X-band GaInP HBT High Power Amplifier

GaAs Monolithic Microwave IC

preliminary

Description

The **CHA7010** is a monolithic two stage GaAs high power amplifier designed for X band applications.

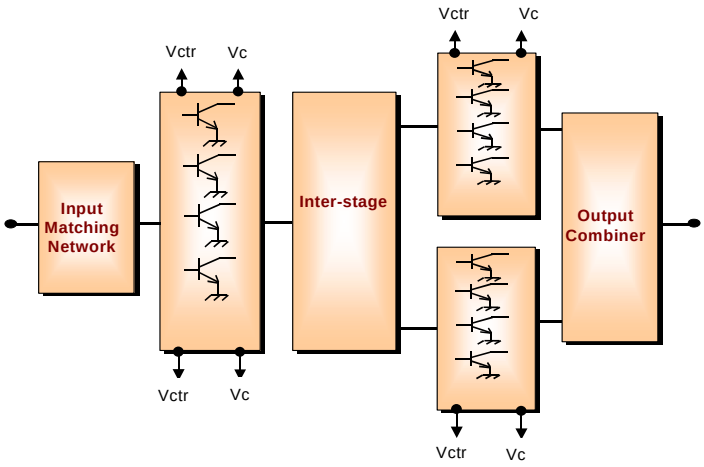
This device is manufactured using a GaInP HBT process, including, via holes through the substrate and air bridges. A nitride layer protects the transistors and the passive components. Special heat removal techniques are implemented to guarantee high reliability.

To simplify the assembly process;

- the backside of the chip is both RF and DC grounded
- bond pads and back side are gold plated for compatibility with eutectic die attach method and thermo-sonic or thermo-compression bonding process.

Main Features

- 10W output power
- High gain : > 18dB @ 10GHz
- High PAE : > 35% @ 10GHz
- On-chip bias control
- Linear collector current control
- High impedance interface for pulse mode
- Temperature compensated
- Chip size: 4.74 x 4.36 x 0.1 mm



Main Characteristics

Tamb = +25°C

Symbol	Parameter	Min	Typ	Max	Unit
F_op	Operating frequency range	8.4	9.4	10.4	GHz
P_sat	Saturated output power		10		W
P_1dBc	Output power @ 1dBc		8		W
G_lin	Linear gain		18		dB

ESD Protections : Electrostatic discharge sensitive device observe handling precautions !

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Electrical Characteristics

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Tamb = 25°C, Vc=9V, Vctr=5.5V, Pulse width=80µs , Duty cycle = 30%

Symbol	Parameter	Min	Typ	Max	Unit
F_op	Operating frequency	8.4	9.4	10.4	GHz
G_lin_1	Linear gain (8.4 to 9.4GHz)	14	16		dB
G_lin_2	Linear gain (9.4 to 10.4GHz)	16	18		dB
G_lin_T	Linear gain variation versus temperature		-0.035		dB/°C
RL_in	Input Return Loss	8	12		dB
RL_out	Output Return Loss	6	12		dB
P_sat_1	Saturated output power (8.4 to 9.8GHz)	39	40		dBm
P_sat_2	Saturated output power (9.8 to 10.4GHz)	38	39		dBm
P_sat_T	Saturated output power variation versus temperature		-0.01		dB/°C
P_1dBc_1	Output power @ 1dBc (8.4 to 9.8GHz)	38	39		dBm
P_1dBc_2	Output power @ 1dBc (9.8 to 10.4GHz)	37	38		dBm
PAE_sat	Power Added Efficiency in saturation	30	35		%
PAE_1dBc	Power Added Efficiency @ 1dBc	27	32		%
Vc	Power supply voltage		9		V
Ic	Power supply quiescent current (1)		2.4		A
Vctr	Collector current control voltage		5.5		V
Zctr	Vctr input port impedance (2)		350		Ohm
Top	Operating temperature range (3)	-30		+80	°C

