

## W-band Multi-function: Multiplier / MPA

### GaAs Monolithic Microwave IC

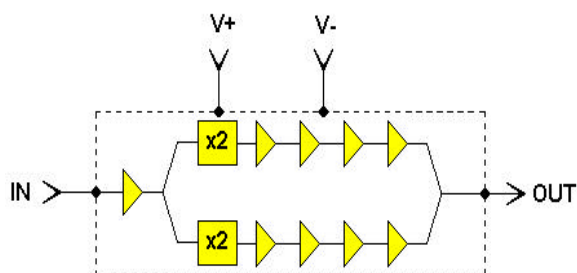
#### Description

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: 0.15 $\mu$ m 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

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_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  $\leq 1.5:1$ .

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

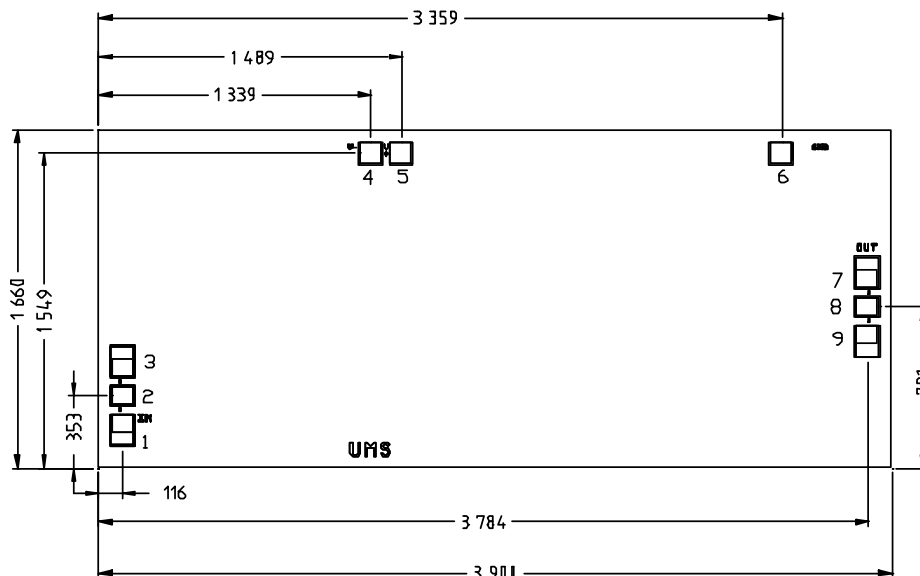
## Absolute Maximum Ratings (3)

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.

