

X Band HBT Driver Amplifier

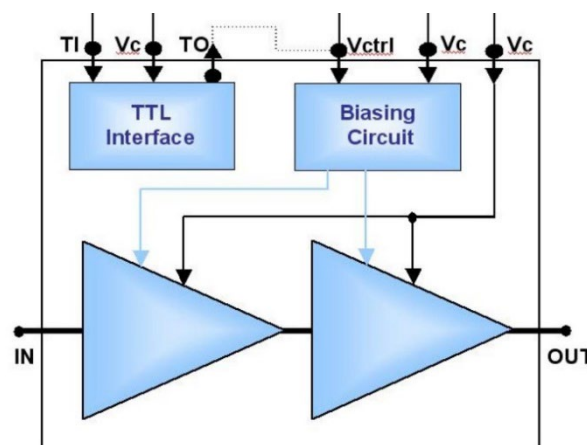
GaAs Monolithic Microwave IC

Description

The CHA5014-99F chip is a monolithic two-stage medium power amplifier designed for X band applications. Moreover this amplifier is relevant for systems that require an output power weakly sensitive to temperature.

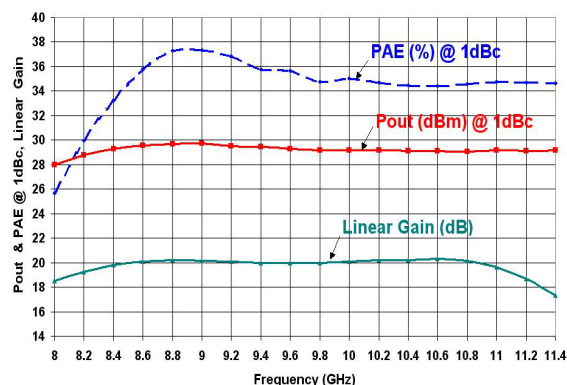
This device is manufactured using a GaInP HBT process, including via holes through the substrate and air bridges. A nitride layer protects the transistors and the passive components.

A special control circuit is implemented to stabilize the output power in temperature.



Main Features

- Frequency range: 8.5-11GHz
- 30dBm Saturated output power
- Temperature compensated Output power
- Two biasing modes:
 - Digital control thanks to TTL interface
 - Analog control thanks to Biasing circuit
- Quiescent bias point: 8.5V@230mA
- Chip size: 2.87 x 1.37 x 0.1mm³



*Pout & PAE @ 1dBc and Linear Gain
(Tbackside = +20°C)*

Main Characteristics

Tbackside = +20°C, Vc = +8.5V (Pulse 100μs 20%)

Symbol	Parameter	Min	Typ	Max	Unit
Fop	Operating frequency range	8.5		11	GHz
G	Small signal gain		20		dB
P1dB	Output power at 1dB gain compression		29		dBm
Icq	Power supply quiescent current		230		mA

Electrical Characteristics

Tbackside = +20°C, Vc = +8.5V (Pulse 100µs 20%)

Symbol	Parameter	Min	Typ	Max	Unit
Top	Operating temperature range	-40		80	°C
Fop	Operating frequency range	8.5		11	GHz
G	Small signal gain at 20°C		20		dB
ΔG	Small signal gain flatness at 20°C		±0.25		dB
ΔG_T	Linear gain variation vs temperature		-0.03		dB/°C
P1dB	Output power at 1dB gain compression		29		dBm
Psat	Saturated output power		30		dBm
PAE_1dBc	Pae at 1dB gain compression at 20°C		35		%
dBS11	Input Return Loss		-12		dB
dBS22	Output Return Loss		-12		dB
Vc	Power supply voltage		8.5		V
Icq	Power supply quiescent current (1)		230		mA
Ic_1dBc	Consumption under 1dB gain compression		260		mA
Vctrl	Collector current control voltage		5		V
Ictrl	Biasing circuit consumption		5		mA
TI_Low	TTL input voltage low level	0		0.4	V
TI_High	TTL input voltage high level (1)	2.5		7.0	V
I_TI	TTL input current		1		mA

