

# PRELIMINARY DATASHEET

## CGY2390SUH/C1

### 3-bit 6 – 18 GHz Attenuator

#### DESCRIPTION

The CGY2390SUH/C1 is a high performance GaAs MMIC 3-Bit Attenuator operating from 6 GHz up to 18 GHz.

The CGY2390SUH/C1 has an attenuation range of 35 dB with 5 dB steps. It is part of Ommic's new 6 - 18 GHz chipset that is dedicated to Radar, Telecommunication and Instrumentation applications.

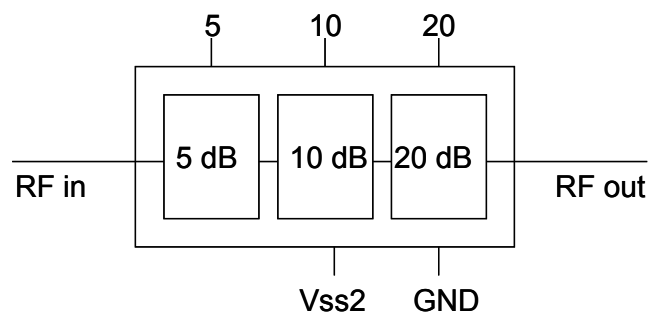
The die is manufactured using ED02AH OMMIC's 0.18  $\mu\text{m}$  gate length PHEMT process. The MMIC uses gold bonding pads, backside metallization and is fully protected with Silicon Nitride passivation to obtain the highest level of reliability. This technology has been evaluated for Space applications and is on the European Preferred Parts List of the European Space Agency.

#### APPLICATIONS

- ▶ Radar
- ▶ Telecommunication
- ▶ Instrumentation

#### FEATURES

- ▶ Operating Range : 6 GHz to 18 GHz
- ▶ Insertion Loss : 2.2 dB @ 12 GHz
- ▶ Attenuation Range = 35 dB
- ▶ RMS Attenuation Error  $\approx$  0.2 dB @ 12 GHz
- ▶  $S_{11}$  &  $S_{22} < -19$  dB
- ▶ 0 / +5V Control Lines
- ▶ Chip size = 1800 x 1200  $\mu\text{m}$
- ▶ Tested, Inspected Known Good Die (KGD)
- ▶ Samples Available
- ▶ Space and MIL-STD Available



CGY2390S 6 -18 GHz 3 bit Attenuator Block diagram



## LIMITING VALUES

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

Symbol	Parameter	Conditions	MIN.	MAX.	UNIT
05 / ,, / 16	Attenuation Control Inputs		0	+5,5	V
V <sub>SS</sub>	Source supply voltage	V <sub>SS2</sub> pad is open	-5	0.5	V
V <sub>SS2</sub>	Source supply voltage	V <sub>SS</sub> pad is open	-7	0.5	V
P <sub>IN</sub>	Input power	At RF <sub>IN</sub>		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

V<sub>SS2</sub> = -5 V; I<sub>SS2</sub> = 11 mA; T<sub>amb</sub> = 25 °C, measured on reference.

Symbol	Parameter	Conditions	MIN.	TYP.	MAX.	UNIT
<i>Supplies</i>						
V <sub>SS2</sub>	Source supply voltage	V <sub>SS</sub> pad is open	-7	-5	-4	V
I <sub>SS2</sub>	Source supply current			11		mA
V <sub>SS</sub>	Source supply voltage	V <sub>SS2</sub> pad is open	-5	-3,5	-3	V
I <sub>SS</sub>	Source supply current			11		mA
BW	Bandwidth		6		18	GHz
<i>RF Performance for BW unless otherwise stated</i>						
IL	Insertion Loss at 12 GHz			2,2		dB
ATT <sub>range</sub>	Attenuation range			35		dB
ATT <sub>error (RMS)</sub>	RMS Attenuation Error			0,2		dB
PH <sub>error (RMS)</sub>	RMS Phase Variation at 12 GHz			14		°
S <sub>11</sub>	Input Return Loss, All States	50 Ω source		-15		dB
S <sub>22</sub>	Output Return Loss, All States	50 Ω load		-16		dB
P <sub>1dB</sub>	Input Power at 1 dB Compression Point			25		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**

Nominal Attenuation	5 dB	10 dB	20 dB
Pad	5	10	20
Reference state	Low (0)	Low (0)	Low (0)
Attenuation active	High (1)	High (1)	High (1)

