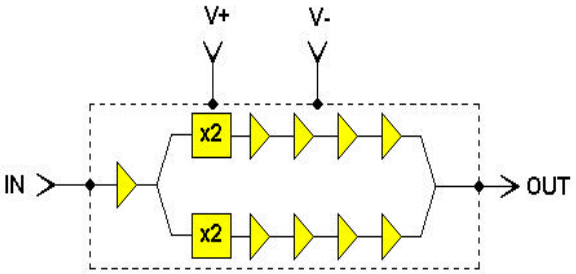
W-band Multi-function: Multiplier / MPA

GaAs Monolithic Microwave IC

Description

The CHU3277 is a W-band monolithic multifunction, which integrates an input buffer/power divider and two W-band chains in parallel combined at the output. Each one includes a frequency multiplier and a four-stages medium power amplifier. The frequency multipliers are based on active transistors and allow operation at low input level with reduced power consumption.
All the active devices are internally self-biased to ease bias configuration. This chip is compatible with automatic equipment for assembly.
The circuit is manufactured with the P-HEMT process: 0.15µm gate length, via holes through the substrate, air bridges and electron beam gate lithography.
It is available in chip form.



W-band multifunction block-diagram

Main Features

- Wide operating frequency range
- Low input power: 5dBm typical
- High output power
- Low AM noise
- Wide temperature range
- On-chip self biasing
- Very simple bias configuration
- Low DC power consumption
- Automatic assembly oriented
- BCB layer protection
- Chip size: 3.9 x 1.66 x 0.1mm

Main Typical Characteristics

Tamb = +25°C

Symbol	Parameter	Min	Typ	Max	Unit
F_in	Input frequency	38		38.5	GHz
P_in	Input power		5		dBm
F_out	Output frequency	76		77	GHz
Pout	Output power		18		dBm

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ESD Protections: Electrostatic discharge sensitive device observe handling precautions!

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Electrical Characteristics

Full operating temperature range, used according to section “Typical assembly and bias configuration”

Symbol	Parameter	Min	Typ	Max	Unit
F_in	Input frequency	38		38.5	GHz
F_out	Output frequency	76		77	GHz
P_in	Input power	3	5	10	dBm
Pout	Output power (1)	15.5	18	20.5	dBm
Pout_Flat	Output power flatness			<1	dB
AM_noise	Amplitude noise @ 1kHz (SSB) Amplitude noise @ 10kHz (SSB) Amplitude noise @ 100kHz (SSB) Amplitude noise @ 200kHz (SSB) Amplitude noise @ 1MHz (SSB)		-137 -145 -151 -153 -157	-132 -140 -146 -148 -152	dBc/Hz
VSWR_in	VSWR at input port (50Ω)		2:1	2.5:1	
+V	Positive supply voltage (2)	4.25	4.5	4.75	V
+I	Positive supply current		280	400	mA
-V	Negative supply voltage (2)	-4.75	-4.5	-4.25	V
-I	Negative supply current		8	12	mA
Top	Operating temperature range	-40	25	100	°C
Tstg	Storage temperature range	-40	25	120	°C

(1)Defined on load VSWR £1.5:1.
(2)Negative supply voltage must be applied at least 1us before positive supply voltage.

Absolute Maximum Ratings (3)

Symbol	Parameter	Values	Unit
P_in	Input power (4)	12	dBm
+V	Positive supply voltage	5	V
-V	Negative supply voltage	-5	V
+I	Positive supply current	450	mA
-I	Negative supply current	15	mA
Tstg	Storage temperature range	-55 to +155	°C

(3) Operation of this device above anyone of these parameters may cause permanent damage.
(4) Duration < 1s.

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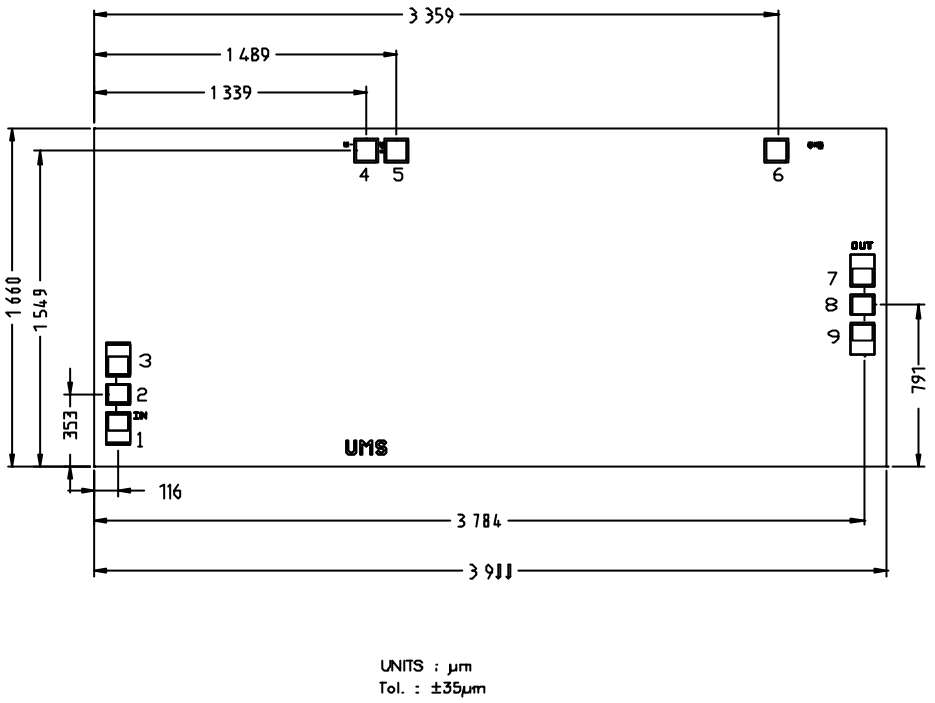
Chip Mechanical Data and Pin References



