United Monolithic Semiconductors

CHA3023-99F

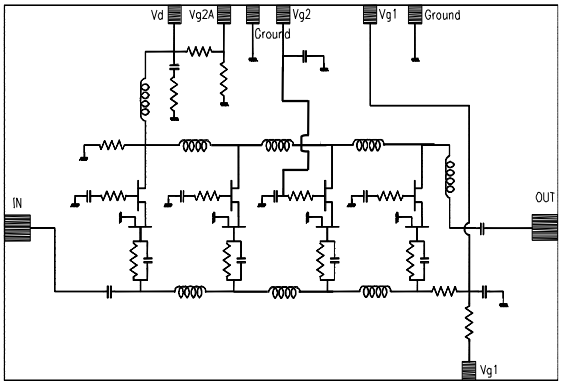
1-18GHz WIDE BAND AMPLIFIER

GaAs Monolithic Microwave IC

Description

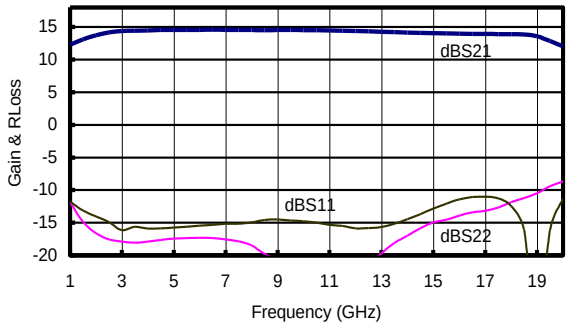
The CHA3023-99F is a travelling wave amplifier using cascode FET. It is designed for a wide range of applications.

The circuit is manufactured with a pHEMT process of 0.25µm gate length, via holes through the substrate and air bridges and it is available in die form.



Main Features

- Broadband performances: 1-18GHz
- 14dB gain
- 3dB typical Low Noise Figure
- ± 0.7dB gain flatness
- Chip size: 2.15 X 1.42 X 0.10mm



Main Electrical Characteristics

Tamb.= +25°C

Symbol	Parameter	Min	Typ	Max	Unit
Fop	Operating frequency range	1		18	GHz
G	Small signal Gain	12.5	14		
NF	Noise figure			4	dB
Id	Bias current		95		mA

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

United Monolithic Semiconductors S.A.S.
Bât. Charmille - Parc Mosaic - 10, Avenue du Québec - 91140 VILLEBON-SUR-YVETTE - France
Tel.: +33 (0) 1 69 86 32 00 - Fax: +33 (0) 1 69 86 34 34 - www.ums-rf.com

Specifications (for Broadband Operation)

Tamb. = +25°C
Vd = 5V, Vg1 = -0.3V tuned to have Id = 95mA, Vg2 = +2V

Symbol	Parameter	Min	Typ	Max	Unit
Fop	Operating frequency range	1		18	GHz
G	Small signal gain F= 1 to 3GHz F= 3 to 18GHz	 11.5 12.5	 13 14		 dB dB
ΔG	Small signal gain flatness		± 0.7		dB
P1dB	Output power at 1dB gain compression	15	17		dBm
VSWRin	Input VSWR		2.2:1		
VSWRout	Output VSWR		2.2:1		
NF	Noise Figure F= 1 to 4GHz F= 1 to 18GHz		 4 2.5	 6 4	 dB dB
Vdc	DC voltage Vd Vg1 Vg2		+5 -0.3 +2		V V V
Id	Bias current		95		mA

Absolute Maximum Ratings (1)

Tamb.= +25°C

Symbol	Parameter	Min.	Max.	Unit
Vd	Drain to ground bias voltage	0	6.5	V
Id	Drain current		110	mA
Vg1	Gate to ground bias voltage	-1.5	0.3	V
Vg2	Gate to ground bias voltage	0	3	V
Pin	Maximum peak input power overdrive		+15	dBm
Pin	Maximum input CW power		+10	dBm
Top	Operating temperature	-40	85	°C
Tstg	Storage temperature range	-55	150	°C

