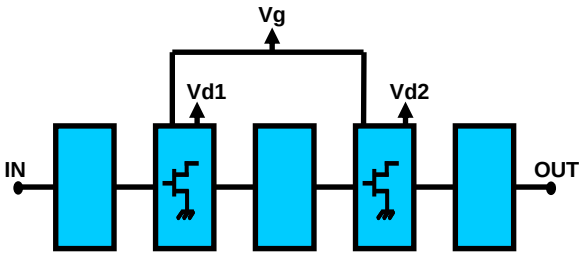
X-band Medium Power Amplifier

GaAs Monolithic Microwave IC

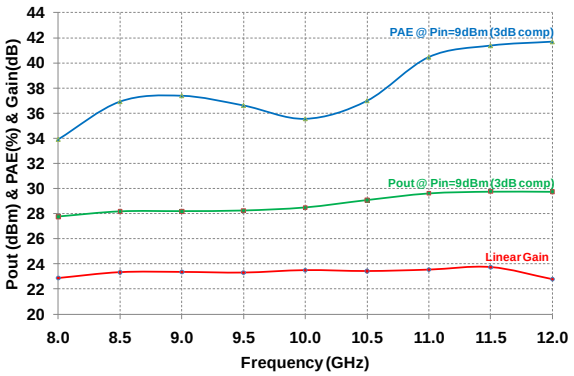
Description

The CHA5115-99F is a monolithic two-stage GaAs medium power amplifier designed for X-band applications.
The MPA provides typically 28dBm output power associated to 37% power added efficiency at 3dB gain compression.
This device is manufactured using 0.25µm Power pHEMT process, including, via holes through the substrate and air bridges.
It is available in chip form.



Main Features

- 0.25µm Power pHEMT Technology
- Frequency band: 8-12GHz
- Output power: 28dBm @ 3dBcomp
- Linear gain: 23dB
- High PAE: 37% @ 3dBcomp
- Noise Factor: 5dB typ.
- Quiescent bias point: Vd=8V, Id=0.17A
- Chip size: 2.37x1.82x0.07mm



Main Characteristics

Tamb =+25°C, Vd =8V, Id (Quiescent) =170mA, Drain Pulse width =100µs, Duty cycle = 20%

Symbol	Parameter	Min	Typ	Max	Unit
Fop	Operating frequency range	8		12	GHz
PAE_P_{-3dB}	Power added efficiency @3dBcomp		37		%
P_{-3dB}	Output power @ 3dBcomp		28		dBm

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Main Characteristics on wafer

Tamb =+25°C,
Vd =8V, Id (Quiescent) =170mA, Drain Pulse width =100µs, Duty cycle = 20%

Symbol	Parameter	Min	Typ	Max	Unit
Fop	Operating frequency	8		12	GHz
G	Small signal gain		23		dB
RLin	Input Return Loss		10		dB
RLout	Output Return Loss		8		dB
P_{-1dB}	Ouput power @ 1dBcomp		27		dBm
P_{-3dB}	Output power @ 3dBcomp		28		dBm
PAE_ P_{-3dB}	Power Added Efficiency @ 3dBcomp		37		%
Id_ P_{-3dB}	Supply drain current @ 3dBcomp		250		mA
NF	Noise Factor		5		dB
Vd1, Vd2, Vd3	Drain supply voltage		8		V
Id	Supply quiescent current (1)		170		mA
Vg	Gate supply voltage		-1		V

(1) Parameter can be adjusted by tuning of Vg.

Absolute Maximum Ratings (1)

Tamb.= +25°C

Symbol	Parameter	Values	Unit
Cmp	Compression level (2)	6	dB
Vd	Supply voltage (3)	9.5	V
Id	Supply quiescent current	240	mA
Id_sat	Supply current in saturation	320	mA
Vg	Supply voltage	-0.6	V
Tj	Maximum junction temperature	175	°C
Tstg	Storage temperature range	-55 to +150	°C
Top	Operating temperature range	-40 to +85	°C

(1) Operation of this device above anyone of these parameters may cause permanent damage.
(2) For higher compression the level limit can be increased by decreasing the voltage Vd using the rate 0.5V/dBcomp.
(3) Without RF input power.

