

W-band Low Noise Amplifier

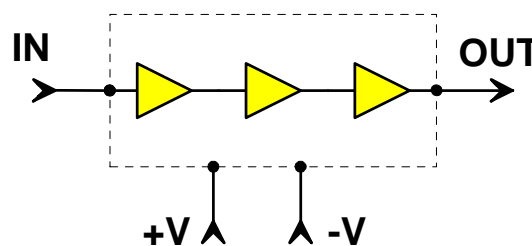
GaAs Monolithic Microwave IC

Description

The CHA1077 is a W-band monolithic 3-stages low noise amplifier. All the active devices are internally self-biased. This chip is compatible with automatic equipment for assembly.

The circuit is manufactured on P-HEMT process: 0.15 μ m gate length, via holes through the substrate, air bridges and electron beam gate lithography.

It is available in chip form.



W-band amplifier block-diagram

Main Features

- W-band low noise amplifier
- High gain
- Wide operating frequency range
- High temperature range
- On-chip self biasing
- Automatic assembly oriented
- Low DC power consumption
- Chip size: 2.6x1.32x 0.1mm

Main Characteristics

T_{amb} = +25°C

Symbol	Parameter	Min	Typ	Max	Unit
F _{op}	Operating frequency	76		77	GHz
G _{lin}	Small signal gain		15		dB
NF	Noise figure		4.5		dB
P _{1dB}	Output power at 1dB		10		dBm

ESD Protections : Electrostatic discharge sensitive device observe handling precautions !

Electrical Characteristics

Full operating temperature range, used according to section "Typical assembly and bias configuration".

Symbol	Parameter	Min	Typ	Max	Unit
F_op	Operating frequency	76		77	GHz
G_lin	Small signal gain	11	15	19	dB
G_fl	Small signal gain flatness		0.5	1	dB
NF	Noise figure		4.5	6.5	dB
P_out_1dB	Output power at 1dB	6.5	10		dBm
Is	Reverse isolation	20	30		dB
VSWR_in	VSWR at input port (50Ω)		2:1	2.5:1	
VSWR_out	VSWR at output port (50Ω)		2:1	2.5:1	
+V	Positive supply voltage (1)	4.4	4.5	4.6	V
+I	Positive supply current		40	70	mA
-V	Negative supply voltage (1)	-4.6	-4.5	-4.4	V
-I	Negative supply current		6	10	mA
Top	Operating temperature range	-40		100	°C

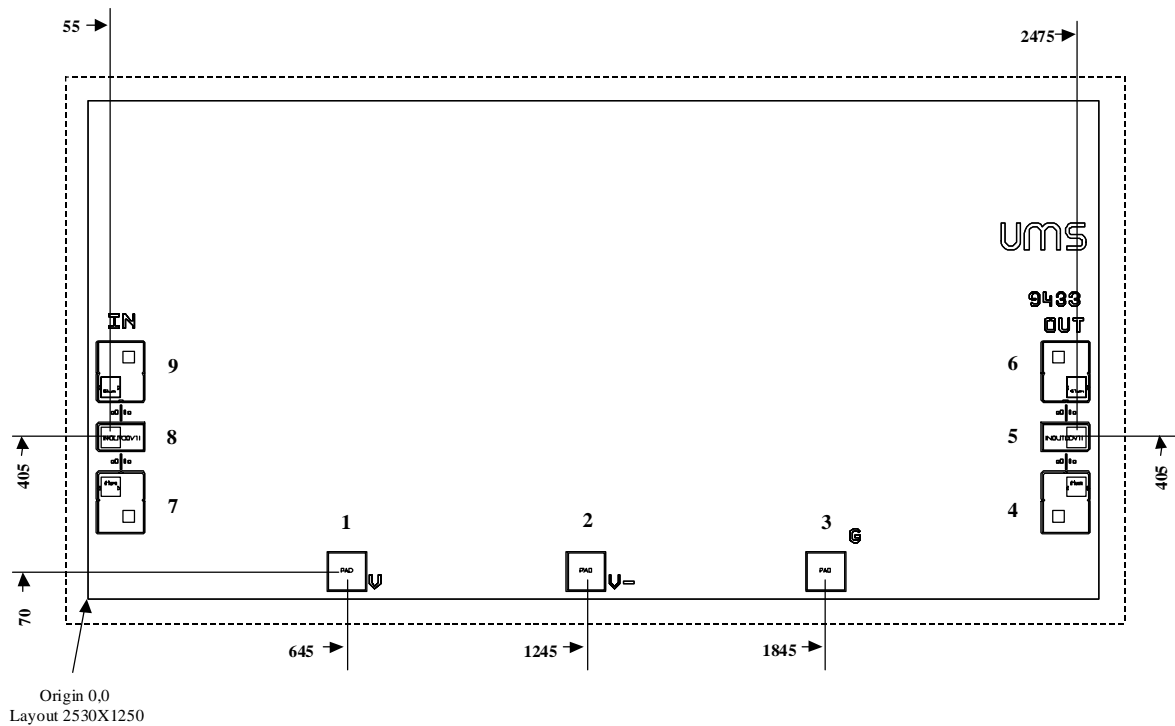
(1) Negative supply voltage must be applied at least 1us before positive supply voltage.

