

Wireless Module for Crowpanel Advanced Series-ESP32-H2 DataSheet

(Thread/Zigbee/Matter)

Wireless Module-Powered by Espressif

DataSheet

V1.1



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1 Overview

1.1 Product Description

The ESP32-H2 wireless module is a highly integrated IoT communication solution based on the ESP32-H2FH4 chip, specifically designed for multi-protocol smart terminals. Powered by a 32-bit single-core RISC-V processor, it features 320KB SRAM, 128KB ROM, and 4MB Flash, supporting complex protocol stack operations and data caching requirements. The module integrates dual-mode wireless communication, compatible with Bluetooth 5 LE and IEEE 802.15.4 standards, as well as mainstream IoT protocols including Thread, Zigbee, and Matter.

In terms of hardware design, it adopts an ultra-compact form factor of 18×23.7×1.6mm, offering rich peripheral interfaces such as UART, SPI, I2C, ADC, and USB. It supports a wide operating temperature range of -40°C to +105°C and can be powered via the USB interface or module interface. On-board BOOT/RESET buttons and LED status indicators simplify device debugging and status monitoring processes.

Widely used in scenarios such as smart home device interconnection, industrial sensor networks, medical wearable monitoring, and smart office automation, the module provides full-stack support from communication protocols to hardware interfaces for high-density, low-latency IoT edge nodes. It serves as a core communication module for building open-ecosystem smart systems.

1.2 Core Features

- **High-Performance Main Chip:** Equipped with a 32-bit single-core RISC-V processor (96MHz clock speed, 4-stage pipeline), integrated with 320KB SRAM and 4MB Flash, balancing efficient computing and large-capacity storage.
- **High-Speed Wireless Connectivity:** Supports dual-mode communication (Bluetooth LE 5.3 + IEEE 802.15.4) and is compatible with Thread/Zigbee/Matter protocols, meeting multi-protocol IoT networking requirements.
- **High-Performance Antenna Interface:** IPEX-1 antenna connector for external coaxial antenna connection.
- **User Interaction Interfaces:** Configured with BOOT/RESET buttons, LED indicators, and a USB interface, simplifying debugging processes and enabling visual monitoring of device status.
- **Wide Operating Temperature Range:** Adapts to extreme environments from -40°C to +105°C, ensuring industrial-grade reliability and stability in outdoor scenarios.
- **Compact Dimensions:** Ultra-miniature package of 18×23.7×1.6mm with a highly integrated design, suitable for wearables and space-constrained embedded applications.

1.3 Application Fields

- **Smart Home**
- **Smart Wearables**
- **Industrial IoT (IIoT)**
- **Smart Office**
- **Healthcare**