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

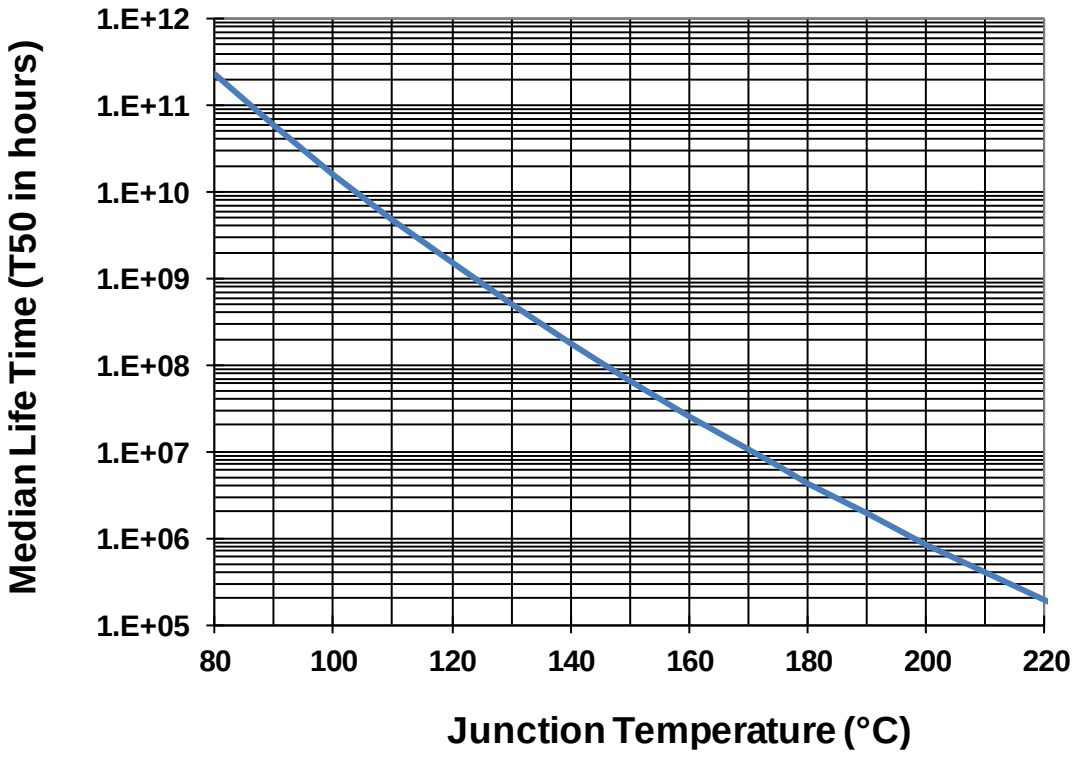
Bât. Charmille - Parc Mosaic - 10, Avenue du Québec - 91140 VILLEBON-SUR-YVETTE - France
Tel.: +33 (0) 1 69 86 32 00 - Fax: +33 (0) 1 69 86 34 34 - www.ums-rf.com

Device thermal performances

All the figures given in this section are obtained assuming that the packaged device is only cooled down by conduction through the package thermal pad (no convection mode considered).
The temperature is monitored at the package back-side interface (T_{case}).
The system maximum temperature must be adjusted in order to guarantee that $T_{junction}$ remains below the maximum value specified in the Absolute Maximum Ratings table.
So, the system PCB must be designed to comply with these requirements.

Parameter	Biasing conditions	$T_{junction}$ (°C)	R_{TH} (°C/W)	T50 (Hours)
R_{TH} (1) Thermal Resistance (Junction to Case)	Vd = 5V Idq = 95mA Pdiss = 475mW	115	63	5E+09

(1) Assuming 85°C T_{case}



Bât. Charmille - Parc Mosaic - 10, Avenue du Québec - 91140 VILLEBON-SUR-YVETTE - France
Tel.: +33 (0) 1 69 86 32 00 - Fax: +33 (0) 1 69 86 34 34 - www.ums-rf.com

