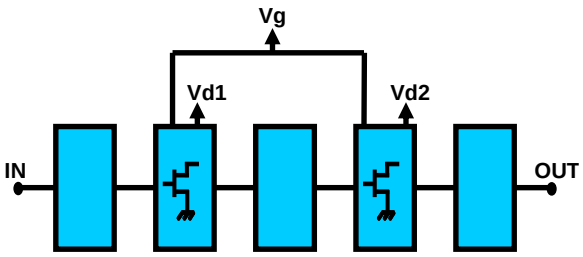
CHA5115-99F

X-band Medium Power Amplifier

GaAs Monolithic Microwave IC

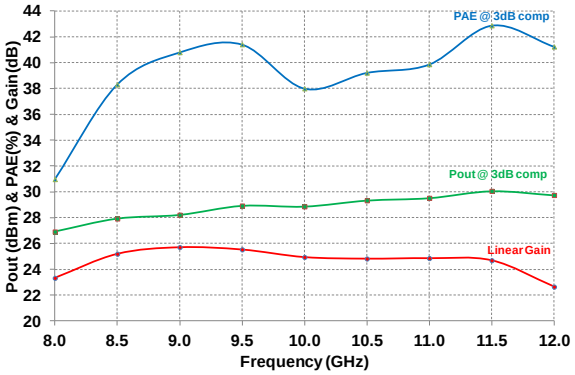
Description

The CHA5115-99F is a monolithic two-stage GaAs medium power amplifier designed for X-band applications.
The MPA provides typically 29dBm output power associated to 39% 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: 29dBm @ 3dBcomp
- Linear gain: 25dB
- High PAE: 39% @ 3dBcomp
- Noise Factor: 5dB typ.
- Quiescent bias point: Vd=8V, Id=0.19A
- Chip size: 2.37x1.82x0.07mm



Main Characteristics

Tamb =+25°C, Vd =8V, Id (Quiescent) =190mA, Drain Pulse width =100µs, Duty cycle = 20%

Symbol	Parameter	Min	Typ	Max	Unit
Fop	Operating frequency range	8		12	GHz
P_{-3dB}	Output power @ 3dB comp		29		dBm
PAE_P_{-3dB}	Power added efficiency @ 3dB comp		39		%

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Electrical Characteristics (Pulsed mode)

Tamb =+25°C,
Vd =8V, Drain Pulse width =100µs, Duty cycle = 20%

Symbol	Parameter	Min	Typ	Max	Unit
Fop	Operating frequency	8		12	GHz
G	Small signal gain		25		dB
RLin	Input Return Loss	8	10		dB
RLout	Output Return Loss	5	8		dB
P_{-1dB}	Ouput power @ 1dBcomp	24.5	28		dBm
P_{-3dB}	Output power @ 3dBcomp	25.5	29		dBm
PAE_ P_{-3dB}	Power Added Efficiency @3dB comp		39		%
Id_ P_{-3dB}	Supply drain current @3dB comp		250		mA
NF	Noise Factor		5		dB
Vd1, Vd2, Vd3	Drain supply voltage		8		V
Id	Supply quiescent current (1)		190		mA
Vg	Gate supply voltage		-1		V

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

Electrical Characteristics (CW mode)

Tamb =+25°C,
Vd =8V, Idq=190mA

Symbol	Parameter	Min	Typ	Max	Unit
Fop	Operating frequency	8		12	GHz
G	Small signal gain		24		dB
RLin	Input Return Loss		10		dB
RLout	Output Return Loss		8		dB
P_{-1dB}	Ouput power @ 1dBcomp		28		dBm
P_{-3dB}	Output power @ 3dBcomp		29		dBm
PAE_ P_{-3dB}	Power Added Efficiency @3dB comp		38		%
Id_ P_{-3dB}	Supply drain current @3dB comp		250		mA
Vd1, Vd2, Vd3	Drain supply voltage		8		V
Id	Supply quiescent current (1)		190		mA
Vg	Gate supply voltage		-1		V

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

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Absolute Maximum Ratings (1)