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Typical on-wafer Sij parameters

Tamb.= +25°C, Vd =+8V, Id =170mA

Freq (GHz)	S11 (dB)	PhS11 (°)	S12 (dB)	PhS12 (°)	S21 (dB)	PhS21 (°)	S22 (dB)	PhS22 (°)
1.00	-0.14	-17.18	-70.56	131.00	-44.86	93.40	-0.26	-51.82
2.00	-0.89	-38.60	-66.95	58.43	-15.60	140.00	-0.40	-95.81
3.00	-1.92	-36.78	-73.99	162.70	-2.90	-8.50	-0.68	-131.70
4.00	-1.22	-57.88	-66.71	-23.40	-1.76	-77.01	-1.13	-164.70
5.00	-1.62	-79.93	-68.60	-42.68	2.41	-132.20	-2.52	161.00
6.00	-2.65	-106.50	-69.42	-101.30	8.40	166.70	-5.64	118.50
7.00	-5.44	-142.00	-56.24	-167.90	15.64	86.30	-12.37	45.77
8.00	-13.17	167.30	-50.35	139.40	20.84	-22.05	-12.57	-72.91
9.00	-13.29	-2.85	-48.75	40.44	21.50	-132.90	-9.43	-116.00
10.00	-7.26	-77.96	-47.40	-32.68	20.93	130.80	-7.34	-137.20
11.00	-10.87	-133.00	-47.35	-116.50	22.08	33.31	-5.92	-170.10
12.00	-14.26	-85.45	-45.87	122.00	22.20	-88.45	-8.73	143.50
13.00	-7.25	-92.43	-47.87	-22.55	18.59	130.10	-9.89	38.02
14.00	-4.33	-141.80	-51.68	-142.90	7.69	10.25	-6.96	-56.60
15.00	-3.88	-178.60	-55.91	169.30	-1.59	-83.07	-4.89	-86.78
16.00	-3.47	148.50	-60.96	100.90	-11.16	161.30	-3.08	-104.30
17.00	-3.11	119.80	-59.85	115.40	-29.52	59.84	-2.15	-118.40
18.00	-2.73	97.19	-58.71	98.78	-55.66	27.94	-1.28	-129.10
19.00	-2.39	75.26	-59.21	102.80	-60.45	26.28	-0.80	-139.10
20.00	-1.98	57.37	-64.93	76.45	-52.10	-9.35	-0.40	-148.40
21.00	-1.62	42.54	-65.58	38.34	-64.57	-54.50	-0.08	-156.30
22.00	-1.43	28.22	-62.58	37.89	-55.29	97.29	0.15	-163.10
23.00	-1.16	15.69	-64.00	66.25	-51.78	79.43	0.20	-169.90
24.00	-0.93	5.85	-68.67	84.00	-52.42	-13.69	0.29	-177.20
25.00	-0.93	-4.28	-83.68	-105.10	-58.90	-174.90	0.51	178.20
26.00	-0.58	-13.45	-78.90	5.21	-54.56	160.70	0.16	171.70
27.00	-0.50	-21.55	-70.72	-47.68	-60.62	80.79	0.14	166.50
28.00	-0.79	-29.11	-78.47	-60.17	-57.15	-72.92	0.29	162.60
29.00	-0.46	-35.82	-61.80	-177.60	-53.85	-148.30	0.15	159.00
30.00	-0.06	-41.62	-55.89	177.40	-54.31	178.90	0.10	153.30