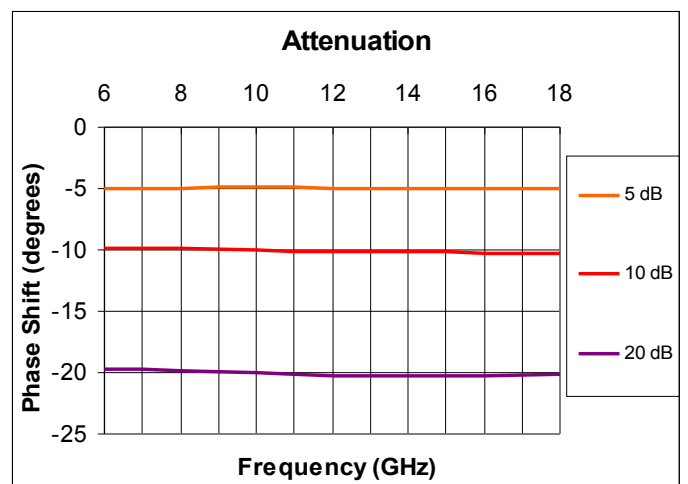
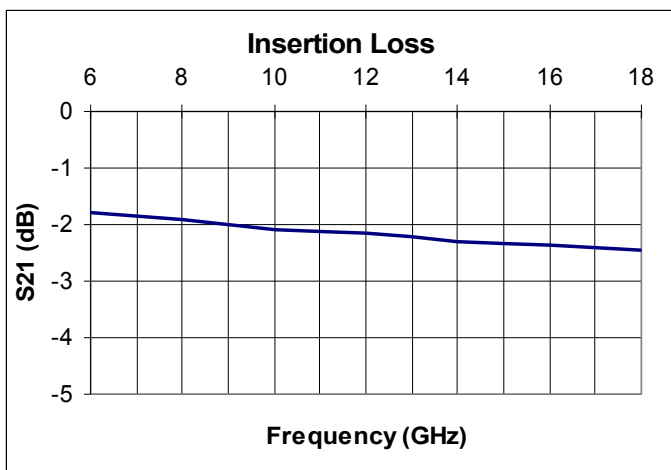
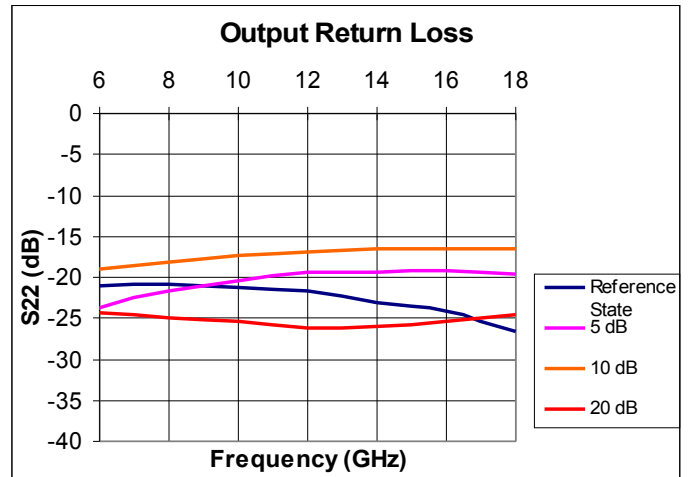
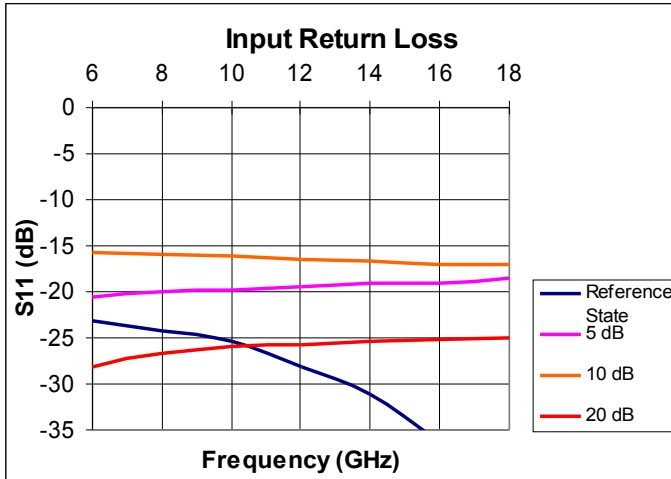
	5	10	20
Attenuation (dB)	5 dB	10 dB	20 dB
0	0	0	0
5	1	0	0
10	0	1	0
15	1	1	0
20	0	0	1
25	1	0	1
30	0	1	1
35	1	1	1