2 Dimensions Drawing

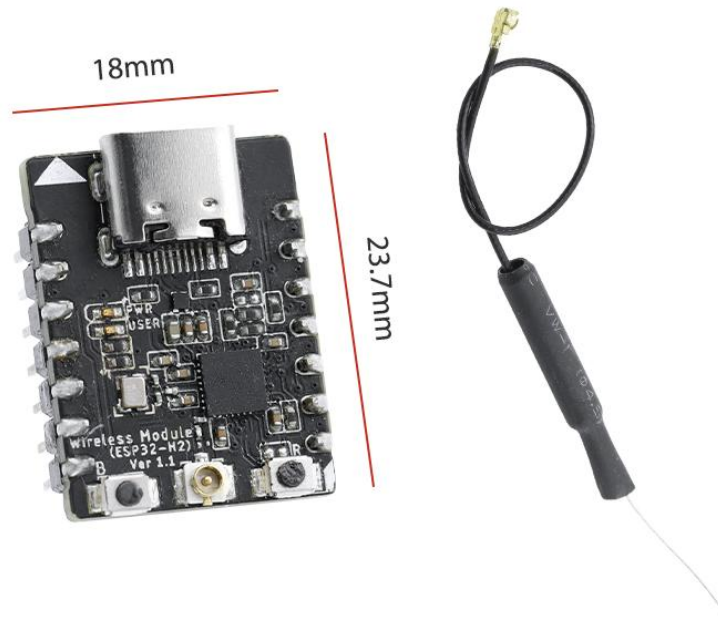


Figure 1:Dimensions Drawing

3 System Block Diagram

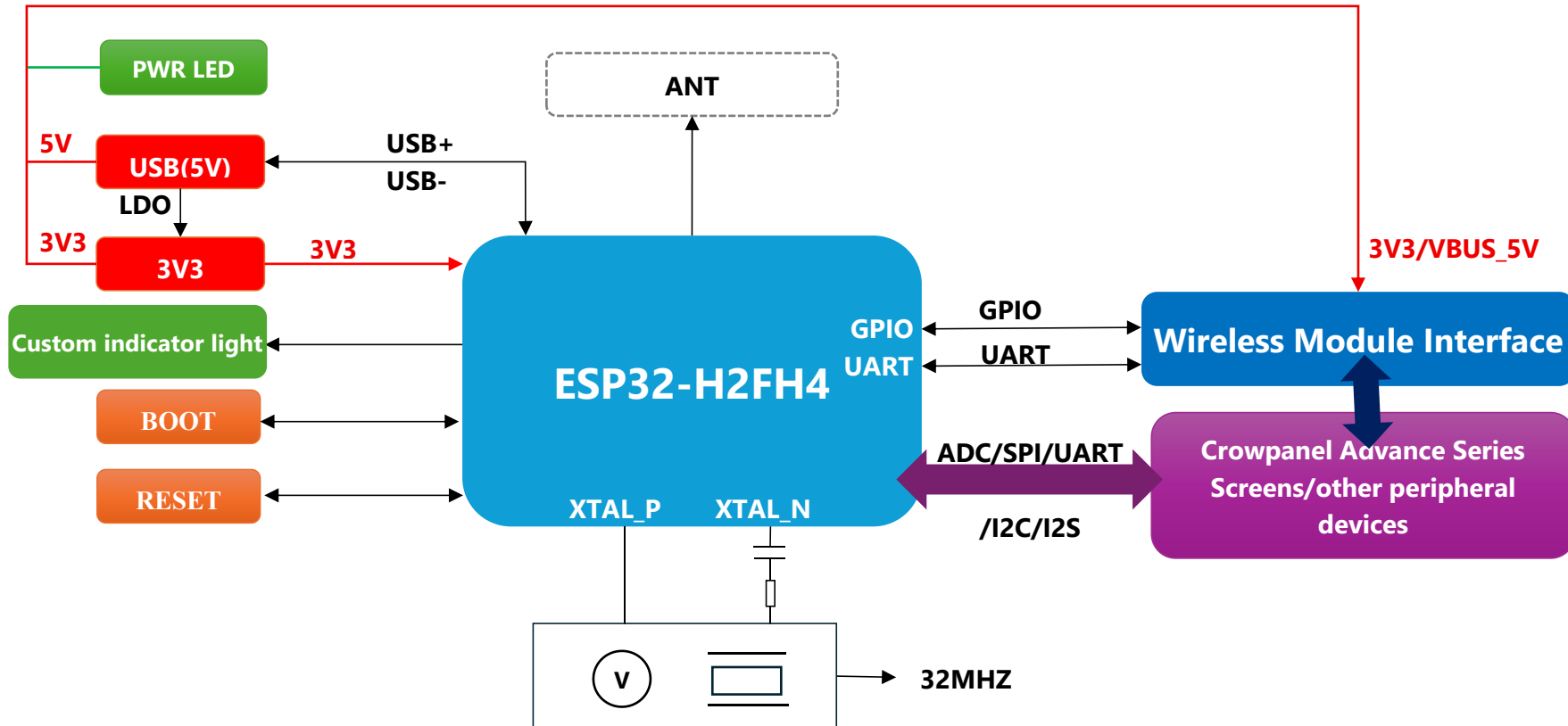


Figure 2: System Block Diagram

4 Hardware Overview

The hardware overview covers the ESP32-H2 module's interfaces, pin layout, and corresponding pin functions.

