W01

Datasheet

Version 1.0

pycom
GO INVENT

8MB flash
memory

ESP32 Dual Core
Microcontroller and
WiFi/Bluetooth 4.2 radio

Size
20mm x 16mm x 2.7mm

Operating temperature
−40 to +85 °C

1.0   Overview

Introducing the W01 OEM Module. The tiny MicroPython
enabled Wifi & Bluetooth IoT development platform.
With a 1KM WiFi range, state of the art Espressif ESP32
chipset and dual processor, the W01 is all about taking
the Internet of Things to the next level. Create and
connect your things everywhere. Fast.

2.0   Features

–   Powerful CPU, BLE and state of the art WiFi radio
–   Can also double up as a Nano LoRa gateway
–   MicroPython enabled
–   Can be directly surface mount inside your product like
     a regular component
–   Ultra−low power usage: a fraction compared to other
     connected micro controllers

3.0   Specifications

3.1   CPU
– Xtensa® dual–core 32–bit LX6 microprocessor(s), up to 600 DMIPS

– Hardware floating point acceleration

– Python multi–threading

– An extra ULP–coprocessor that can monitor GPIOs, the ADC channels and control most of the internal peripherals during deep–sleep mode while only consuming 25uA.

3.2   Memory
– RAM: 520KB + 4MB
– External flash: 8MB

3.3   WiFi
– 802.11b/g/n 16mbps

3.4   Bluetooth
– Low energy and classic

3.5   RTC
– Running at 150kHz

3.6   Security
– SSL/TLS support
– WPA Enterprise security

3.7   Hash / encryption
– SHA
– MD5
– DES
– AES

4.0   Block Diagram

Figure 1 – System block diagram

5.0 Pinout

23/01/18

Only Input pins!
No pullup/pulldown
internal resistance

Absolute MAX per pin 12mA
recommended 6mA

Supply with a stable 3V3 power source
capable of delivering at least 450mA

Outputs 1V8 while the module
is in active mode, and drops
to 0V during deep sleep

WiFi / Bluetooth
Antenna

PROGRAM
Port

Boot modes and safe boot

P12 + 3V3

1-3 sec   Safe boot, latest firmware is selected
4-6 sec   Safe boot, previous user update selected
7-9 sec   Safe boot, the factory firmware is selected

Low Level Bootloader

P2 + GND

Power
GND
Serial Pin
Analog Pin
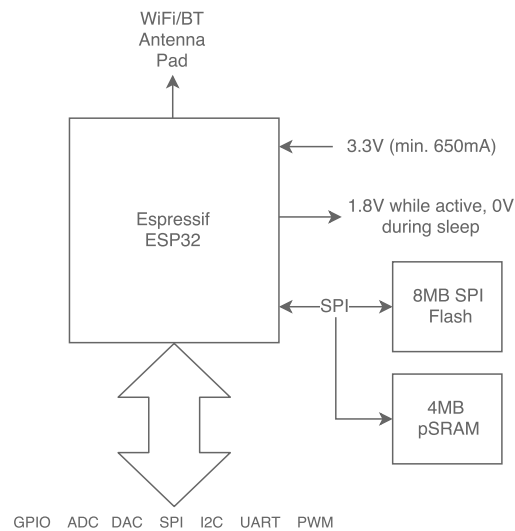Control
Physical Pin
Port Pin
Touch Pin
DAC Pin
PWM Pin

Figure 2 – Module pinout diagram

Note: The ESP32 supports remapping its peripherals to alternative pins. See below for a detailed list.

6.0   Pin Details

Table 1 – Module pinout

Module Pin	ESP32 GPIO	Pin Name	Default Function	ADC	PWM	RTC†	Notes
1	–	–	Ground				
2		–	Reset				Active Low
3	3	P0	RX0 (Programming)		•		Used by the bootloader and to program the module
4	1	P1	TX0 (Programming)		•		Used by the bootloader and to program the module
5	0	P2		2*	•	•	If tied to GND during boot the device will enter bootloader mode
6	4	P3	TX1	2*	•	•	
7	15	P4	RX1	2*	•	•	JTAG TDO, SD card CMD
8	5	P5			•		
9	27	P6		2*	•	•	
10	19	P7			•		
11	2	P8		2*	•	•	SD card DAT0
12	12	P9	SDA	2*	•	•	JTAG TDI
13	13	P10	SCL (I2C) / CLK (SPI)	2*	•	•	JTAG TCK
14	22	P11	MOSI		•		
15	21	P12			•		If tied to 3.3V during boot the device enters safe boot mode, JTAG MISO
16	–		Ground				
17	–		Ground				
18	–		WiFi/BT antenna				50 Ohm impedance required
19	–		Ground				
20	–		Ground				

6.0   Pin Details

Table 1 – Module pinout

Module Pin	ESP32 GPIO	Pin Name	Default Function	ADC	PWM	RTC†	Notes
21		–	Ground				
22	36	P13		1		•	Input only
23	37	P14	MISO	1		•	Input only
24	38	P15		1		•	Input only
25	39	P16		1		•	Input only
26	35	P17		1		•	Input only
27	34	P18		1		•	Input only
28	32	P19		1	•	•	
29	33	P20		1	•	•	
30	26	P21		2*	•	•	DAC
31	25	P22		2*	•	•	DAC
32	14	P23		2*	•	•	JTAG TMS, SD card SCLK
33	–	–	3.3V input				This supply should be able to source 650mA
34	–	–	Ground				
35	–	–	1.8V Output				Only when the device is active, during deep sleep this drops to 0V

† The pins on the RTC power domain can be used during deep sleep, specifically GPIO pins will maintain their state while in deep sleep.

