

8-12GHz High Power Amplifier

GaAs Monolithic Microwave IC

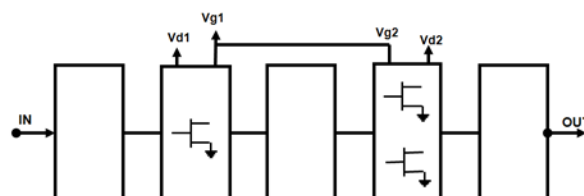
Description

The CHA6005-99F is a High Power Amplifier monolithic circuit, which integrates two stages and produces 32.5dBm output power associated to a high power added efficiency of 38%.

It is designed for a wide range of applications, from defense to commercial communication systems.

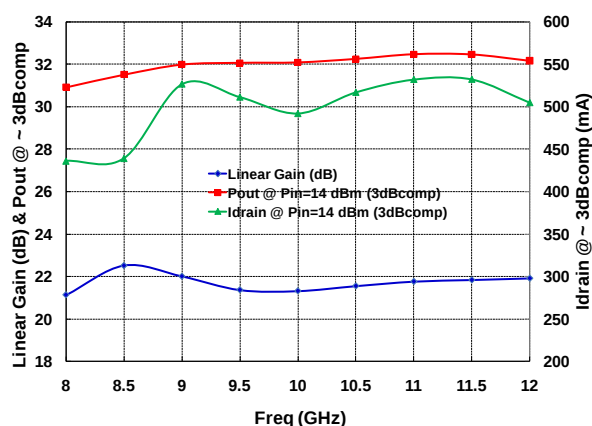
The circuit is manufactured with a pHEMT process, 0.25 μ m gate length, via holes through the substrate, air bridges and electron beam gate lithography.

It is available in chip form.



Main Features

- High power : 32.5dBm
- High PAE : 38%
- Frequency band : 8-12GHz
- Linear gain : 22dB
- DC bias: Vd=8Volt@Id=350mA
- Chip size 3.0x1.5x0.1mm



Main Electrical Characteristics

Tamb.= +25°C

Symbol	Parameter	Min	Typ	Max	Unit
Freq	Frequency range	8		12	GHz
G	Linear Gain	20	22		dB
P3dB	Output Power @ 3dB comp.	30	32.5		dBm
PAE	Power Added Efficiency @ 3dB comp.		38		%

Electrical Characteristics

Tamb.= +25°C, Vd = +8V; Drain Pulse width = 25µs, Duty cycle = 10%

Symbol	Parameter	Min	Typ	Max	Unit
Freq	Operating frequency	8		12	GHz
G	Small signal gain	20	22		dB
dBS11	Input Return Loss		13		dB
dBS22	Output Return Loss		10		dB
P1dB	Output power @ 1dBcomp	29	31.5		dBm
P3dB	Output power @ 3dBcomp	29.5	32		dBm
PAE	Power Added Efficiency @ 3dBcomp		38		%
Id_3dBc	Supply drain current @ 3dBcomp		500	600	mA
Vd1, 2	Drain supply voltage		8		V
Idq	Supply quiescent current		350		mA
Vg	Gate supply voltage		-1		V

These values are representative of on-wafer measurements that are made without bonding wires at the RF ports.

A bonding wire of typically 0.25 to 0.3nH will improve the matching at the accesses.

