

# PRODUCT DATASHEET

## CGY2105XHV

### Dual Ultra Low Noise High IP3 Amplifier

#### DESCRIPTION

The CGY2105XHV is an extremely Low Noise Figure Dual Amplifier with state of the art Noise Figure and Linearity suitable for applications from 500 MHz to 4 000 MHz.

The CGY2105XHV consists of two identical amplifiers on the same MMIC, and is ideal for use in a balanced configuration. Extremely low noise, high gain and high IP3 results have been achieved on several demonstrators. The minimum Noise Figure of the CGY2105XHV itself is **0.23 dB** at **1.9 GHz**.

The MMIC is manufactured using OMMIC's qualified 0.13  $\mu\text{m}$  PHEMT GaAs D01PH technology. The D01PH process is one of the European Space Agency (ESA) european preferred part list (EPPL) technologies. The device is available in a 4x4 mm QFN plastic package.

#### APPLICATIONS

- ▶ High performance LNA in the band 0.5 – 4 GHz
- ▶ Base Station applications (LTE, GSM, CDMA, WCDMA, TD-SCDMA, CDMA2000, WiMAX, etc)
- ▶ Tower mounted amplifiers
- ▶ Repeaters

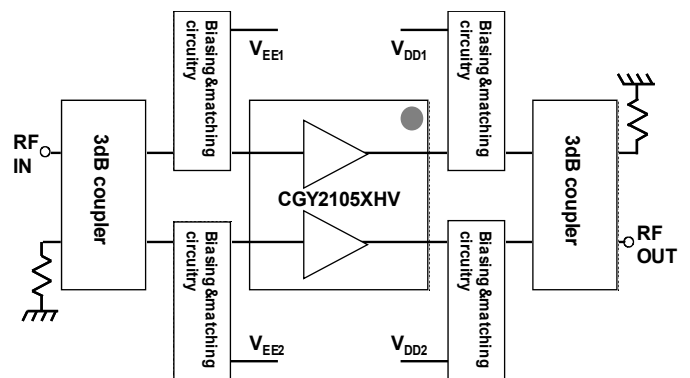
#### FEATURES

- ▶ Usable frequency range from 500 MHz to 4000 MHz

central frequency (GHz)	NF (dB)	Gain (dB)	OIP3 (dBm)	P1dB (dBm)
1,9	0,42	19	35	21
2,5	0,5	18,5	33	21

(\* ) measured figures including noise contribution of couplers, connectors and biasing circuitry

- ▶ Dual MMIC LNA with excellent tracking
- ▶ Uses a highly reliable PHEMT MMIC process
- ▶ Delivered as 100 % RF tested devices
- ▶ Samples and Demonstration Boards Available
- ▶ Space and MIL-STD Available



Schematic diagram of the CGY2105XHV used in a balanced configuration.

## LIMITING VALUES

$T_{amb} = + 23 \text{ }^{\circ}\text{C}$ , at QFN package lead; unless otherwise specified.

Symbol	Parameter	Conditions	MIN.	MAX.	UNIT
$V_{EE1}, V_{EE2}$	Gate voltage	$V_{DD}$ open-circuited	-3	0	V
$V_{DD1}, V_{DD2}$	Drain voltage	$V_{EE}$ open-circuited	0	+ 6	V
$I_{D1}, I_{D2}$	Drain current			200	mA
$P_{IN}$	Input power			10	dBm
$T_{amb}$	Ambient temperature		-40	+85	$^{\circ}\text{C}$
$T_j$	Junction temperature			+150	$^{\circ}\text{C}$
$T_{stg}$	Storage temperature		-55	+150	$^{\circ}\text{C}$