(1) This parameter is fixed by Vctr
(2) This value corresponds to the 4 ports in parallel (Pin 4, 9, 17, 22)
(3) The reference is the back-side of the chip

Absolute Maximum Ratings (1)

Tamb = 25°C

Symbol	Parameter	Values	Unit
Cmp	Compression level	6	dB
Vc	Power supply voltage	10	V
Ic	Power supply quiescent current	2.8	A
Ic_sat	Power supply current in saturation	3.5	A
Vctr	Collector current control voltage	6.5	V
Tstg	Storage temperature range	-55 to +125	°C

(1) Operation of this device above anyone of these parameters may cause permanent damage.

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Typical measured characteristics

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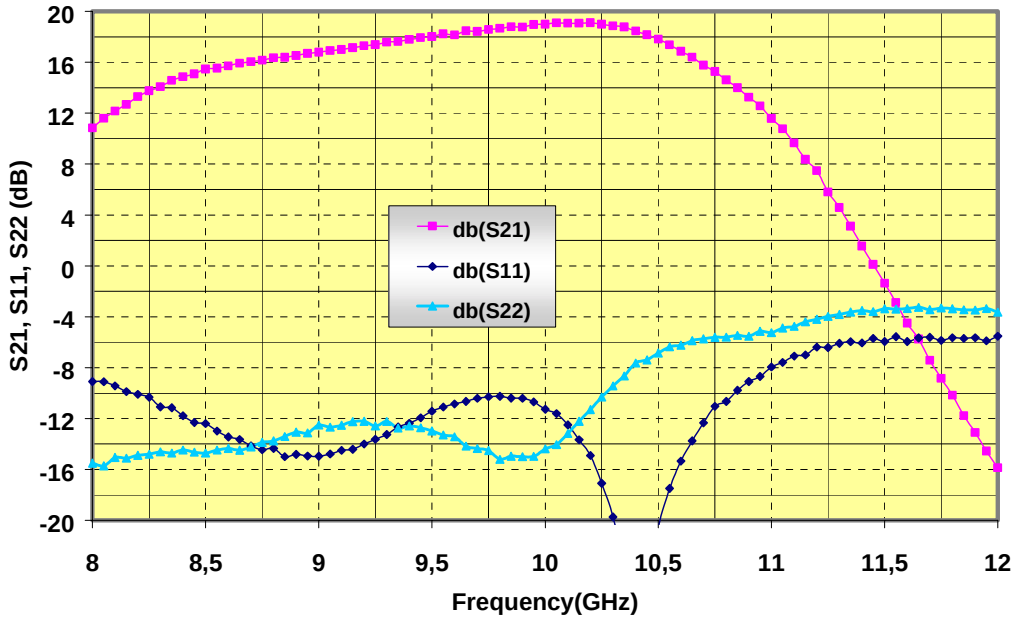
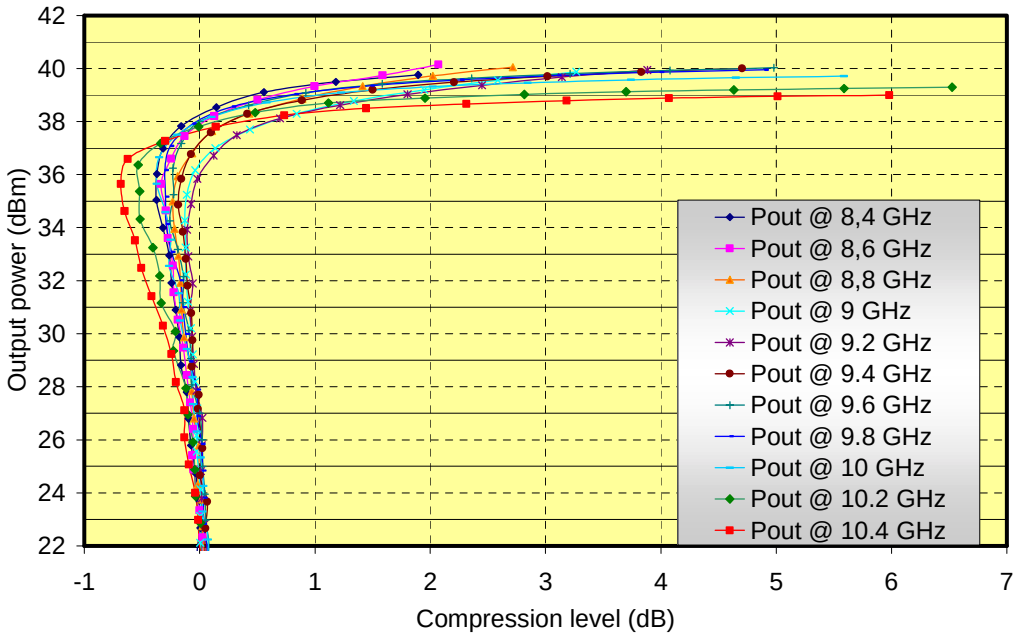
Measurements in test fixture :
Tamb=25°C, Vc=9V, Vctr=5.5V, Pulse width=80µs , Duty cycle = 30%