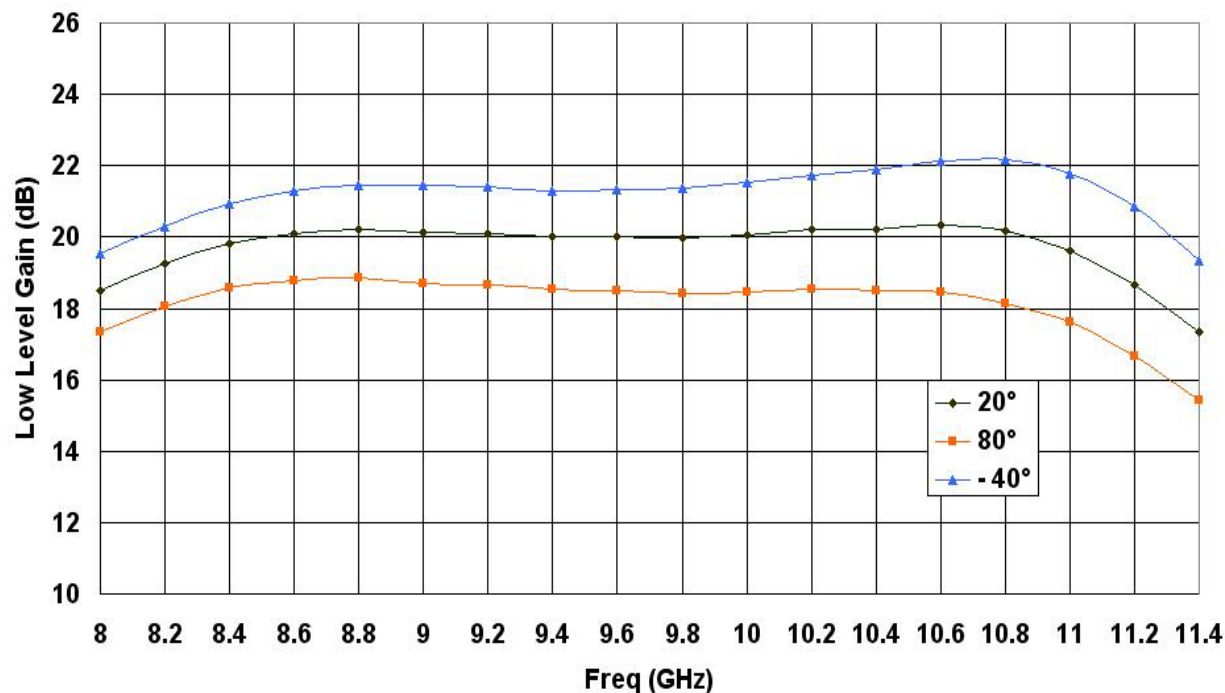
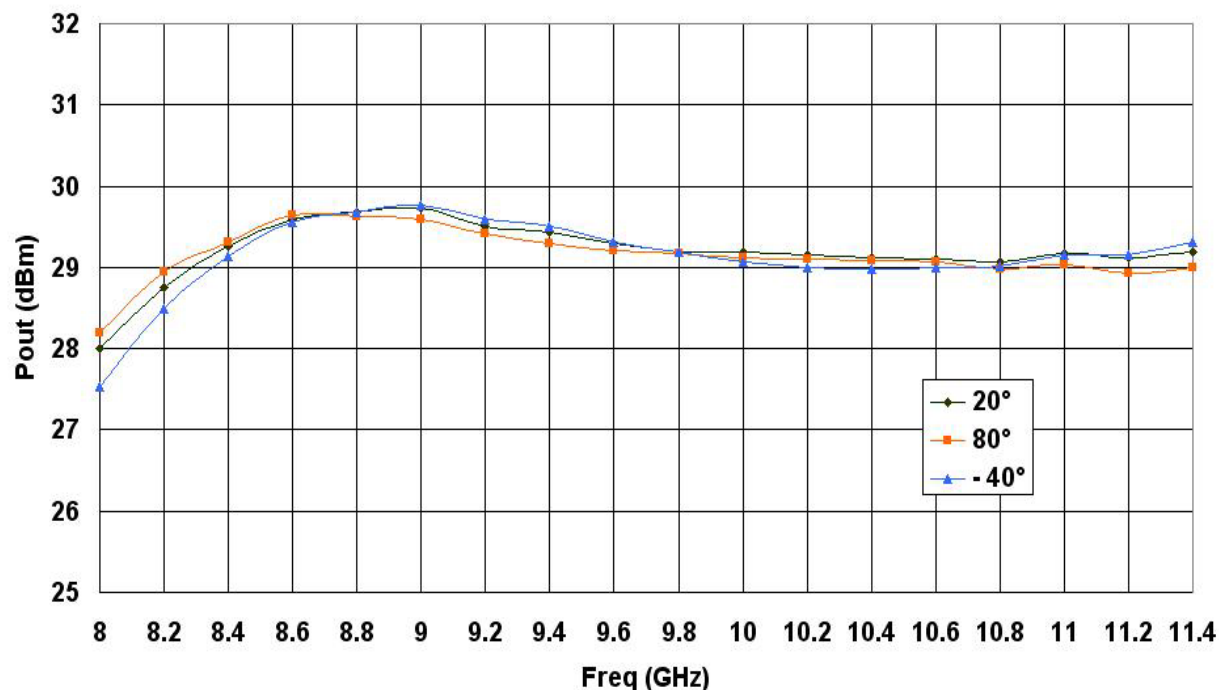
(1) For Vc = 8.5V, TTL interface settles Icq to 230mA when TI=TI_High. If needed, Icq can be tuned thanks to Vctrl if the analog biasing circuit is used.