## THERMAL CHARACTERISTICS

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

## CHARACTERISTICS

$T_{amb} = + 23 \text{ }^{\circ}\text{C}$

Symbol	Parameter	Conditions	MIN.	TYP.	MAX.	UNIT
$f_i$	Input frequency		0.5		4	GHz
<i>Performance at QFN package lead; <math>f_i = 1.9 \text{ GHz}</math></i>						
$V_D$	Supply voltage			3		V
$I_D$	Supply current	$V_{EE} = - 0.45 \text{ V}$		50		mA
G	Gain			19.4		dB
$NF_{min}$	Minimum Noise Figure			0.23		dB
$ISO_{IN1-IN2}$	Isolation between IN1 and IN2	IN1/IN2		35		dB
<i>Performance * of Reference Board (Balanced configuration with on-board bias resistors); <math>f_i = 1.9 \text{ GHz}</math></i>						
$V_{DD1}, V_{DD2}$	Supply voltage			5		V
$I_{D1}, I_{D2}$	Supply current	$V_{EE1} = V_{EE2} = - 0.56 \text{ V}$		50		mA
G	Gain			19		dB
NF	Noise Figure			0.42		dB
$ISO_{rev}$	Reverse Isolation	OUT/IN		23		dB
OIP3	Output third order intercept point			35		dBm
$P_{1dB}$	Output Power @ 1dB gain compression			21		dBm
$S_{11}$	Input reflection coefficient	50 $\Omega$ source		- 22	-18	dB
$S_{22}$	Output reflection coefficient	50 $\Omega$ load		- 22		dB

(\*) Measurement reference planes are the INPUT and OUTPUT SMA connectors.