* ADC2 is currently not supported in the micropython firmware

6.1   Remapping Pins

The ESP32 features comprehensive pin remapping functionality. This allows peripherals to be mapped onto almost any available GPIO pins. The above table merely shows the default assignments. For example, the default mapping has the SPI and I2C clocks overlapping, meaning both cannot be used simultaneously without remapping one to a different pin. For a detailed guide of what peripheral can be assigned to what pins please read "Appendix A – ESP32 Pin Lists" of the ESP32 datasheet.

7.0   ESP32 Peripherals

Table 2 – Peripherals

Peripheral	Count	Pins
UART	3	Remappable to any GPIO. Note: P13–18 can only be mapped to RX or CTS since they are input only.
I2C	2	Remappable to any GPIO except P13–18 since they are input only and I2C is bi–directional.
SPI	3	Remappable to any GPIO. Note: P13–18 can only be mapped to MISO since they are input only.
CAN*	1	Remappable to any GPIO. Note: P13–18 can only be mapped to RX since they are input only.
JTAG	1	TDO = P4, TDI = P9, TCK = P10, TMS = P24
PWM	1	All GPIO except P13–18 which are input only
ADC	18	Fixed mapping, see Table 1, Only ADC 1 is supported in our micropython firmware.
DAC	2	Only available on P21 and P22
SD	1	DAT0 = P8, SCLK = P23, CMD = P4

* Requires an external CAN bus transceiver, we recommend the SN65HVD230 from Texas Instruments.

For a more detailed description of the ESP32 peripherals along with peripherals not currently supported by our firmware, please check the ESP32 datasheet.

7.1   RTC
Our modules by default all use the internal RC oscillator at 150kHz for the RTC. If you require better accuracy/stability you can connect a 32.768 kHz crystal (or TCXO) externally on pins P19 and P20 (or P19 for a TXCO)
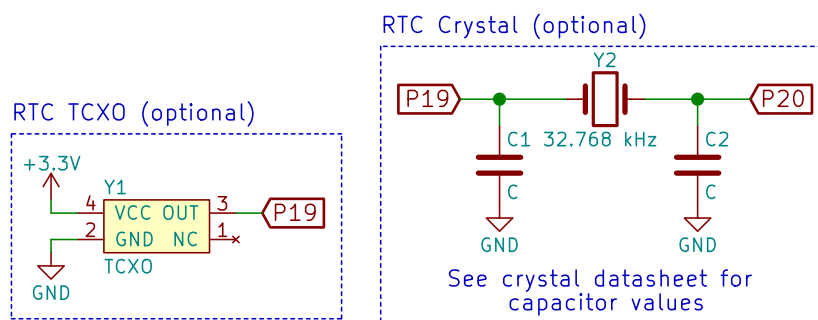

Figure 3 – External RTC crystal circuits

8.0 Programming the device

8.1 UART

By default, the modules run an interactive python REPL on UART0 which is connected to P0 (RX) and P1 (TX) running at 115200 baud. Code can be run via this interactive REPL or you can use our PyMakr plugin for Atom or Visual Studio Code to upload code to the board.

8.2 Wi−Fi

By default, the W01 also acts as a Wi−Fi access point. .
SSID: wipy−wlan−XXXX
Password: www.pycom.io
Once connected to the W01's Wi−Fi network you can access it in two ways.

8.2.1 Telnet

Running on port 23 is a telnet server. This acts in a very similar way to the UART. It presents you with an interactive REPL and can also be used to upload code via PyMakr.

8.2.2 FTP

The W01 also runs a FTP server that allows you to copy files to and from the device, include an SD card if one is connected. To connect to this FTP server, you need to use plain FTP (un−encrypted) with the following credentials:
User: micro
Password: python

9.0 Boot modes

9.1 Bootloader mode

In order to update the firmware of the W01 device, it needs to be placed into bootloader mode. In order to do this, P2 needs to be connected to ground when the device reboots. Once in bootloader mode you can use the Pycom firmware update tool to update to the latest official firmware. If you are developing your own firmware based on our open−source firmware, a flashing script is provided with the source code.

9.2 Safe boot

The micropython firmware features a safe boot feature that skips the boot.py and main.py scripts and goes straight to the REPL. This is useful if the device is programmed with code that causes the device to crash or become inaccessible. To access this mode, you need to connect P12 to 3.3V and reset the device. Upon entering safe boot mode, the on−board LED will begin to blink orange. Depending on the duration the pin is held at 3.3V, a different firmware will be run.

Table 3 − Boot modes

0−3 Seconds	3−6 Seconds
Current firmware without running boot.py or main.py	Previous firmware if the firmware was uploaded via OTA (without running boot.py and main.py)

10.0   Power

The W01 features an on−board voltage regulator that takes 3.5V − 5.5V from the VIN pin and regulates it to 3.3V. It is important to only use the 3.3V as an output and not try to feed 3.3V into this pin as this could damage the regulator.

