

PRELIMINARY DATASHEET

CGY2151HV

Single Ended Ultra Low Noise High IP3 Amplifier

DESCRIPTION

The CGY2151HV is an extremely Low Noise Figure **Single Ended** Amplifier with state of the art Noise Figure and Linearity optimised for applications from 1 GHz to 2 GHz.

The minimum Noise Figure of the CGY2151HV itself is 0.23 dB at 1.9 GHz.

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 1 – 2 GHz
- ▶ Base Station applications (LTE, GSM, CDMA, WCDMA, TD-SCDMA, CDMA2000, WiMAX, etc)
- ▶ Tower mounted amplifiers
- ▶ Repeaters

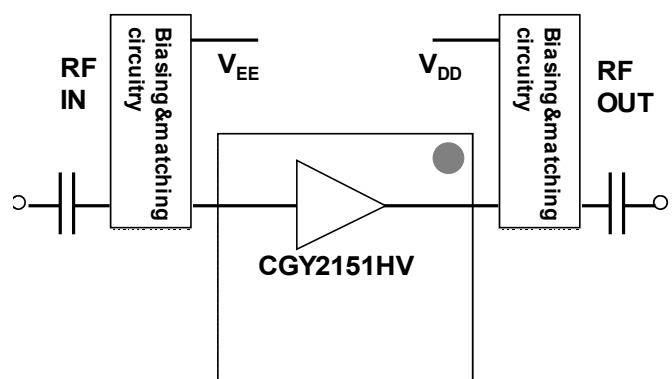
FEATURES

- ▶ Usable frequency range from 1 GHz to 2 GHz

central frequency (GHz)	NF (dB)	Gain (dB)	OIP3 (dBm)	Bias cond.
1.9	0.38	17	30	3V 50 mA
1.9	0.42	17	32	5V 50 mA

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

- ▶ Uses a highly reliable PHEMT MMIC process
- ▶ Samples and Demonstration Boards Available
- ▶ Space and MIL-STD Available



Schematic diagram of the CGY2151HV in a Single Ended configuration.

LIMITING VALUES

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

Symbol	Parameter	Conditions	MIN.	MAX.	UNIT
V_{EE}	Gate voltage	V_{DD} open-circuited	-3	0	V
V_{DD}	Drain voltage	V_{EE} open-circuited	0	+ 6	V
I_{D1}	Drain current			150	mA
P_{IN}	Input power			TBD	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		1		2	GHz
<i>Performance at QFN package lead; $f_i = 1.9 \text{ GHz}$</i>						
V_D	Supply voltage			4.5		V
I_D	Supply current	$V_{EE} = - 0.45 \text{ V}$		50		mA
G	Gain			16.5		dB
NF_{min}	Minimum Noise Figure			0.23		dB
<i>Performance * of Reference Board (Single Ended configuration with on-board bias resistors); $f_i = 1.9 \text{ GHz}$</i>						
V_{DD}	Supply voltage			5		V
I_D	Supply current	$V_{EE1} = - 0.58 \text{ V}$		50		mA
G	Gain			17		dB
NF	Noise Figure			0.44		dB
ISO_{rev}	Reverse Isolation	OUT/IN		23		dB
OIP3	Output third order intercept point			32		dBm
P_{1dB}	Output Power @ 1dB gain compression			21.5		dBm
S_{11}	Input reflection coefficient	50 Ω source		-18		dB
S_{22}	Output reflection coefficient	50 Ω load		-13		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
 $V_D = 4.5 \text{ V}; I_D = 50 \text{ mA}; T_{\text{amb}} = + 23 \text{ }^\circ\text{C}$

