

# ES3C28P&ES3N28P

## 2.8 inch IPS ESP32-S3 Display Module Specification



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REV	Record	Date
V1.0	First Release	2025-06-14

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## 1. GENERAL DESCRIPTION

### 1.1. Product Introduction

ES3C28P and ES3N28P are two 2.8-inch IPS display modules with built-in ESP32-3 main control, where ES3C28P comes with FT6336G capacitive touch screen and ES3N28P does not. Both products use LI9341V screen display driver IC with a resolution of 240x320 and can connect to a variety of peripherals, such as I2 interface devices, audio speakers, lithium batteries, MicroSD cards, serial ports, expansion IO devices, etc., and they also have built-in microphones and touch functions, greatly facilitate users to carry out various DIY, while meeting the needs of users to develop Internet of Things and human-computer interaction functions.

### 1.2. Image

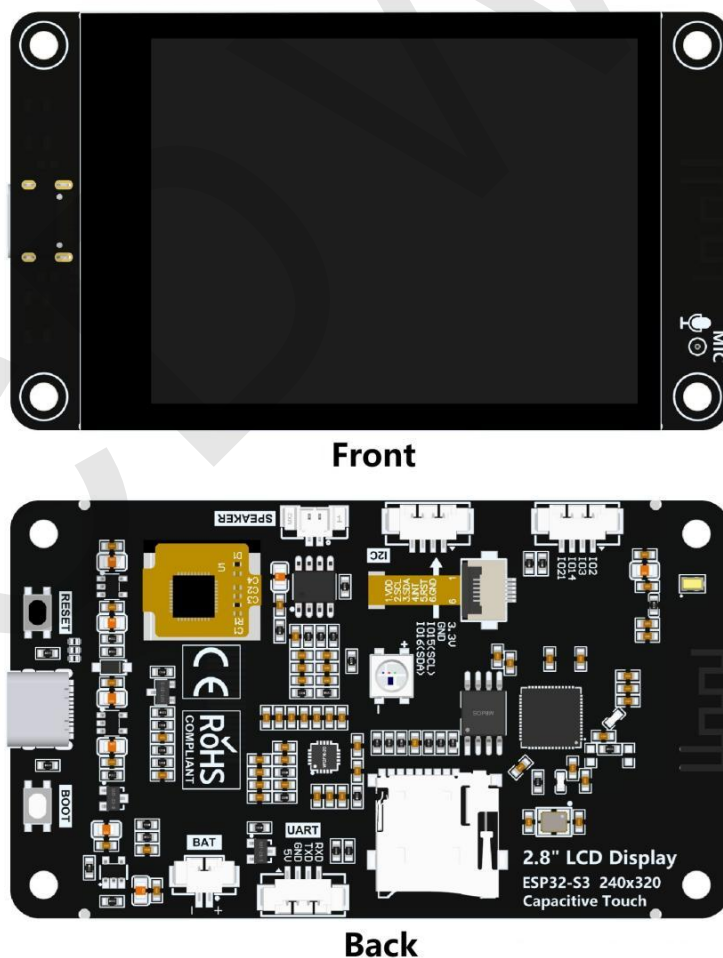


Figure 1.1 ES3C28P product diagram

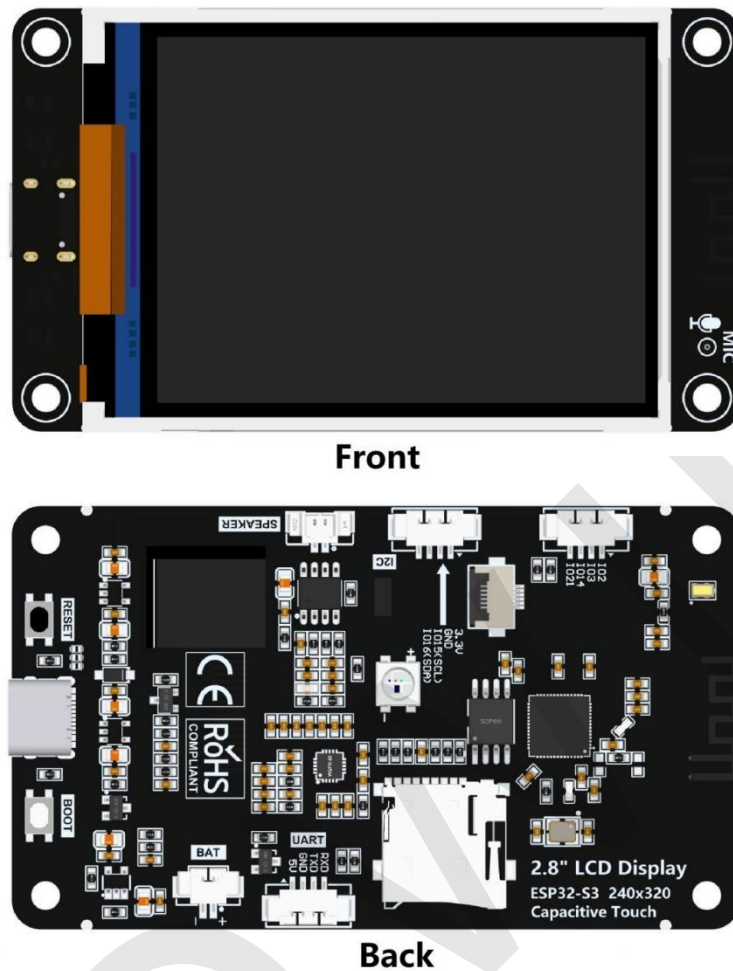


Figure 1.2 ES3N28P product diagram

### 1.3. Accessory List

Configure a 4P 1.25mm to 2.54mm terminal wire and a Type-C data power line.

The terminal wire is 20cm long, and the Type-C line is about 1m long.



Figure 1.3 4P 1.25mm to 2.54mm terminal wire connector



Figure 1.4 Type-C data power cable

## 2. PRODUCT FEATURES

### 2.1. Feature Description

- Equipped with ESP32-S3 main control chip, sufficient development resources, and convenient development
- 2.8-inch IPS color screen with 240x320 resolution, supporting up to 262K colors (RGB666), offering rich display colors
- Rich interfaces for easy connection various peripherals (IIC,UART,extended IO,etc.)
- Supports external speakers to play audio
- Equipped with a microphone, supporting audio input