Typical on-wafer Sij parameters

Tamb.= +25°C

Vd = 5.0V ; Vg2 = 2V and Vg1 tuned to Id = 95mA

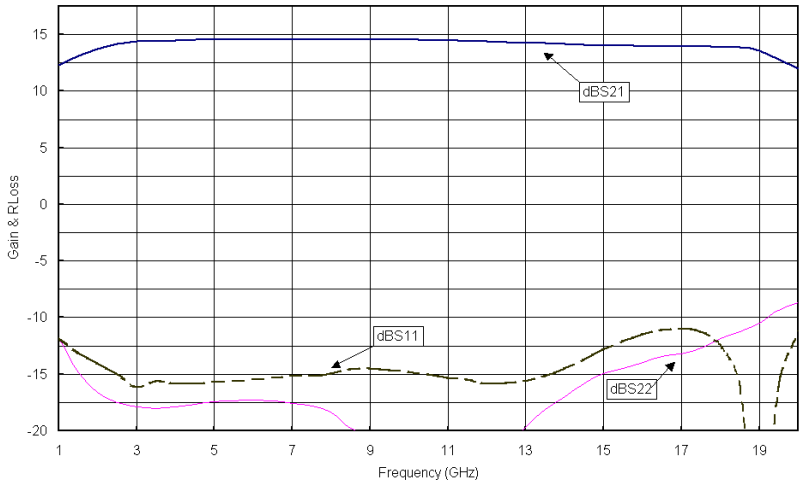
Freq (GHz)	S11 (dB)	PhS11 (°)	S12 (dB)	PhS12 (°)	S21 (dB)	PhS21 (°)	S22 (dB)	PhS22 (°)
1.00	-11.84	-86.69	-68.86	12.95	12.27	175.21	-11.75	175.50
1.50	-14.88	-96.63	-59.00	-65.50	13.11	164.60	-13.13	134.72
2.00	-16.59	-102.61	-57.76	-85.24	13.74	152.90	-14.05	103.57
2.50	-17.55	-106.89	-55.88	-101.83	14.21	140.45	-14.93	77.53
3.00	-17.90	-110.67	-56.09	-133.36	14.38	127.54	-16.15	60.98
3.50	-18.04	-114.80	-54.51	-146.60	14.42	116.64	-15.59	48.79
4.00	-17.90	-119.10	-53.45	-166.51	14.50	105.01	-15.88	36.69
4.50	-17.64	-124.04	-52.07	178.88	14.55	93.81	-15.86	24.61
5.00	-17.43	-129.21	-52.57	165.06	14.56	82.83	-15.73	15.78
5.50	-17.36	-134.92	-50.96	155.03	14.57	71.87	-15.62	6.63
6.00	-17.32	-140.65	-49.52	145.22	14.57	61.00	-15.45	-1.24
6.50	-17.35	-146.35	-48.93	131.37	14.59	50.26	-15.32	-9.98
7.00	-17.55	-152.20	-48.40	115.97	14.58	39.44	-15.18	-16.89
7.50	-17.83	-157.72	-47.52	106.26	14.57	28.65	-15.15	-23.44
8.00	-18.45	-162.53	-46.94	95.20	14.56	17.95	-14.94	-30.10
8.50	-19.80	-164.62	-46.12	84.24	14.54	7.35	-14.56	-35.12
9.00	-20.69	-168.37	-45.55	74.79	14.55	-3.41	-14.48	-41.40
9.50	-21.89	-169.76	-44.84	62.64	14.55	-14.27	-14.67	-46.03
10.00	-23.72	-166.34	-44.04	53.09	14.53	-25.14	-14.80	-51.30
10.50	-25.53	-158.58	-43.80	39.38	14.50	-36.02	-14.99	-53.99
11.00	-26.70	-141.85	-43.12	26.47	14.48	-46.99	-15.32	-57.64
11.50	-25.89	-122.93	-42.27	14.98	14.44	-57.87	-15.48	-58.42
12.00	-24.09	-110.31	-41.97	2.10	14.40	-68.96	-15.87	-59.30
12.50	-21.74	-106.76	-41.35	-12.13	14.35	-79.91	-15.80	-58.07
13.00	-19.70	-104.76	-41.15	-24.23	14.29	-90.92	-15.65	-56.60
13.50	-18.11	-106.18	-40.87	-38.14	14.23	-101.96	-15.16	-55.31
14.00	-17.00	-112.34	-40.38	-49.23	14.17	-112.98	-14.47	-55.03
14.50	-15.86	-116.67	-40.14	-64.35	14.11	-124.02	-13.71	-56.11
15.00	-14.97	-120.58	-39.83	-75.76	14.05	-135.10	-12.85	-58.60
15.50	-14.53	-124.94	-39.66	-88.72	14.01	-146.32	-12.09	-63.04
16.00	-13.93	-128.81	-39.29	-102.25	13.97	-157.55	-11.44	-69.64
16.50	-13.43	-132.05	-38.83	-118.12	13.93	-168.97	-11.06	-77.10
17.00	-13.18	-134.80	-38.87	-127.14	13.92	179.41	-11.02	-85.48
17.50	-12.67	-137.46	-38.86	-144.06	13.92	167.15	-11.28	-95.81
18.00	-11.85	-137.37	-37.71	-156.10	13.91	154.49	-12.47	-109.17
18.50	-11.23	-139.77	-37.48	-170.79	13.84	140.84	-16.01	-125.94
19.00	-10.46	-143.04	-37.24	175.70	13.57	125.81	-32.15	-109.28
19.50	-9.39	-147.86	-36.76	157.84	12.86	111.51	-16.15	-15.25
20.00	-8.65	-153.32	-36.48	142.87	12.02	99.83	-11.25	-34.96