10.1   Current consumption by power modes/features running at 3.7V

Table 4 − Power consumption by feature

Mode	Min	Avg.	Max	Units
Idle (no radios)	−	34	−	mA
WiFi AP	−	110	−	mA
WiFi client	−	123	−	mA
Bluetooth	−	107	−	mA
Deep sleep	−	5.40	−	µA

11.0   Memory Map

11.1   Flash

Table 5 – Flash memory map

Name	Description	Start address	Size
NVS	Non–volatile RAM area. Used by the NVS API	0x9000	0x7000
Firmware Slot 0	First firmware slot. Factory firmware is flashed here	0x10000	0x180000
OTA info	Information about the current active firmware	0x190000	0x1000
Firmware Slot 1	Second firmware slot	0x1A0000	0x180000
File system (1)	504KB file system on devices with 4MB flash	0x380000	0x7F000
Config	Config area for LoRa, Sigfox and LTE	0x3FF000	0x1000
File system (2)	4MB file system on devices with 8MB flash	0x400000	0x400000

11.2   RAM

Table 6 – RAM memory map

Name	Description	Size
On–chip SRAM	Internal RAM memory used by the 2 xtensa CPUs	520KB
Fast RTC RAM	Fast RAM area accessible by the xtensa cores during boot and sleep modes	8KB
Slow RTC RAM	Slow RAM area accessible by the Ultra–Low Power Coprocessor during deep sleep	8KB
External pSRAM	External QSPI RAM memory clocked @ 40MHz	4MB

11.3   ROM and eFuses

Table 7 – Miscellaneous memory

Name	Description	Size
On–chip ROM	Contains core functions and boot code.	448KB
eFuse	256 bits are used for the system (MAC address and chip configuration) and the remaining 768 bits are reserved for customer applications, including Flash–Encryption and Chip–ID	1kbit

12.0   WiFi

12.1   Supported features

- 802.11 b/g/n/e/i
- 802.11 n (2.4 GHz), up to 150 Mbps
- 802.11 e: QoS for wireless multimedia technology
- WMM–PS, UAPSD
- A–MPDU and A–MSDU aggregation
- Block ACK
- Fragmentation and defragmentation
- Automatic Beacon monitoring/scanning
- 802.11 i security features: pre–authentication and TSN
- Wi–Fi Protected Access (WPA/WPA2/WPA2–Enterprise/Wi–Fi Protected Setup (WPS)
- Infrastructure BSS Station mode/SoftAP mode
- Wi–Fi Direct (P2P), P2P Discovery, P2P Group Owner mode and P2P Power Management

12.2   Specifications

Table 8 – WiFi specifications

Description	Min	Typ.	Max	Unit
Input Frequency	2412	–	2484	MHz
Tx power Output power of PA for 72.2 Mbps	13	14	15	dBm
Output power of PA for 11b mode	19.5	20	20.5	dBm
Sensitivity				
DSSS, 1Mbps	–	–	98	dBm
CCK, 11 Mbps	–	–	91	dBm
OFDM, 6 Mbps	–	–	93	dBm
OFDM, 54 Mbps	–	–	75	dBm
HT20, MCS0	–	–	93	dBm
HT20, MCS7	–	–	73	dBm
HT40, MCS0	–	–	90	dBm
HT40, MCS7	–	–	70	dBm
MCS32	–	–	89	dBm
Adjacent channel rejection				
OFDM, 6 Mbps	–	37	–	dB
OFDM, 54 Mbps	–	21	–	dB
HT20, MCS0	–	37	–	dB
HT20, MCS7	–	20	–	dB

13.0   Bluetooth

13.1   Supported features

- Compliant with Bluetooth v4.2 BR/EDR and BLE specification
- Class−1, class−2 and class−3 transmitter without external power amplifier
- Enhanced power control
- +12 dBm transmitting power
- NZIF receiver with −97 dBm sensitivity
- Adaptive Frequency Hopping (AFH)
- Standard HCI based on SDIO/SPI/UART
- High−speed UART HCI, up to 4 Mbps
- BT 4.2 controller and host stack

- Service Discover Protocol (SDP)
- General Access Profile (GAP)
- Security Manage Protocol (SMP)
- ATT/GATT
- HID
- All GATT−based profile supported
- SPP−like GATT−based profile
- BLE Beacon
- A2DP/AVRCP/SPP, HSP/HFP, RFCOMM
- CVSD and SBC for audio codec
- Bluetooth Piconet and Scatternet

13.2   Specification

13.2.1   Receiver − Basic Data Rate

Table 9 − Receiver (basic data rate) specifications

Parameter		Min	Typ.	Max	Unit
Sensitivity @0.1% BER		−	−94	−	dBm
Maximum received signal @0.1% BER		0	−	−	dBm
Co−channel C/I		−	+7	−	dB
Adjacent channel selectivity C/I	F = F0 + 1 MHz	−	−	−6	dB
	F = F0 − 1 MHz	−	−	−6	dB
	F = F0 + 2 MHz	−	−	−25	dB
	F = F0 − 2 MHz	−	−	−33	dB
	F = F0 + 3 MHz	−	−	−25	dB
	F = F0 − 3 MHz	−	−	−45	dB
Out−of−band blocking performance	30Mhz ~ 2000MHz	−10	−	−	dBm
	2000MHz ~ 2400MHz	−27	−	−	dBm
	2500MHz ~ 3000MHz	−27	−	−	dBm
	3000MHz ~ 12.5GHz	−10	−	−	dBm
Intermodulation		−36	−	−	dBm