- Equipped with RGB three-color indicator lights, offering rich status indications
- Equipped with a capacitive touch screen, facilitating human-machine interaction
- Standard TYPE-C interface for convenient program and power supply
- Equipped with a micro TF card slot, convenient for expanding storage
- Supports external lithium batteries, lightweight and portable
- Equipped with battery charging management circuit, safe battery charging and discharging
- Provides rich example programs for easy learning
- Provides low-level driver technical support, and WIKI materials are updated online
- The module undergone aging tests and multiple inspections to meet military-grade standards, supporting long-term stable operation

## 3. PRODUCT PARAMETERS

### 3.1. ESP32S3 main control parameters

item	Parameters	Unit
Main control chip	ESP32-S3	-
CPU	Xtensa LX7 32-bit dual-core processor	-
Clock frequency	240MHz (max)	-
Storage	84KB ROM+512KB SRAM+16KB RTC SRAM+8M internal OPI PSRAM	-

	+16M external SPI Flash	
<b>WIFI</b>	2.4GHz, 802.11b/g/n mode	-
<b>Bluetooth</b>	Bluetooth V5.0 BR/EDR and Bluetooth LE standard	-
<b>Working voltage</b>	3.0~3.6	V
<b>Working temperature</b>	-40~85	°C

### 3.2. TFT Parameters

item	Parameters	Unit
<b>Screen size</b>	2.8	inch
<b>Screen type</b>	IPS TFT	-
<b>Screen resolution</b>	240xRGBx320	pixels
<b>Effective display area</b>	43.20(W)x57.60(H)	mm
<b>Number of colors</b>	MAX: 262K (RGB666) TYP: 56K (RGB565)	-
<b>Driving IC</b>	ILI9341V	-
<b>Display interface</b>	4-Line SPI(Received on ESP32-S3)	-
<b>Pixel size</b>	0.153(H)x0.153	mm
<b>Viewing angle</b>	ALL 0'CLOCK	deg
<b>Back brightness (typical value)</b>	280	cd/m <sup>2</sup>
<b>Backlight lamp type</b>	White LED*4	-
<b>Operating temperature</b>	-30~80	°C
<b>Storage temperature</b>	-30~80	°C