Frequency (GHz)	S11	Ang S11 (°)	S21	Ang S21 (°)	S12	Ang S12 (°)	S22	Ang S22 (°)
0.1	0.9942	-6.632	11.6101	173.30	0.0038	87.64	0.0659	167.1027
0.2	0.9846	-13.216	11.5089	166.65	0.0076	88.10	0.0654	154.1627
0.3	0.9691	-19.705	11.3457	160.10	0.0115	87.75	0.0647	141.1486
0.4	0.9485	-26.059	11.1283	153.68	0.0156	87.04	0.0640	128.0534
0.5	0.9235	-32.248	10.8657	147.44	0.0199	86.03	0.0634	114.9088
0.6	0.8953	-38.248	10.5681	141.39	0.0243	84.76	0.0631	101.7958
0.7	0.8646	-44.046	10.2452	135.54	0.0289	83.26	0.0633	88.8477
0.8	0.8325	-49.634	9.9060	129.91	0.0337	81.56	0.0641	76.2367
0.9	0.7995	-55.013	9.5584	124.50	0.0386	79.69	0.0655	64.1468
1	0.7665	-60.188	9.2089	119.30	0.0435	77.69	0.0676	52.7411
1.1	0.7338	-65.168	8.8625	114.31	0.0486	75.58	0.0703	42.1367
1.2	0.7020	-69.965	8.5232	109.50	0.0537	73.40	0.0734	32.3947
1.3	0.6713	-74.590	8.1938	104.88	0.0589	71.15	0.0770	23.5253
1.4	0.6418	-79.057	7.8763	100.43	0.0641	68.85	0.0808	15.5008
1.5	0.6139	-83.379	7.5717	96.14	0.0694	66.53	0.0848	8.2705
1.6	0.5875	-87.570	7.2808	91.99	0.0746	64.18	0.0890	1.7726
1.7	0.5627	-91.641	7.0038	87.97	0.0798	61.82	0.0932	-4.0570
1.8	0.5395	-95.605	6.7406	84.08	0.0850	59.45	0.0974	-9.2796
1.9	0.5180	-99.472	6.4910	80.29	0.0903	57.07	0.1015	-13.9513
2	0.4982	-103.251	6.2544	76.61	0.0954	54.70	0.1056	-18.1217
2.1	0.4799	-106.952	6.0303	73.02	0.1006	52.32	0.1095	-21.8343
2.2	0.4632	-110.582	5.8181	69.51	0.1058	49.94	0.1134	-25.1267
2.3	0.4481	-114.147	5.6172	66.07	0.1109	47.57	0.1172	-28.0315
2.4	0.4345	-117.654	5.4270	62.71	0.1160	45.20	0.1210	-30.5774
2.5	0.4223	-121.107	5.2467	59.41	0.1210	42.83	0.1247	-32.7898
2.6	0.4116	-124.510	5.0758	56.16	0.1261	40.47	0.1284	-34.6920
2.7	0.4022	-127.867	4.9137	52.96	0.1310	38.10	0.1321	-36.3059
2.8	0.3943	-131.180	4.7598	49.81	0.1360	35.74	0.1359	-37.6528
2.9	0.3876	-134.450	4.6135	46.70	0.1409	33.38	0.1398	-38.7540
3	0.3822	-137.680	4.4743	43.63	0.1458	31.02	0.1438	-39.6318
3.2	0.3751	-144.024	4.2153	37.58	0.1555	26.29	0.1528	-40.8114
3.4	0.3727	-150.216	3.9791	31.64	0.1650	21.55	0.1631	-41.3932
3.6	0.3747	-156.262	3.7627	25.78	0.1743	16.80	0.1754	-41.5957
3.8	0.3809	-162.170	3.5631	19.99	0.1833	12.03	0.1899	-41.6382
4	0.3909	-167.948	3.3780	14.24	0.1920	7.23	0.2071	-41.7196
4.5	0.4307	178.100	2.9651	0.05	0.2123	-4.86	0.2619	-43.0100
5	0.4870	164.712	2.6044	-13.93	0.2294	-17.05	0.3322	-46.5629
5.5	0.5531	151.794	2.2808	-27.63	0.2425	-29.20	0.4124	-52.1856
6	0.6219	139.377	1.9875	-40.88	0.2512	-41.08	0.4956	-59.1796