Absolute Maximum Ratings (2)

Tbackside = 20°C

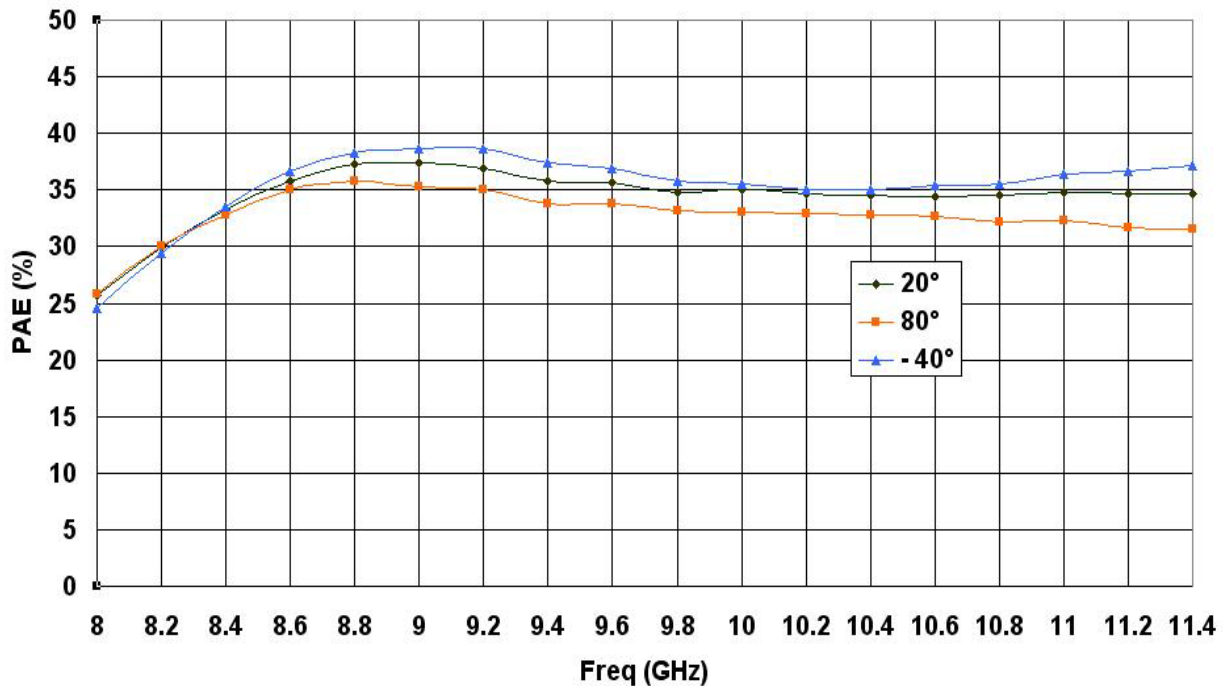
Symbol	Parameter	Values	Unit
Cmp	Compression level (3)	6	dB
Vc	Power supply voltage (4)	10	V
Icq	Power supply quiescent current	320	mA
Ic_sat	Power supply current in saturation	370	mA
Vctrl	Collector current control voltage	6	V
Ai	CTRL voltage (TI_low, TI_high)	-2 , +8	V
Tstg	Storage temperature range	-55 to +150	°C

