17-24GHz Low Noise Amplifier

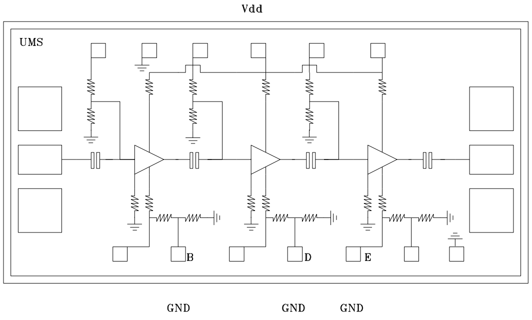
GaAs Monolithic Microwave IC

Description

The CHA2090-99F is a three-stage self-biased wide band monolithic low noise amplifier.

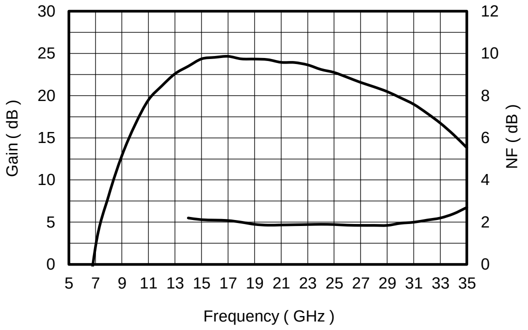
The circuit is manufactured with a standard 0.25µm gate length pHEMT process, via holes through the substrate, air bridges and electron beam gate lithography.

It is supplied in chip form.



Main Features

- Broadband performance 17-24GHz
- 2.0dB noise figure
- 23dB gain, ± 1dB gain flatness
- Low DC power consumption, 55mA
- Chip size: 2,17 x 1,27 x 0.1mm



On wafer typical measurement

Main Characteristics

Tamb = +25°C, Vd=4.5V, Pads B,D,E=GND

Symbol	Parameter	Min	Typ	Max	Unit
Fop	Operating frequency range	17		24	GHz
NF	Noise figure		2.0	3.0	dB
G	Gain	19	23		dB
VSWRin	Input VSWR			2:1	
VSWRout	Output VSWR			2:1	

ESD Protection : Electrostatic discharge sensitive device. Observe handling precautions !

Main Characteristics

Tamb = +25°C, Vd=4.5V, Pads B, D, E=GND

Symbol	Parameter	Min	Typ	Max	Unit
Fop	Operating frequency range	17		24	GHz
NF	Noise figure (1)		2	3	dB
G	Gain (1)	19	23		dB
Pout	Pout -1dB gain compression		10		dBm
VSWRin	Input VSWR (1)		2.0:1	2.5:1	
VSWRout	Output VSWR (1)		2.0:1	2.5:1	
Vdd	Positive Drain voltage (2)		4.5	5.0	V

(1) These values are representative of on-wafer measurements that are made without bonding wires at the RF ports. When the chip is attached with typical 0.15nH input and output bonding wires, the indicated parameter values should be improved.

(2) See chip biasing option page 7/8.

Absolute Maximum Ratings (1)

Tamb = +25°C

Symbol	Parameter	Values	Unit
Vd	Drain bias voltage (3)	5.5	V
Pin	Maximum peak input power overdrive (2)	+15	dBm
Top	Operating temperature range	-40 to +85	°C
Tstg	Storage temperature range	-55 to +150	°C

(1) Operation of this device above anyone of these parameters may cause permanent damage.

(2) Duration < 1s.

(3) See chip biasing option page 7/8.