Tamb.= +25°C

Symbol	Parameter	Values	Unit
Vd	Supply voltage (3)	9.5	V
Id	Supply current	525	mA
Pin	Maximum peak input power overdrive	+20	dBm
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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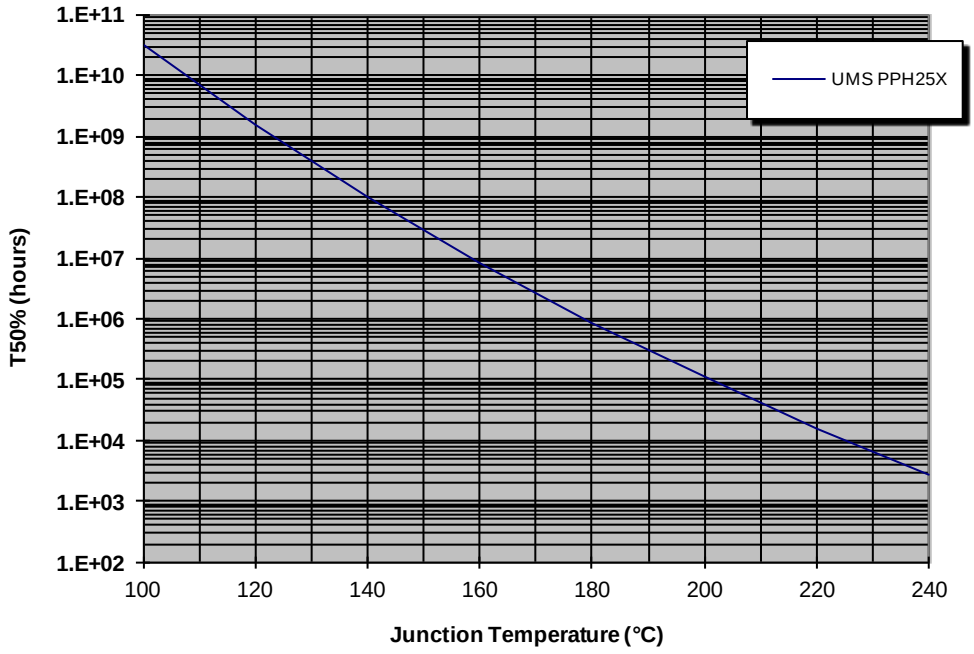
Device thermal information

The thermal performances of the device given below are based on UMS rules to evaluate the junction temperature.
This same procedure is the basis for junction temperature evaluation of the samples used to derive the Median lifetime and activation energy for the particular technology on which the CHA5115-99F is fabricated (AsGa Power PHEMT 0.25µm).
The temperature Tb is defined as the chip back side temperature
The thermal resistance (Rth_eq) is given for the full circuit, and assumes CW operation mode as given in the table.

Parameters	Symbol	Conditions	Value	Unit
Thermal Resistance	Rth_eq	**Tb=85°C**, Vd=8V, Id_drive=0.17A Pin=-20dBm Pout=3.5dBm Pdiss=1.36W **CW mode**	50	°C/W
Junction Temperature	Tj		153	°C
Median Life	T50		$1.96x10^7$	Hrs

Thermal Resistance	Rth_eq	**Tb=85°C**, Vd=8V, Id_drive=0.155A Pin=9dBm (3dB comp) Pout=28dBm Pdiss=1.24W **CW mode**	57	°C/W
Junction Temperature	Tj		157	°C
Median Life	T50		$1.2x10^7$	Hrs

Median Life Time versus Junction Temperature



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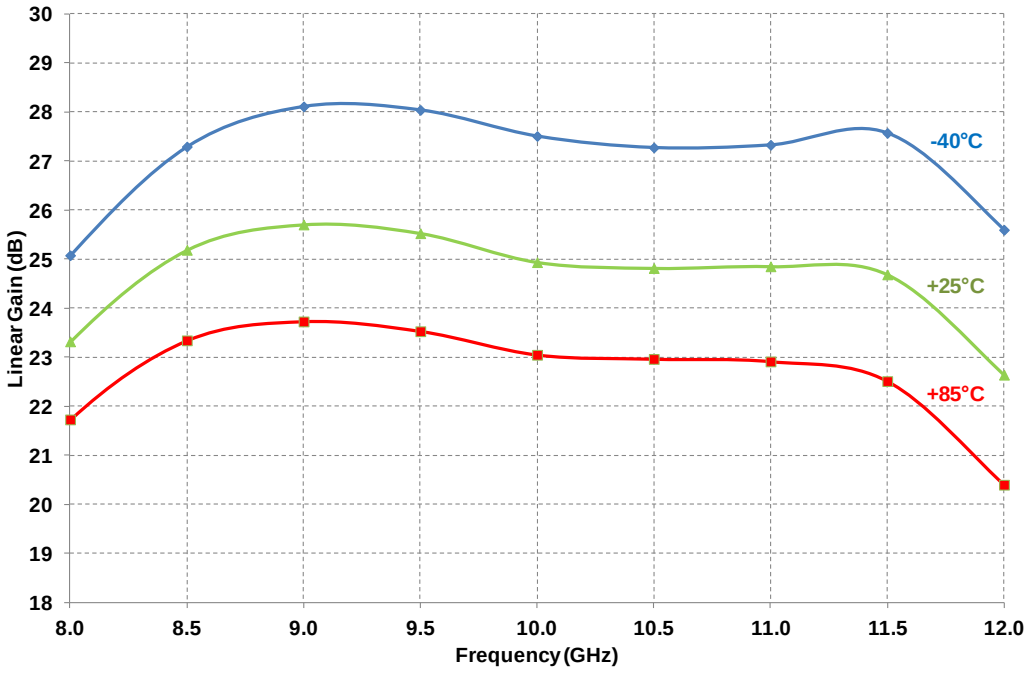
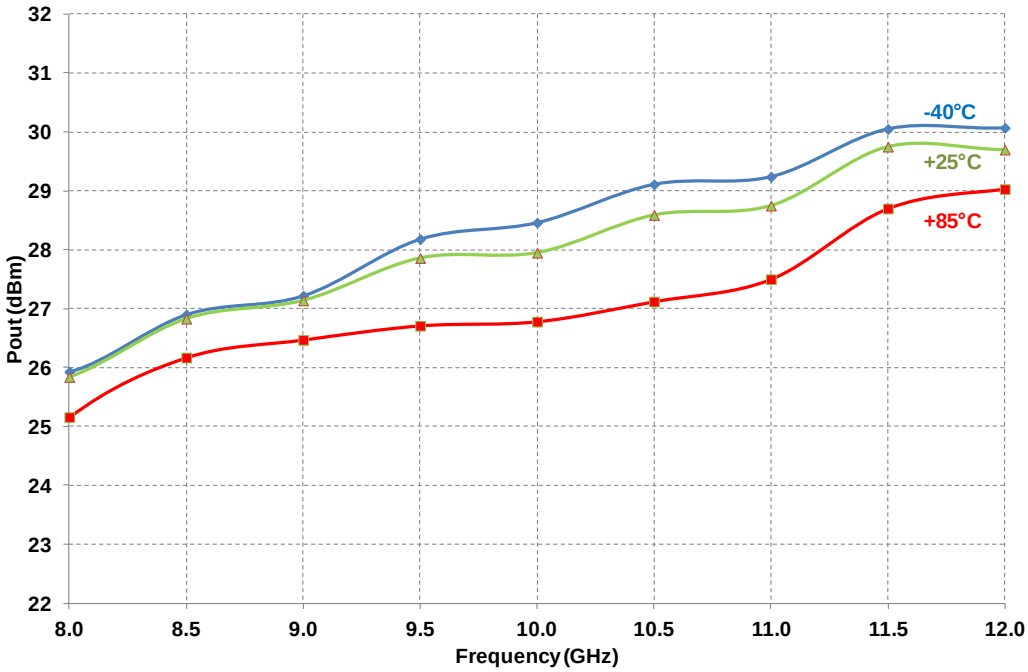
Typical on Jig Measurements (Pulse mode)