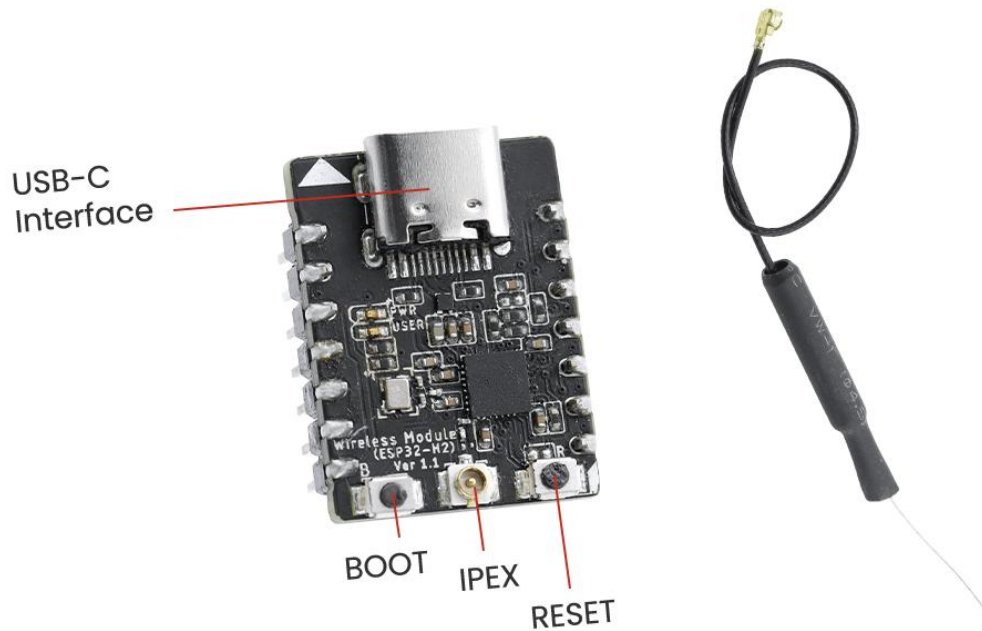


Figure 3: Module Interface Diagram

4.1 Buttons & LEDs

No.	Button Name	Silkscreen	Pin	MCU Pin	Description
1	BOOT	BOOT	EN	CHIP_EN	Press and hold the BOOT button, then press the RST button, and release the BOOT button to enter programming mode.
2	RESET	RST	GPIO9	GPIO9	Pressing the RESET button restarts the program or enables program flashing.

No.	Name	Silkscreen	Pin	MCU Pin	Color	Description
1	Power Indicator	PWR	VDD3V3	/	Green	Power indicator: stays steadily lit in green when the module is powered on.
2	User-Defined Indicator	USER	GPIO25	GPIO25	Blue	User-configurable function (for custom application scenarios).

4.2 USB Interface

No.	Name	Pin	MCU Pin	Description
1	USB-C Interface	USB+	GPIO27	Serves as the D+ differential signal positive terminal of the USB Serial/JTAG interface, a core signal pin for USB communication.
2		USB-	GPIO26	Serves as the D- differential signal negative terminal of the USB Serial/JTAG interface, forming a differential signal pair with USB+.

4.3 Antenna Interface

No.	Name	MCU Pin	Description
1	IPEX-1	ANT	External 2.4GHz coaxial antenna connection

4.4 Pin Layout

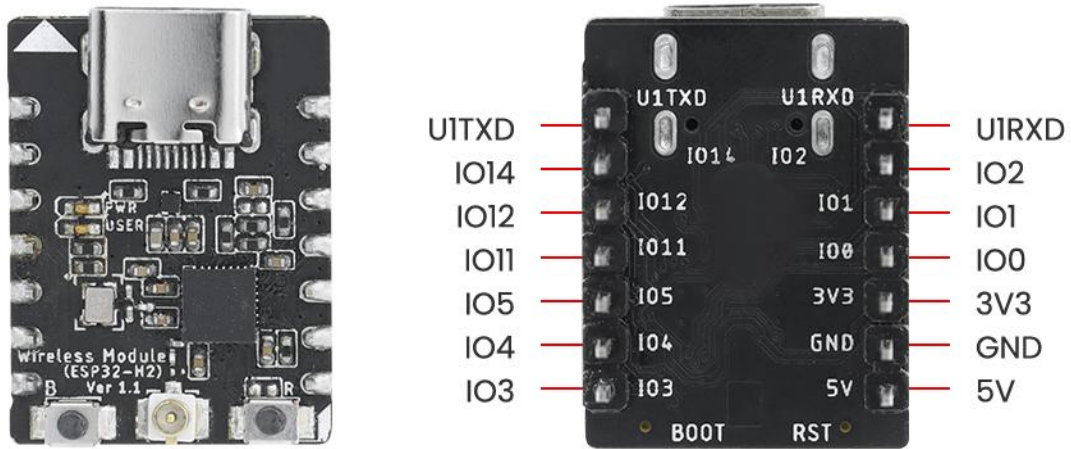


Figure 4: Module Pin Diagram

Pin Definition:The following table shows the pin definitions and descriptions of the ESP32-H2 wireless module:

