

PRODUCT DATASHEET

CGY2176AUH/C1

6-bit 1GHz-8GHz Attenuator

DESCRIPTION

The CGY2176AUH/C1 is a high performance GaAs MMIC 6-bit Attenuator operating in L, S and C-band. It has an attenuation range of 31.5 dB with 0.5 dB steps, covers the frequency range from 1 to 8 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.

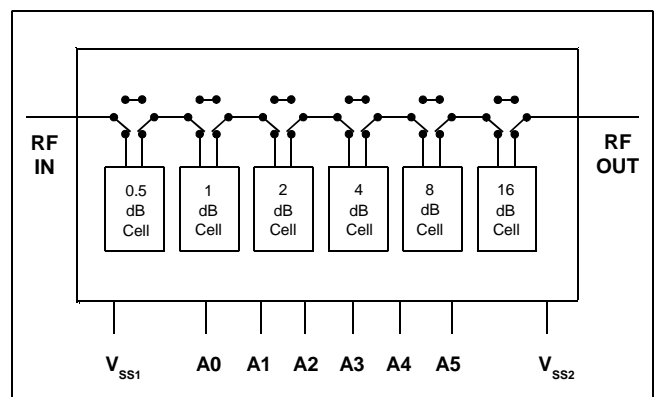
APPLICATIONS

- ▶ Radar
- ▶ Telecommunication
- ▶ Instrumentation



FEATURES

- ▶ Operating Range : 1 GHz to 8 GHz
- ▶ Insertion Loss : 5.6 dB @ 5.4 GHz
- ▶ Attenuation Range = 31.5 dB
- ▶ RMS Attenuation Error \approx 0.2 dB @ 5.4 GHz
- ▶ RMS Phase Variation \approx 1.3° @ 5.4 GHz
- ▶ S_{11} & S_{22} < -15 dB @ 5.4 GHz (All states)
- ▶ 0 / +5V Control Lines
- ▶ Chip size = 3800 x 2250 μm \pm 5 μm
- ▶ Tested, Inspected Known Good Die (KGD)
- ▶ Samples Available
- ▶ Demonstration Boards Available
- ▶ Space and MIL-STD Available



Block Diagram of the 6-Bit Attenuator

LIMITING VALUES

$T_{amb} = 25\text{ °C}$ unless otherwise noted

Symbol	Parameter	Conditions	MIN.	MAX.	UNIT
A_N	Attenuation Control Inputs		0	+6	V
V_{SS1}	Source supply voltage	V_{SS2} pad is open	-5	0.5	V
V_{SS2}	Source supply voltage	V_{SS1} pad is open	-6	0.5	V
P_{IN}	Input power	At RF_{IN}		30	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 ($T_a = 25\text{ °C}$)	TBD	°C/W

CHARACTERISTICS

$V_{SS2} = -4.5\text{ V}$; $I_{SS2} = 8\text{ mA}$; $T_{amb} = 25\text{ °C}$, measured on reference.

Symbol	Parameter	Conditions	MIN.	TYP.	MAX.	UNIT
<i>Supplies</i>						
V_{SS2}	Source supply voltage	V_{SS1} pad is open	-6	-4,5	-4	V
I_{SS2}	Source supply current			8		mA
V_{SS1}	Source supply voltage	V_{SS2} pad is open	-5	-3,5	-3	V
I_{SS1}	Source supply current			8		mA
BW	Bandwidth		1		8	GHz
<i>RF Performance for BW unless otherwise stated</i>						
IL	Insertion Loss at 5.4 GHz			5.6		dB
ATT_{range}	Attenuation range			31.5		dB
$ATT_{error(RMS)}$	RMS Attenuation Error at 5.4 GHz			0.2		dB
$PH_{error(RMS)}$	RMS Phase Error at 5.4 GHz			1.3		°
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 1 dB Compression Point			25		dBm

