17-26GHz Medium Power Amplifier

GaAs Monolithic Microwave IC

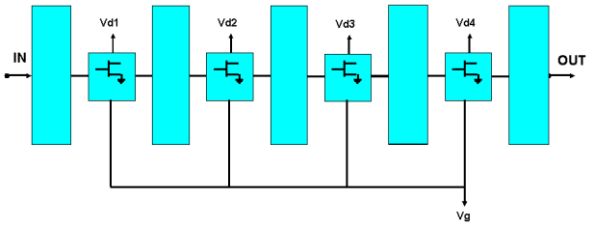
Description

The CHA5050-99F is a four stage monolithic MPA that provides typically 25.5dBm of output power associated to 20% of power added efficiency at 3dB gain compression.

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

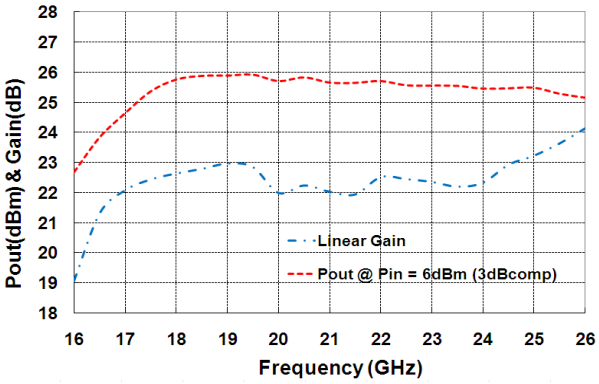
The circuit is manufactured with a pHEMT process, 0.25µm gate length, via holes through the substrate, air bridges and electron beam gate lithography.

It is available in chip form.



Main Features

- 0.25µm Power pHEMT Technology
- Frequency band: 17-26GHz
- Output power: 25.5dBm @ 3dBcomp
- Linear gain: 22dB
- Quiescent bias point: Vd=6V, Id=230 mA
- Chip size: 2.38x1.14x0.07mm



Main Electrical Characteristics

Tamb =+25°C,
Vd = 6V, Id (Quiescent) = 230 mA, CW mode.

Symbol	Parameter	Min	Typ	Max	Unit
Freq	Frequency range	17.0		26.0	GHz
Gain	Linear Gain		22.0		dB
Pout	Output Power @1dB comp.		25.0		dBm

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Electrical Characteristics

Tamb =+25°C, Vd = 6V, Id (Quiescent) = 230 mA, CW mode.

Symbol	Parameter	Min	Typ	Max	Unit
Fop	Operating frequency	17		26	GHz
G	Small signal gain		22		dB
RLin	Input Return Loss		8		dB
RLout	Output Return Loss		10		dB
P_{-1dB}	Output power @ 1dBcomp		25		dBm
P_{-3dB}	Output power @ 3dBcomp		25.5		dBm
PAE_ P_{-3dB}	Power Added Efficiency @ 3dBcomp		20		%
Id_ P_{-3dB}	Supply drain current @ 3dBcomp		320		mA
Vd1, Vd2	Drain supply voltage		6		V
Id	Supply quiescent current (1)		230		mA
Vg	Gate supply voltage		-0.5		V

These values are representative of on-wafer measurements that are made without bonding wires at the RF ports.
A bonding wire of typically 0.2 to 0.25nH will improve the matching at the accesses.

Absolute Maximum Ratings (1)

Tamb.= +25°C

Symbol	Parameter	Values	Unit
Cmp	Compression level (2)	8	dB
Vd	Supply voltage (3)	8	V
Id	Supply quiescent current	400	mA
Id_sat	Supply current in saturation	450	mA
Vg	Supply voltage	-0.2	V
Tj	Maximum junction temperature	175	°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) Without RF input power.

Typical Bias Conditions

Tamb.= +25°C

Symbol	Pad N°	Parameter	Values	Unit
Vd	D1,D2,D3,D4	DC drain Voltage	6	V
Vg	G1	DC gate Voltage	≈-0.5(1)	V
Id		DC Drain current controlled with Vg	230	mA

(1) To be adjusted until to obtain Id: 230mA

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Typical on-wafer Sij parameters

Tamb.= +25°C, Vd =+6V, Id =230 mA, CW mode.