Tamb= -40°C/+25°C/+85°C;
Vd =8V, Id (Quiescent) =190mA, Drain Pulse width =100µs, Duty cycle =20%

Linear Gain versus frequency



Output Power @ 1dB comp versus frequency



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Typical on Jig Measurements (Pulse mode)

Tamb= -40°C/+25°C/+85°C;
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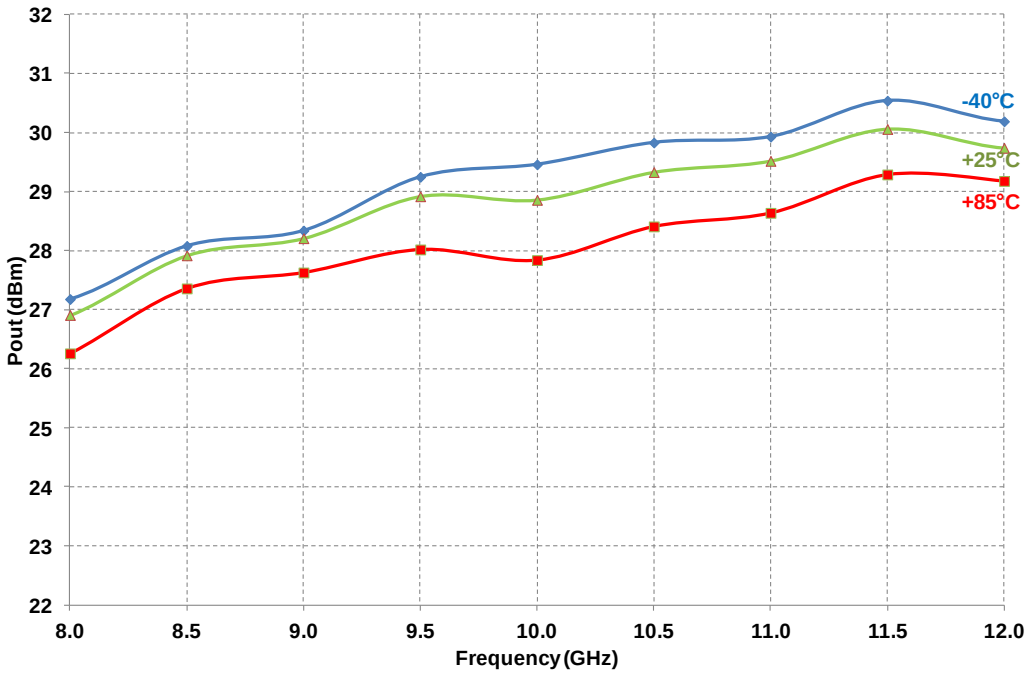
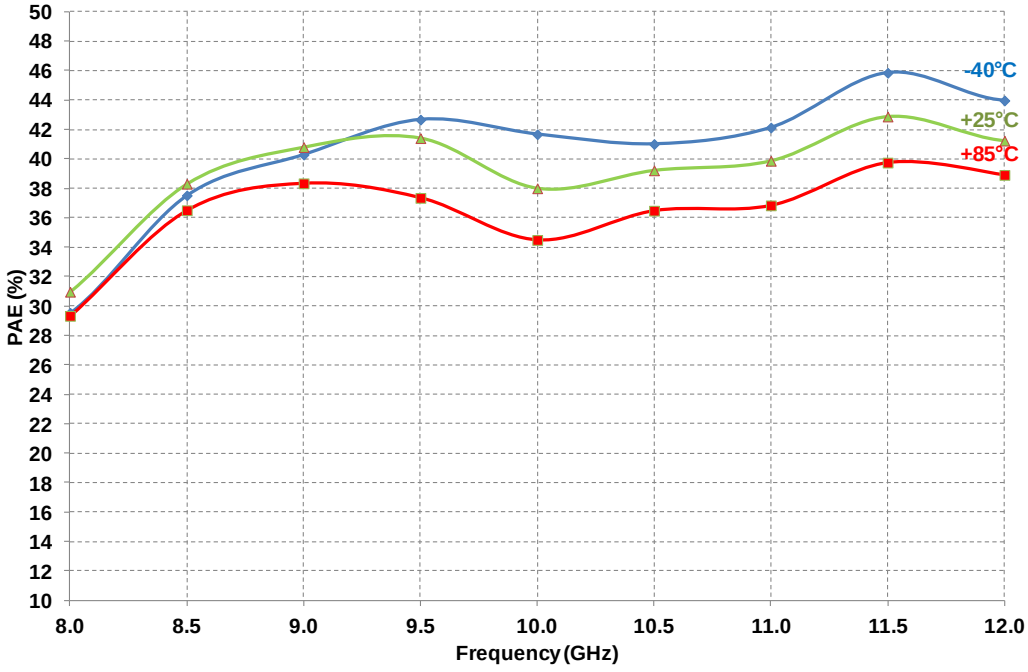
Output Power @ 3dB comp versus frequency



