PRODUCT DATASHEET

CGY2106XHV

Dual Ultra Low Noise High IP3 Amplifier

DESCRIPTION

The CGY2106XHV is an extremely Low Noise Figure Dual Amplifier with state of the art Noise Figure and Linearity suitable for applications from 100 MHz to 3 000 MHz.

The CGY2106XHV consists of two identical amplifiers on the same MMIC, and is ideal for use in balanced configuration. Extremely low noise, high gain and high IP3 results have been achieved on several demonstrators. The minimum Noise Figure of the CGY2106XHV itself is **0.12 dB** at **900 MHz**.

The MMIC is manufactured using OMMIC's qualified 0.13 µm 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 0.1 – 3 GHz
- Base Station applications (LTE, GSM, CDMA, WCDMA, TDS-CDMA, CDMA 2000, WiMAX, etc)
- Tower mounted amplifiers
- Repeaters

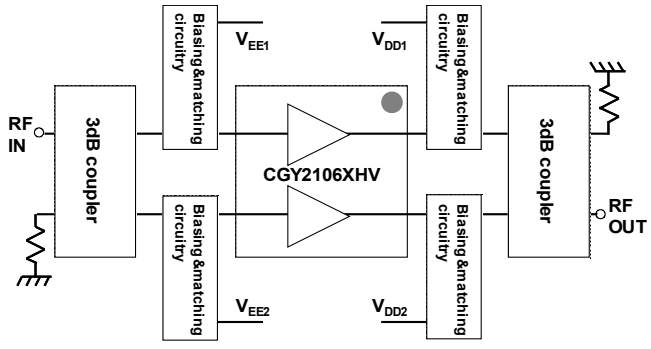
FEATURES

- Usable frequency range from 100 MHz to 3000 MHz

central frequency (GHz)	NF (dB)	Gain (dB)	OIP3 (dBm)	P1dB (dBm)
0.9	0.45	19	35	19

(*) *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 CGY2106XHV used in a balanced configuration

RoHS Compliant

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LIMITING VALUES

T_{amb} = + 23 °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	° 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 °C)	TBD	° C/W

CHARACTERISTICS

T_{amb} = + 23 °C

Symbol	Parameter	Conditions	MIN.	TYP.	MAX.	UNIT
f_i	Input frequency		0.1		3	GHz
Performance at QFN package lead; f_i = 0.9 GHz						
V_D	Supply voltage			2.5		V
I_D	Supply current	V_{EE} = - 0.7 V		50		mA
G	Gain			18.4		dB
NF_{min}	Minimum Noise Figure			0.12		dB
$ISO_{IN1-IN2}$	Isolation between IN1 and IN2	IN1/IN2		35		dB
*Performance * of Reference Board (Balanced configuration with on-board bias resistors);* f_i = 0.9 GHz						
V_{DD1}, V_{DD2}	Supply voltage			2.5		V
I_{D1}, I_{D2}	Supply current	V_{EE1} = V_{EE2} = - 0.64 V		50		mA
G	Gain			18.6		dB
NF	Noise Figure			0.45 (*)		dB
ISO_{rev}	Reverse Isolation	OUT/IN		24		dB
OIP3	Output third order intercept point			35		dBm
P_{1dB}	Output Power @ 1dB gain compression			19		dBm
S_{11}	Input reflection coefficient	50 Ω source		- 27		dB
S_{22}	Output reflection coefficient	50 Ω load		- 27		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 = 2.5 V; I_D = 50 mA T_{amb} = + 23 °C