- (2) Operation of this device above anyone of these parameters may cause permanent damage.
 (3) For higher compression the level limit can be increased by decreasing the voltage Vc using the rate 0.5V/dBc. Compression level shall not be higher than 3dB at -40°C.
 (4) Without RF input power

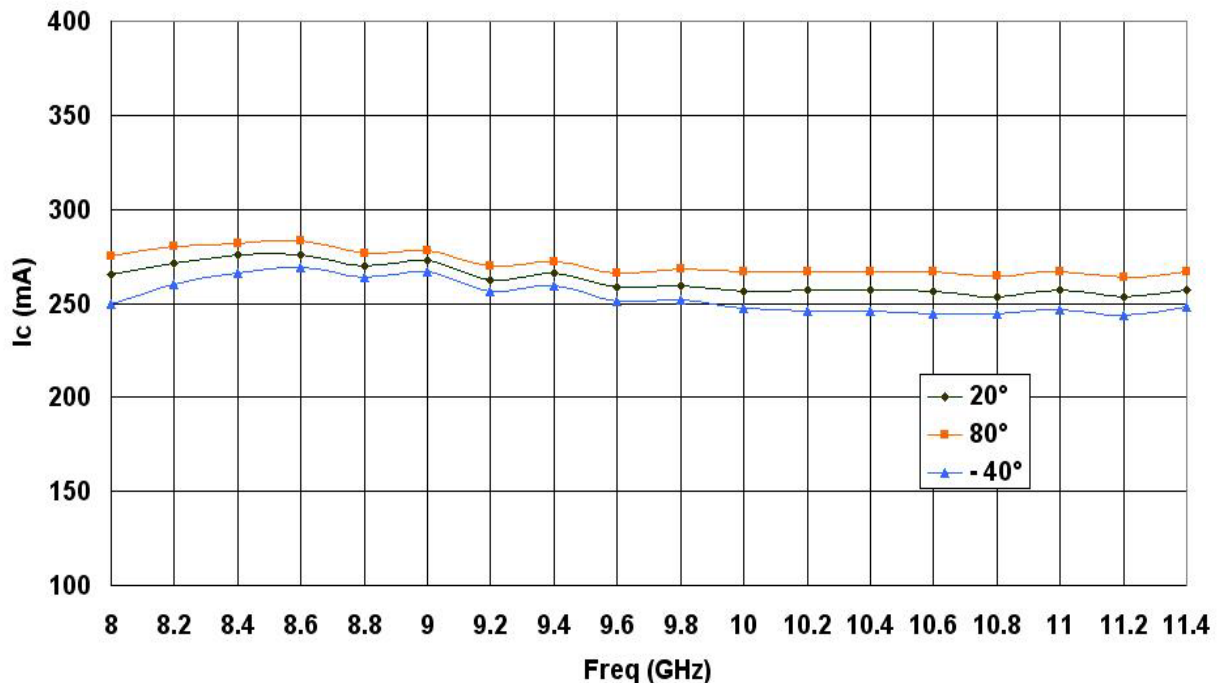
Typical measurement characteristicsT_{backside} = 20°C, V_c = 8.5V, I_c (Quiescent) = 230mA (Pulse = 100μs 20%)**Linear gain vs. frequency and temperature****Output Power @ 1dB gain compression vs. frequency and temperature**