Absolute Maximum Ratings ⁽¹⁾T_{amb.} = +25°C

Symbol	Parameter	Values	Unit
V _d	Drain bias voltage	9.5	V
I _{dq}	Quiescent drain bias current	450	mA
I _d	Drain bias current	800	mA
P _{in}	Maximum peak input power overdrive ⁽²⁾	+20	dBm
T _j	Junction temperature	175	°C
T _a	Operating temperature range	-40 to +85	°C
T _{stg}	Storage temperature range	-55 to +150	°C

⁽¹⁾ Operation of this device above anyone of these parameters may cause permanent damage.⁽²⁾ Duration < 1s.**Typical Bias Conditions**T_{amb.} = +25°C

Symbol	Pad N°	Parameter	Values	Unit
V ₁	V1	Drain supply voltage	8	V
V ₂	V2	Gate supply voltage	-1	V

Typical on-wafer Sij parameters

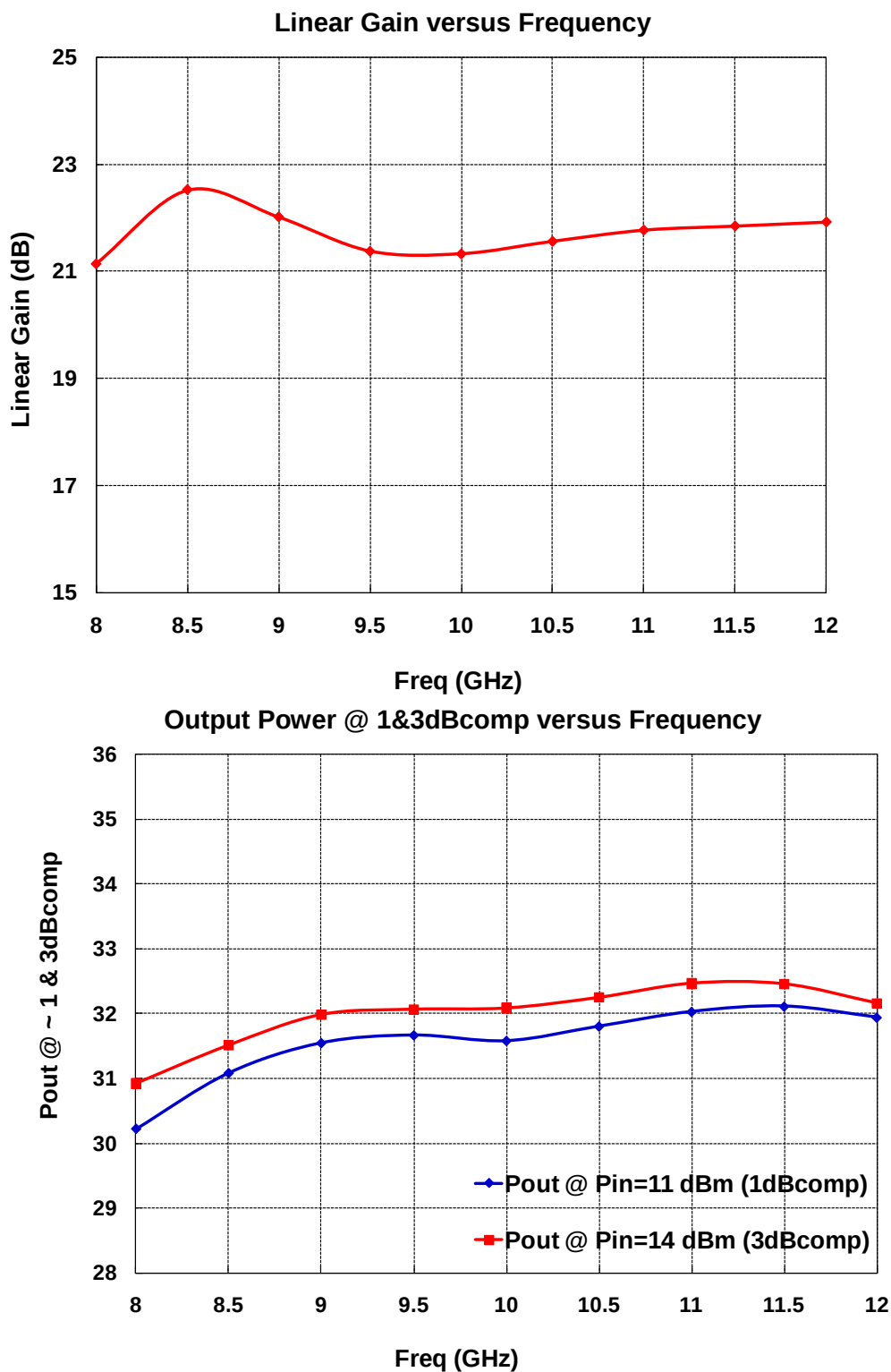
Tamb.= +25°C, Vd = +8V, Id = 350mA

Freq (GHz)	S11 (dB)	PhS11 (°)	S12 (dB)	PhS12 (°)	S21 (dB)	PhS21 (°)	S22 (dB)	PhS22 (°)
1.0	-0.13	-24.56	-41.65	94.28	-41.00	5.33	-0.14	-31.59
1.5	-0.41	-36.99	-73.73	-169.07	-33.87	124.41	-0.25	-46.43
2.0	-0.91	-49.02	-69.95	74.68	-23.74	83.31	-0.36	-60.62
2.5	-1.58	-59.45	-63.20	3.88	-18.60	78.66	-0.45	-76.49
3.0	-2.38	-68.02	-56.66	157.15	-10.90	48.69	-0.33	-92.84
3.5	-2.84	-74.73	-63.04	94.69	-6.27	4.33	-0.30	-108.37
4.0	-3.31	-82.38	-57.85	-114.80	-3.73	-33.50	-0.46	-125.86
4.5	-3.93	-90.68	-60.34	158.64	-1.35	-66.01	-0.48	-144.00
5.0	-4.31	-97.82	-60.03	24.56	1.15	-94.43	-1.12	-163.74
5.5	-4.83	-106.35	-50.57	-80.01	4.11	-123.24	-1.84	175.57
6.0	-5.46	-116.08	-70.50	131.94	7.63	-154.66	-2.81	149.75