Absolute Maximum Ratings (1)

Symbol	Parameter	Values	Unit
P_in	Maximum input power (2)	3	dBm
+V	Positive supply voltage	5	V
-V	Negative supply voltage	-5	V
+I	Positive supply current	80	mA
-I	Negative supply current	13	mA
Tstg	Storage temperature range	-55 to +155	°C

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

Chip Mechanical Data and Pin References



Unit = μm

External chip size (layout size + dicing streets) = 2600X1320 +/-35

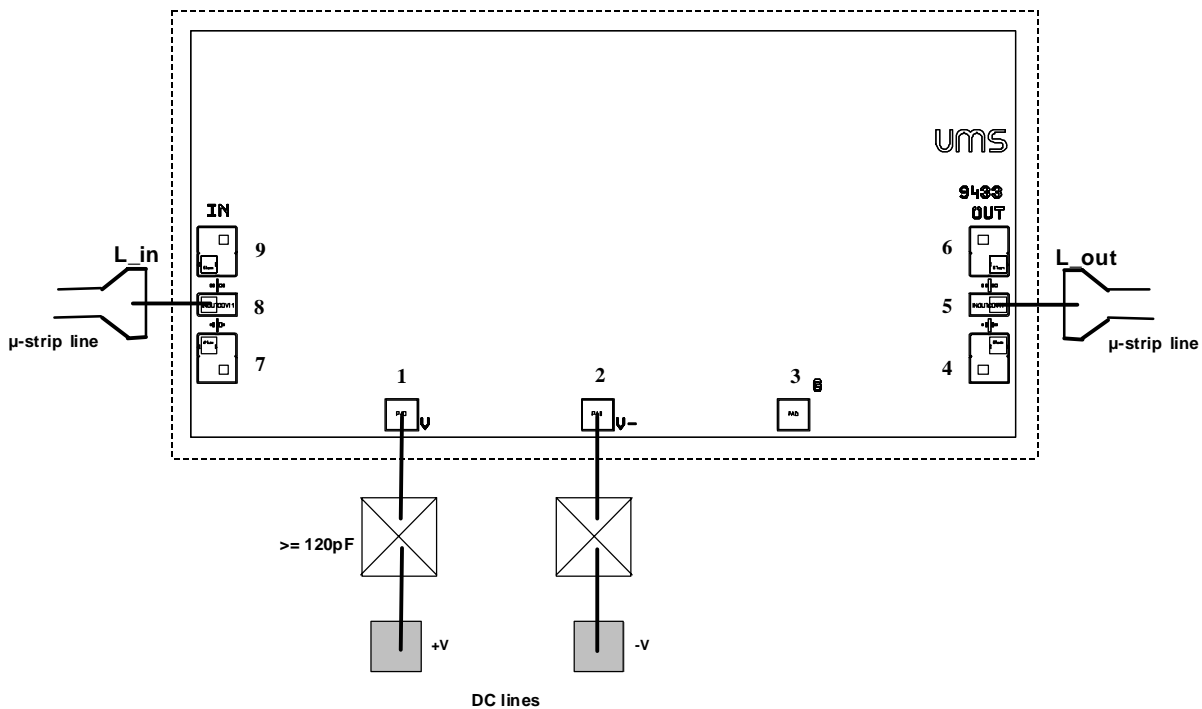
Chip thickness = 100 +/- 10

HF Pads (5,8) = 68 x 118

DC/IF Pads = 100 x 100

Pin number	Pin name	Description
4, 6, 7, 9		Ground: should not be bonded. If required, please ask for more information.
3		Ground (optional)
5	OUT	RF output port
8	IN	RF input port
1	+V	Positive supply voltage
2	-V	Negative supply voltage

Typical Assembly and Bias Configuration



This drawing shows an example of assembly and bias configuration. All the transistors are internally self biased. An external capacitor is recommended for the positive and negative supply voltages.