### 3.3. Touch Screen Parameters

item	Parameters	Unit
<b>Effective area size</b>	2.8	inch
<b>Touch screen type</b>	Capacitive touch screen	-
<b>Driver IC</b>	FT6336G	-
<b>Effective touch area</b>	43.20(W)x57.60(H)	mm
<b>Visible window size</b>	43.60±0.15(W)x58.05±0.15(H)	mm
<b>Communication interface</b>	I2C (From device address:0x38)	-

<b>Structural material</b>	G+F	-
<b>Operating temperature</b>	-30~80	°C
<b>temperature</b>	-30~80	°C

### 3.4. Size Parameters

item	Parameters	Unit
<b>LCD screen size</b>	50.00±0.2(W)x69.20±0.2(H)x2.3±0.1(D) (No solder paste or back adhesive)	mm
<b>Touch screen size</b>	50.00±0.1(W)x69.20±0.1(H)x1.0(D)±0.1(D) (No solder paste or back adhesive)	mm
<b>Module size</b>	Touch screen: 50.00(W)x86.00(H)x5.60(D) Touchless screen: 50.00(W)x86.00(H)x4.40(D)	mm

### 3.5. Battery charging parameters

item	Parameters	Unit
<b>Charging voltage;</b>	Range: 4.2~6.5 Typical value: 5.0	V
<b>Charging current;</b>	Maximum value: 500; Module actual: 290;	mA
<b>Charging saturation voltage;</b>	4.24	V
<b>Charging temperature;</b>	Module actual maximum value: 62	°C
<b>Charging battery specifications</b>	3.7V lithium polymer battery	-

### 3.6. Electrical Parameters

item	Parameters	Unit
<b>Working voltage</b>	5.0	V
<b>Backlight current</b>	79	mA
<b>Backlight brightness (actual value)</b>	touch screen: 230 Touchless screen: 270	cd/m <sup>2</sup>
<b>Total current</b>	ESP32-S3 reset: 0 Only display works: 140 Display, speaker, battery charging all work: 560	mA

Consumption power	0.7 (Only the display works)	W
	2.8 (Display, speaker, battery charging all work)	
Supported speaker power (max)	1.5(8Ω) or 2(4Ω)	W

### 3.7. Basic Parameters

item	Parameters	Unit
SKU	Touch screen: ES3C28P Touchless screen: ES3N28P	-
Power interface	TYPE-C	-
Weight (including packaging)	ES3C28P: 86 ES3N28P: 78	g