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

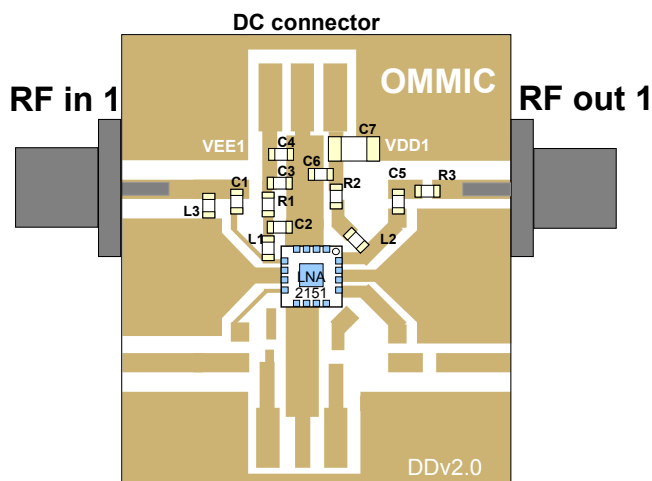
NOISE-PARAMETERS
 $V_D = 4.5 \text{ V}; I_D = 50 \text{ mA}; T_{\text{amb}} = + 23 \text{ }^\circ\text{C}.$

Frequency (GHz)	NF _{min} (dB)	$ \Gamma_{\text{opt}} $	Ang Γ_{opt} (°)	R _{n0}
0.1	0.1273	0.9781	3.413	0.0738
0.2	0.1333	0.9550	6.644	0.0653
0.3	0.1392	0.9324	9.866	0.0622
0.4	0.1451	0.9103	13.097	0.0604
0.5	0.1511	0.8885	16.342	0.0590
0.6	0.1570	0.8671	19.608	0.0578
0.7	0.1629	0.8461	22.899	0.0567
0.8	0.1688	0.8254	26.219	0.0555
0.9	0.1746	0.8051	29.573	0.0544
1	0.1805	0.7850	32.967	0.0531
1.1	0.1864	0.7652	36.404	0.0518
1.2	0.1922	0.7458	39.890	0.0505
1.3	0.1980	0.7266	43.429	0.0491
1.4	0.2038	0.7078	47.027	0.0476
1.5	0.2096	0.6892	50.688	0.0461
1.6	0.2154	0.6710	54.418	0.0445
1.7	0.2211	0.6532	58.221	0.0429
1.8	0.2268	0.6357	62.103	0.0413
1.9	0.2325	0.6187	66.068	0.0396
2	0.2382	0.6022	70.121	0.0378
2.1	0.2438	0.5861	74.266	0.0361
2.2	0.2495	0.5707	78.506	0.0344
2.3	0.2551	0.5558	82.845	0.0326
2.4	0.2606	0.5417	87.284	0.0308
2.5	0.2661	0.5283	91.824	0.0291
2.6	0.2716	0.5157	96.463	0.0274
2.7	0.2771	0.5040	101.201	0.0257
2.8	0.2825	0.4932	106.031	0.0240
2.9	0.2879	0.4834	110.946	0.0224
3	0.2933	0.4746	115.939	0.0209
3.2	0.3039	0.4605	126.104	0.0180
3.4	0.3143	0.4509	136.407	0.0155
3.6	0.3246	0.4461	146.703	0.0134
3.8	0.3347	0.4458	156.837	0.0117
4	0.3446	0.4496	166.668	0.0106
4.5	0.3684	0.4736	-170.740	0.0107
5	0.3908	0.5103	-151.460	0.0154
5.5	0.4117	0.5513	-135.293	0.0252
6	0.4308	0.5911	-121.680	0.0403