13.2.2 Receiver – Enhanced Data Rate

Table 10 – Receiver (basic data rate) specifications

Parameter		Min	Typ.	Max	Unit
π/4 DQPSK					
Sensitivity @0.1% BER		–	−90	–	dBm
Maximum received signal @0.1% BER		–	0	–	dBm
Co−channel C/I		–	11	–	dB
Adjacent channel selectivity C/I	F = F0 + 1 MHz	–	−7	–	dB
	F = F0 − 1 MHz	–	−7	–	dB
	F = F0 + 2 MHz	–	−25	–	dB
	F = F0 − 2 MHz	–	−35	–	dB
	F = F0 + 3 MHz	–	−25	–	dB
	F = F0 − 3 MHz	–	−45	–	dB
8DPSK					
Sensitivity @0.1% BER		–	−84	–	dBm
Maximum received signal @0.1% BER		–	−5	–	dBm
C/I c−channel		–	18	–	dB
Adjacent channel selectivity C/I	F = F0 + 1 MHz	–	2	–	dB
	F = F0 − 1 MHz	–	2	–	dB
	F = F0 + 2 MHz	–	−25	–	dB
	F = F0 − 2 MHz	–	−25	–	dB
	F = F0 + 3 MHz	–	−25	–	dB
	F = F0 − 3 MHz	–	−38	–	dB

13.2.3   Receiver – Bluetooth LE

Table 11 – Receiver (BLE) specifications

Parameter		Min	Typ.	Max	Unit
Sensitivity @30.8% PER		–	−97	–	dBm
Maximum received signal @30.8% PER		0	–	–	dBm
Co−channel C/I		–	+10	–	dB
Adjacent channel selectivity C/I	F = F0 + 1MHz	–	−5	–	dB
	F = F0 − 1MHz	–	−5	–	dB
	F = F0 + 2MHz	–	−25	–	dB
	F = F0 − 2MHz	–	−35	–	dB
	F = F0 + 3MHz	–	−35	–	dB
	F = F0 − 3MHz	–	−45	–	dB
Out−of−band blocking performance	30MHz ~ 2000MHz	−10	–	–	dB
	2000MHz ~ 2400MHz	−27	–	–	dBm
	2500MHz ~ 3000MHz	−27	–	–	dBm
	3000MHz ~ 12.5GHZ	−10	–	–	dBm
Intermodulation		−36	–	–	dBm

13.2.4 Transmitter – Basic Data Rate

Table 12 – Transmitter (basic data rate) specifications

Parameter		Min	Typ.	Max	Unit
RF transmit power		–	0	–	dBm
Gain control step		–	±3	–	dBm
RF power control range		−12	–	+12	dBm
+20 dB bandwidth		–	0.9	–	MHz
Adjacent channel transmit power	F = F0 + 1 MHz	–	−24	–	dBm
	F = F0 − 1 MHz	–	−16.1	–	dBm
	F = F0 + 2 MHz	–	−40.8	–	dBm
	F = F0 − 2 MHz	–	−35.6	–	dBm
	F = F0 + 3 MHz	–	−45.7	–	dBm
	F = F0 − 3 MHz	–	−40.2	–	dBm
	F = F0 + >3 MHz	–	45.6	–	dBm
	F = F0 − >3 MHz	–	44.6	–	dBm
$\Delta f1_{avg}$		–	–	155	KHz
$\Delta f2_{max}$		133.7			KHz
$\Delta f2_{avg}/\Delta f1_{avg}$		–	0.92	–	–
ICFT		–	−7	–	KHz
Drift rate		–	0.7	–	KHz/50µs
Drift (1 slot packet)		–	6	–	KHz
Drift (5 slot packet)		–	6	–	KHz

13.2.5 Transmitter – Enhanced Data Rate

Table 13 – Transmitter (enhanced data rate) specifications

Parameter		Min	Typ.	Max	Unit
RF transmit power		–	0	–	dBm
Gain control step		–	±3	–	dBm
RF power control range		−12	–	+12	dBm
π/4 DQPSK max w0		–	−0.72	–	KHz
π/4 DQPSK max wi		–	−6	–	KHz
π/4 DQPSK max |wi + w0|		–	−7.42	–	KHz
8DPSK max w0		–	0.7	–	KHz
8DPSK max wi		–	−9.6	–	KHz
8DPSK max |wi + w0|			−10		KHz
π/4 DQPSK modulation accuracy	RMS DEVM	–	4.28	–	%
	99% DEVM	–	–	30	%
	Peak DEVM	–	13.3	–	%
8 DPSK modulation accuracy	RMS DEVM	–	5.8	–	%
	99% DEVM	–		20	%
	Peak DEVM	–	14	–	%
In−band spurious emissions	F = F0 + 1MHz	–	−34	–	dBm
	F = F0 − 1MHz	–	−40.2	–	dBm
	F = F0 + 2MHz	–	−34	–	dBm
	F = F0 − 2MHz	–	−36	–	dBm
	F = F0 + 3MHz	–	−38	–	dBm
	F = F0 − 3MHz	–	−40.3	–	dBm
	F = F0 ± >3MHz	–	–	−41.5	dBm
EDR differential phase coding		–	100	–	%