S-parameters



Output power versus compression level : F= 8.4 to 10.4GHz

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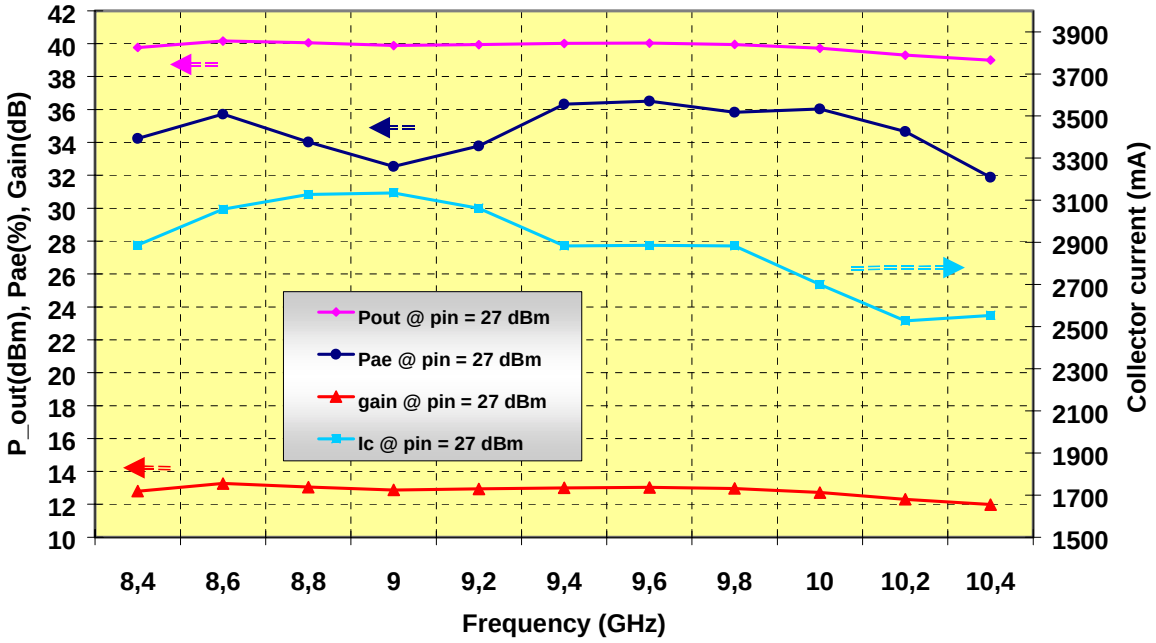

Saturated output power, PAE, Gain and collector current versus frequency

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Dimensions and Pad allocation