6.5	-6.62	-124.18	-55.54	-157.24	11.36	170.68	-4.14	117.44
7.0	-8.19	-132.30	-53.46	-7.29	15.47	129.40	-6.12	71.13
7.5	-9.90	-137.14	-55.00	-29.83	19.90	79.16	-7.72	6.74
8.0	-11.75	-139.76	-57.16	-149.65	22.91	14.32	-8.43	-68.64
8.5	-14.25	-147.90	-51.44	49.02	23.09	-50.26	-10.58	-110.20
9.0	-22.50	-149.89	-61.08	68.48	22.44	-104.62	-12.35	-122.40
9.5	-19.68	-36.57	-61.46	37.28	22.18	-154.83	-11.34	-131.10
10.0	-11.97	-46.88	-49.78	-37.51	22.25	154.10	-10.95	-144.80
10.5	-9.48	-66.85	-54.09	43.84	22.31	99.85	-11.30	-158.95
11.0	-9.03	-76.06	-45.08	-123.49	22.21	43.81	-12.08	-174.53
11.5	-8.28	-75.50	-45.12	-167.53	22.20	-18.84	-14.05	168.12
12.0	-7.24	-77.36	-46.53	178.36	21.59	-93.01	-19.54	110.78
12.5	-6.28	-73.12	-50.56	143.28	17.68	-177.82	-16.12	-41.18
13.0	-4.14	-77.38	-45.11	-73.10	10.97	108.88	-11.80	-75.70
13.5	-2.77	-86.29	-40.75	-41.28	3.20	49.97	-10.40	-90.23
14.0	-2.03	-97.24	-43.07	39.37	-4.83	-0.77	-8.93	-101.41
14.5	-1.55	-108.80	-46.25	-168.74	-12.75	-42.90	-7.39	-116.10
15.0	-1.57	-118.06	-61.73	-65.61	-20.85	-80.03	-6.32	-123.79
15.5	-1.81	-127.31	-40.65	56.06	-28.30	-106.29	-5.11	-131.17
16.0	-1.92	-138.32	-51.69	-38.56	-36.54	-126.10	-4.24	-145.42
16.5	-2.40	-143.30	-37.13	17.09	-40.98	170.77	-5.04	-150.20
17.0	-1.78	-155.35	-53.00	-31.01	-52.02	96.09	-3.40	-156.88
17.5	-2.71	-171.55	-30.56	-18.51	-34.16	104.30	-2.95	-165.99
18.0	-4.54	169.63	-37.57	-134.74	-41.04	-142.48	-3.18	-173.70

