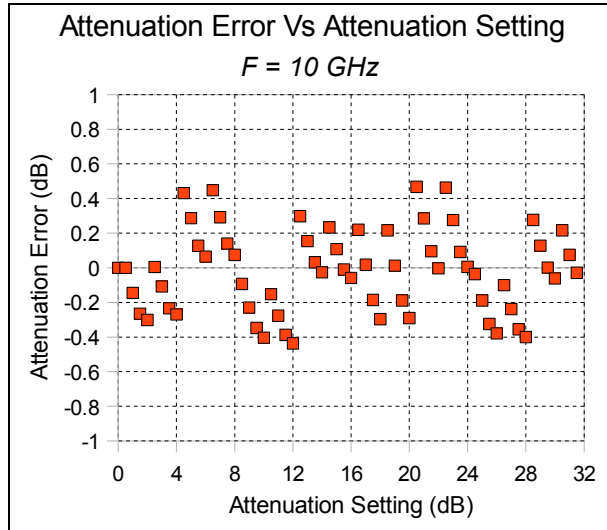
Calculated with input and output inductance of 0.3 nH



## ON WAFER MEASUREMENTS – ATTENUATION ERRORS

Measured on wafer @ T = 25 °C

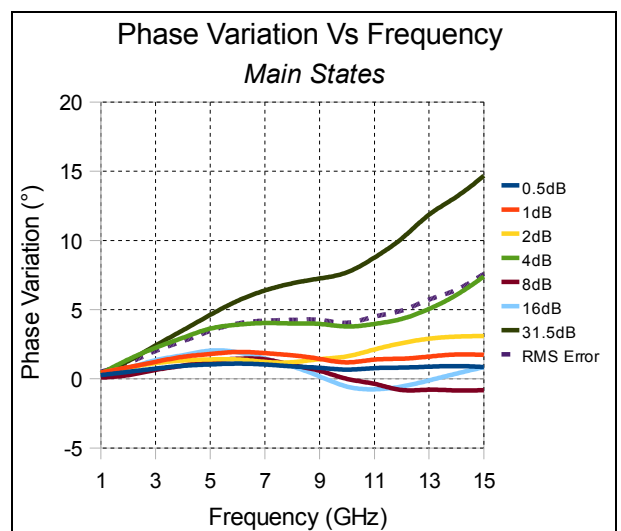
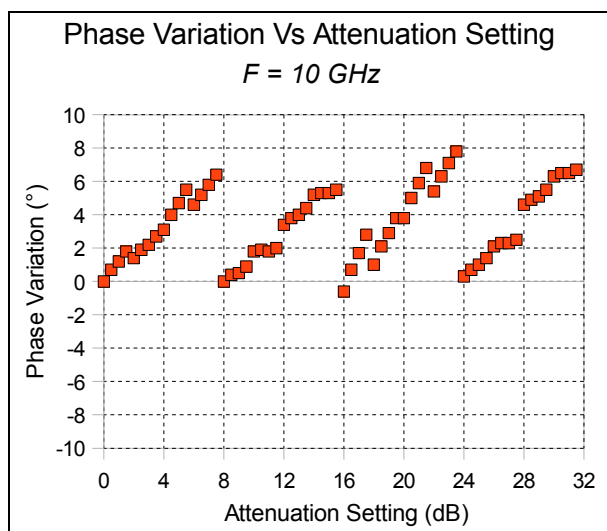
Calculated with input and output inductance of 0.3 nH



## ON WAFER MEASUREMENTS – PHASE SHIFTING VARIATIONS

Measured on wafer @ T = 25 °C

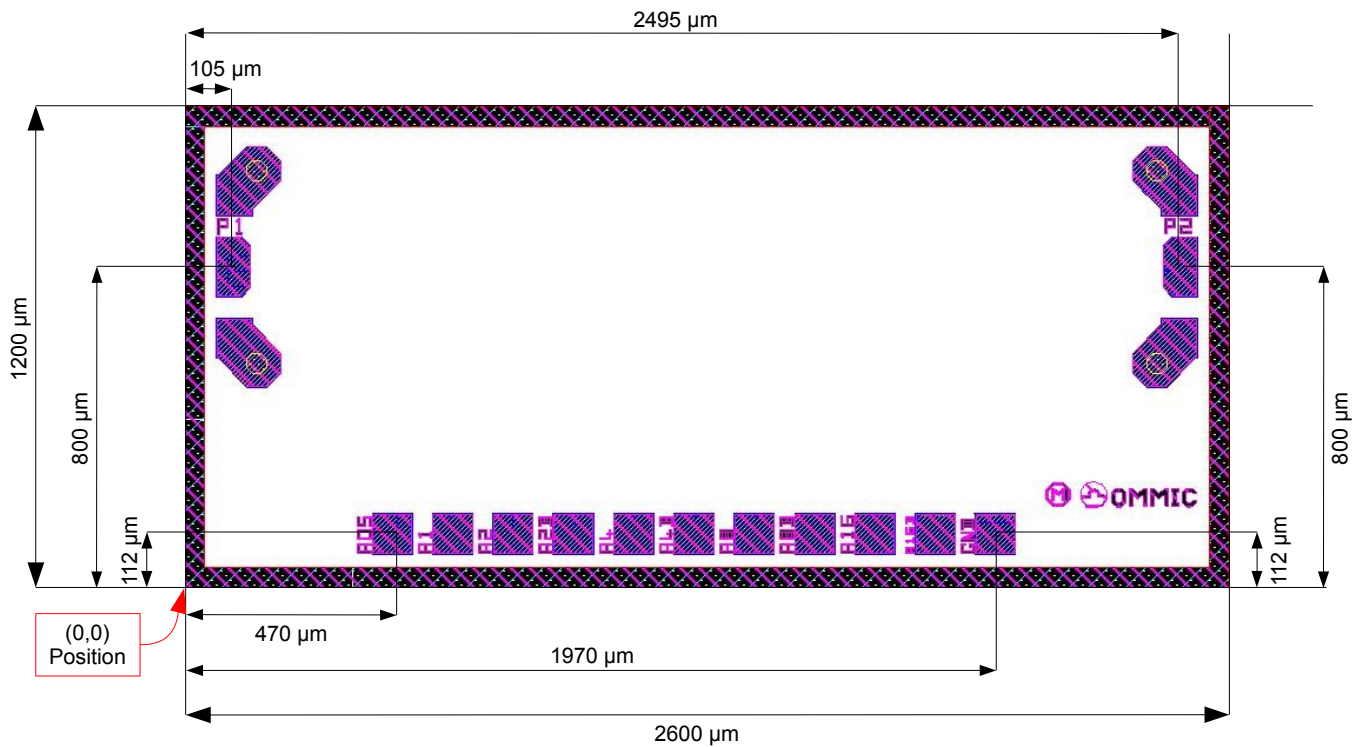
Calculated with input and output inductance of 0.3 nH