Typical measurement characteristics

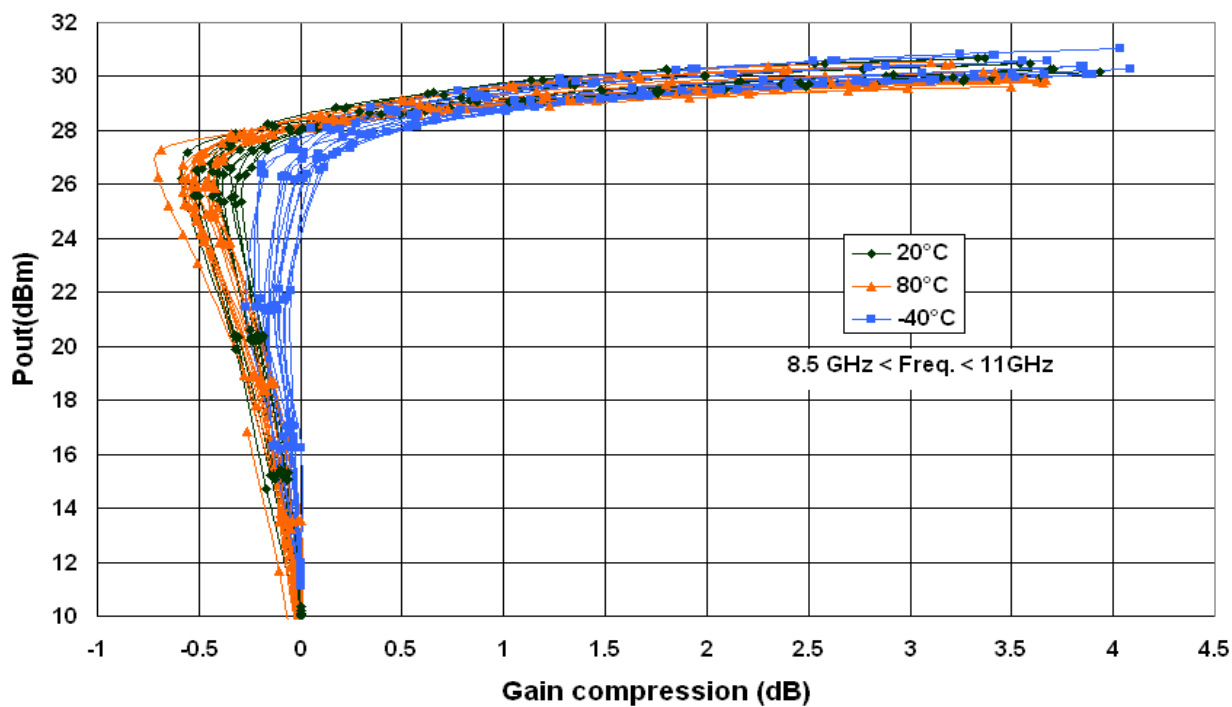
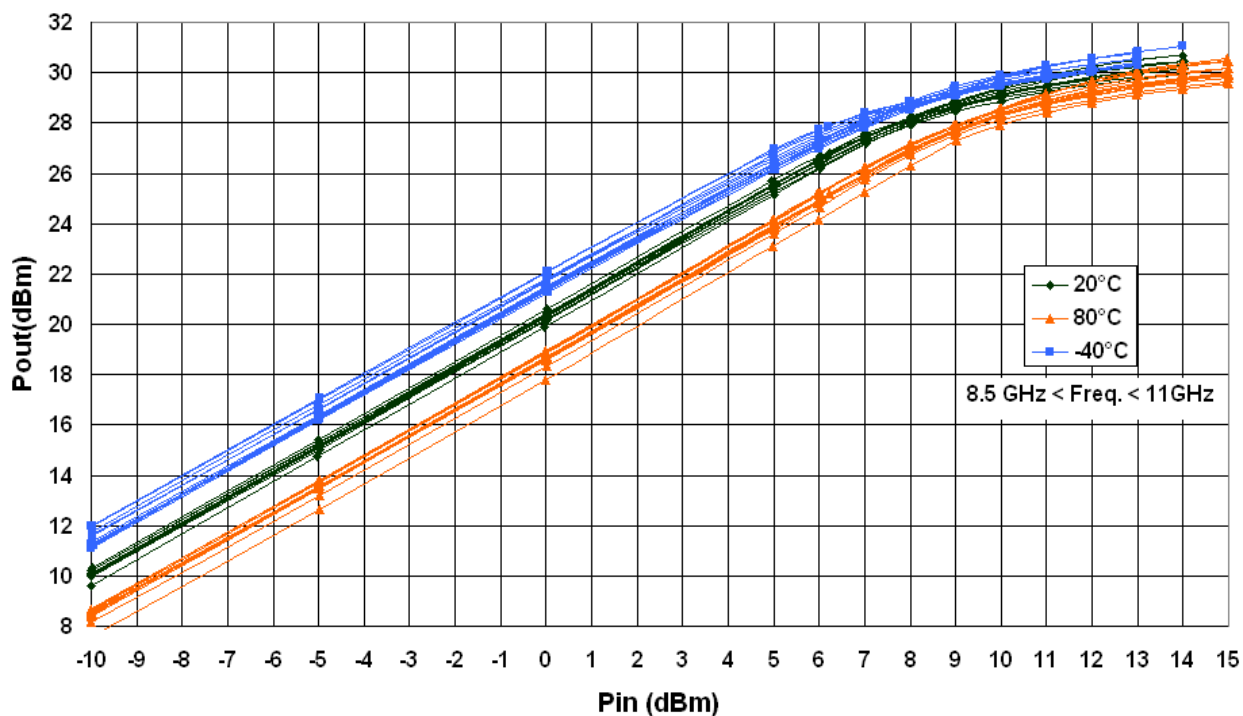
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Power added efficiency@1dB gain compression vs. frequency