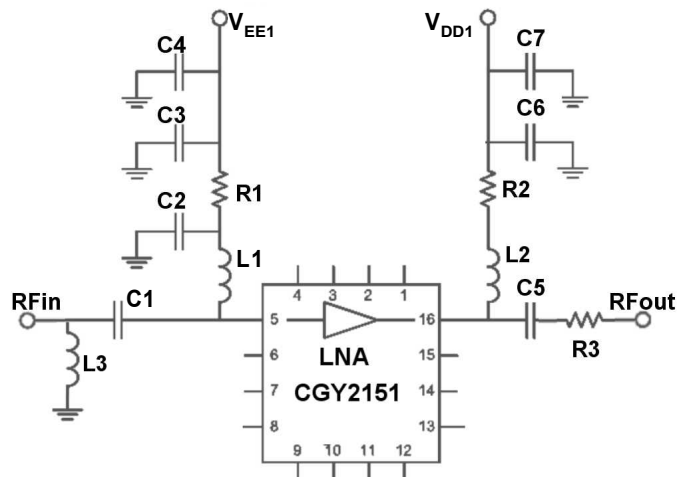
Note : The reference planes are the QFN Package Leads, R_{n0} is the Noise Resistance normalised to 50 Ω.

SINGLE ENDED REFERENCE BOARD 1900 MHz

Assembly Drawing



Circuit Diagram (centre frequency 1900 MHz)



Bill of materials

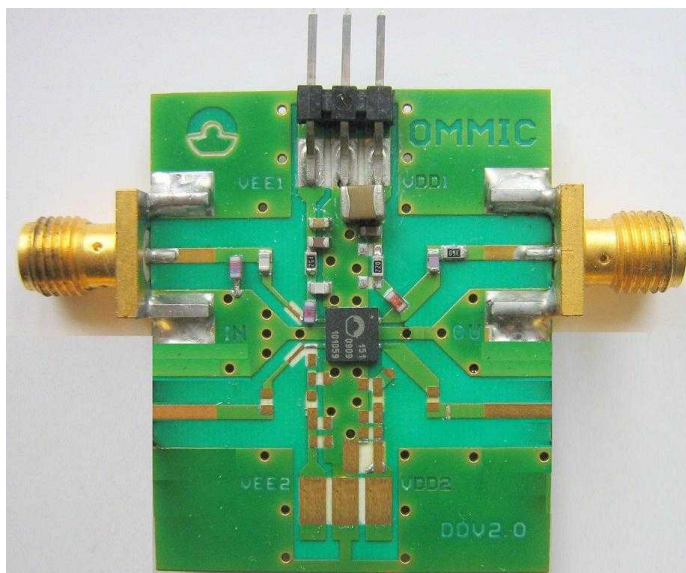
Component	Value	Reference
R1	470 Ω	0603
R2	10 Ω	0603
R3	12 Ω	0603
L1	10 nH	Coilcraft 0603CS
L2	110 nH	Coilcraft 0603CS
L3	8.2 nH	Coilcraft 0603CS
C1	3.2 pF	Dielectric labs C06UL
C2	2.5 pF	0603 C0G
C3	100 pF	0603 C0G
C4, C6	10 nF	0603 X7R
C5	3.2 pF	0603 C0G
C7	47 μ F	1210 X5R

Notes:

Capacitor C7 prevents low frequency oscillations when the board is biased from laboratory power supplies. It is not required when on-board voltage regulators are used.

Board material is Rogers RO4350, height 508 μ m.