Typical on Test Fixture Measurements

Tamb.= +25°C,

Vd = 8V, Id (Quiescent) = 350mA, Drain Pulse width = 25μs, Duty cycle = 10%

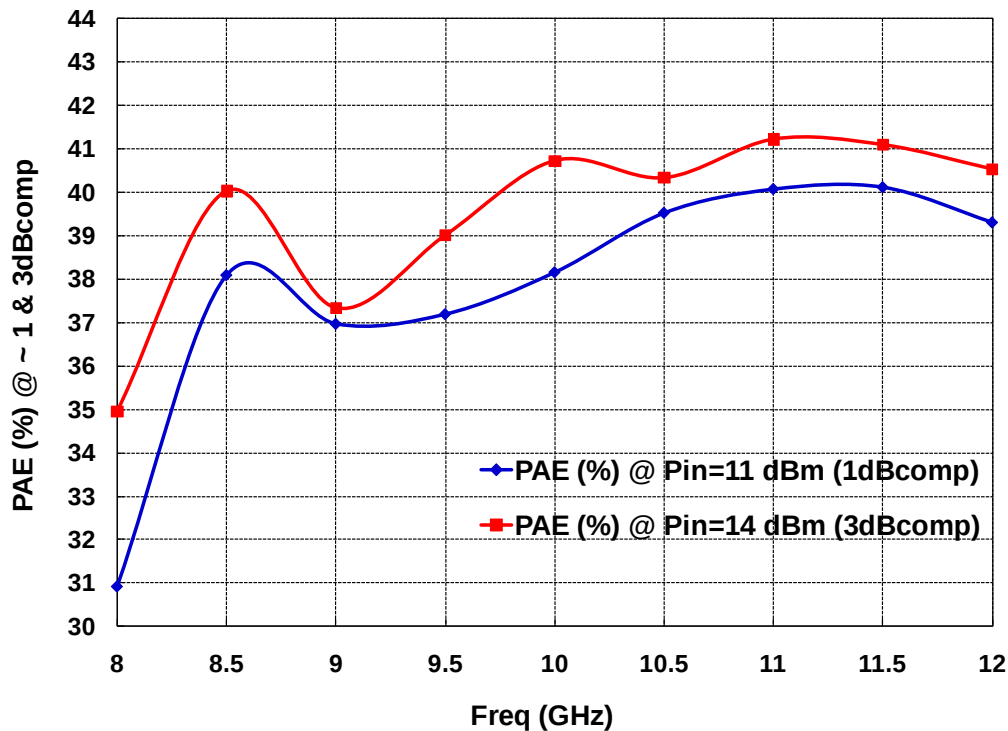


Typical Test Fixture Measurements