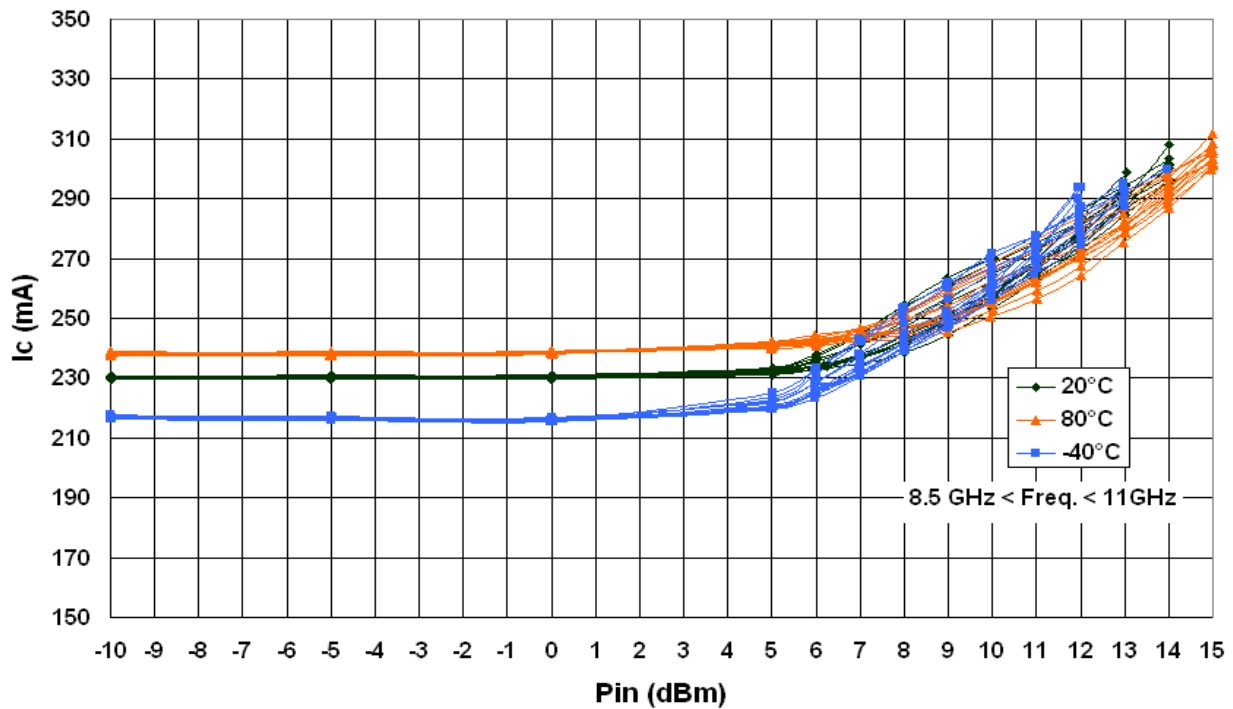


Collector current @1dB gain compression vs. frequency

Typical measurement characteristicsT_{backside} = 20°C, V_c = 8.5V, I_c (Quiescent) = 230mA (Pulse = 100μs 20%)