**CONTROL VOLTAGE**

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

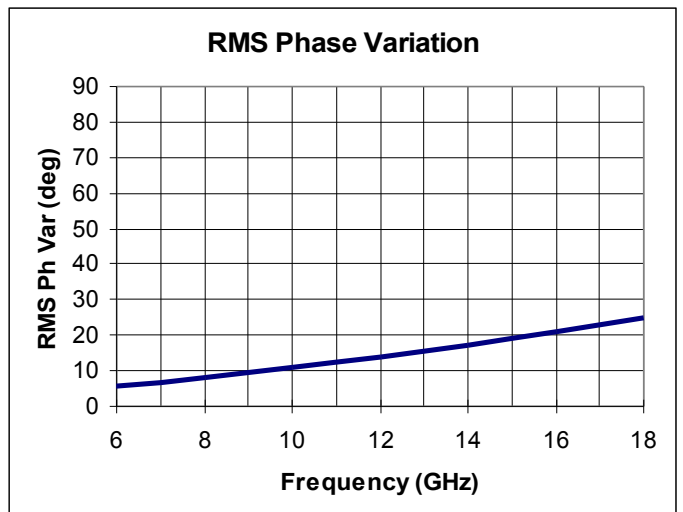
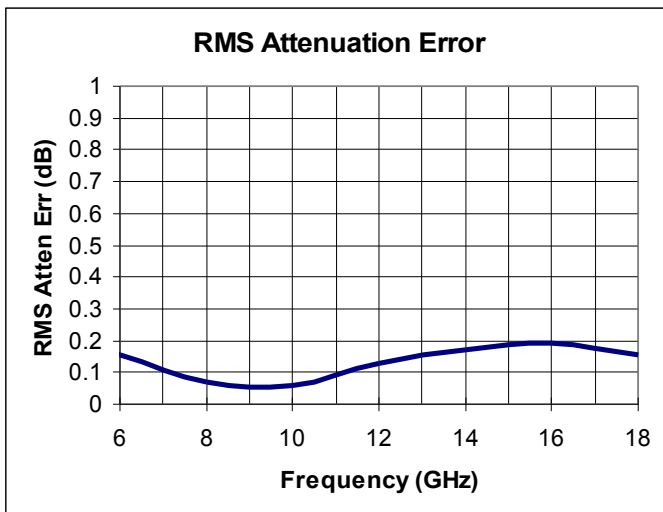
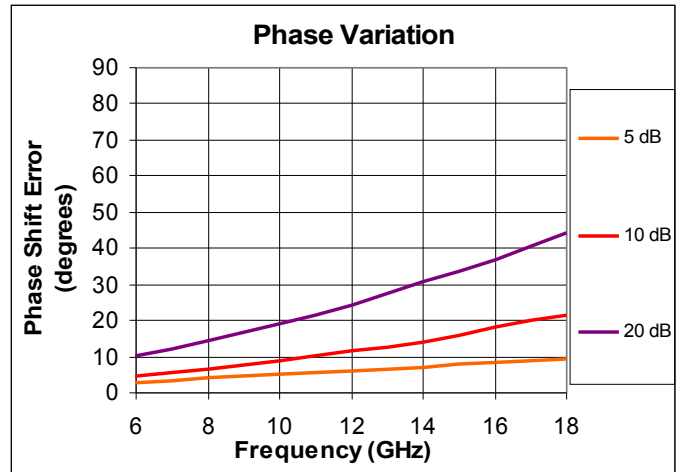
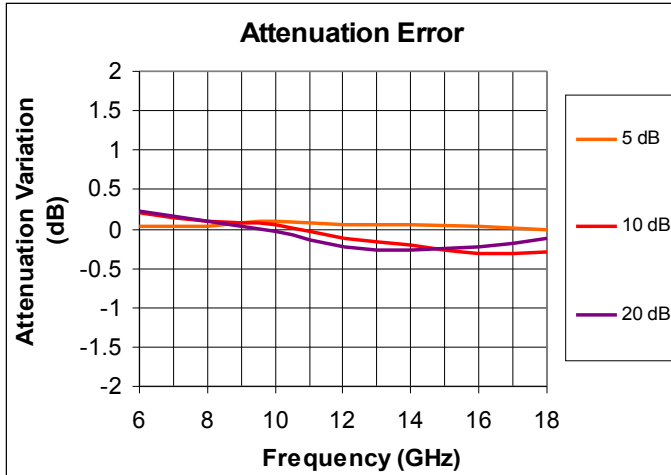
**ON WAFER MEASUREMENTS – S PARAMETERS**