**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.

**S-PARAMETERS**
 $V_D = 3 \text{ V}; I_D = 50 \text{ mA}; T_{\text{amb}} = + 23 \text{ }^\circ\text{C}$ 

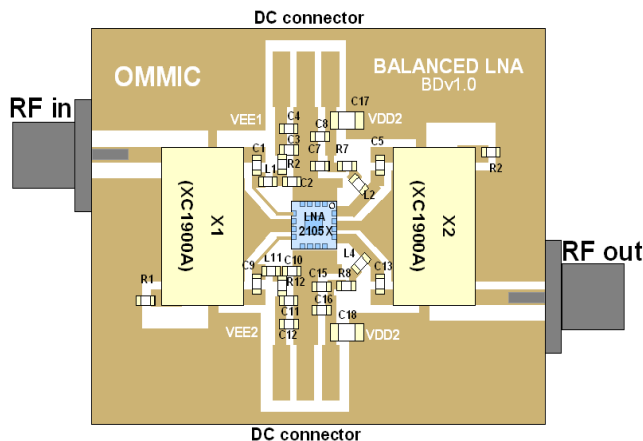
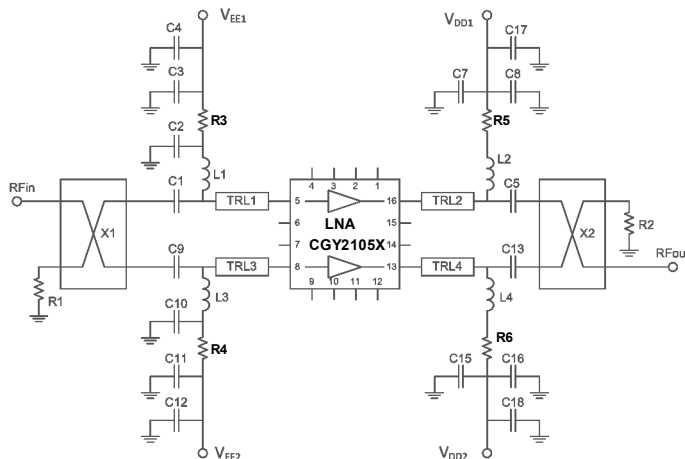
Frequency (GHz)	S11	Ang S11 (°)	S21	Ang S21 (°)	S12	Ang S12 (°)	S22	Ang S22 (°)
0.10	1.00	-6.09	10.39	175.75	0.00	84.64	0.11	-173.23
0.20	1.00	-12.18	10.37	171.51	0.01	82.55	0.12	-167.12
0.30	0.99	-18.27	10.33	167.27	0.01	79.73	0.12	-162.10
0.40	0.99	-24.36	10.28	163.05	0.02	76.75	0.13	-158.32
0.50	0.98	-30.46	10.21	158.83	0.02	73.70	0.15	-155.73
0.60	0.98	-36.56	10.13	154.63	0.02	70.63	0.16	-154.19
0.70	0.97	-42.66	10.04	150.45	0.03	67.56	0.17	-153.51
0.80	0.96	-48.76	9.93	146.30	0.03	64.49	0.19	-153.53
0.90	0.95	-54.86	9.81	142.16	0.03	61.44	0.20	-154.11
1.00	0.94	-60.96	9.68	138.06	0.04	58.40	0.22	-155.13
1.10	0.94	-67.05	9.53	134.00	0.04	55.39	0.23	-156.50
1.20	0.93	-73.13	9.38	129.97	0.04	52.41	0.25	-158.16
1.30	0.92	-79.19	9.21	125.98	0.05	49.47	0.26	-160.04
1.40	0.91	-85.23	9.04	122.03	0.05	46.56	0.28	-162.10
1.50	0.90	-91.25	8.86	118.13	0.05	43.69	0.29	-164.30
1.60	0.89	-97.23	8.68	114.29	0.05	40.86	0.30	-166.62
1.70	0.88	-103.17	8.48	110.49	0.06	38.08	0.32	-169.02
1.80	0.87	-109.06	8.29	106.75	0.06	35.35	0.33	-171.50
1.90	0.86	-114.89	8.09	103.07	0.06	32.66	0.34	-174.03
2.00	0.85	-120.65	7.89	99.45	0.06	30.03	0.35	-176.59
2.10	0.84	-126.33	7.68	95.89	0.07	27.45	0.36	-179.19
2.20	0.84	-131.94	7.48	92.39	0.07	24.93	0.38	178.20
2.30	0.83	-137.44	7.27	88.95	0.07	22.46	0.38	175.58
2.40	0.83	-142.85	7.07	85.58	0.07	20.05	0.39	172.96
2.50	0.82	-148.15	6.87	82.28	0.07	17.69	0.40	170.33
2.60	0.82	-153.33	6.67	79.04	0.07	15.39	0.41	167.72
2.70	0.81	-158.39	6.47	75.87	0.07	13.15	0.42	165.12
2.80	0.81	-163.32	6.28	72.76	0.07	10.96	0.43	162.53
2.90	0.81	-168.12	6.09	69.71	0.07	8.83	0.43	159.96
3.00	0.81	-172.79	5.90	66.73	0.08	6.75	0.44	157.40
3.20	0.81	178.28	5.54	60.95	0.08	2.75	0.45	152.36
3.40	0.81	169.89	5.20	55.40	0.08	-1.05	0.47	147.40
3.60	0.81	162.05	4.88	50.09	0.08	-4.66	0.48	142.53
3.80	0.82	154.72	4.57	44.99	0.08	-8.09	0.48	137.76
4.00	0.82	147.89	4.29	40.09	0.08	-11.36	0.49	133.07
4.50	0.84	132.79	3.66	28.64	0.08	-18.90	0.51	121.75
5.00	0.86	120.13	3.14	18.18	0.08	-25.68	0.53	110.92
5.50	0.87	109.44	2.71	8.54	0.08	-31.86	0.55	100.54
6.00	0.89	100.35	2.35	-0.42	0.07	-37.57	0.56	90.56