Power added efficiency @ 3dBcomp versus frequency



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Typical on Jig Measurements (Pulse mode)

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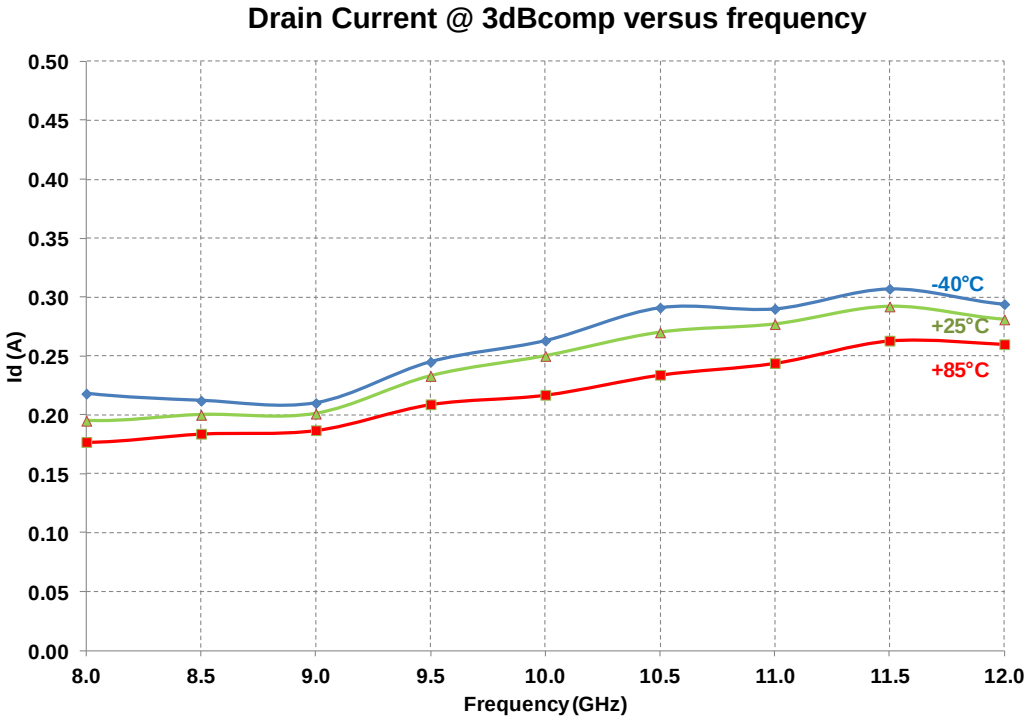