Units = µm
Chip size = 3900 x 1660 ± 35
Chip thickness = 100 ± 10
HF Pads (2,8) = 90 x 110 (BCB opening)
DC Pads (4,5,6) = 100 x 100 (BCB opening)

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

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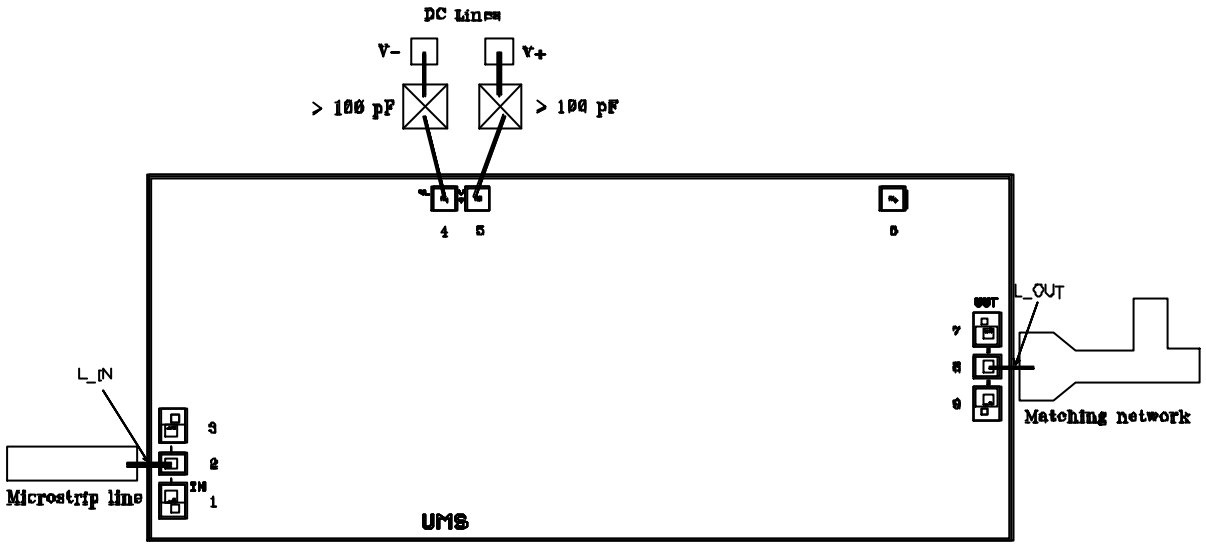
Typical Assembly and Bias Configuration



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=25µm) has to be according to the following recommendation.

Port	Equivalent inductance (nH)	Wire length (mm) (1)
IN (2)	L_in = 0.27	0.34
OUT (8)	L_out = 0.27	0.34

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

For a microstrip configuration a hole in the substrate is necessary for chip assembly.

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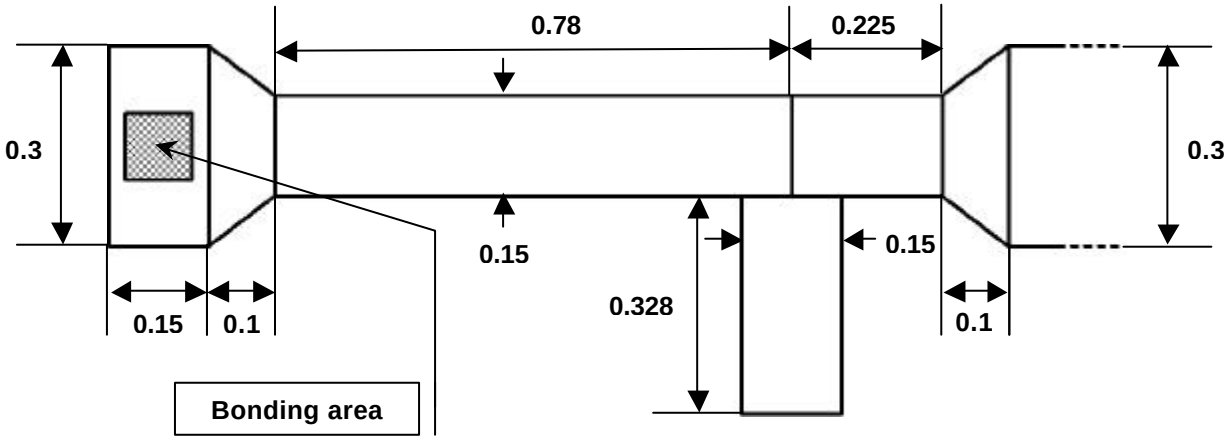
As the connection at 77GHz (between MMIC and external substrate) is critical, the transition matching network is split into two parts: one on MMIC and one on the external substrate. The following drawing gives the dimensions for a RO3003 substrate.
RO3003 thickness = 0.127 mm, εr=3.



Proposed matching network for a transition between MMIC Output port and a 50Ω microstrip line on RO3003 substrate.

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Ordering Information

Chip form : CHU3277-98F/00

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