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

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

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

LOGIC TRUTH TABLE

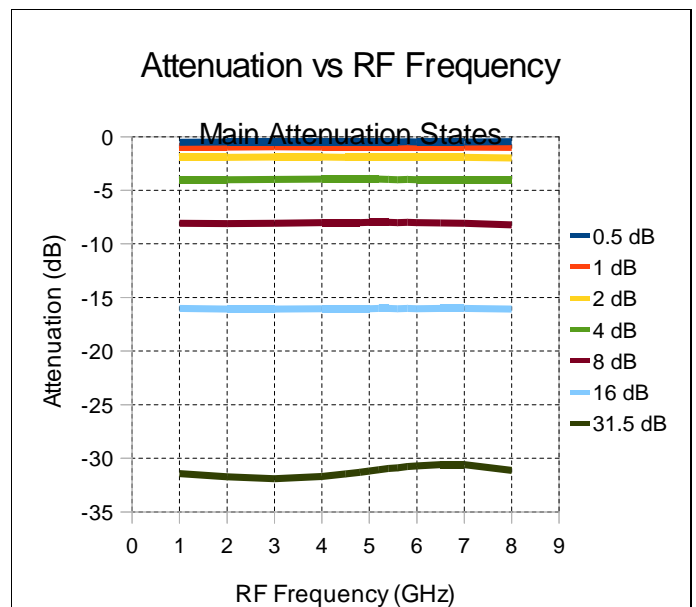
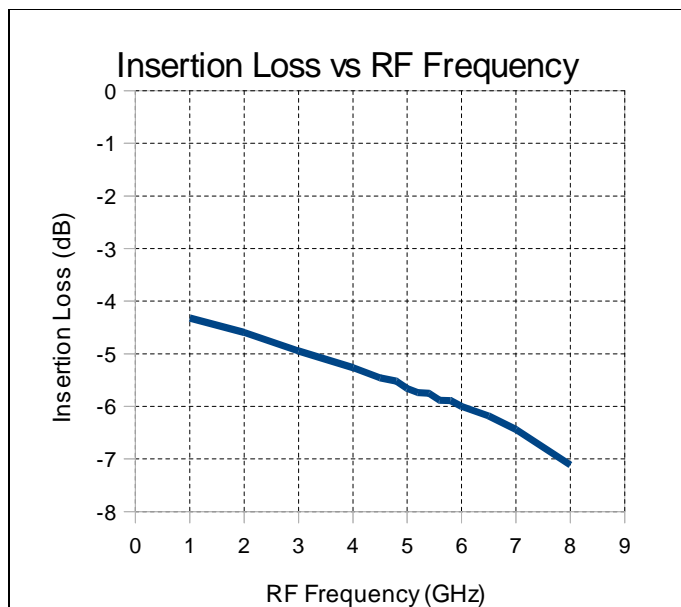
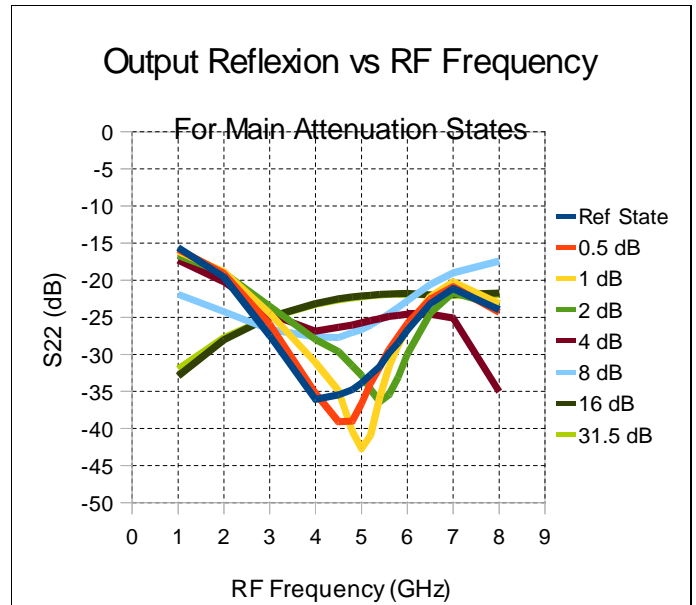
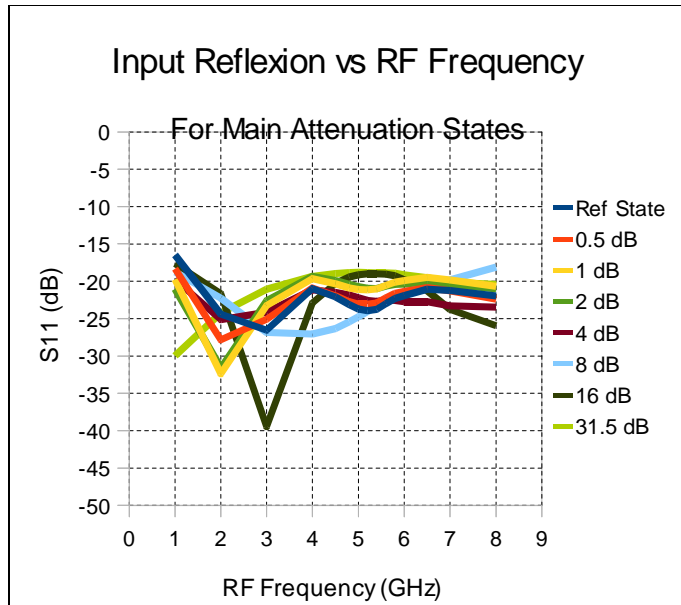
	Bit 0	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5
Nominal attenuation	0.5 dB	1 dB	2 dB	4 dB	8 dB	16 dB
Pad	A0	A1	A2	A3	A4	A5
Reference state	0 V	0 V	0 V	0 V	0 V	0 V
Attenuation active	+5 V	+5 V	+5 V	+5 V	+5 V	+5 V