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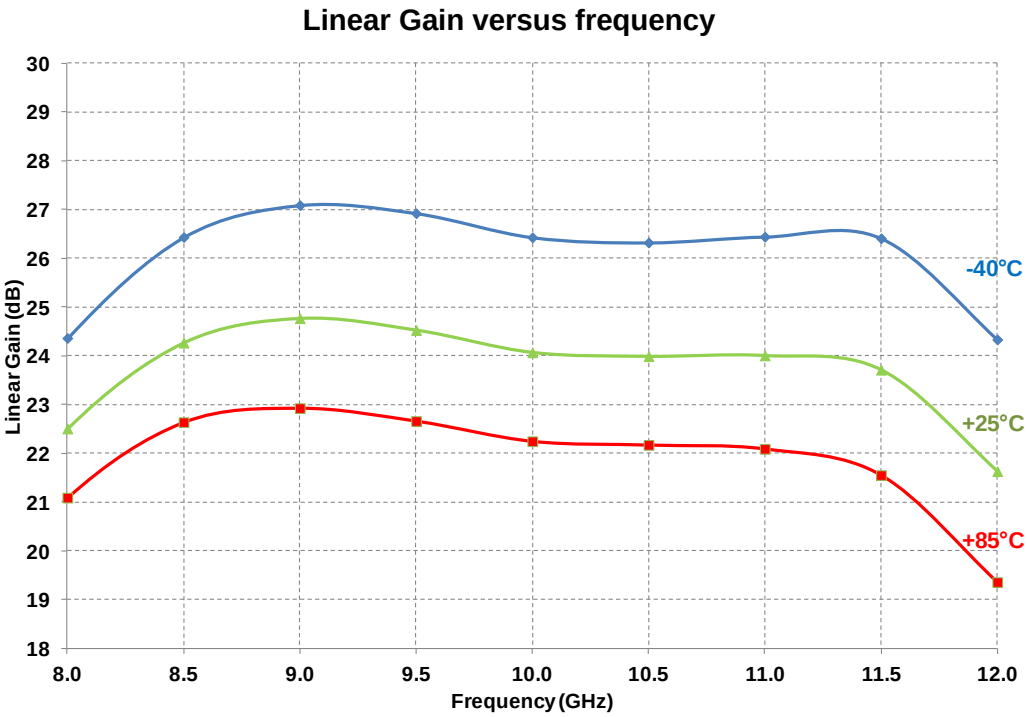
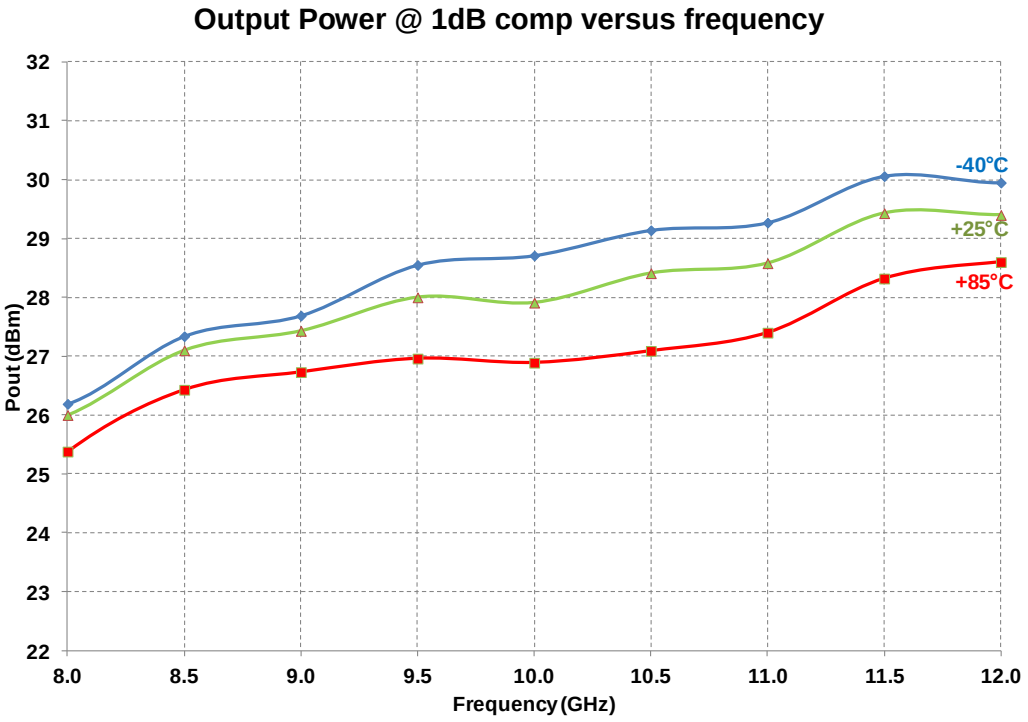
Typical on Jig Measurements (CW mode)