Freq (GHz)	S11 (dB)	PhS11 (°)	S12 (dB)	PhS12 (°)	S21 (dB)	PhS21 (°)	S22 (dB)	PhS22 (°)
Freq	dBS11	PhS11	dBS12	PhS12	dBS21	PhS21	dBS22	PhS22
1.00	-0.06	-11.52	-65.84	129.40	-51.96	-45.86	-0.10	-11.30
2.00	-0.11	-22.78	-70.73	150.50	-48.12	-131.60	-0.08	-22.62
3.00	-0.19	-34.46	-73.59	-100.10	-51.41	142.40	-0.12	-34.68
4.00	-0.37	-46.03	-67.18	-35.91	-49.98	31.35	-0.20	-47.36
5.00	-0.59	-57.83	-68.21	-41.60	-45.46	-69.67	-0.41	-60.86
6.00	-0.82	-69.91	-71.44	93.39	-47.85	-138.80	-0.70	-75.99
7.00	-1.19	-82.40	-76.13	130.40	-40.31	160.80	-1.38	-93.16
8.00	-1.69	-95.15	-67.42	-117.50	-30.30	105.40	-2.72	-111.90
9.00	-2.40	-108.60	-84.26	56.99	-21.08	41.44	-5.15	-130.00
10.00	-3.38	-122.40	-62.14	7.22	-14.37	-29.19	-8.57	-143.10
11.00	-4.78	-137.70	-64.54	10.29	-9.26	-89.26	-13.11	-155.50
12.00	-6.88	-153.10	-74.45	-129.90	-4.29	-141.10	-24.33	-154.30
13.00	-10.60	-167.50	-60.49	-134.50	0.96	170.10	-17.65	-33.06
14.00	-17.65	176.20	-61.05	-145.40	6.61	119.80	-11.24	-44.64
15.00	-26.57	-66.82	-66.18	-129.30	12.67	64.91	-8.42	-61.70
16.00	-16.13	-80.08	-65.08	73.52	18.72	-2.23	-7.18	-78.01
17.00	-21.30	-97.79	-66.74	-179.60	22.17	-84.34	-6.45	-95.20
18.00	-15.82	-41.25	-72.50	-132.10	22.90	-156.10	-6.81	-113.10
19.00	-10.26	-49.12	-58.77	-174.20	22.60	141.50	-8.92	-129.20
20.00	-8.27	-63.27	-58.87	-172.90	22.26	86.10	-11.55	-131.30
21.00	-7.38	-72.30	-60.64	161.10	21.86	36.20	-12.56	-121.00
22.00	-5.87	-82.61	-55.85	99.18	21.95	-12.88	-12.77	-119.00
23.00	-5.69	-94.05	-58.92	121.60	22.12	-57.51	-12.01	-122.20
24.00	-6.05	-105.80	-59.39	116.40	23.02	-104.50	-13.18	-136.70
25.00	-7.30	-111.60	-64.00	22.15	23.74	-156.60	-17.84	-131.50
26.00	-8.80	-108.40	-64.31	-12.45	24.33	148.40	-17.29	-80.63
27.00	-8.62	-94.46	-67.93	-130.00	24.12	87.81	-11.71	-73.06
28.00	-6.47	-86.97	-56.53	-164.80	22.73	26.56	-7.99	-83.28
29.00	-3.83	-88.39	-54.45	162.30	20.39	-32.26	-5.80	-98.65
30.00	-1.90	-98.80	-53.49	174.90	17.48	-89.01	-4.42	-114.20
31.00	-0.89	-111.60	-50.44	160.30	13.75	-142.20	-3.54	-129.70
32.00	-0.51	-122.60	-46.61	136.40	9.64	169.10	-3.07	-144.50
33.00	-0.28	-132.30	-44.40	116.90	5.36	124.50	-2.66	-159.30
34.00	-0.33	-140.60	-44.16	80.16	0.96	81.63	-2.46	-174.30
35.00	-0.19	-147.80	-44.33	67.77	-3.56	41.54	-1.93	170.50
36.00	-0.17	-154.70	-44.49	39.31	-8.48	1.91	-1.69	154.00
37.00	-0.17	-160.60	-45.12	24.13	-13.91	-35.51	-1.36	136.00
38.00	-0.16	-166.50	-46.36	7.06	-20.14	-70.88	-0.82	116.80