Frequency (GHz)	|S11|	Ang S11 (°)	|S21|	Ang S21 (°)	|S12|	Ang S12 (°)	|S22|	Ang S22 (°)
0.1	1.00	-7.14	10.05	174.96	0.00	84.53	0.24	-179.51
0.2	0.99	-14.25	10.00	169.94	0.01	82.50	0.24	-179.12
0.3	0.99	-21.34	9.92	164.95	0.01	79.73	0.25	-178.93
0.4	0.98	-28.37	9.82	160.01	0.02	76.82	0.26	-179.00
0.5	0.98	-35.33	9.69	155.13	0.02	73.88	0.26	-179.37
0.6	0.97	-42.21	9.53	150.32	0.03	70.96	0.27	179.95
0.7	0.96	-49.00	9.36	145.60	0.03	68.08	0.28	178.96
0.8	0.95	-55.68	9.16	140.97	0.03	65.26	0.30	177.70
0.9	0.94	-62.26	8.96	136.44	0.04	62.52	0.31	176.20
1	0.93	-68.71	8.74	132.01	0.04	59.84	0.32	174.48
1.1	0.92	-75.03	8.51	127.69	0.04	57.25	0.33	172.59
1.2	0.91	-81.23	8.28	123.47	0.05	54.73	0.34	170.56
1.3	0.90	-87.30	8.04	119.36	0.05	52.29	0.36	168.43
1.4	0.89	-93.23	7.80	115.37	0.05	49.92	0.37	166.21
1.5	0.88	-99.02	7.56	111.47	0.05	47.63	0.38	163.93
1.6	0.87	-104.68	7.32	107.68	0.06	45.41	0.39	161.61
1.7	0.86	-110.20	7.09	103.99	0.06	43.26	0.40	159.26
1.8	0.86	-115.58	6.86	100.40	0.06	41.17	0.42	156.91
1.9	0.85	-120.83	6.63	96.91	0.06	39.14	0.43	154.56
2	0.84	-125.94	6.41	93.50	0.07	37.17	0.44	152.21
2.1	0.84	-130.92	6.19	90.18	0.07	35.26	0.45	149.88
2.2	0.83	-135.77	5.98	86.95	0.07	33.40	0.46	147.58
2.3	0.83	-140.48	5.78	83.80	0.07	31.59	0.47	145.30
2.4	0.83	-145.07	5.58	80.73	0.07	29.82	0.48	143.05
2.5	0.82	-149.53	5.39	77.73	0.07	28.10	0.49	140.84
2.6	0.82	-153.86	5.20	74.80	0.08	26.41	0.50	138.66
2.7	0.82	-158.08	5.02	71.95	0.08	24.77	0.51	136.52
2.8	0.82	-162.17	4.85	69.16	0.08	23.16	0.52	134.41
2.9	0.82	-166.15	4.68	66.43	0.08	21.59	0.53	132.35
3	0.82	-170.01	4.52	63.76	0.08	20.05	0.54	130.32
3.2	0.82	-177.41	4.21	58.61	0.08	17.05	0.56	126.38
3.4	0.82	175.61	3.93	53.68	0.08	14.18	0.58	122.60
3.6	0.82	169.03	3.67	48.95	0.08	11.40	0.59	118.97
3.8	0.82	162.82	3.42	44.42	0.09	8.73	0.61	115.48
4	0.83	156.97	3.20	40.06	0.09	6.14	0.63	112.14
4.5	0.84	143.72	2.71	29.91	0.09	0.06	0.67	104.38
5	0.85	132.21	2.30	20.70	0.09	-5.54	0.70	97.38
5.5	0.87	122.15	1.97	12.31	0.09	-10.70	0.73	91.08
6	0.88	113.32	1.69	4.65	0.09	-15.45	0.76	85.38

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

NOISE-PARAMETERS

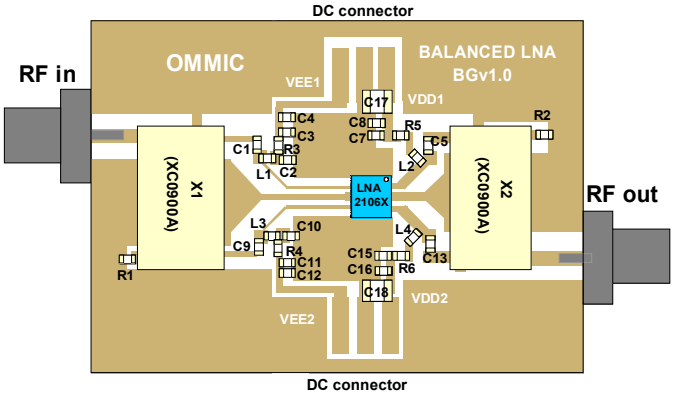
V_D = 2.5 V; I_D = 50 mA T_{amb} = + 23 °C.