Left Interface:

No.	Pin No.	Type	Pin	MCU Pin	Description
1	P\$1	O	U1TXD	U1TXD	UART1 Transmit Pin: Used for UART communication data transmission (TX)
2	P\$2	I/O	GPIO14	XTAL_32K_N	General Purpose Input/Output (GPIO)
3	P\$3	I/O	GPIO12	GPIO12	General Purpose Input/Output (GPIO)
4	P\$4	I/O	GPIO11	GPIO11	General Purpose Input/Output (GPIO)
5	P\$5	I/O	GPIO5	MTDI	General Purpose Input/Output (GPIO)
6	P\$6	I/O	GPIO4	MTCK	General Purpose Input/Output (GPIO)
7	P\$7	I/O	GPIO3	MTDO	General Purpose Input/Output (GPIO)

Right Interface:

No.	Pin No.	Type	Pin	MCU Pin	Description
1	P\$1	I	U1RXD	U1RXD	UART1 Receive Pin: Used for UART communication data reception (RX).
2	P\$2	I/O	GPIO2	MTMS	General Purpose Input/Output (GPIO)
3	P\$3	I/O	GPIO1	GPIO1	General Purpose Input/Output (GPIO)
4	P\$4	I/O	GPIO0	GPIO0	General Purpose Input/Output (GPIO)
5	P\$5	VDD	VDD3V3	/	Provides 3.3V power for the analog circuit section
6	P\$6	GND	GND	/	Ground Pin
7	P\$7	P	VBUS	/	Provides 5V power

5 Module Specifications

No.	Item	Parameter	Specification
1		Main Chip	ESP32-H2FH4 Chip
2	Core & Performance	Processor	32-bit single-core RISC-V processor with 4-stage pipeline architecture, maximum clock speed of 96MHz
3		SRAM	320KB
4		ROMS	128KB
5		LP Memory (Low-Power Memory)	4KB
6		flash memory	4MB
7		cache	16KB
8		Wireless Connectivity & Bluetooth	Bluetooth Low Energy (BLE)
9	IEEE 802.15.4		Compatible with Zigbee 3.0 and Thread 1.3
10	Operating Channel Center Frequency Range		2400MHz ~ 2483.5MHz
11	RF Transmit Power Range		-24.0~20.0dBm
12	Communication Interfaces		Provides rich peripheral interfaces including ADC, SPI, UART, I2C, and I2S
13	Antenna Characteristics	Gain	3dbi
14		Operating Frequency	2400-2500MHZ
15		Cable Length	120mm
16		Coaxial Cable Diameter	5mm
17		Antenna Interface	IPEX-1
18		Voltage Standing Wave Ratio (VSWR)	≤1.8
19		Antenna Efficiency	35-80%
20		Polarization	Vertical Polarization
21		Radiation Pattern	Omnidirectional
22		Feed Impedance	50Ω
23		Power Handling Capacity	33dbm
24		Package Type	Dimensions
25	Electrical	Operating Voltage	3.3V

26	Characteristics	Wi-Fi Communication Distance	130m
27		BT Communication Distance	70m
28		Operating Temperature	-40°C ~ +105°C

6 Electrical Characteristics

6.1 Power Consumption Parameters

No.	Mode	Current	Power
1	Operating Power Consumption (3.3V)	8.8mA	29.04mW

6.2 Absolute Maximum Ratings

No.	Item	Description	Min	Max	Unit
1	VBUS	USB Interface Supply Voltage	-0.3	6.5	V
2	VDD	Module Interface Supply Voltage	3.0	3.6	V
3	Tstore	Storage Temperature	-40	+150	°C

6.3 Recommended Operating Conditions

No.	Item	Description	Min	Typ	Max	Unit
1	VBUS	USB Interface Supply Voltage	1.4	5	5.5	V
2	VDD	Module Interface Supply Voltage	3.0	3.3	3.6	V
3	T _A	Ambient Temperature	-40	-	+105	°C