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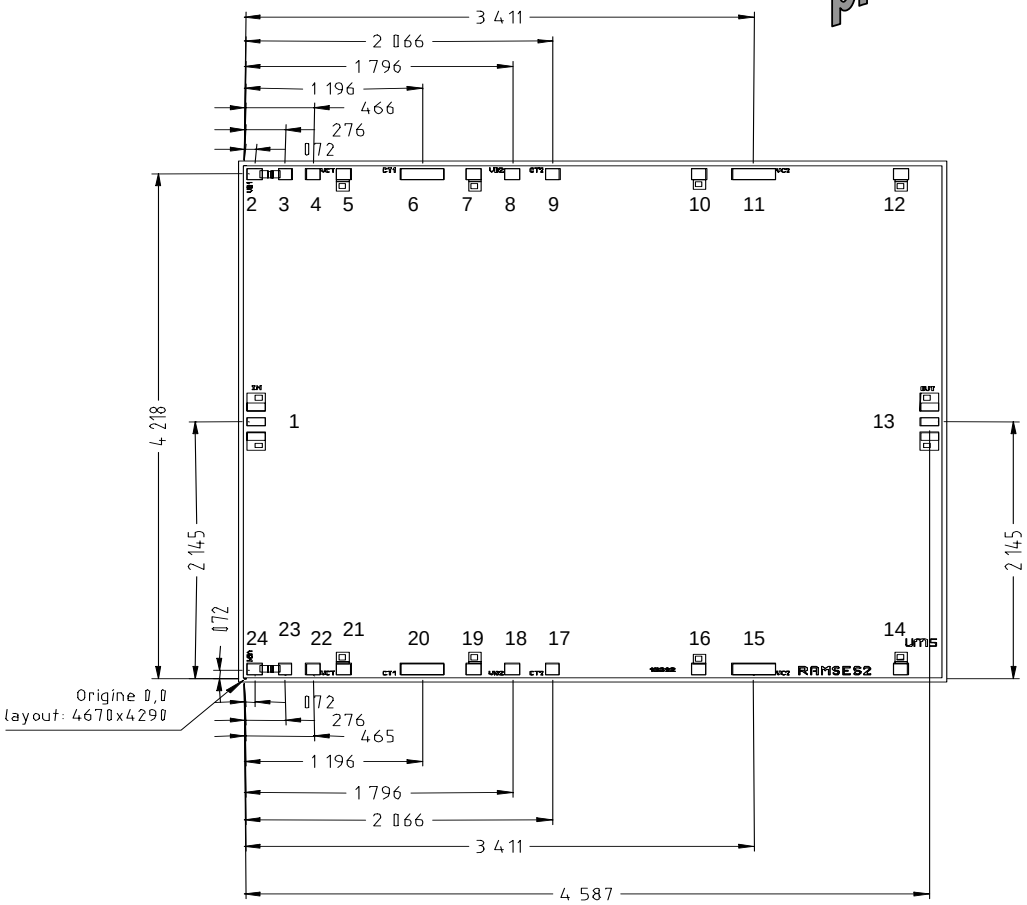

Unit = µm
External chip size (including saw streets) = 4740 x 4360 +/- 35
Chip thickness = 100 +/- 10
HF pads (1, 13) = 118 x 68
DC pads (4, 9, 17, 22) = 96 x 96
DC pads (6, 11, 15, 20) = 288 x 96

Pin number	Pin name	Description
1	**IN**	Input RF port
2, 3, 8, 18, 23, 24		NC
4, 9, 17, 22	**Vctr**	Collector control current port
5, 7, 10, 12, 14, 19, 16, 21	**GND**	Ground (NC)
6, 11, 15, 20	**Vc**	Power supply voltage
13	**OUT**	Output RF port