Frequency (GHz)	NF_{min} (dB)	$\|\Gamma_{opt}\|$	Ang Γ_{opt} (°)	R_{n0}
0.1	0.07	0.97	2.93	0.06
0.2	0.07	0.94	5.63	0.06
0.3	0.08	0.92	8.32	0.05
0.4	0.09	0.89	11.02	0.05
0.5	0.09	0.86	13.73	0.05
0.6	0.10	0.84	16.46	0.05
0.7	0.11	0.81	19.21	0.05
0.8	0.11	0.79	21.98	0.05
0.9	0.12	0.77	24.79	0.05
1	0.12	0.74	27.64	0.05
1.1	0.13	0.72	30.52	0.05
1.2	0.14	0.70	33.46	0.05
1.3	0.14	0.68	36.44	0.04
1.4	0.15	0.65	39.49	0.04
1.5	0.16	0.63	42.59	0.04
1.6	0.16	0.61	45.77	0.04
1.7	0.17	0.59	49.03	0.04
1.8	0.17	0.57	52.37	0.04
1.9	0.18	0.55	55.81	0.04
2	0.19	0.53	59.34	0.04
2.1	0.19	0.51	62.99	0.04
2.2	0.20	0.50	66.76	0.03
2.3	0.20	0.48	70.65	0.03
2.4	0.21	0.46	74.67	0.03
2.5	0.22	0.45	78.84	0.03
2.6	0.22	0.43	83.16	0.03
2.7	0.23	0.42	87.64	0.03
2.8	0.24	0.40	92.27	0.03
2.9	0.24	0.39	97.06	0.03
3	0.25	0.38	102.00	0.02
3.2	0.26	0.36	112.31	0.02
3.4	0.27	0.35	123.06	0.02
3.6	0.28	0.34	134.06	0.02
3.8	0.29	0.34	145.03	0.02
4	0.31	0.35	155.71	0.02
4.5	0.34	0.38	179.88	0.01
5	0.36	0.43	-160.38	0.02
5.5	0.39	0.49	-144.52	0.02
6	0.42	0.54	-131.60	0.03

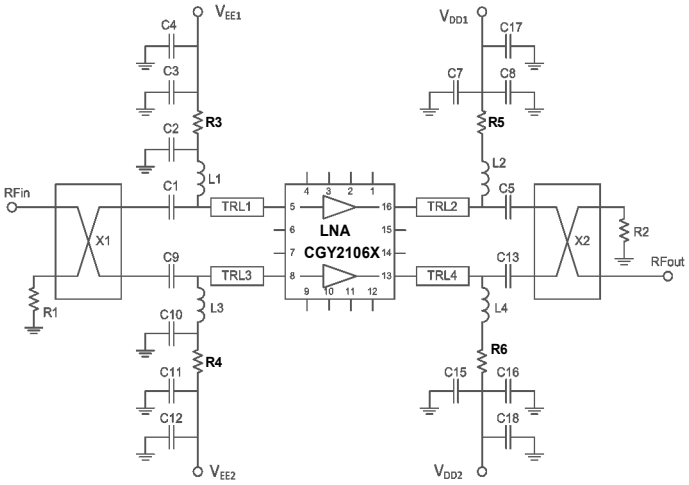
Note : The reference planes are the QFN Package Leads, R_{n0} is the Noise Resistance normalised to 50 Ω.

BALANCED REFERENCE BOARD 900MHz

Assembly Drawing



Circuit Diagram (centre frequency 900 MHz)



Bill of materials

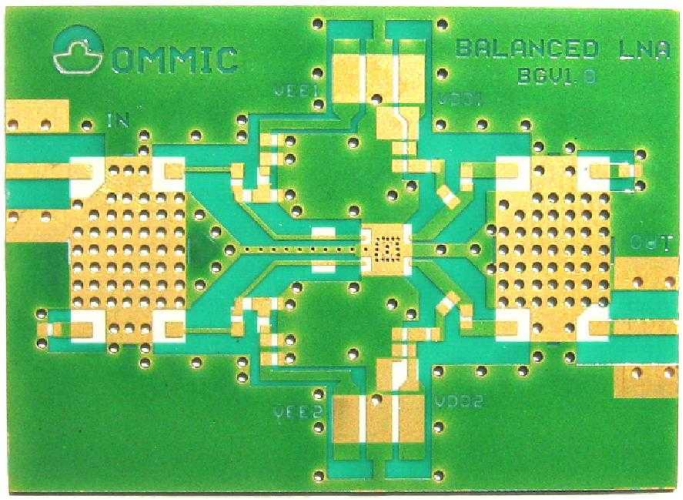
Component	Value	Reference
R1, R2	50 Ω	0603
R3, R4	470 Ω	0603
R5, R6	0 Ω	0603
L1, L3	30 nH	Coilcraft 0603CS
L2, L4	51 nH	Coilcraft 0603CS
C1, C9	47 pF	Dielectric labs C06UL
C2, C10	220 pF	0603 C0G
C3, C11, C7, C15	100 pF	0603 C0G
C4, C12, C8, C16	10 nF	0603 X7R
C5, C13	3 pF	0603 C0G
C17, C18	47 µF	1210 X5R
Couplers X1,X2		Anaren XC0900A-03

Component	Z0 (Ω)	Length in λ @0.9 GHz	Length (µm)	Width (µm)
TRL1, TRL3	94	0.05	10 000	300
TRL2, TRL4	50	0.021	4000	1100

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.