## 4. PRODUCT INTERFACE

### 4.1. Interface Function Description

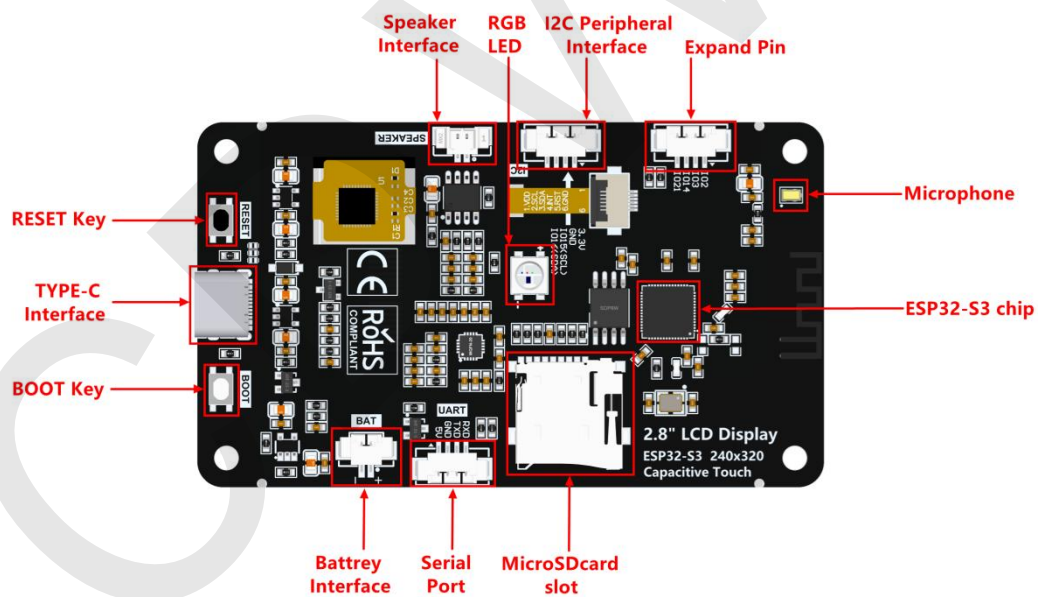


Figure 4.1 E32R28T product interface diagram

Interface name	Function Description
ESP32-S3 chip	Main control of the display module, working together with the peripheral circuit, is used to control on-board peripherals and external peripherals.
MicroSD card slot	Insert a SD card to expand storage space, such as storing large data content such as font libraries, images, audio files,



	etc.
<b>RGB tricolor light</b>	Contains LEDs of three colors: red, green, blue. It has a built-in control IC and only needs one IO port to control. It can be used for LED testing and status indication.
<b>Serial port</b>	1.25mm4P socket. It can be used for serial port debugging, downloading, and communication. An external USB to serial port module is required.
<b>Battery interface</b>	1.25mm 2P socket. Used to connect to a 3.7V polymer lithium battery, charge the battery through the battery management circuit, and can also be used for battery power supply. Note the positive and negative terminals of the interface.
<b>BOOT button</b>	Used to enter the download mode or key test. Press and this key to power up, then release to enter the download mode, or after powering up, press and hold this key, then press the RESET key, release the RES key and then release this key, you can also enter the download mode. When you don't need to enter the download mode, this key can be used as a normal key
<b>TYPE-C interface</b>	It is used for module power supply and program download, debugging. This interface is connected to the internal USB bus of ESP32-S3, which can generate a USB serial port. <b>Note:</b> win10 and above systems support USB virtual serial port function. If you use this interface on other versions of the system, you need to solve the problem USB virtual serial port not working by yourself.
<b>RESET button</b>	For ESP32-S3 main control and LCD reset, press to reset low level.
<b>Expansion pin</b>	1.25mm 4P socket. Four pins are GPIO2, GPIO3, GPIO14, GPIO21. It can be used to connect other peripherals.
<b>Loudspeaker interface</b>	1.25mm P socket. Used to connect the speaker to play audio. Used to connect the speaker to play audio (maximum support 1.5W (8Ω) or 2W4Ω) speaker).
<b>I2C peripheral interface</b>	1.25mm 4P socket. Used for external I2C communication device. This I2C interface and the capacitive touch and audio codec IC share. If the touch and audio functions are not used, it can be used as a normal IO.
<b>Microphone</b>	Downward-facing MEMS silicon microphone. Used to capture external sound. Can be used for those projects that require audio input function.

## 4.2. ESP32-S3 pin allocation

Device	ESP32-S3 pin	pin allocation
LCD	GPIO10	LCD screen segment control signal, low level active
	GPIO46	LCD screen command/data select control signal High level: data low level: command
	GPIO12	LCD screen SPI bus clock signal
	GPIO11	LCD screen SPI bus write data signal
	GPIO13	LCD screen SPI bus data signal
	CHIP_PU	LCD screen reset control signal, low level reset (share reset pin with ESP32-S3 main control)
	GPIO45	LCD screen backlight control signal ( level turn on backlight, low level turn off backlight)
Capacitive touch screen	GPIO16	Capacitive touch screen I2C bus data signal (share with audio codec IC and extended I2C)
	GPIO15	Capacitive touch screen I2C bus clock signal (share with audio codec IC and extended I2C)
	GPIO18	Capacitive touch screen reset control signal, low level
	GPIO17	Capacitive touch screen interrupt input signal, input low level when touch event occurs.
RGB light	GPIO42	RGB three-color LED light control signal with built-in control IC. Different timing can be input to control the internal red, green and blue three kinds of beads respectively.
MicroSD Card	GPIO38	SD card SDIO bus clock signal
	GPIO40	SD card SDIO bus command signal
	GPIO39	SD SDIO bus data signal DATA0
	GPIO41	SD card SDIO bus data signal DATA1
	GPIO48	SD card SDIO bus data signal DATA2
	GPIO47	SD card SDIO bus data signal DATA3
Battery	GPIO9	Battery voltage ADC value acquisition input signal