**Note : Measurement reference planes are the QFN Package Leads, a TRL calibration method is used.**

**NOISE-PARAMETERS**
 $V_D = 3 \text{ V}; I_D = 50 \text{ mA}; T_{\text{amb}} = + 23 \text{ }^\circ\text{C}.$ 

Frequency (GHz)	NF <sub>min</sub> (dB)	$ \Gamma_{\text{opt}} $	Ang $\Gamma_{\text{opt}}$ (°)	R <sub>n0</sub>
0.10	0.15	0.90	2.79	0.07
0.20	0.15	0.89	5.37	0.06
0.30	0.15	0.88	7.95	0.06
0.40	0.16	0.87	10.53	0.06
0.50	0.16	0.85	13.13	0.06
0.60	0.16	0.84	15.74	0.05
0.70	0.17	0.82	18.39	0.05
0.80	0.17	0.80	21.06	0.05
0.90	0.18	0.79	23.76	0.05
1.00	0.18	0.77	26.51	0.05
1.10	0.19	0.75	29.30	0.05
1.20	0.19	0.73	32.15	0.05
1.30	0.20	0.71	35.05	0.05
1.40	0.20	0.69	38.01	0.05
1.50	0.21	0.67	41.04	0.05
1.60	0.21	0.66	44.16	0.04
1.70	0.22	0.64	47.35	0.04
1.80	0.22	0.62	50.65	0.04
1.90	0.23	0.60	54.04	0.04
2.00	0.23	0.58	57.55	0.04
2.10	0.24	0.56	61.18	0.04
2.20	0.24	0.54	64.95	0.04
2.30	0.25	0.52	68.86	0.03
2.40	0.25	0.50	72.94	0.03
2.50	0.26	0.49	77.18	0.03
2.60	0.26	0.47	81.61	0.03
2.70	0.27	0.45	86.24	0.03
2.80	0.27	0.44	91.08	0.03
2.90	0.28	0.42	96.12	0.02
3.00	0.28	0.41	101.39	0.02
3.20	0.29	0.39	112.57	0.02
3.40	0.31	0.37	124.52	0.02
3.60	0.32	0.36	136.99	0.02
3.80	0.33	0.36	149.63	0.01
4.00	0.34	0.36	162.01	0.01
4.50	0.36	0.40	-170.23	0.01
5.00	0.39	0.47	-148.27	0.02
5.50	0.41	0.54	-131.20	0.03
6.00	0.44	0.60	-117.65	0.05

**Note :** The reference planes are the QFN Package Leads, R<sub>n0</sub> is the Noise Resistance normalised to 50 Ω.

**BALANCED REFERENCE BOARD 1900 MHz**
*Assembly Drawing.*

*Circuit Diagram (centre frequency 1900 MHz).*

*Bill of materials*

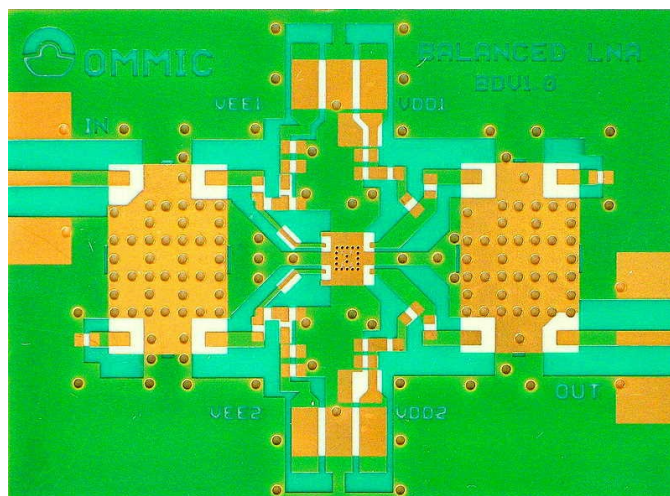
Component	Value	Reference
R1, R2	50 Ω	0603
R3, R4	470 Ω	0603
R5, R6	39 Ω	0603
L1, L3	30 nH	Coilcraft 0603CS
L2, L4	51 nH	Coilcraft 0603CS
C1, C9	33 pF	Dielectric labs C06UL
C2, C10	150 pF	0603 C0G
C3, C11, C7, C15	100 pF	0603 C0G
C4, C12, C8, C16	10 nF	0603 X7R
C5, C13	5 pF	0603 C0G
C17, C18	47 μF	1210 X5R
Couplers X1,X2		Anaren XC1900A-03

Component	Z0 (Ω)	Length in λ @ 1.9 GHz	Length (μm)	Width (μm)
TRL1, TRL3	94	0,05	5200	300
TRL2, TRL4	43	0.045	4300	1400

**Notes:**

Capacitors C17 and C18 prevent low frequency oscillations when the board is biased from laboratory power supplies. They are not required when on-board voltage regulators are used.