Tamb= -40°C/+25°C/+85°C;
Vd =8V, Id (Quiescent) =190mA





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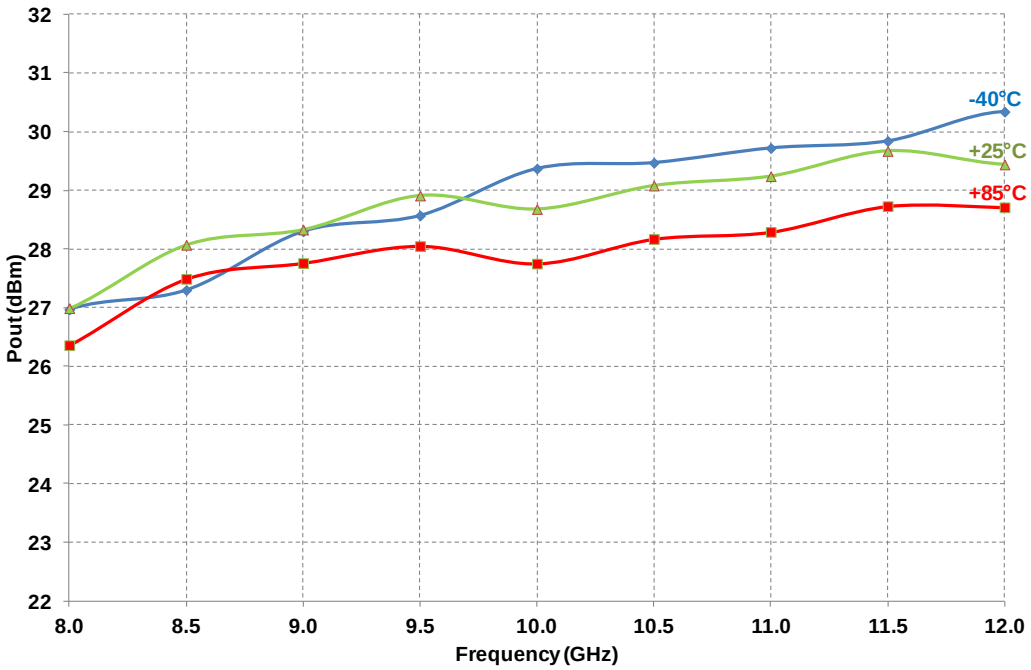
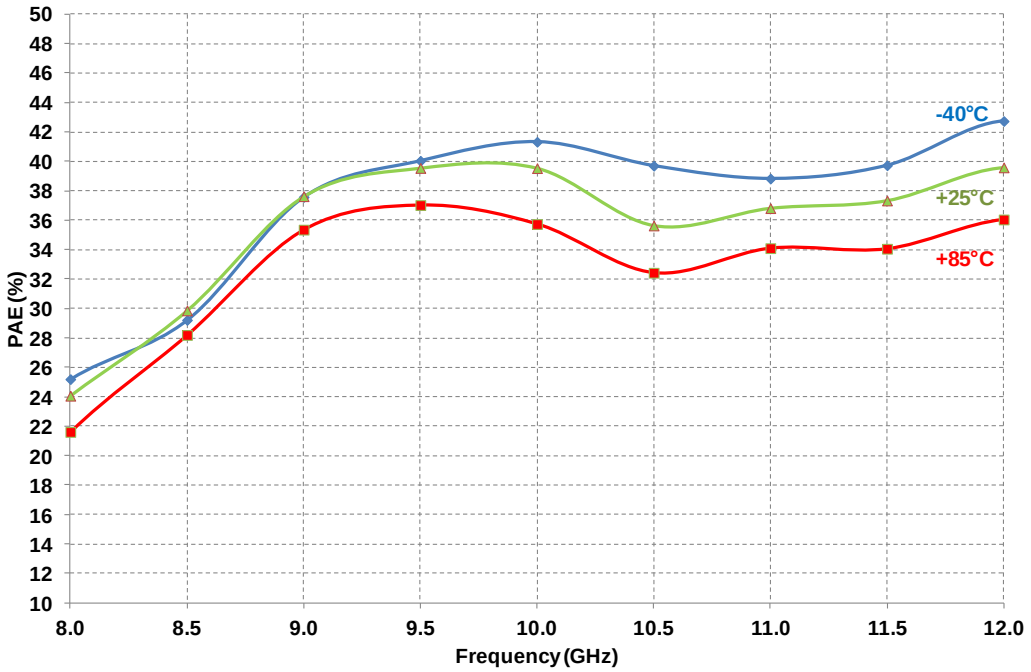
Typical on Jig Measurements (CW mode)

