WT99P4C5-S1
Development Board Guide

Version 1.2

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Revision History

Version	Date	Developed/changed content	Modifier By	Auditor
V1.0	2025-3-14	Creating Documents	Pail	Louie
V1.1	2025-5-26	1、Updated 1.1 Development Board Overview, ESP32-C5-WROOM-1 is standard. 2、Updated WT99P4C5-S1 product image in the document. 3、Updated the description of ESP32-C5-WROOM-1 in 2.1 Component Introduction. 4、Updated the link to **Wire-less Tag GitHub Examples** in 2.4 Software Setup.	Pail	Louie
V1.2	2025-6-06	1、Correct the description of the ESP32-P4 frequency of 400 MHz in the article to 360 MHz. 2、Updates Related Documents：WT99P4C5-S1 schematic，WT0132P4-A1 datasheet，ESP32-C5-WROOM-1 datasheet.	Pail	Louie

Contents

1. Development Board Introduction

1.1. Development Board Overview

WT99P4C5-S1 development board is a multimedia development board based on WT0132P4-A1 core board launched 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.

Espressif Wi-Fi & BLE module ESP32-C5-WROOM-1, which communicates with the WT0132P4-A1 core board, has been installed on the development board for developing Wi-Fi and Bluetooth communication on the board.It also supports Wireless-tag self-developed 7-inch capacitive touchscreen to enhance the development experience. This board is well-suited for prototyping IPC, HMI, and AIoT products.

Most pins of the core board are routed to headers, allowing developers to easily connect external peripherals via jumpers or use the board on a breadboard.

1.2. Development Board Pictures

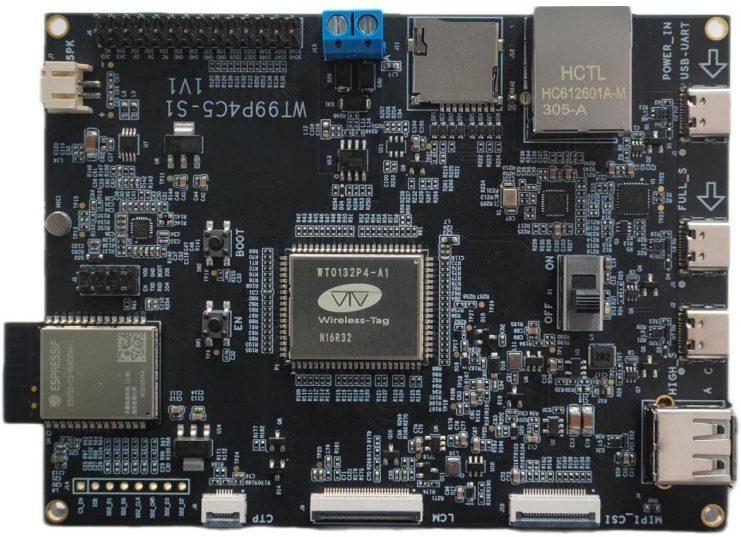

Figure 1: WT99P4C5-S1 Development Board (front)

2. Getting Started

This section provides a brief introduction to WT99P4C5-S1 development board, instructions on how to do the initial hardware setup and how to flash firmware onto it.