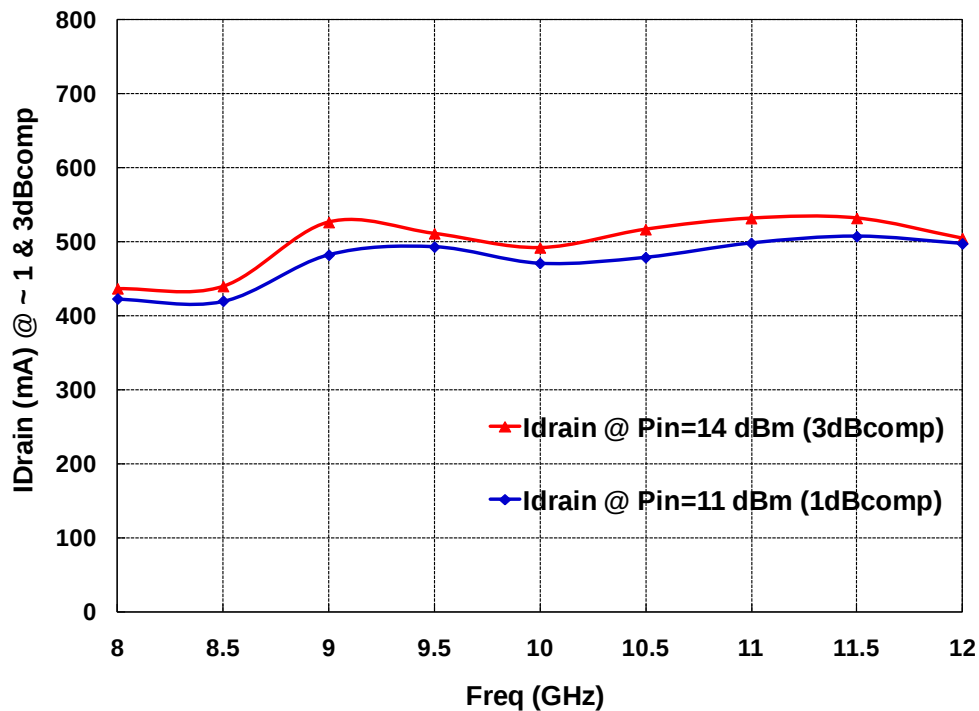
Tamb.= +25°C,

Vd = 8V, Id (Quiescent) = 350mA, Drain Pulse width = 25µs, Duty cycle = 10%

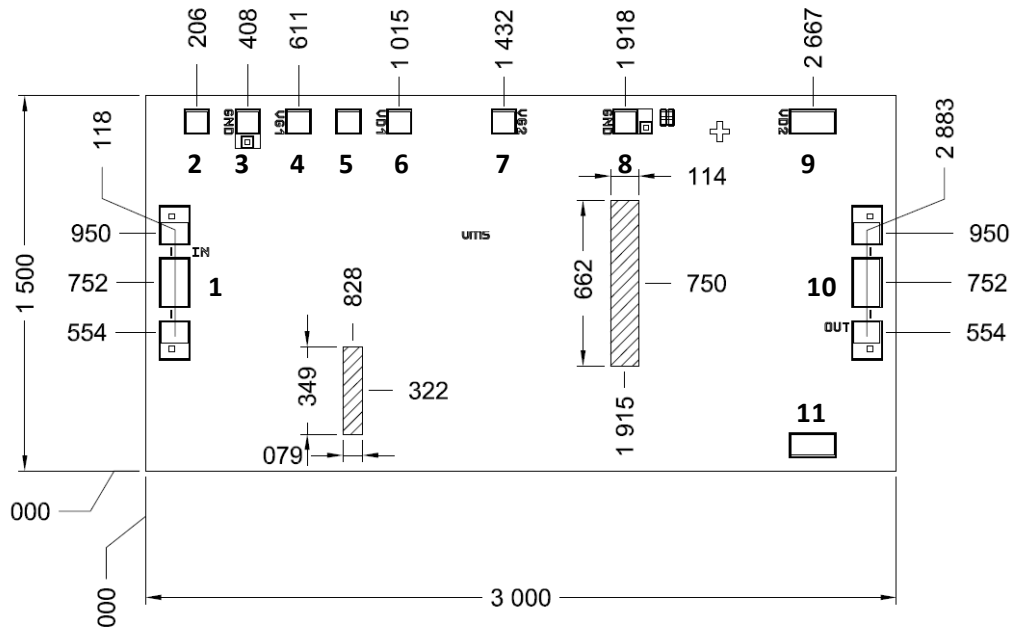
Power added efficiency @ 1 & 3dBcomp versus Frequency