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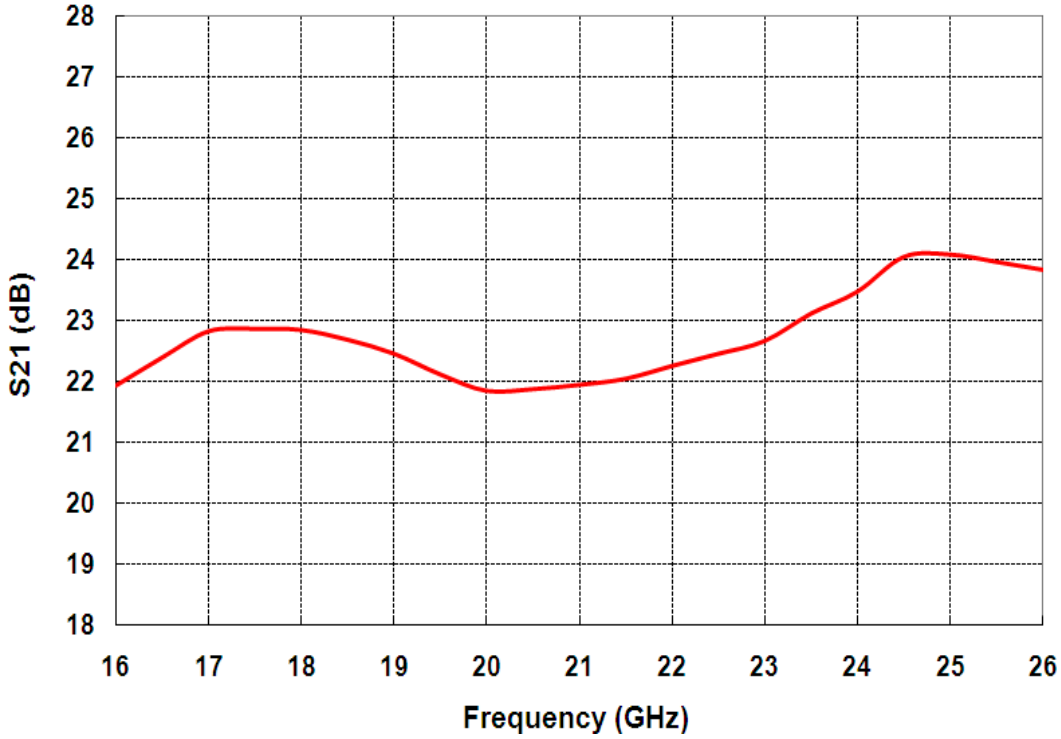
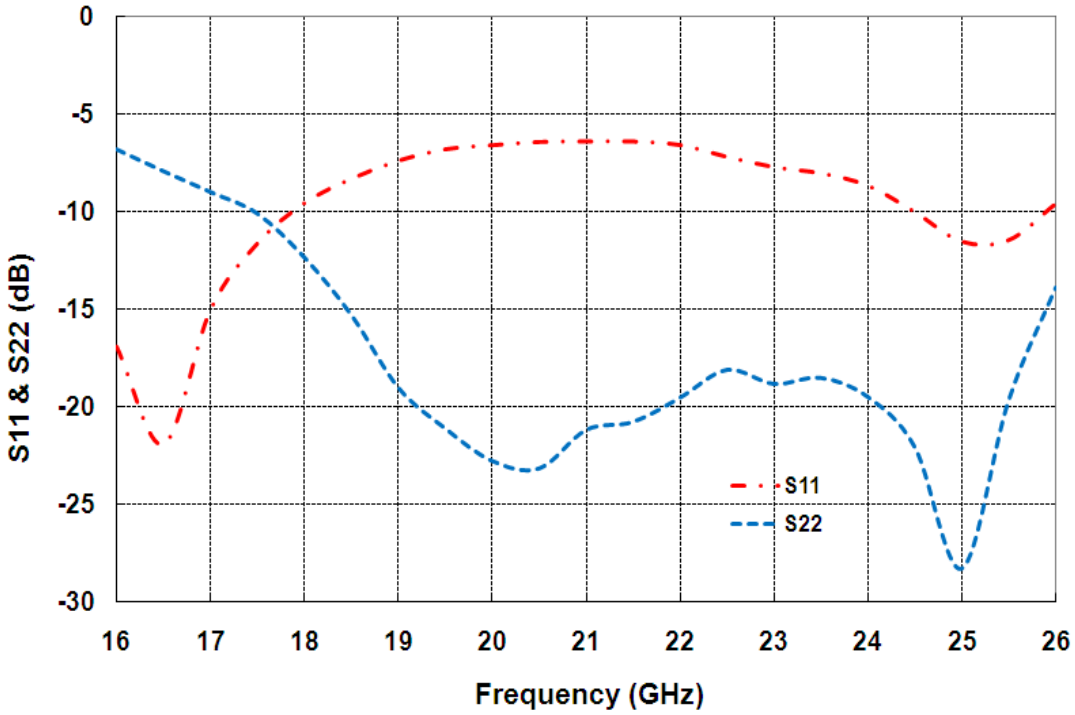
Typical on wafer Measurements