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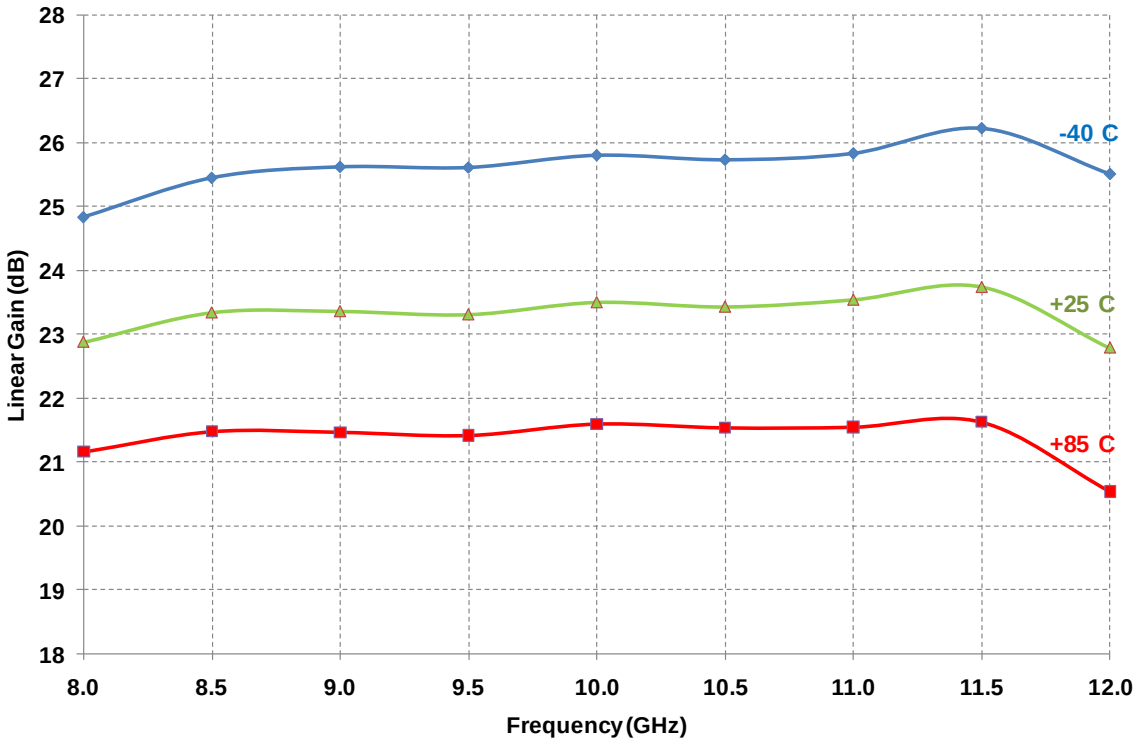
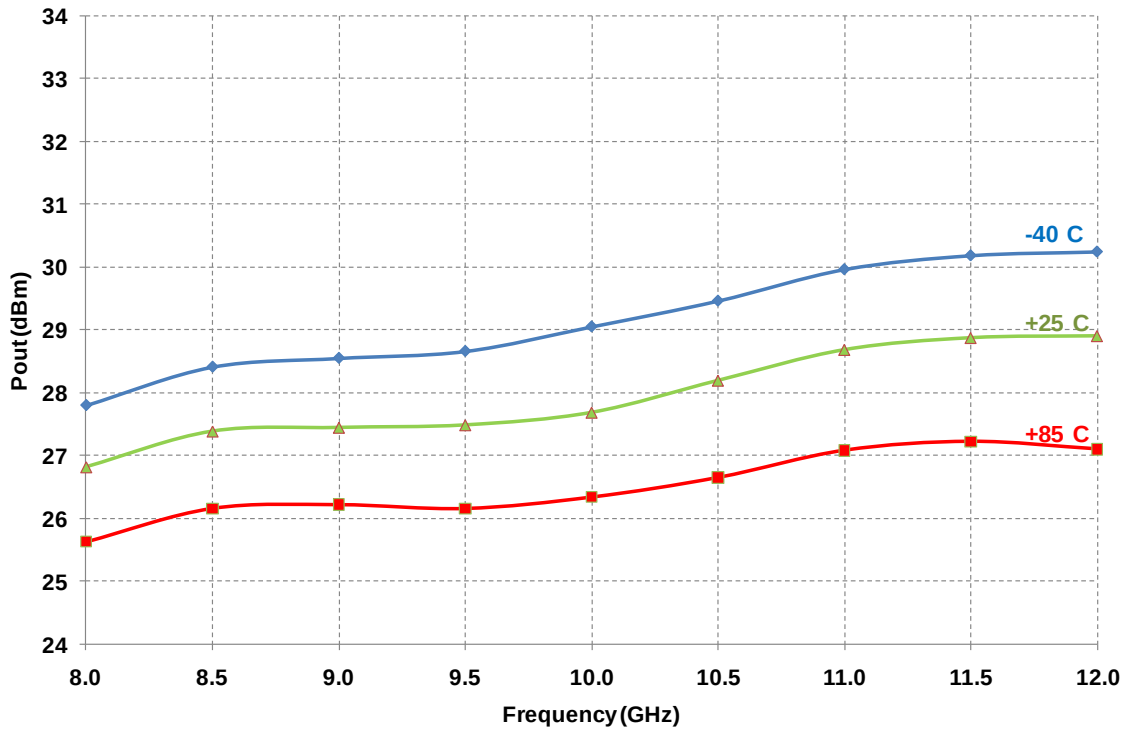
Typical on Jig Measurements