Bât. Charmille - Parc Mosaic - 10, Avenue du Québec - 91140 VILLEBON-SUR-YVETTE - France
Tel.: +33 (0) 1 69 86 32 00 - Fax: +33 (0) 1 69 86 34 34 - www.ums-rf.com

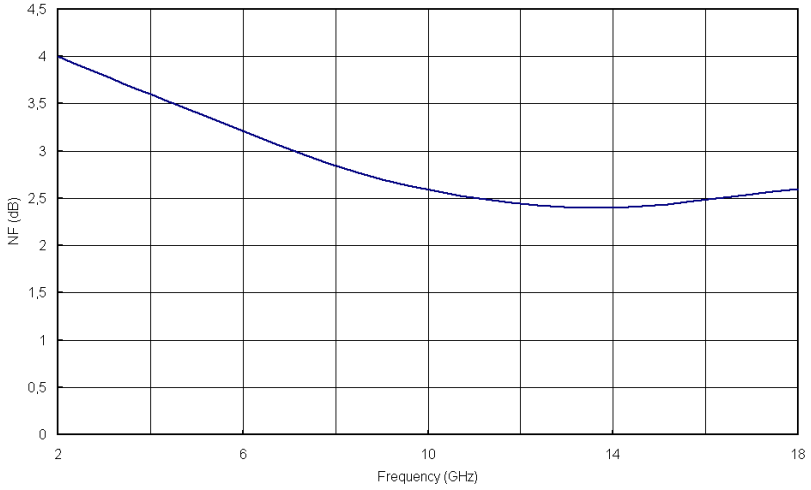
Typical on wafer Measurements

Tamb = +25°C, Vd = 5.0V ; Vg2 = 2V and Vg1 tuned to Id = 95mA

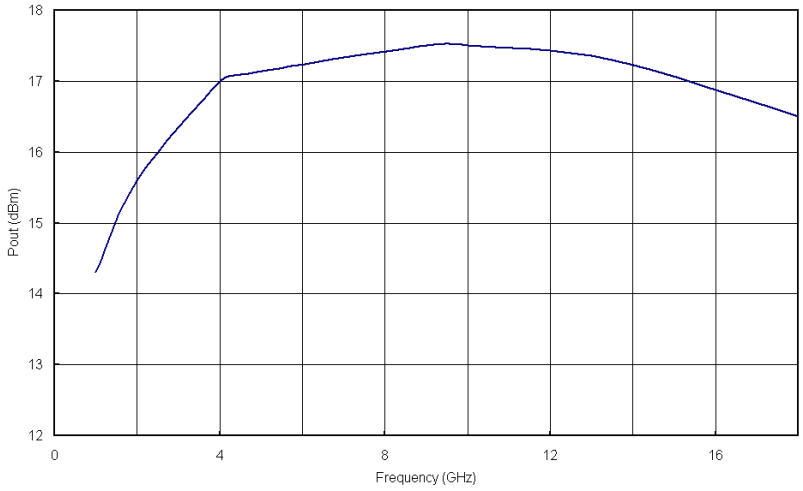
Typical on wafer S parameters



Typical on wafer Noise Figure



Pout vs Frequency (Pin=4dBm)

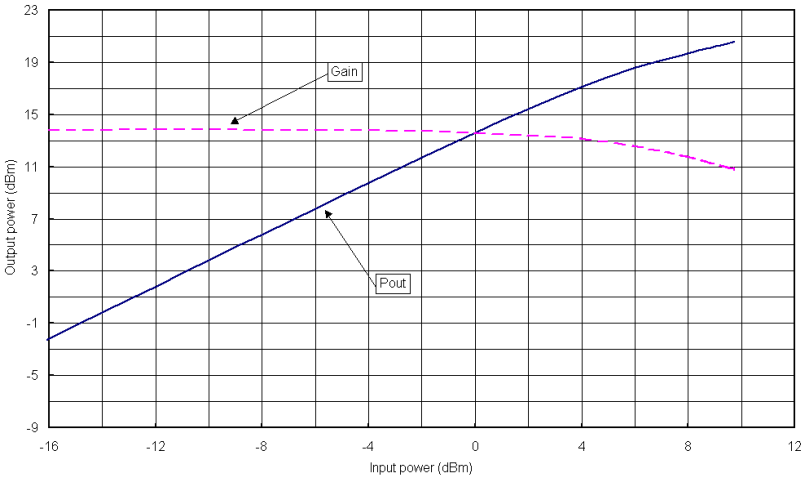


Bât. Charmille - Parc Mosaic - 10, Avenue du Québec - 91140 VILLEBON-SUR-YVETTE - France
Tel.: +33 (0) 1 69 86 32 00 - Fax: +33 (0) 1 69 86 34 34 - www.ums-rf.com