Tamb= +25°C; Vd =6V, Id (Quiescent) =230 mA, CW mode

Linear Gain versus frequency



Return losses versus frequency



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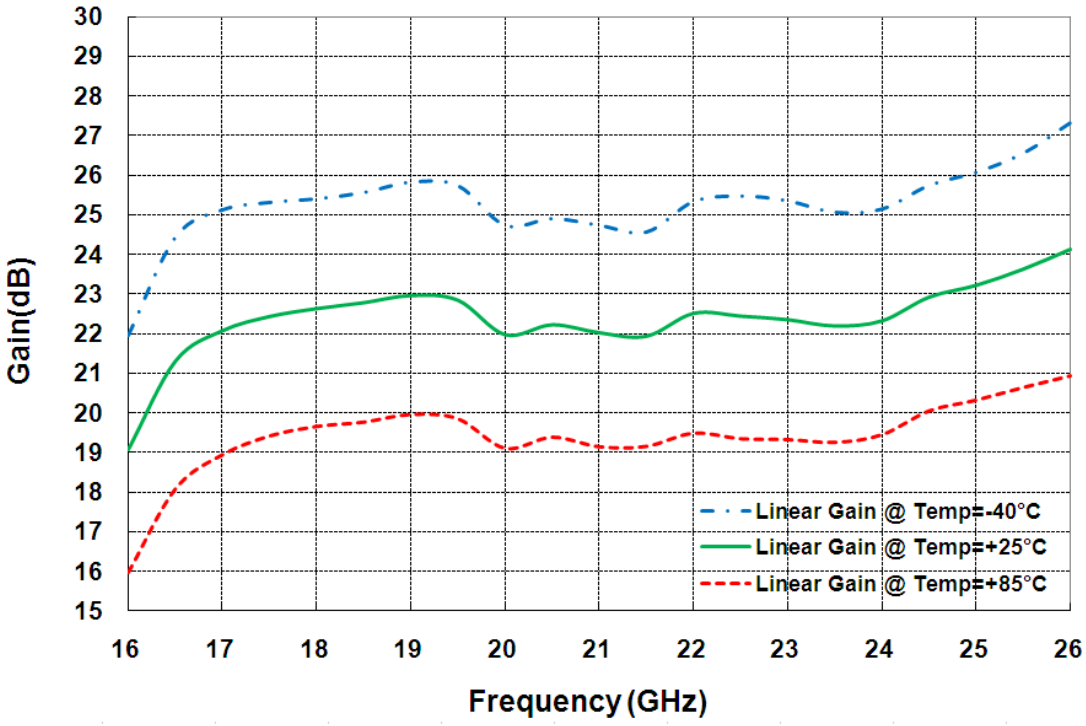
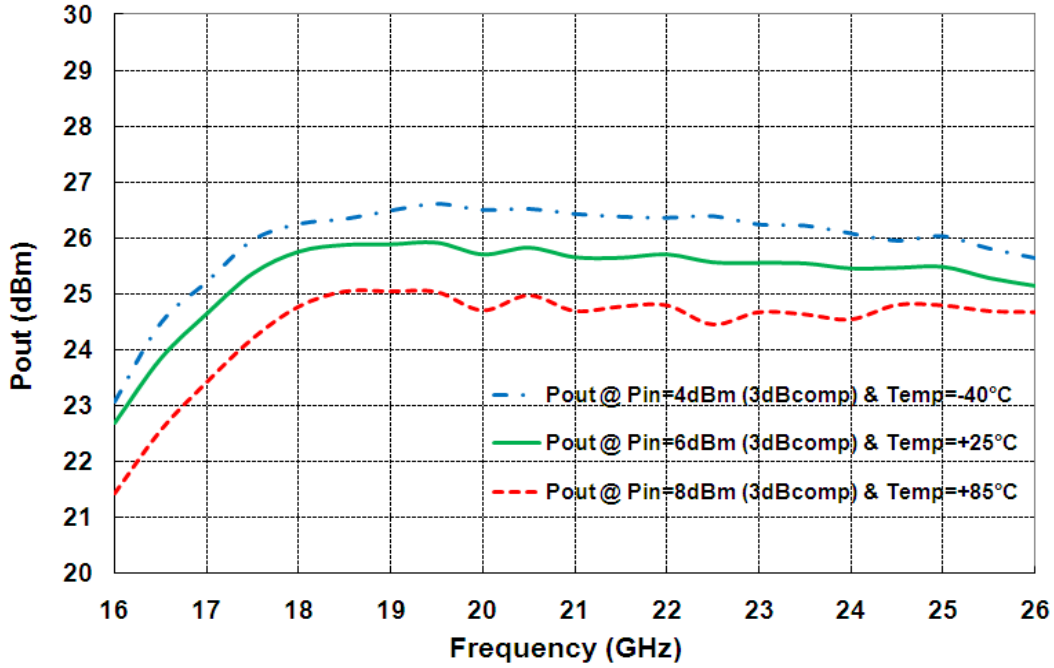
Typical Test Fixture Measurements