Supply voltage :  $V_{SS2} = -5\text{ V}$



## ON WAFER MEASUREMENTS – ATTENUATION & PHASE SHIFTING ERRORS

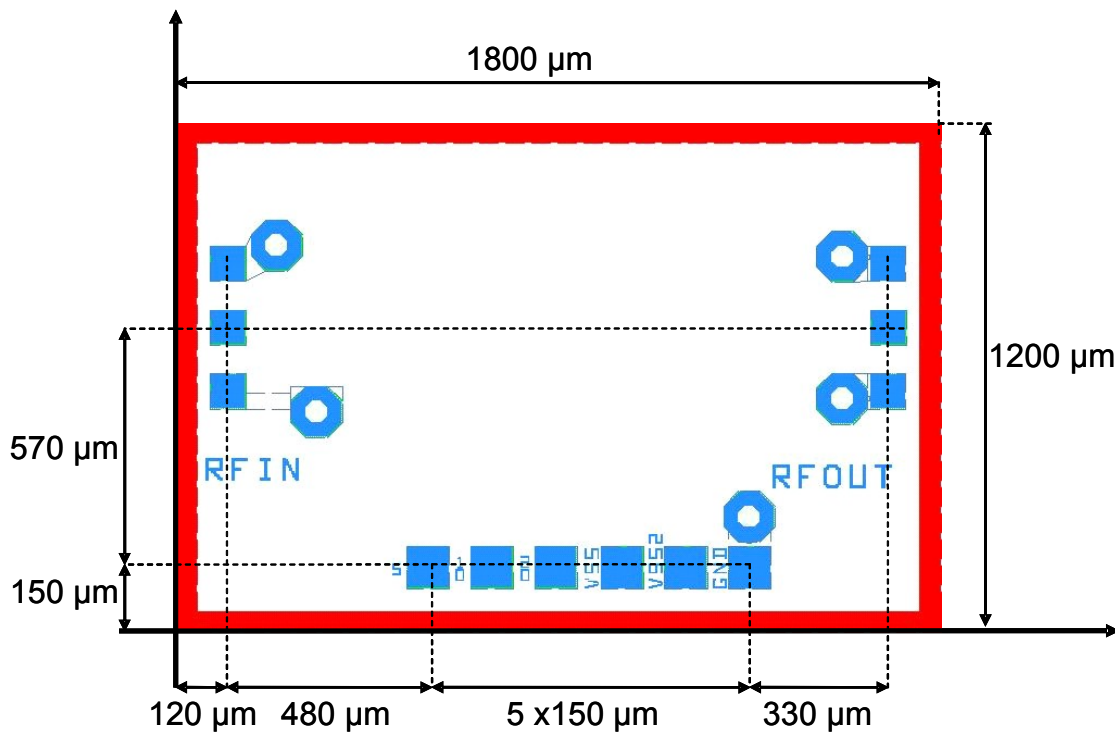
Measured on wafer @ T = 25 °C



**MECHANICAL INFORMATION**

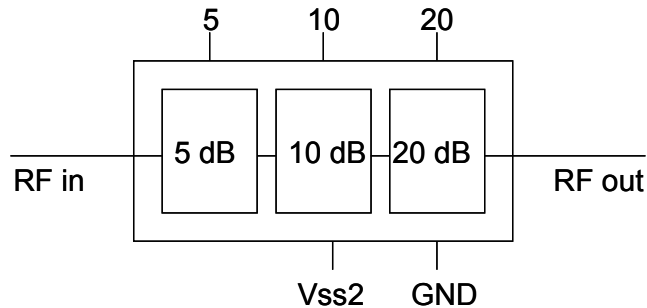
 Chip size = 1800 x 1200  $\mu\text{m}$ 

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

## BLOCK DIAGRAM AND PIN CONFIGURATION



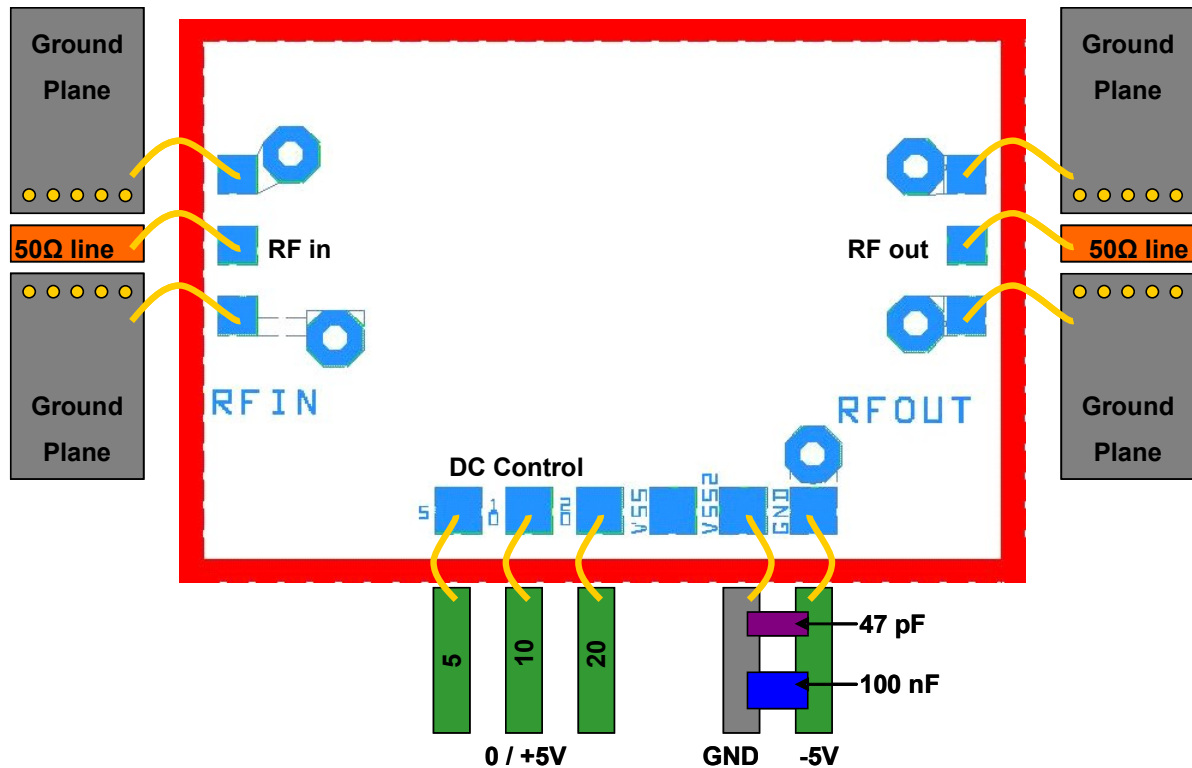
Block Diagram of the 3-bit 6 -18 GHz Attenuator

## PAD POSITION

PAD NAME	COORDINATES		DESCRIPTION
	X	Y	
GND	120	570	Ground (connected to MMIC back side metal)
RF <sub>IN</sub>	120	720	RF Input
GND	120	870	Ground (connected to MMIC back side metal)
GND	1680	570	Ground (connected to MMIC back side metal)
RF <sub>OUT</sub>	1680	720	RF Output
GND	1680	670	Ground (connected to MMIC back side metal)
5	600	150	5 dB cell control
10	750	150	10 dB cell control
20	900	150	20 dB cell control
VSS	1050	150	V <sub>SS</sub> supply voltage, V <sub>SS2</sub> not connected
VSS2	1200	150	V <sub>SS2</sub> supply voltage, V <sub>SS</sub> not connected
GND	1350	150	Ground (connected to MMIC back side metal)

## NOTE

1. Only V<sub>SS</sub> or V<sub>SS2</sub> is to be connected. For example, if V<sub>SS2</sub> is connected, V<sub>SS</sub> must be left open.

**BONDING DIAGRAM AND ASSEMBLY INFORMATION**


The RF interfacing bond wires or ribbon should be kept as short as possible.

The RF lines should be 300um wide or less to minimize discontinuities associated with the connection to the MMIC bond pads.

The power supply (VSS or VSS2) must be decoupled to the ground with capacitors as close as possible to the chip.

**Decoupling BOM:**

	VSS2 (or VSS)
Chip SMD capacitor 1	47pF or 100pF
Chip SMD capacitor 2	100nF



**NO DECOUPLING ON DIGITAL CONTROL PADS**



## 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.

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## ORDERING INFORMATION

Generic Type	Package type	Version	Sort Type	Description
CGY2390S	UH	C1		3-bit 6 – 18 GHz Attenuator



**Document History : Version 1.0, Last Update 13/06/2013**