13.2.6   Transmitter – Bluetooth LE

Table 14 – Transmitter (BLE) specifications

Parameter		Min	Typ.	Max	Unit
RF transmit power		–	0	–	dBm
Gain control step		–	±3	–	dBm
RF power control range		−12	–	+12	dBm
Adjacent channel transmit power	F = F0 + 1MHz	–	−14.6	–	dBm
	F = F0 − 1MHz	–	−12.7	–	dBm
	F = F0 + 2MHz	–	−44.3	–	dBm
	F = F0 − 2MHz	–	−38.7	–	dBm
	F = F0 + 3MHz	–	−49.2	–	dBm
	F = F0 − 3MHz	–	−44.7	–	dBm
	F = F0 + >3MHz	–	−50	–	dBm
	F = F0 − >3MHz	–	−50	–	dBm
$\Delta f1_{avg}$		–	–	265	KHz
$\Delta f2_{max}$		247	–	–	KHz
$\Delta f2_{avg}/\Delta f1_{avg}$		–	−0.92	–	–
ICFT		–	−10	–	KHz
Drift rate		–	0.7	–	KHz/50µs
Drift		–	2	–	KHz

14.0 Electrical Characteristics

14.1 Absolute maximum ratings

Table 15 − Absolute maximum ratings

Parameter	Symbol	Min	Typ.	Max	Unit
Supply Input Voltage	V_{IN}	3.5	–	5.5	V
Supply Output Current	I_{OUT}	–	–	1.2	A
Supply Output Voltage	V_{3V3}	–	3.3	–	V
Storage Temperature	T_{STR}	–	–	–	°C
Operating Temperature	T_{OPR}	−40	–	85	°C
Moisture Sensitivity Level	MSL	–	1	–	–

14.2 Input/Output characteristics

Table 22 − Input/Output characteristics

Parameter	Symbol	Min	Typ.	Max	Unit
Input low voltage	V_{IL}	−0.3	–	$0.25{\times}V_{3V3}$	V
Input high voltage	V_{IH}	$0.75{\times}V_{3V3}$	–	$V_{3V3}{+}0.3$	V
Max Input sink current	I_{SINK}	–	6	12	mA
Input leakage current	I_{IL}	–	–	50	nA
Input pin capacitance	C_{pin}	–	–	2	pF
Output low voltage	V_{OL}	$0.1{\times}V_{3V3}$	–	–	V
Output high voltage	V_{OH}	$0.8{\times}V_{3V3}$	–	–	V
Max Output source current	I_{SOURCE}	–	6	12	mA