Temp= -40°C, +25°C, +85°C; Vd =6V, Id (Quiescent) =230 mA, CW mode

Linear Gain @ Temp=-40°C, +25°C, +85°C versus frequency



Output Power @ ≈3dBcomp & Temp=-40°C, +25°C, +85°C versus frequency



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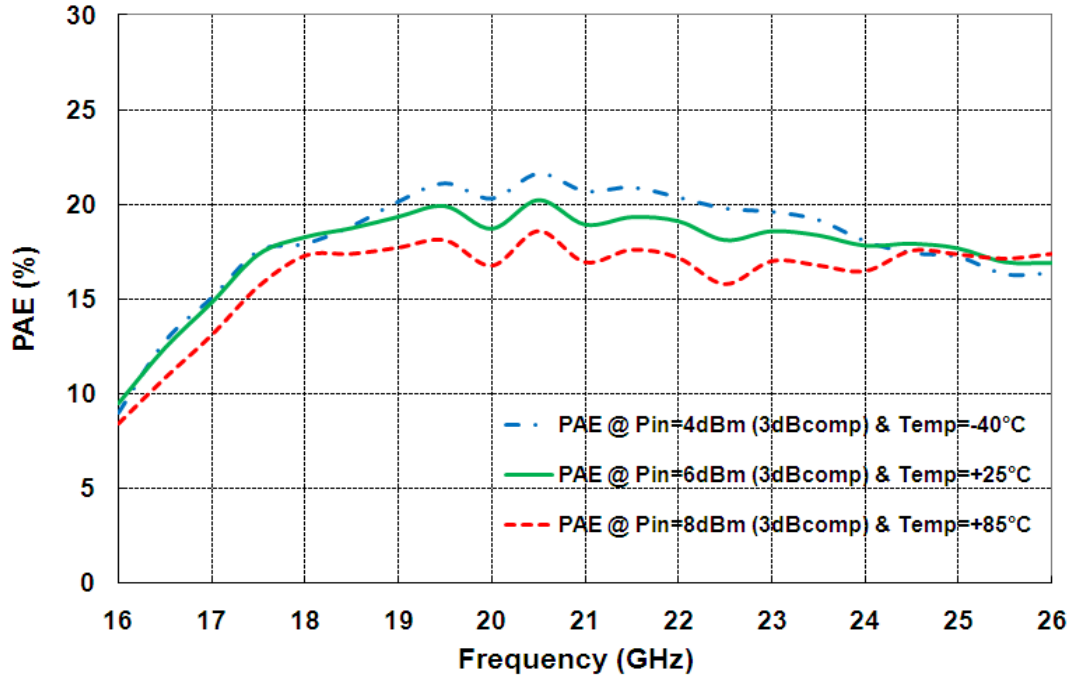
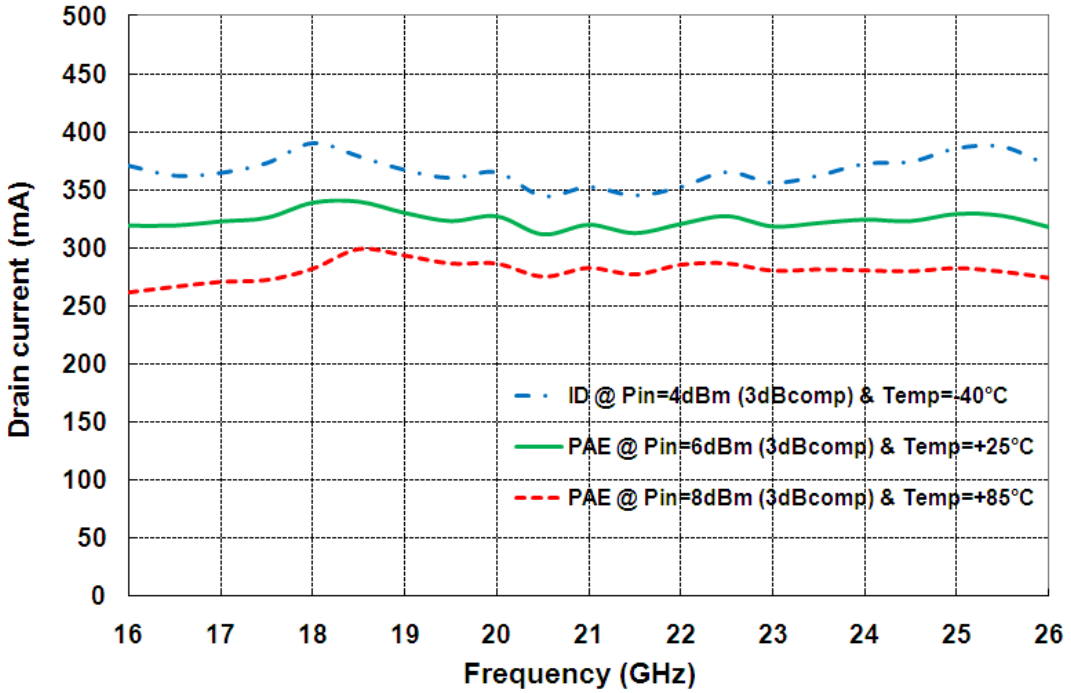
Typical Test Fixture Measurements