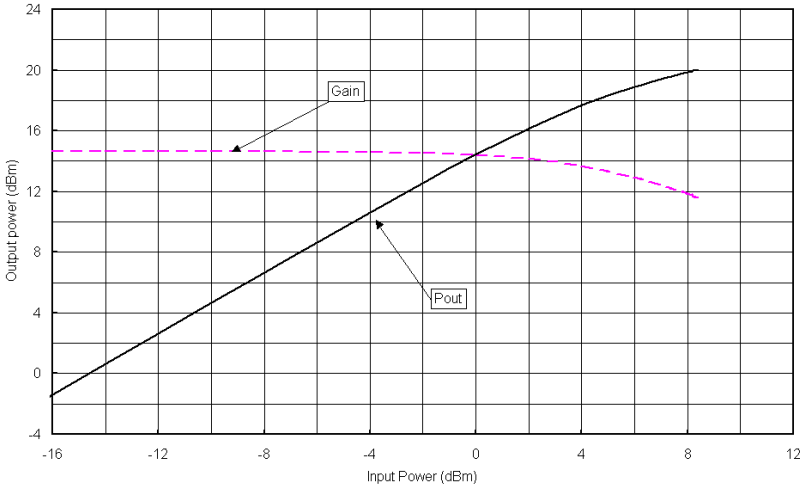
Typical Test Fixture Measurements

Tamb = +25°C, Vd = 5.0V ; Vg2 = 2V and Vg1 tuned to Id = 95mA

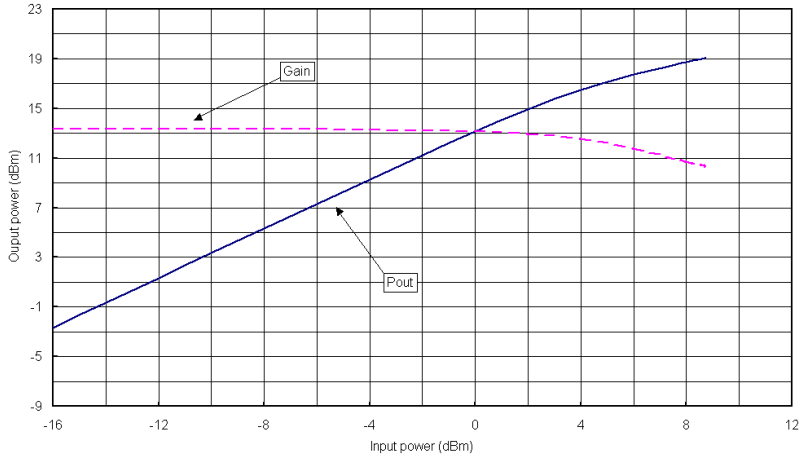
Power compression @ 1GHz



Power compression @ 12GHz



Power compression @ 18GHz

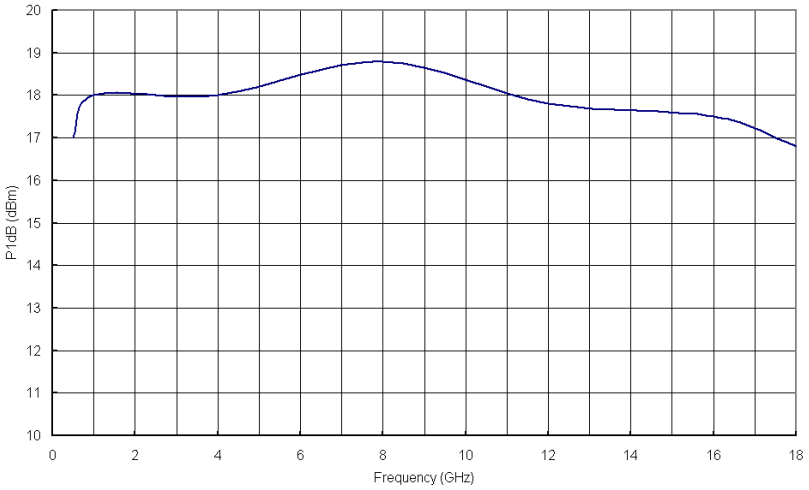


Bât. Charmille - Parc Mosaic - 10, Avenue du Québec - 91140 VILLEBON-SUR-YVETTE - France
Tel.: +33 (0) 1 69 86 32 00 - Fax: +33 (0) 1 69 86 34 34 - www.ums-rf.com