Typical Result

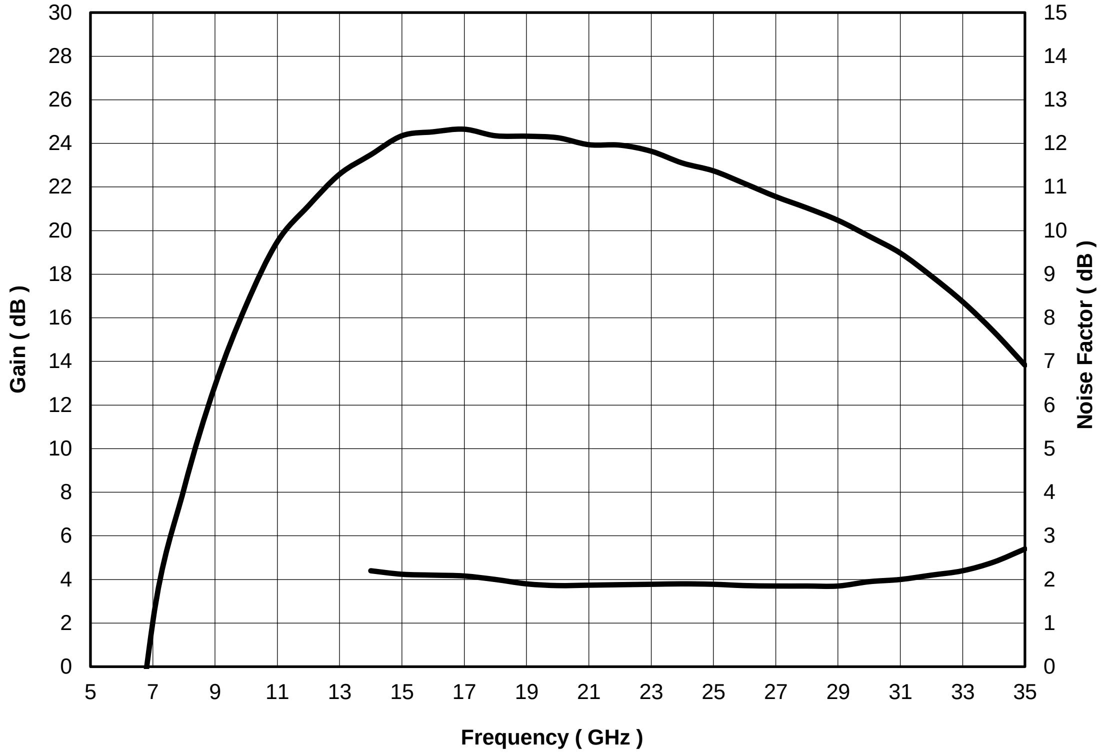
Chip Typical Response (On wafer Sij) :