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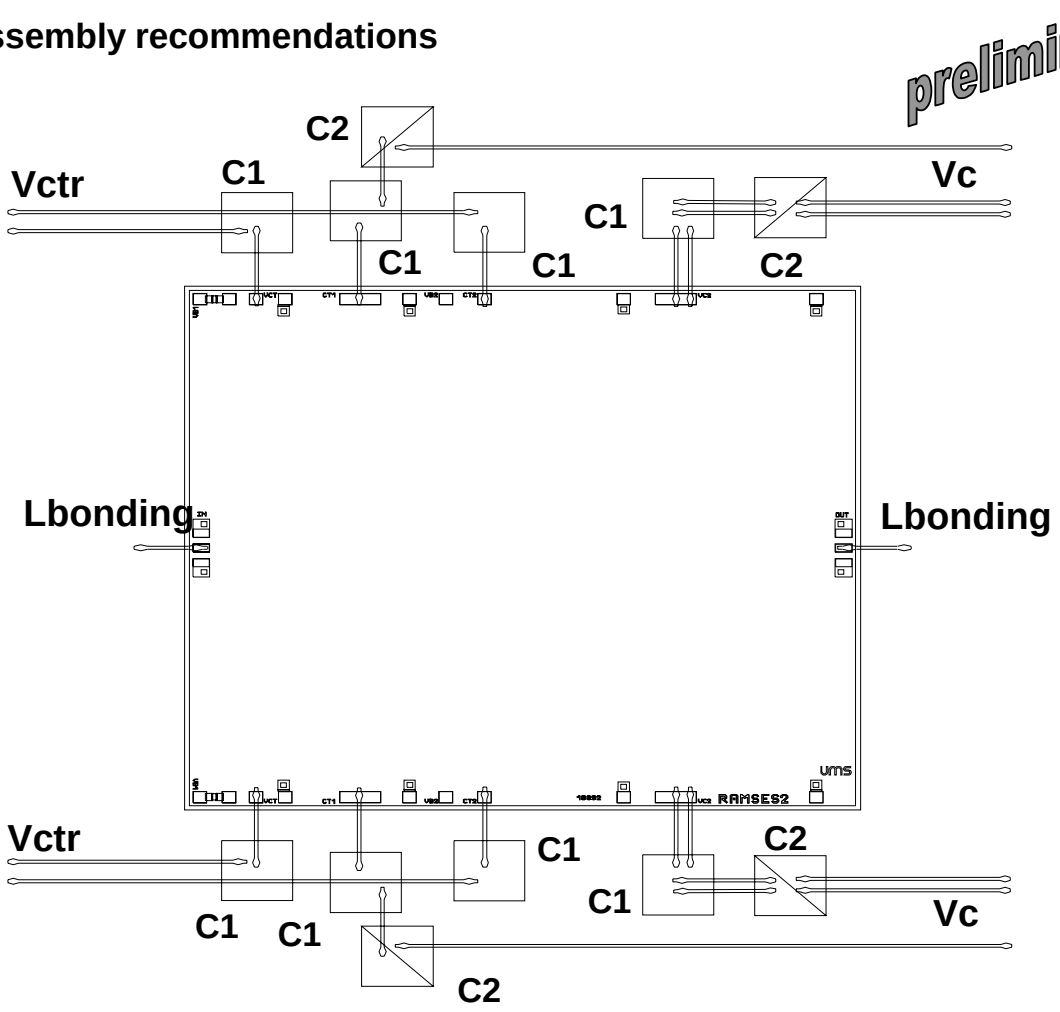
Assembly recommendations



For thermal and electrical considerations, the chip should be brazed on a metal base plate.
The RF, DC and modulation port inter-connections should be done according to the following table:

Port	Connection	External capacitor
IN (1)	Inductance (Lbonding) = 0.4nH	
OUT (13)	Inductance (Lbonding) = 0.4nH	
Vc (6, 11, 15, 20))	Inductance ~ 1nH	C1 ~ 100pF C2 ~ 10nF
Vctr (4, 9, 17, 22)	Inductance ~ 1nH	C1 ~ 100pF

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Ordering Information

Chip form : CHA7010-99F/00

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