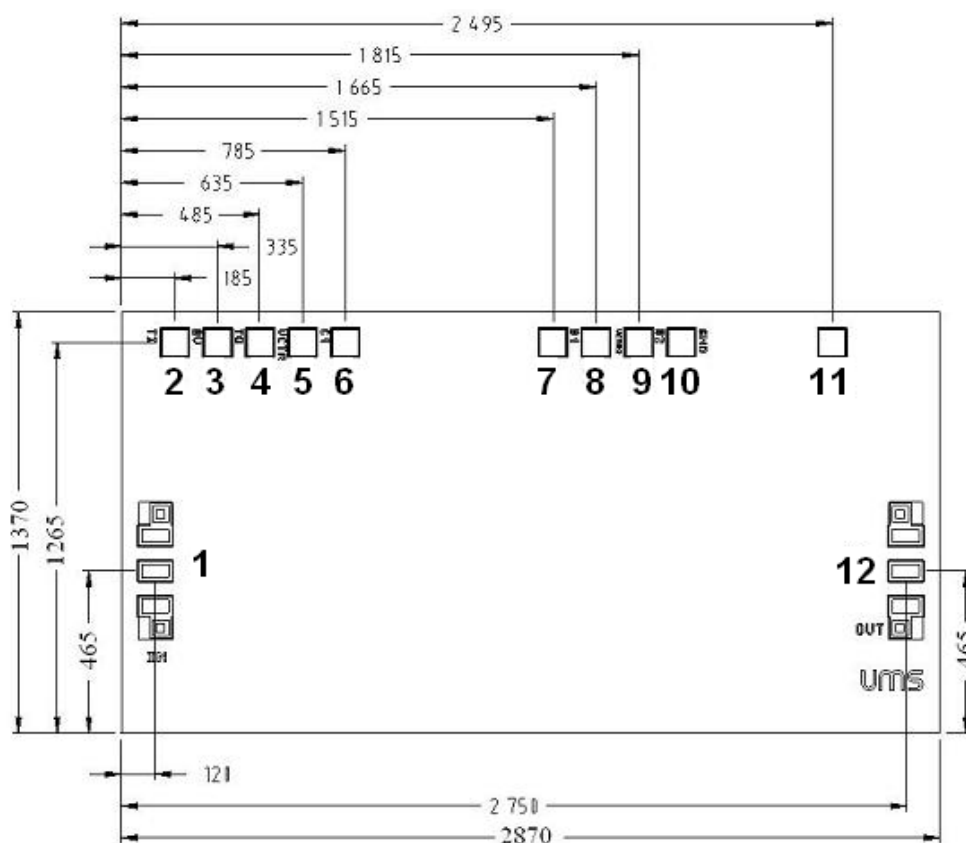
Typical measurement characteristics

T_{backside} = 20°C, V_c = 8.5V, I_c (Quiescent) = 230mA (Pulse = 100μs 20%)



