Ezlo_EP01

Ezlo_EP01 is a low-power embedded Wi-Fi and Bluetooth module that Ezlo has developed. It consists of a highly integrated chip (ESP32-D0WDQ6), a number of peripherals, an embedded Wi-Fi network protocol stack, the Bluetooth LE network protocol, and varied library functions.

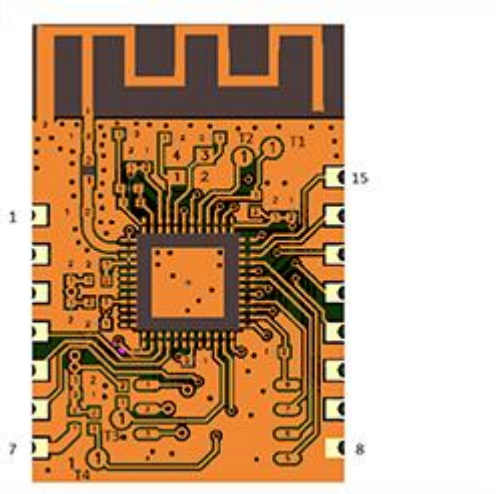
1. Scope of application

The Ezlo_EP01 is a versatile Wi-Fi + Bluetooth® + Bluetooth LE MCU designed for a wide range of applications, from low-power networked sensors to the most challenging tasks such as voice encoding, music streaming and MP3 decoding. This module is based on the ESP32-D0WDQ6* chip. The embedded chip is designed to scale and adapt. The module consists of a ESP32-U4WDH embedded chip with a 32-bit LX6 microprocessor with 448KB ROM, 520 KB SRAM and 16KB SRAM in RTC. It also has a 128 MBit SPI flash, built-in Wi-Fi 802.11b/g/n network protocol along with Bluetooth v4.2 BR/EDR and Bluetooth LE. The central frequency ranges from 2412 ~ 2484 MHz. The operating voltage/Power supply is 3.0 ~ 3.6 V with Operating ambient temperature of –40 ~ 85 °C for – 85 °C version module and –40 ~ 105 °C for – 105 °C version module. The module comes with an onboard PCB antenna.

2. Module interfaces

2.1 Dimensions and footprint

Ezlo_EP01 has two rows of pins with a 2 ± 0.1 mm pin spacing. The Ezlo_EP01 dimensions are 16 mm (W) × 24 mm (L) × 1.2 mm (H).



2.2 Pin definition

Pin 1	GPIO21	(ADC AI)
Pin 2	EN	(I – Enabling pin, which needs to be connected to the voltage of 3.3V in normal cases and corresponds to CHIP_EN)
Pin 3	GPIO25	(I/O – Common IO pin)
Pin 4	GPIO26	(P – Support hardware PWM)
Pin 5	GPIO27	(I/O – Support hardware PWM and Common IO pin)
Pin 6	GPIO16	(I/O – Support hardware PWM and Common IO pin)
Pin 7	Power +3.3V	(P – Power supply source (3.3V))
Pin 8	GND	(P – Power supply reference ground)
Pin 9	GPIO19	(O – Common IO pin)
Pin 10	GPIO22	(O – Common IO pin)
Pin 11	GPIO4	(I/O – Common IO pin)
Pin 12	GPIO17	(I/O – Support hardware PWM and Common IO pin)
Pin 13	GPIO23	(I/O – Support hardware PWM and Common IO pin)
Pin 14	Rx1	(I/O – UART0_RXD)
Pin 15	Tx1	(I/O – UART0_TXD)

3. Electrical parameters

3.1 Absolute Maximum Ratings

Parameter	Description	Min	Max	Unit
VDDA, VDD3P3, VDD3P3_RTC, VDD3P3_CPU, VDD_SDIO	Allowed input voltage	– 0.3	3.6	V
Ioutput	Cumulative IO output current (1)	-	1200	mA
TSTORE	Storage temperature	- 40	150	°C

*The product proved to be fully functional after all its IO pins were pulled high while being connected to ground for 24 consecutive hours at ambient temperature of 25 °C.

3.2 Recommended Power Supply Characteristics

Parameter	Description	Min	Typ.	Max	Unit
VDDA, VDD3P3_RTC, VDD3P3, VDD_SDIO (3.3 V mode)	Voltage applied to power supply pins per power domain	2.3/3.0	3.3	3.6	V
VDD3P3_CPU	Voltage applied to power supply pin	1.8	3.3	3.6	V
IVDD	Current delivered by external power supply	0.5	-	-	A
T	Operating temperature	–40	-	125	°C