15.0 Minimum Recommended Circuit
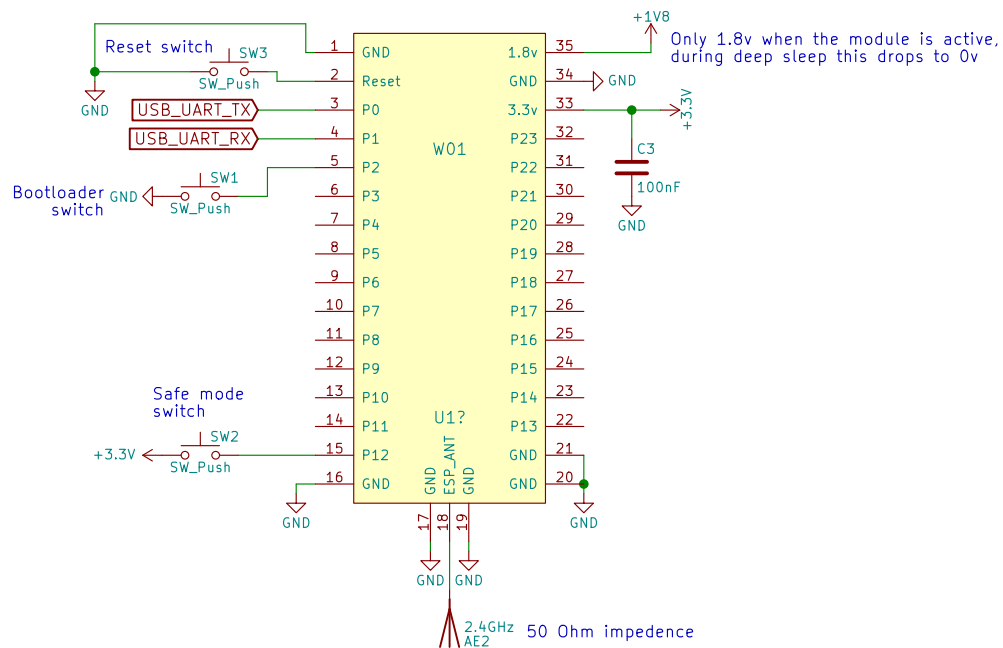
Figure 4 – Minimum required circuit

16.0   Mechanical Specifications
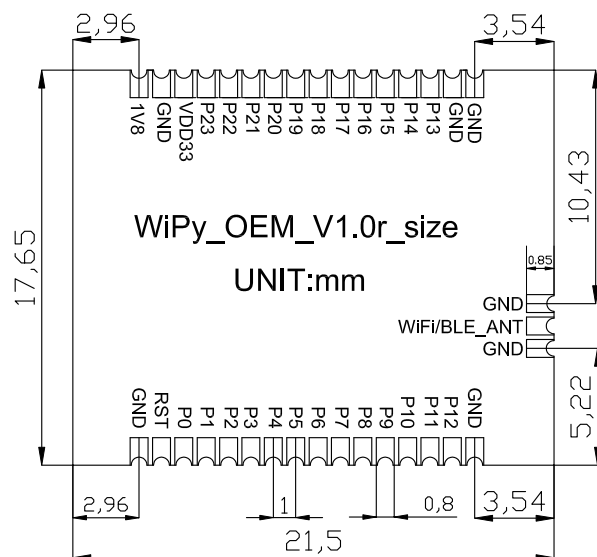
Figure 5 – Mechanical drawing (top down view)

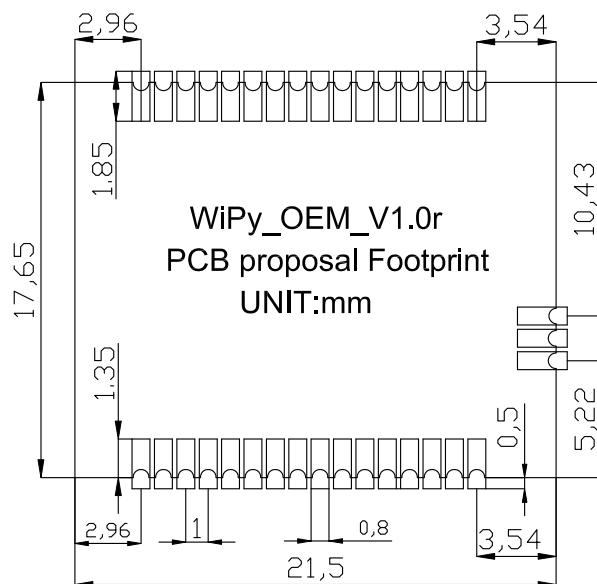## 17.0   Recommended Land Patterns

Figure 6 – Recommended land pattern

18.0   Design Considerations

18.1   Antenna Impedance

Our OEM modules are intended to be used with a 50–ohm antenna. They are also required to be connected to the antenna by a 50–ohm grounded co–planar waveguide (as shown in the reference design below with the yellow lines) or a microstrip.
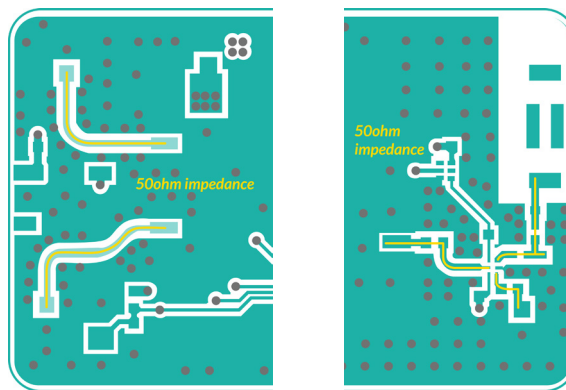
Figure 7 – 50–ohm impedance antenna connections

18.2   Deep sleep power

When selecting a voltage regulator for your application ensure that it has a low power mode, and that this is enabled when the device enters deep sleep. We also recommend cutting off power to all non–essential components such as LEDs, logic gates, sensors etc. when the device is in deep sleep. This can be done using the circuit shown right:

This circuit uses the 1.8V output of the module to cut off supply to non–essential circuitry. The 1.8V output is only active when the module is running, when it goes to deep sleep it drops to 0V. The non–essential circuitry is then powered from the "ACTIVE_POWER" bus.
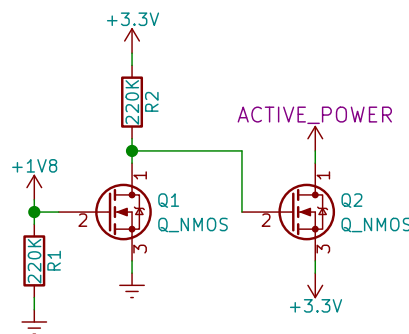