Tamb= -40°C/+25°C/+85°C;
Vd =8V, Id (Quiescent) =170mA, Drain Pulse width =100µs, Duty cycle =20%

Linear Gain versus frequency



Output Power @ Pin=6dBm (1dB comp) versus frequency



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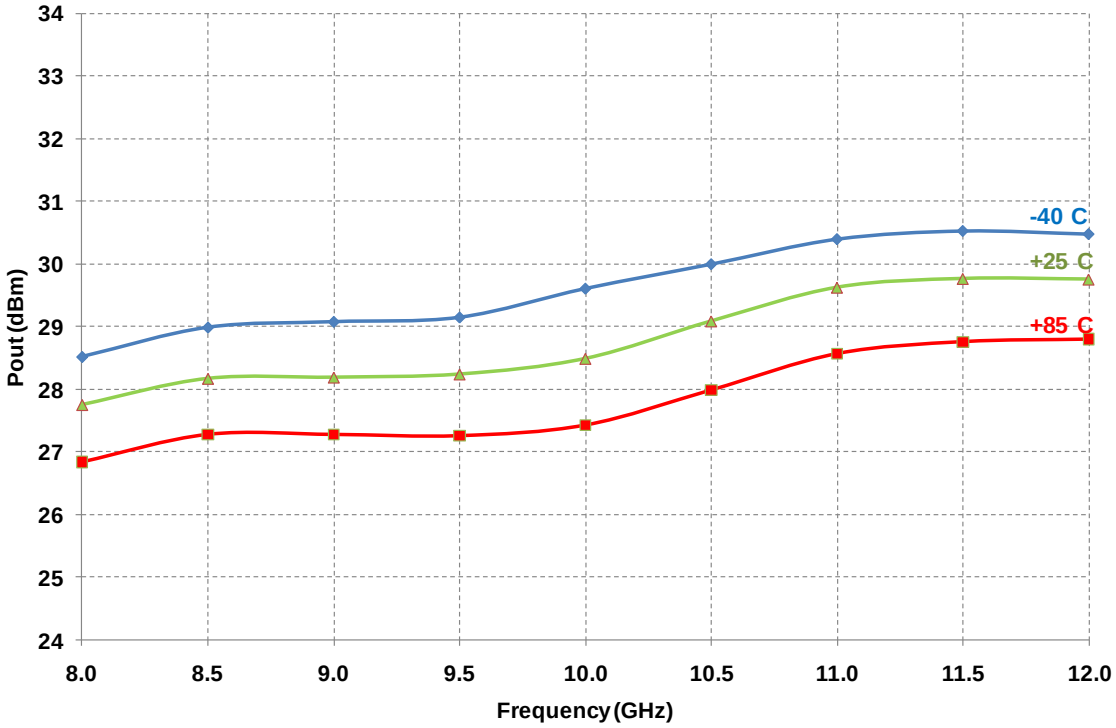
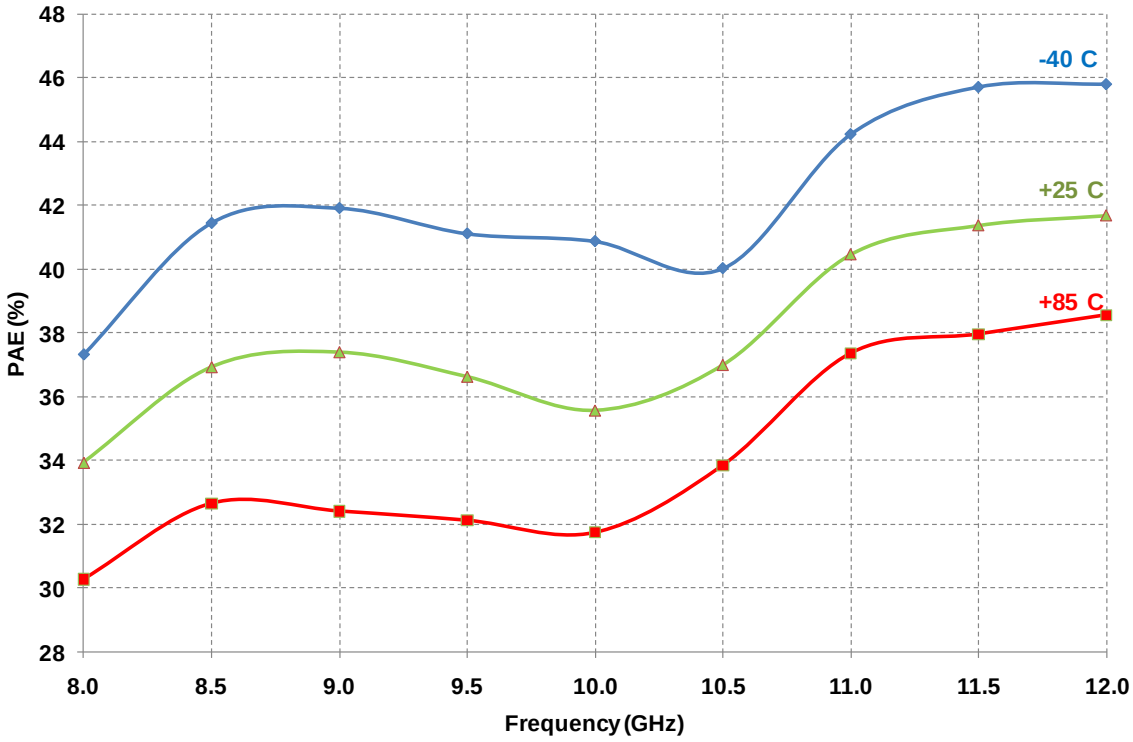
Tamb= -40°C/+25°C/+85°C;
Vd =8V, Id (Quiescent) =170mA, Drain Pulse width =100µs, Duty cycle =20%