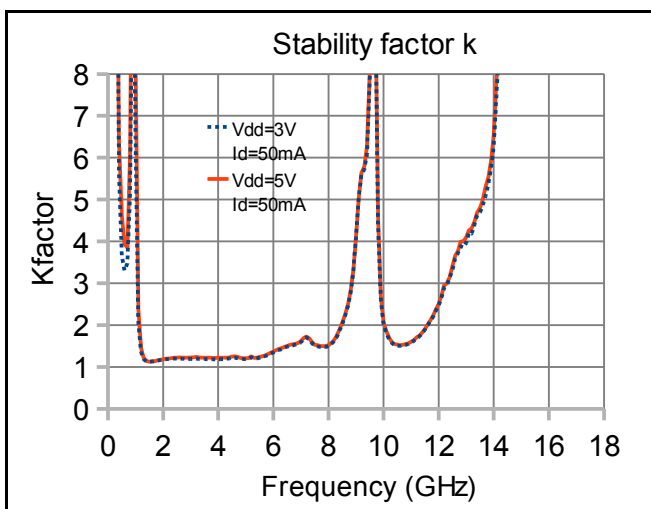
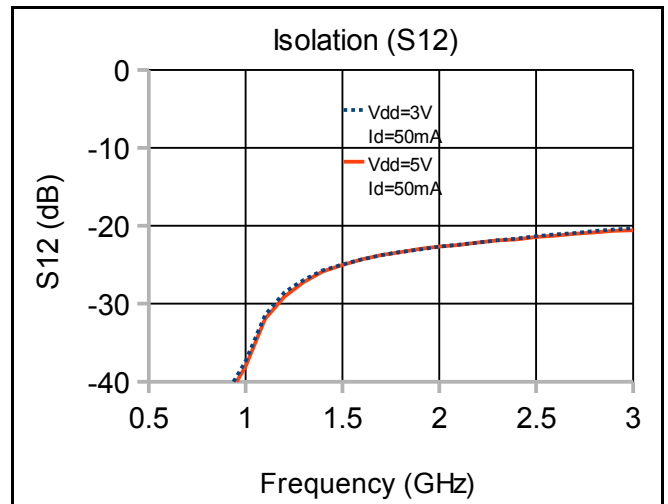
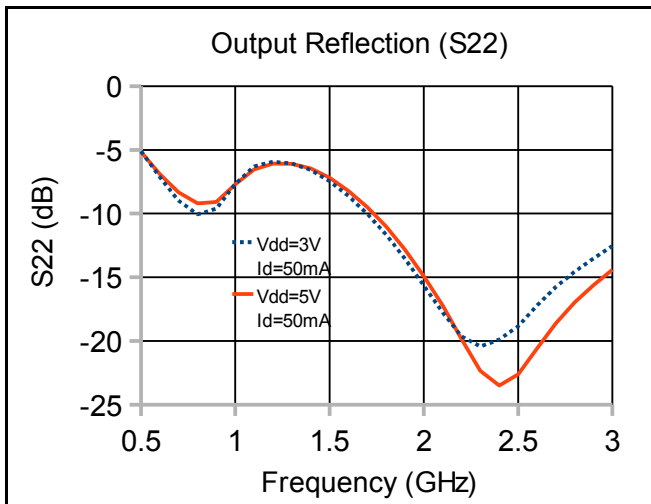
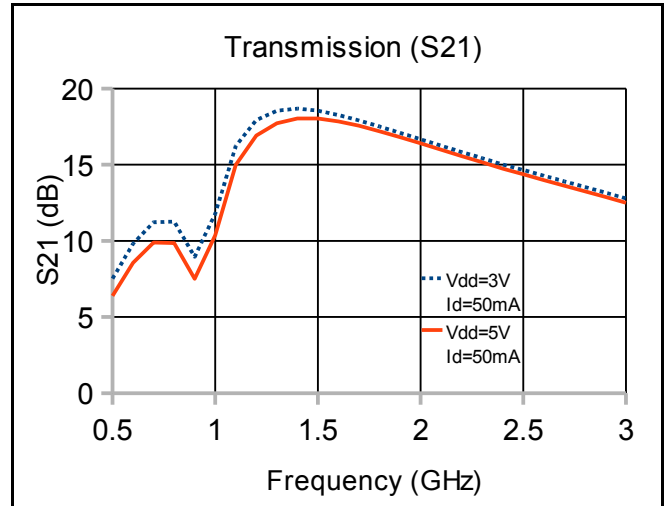
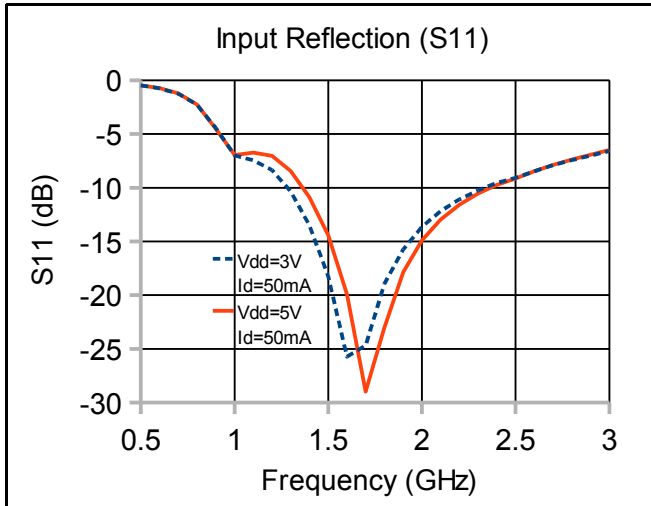
Populated Printed Circuit Board (ref DDV20)