<b>Audio</b>	GPIO1	Audio power amplifier IC enable pin, low level enable
	GPIO4	Audio I2S bus master clock signal
	GPIO5	Audio I2S bus bit clock signal
	GPIO6	Audio I2S bus bit output data signal
	GPIO7	Audio I2S bus left and right channel selection signal. High level: right channel; low level: left channel
	GPIO8	I2S bus bit input data signal
	GPIO16	Audio codec IC's I2C bus data signal (share with capacitive touch screen and extended I2C)
	GPIO15	Audio codec's I2C bus clock signal (share with capacitive touch screen and extended I2C)
<b>Button</b>	IO0	Download mode selection button (hold this button to power up, then release enter download mode)
	CHIP_PU	ESP32-S3 reset button, low level reset (share with LCD screen reset)
<b>USB</b>	GPIO19	USB bus differential signal data line negative
	GPIO20	USB bus signal data line positive
<b>Serial port</b>	GPIO43(TX0)	ESP32-S3 serial port 0 receive signal interface (if the serial port communication function is not used, it can be used as a IO port)
	GPIO44(RX0)	ESP32-S3 serial port 0 receive signal interface (if the serial port communication function is not used, it can be used as a general port)
<b>Internal PSRAM</b>	GPIO26	Internal OPI PSRAM chip select pin, active low
	GPIO30	Internal OPI PSRAM clock pin (shared with external flash)
	GPIO32	Internal O PSRAM DATA0 pin (shared with external flash)
	GPIO31	Internal OPI PSRAM DATA1 pin (shared with external flash)
	GPIO28	Internal OPI PSRAM DATA2 pin ( with external flash)

	GPIO27	Internal OPI PSRAM DATA3 pin (shared with external flash)
	GPIO33	Internal OPI PSRAM DATA4 pin
	GPIO34	Internal OPI PSRAM DATA5
	GPIO35	Internal OPI PSRAM DATA6 pin
	GPIO36	Internal OPI PSRAM DATA7 pin
	GPIO37	Internal OPI PSRAM data mask and data clock read pin
<b>External Flash</b>	GPIO29	External QSPI FL chip select pin, active low
	GPIO30	External QSPI FLASH clock pin (shared with internal PSRAM)
	GPIO32	External QSPI FLASH DATA0 pin (shared with internal PSRAM)
	GPIO31	External QSPI FLASH DATA1 pin (shared with internal PSRAM)
	GPIO28	External QSPI FLASH DATA2 pin (shared with internal PSRAM)
	GPIO27	External QSPIASH DATA3 pin (shared with internal PSRAM)
<b>I2C expansion</b>	GPIO16	Expansion interface I2C bus data signal (shared with capacitive touch screen and audio codec IC, can be used a general IO when touch and audio functions are not used, otherwise it can only be used as an I2C interface)
	GPIO15	Expansion interface I2C bus clock signal ( with capacitive touch screen and audio codec IC, can be used as a general IO when touch and audio functions are not used, otherwise it can only be used as an I2 interface)
<b>Expansion pin</b>	GPIO2	This is 4 idle IO ports that can be used to connect peripherals, and can also be used as SPI interface
	GPIO3	
	GPIO14	
	GPIO21	