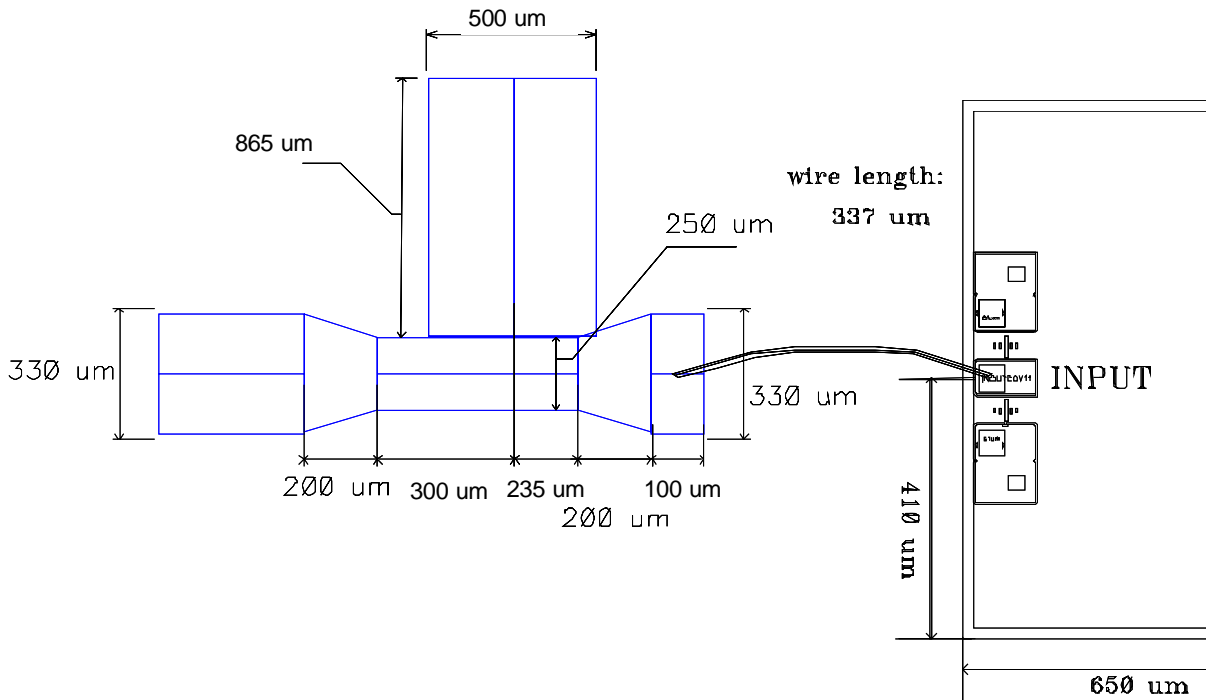
For the RF pads the equivalent wire bonding inductance (diameter=25 μ m) have to be according to the following recommendation.

Port	Equivalent inductance (nH)	Wire length (mm) (1)
IN	$L_{in} = 0.25$	0.34
OUT	$L_{out} = 0.25$	0.34

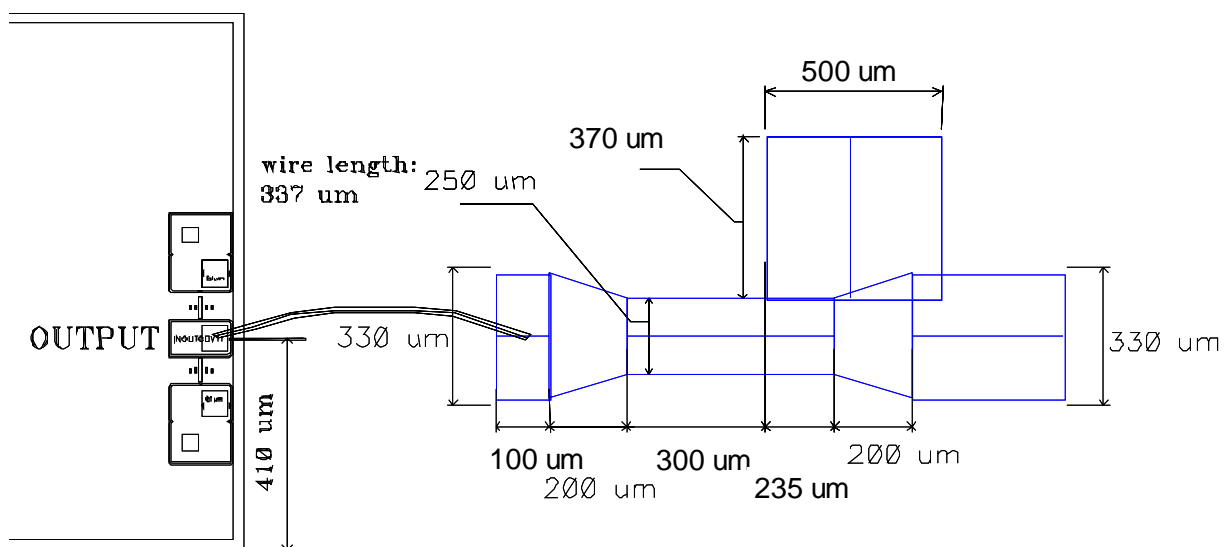
(1) This value is the total length including the necessary loop from pad to pad.

For a micro-strip configuration a hole in the substrate is necessary for chip assembly.

As the connections at 77GHz (between MMIC and MMIC or between MMIC and external substrate) are critical, the transition matching network is split into two parts: one on MMIC and one on the external substrate. This choice allows doing also a direct connection between MMICs. For a connection to an external substrate a network is proposed on soft substrate for IN and OUT ports. The following drawings give the dimensions for a RO3003 substrate (thickness=0.127mm, $\epsilon_r=3$).



Proposed matching network for a 50 Ω transition between IN port and a μ -strip line on RO3003 substrate



Proposed matching network for a 50 Ω transition between OUT port and a μ -strip line on RO3003 substrate

Ordering Information

Chip form : CHA1077-99F/00

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