Output Power @ Pin=9dBm (3dB comp) versus frequency



Power added efficiency @ Pin=9dBm (3dBcomp) versus frequency



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Tamb= -40°C/+25°C/+85°C;
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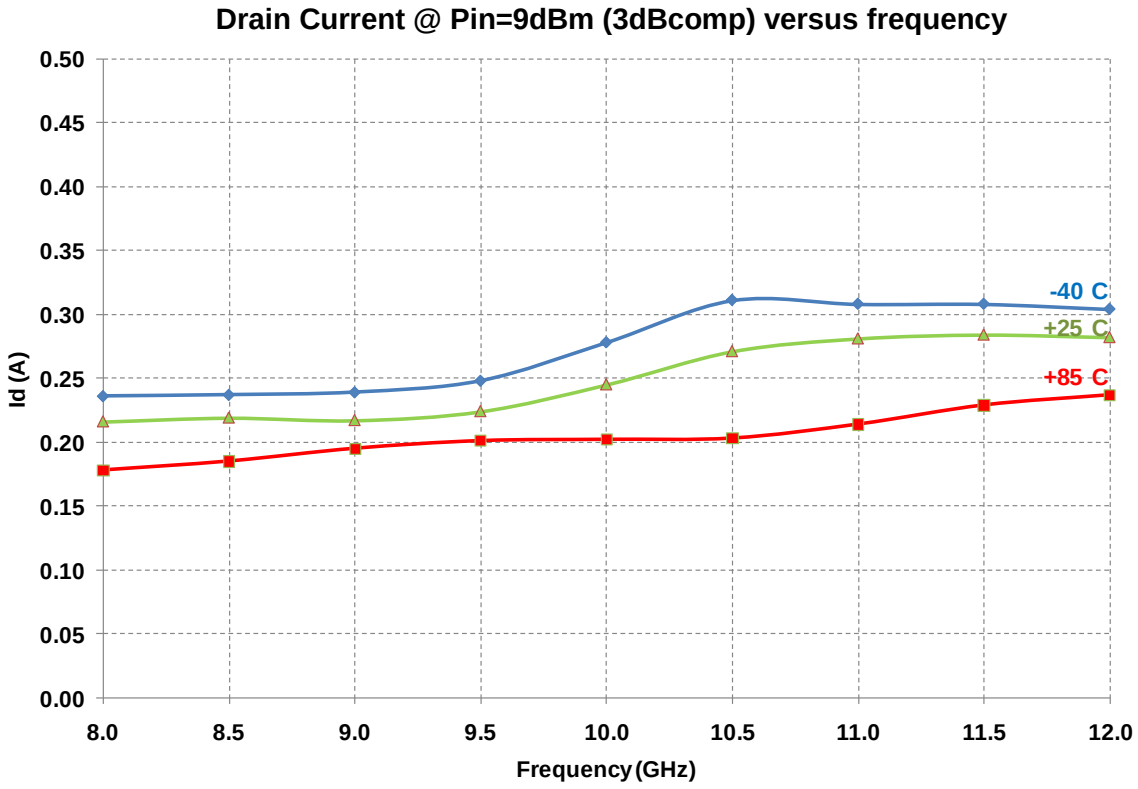

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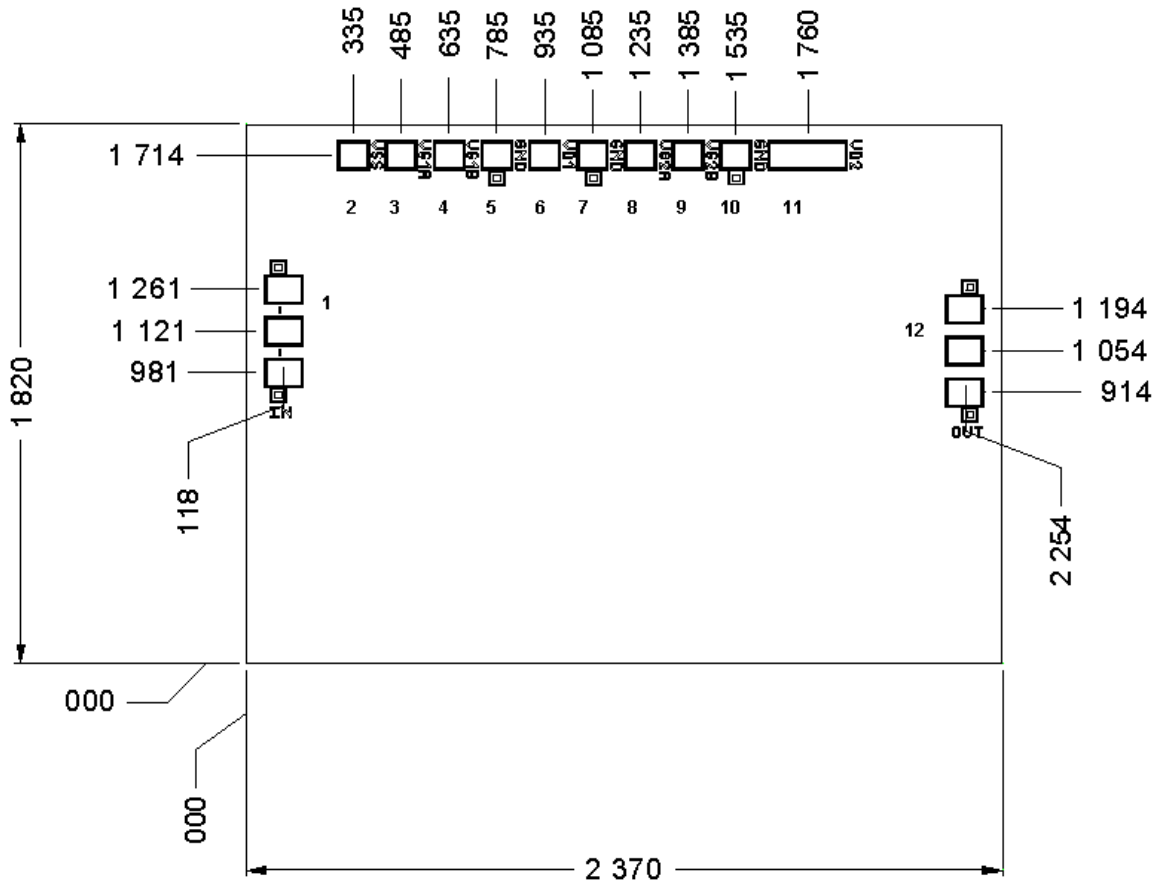
Mechanical data