Tamb= -40°C/+25°C/+85°C;
Vd =8V, Id (Quiescent) =190mA

Output Power @ 3dB comp versus frequency



Power added efficiency @ 3dBcomp versus frequency



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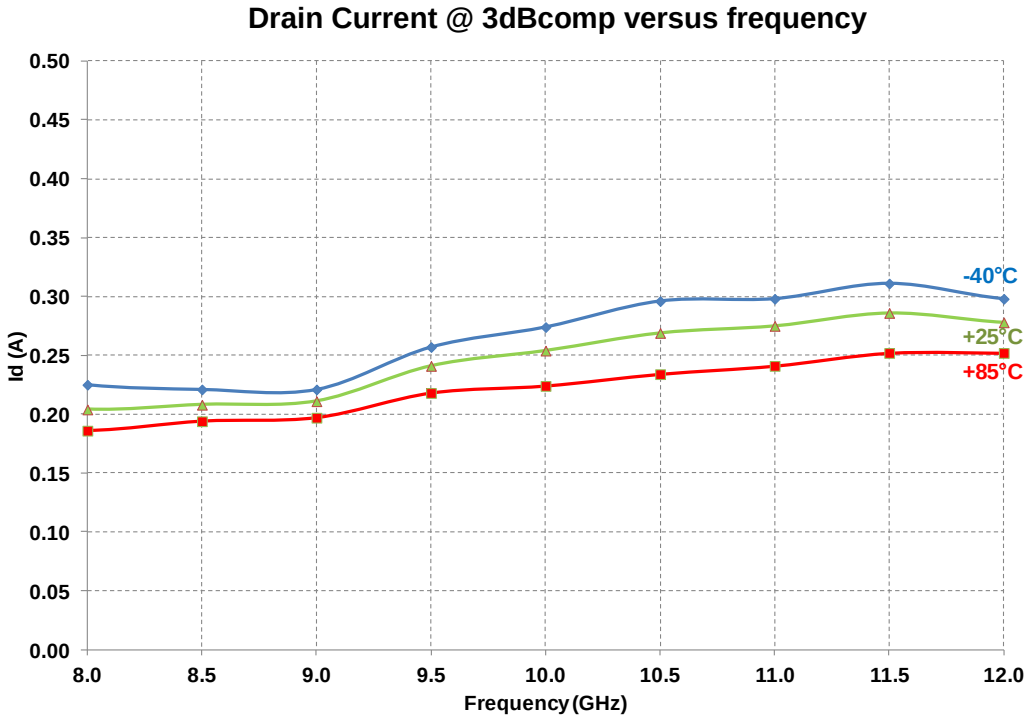

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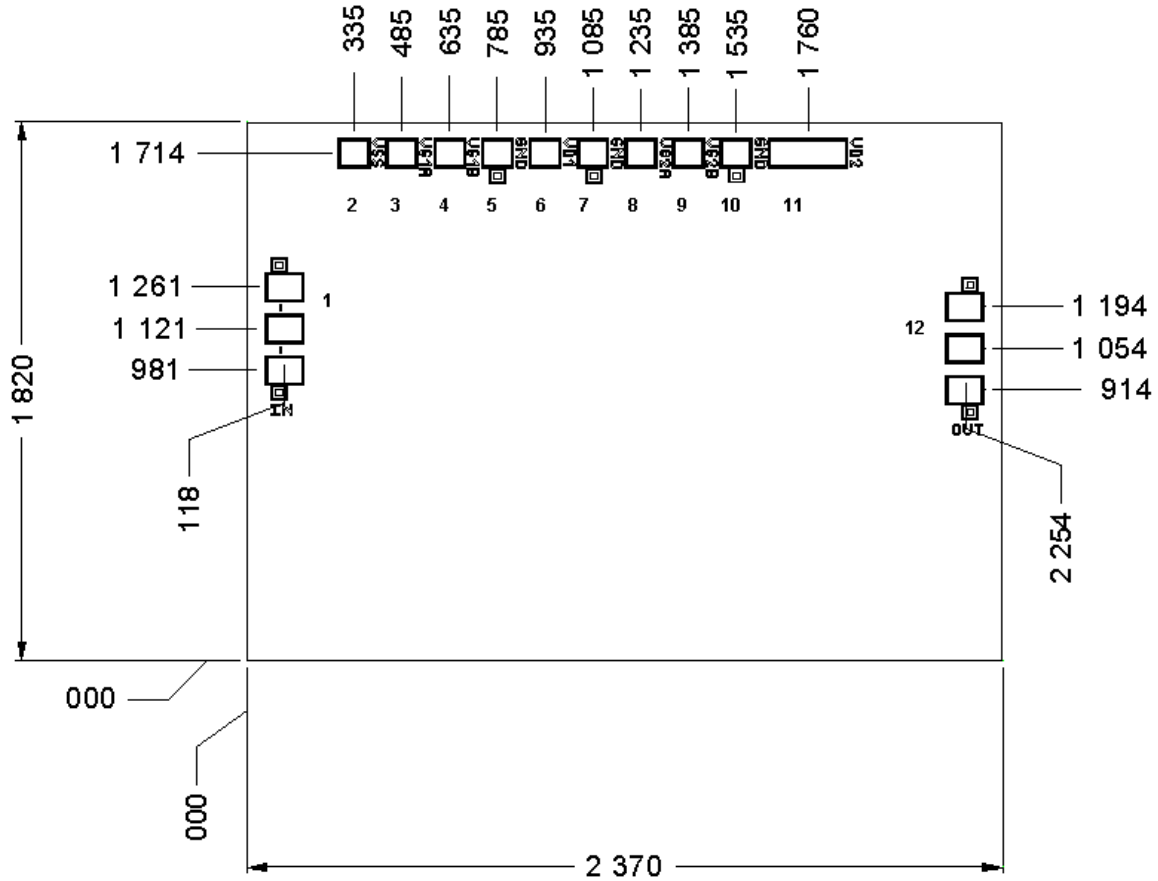
Mechanical data



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, 8, 9	VSS, VG1B, VG2A, VG2B	NC
3	VG1A	Vg
5, 7, 10	GND	Ground
6, 11	VD1, VD2	Vd
12	OUT	Output RF