5. PRODUCT OUTLINE DRAWING

5.1. ES3C28P OUTLINE DRAWING

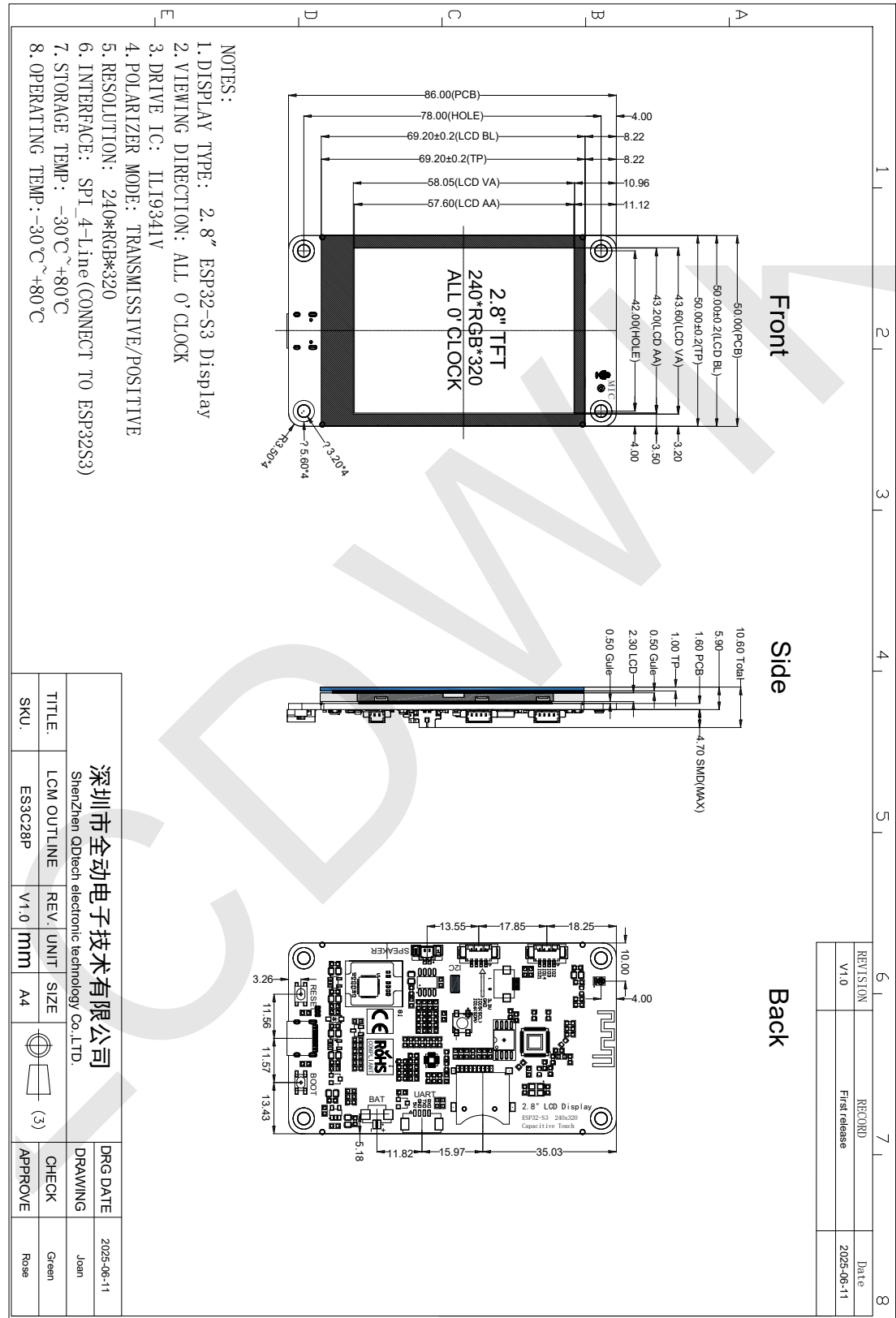


Figure 5.1 ES3C28P Outline Drawing

5.2. ES3N28P OUTLINE DRAWING

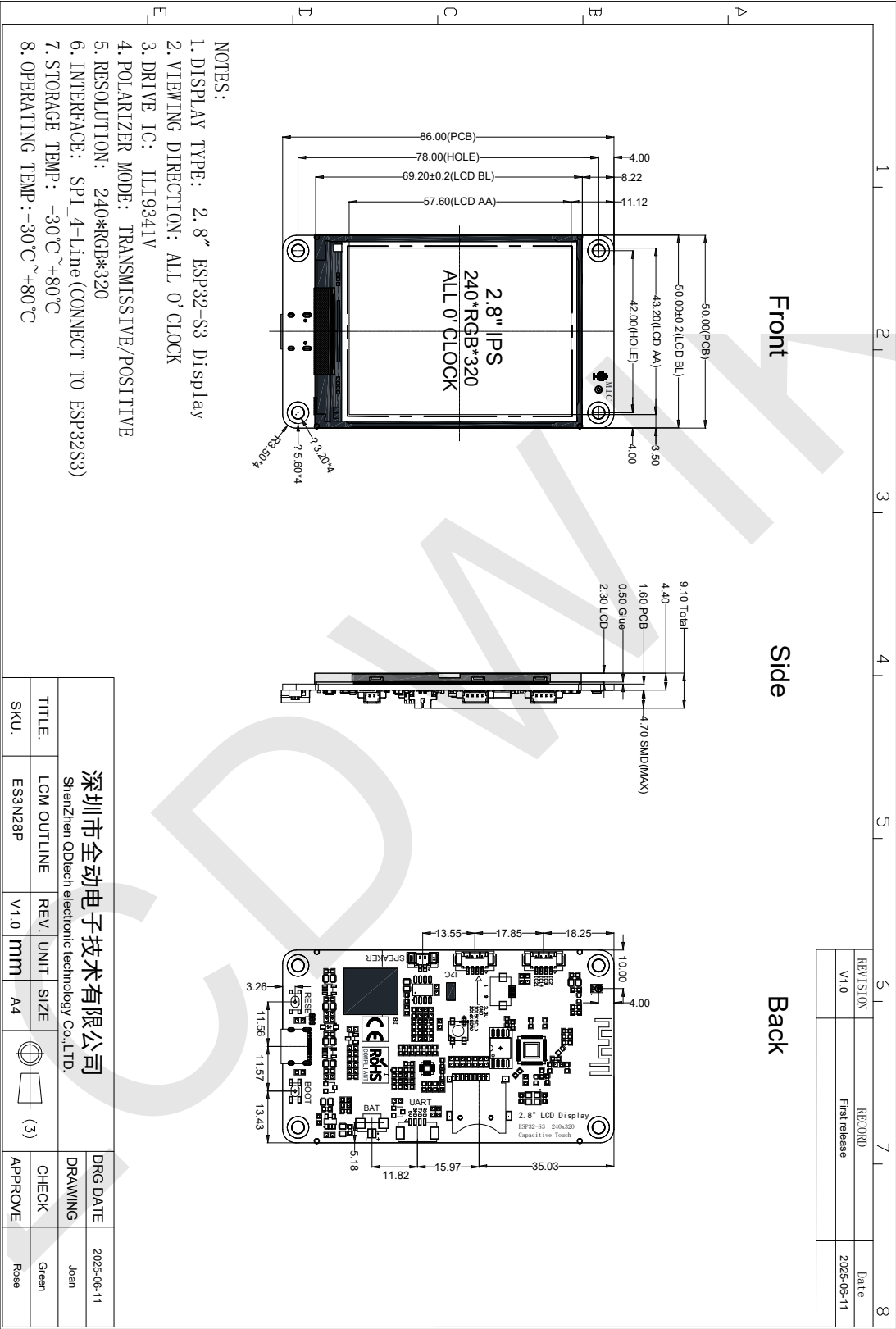


Figure 5.2 ES3N28P Outline Drawing

## 6. PRECAUTIONS

### 6.1. Safe Use of Products

- Do not press or hit the screen violently to avoid damaging the screen
- Do not scrape the screen with hard objects to avoid scratching the screenDo not place heavy objects on the product to avoid crushing the screen
- Please keep the product clean, do not drop water or oil on the screen
- Please use a clean, soft dry cloth to wipe the screen, do not spray water or cleaning agent directly on the screen
- Do not disassemble the product at will to avoid damaging the screen or the F
- Do not place the product in a high temperature and high humidity environment
- Please place the product face up on a flat surface to avoid falling and breaking the product
- Please use the voltage to connect the product to avoid damage to the product due to excessive voltage
- When using the product, do not touch the components or pins with wet hands to avoid causing a short and damaging the product
- When not using the product for a long time, please unplug the power supply
- When charging the battery, pay attention to ventilation and heat dissipation to avoid damage the product due to high temperature
- When charging the battery, pay attention to do not touch the charging management IC to avoid being burned by high