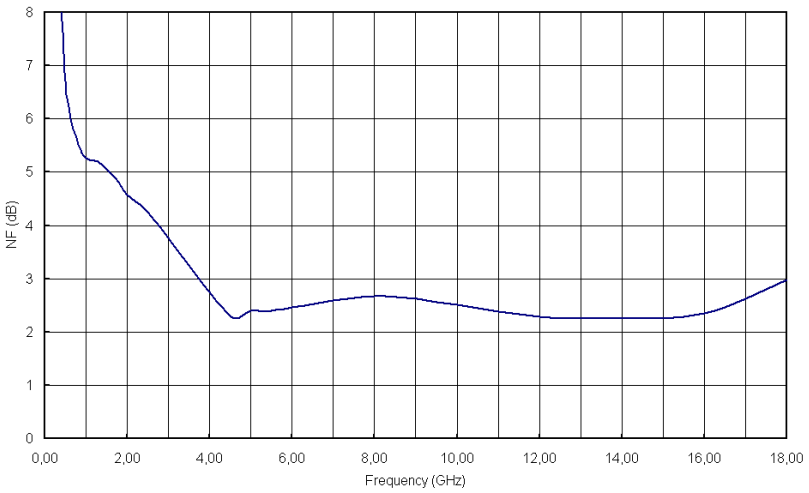
Typical Test Fixture Measurements

Tamb = +25°C, Vd = 5.0V ; Vg2 = 2V and Vg1 tuned to Id = 95mA

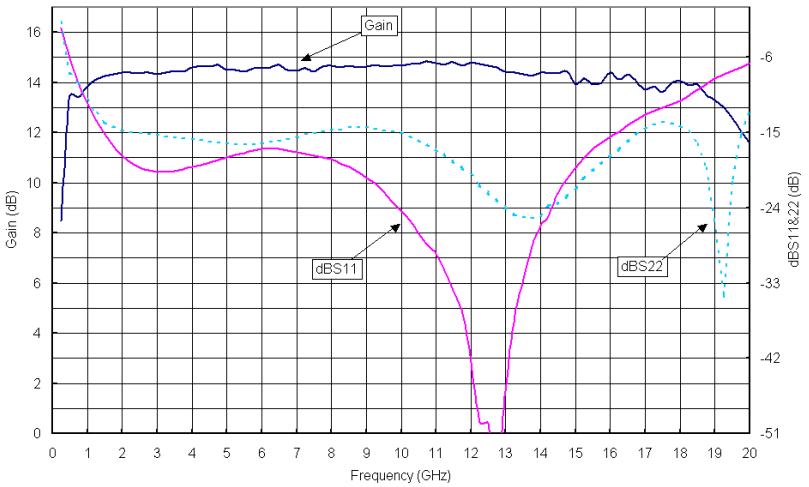
P1dB vs Frequency



Noise Figure vs Frequency

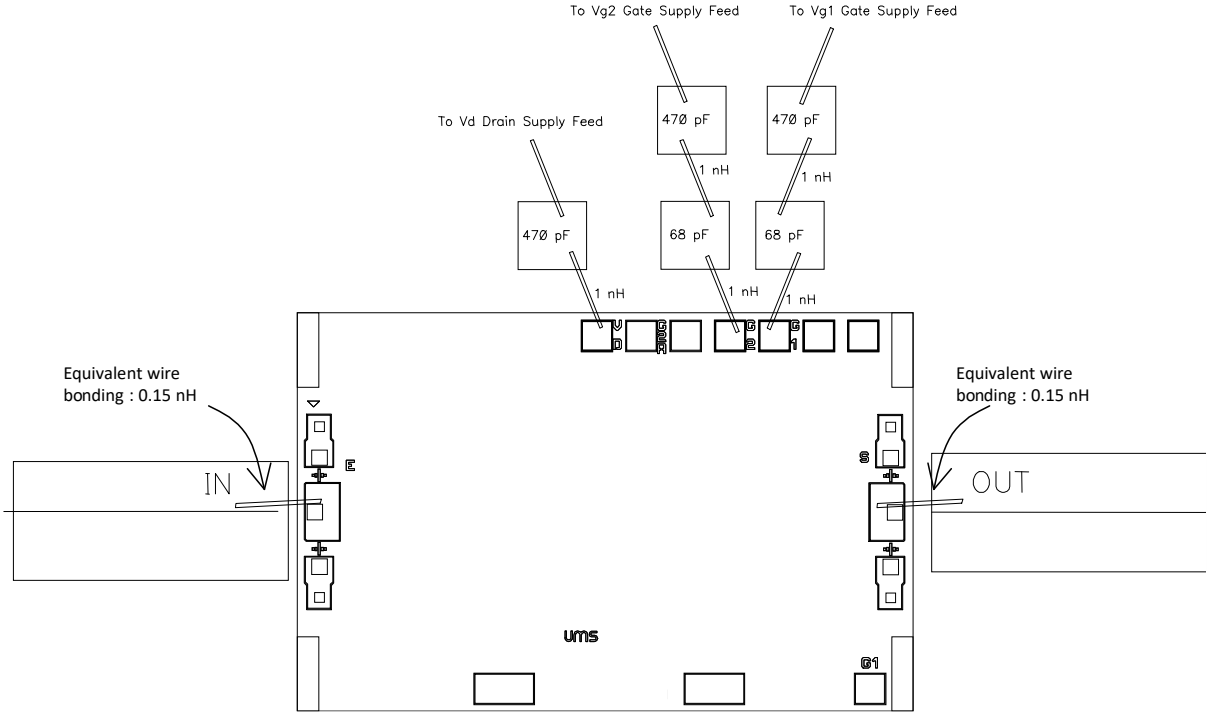