Temp= -40°C, +25°C, +85°C; Vd =6V, Id (Quiescent) =230 mA, CW mode

PAE @ ≈3dBcomp & Temp=-40°C, +25°C, +85°C versus frequency



Drain current @ ≈3dBcomp & Temp=-40°C, +25°C, +85°C versus frequency



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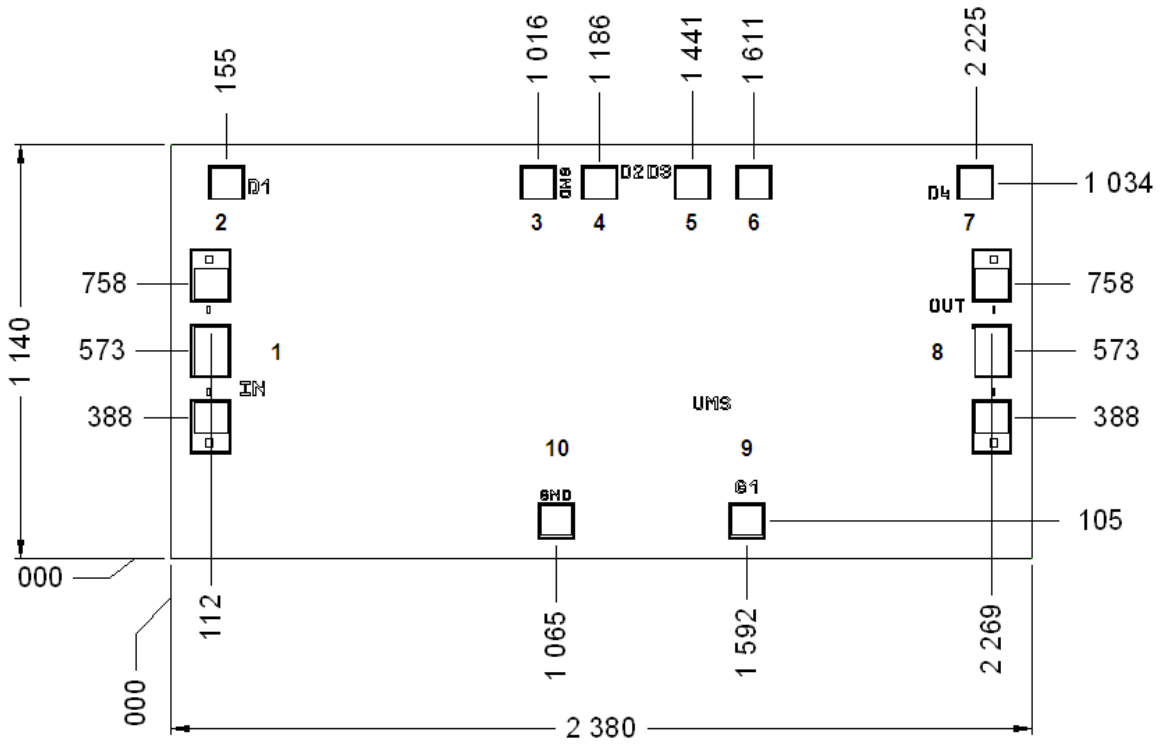
Mechanical data



All dimensions are in micrometers
Chip size = 2380x1140 ±35µm
