ESP32-P4-MINI
Development Board Guide

Version 1.0

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Revision History

Version	Date	Developed/changed content	Modifier By	Auditor
V1.0	2025-6-9	Creating Documents	Pail	Louie

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1. Development Board Introduction

1.1. Development Board Overview

ESP32-P4-MINI development board is a multimedia development board based on WT0132P4-A1 core board designed by Wireless-tag Technology Co., Limited.The WT0132P4-A1 core board based on Espressif ESP32-P4 series chip, featuring a dual-core 360 MHz RISC-V processor and 32 MB PSRAM.Additionally, the ESP32-P4 supports various peripherals such as USB 2.0, MIPI-CSI and MIPI-DSI, making it ideal for cost-effective, low-power multimedia product development.

1.2. Development Board Pictures

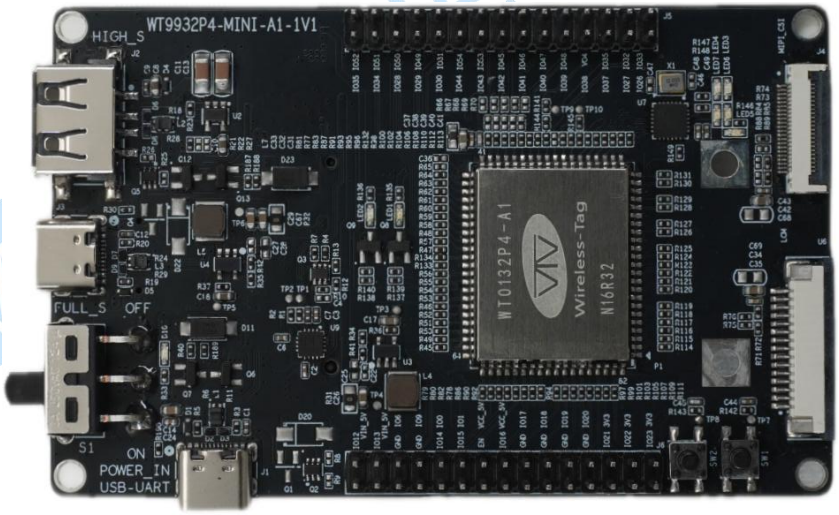

Figure 1: ESP32-P4-MINI Development Board (front)

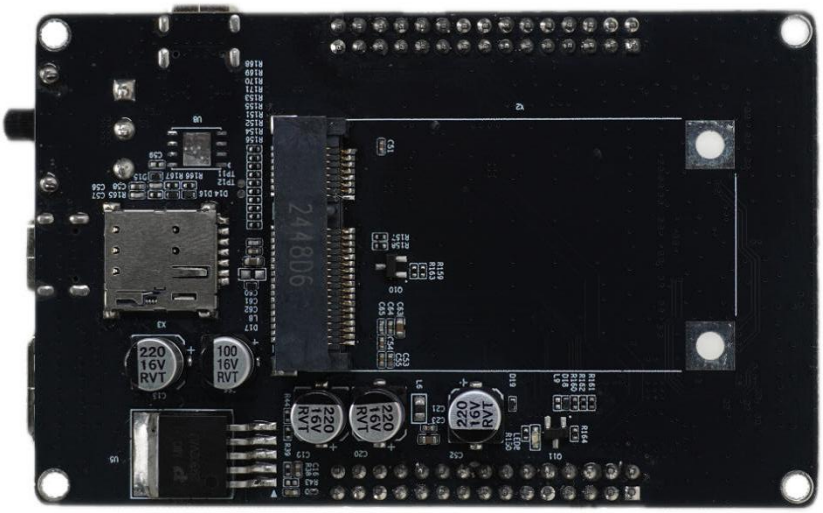

Figure 2: ESP32-P4-MINI Development Board (back)

2. Getting Started

This section provides a brief introduction to ESP32-P4-MINI development board, instructions on how to do the initial hardware setup and how to flash firmware onto it.