	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Attenuation (dB)	16 dB	8 dB	4 dB	2 dB	1 dB	0.5 dB
0	0	0	0	0	0	0
0.5	0	0	0	0	0	1
1	0	0	0	0	1	0
2	0	0	0	1	0	0
4	0	0	1	0	0	0
5	0	0	1	0	1	0
8	0	1	0	0	0	0
10	0	1	0	1	0	0
15	0	1	1	1	1	1
16	1	0	0	0	0	0
20	1	0	1	0	0	0
25	1	1	0	0	1	0
30	1	1	1	1	0	0
31.5	1	1	1	1	1	1

CONTROL VOLTAGE

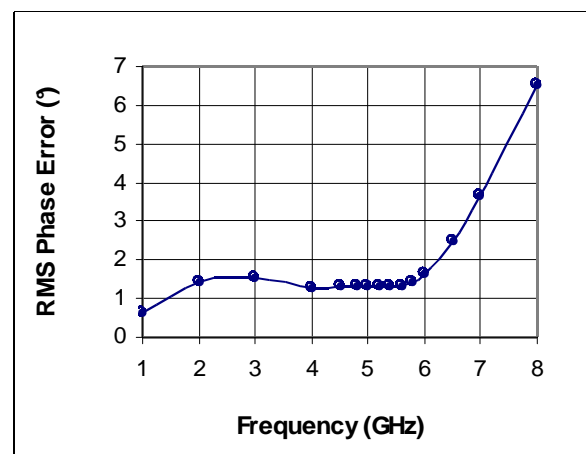
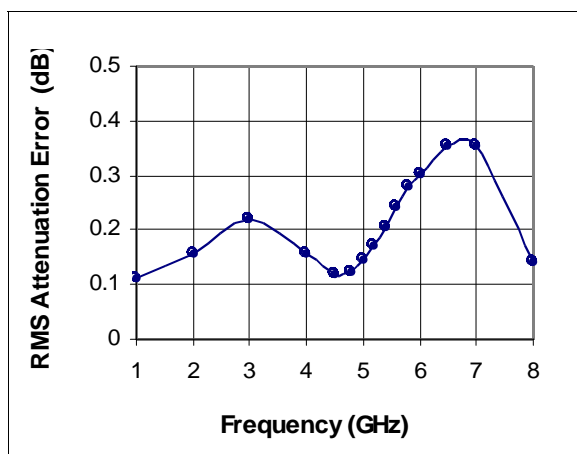
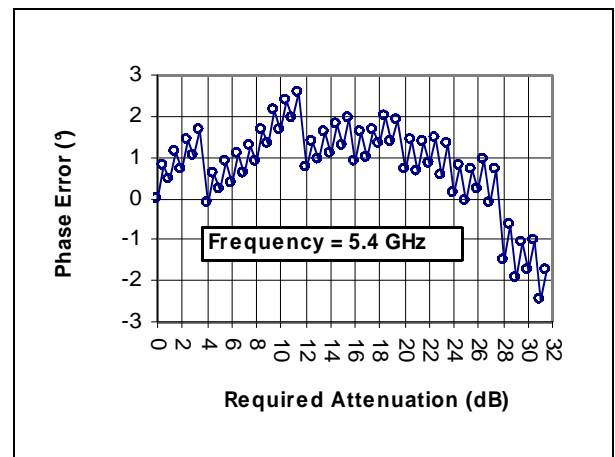
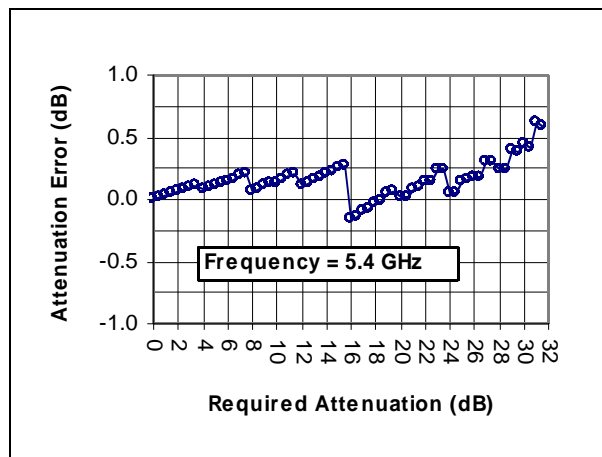
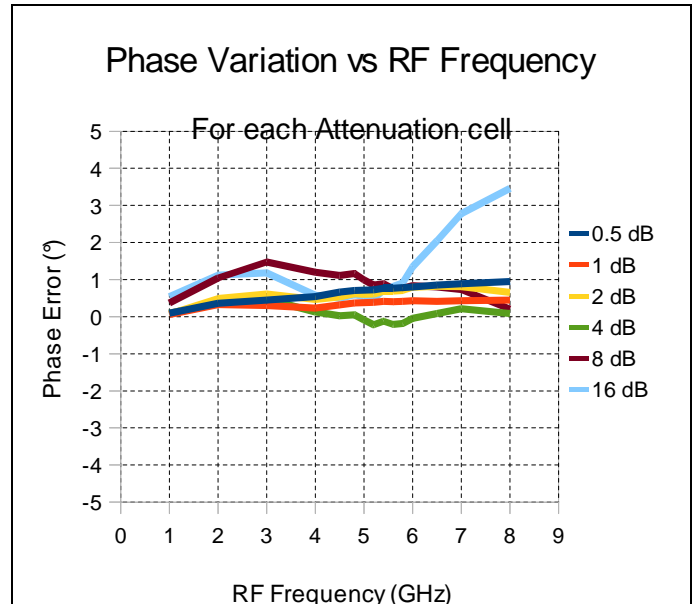
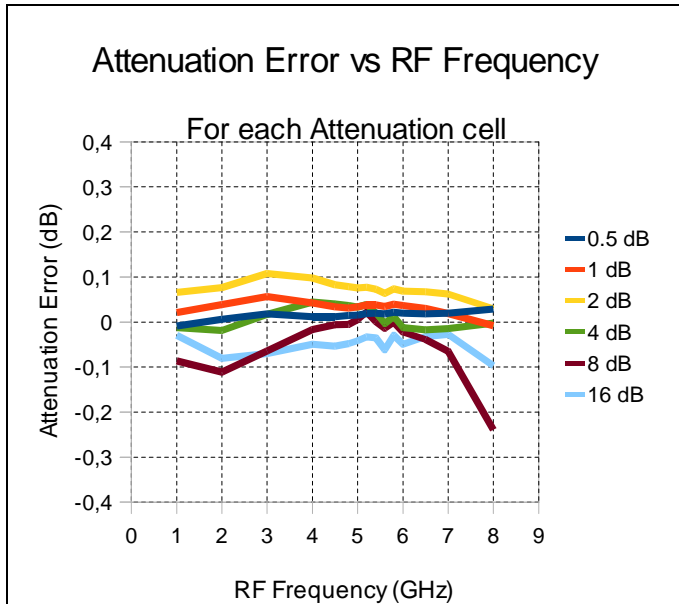
State	MIN.	MAX.	UNIT
Low (0)	0	1	V
High (1)	+4	+6	V