Chip thickness = 70µm ±10µm
RF pads (1, 8) = 110 x 150µm²
DC pads (2, 4, 5, 7, 9) = 100 x 100µm²
Chip width and length are given with a tolerance of ±35µm

Pin number	Pin name	Description
1	IN	Input RF
2	D1	Vd1
3, 6, 10	GND	NC
4	D2	Vd2
5	D3	Vd3
7	D4	Vd4
8	OUT	Output RF
9	G1	Vg

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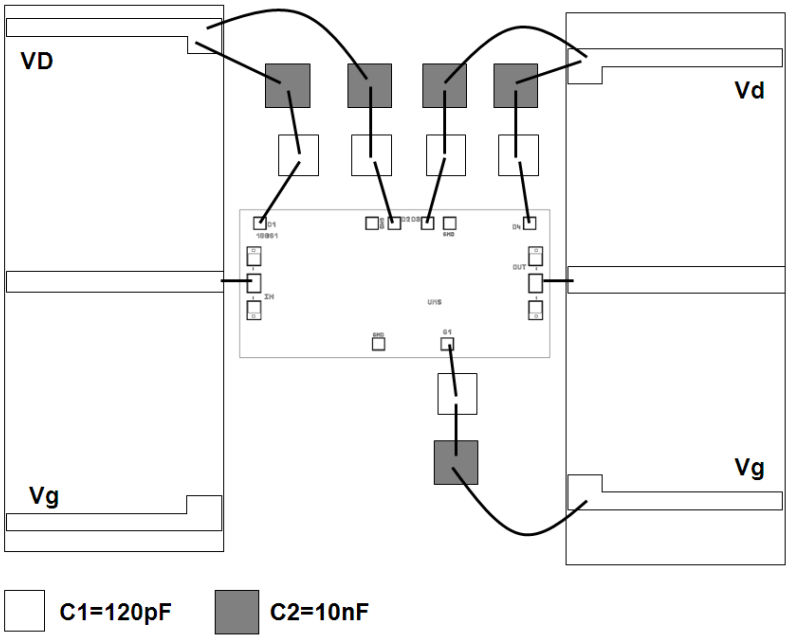
Recommended assembly plan