Gain & Return Loss vs Frequency

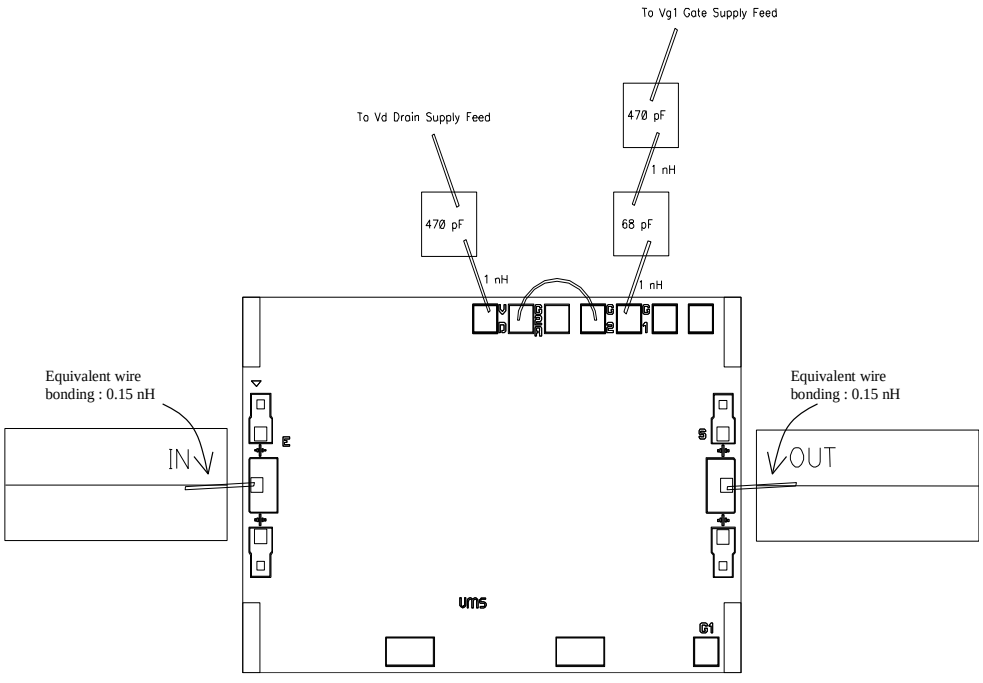


Bât. Charmille - Parc Mosaic - 10, Avenue du Québec - 91140 VILLEBON-SUR-YVETTE - France
Tel.: +33 (0) 1 69 86 32 00 - Fax: +33 (0) 1 69 86 34 34 - www.ums-rf.com