Drain current @ 1 & 3dBcomp versus Frequency



Mechanical data



 Active device

UNITS : µm

Tol : ±35µm

Chip thickness: 70µm ±10µm

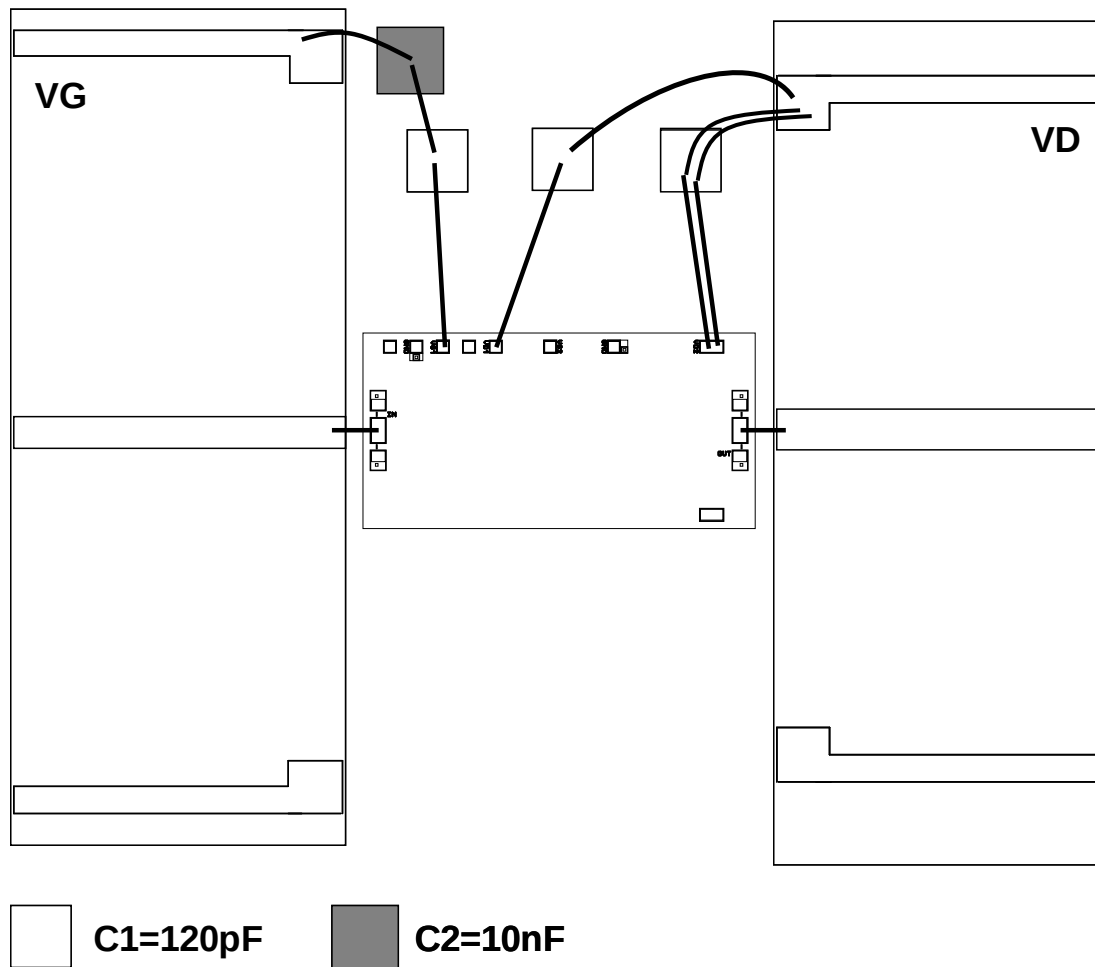
Chip size: 3000µm x 1500µm ±35µm

All dimensions are in micrometers

RF pads (1, 10) = 128 x 200µm²
 DC pads (4, 6, 7, 8) = 100 x 100µm²
 DC pad 9 = 200 x 100µm²