Figure 8 – Power switch for deep sleep mode

18.3 Reference layout

Below you will find the designs for our universal reference board that fits all of our OEM modules. The design files can be downloaded from our website.
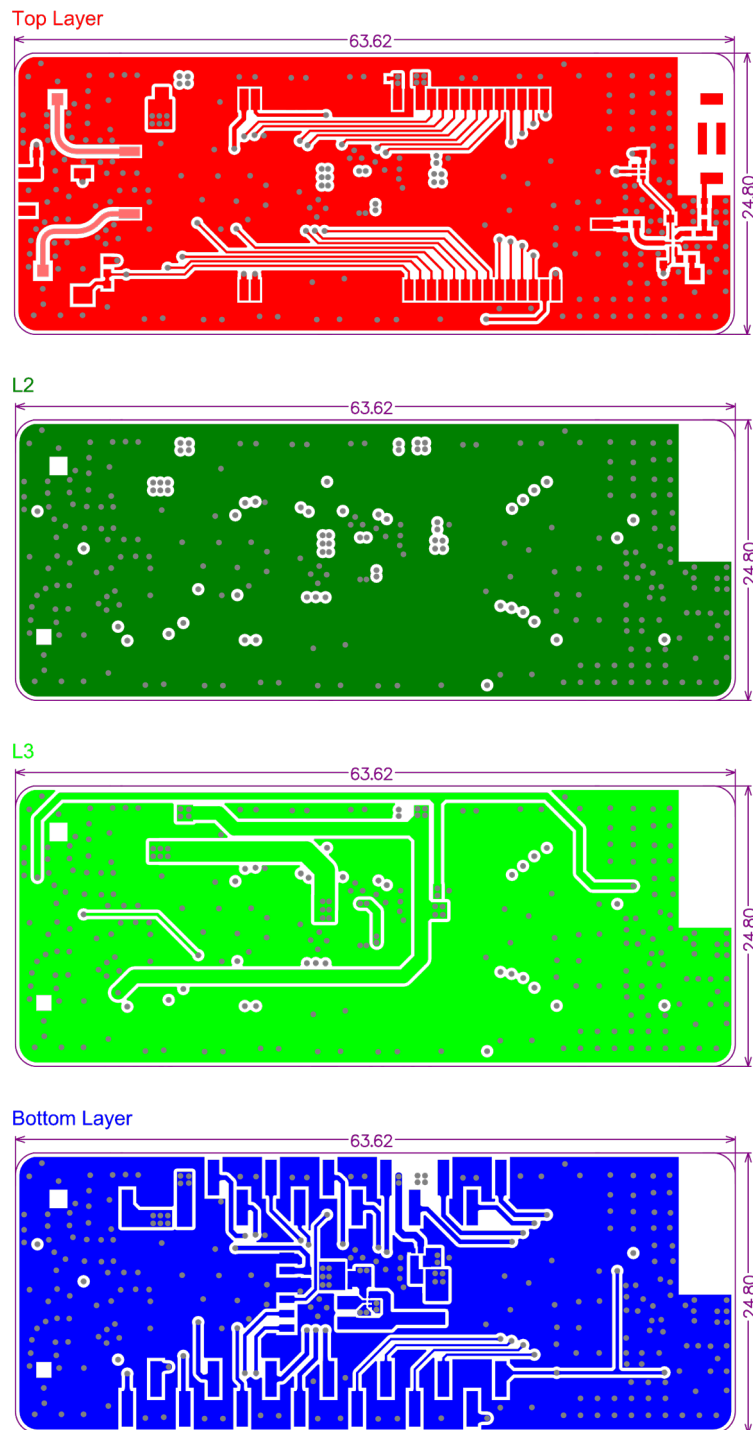
Top Layer

L2

L3

Bottom Layer

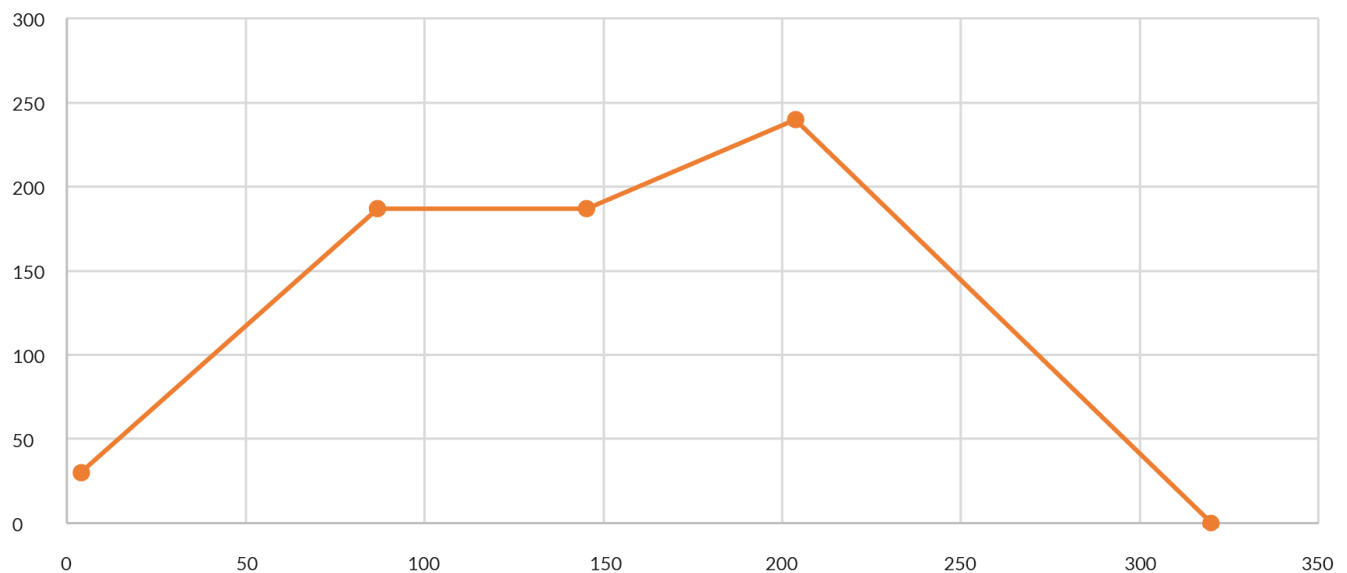*Figure 9 – PCB layers for reference design – Units: mm*

19.0   Soldering Profile

Figure 10 – Reflow soldering temperature profile

Table 17 – Soldering profile temperatures

Stage	Duration/Rate	Temperature
Ramp to soak	2°C/s	Ambient – 185°C
Soak	60s	185°C
Ramp to peak	1°C/s	240°C
Reflow	45s	>225°C
Cool down	2°C/s	