Mechanical data

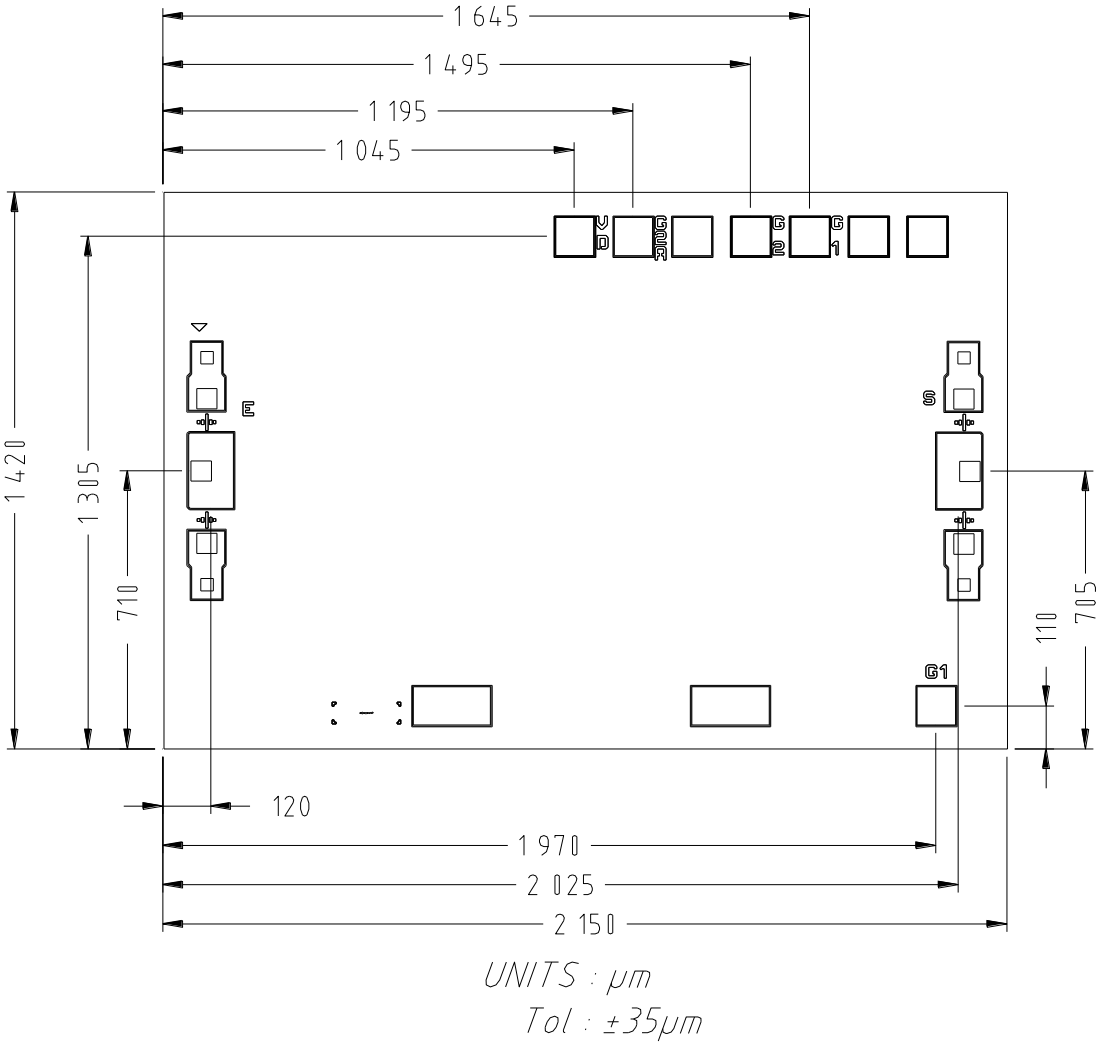


The CHA3023-99F could be used without Vg2 bias. There is a resistor bridge inside the chip. This one generates the correct value of Vg2 Bias. Pads G2a and G2 must be connected. Equivalent RF Wire Bondings: 0.15 nH (typical length of 200µm for a 25µm diameter wire).



Bât. Charmille - Parc Mosaic - 10, Avenue du Québec - 91140 VILLEBON-SUR-YVETTE - France
Tel.: +33 (0) 1 69 86 32 00 - Fax: +33 (0) 1 69 86 34 34 - www.ums-rf.com

Bonding pad positions



Chip Thickness: 100um
Chipsize: 2150X1420 ±35 µm

Bât. Charmille - Parc Mosaic - 10, Avenue du Québec - 91140 VILLEBON-SUR-YVETTE - France
Tel.: +33 (0) 1 69 86 32 00 - Fax: +33 (0) 1 69 86 34 34 - www.ums-rf.com

Recommended ESD management

Refer to the application note AN0020 available at https://www.ums-rf.com for ESD sensitivity and handling recommendations for the UMS products.

Recommended environmental management

UMS products are compliant with the regulation in particular with the directives RoHS N°2011/65 and REACh N°1907/2006. More environmental data are available in the application note AN0019 also available at https://www.ums-rf.com.

Ordering Information

Chip form:	CHA3023-99F/00

Bât. Charmille - Parc Mosaic - 10, Avenue du Québec - 91140 VILLEBON-SUR-YVETTE - France
Tel.: +33 (0) 1 69 86 32 00 - Fax: +33 (0) 1 69 86 34 34 - www.ums-rf.com