Pin number	Pin name	Description
1	IN	Input RF
2; 5; 11	-	Not Connected
4	VG1	Vg1
6	VD1	Vd1
7	VG2	Not Connected
3; 8	GND	Not Connected
9	VD2	Vd2
10	OUT	Output RF

Recommended assembly plan



25μm wedge bonding is preferred

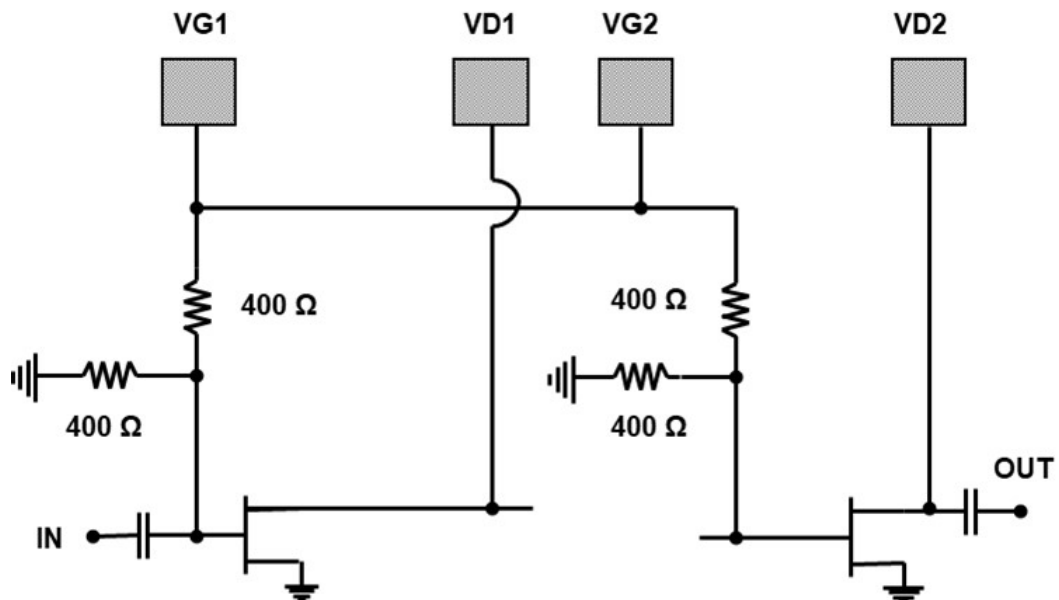
Note: Equivalent RF Wire Bonding: 0.25nH (typical length of 200μm for a 25μm diameter wire).

Recommended circuit bonding table

Port	Connection	External capacitor
IN	Inductance (Lbonding) = 0.3nH 400μm length with a wire diameter of 25 μm	
OUT	Inductance (Lbonding) = 0.3nH 400μm length with a wire diameter of 25 μm	
VG	Inductance ≤ 1nH	C1 ~ 120pF, C2 ~ 10nF
VD	Inductance ≤ 1nH	C1 ~ 120pF

DC Schematic

Medium Power Amplifier: 8V, 350mA



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:

CHA6005-99F/00

Information furnished is believed to be accurate and reliable. However **United Monolithic Semiconductors S.A.S.** assumes no responsibility for the consequences of use of such information nor for any infringement of patents or other rights of third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of **United Monolithic Semiconductors S.A.S.**. Specifications mentioned in this publication are subject to change without notice. This publication supersedes and replaces all information previously supplied. **United Monolithic Semiconductors S.A.S.** products are not authorised for use as critical components in life support devices or systems without express written approval from **United Monolithic Semiconductors S.A.S.**