**MECHANICAL INFORMATION**

Chip size = 2600 x 1200  $\mu\text{m}$  (2565 x 1165  $\mu\text{m}$   $\pm$  5  $\mu\text{m}$  after dicing)

- DC Pads = 100 x 100  $\mu\text{m}$ , spacing = 150  $\mu\text{m}$ , top metal = Au
- RF Pads = 85 x 150  $\mu\text{m}$ , top metal = Au
- Chip Thickness 100  $\mu\text{m}$



**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.

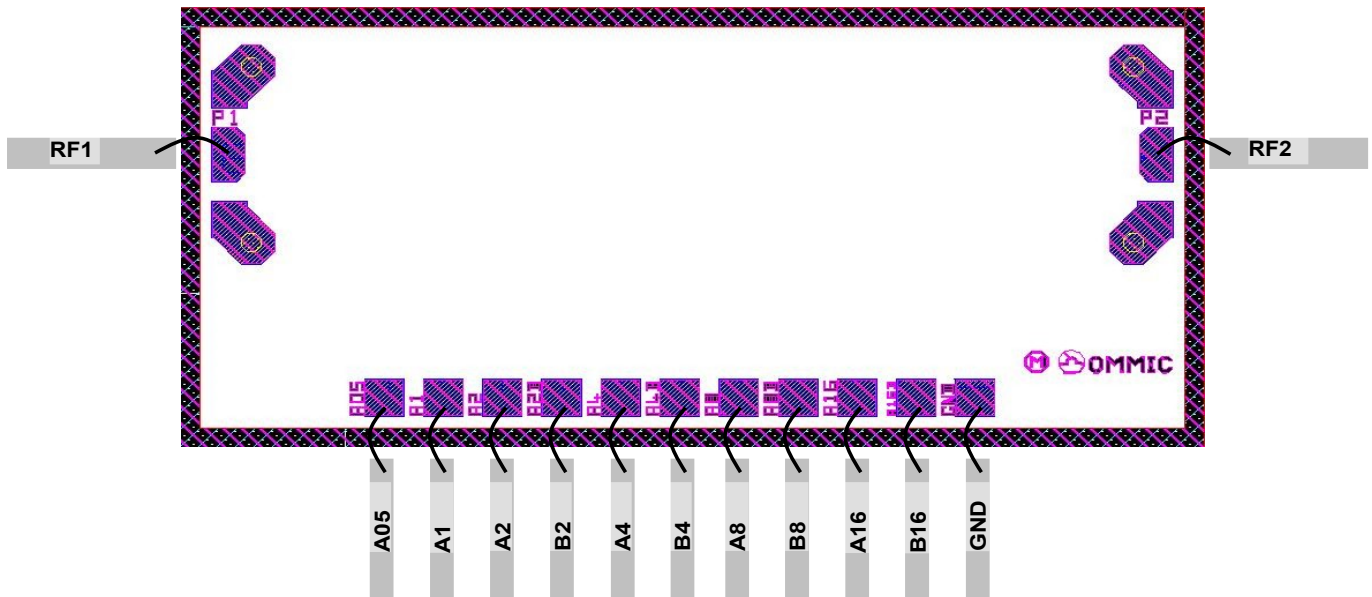
**PAD POSITION**

PAD NAME	SYMBOL	COORDINATES		DESCRIPTION
		X	Y	
P1	RF1	105	800	RF Port 1
P2	RF2	2495	800	RF Port 2
A05	A05	470	112	0.5 dB cell control
A1	A1	620	112	1 dB cell control
A2	A2	770	112	2 dB cell control
A2B	B2	920	112	2 dB cell control
A4	A4	1070	112	4 dB cell control
A4B	B4	1220	112	4 dB cell control
A8	A8	1370	112	8 dB cell control
A8B	B8	1520	112	8 dB cell control
A16	A16	1670	112	16 dB cell control
A16B	B16	1820	112	16 dB cell control
GND	GND	1970	112	Ground (back side)

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

See Mechanical Information for more details.

**BONDING DIAGRAM AND ASSEMBLY INFORMATION**



**RF interface** : coplanar or microstrip, bonding  $\approx$  400/500  $\mu$ m.



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**PACKAGE**

Type	Description	Terminals	Pitch (mm)	Die size (mm)
UH	Bare Die	-	-	2.6 x 1.2 (Before dicing) Die Thickness : 100 $\mu$ m



**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
CGY2171XA	UH	C1	-	6-bit 1-15 GHz Attenuator


**Document History : Version 1.0, Last Update 11/4/2010**