2.1. Component Introduction

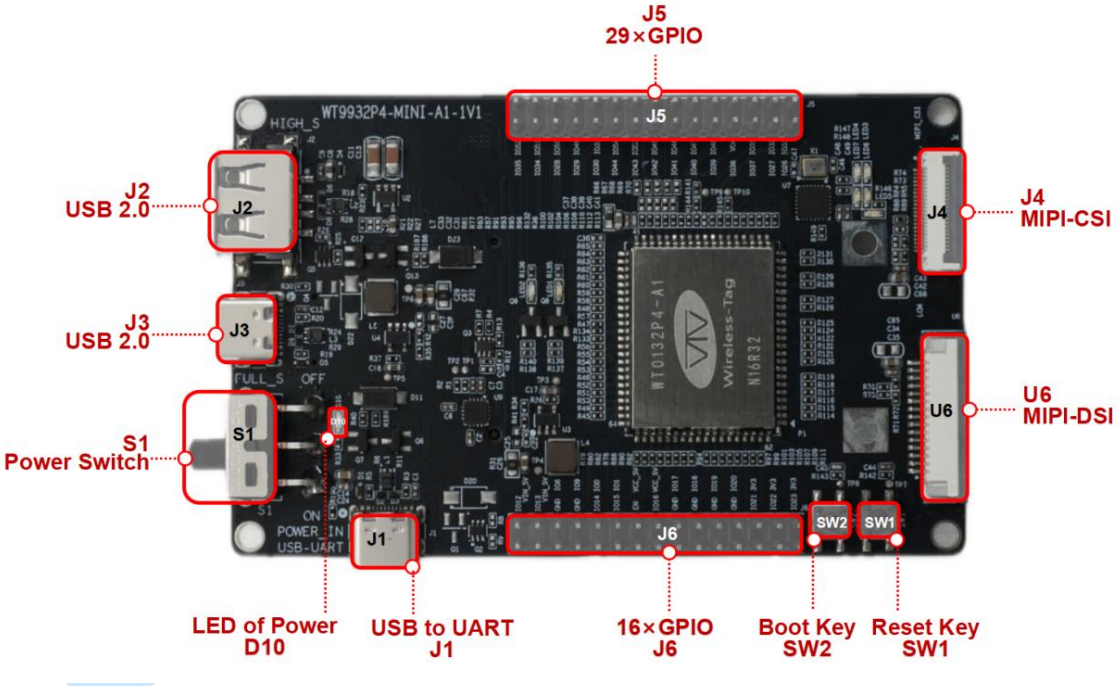

Figure 3: ESP32-P4-MINI Development Board Component Description (front)

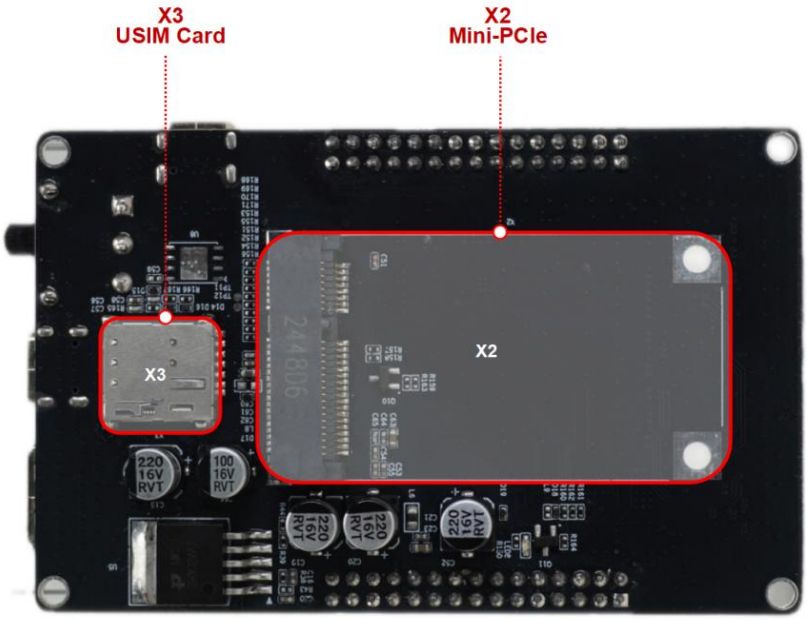

Figure 4: ESP32-P4-MINI Development Board Component Description (back)

The key components of the board are described in a clockwise direction.

Key Component	Description
J5	Some of the available pins on the core board have been routed to J5.For more details,see Header Block.
MIPI-CSI	MIPI CSI FPC connector is used for connecting external camera module to enable image transmission.
MIPI-DSI	MIPI DSI FPC connector is used for connecting displays.
Reset Key	Resets the board.
Boot Key	The boot mode control button.Press the **Reset Key** while holding down the **Boot Key** to reset WT0132P4-A1 and enter firmware download mode.Firmware can then be downloaded to SPI flash via the USB-to-UART Port.
J6	Some of the available pins on the core board have been routed to J6.For more details,see Header Block.
USB to UART	This port can be used to power the board,flash firmware to the chip,and communicate with the WT0132P4-A1 via the USB-to-UART Bridge Chip.
LED of Power	Lights up when the development board is connected to the power supply through any of the power supply connectors.
Power Switch	Power On/Off Switch.Toggling toward the ON sign powers the board on (5 V),toggling away from the ON sign powers the board off.
USB 2.0	The USB 2.0 Type-C Port connected to the USB 2.0 OTG Full-Speed interface of the ESP32-P4 chip on the WT0132P4-A1 core board.When communicating with other devices via this port, ESP32-P4 acts as a USB device connecting to a USB host,which can also be used as the power supply interface of the development board.