ON WAFER MEASUREMENTS – S PARAMETERS

 Supply voltages : $V_{SS2} = -4.5$ V, Input/Output Inductance : 0.5 nH


ON WAFER MEASUREMENTS – ATTENUATION & PHASE SHIFTING ERRORS

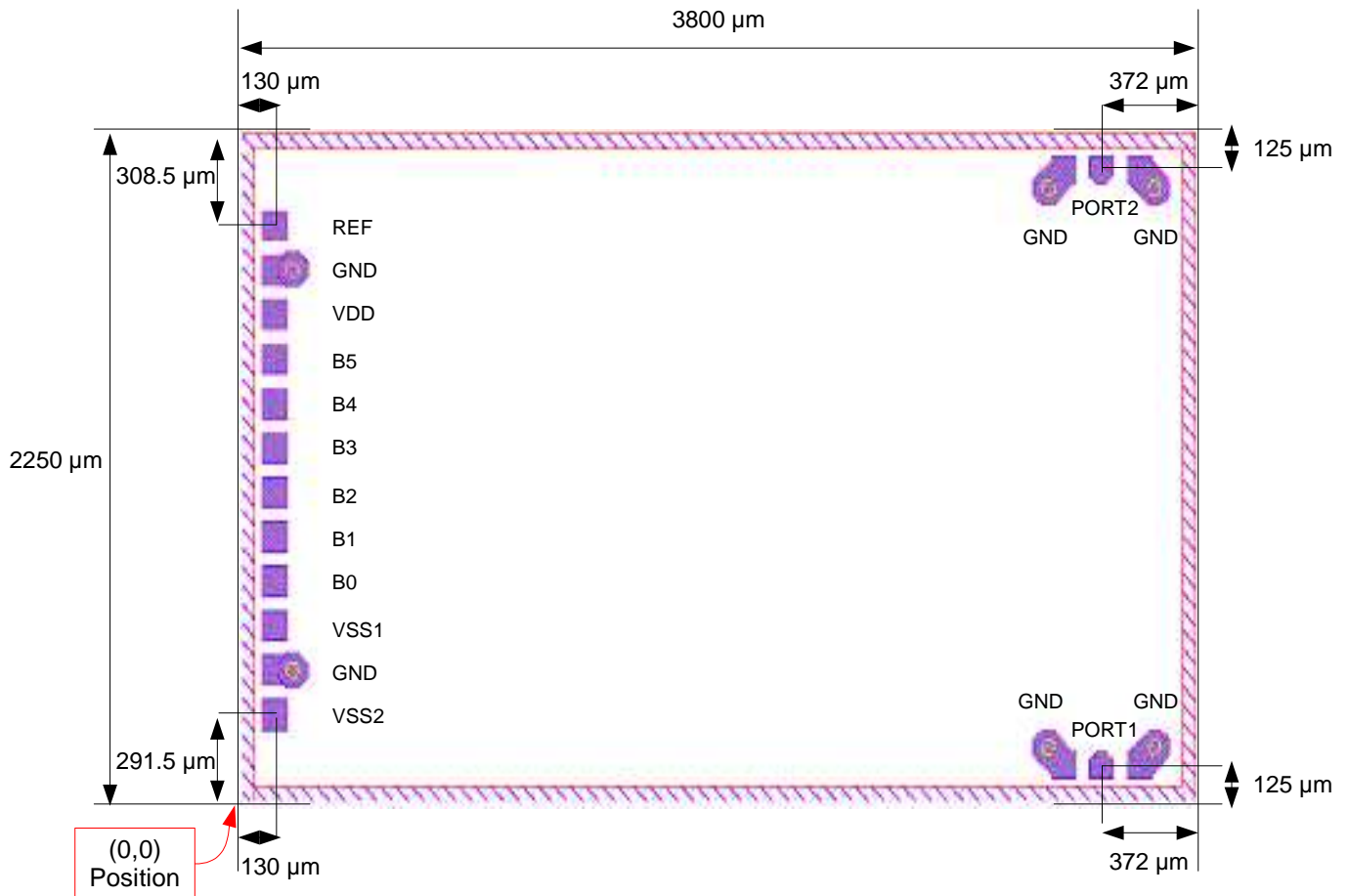
Measured on wafer @ T = 25 °C



MECHANICAL INFORMATION

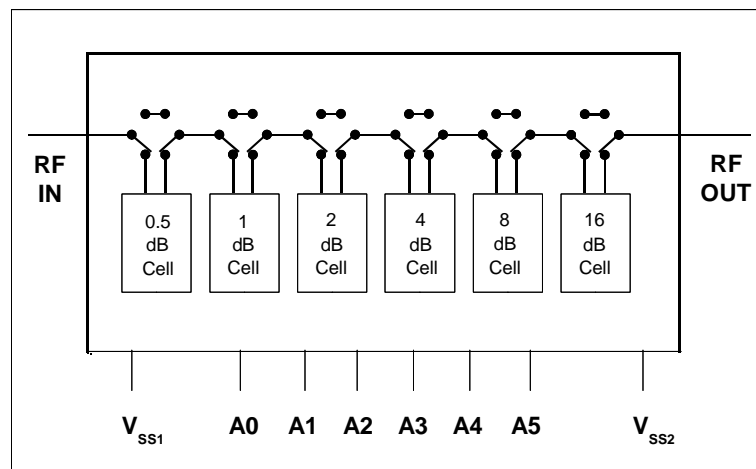
 Chip size = 3800 x 2250 μm ($\pm 5 \mu\text{m}$)

- DC Pads = 100 x 100 μm spacing = 150 μm , top metal = Au
- RF Pads = 100 x 100 μm spacing = 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 PIN CONFIGURATION



Block Diagram of the 6-Bit Attenuator

PAD POSITION

PAD NAME	SYMBOL	COORDINATES		DESCRIPTION
		X	Y	
PORT1	RF _{IN}	3428	125	RF Input
PORT2	RF _{OUT}	3428	2125	RF Output
VSS2	V _{SS2}	130	291.5	V _{SS2} supply voltage, V _{SS1} not connected
GND	GND	130	441.5	Ground (connected to MMIC back side metal)
VSS1	V _{SS1}	130	591.5	V _{SS1} supply voltage, V _{SS2} not connected
B0	A0	130	741.5	0.5 dB cell control
B1	A1	130	891.5	1 dB cell control
B2	A2	130	1041.5	2 dB cell control
B3	A3	130	1191.5	4 dB cell control
B4	A4	130	1341.5	8 dB cell control
B5	A5	130	1491.5	16 dB cell control
VDD	V _D	130	1641.5	Do not use
GND	GND	130	1791.5	Ground (connected to MMIC back side metal)
REF	V _{REF}	130	1941.5	-3V DC Voltage available at this pad : Do not connect

NOTE

1. Only V_{SS1} or V_{SS2} is to be connected. For example, if V_{SS2} is connected, V_{SS1} must be left open.
2. The power supply (VSS1 or VSS2) and 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
CGY2176A	UH	C1		6-bit 1GHz-8GHz Attenuator
CGY2176A	UH	C1	EK	Reference Board with RF Connectors


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