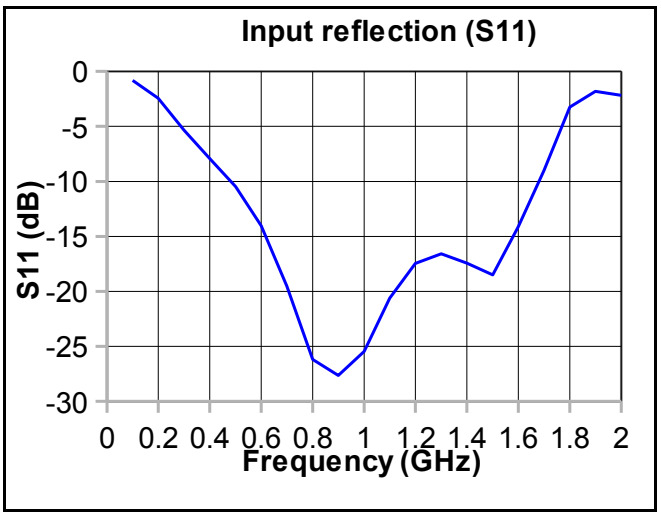
Reference Circuit Board (BGv10)

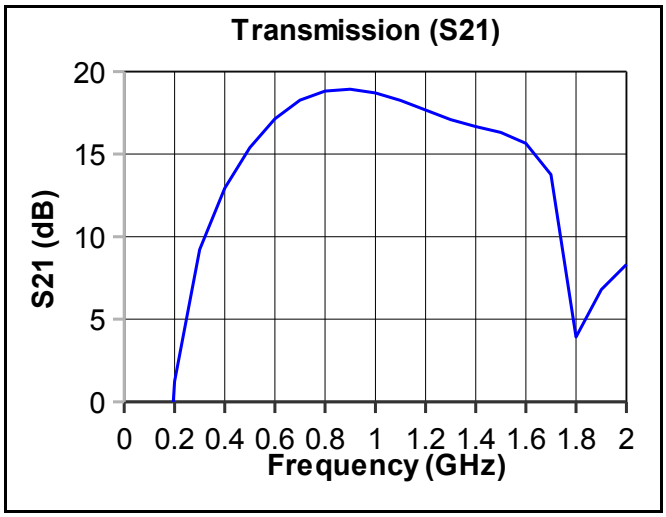


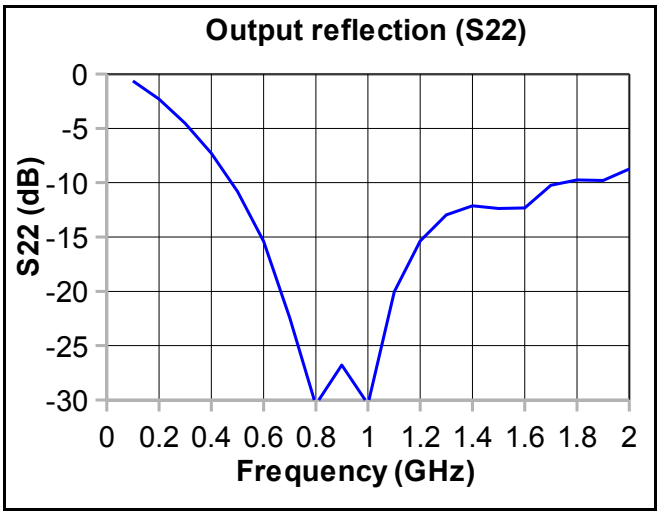
MEASURED PERFORMANCE OF BALANCED REFERENCE BOARD 900 MHZ

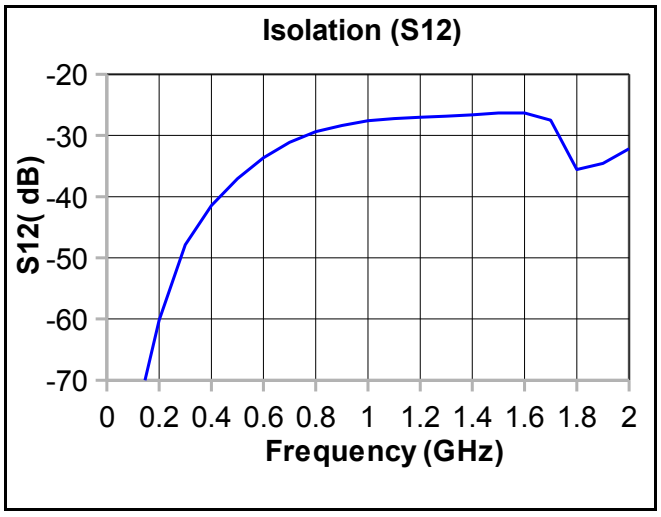
Conditions : $V_{DD1} = V_{DD2} = 2.5$ V, $I_{D1} + I_{D2} = 100$ mA; $T_{amb} = +23°C$, unless otherwise stated.

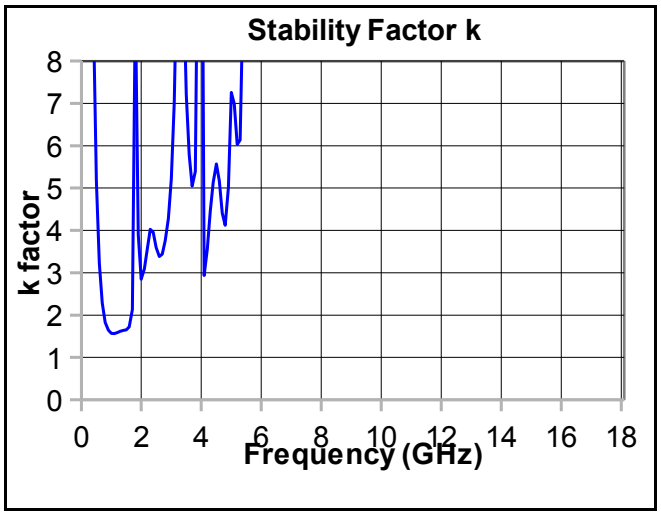
Measurements include RF connector contributions.