USB 2.0	The USB 2.0 Type-C Port connected to the USB 2.0 OTG High-Speed interface of the ESP32-P4 chip on the WT0132P4-A1 core board.When communicating with other devices via this port,ESP32-P4 acts as a USB host and supply power to the other devices.
USIM Card	USIM card slot for inserting a USIM card to realize the communication function based on the mobile communication network.
Mini-PCIe	Mini-PCIe interface, connected to the UART and USB interfaces of the ESP32-P4 chip on the WT0132P4-A1 core board, can be used to extend the communication capability of the development board.

2.2. Preliminary

- ESP32-P4-MINI
- USB-C cables
- Computer running Windows,Linux,or macOS
- LCD（Optional）
- Camera（Optional）
- CAT.1 Module and USIM card（Optional）

2.3. Hardware Setup

Connect the ESP32-P4-MINI to your computer using a USB cable.The board can be powered through any of the USB Type-C ports.The USB-to-UART Port is recommended for flashing firmware and debugging.

2.4. Software Setup

To set up your development environment and flash an application example onto your board,please follow the instructions in ESP-IDF Get Started.Or go to Wireless-Tag GitHub Examples, development board application examples have been stored,download compile and burn the application to the

development board to start development.

3. Hardware Reference

3.1. Block Diagram

The block diagram below shows the components of ESP32-P4-MINI and their interconnections.

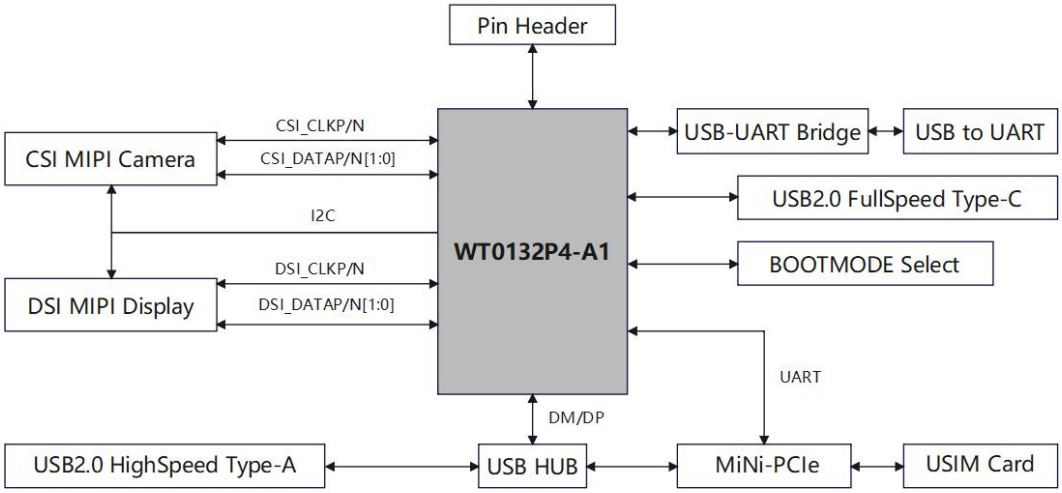

Figure 3: ESP32-P4-MINI Block Diagram

3.2. Header Block

The tables below provide the Name and Function of the pin header(J5、J6),The pin header names are shown in Development Board Pictures.

Table 1: Detailed Functional Description of J5 Pin Header

No.	Name	Function
1	IO33	GPIO33，I3CMST_SDA，GPSPI SPI2 WP，EMAC PHY TXEN，DBG_PSRAM_DQ5
2	IO26	GPIO26，USB1P1_N1
3	IO32	GPIO32，I3CMST_SCL，GPSPI SPI2 HOLD，EMAC RMII CLK，DBG_PSRAM_DQ4
4	IO27	GPIO27，USB1P1_P1
5	IO35	GPIO35，GPSPI SPI2 IO5，EMAC PHY TXD1，DBG_PSRAM_DQ7