All dimensions are in micrometers
Chip size = 1820x2370 ±35µm
Chip thickness = 70µm ±10µm
RF pads (1, 12) = 100 x 122µm²
DC pads (3, 6, 8, 11) = 100 x 100µm²
Chip width and length are given with a tolerance of ±35µm

Pin number	Pin name	Description
1	IN	Input RF
2, 4	G	NC
3	VG1A	Vg
5, 7, 10	GND	Ground
6, 11	VD1, VD2	Vd
12	OUT	Output RF

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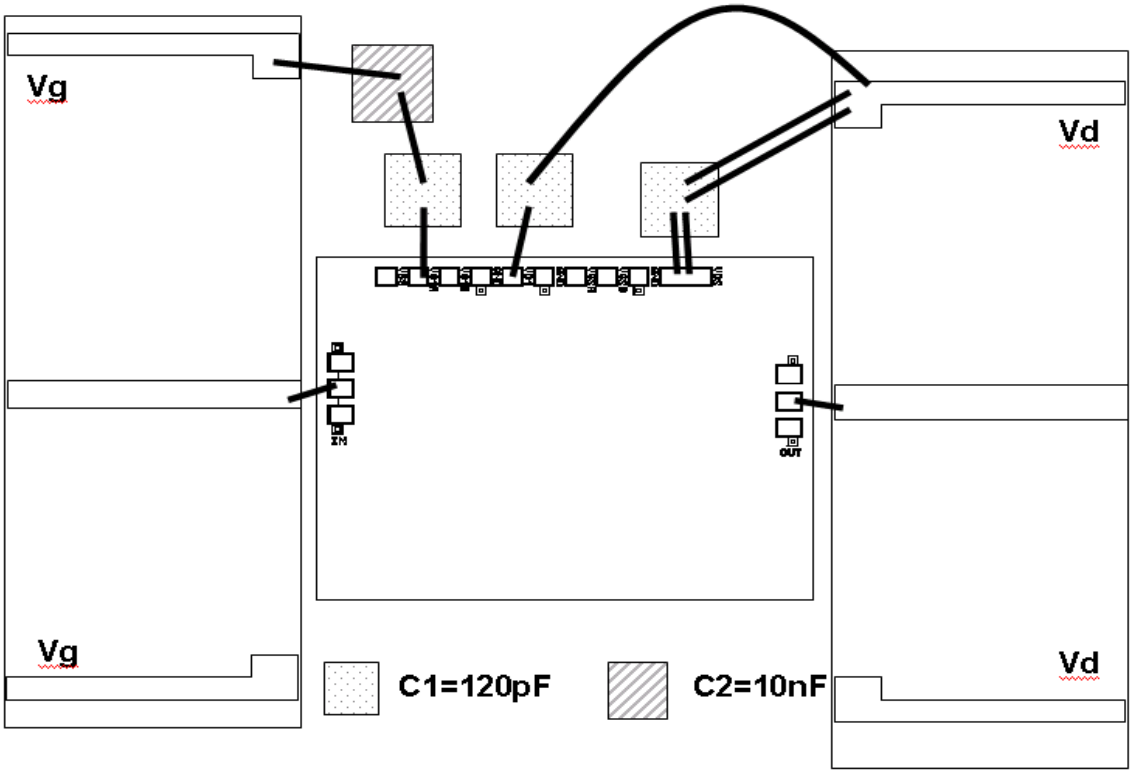
Recommended assembly plan