3.3 DC Characteristics (3.3 V, 25 °C)

Parameter	Description		Min	Typ.	Max	Unit
CIN	Pin capacitance		-	2	-	pF
VIH	High-level input voltage		0.75×VDD	-	VDD+0.3	V
VIL	Low-level input voltage		- 0.3	-	0.25×VDD	V
IIH	High-level input current		-	-	50	nA
IIL	Low-level input current		-	-	50	nA
VOH	High-level output voltage		-	-	-	V
VOL	Low-level output voltage		-	-	0.1×VDD	V
IOH	High-level source current (VDD1 = 3.3 V, VOH >= 2.64 V	VDD3P3_CPU power domain	- -	40 40	- -	mA mA
		VDD3P3_RTC power domain	-	20	-	mA
		VDD_SDIO power domain				

	output drive strength set to the maximum				
IOL	Low-level sink current (VDD1= 3.3 V, VOL = 0.495 V,	—	28	—	mA
RPU	Resistance of internal pull-up resistor	—	45	—	VkΩ
RPD	Resistance of internal pull-down resistor	—	45	—	VkΩ
VIL_nRS	Low-level input voltage of CHIP_ PU to shut down the chip	—	—	0.6	V

3.4 RF Current Consumption in Active Mode Current Consumption Depending on RF Modes

Work Mode	Min	Typ	Max	Unit
Transmit 802.11b, DSSS 1 Mbps, POUT = +19.5 dBm	—	240	—	mA
Transmit 802.11g, OFDM 54 Mbps, POUT = +16 dBm	—	190	—	mA
Transmit 802.11n, OFDM MCS7, POUT = +14 dBm	—	180	—	mA
Receive 802.11b/g/n	—	95 ~ 100	—	mA
Transmit BT/BLE, POUT = 0 dBm	—	130	—	mA
Receive BT/BLE	—	95 ~ 100	—	mA

3.5 Wi-Fi Radio Characteristics

Parameter	Description	Min	Typ.	Max	Unit
Operating frequency range	—	2412	—	2484	MHz
Output impedance	—	—	30+j10	—	Ω
TX power	11n, MCS7	12	13	14	dBm
	11b mode	18.5	19.5	20.5	dBm
Sensitivity	11b, 1 Mbps	—	–98	—	dBm
	11b, 11 Mbps	—	–88	—	dBm
	11g, 6 Mbps	—	–93	—	dBm
		—	–75	—	dBm

	11g, 54 Mbps	—	–93	—	dBm
	11n, HT20, MCS0	—	–73	—	dBm
	11n, HT20, MCS7	—	–90	—	dBm
	11n, HT40, MCS0	—	–70	—	dBm
	11n, HT40, MCS7				
Adjacent channel rejection	11g, 6 Mbps	—	27	—	dBm
	11g, 54 Mbps	—	13	—	dBm
	11n, HT20, MCS0	—	27	—	dBm
	11n, HT20, MCS7	—	12	—	dBm

4. Antenna

4.1 Antenna type

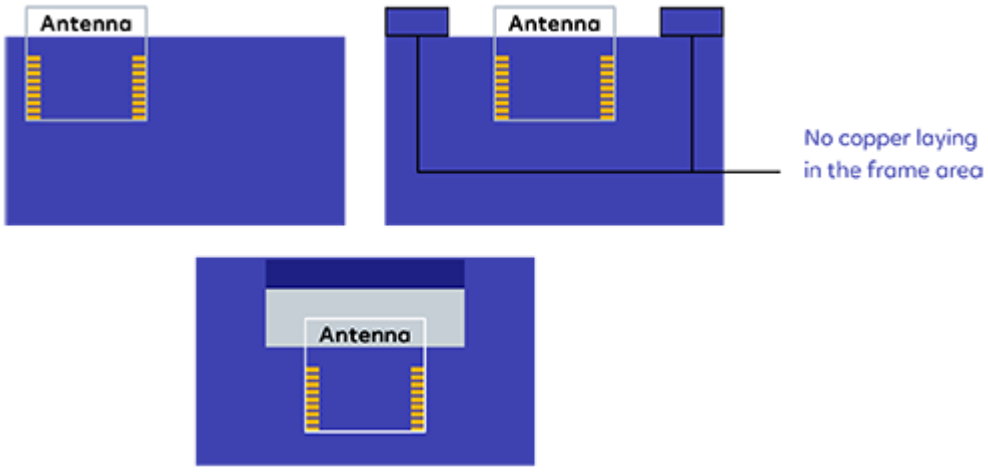
Ezlo_EP01 uses only an onboard PCB antenna.

4.2 Antenna interference reduction

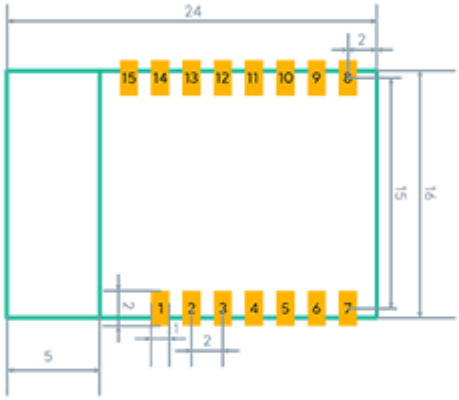
To ensure optimal Wi-Fi performance when the Wi-Fi module uses an onboard PCB antenna, it is recommended that the antenna be at least 15 mm away from other metal parts.

To ensure antenna performance, the PCB should not be routed or clad with copper in the antenna area. The main points of the layout: Make sure that there is no substrate medium directly below or above the printed antenna.