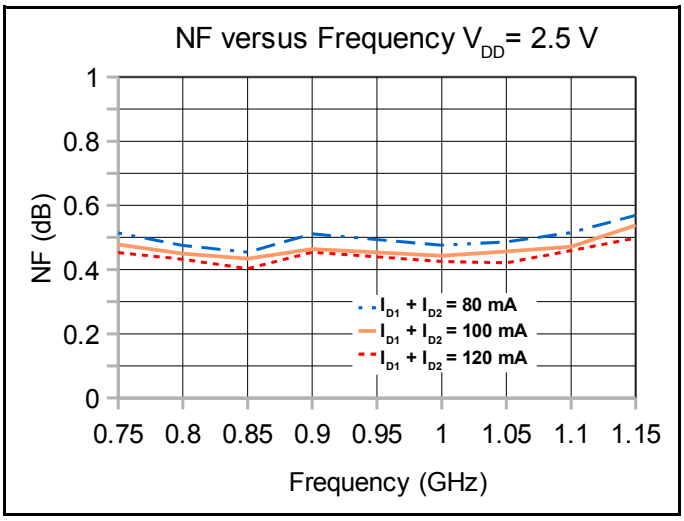


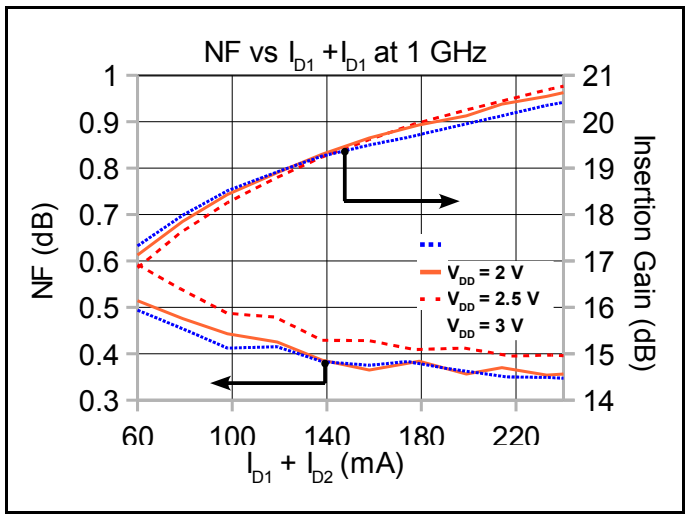












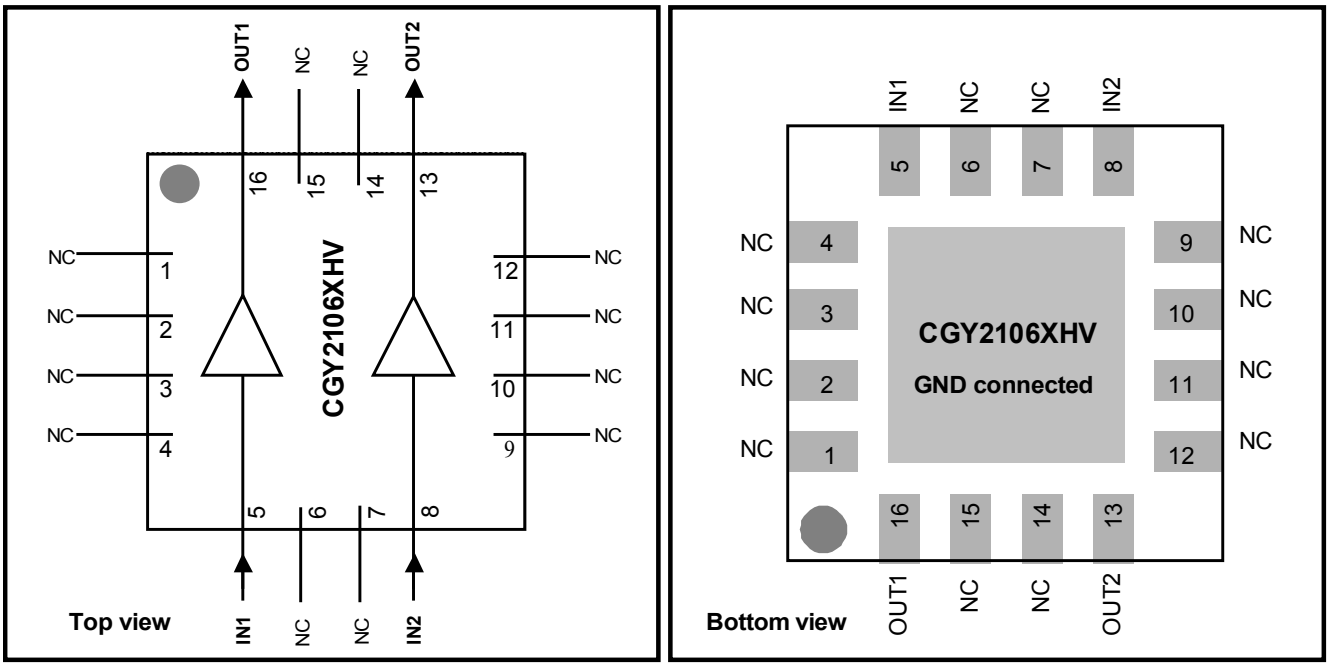
V_{DD} (V)	I_{D1} + I_{D2} (mA)	V_{EE} (V)	Gain (dB)	IIP3 (dBm)	OIP3 (dBm)	P_{1dB} (dBm)	NF (dB)
2	56	-0.93	18	17	34	16	0.50
2	74	-0.89	18	14	32	16	0.45
2	92	-0.85	19	12	31	18	0.41
2	110	-0.81	19	11	30	17	0.42
2	128	-0.78	20	10	30	16	0.38
2	146	-0.75	20	9	29	17	0.38
2.5	56	-0.99	17	13	31	18	0.52
2.5	75	-0.94	18	15	33	19	0.48
2.5	**93**	**-0.90**	**19**	**16**	**35**	**19**	**0.44**
2.5	111	-0.86	19	15	35	19	0.43
2.5	129	-0.82	20	14	34	19	0.39
2.5	147	-0.79	20	13	33	19	0.37

Summary Performance of the LNA CGY2106XHV Balanced Reference Board at 1 GHz

Note :

These results have been obtained on a Balanced Reference Board optimised at 900 MHz. The frequency range of the Balanced Configuration is mainly determined by the couplers used - the CGY2106XHV can be used up to 3 GHz, in balanced applications, with excellent results. For more details on the reference board used, please refer to CGY2106XHV application notes.