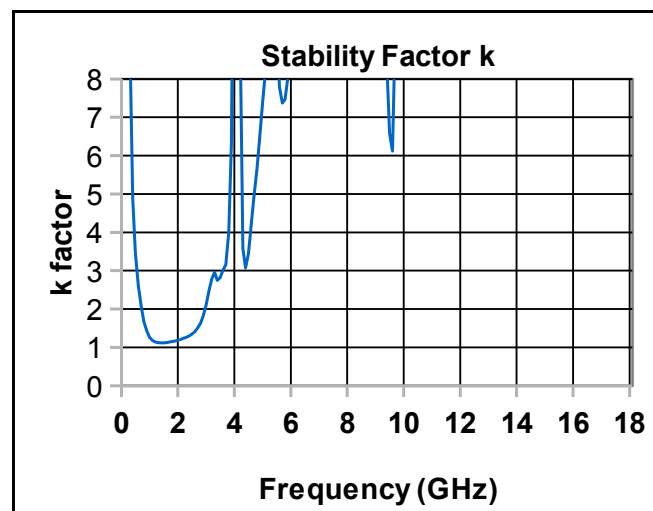
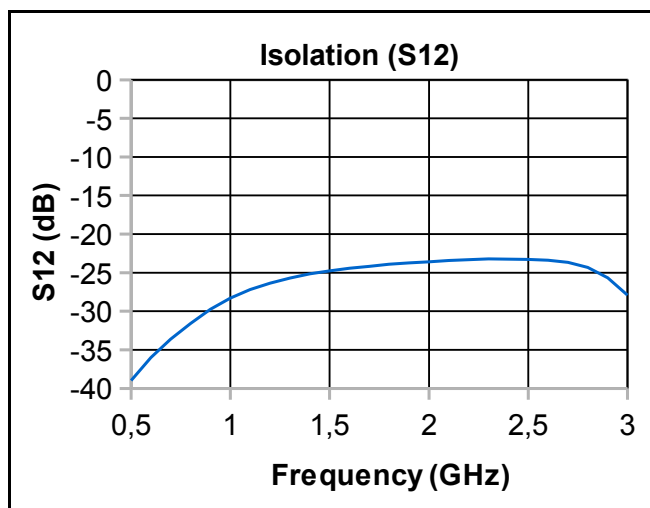
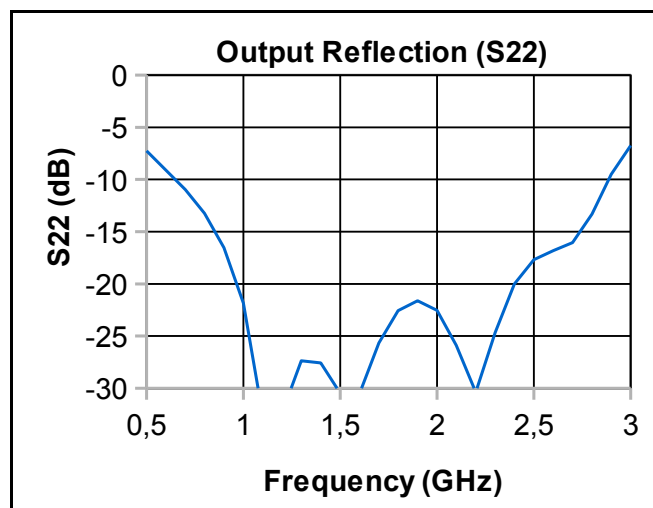
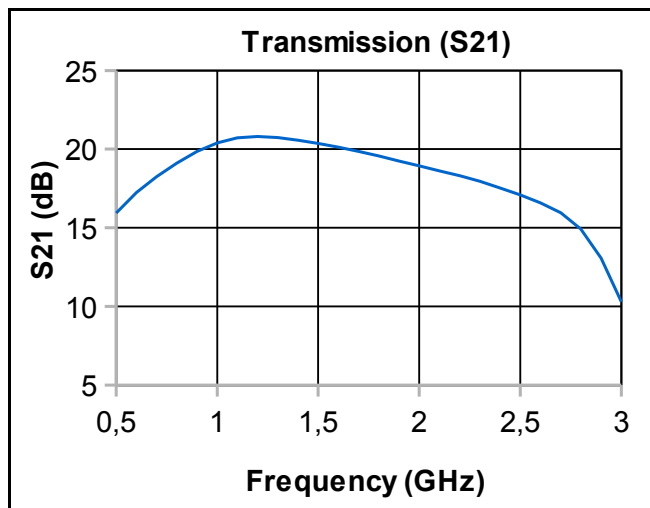
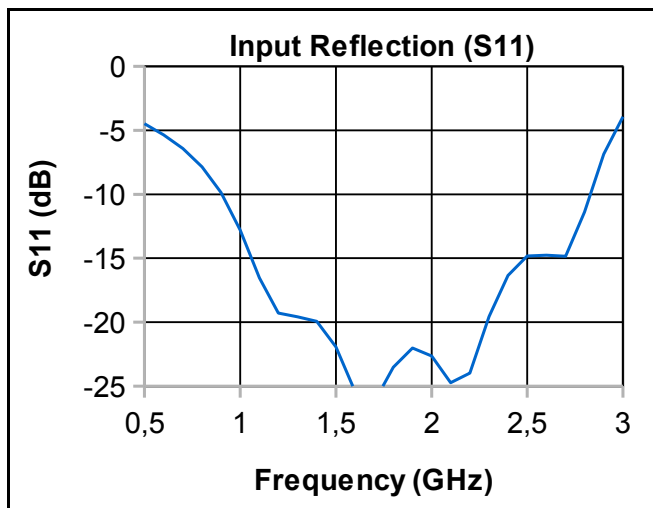
Board material is Rogers RO4350, height 508 μm.