2.1. Component Introduction

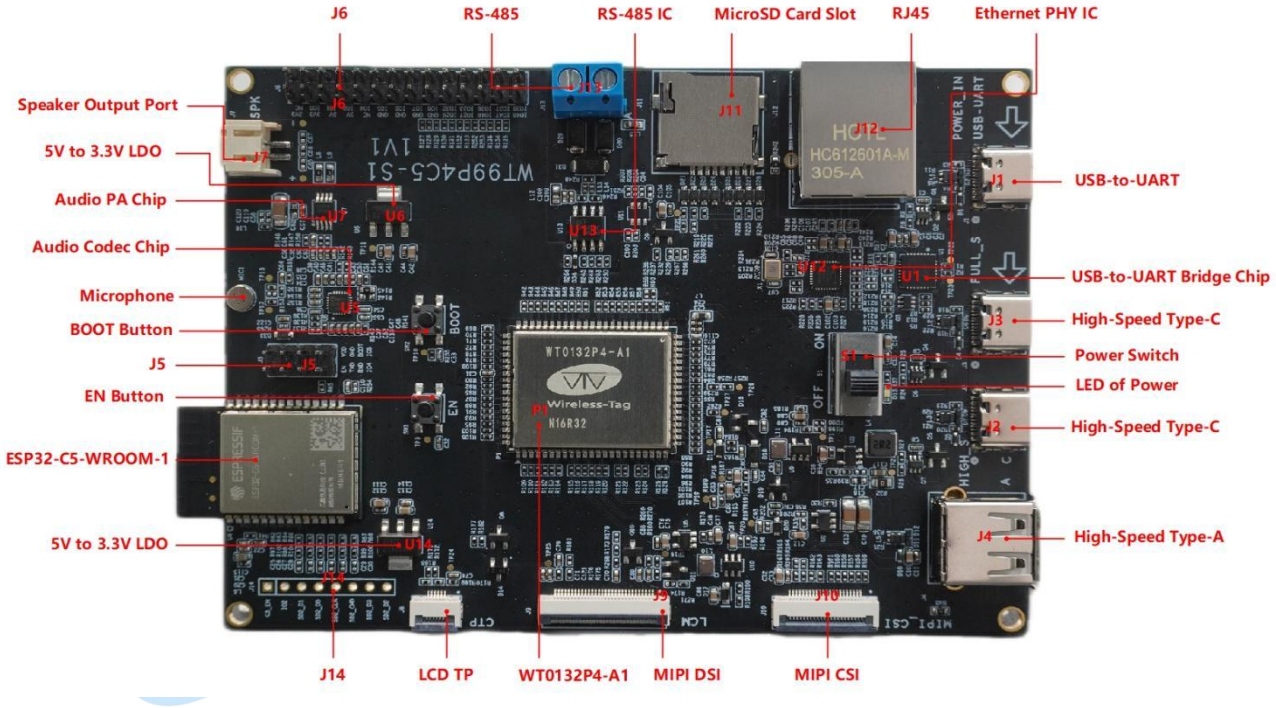

Figure 2: WT99P4C5-S1 Development Board Component Description

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

Key Component	Description
J6	Part of available GPIO pins are broken out to the header block J6 for easy interfacing.For more details,see Header Block.
RS-485 Interface	RS-485 interface connected to the interface of RS-485 Chip.
RS-485 Chip	SIT3088EESA is an RS-485 transceiver that fully meets the requirements of the TIA/EIA-485 standard and consists of a driver and a receiver that can be independently enabled and disabled.It can realize

	14Mbps error-free data transmission.It interfaces with the WT0132P4-A1 over UART.
MicroSD Card Slot	The development board supports a MicroSD card in 4-bit mode and can store or play audio files from the MicroSD card.
RJ45 Ethernet Port	An Ethernet Port supporting 10/100 Mbps adaptive.
Ethernet PHY IC	Ethernet PHY chip connected to the WT0132P4-A1 EMAC RMII interface and RJ45 Ethernet Port.
USB-to-UART Port	The USB Type-C 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.
USB-to-UART Bridge Chip	CP2102N is a single USB-to-UART bridge chip connected to the WT0132P4-A1 UART0 interface,ESP_EN,GPIO35(strapping pin),It provides firmware downloading and debugging,supporting the automatic download functionality.
Full-Speed USB 2.0 Type-C	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.
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.
LED Of Power	This LED lights up when the development board is connected to the power supply through any of the power supply connectors.

High-Speed USB 2.0 Type-C	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 device connecting to a USB host,which can also be used as the power supply interface of the development board.Please note that High-Speed USB 2.0 Type-C Port and High-Speed USB 2.0 Type-A Port cannot be used simultaneously.
High-Speed USB 2.0 Type-A	The USB 2.0 Type-A 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.Please note that High-Speed USB 2.0 Type-C Port and High-Speed USB 2.0 Type-A Port cannot be used simultaneously.
MIPI CSI	MIPI CSI FPC connector is used for connecting external camera module to enable image transmission.For details, please refer to specification in Related Documents.FPC specifications:0.5 mm pitch,0.3 mm pin width,0.3 mm thickness,22 pins.
MIPI DSI	MIPI CSI FPC connector is used for connecting displays.For details, please refer to Specification in Related Documents.FPC specifications:0.5 mm pitch,0.3 mm pin width,0.3 mm thickness,30 pins.
WT0132P4-A1	A high-performance Core-Board based on Espressif ESP32-P4 with powerful image and voice processing capabilities.
LCD TP	LCM TP connector is used for connecting displays touch