BLOCK DIAGRAM AND PIN CONFIGURATION



PINNING

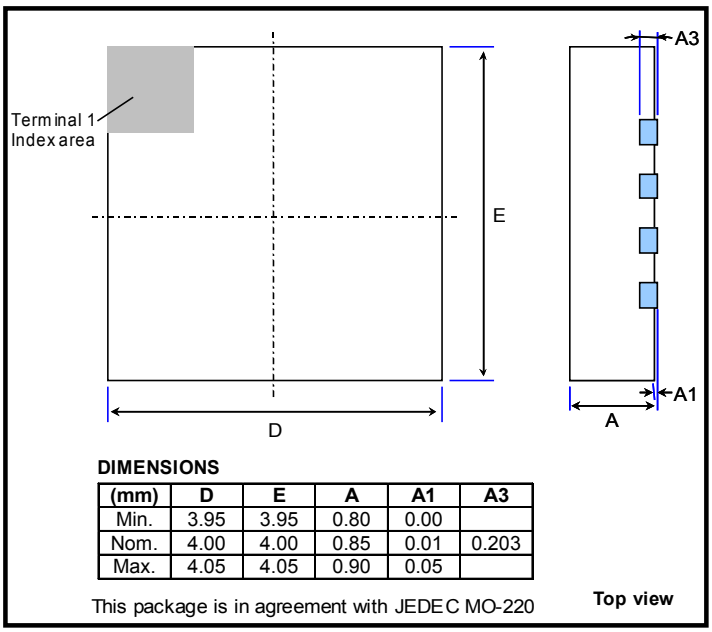
Symbol	Pin	Description
GND	GND	Amplifier 1 : Source
IN1	5	Amplifier 1 : Gate (RF input)
IN2	8	Amplifier 2 : Gate (RF input)
OUT1	16	Amplifier 1 : Drain (RF output)
OUT2	13	Amplifier 2 : Drain (RF output)
NC	1, 2, 2, 4, 6, 7, 9, 10, 11, 12, 14, 15	Not Connected

Note :
It is essential 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	4x4x0.9

PACKAGE OUTLINE AND PCB LAND PATTERN

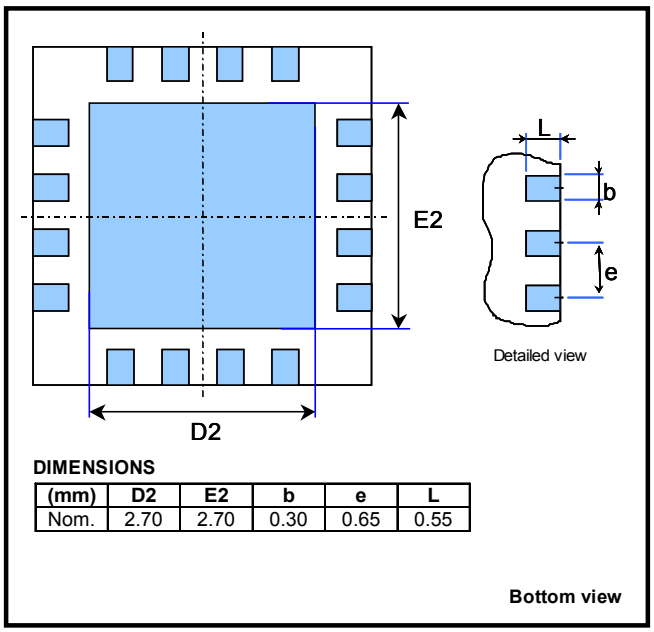


DIMENSIONS

(mm)	D	E	A	A1	A3
Min.	3.95	3.95	0.80	0.00	
Nom.	4.00	4.00	0.85	0.01	0.203
Max.	4.05	4.05	0.90	0.05	

This package is in agreement with JEDEC MO-220

Top view



DIMENSIONS

(mm)	D2	E2	b	e	L
Nom.	2.70	2.70	0.30	0.65	0.55

Bottom view

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
CGY2106X	HV	C1		DUAL LNA, QFN Plastic Package
CGY2106X	HV	C1	REFBOARD	Balanced Reference Board 900 MHz

RoHS Compliant

Document History : Version 1.2, Last Update 13/4/2010