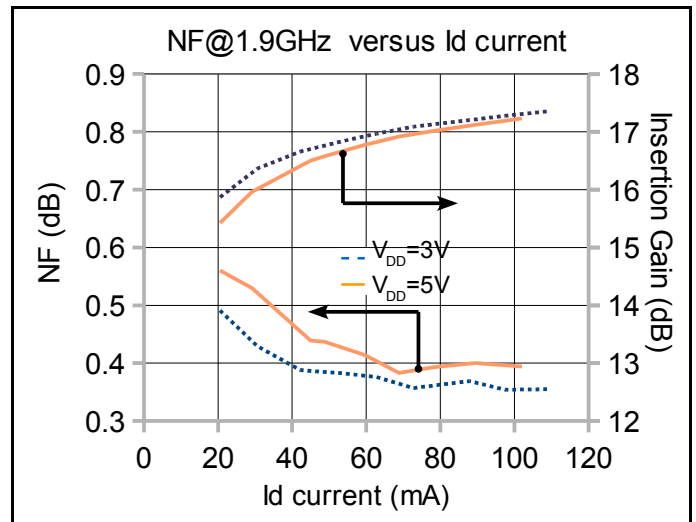
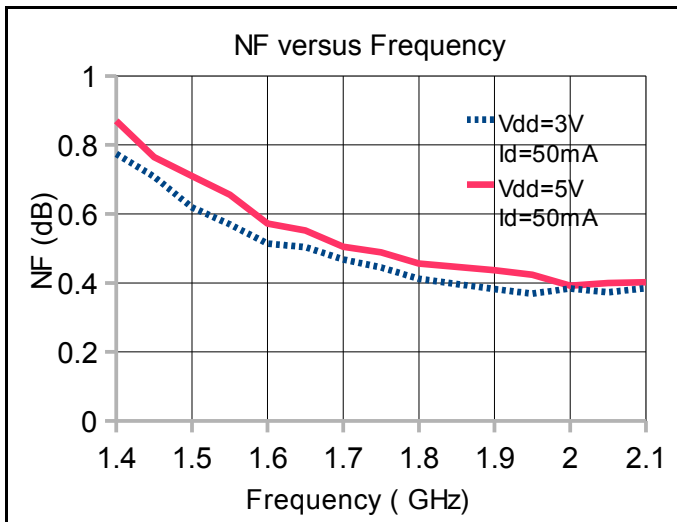


MEASURED PERFORMANCE OF SINGLE ENDED REFERENCE BOARD 1.9 GHZ

Conditions : $V_{DD} = 5\text{ V}$, $I_D = 50\text{ mA}$ in straight line, $V_{DD} = 3\text{ V}$, $I_D = 50\text{ mA}$ in dash line, $T_{amb} = +23^\circ\text{C}$, unless otherwise stated.

Measurements include RF connector contributions.



