

W-band Multi-function: Multiplier / MPA

GaAs Monolithic Microwave IC

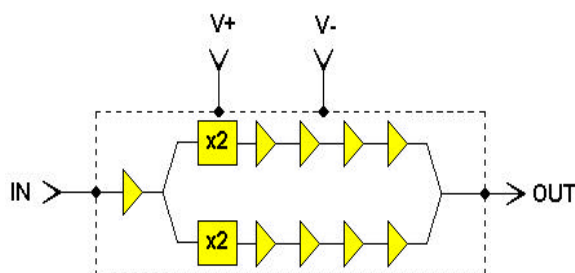
Description

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

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.

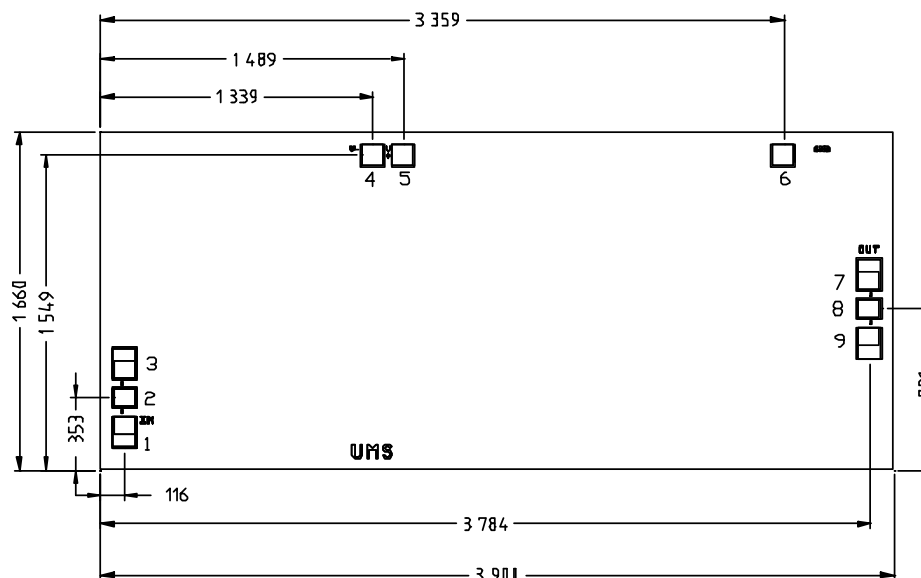
Absolute Maximum Ratings (3)

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

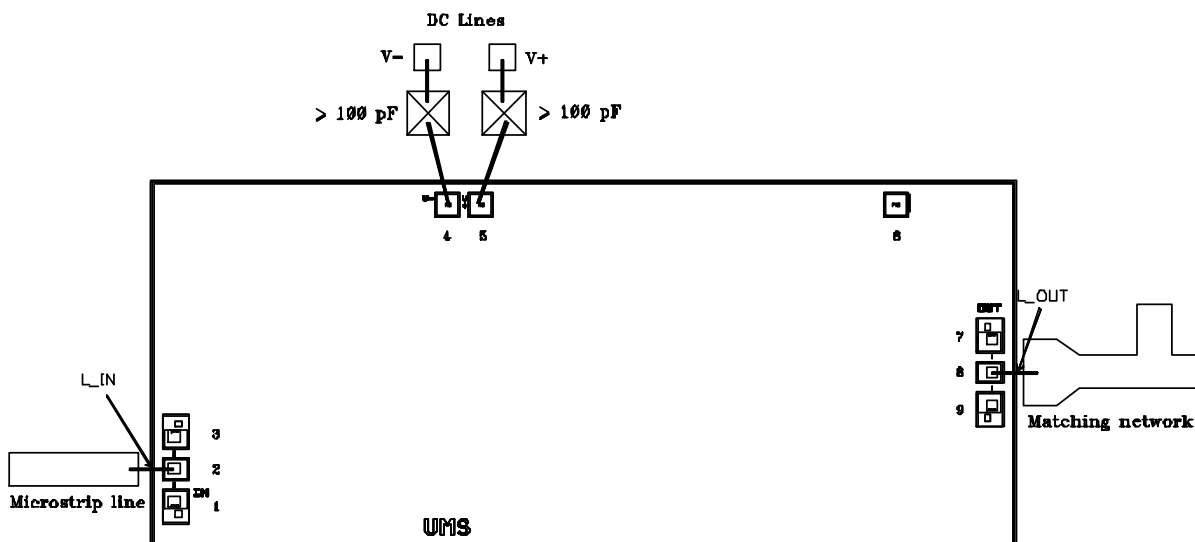


UNITS : μm
Tol. : $\pm 35\mu\text{m}$

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

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) has to be according to the following recommendation.

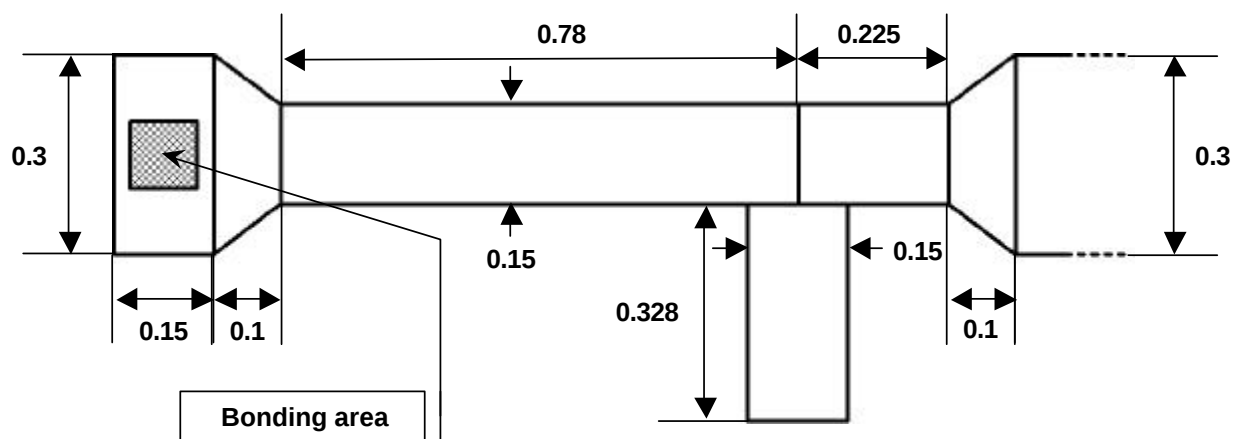
Port	Equivalent inductance (nH)	Wire length (mm) (1)
IN (2)	$L_{in} = 0.27$	0.34
OUT (8)	$L_{out} = 0.27$	0.34

(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 50 Ω microstrip line on RO3003 substrate.

Ordering Information

Chip form : CHU3277-98F/00

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