## Chip Mechanical Data and Pin References



UNITS :  $\mu\text{m}$   
Tol. :  $\pm 35\mu\text{m}$

Units =  $\mu\text{m}$

Chip size =  $3900 \times 1660 \pm 35$

Chip thickness =  $100 \pm 10$

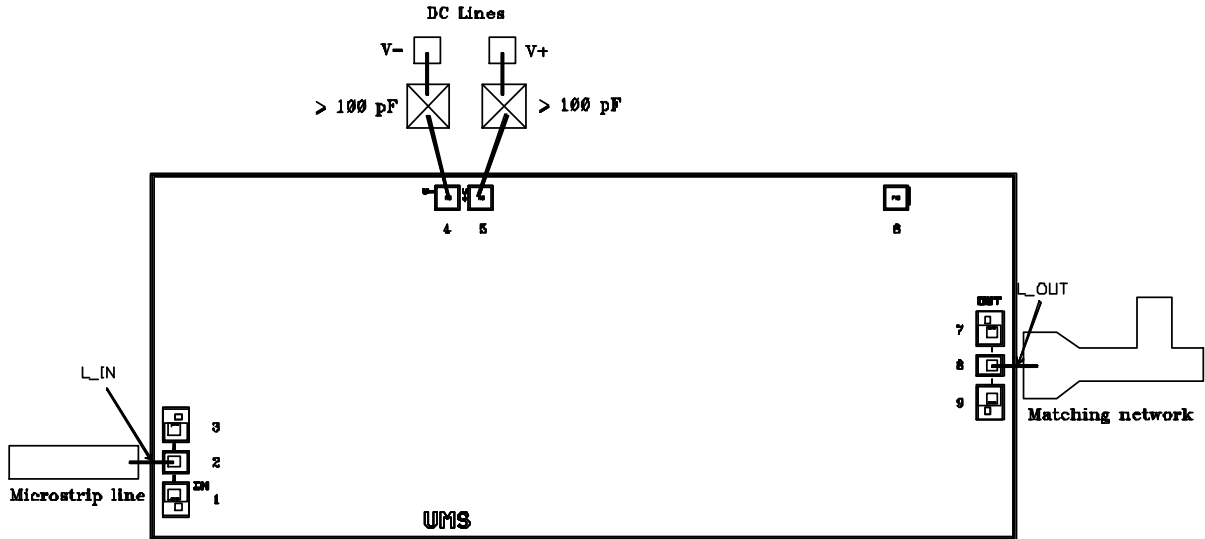
HF Pads (2,8) =  $90 \times 110$  (BCB opening)

DC Pads (4,5,6) =  $100 \times 100$  (BCB opening)

Pin number	Pin name	Description
<b>1,3,7,9</b>		Ground: should not be bonded. If required, please ask for more information.
<b>6</b>	<b>GND</b>	Ground (optional)
<b>2</b>	<b>IN</b>	Input port
<b>8</b>	<b>OUT</b>	Output port
<b>5</b>	<b>+V</b>	Positive supply voltage
<b>4</b>	<b>-V</b>	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=25µm) has to be according to the following recommendation.

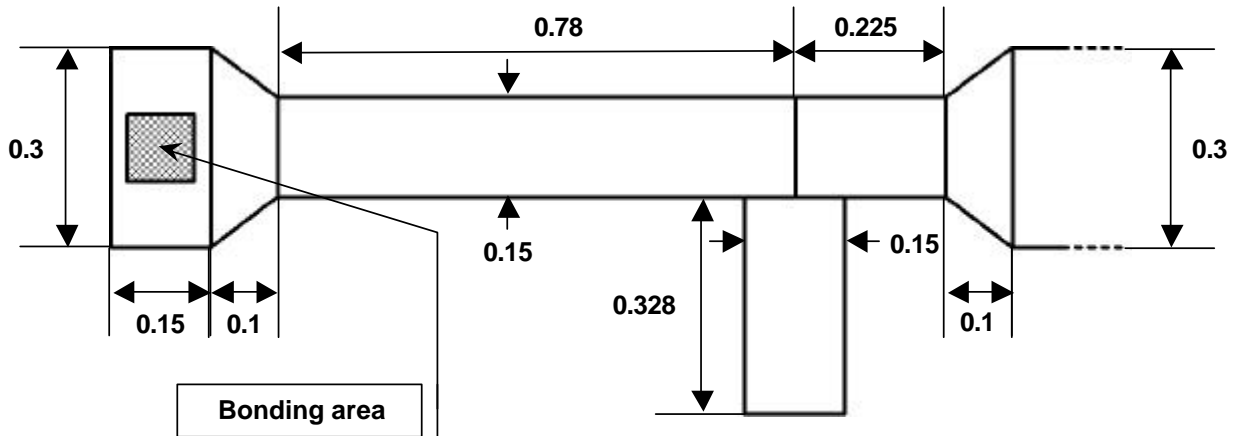
Port	Equivalent inductance (nH)	Wire length (mm) (1)
IN (2)	$L_{in} = 0.27$	0.34
OUT (8)	$L_{out} = 0.27$	0.34

(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.

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,  $\epsilon_r=3$ .



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

## Ordering Information

Chip form : CHU3277-98F/00

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