	functions.For details,please refer to Specification in Related Documents.FPC specifications:0.5 mm pitch,0.3 mm pin width,0.3 mm thickness,6 pins.
J14	Part of available GPIO pins are broken out to the header block J14 for easy interfacing.For more details,see Header Block.
5V to 3.3V LDO	A power regulator that converts a 5 V supply to a 3.3 V output.
ESP32-C5-WROOM-1	Espressif ESP32-C5-WROOM-1-N8R4 modules, support 5GHz & 2.4GHz dual-band Wi-Fi6 and BLE 5.3, provide communication capability for onboard core board WT0132P4-A1.Detailed information on the modules can be found in Related Documents.
EN Button	Resets the board.
J5	Part of available GPIO pins of ESP32-C5-WROOM-1 are broken out to the header block J5 for easy interfacing.For more details,see Header Block.
BOOT Button	The boot mode control button.Press the **EN Button** while holding down the **Boot Button** to reset WT0132P4-A1 and enter firmware download mode.Firmware can then be downloaded to SPI flash via the USB-to-UART Port.
Microphone	Onboard microphone connected to the interface of Audio Codec Chip.
Audio Codec Chip	ES8311 is a low-power mono audio codec chip.It includes a single-channel ADC,a single-channel DAC,a low-noise pre-amplifier,a headphone driver,digital sound effects,analog mixing,and gain functions.It interfaces with the WT0132P4-A1 over I2S and I2C buses to provide hardware audio processing independent of the audio

	application.
Audio PA Chip	NS4150B is an EMI-compliant,3 W mono Class D audio power amplifier that amplifies audio signals from the audio codec chip to drive speakers.
5V to 3.3V LDO	A power regulator that converts a 5 V supply to a 3.3 V output.
Speaker Output Port	This port is used to connect a speaker.The maximum output power can drive a 4 Ω,3 W speaker.

2.2. Preliminary

- WT99P4C5-S1
- USB-C cables
- Computer running Windows,Linux,or macOS
- LCD（Optional）
- Camera（Optional）
- MicroSD Card（Optional）

2.3. Hardware Setup

Connect the WT99P4C5-S1 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 WT99P4C5-S1 and

their interconnections.

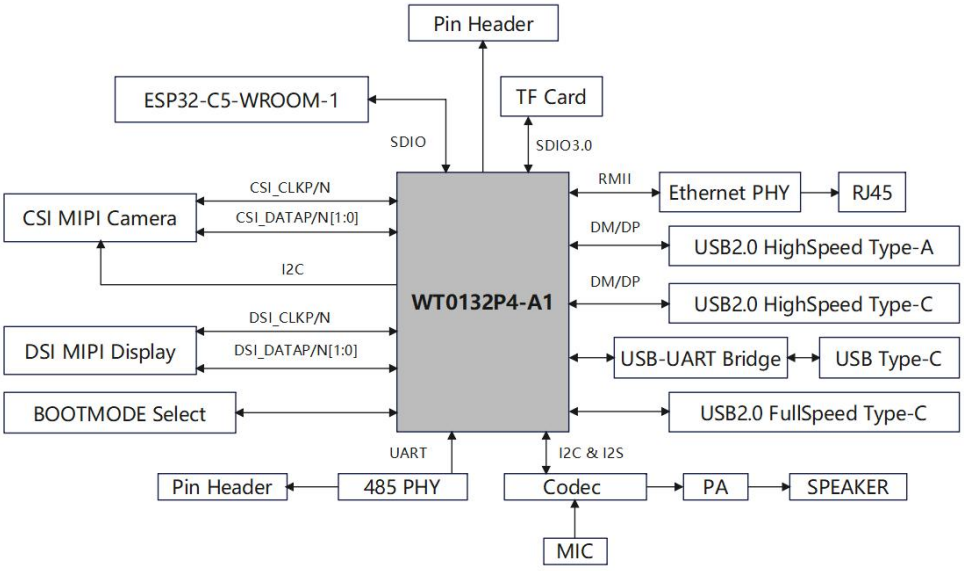

Figure 3: WT99P4C5-S1 Block Diagram

3.2. Header Block

The tables below provide the Name and Function of the pin header(J14、J5、J6),The pin header names are shown in Figure WT99P4C5-S1-front.