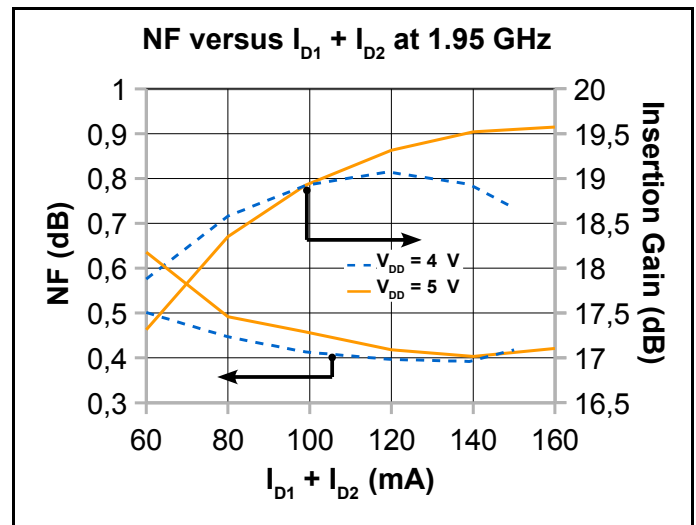
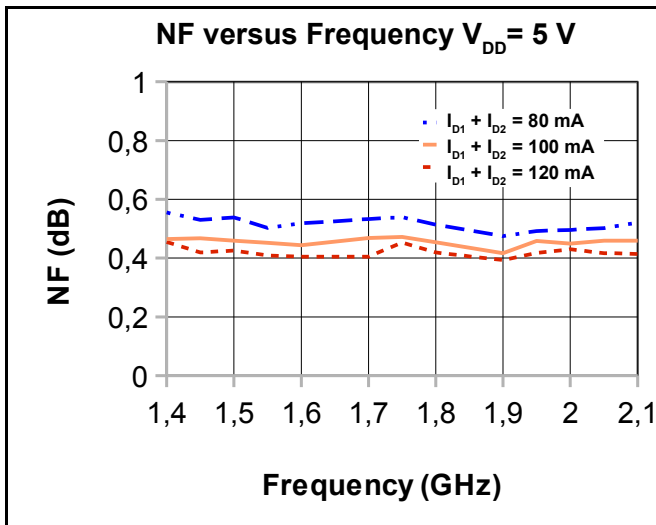
*Reference Circuit Board (BDv10)*


**MEASURED PERFORMANCE OF BALANCED REFERENCE BOARD 1900 MHz**

 Conditions :  $V_{DD1} = V_{DD2} = 5\text{ V}$ ,  $I_{D1} + I_{D2} = 100\text{ mA}$ ;  $T_{amb} = + 23^{\circ}\text{C}$ , unless otherwise stated.

Measurements include RF connector contributions.