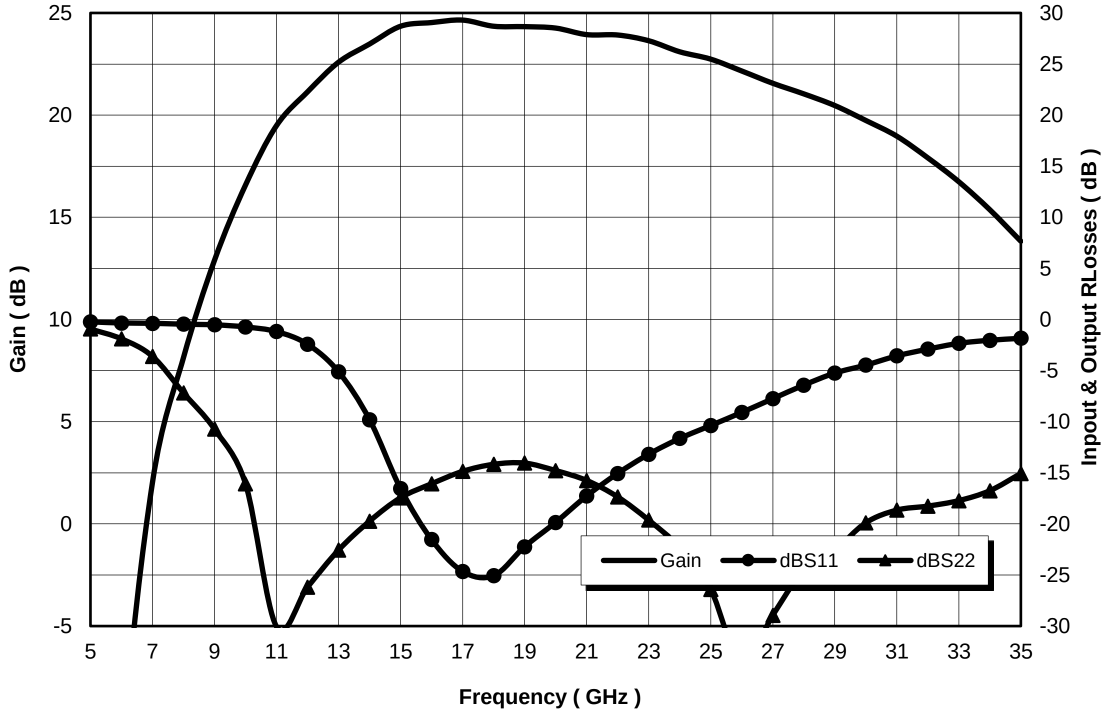
Tamb = +25°C VD = 4.5V   ID = 55mA

Frequency	**MS11**	**PS11**	**MS12**	**PS12**	**MS21**	**PS21**	**MS22**	**PS22**
	mod	*pha*	*mod*	*pha*	*mod*	*pha*	*mod*	*pha*
GHz	dB	deg	dB	deg	dB	deg	dB	deg
1.000	-0.53	-20.8	-89.62	-92.0	-41.76	-148.5	-0.72	-23.8
2.000	-0.06	-39.0	-97.43	26.6	-48.17	170.5	-0.30	-50.3
3.000	-0.10	-58.5	-87.21	-23.0	-52.46	74.5	-0.33	-75.6
4.000	-0.16	-77.4	-84.87	-135.7	-61.22	154.8	-0.49	-101.9
5.000	-0.23	-96.5	-83.35	120.1	-35.86	-69.1	-0.89	-129.8
6.000	-0.34	-115.2	-66.23	84.2	-12.12	-123.6	-1.77	-159.0
7.000	-0.35	-134.1	-72.40	-58.1	1.34	145.9	-3.35	168.8
8.000	-0.45	-154.1	-73.93	-13.6	7.48	75.4	-6.63	141.1
9.000	-0.52	-175.4	-72.23	-7.1	11.96	18.3	-9.34	119.1
10.000	-0.75	160.3	-66.01	-34.2	15.54	-28.2	-13.97	85.5
11.000	-1.21	132.1	-60.26	-60.3	18.30	-72.2	-22.57	53.2
12.000	-2.33	97.8	-56.60	-94.9	19.92	-116.5	-39.69	-60.4
13.000	-4.60	57.2	-53.53	-135.9	21.36	-163.1	-30.19	-133.1
14.000	-8.86	8.5	-52.43	-173.4	22.49	149.3	-25.30	-127.8
15.000	-16.48	-40.4	-52.50	157.8	23.60	100.6	-21.56	-134.5
16.000	-24.70	-70.2	-52.26	135.4	23.89	62.2	-19.34	-144.1
17.000	**-27.75**	**-80.6**	**-52.62**	**108.9**	**24.01**	**28.4**	**-17.60**	**-158.0**
18.000	**-23.51**	**-87.4**	**-51.36**	**100.6**	**23.66**	**-1.9**	**-16.51**	**-172.3**
19.000	**-21.41**	**-95.7**	**-51.27**	**60.6**	**23.52**	**-30.5**	**-16.34**	**163.7**
20.000	**-18.63**	**-107.0**	**-54.07**	**52.8**	**23.46**	**-57.8**	**-17.75**	**149.6**
21.000	**-16.77**	**-115.6**	**-55.06**	**30.3**	**23.11**	**-84.4**	**-19.33**	**131.6**
22.000	**-14.95**	**-123.2**	**-57.35**	**23.7**	**23.14**	**-111.0**	**-22.26**	**113.9**
23.000	**-13.73**	**-132.0**	**-59.54**	**8.0**	**22.82**	**-137.3**	**-25.44**	**89.1**
24.000	**-12.59**	**-138.8**	**-60.85**	**32.3**	**22.36**	**-162.8**	**-29.95**	**43.8**
25.000	-11.60	-144.7	-62.07	49.5	22.01	171.8	-28.26	-24.5
26.000	-10.61	-149.8	-54.29	40.2	21.46	147.9	-22.90	-58.9
27.000	-9.34	-154.5	-55.03	23.9	20.91	125.0	-19.22	-84.3
28.000	-7.89	-160.6	-52.05	-11.6	20.49	102.3	-17.12	-102.6
29.000	-6.63	-171.3	-60.41	-22.1	20.06	78.5	-16.20	-114.2
30.000	-5.86	179.9	-56.56	23.2	19.50	55.4	-14.73	-123.1
31.000	-4.83	172.0	-52.73	-13.7	19.03	31.5	-13.72	-137.5
32.000	-3.95	161.7	-54.11	-40.7	18.31	6.9	-13.60	-147.0
33.000	-3.18	151.2	-54.59	-51.2	17.51	-17.5	-13.61	-155.8
34.000	-2.61	140.2	-55.15	-37.9	16.54	-42.3	-14.22	-161.4
35.000	-2.15	129.3	-51.68	-92.2	15.35	-66.8	-14.94	-161.8
36.000	-1.77	117.9	-57.64	-111.2	13.94	-91.0	-15.31	-154.5
37.000	-1.65	106.7	-60.87	-68.5	12.41	-114.4	-13.87	-143.9
38.000	-1.64	95.9	-53.10	-33.4	10.67	-137.5	-11.60	-140.4
39.000	-1.65	85.9	-47.45	-99.7	8.76	-159.6	-9.18	-143.5
40.000	-1.76	75.2	-46.80	-137.0	6.70	178.9	-7.06	-151.0