Collector current vs. Input power

Chip mechanical data and Pin references



UNITS : μm
Tol : $\pm 35\mu\text{m}$

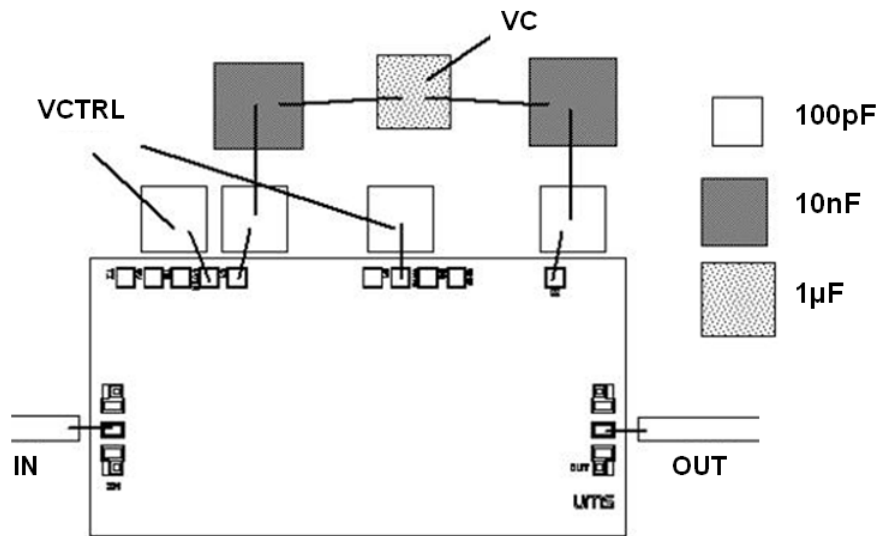
Chip thickness = $100 \pm 10\mu\text{m}$

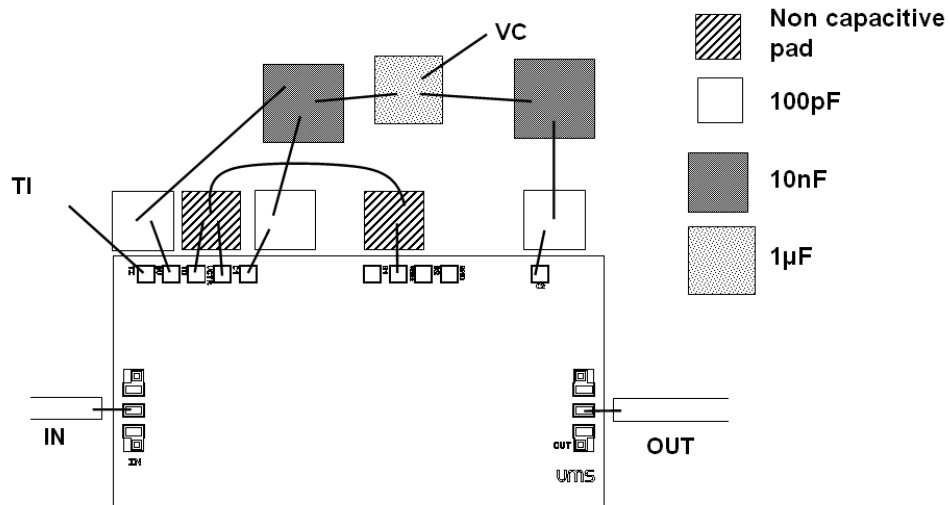
RF pads (1, 12) = $118 \times 68\mu\text{m}^2$

DC pads (2, 3, 4, 5, 6, 7, 8, 9, 10, 11) = $96 \times 96\mu\text{m}^2$

Pin number	Pin name	Description
1	IN	Input RF port
7, 9		NC
5, 8	Vctrl	Collector current control voltage
2	TI	TTL input
4	TO	TTL output
10	GND	Ground (NC)
3, 6, 11	Vc	Power supply voltage
12	OUT	Output RF port

Assembly recommendations in test fixture (using Biasing circuits)



Assembly recommendations in test fixture (TTL interface)

Note: when the TTL interface is used for biasing, the pin TO (pin number 4) must be connected to the pins Vctrl (pins number 5 and 8). The typical switching time with use of TTL interface is around 10ns.

Recommended reflow process assembly

Refer to the application note AN0001 available at <https://www.ums-rf.com> for die attach.

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 : CHA5014-99F/00

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