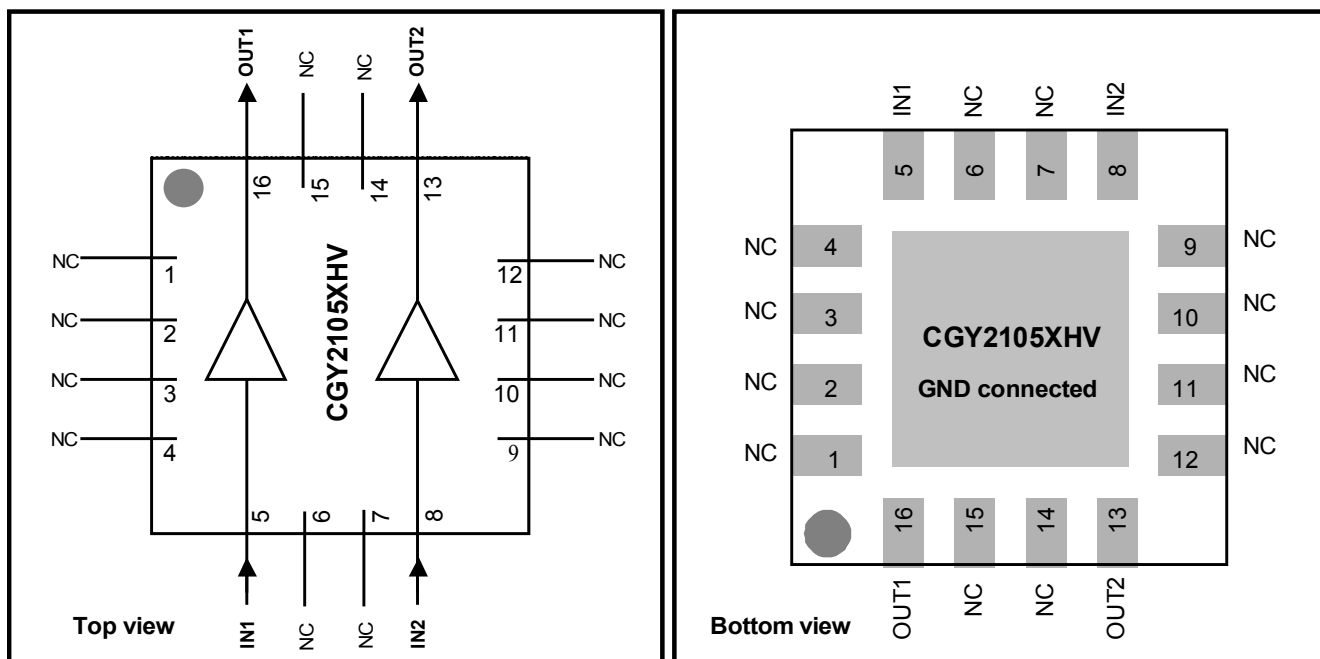


V <sub>DD</sub> (V)	I <sub>D1</sub> + I <sub>D2</sub> (mA)	V <sub>EE</sub> (V)	Gain (dB)	IIP3 (dBm)	OIP3 (dBm)	P <sub>1dB</sub> (dBm)	NF (dB)
4	54	-0.63	18	16	34	19	0.46
4	74	-0.56	19	13	32	20	0.41
4	93	-0.50	19	12	31	19	0.39
4	111	-0.45	19	11	30	18	0.37
4	131	-0.40	19	9	28	17	0.37
4	141	-0.37	19	7	26	16	0.38
5	55	-0.71	17	13	30	22	0.61
5	74	-0.62	18	16	34	22	0.48
<b>5</b>	<b>102</b>	<b>-0.53</b>	<b>19</b>	<b>15</b>	<b>35</b>	<b>21</b>	<b>0.42</b>
5	112	-0.50	20	14	33	21	0.39
5	131	-0.45	20	13	32	21	0.37
5	150	-0.40	20	11	31	20	0,37

Summary of the performance of the CGY2105XHV Balanced Reference Board at 1900 MHz

**Note :**

These results have been obtained on a Balanced Reference Board optimised at 1900 MHz. The frequency range of the Balanced Configuration is mainly determined by the couplers used - the CGY2105XHV can be used up to 4 GHz, in balanced applications, with excellent results. For more details on the reference board used, please refer to CGY2105XHV application notes.