7 Mechanical Characteristics

7.1 Module Dimensions

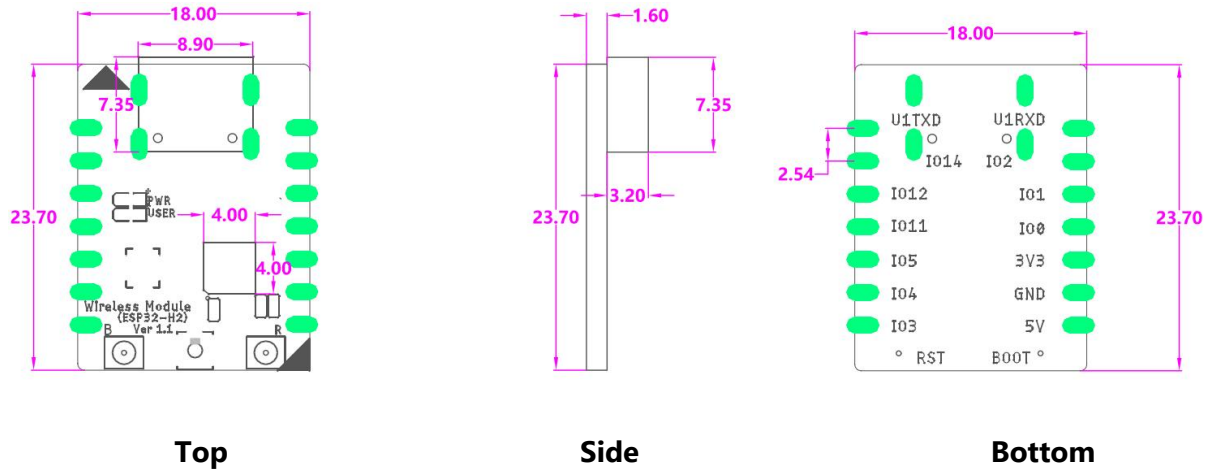


Figure 5:Outline Dimensions(Unit:mm)

7.2 Layout Recommendations

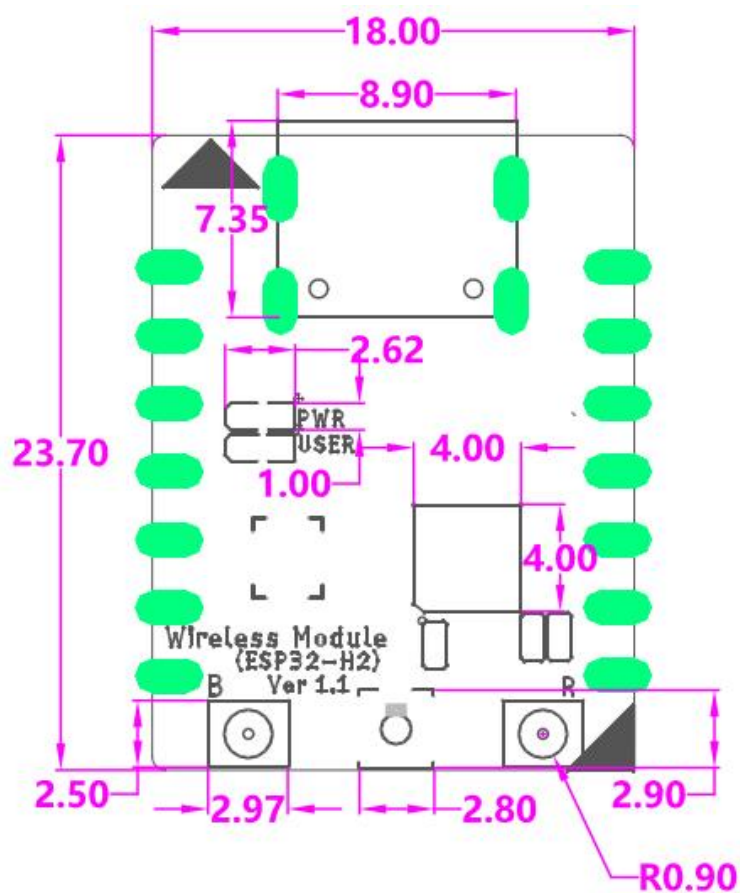


Figure 6:PCB Layout (Unit:mm)

8 Related Documents & Resources

- [ESP32-H2FH4 Datasheet](#)
- [Wireless module for Crowpanel Advanced Series](#)

9 Revision History

Date	Version	Release Notes
2025/11/30	V1.0	Initial Release