Typical on Wafer Measurements

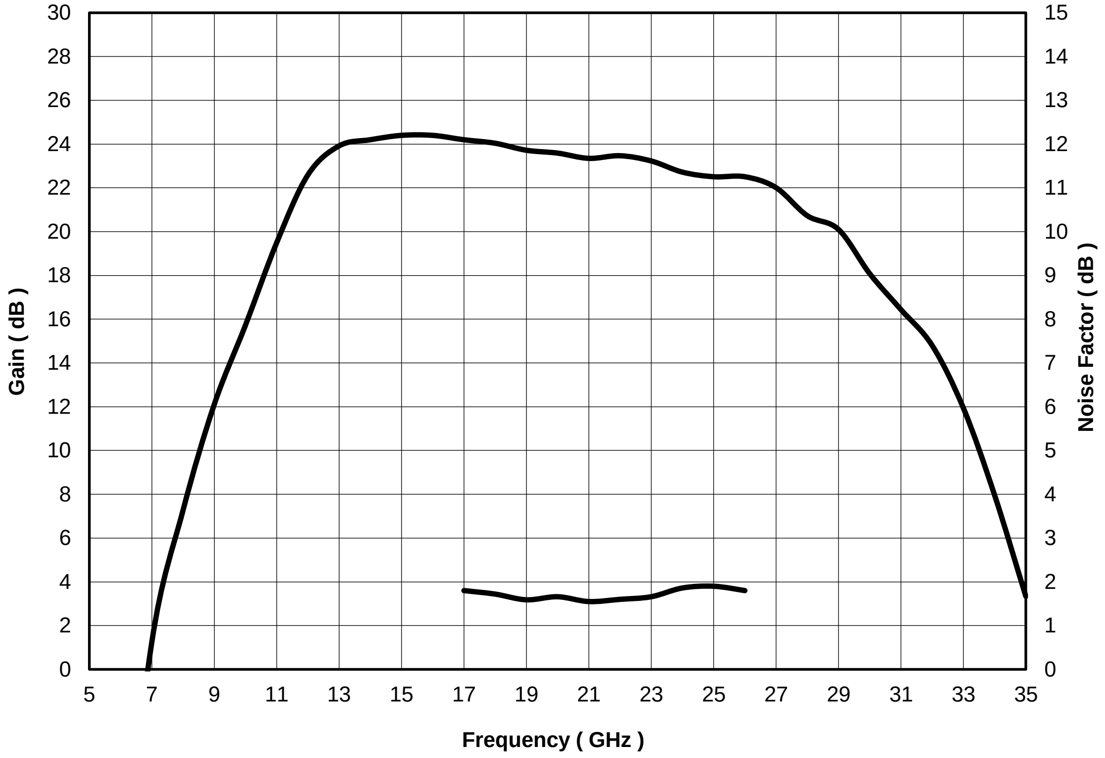
Bias conditions: Vd = 4.5V, Id = 55mA

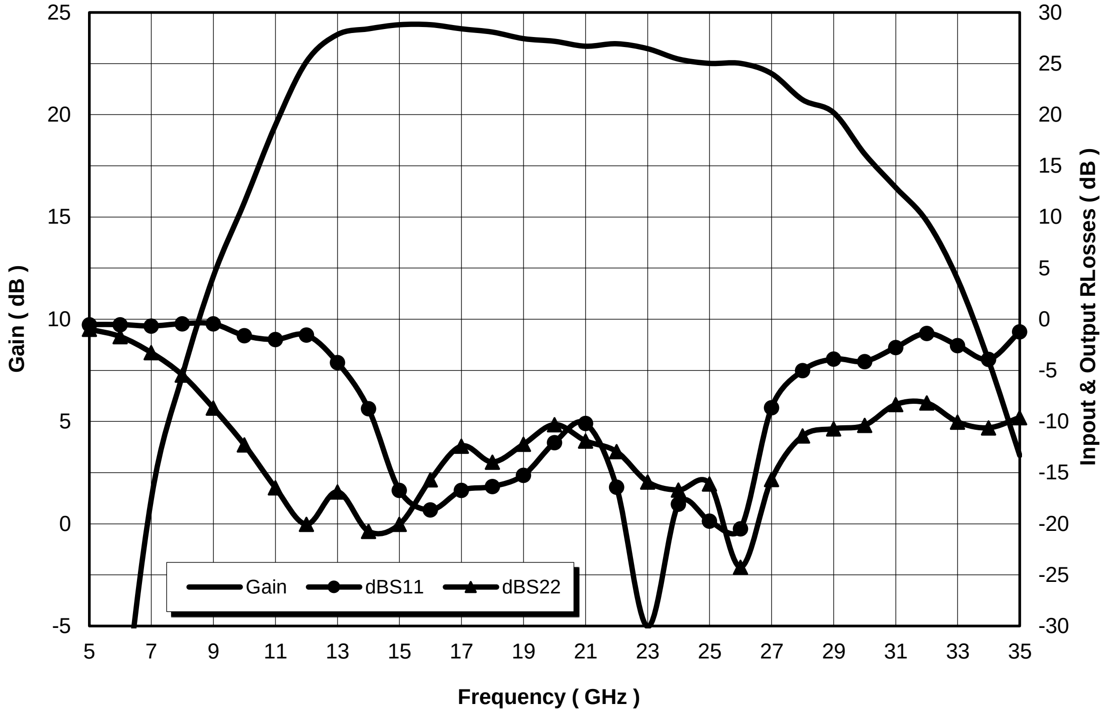




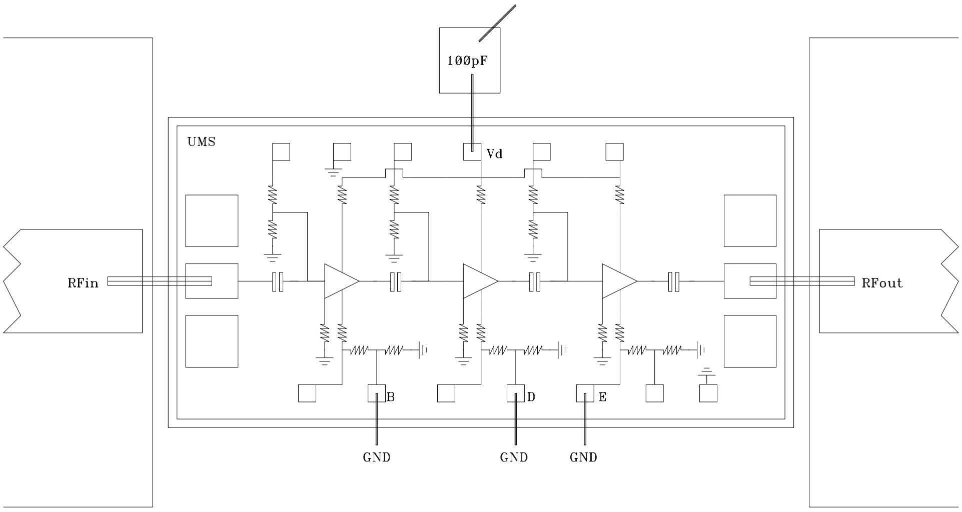
Typical on Test Jig Measurements

Bias conditions: Vd = 4.5V, Id = 55mA

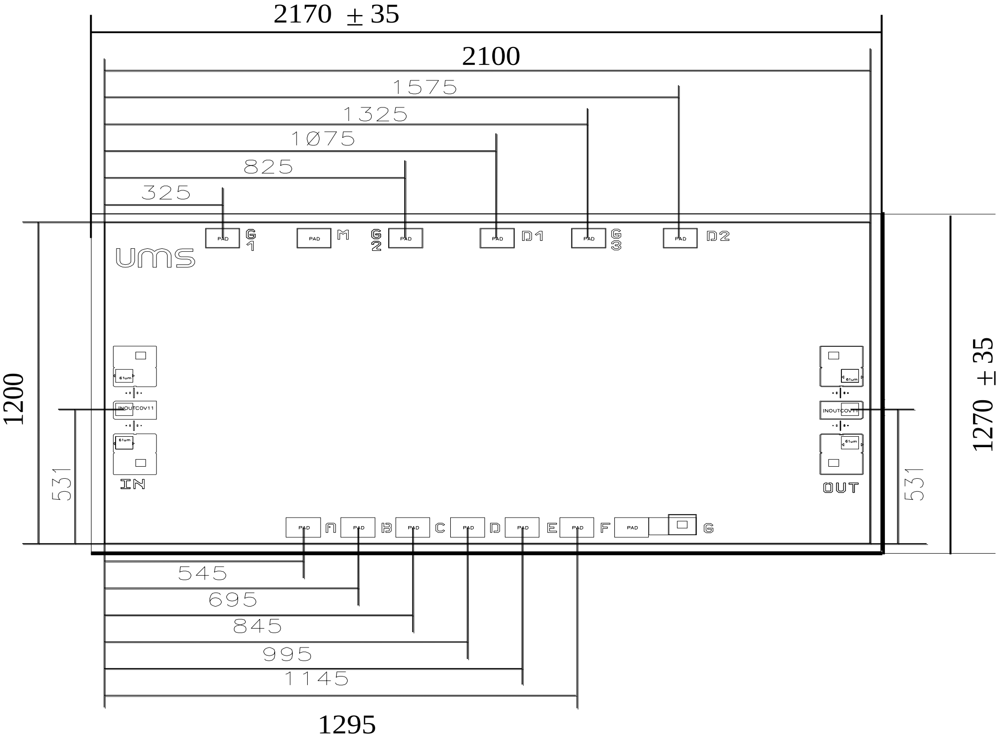




Chip Assembly and Mechanical Data



Note : Supply feed should be capacitively bypassed. 25µm diameter gold wire is to be preferred.



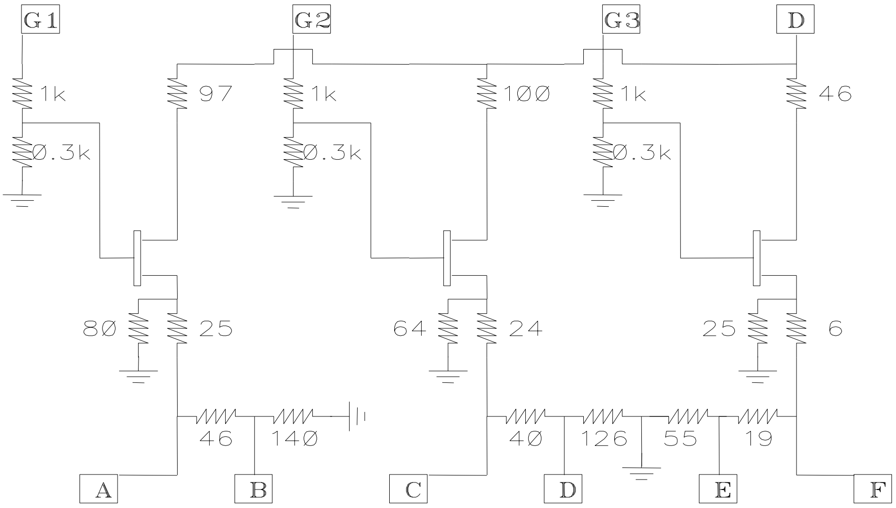
Bonding pad positions.

(Chip thickness: 100µm. Pad size: 100x80µm²)

(All dimensions are in micrometers)

Chip Biasing options

This chip is self-biased, and flexibility is provided by the access to number of pads. The internal DC electrical schematic is given in order to use these pads in a safe way.



The two requirements are:
N°1: Not exceed Vds = 3.5Volt (internal Drain to Source voltage)
N°2: Not biased in such a way that Vgs becomes positive.
(internal Gate to Source voltage)

We propose two standard biasing:
Low Noise and low consumption: Vd = 4.5V and B, D, E grounded
All the other pads non connected (NC)
Idd = 55mA & Pout-1dB = 10dBm Typical
(Equivalent to A, B, C, D, E, F: non connected and Vd=4.5V; G1=G2=G3=+1V
Low Noise and higher output power Vd = 4.5V and B, C, F grounded
All the other pads non connected (NC)
Idd = 75mA & Pout-1dB = 12dBm Typical

Ordering Information

Chip form : CHA2090-99F/00