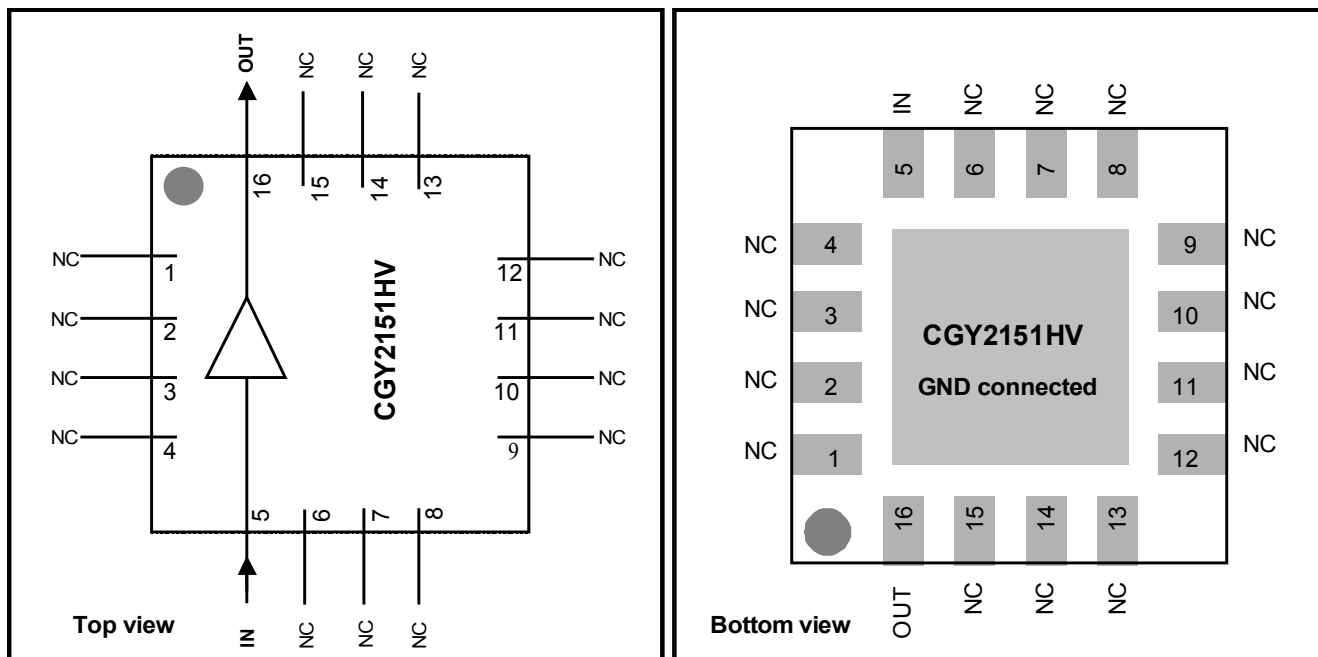


V _{DD} (V)	I _D (mA)	V _{EE} (V)	NF (dB)	IIP3 (dBm)	OIP3 (dBm)	OP _{1dB} (dBm)	S11 (dB)	S21 (dB)	S22 (dB)
3	21	-0.65	0.49	11.4	27.6	16.4	-17.1	16.1	-10.9
3	31	-0.59	0.43	12.8	29.4	16.51	-18.2	16.6	-12.2
3	42	-0.55	0.39	13.3	30.3	17.29	-17.0	16.9	-13.0
3	54	-0.5	0.38	13.4	30.7	17.44	-15.7	17.1	-13.5
3	62	-0.47	0.38	13.4	30.7	17.4	-15.1	17.2	-13.8
3	72	-0.44	0.36	13.5	31.0	17.23	-14.5	17.3	-14.0
3	83	-0.4	0.37	13.4	31.1	16.86	-13.9	17.4	-14.3
3	91	-0.37	0.35	13.7	31.5	16.55	-13.6	17.5	-14.4
3	101	-0.34	0.36	14.3	32.2	16.23	-13.4	17.6	-14.5
5	20	-0.73	0.56	18.0	33.7	21.53	-13.7	15.6	-10.7
5	29	-0.68	0.53	18.4	34.7	21.35	-16.7	16.2	-11.7
5	45	-0.6	0.44	15.0	31.9	21.63	-18.1	16.7	-12.7
5	48	-0.58	0.44	14.8	31.7	21.63	-17.9	16.8	-12.8
5	59	-0.54	0.41	14.4	31.5	21.65	-16.9	17.0	-13.2
5	68	-0.51	0.38	14.3	31.6	21.66	-16.1	17.1	-13.3
5	78	-0.48	0.39	14.2	31.5	21.65	-15.4	17.2	-13.5
5	89	-0.44	0.4	14.0	31.5	21.61	-14.8	17.3	-13.6
5	101	-0.41	0.39	13.8	31.5	21.51	-14.3	17.5	-13.6

Summary of the performance of the CGY2151HV Single Ended Reference Board at 1900 MHz

Note :

These results have been obtained on a Single Ended Reference Board optimised to work at 1900 MHz. The CGY2151HV can be easily used up to 2 GHz, in single ended applications. For more details on the reference board used, or help in the design of application using the CGY2151HV, please refer to CGY2151HV application notes or contact OMMIC at : information@ommic.com.