The above profile is based on Alpha CVP–390 solder paste, which has been successfully tested with our devices.
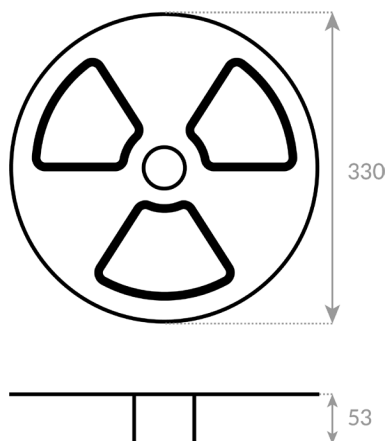
20.0   Ordering Information

Table 22 – Ordering information

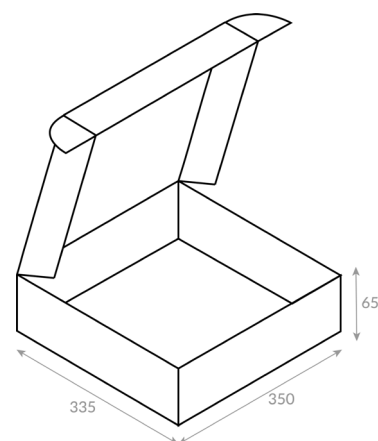| Product EAN	Description
0700461341550	W01 – OEM version of WiPy 3.0
0700461908708	Reel of 250 W01 OEM modules
0700461908920	Reel of 500 W01 OEM modules

21.0   Packaging

21.1   Reel
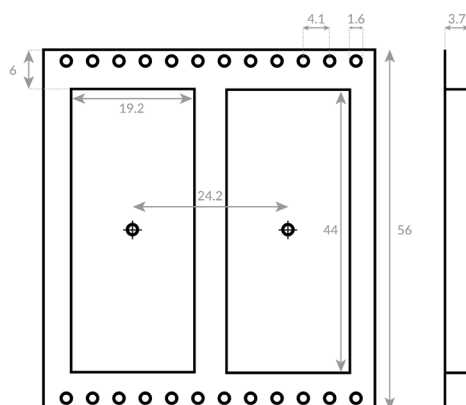
Figure 11 – Mechanical drawing of reel – Units: mm

21.2   Tape

Figure 12 – Mechanical drawing of reel tape – Units: mm

21.3   Box

Figure 13 – Mechanical drawing of reel box – Units: mm

22.0   Certification

FCC   2AJMTWIPY01R
IC   22263−WIPY01R
CE   0700
Copies of the certificates can be found on our website.

23.0   Regulator Information

23.1   EU Regulatory Conformance

Hereby, Pycom Ltd declares that this device is in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC

23.2   Federal Communication Commission Interference Statement

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference.
2. This device must accept any interference received, including interference that may cause undesired operation.

CAUTION: Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

– Reorient or relocate the receiving antenna.
– Increase the separation between the equipment and receiver.
– Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
– Consult the dealer or an experienced radio/TV technician for help.

23.2.1 RF Warning Statement

To comply with FCC RF exposure compliance requirements, the antennas used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co−located or operating in conjunction with any other antenna or transmitter.

23.2.2 OEM integrator conditions

This device is intended only for OEM integrators under the following conditions:

1. The antenna must be installed such that 20 cm is maintained between the antenna and users, and
2. The transmitter module may not be co−located with any other transmitter or antenna.

As long as the two conditions above are met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end−product for any additional compliance requirements required with this module installed.
To ensure compliance with all non−transmitter functions the host manufacturer is responsible for ensuring compliance with the module(s) installed and fully operational. For example, if a host was previously authorized as an unintentional radiator under the Declaration of Conformity procedure without a transmitter certified module and a module is added, the host manufacturer is responsible for ensuring that the after the module is installed and operational the host continues to be compliant with the Part 15B unintentional radiator requirements.

The module is limited to OEM installation ONLY. The module is limited to installation in mobile or fixed application. We hereby acknowledge our responsibility to provide guidance to the host manufacturer in the event that they require assistance for ensuring compliance with the Part 15 Subpart B requirements.

IMPORTANT NOTE: In the event that these conditions cannot be met (for example certain laptop configurations or co−location with another transmitter), then the FCC authorization is no longer considered valid and the FCC ID cannot be used on the final product. In these circumstances, the OEM integrator will be responsible for re−evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

23.2.3 End Product Labelling

This transmitter module is authorized only for use in device where the antenna may be installed such that 20 cm may be maintained between the antenna and users. The final end product must be labelled in a visible area with the following: "Contains FCC ID: 2AJMTWIPY01R". The grantee's FCC ID can be used only when all FCC compliance requirements are met.

The following FCC part 15.19 statement has to also be available on the label:

This device complies with Part 15 of FCC rules. Operation is subject to the following two conditions:

1. this device may not cause harmful interference and
2. this device must accept any interference received, including interference that may cause undesired operation.

23.2.4 Manual Information to the End User

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module.

In the user manual of the end product, the end user has to be informed that the equipment complies with FCC radio−frequency exposure guidelines set forth for an uncontrolled environment.

The end user has to also be informed that any changes or modifications not expressly approved by the manufacturer could void the user's authority to operate this equipment.

The end user manual shall include all required regulatory information/warning as show in this manual.

The maximum operating ambient temperature of the equipment declared by the manufacturer is −40~+85C

Receiver category 3

24.0   Revision History

Table 23 − Document revision history

Version 1.0	Initial Release