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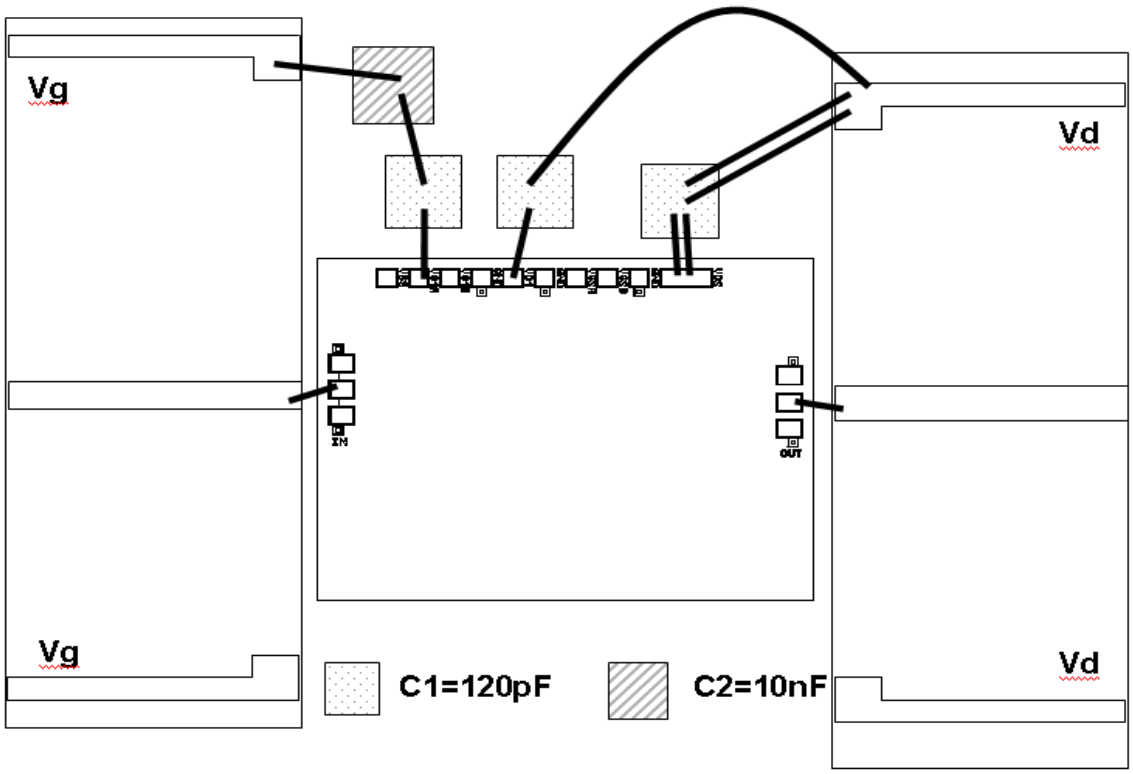
Recommended assembly plan



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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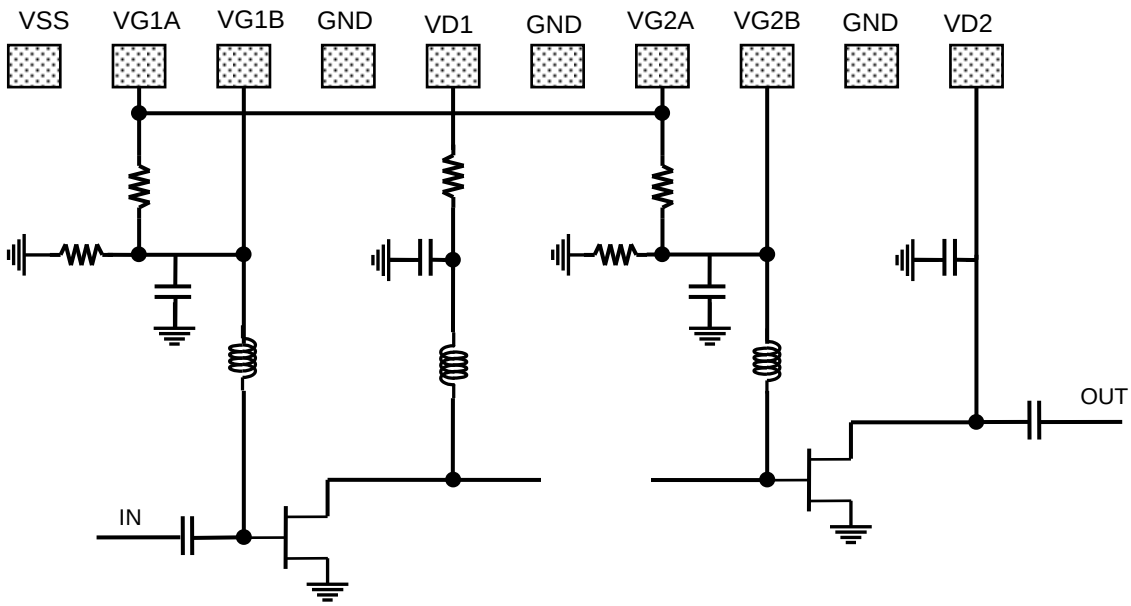
DC Schematic

Medium Power Amplifier: 8V, 190mA



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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:	CHA5115-99F/00

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