Bonding recommendations

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

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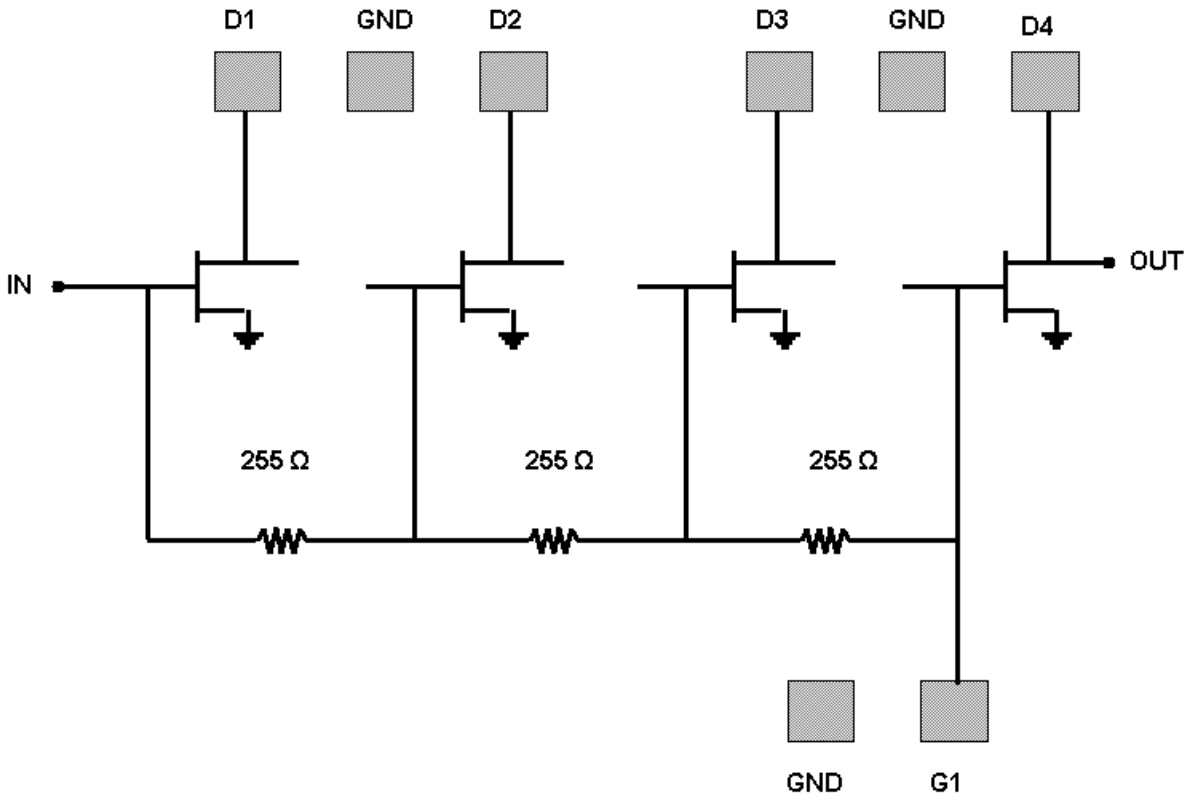
DC Schematic

Medium Power Amplifier: 6V, 230mA



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Recommended ESD management

Refer to the application note AN0020 available at http://www.ums-gaas.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 http://www.ums-gaas.com.

Ordering Information

Chip form:	CHA5050-99F/00

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