Pads VG1A (pin 3) & VG2A (pin 8) are connected inside the chip, so the CHA5115 can be used without VG2A bias.
Equivalent RF Wire Bonding: 0.2nH (typical length of 200µm for a 25µm diameter wire).

Bonding recommendations

Port	Connection	External capacitor
IN	Inductance (Lbonding) = 0.3nH 1 gold wire with diameter of 25µm	
OUT	Inductance (Lbonding) = 0.3nH 1 gold wire with diameter of 25µm	
Vg	Inductance ≤ 1nH	C1 ~ 120pF, C2 ~ 10nF
Vd	Inductance ≤ 1nH	C1 ~ 120pF

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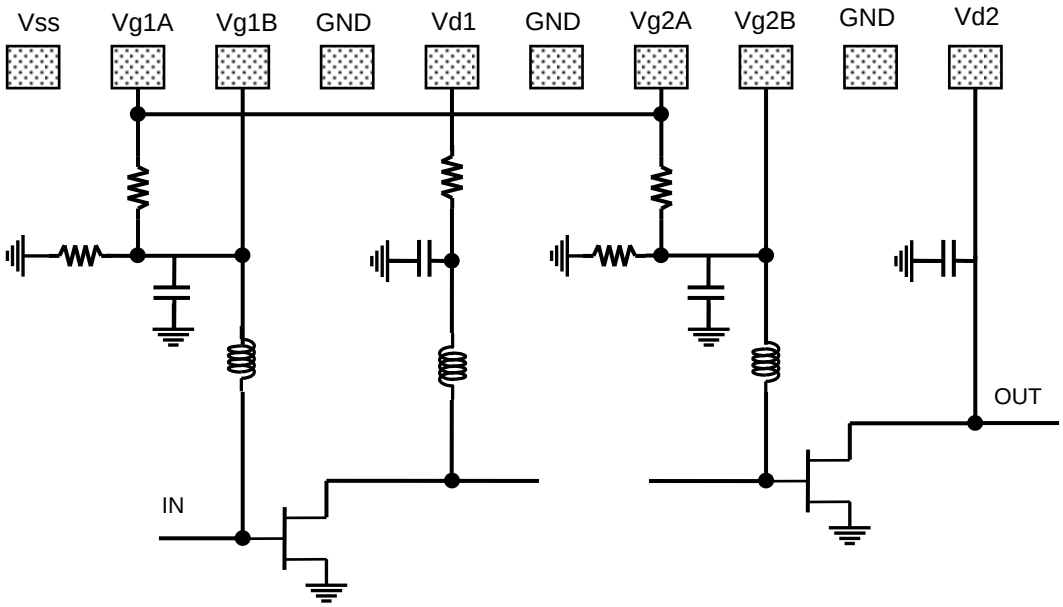
DC Schematic

Medium Power Amplifier: 8V, 170mA



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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.

Ordering Information

Chip form:	CHA5115-99F/00

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