Make sure that the area around the printed antenna is far away from the metal copper skin, so as to ensure the radiation effect of the antenna to the greatest extent.



5. Recommended PCB layout



6. Power-on sequence and resetting

6.1 Treatment of GPIO pins

A few pins of the module will have instantaneous high-level pulses before the chip fully works, and everything will be normal after the chip works. For these pins, if they are directly used as driving light sources or relays, in order to avoid the effect of burrs at the moment of power-on, refer to the following processing methods: Pull down a 1-KΩ resistor at an output port of a pin, and then connect a diode in series.

At this time, the voltage of a GPIO will drop to about 2.7V after passing through the diode. The red box represents the original drive tube on the customer's baseboard. A diode D1 and pull-down 1-KΩ resistor need to be added. If a lamp is directly driven, pull down a 10-KΩ resistor on the grid of the positive Mos. If a lamp is not directly driven and a PWM signal will not be sent until the module is officially launched, there is no need to add a pull-down resistor and diode. If a relay is driven, you can change the diode to a resistor of 0 Ω according to the actual situation.

6.2 Storage Conditions

The products sealed in moisture barrier bags (MBB) should be stored in a non-condensing atmospheric environment of ∠ 40 °C and 90%RH. The module is rated

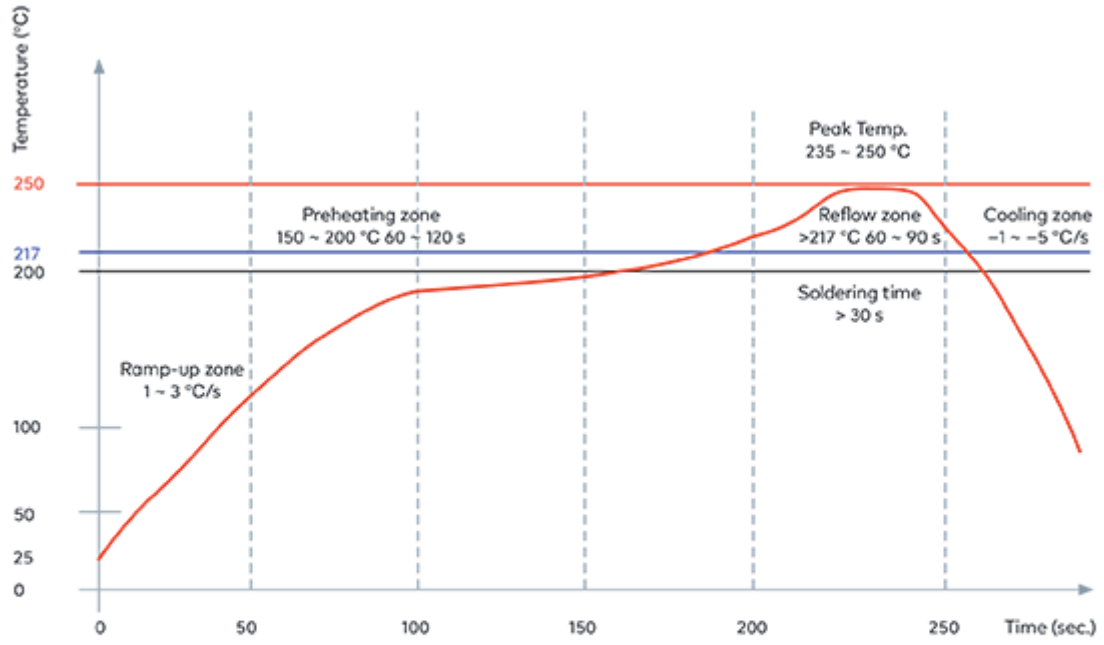
at the moisture sensitivity level (MSL) of 3. After unpacking, the module must be soldered within 168 hours with the factory conditions 25 ± 5 °C and 60 %RH. If the above conditions are not met, the module needs to be baked.

6.3 Electrostatic Discharge (ESD)

- Human body model (HBM): ±2000 V
- Charged-device model (CDM): ±500 V

6.4 Reflow Profile

Solder the module in a single reflow.



Ramp-up zone — Temp.: 25 ~ 150 °CTime: 60 ~ 90 s Ramp-up rate: 1 ~ 3 °C/s
Preheating zone — Temp.: 150 ~ 200 °CTime: 60 ~ 120 s
Reflow zone — Temp.: >217 °CTime: 60 ~ 90 s; Peak Temp.: 235 ~ 250 °CTime: 30 ~ 70 s
Cooling zone — Peak Temp. ~ 180 °CRamp-down rate: −1 ~ −5 °C/s
Solder — Sn-Ag-Cu (SAC305) lead-free solder alloy

6.5 Ultrasonic Vibration

Avoid exposing Ezlo_EP01 modules to vibration from ultrasonic equipment, such as ultrasonic welders or ultrasonic cleaners. This vibration may induce resonance in the in-module crystal and lead to its malfunction or even failure. As a consequence, the module may stop working or its performance may deteriorate.