**BLOCK DIAGRAM AND PIN CONFIGURATION**

**PINNING**

Symbol	Pin	Description
GND	GND	Amplifier 1 : Source
IN1	5	Amplifier 1 : Gate (RF input)
IN2	8	Amplifier 2 : Gate (RF input)
OUT1	16	Amplifier 1 : Drain (RF output)
OUT2	13	Amplifier 2 : Drain (RF output)
NC	1, 2, 2, 4, 6, 7, 9, 10, 11, 12, 14, 15	Not Connected

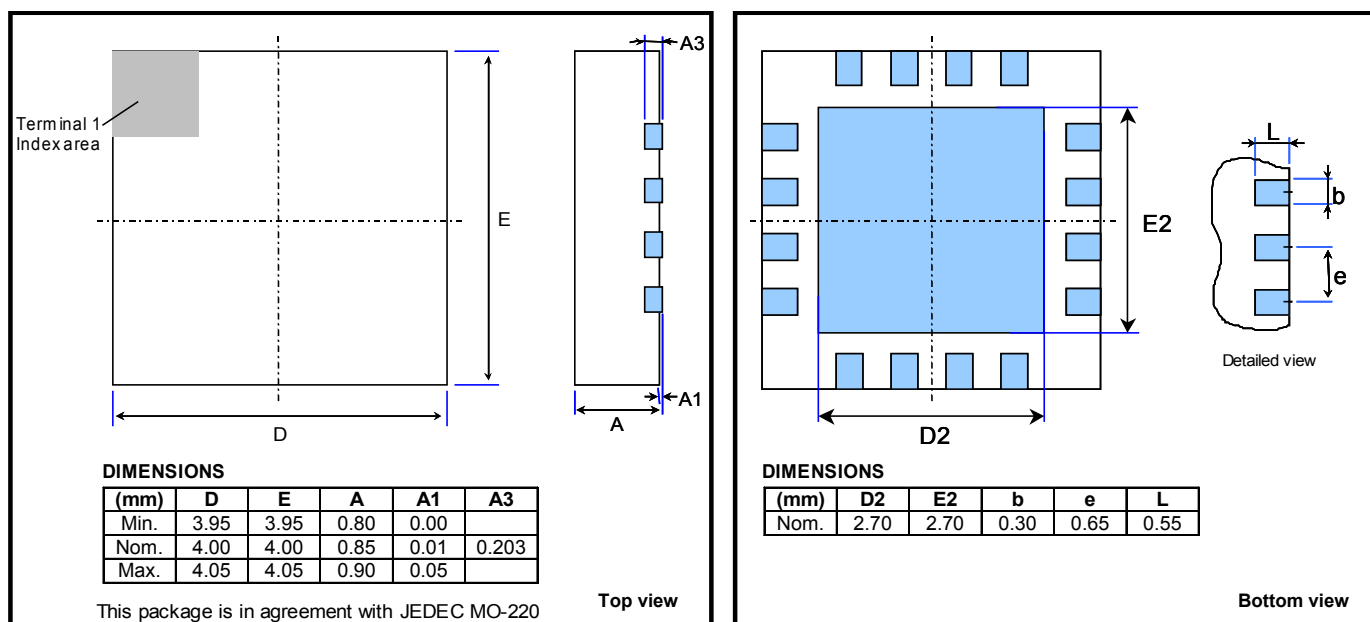
**Note :**

It is essential in order to ensure good performance and stability that the central ground pad of the QFN package is suitably connected to the ground.



**PACKAGE**

Type	Description	Terminals	Pitch (mm)	Package size (mm)
QFN	Quad Flat No lead with exposed heat sink	16	0.65	4 x 4 x 0.9

**PACKAGE OUTLINE AND PCB LAND PATTERN**


## 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
CGY2105X	HV	C1		DUAL LNA, QFN Plastic Package
CGY2105X	HV	C1	REFBOARD1G9	Balanced Reference Board 1900MHz
CGY2105X	HV	C1	REFBOARD2G5	Balanced Reference Board 2500MHz



**Document History : Version 1.3, Last Update 01/02/2012**