6	IO37	GPIO37，UART0_TXD，GPSPI SPI2 IO7
7	VO4	Power out （Output voltage range 0.5~2.7V or 3.3V, maximum output current 0.2A）
8	IO38	GPIO38，UART0_RXD，GPSPI SPI2 DQS
9	IO48	GPIO48，SD1_CDATA7_PAD，GMAC_PHY_RXER_PAD
10	IO39	GPIO39，SD1_CDATA0_PAD，REF_50M_CLK_PAD
11	IO47	GPIO47，SD1_CDATA6_PAD，GMAC_PHY_RXD1_PAD
12	IO40	GPIO40，SD1_CDATA1_PAD，GMAC_PHY_TXEN_PAD
13	IO46	GPIO46，SD1_CDATA5_PAD，GMAC_PHY_RXD0_PAD
14	IO41	GPIO41，SD1_CDATA2_PAD，GMAC_PHY_TXD0_PAD
15	IO45	GPIO45，SD1_CDATA4_PAD，GMAC_PHY_RXDV_PAD
16	IO42	GPIO42，SD1_CDATA3_PAD，GMAC_PHY_TXD1_PAD
17	IO53	GPIO53，GMAC_PHY_RXD1_PAD，ADC2_CHANNEL6，ANA_COMP1
18	IO43	GPIO43，SD1_CCLK_PAD，GMAC_PHY_TXER_PAD
19	IO54	GPIO54，GMAC_PHY_RXER_PAD，ADC2_CHANNEL7，ANA_COMP1
20	IO44	GPIO44，SD1_CCMD_PAD，GMAC_RMII_CLK_PAD
21	IO31	GPIO31，GPSPI SPI2 Q，EMAC PHY RXER，DBG_PSRAM_HOLD
22	IO30	GPIO30，GPSPI SPI2 CK，EMAC PHY RXD1，DBG_PSRAM_WP
23	IO49	GPIO49，GMAC_PHY_TXEN_PAD，ADC2_CHANNEL2
24	IO29	GPIO29，GPSPI SPI2 D，EMAC PHY RXD0，DBG_PSRAM_Q
25	IO50	GPIO50，GMAC_RMII_CLK_PAD，ADC2_CHANNEL3
26	IO28	GPIO28，GPSPI SPI2 CS，EMAC PHY RXDV，DBG_PSRAM_D
27	IO51	GPIO51，GMAC_PHY_RXDV_PAD，ADC2_CHANNEL4，

		ANA_COMP0
28	IO34	GPIO34，GPSPI SPI2 IO4，EMAC PHY TXD0，DBG_PSRAM_DQ6
29	IO52	GPIO52，GMAC_PHY_RXD0_PAD，ADC2_CHANNEL5，ANA_COMP0
30	IO35	GPIO35，GPSPI SPI2 IO5，EMAC PHY TXD1，DBG_PSRAM_DQ7

Table 2: Detailed Functional Description of J6 Pin Header

No.	Name	Function
1	3V3	3.3 V power supply (output)
2	IO23	GPIO23，ADC1_CHANNEL7，REF_50M_CLK_PAD
3	3V3	3.3 V power supply (output)
4	IO22	GPIO22，ADC1_CHANNEL6
5	3V3	3.3 V power supply (output)
6	IO21	GPIO21，ADC1_CHANNEL5
7	IO20	GPIO20，ADC1_CHANNEL4
8	GND	GROUND
9	IO19	GPIO19，ADC1_CHANNEL3
10	GND	GROUND
11	IO18	GPIO18，ADC1_CHANNEL2
12	GND	GROUND
13	IO17	GPIO17，ADC1_CHANNEL1
14	GND	GROUND
15	VCC_5V	5 V power supply (output)
16	IO16	GPIO16，ADC1_CHANNEL0
17	VCC_5V	5 V power supply (output)
18	EN	Enable ESP32-P4
19	IO1	GPIO1，LP_GPIO1，XTAL_32K_P
20	IO15	GPIO15，LP_GPIO15，LP_UART_RXD_PAD，

		TOUCH_CHANNEL13
21	IO0	GPIO0，LP_GPIO0，XTAL_32K_N
22	IO14	GPIO14，LP_GPIO14，LP_UART_TXD_PAD，TOUCH_CHANNEL12
23	IO9	GPIO9，UART0_CTS_PAD，SPI2_CK_PAD，LP_GPIO9，TOUCH_CHANNEL7
24	GND	GROUND
25	IO6	GPIO6，SPI2_HOLD_PAD，LP_GPIO6，TOUCH_CHANNEL4
26	GND	GROUND
27	VIN_5V	Development board 5 V supply (input)
28	IO13	GPIO13，UART1_CTS_PAD，LP_GPIO13，TOUCH_CHANNEL11
29	VIN_5V	Development board 5 V supply (input)
30	IO12	GPIO12，UART1_RTS_PAD，LP_GPIO12，TOUCH_CHANNEL10

4. Related Documents

WT0132P4-A1 datasheet：https://en.wireless-tag.com/product-item-56.html

ESP32-P4-MINI schematic：https://en.wireless-tag.com/product-item-67.html

5. Contact Us

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