BLOCK DIAGRAM AND PIN CONFIGURATION

PINNING

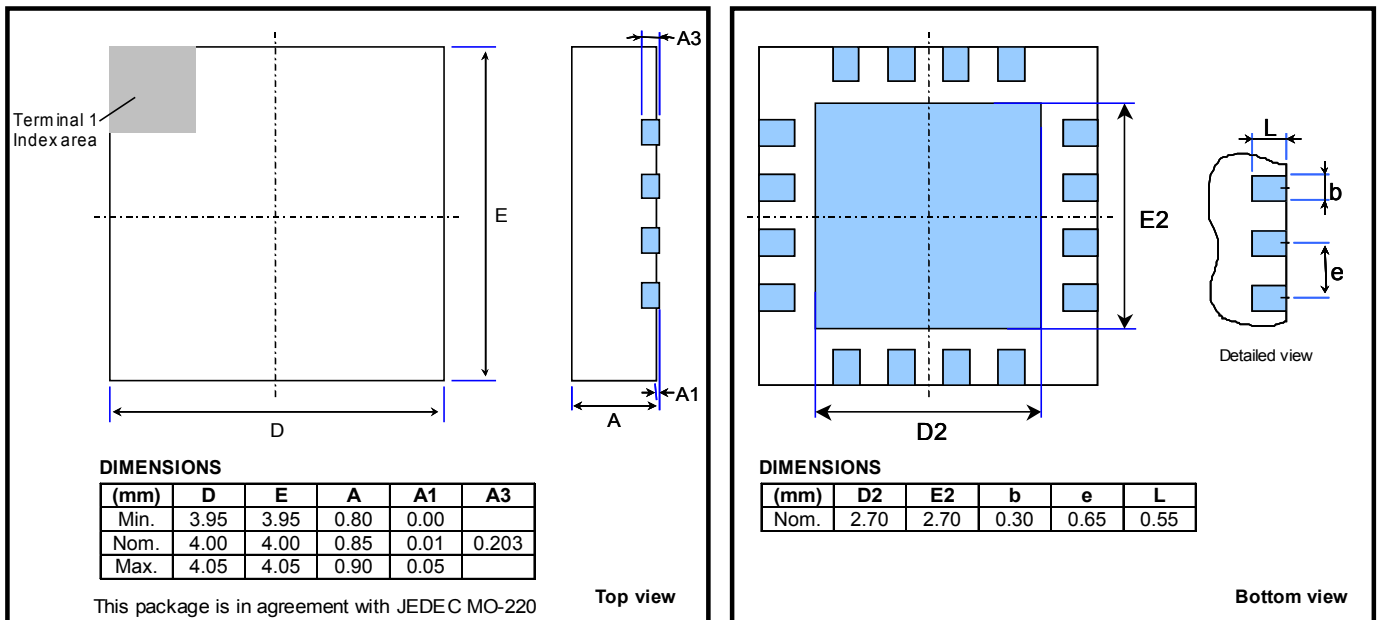
Symbol	Pin	Description
GND	GND	Amplifier : Source
IN	5	Amplifier : Gate (RF & DC input)
OUT	16	Amplifier : Drain (RF & DC output)
NC	1, 2, 3, 4, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15	Not Connected

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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Life support applications

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ORDERING INFORMATION

Generic type	Package type	Version	Sort Type	Description
CGY2151	HV	C1		Single LNA, QFN Plastic Package
CGY2151	HV	C1	REFBOARD1G9	Single Ended Reference Board 1.9GHz
CGY2151	HV	C1	REFBOARD1G7	Single Ended Reference Board 1.7GHz



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