### 6.2. Frequently asked questions FAQ

- **Question 1: No response after powering up the product after burning the program; the screen is also not lit.**

Analysis:

This product needs to pull up the backlight control pin to turn on the backlight, so make sure that the ESP32-S3 main control has flashed with a program that contains the function to turn on the backlight. If the relevant program has been flashed and the backlight is still not on, check the voltage the

power interface and the contact of the power line. If using battery power, check if the battery is sufficiently charged.

If the backlight still does not respond after the operations, it is speculated that there may be a hardware circuit fault.

➤ **Question 2: The backlight is on after powering up the product after burning the program, but there is no display.**

Analysis:

The backlight being on indicates that the module has been powered up normally, but to display images properly, the SPI communication and control signals must also fully functional. It is necessary to check if the programmed code matches correctly, including the selection of the display driver IC, GPIO definitions, etc.

It is recommended to use tested example program for the first time, compile and download the program without any modifications to rule out the possibility of the display not lighting up due to code changes. Also, pay attention whether the compilation and download of the example program prompts success and whether the display module operates normally.

If the display still cannot be normal after multiple attempts following the above steps, it necessary to use necessary tools such as a multimeter/oscilloscope/logic analyzer to analyze and detect the signals, and contact our technical staff for assistance.

➤ **Question 3: The product can display normally, but there is no response to the touch.**

Analysis:

This situation may be due to the following reasons:

- The test program that is burned into the device does not have touch functionality;
- The GPIO related to touch screen control in the test software is not or defined incorrectly;



- Hardware damage, including damage to the touch control IC, damage or breakage of the touch screen flex cable, etc.

➤ **Question 4: The product can display, but the backlight brightness is unstable and sometimes dark.**

Analysis:

The backlight circuit of this product uses field-effect transistors to drive, the backlight control pin inputs a high level to turn on the backlight, low level to turn off the backlight, and the PWM signal can also be input through the backlight control pin to achieve the purpose of adjusting the brightness. If the voltage the backlight control pin changes, the brightness of the backlight will also change, which may cause the backlight to be unstable. In addition, unstable power supply voltage can also this phenomenon.

➤ **Question 5: The external battery of the product cannot be charged.**

Analysis:

The battery charging management circuit of this product is only suitable for charging 3.7V polymer lithium batteries. There may be several reasons why an external battery cannot be.:

- The external battery category is incorrect;
- The positive and negative poles of the battery are connected in reverse;
- The battery power has reached saturation, and will stop charging if it is connected;
- The charging management IC is damaged.

➤ **Question 6: Product burning program failed**

Analysis:

This product uses USB to simulate serial port (via Type-C) or external USB to serial port module (via extended serial port) to burn the program. The burning fails, there may be the following reasons.:

- The program being flashed runs abnormally, causing the ESP32-S3 main controller to be unable to enter the flash mode. this case, you need to

press and hold the BOOT key, then power on the module, and then release the BOOT key, or press and hold the BOOT key it is already powered on, then press the RESET key and release it, and finally release the BOOT key. This will force the ESP32-S3 main controller enter the download mode, and then you can re-flash it.

- Use the Type-C interface to flash the program under the win10 system. Because the TypeC interface of this product is connected to USB, and uses USB to simulate the serial port, while the win10 system does not support the USB to simulate the serial port function In this case, you need to find another way to make the win10 system support the USB to simulate the serial port function, or flash it through the external USB to serial module.
- Computer serial port working abnormally, the serial port number selected for the product is incorrect, and the serial port is occupied by other programs, etc., cause the flash to fail.

➤ **Question 7: No sound output after connecting the product to the speaker.**

Analysis:

This situation may be due to the following reasons.:

- The programmed program is incorrect, or the program runs abnormally
- The speaker interface is in poor contact
- The speaker itself is damaged
- The speaker is too large, and the product's power amplifier circuit cannot support it