Table 1: Detailed Functional Description of J14 Pin Header

No.	Name	Function
1	C5_EN	Enable ESP32-C5 Moudle (10K pull-up)
2	IO2	ESP32-C5-WROOM-1/1U GPIO2
3	SD2_D1	GPIO40，SD1_CDATA1_PAD，GMAC_PHY_TXEN_PAD
4	SD2_D0	GPIO39，SD1_CDATA0_PAD，REF_50M_CLK_PAD
5	SD2_CLK	GPIO43，SD1_CCLK_PAD，GMAC_PHY_TXER_PAD
6	SD2_CMD	GPIO44，SD1_CCMD_PAD，GMAC_RMII_CLK_PAD
7	SD2_D3	GPIO42，SD1_CDATA3_PAD，GMAC_PHY_TXD1_PAD
8	SD2_D2	GPIO41，SD1_CDATA2_PAD，GMAC_PHY_TXD0_PAD

Table 2: Detailed Functional Description of J5 Pin Header

No.	Name	Function
1	EN	Enable ESP32-C5 Chip (10K pull-up)

2	VDD	3.3 V Power
3	TXD	U0TXD, GPIO11
4	GND	GND
5	RXD	U0RXD, GPIO12
6	BOOT	GPIO28
7	IO4	MTCK, GPIO4, LP_GPIO4, LP_UART_RXD, ADC1_CH3, FSPIHD
8	IO5	MTDO, GPIO5, LP_GPIO5, LP_UART_TXD, ADC1_CH4, FSPIWP

Table 3: Detailed Functional Description of J6 Pin Arrangement

No.	Name	Function
1	3V3	3.3 V Power
2	NC	NC
3	3V3	3.3 V Power
4	IO0	GPIO0，LP_GPIO0，XTAL_32K_N
5	5V	5 V Power
6	IO1	GPIO1，LP_GPIO1，XTAL_32K_P
7	5V	5 V Power
8	IO2	GPIO2，MTCK，LP_GPIO2，TOUCH_CHANNEL0
9	NC	NC
10	IO4	GPIO4，MTMS，LP_GPIO4，TOUCH_CHANNEL2
11	GND	GND
12	IO5	GPIO5，MTDO，LP_GPIO5，TOUCH_CHANNEL3
13	GND	GND
14	IO6	GPIO6，SPI2_HOLD_PAD，LP_GPIO6，TOUCH_CHANNEL4
15	GND	GND
16	IO7	GPIO7，SPI2_CS_PAD，LP_GPIO7，TOUCH_CHANNEL5
17	GND	GND

18	IO8	GPIO8，UART0_RTS_PAD，SPI2_D_PAD，LP_GPIO8，TOUCH_CHANNEL6
19	IO26	GPIO26，USB1P1_N1
20	IO32	GPIO32，I3CMST_SCL，GPSPI SPI2 HOLD，EMAC RMII CLK，DBG_PSRAM_DQ4
21	IO27	GPIO27，USB1P1_P1
22	IO33	GPIO33，I3CMST_SDA，GPSPI SPI2 WP，EMAC PHY TXEN，DBG_PSRAM_DQ5
23	IO46	GPIO46，SD1_CDATA5_PAD，GMAC_PHY_RXD0_PAD
24	IO36	GPIO36，GPSPI SPI2 IO6，EMAC PHY TXER，DBG_PSRAM_DQS0
25	IO47	GPIO47，SD1_CDATA6_PAD，GMAC_PHY_RXD1_PAD
26	IO37	GPIO37，UART0_TXD，GPSPI SPI2 IO7
27	IO48	GPIO48，SD1_CDATA7_PAD，GMAC_PHY_RXER_PAD
28	IO38	GPIO38，UART0_RXD，GPSPI SPI2 DQS

Table 4: Detailed Functional Description of RS-485

No.	Name	Function
1	485_B	Receiver Inverted Input and Driver Inverted Output
2	485_A	Receiver In-phase Input and Driver In-phase Output

4. Related Documents

WT99P4C5-S1 schematic：https://en.wireless-tag.com/product-item-66.html

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

ESP32-C5-WROOM-1 datasheet：ESP32-C5-WROOM-1.pdf

FPC Specification：FPC连接器规格书.pdf

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