E-paper Display Driver Board

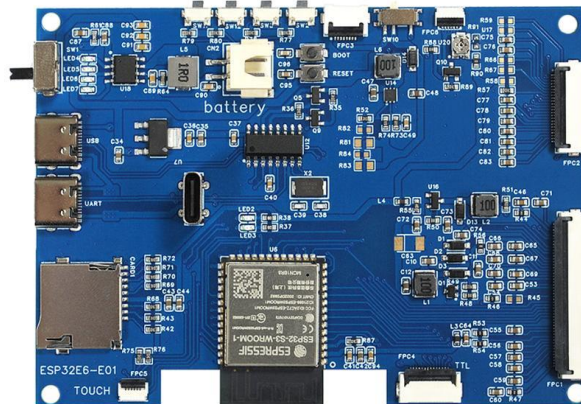## ESP32E6-E01

GooDisplay ®

Product Specifications

Customer	Standard
Description	E-paper display driver board
Model Name	ESP32E6-E01
Date	2024/09/24
Revision	1.0

	Design Engineering		
	Approval	Check	Design
	刘玉宝印	修凤燕印	吴良之印

Zhongnan Building, No.18, Zhonghua West ST,Ganjingzi DST,Dalian,CHINA

Tel: +86-411-84619565

Email: info@good-display.com

Website: www.good-display.com

Contents

1. Overview

The ESP32E6-E01 is a development board that integrates Wi-Fi and Bluetooth functionalities, specifically designed for e-paper display (EPD) applications. Based on the powerful ESP32s3 series chipset, it efficiently handles wireless communication and image updates for e-paper displays. The board comes with two e-paper interfaces: a 24-pin interface compatible with most monochrome, tricolor, and quad-color SPI e-paper displays, and a 50-pin interface suitable for E Ink Spectra™ 6 series 4-inch and 7.3-inch e-paper displays. This development board offers two convenient image transmission methods, helping users quickly get started and experience an optimized image update process.

2. Specifications

Model Name	ESP32E6-E01
Programming Platform	Arduino
Dimensions(mm)	86.3*69.2*1.63
Supported Size	4-inch and 7.3-inch E6 e-paper, 24-pin e-paper displays
Power Supply	Powered by Type-C interface or 4.2V lithium battery
Example Programs	Available
Operating Temperature	-20°C to +70°C
Usage Methods	1. Image update via Wi-Fi 2. Image update via BLE 3. Image update via USB serial port 4. Image update by parsing pre-stored images from SD card 5. Four functional buttons 6. TOUCH I²C interface

	7. Front light interface, supporting default 27V and 3.3V front light
	8. Can connect to IT8951 TCON board via SPI interface to drive TTL parallel e-paper display
	9. Two UART interfaces and one USB interface
	10. Lithium battery charging and discharging

3. Main Features

ESP32E6-E01
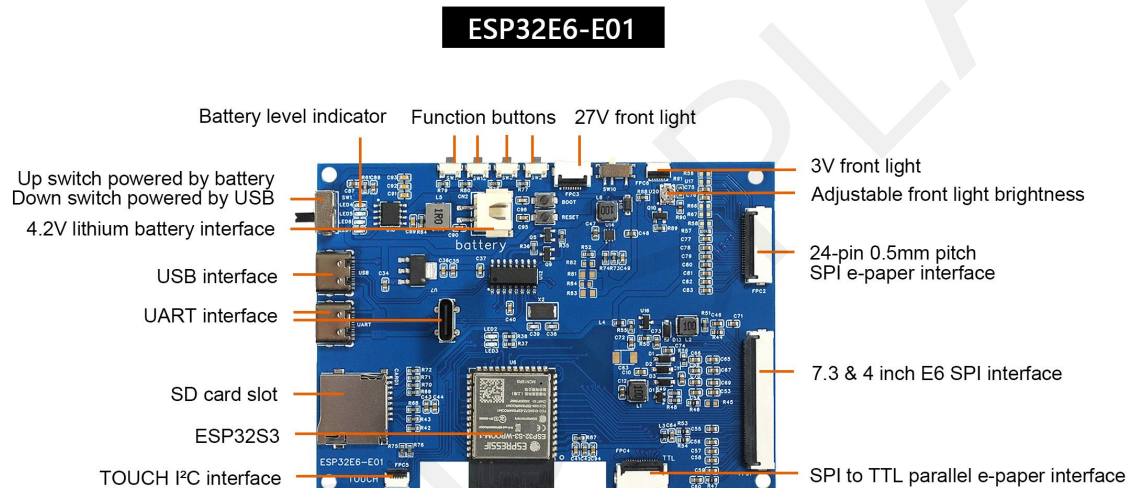
3.1 Functional Buttons

The development board has 4 reserved functional buttons: SW2, SW3, SW11, and SW12. All buttons are triggered by a low level. Pin definitions are as follows:

* SW2 —— IO46
* SW3 —— IO9
* SW11 —— IO42
* SW12 —— IO41

3.2 Front Light

The development board has two reserved front light interfaces: FPC3 and FPC6.

FPC3 is an 8-pin 0.5 mm pitch FPC connector, with default front light voltage of 27V.
FPC6 is a 6-pin 0.5 mm pitch FPC connector, with default front light voltage of 3V.

The front light can be controlled through IO38. When IO38 is high, the light turns

on; when IO38 is low, the light turns off. It can also be controlled with functional buttons to switch the front light on and off.

3.3 TOUCH I²C Interface
The development board has a reserved TOUCH I²C interface at FPC5, which is a 6-pin 0.5 mm pitch FPC connector. It can be used to connect a touchscreen or other I²C sensor applications. Pin definitions are as follows:

* TOUCH_SDA —— IO39
* TOUCH_SCL —— IO40
* TOUCH_INT —— IO8
* TOUCH_RST —— IO10

3.4 SD Card
The development board has a reserved SD card slot. Users can expand the board's storage capacity with a memory card. Pin definitions are as follows:

* SD_CS —— IO48
* SD_MOSI —— IO47
* SD_MISO —— IO13
* SD_SCK —— IO21

3.5 SPI TTL Interface
The development board has a reserved SPI TTL interface at FPC4, which is a 14-pin 0.5 mm pitch FPC connector. This interface connects to the IT8951 TCON board via the SPI protocol to drive TTL parallel e-paper displays. Pin definitions are as follows:

* VSPI_MISO —— IO18
* VSPI_MOSI —— IO17
* VSPI_SCLK —— IO16
* VSPI_SS —— IO15
* IT8951_SPI_CS —— IO15
* IT8951_RESET —— IO7
* IT8951_HOST_HRDY —— IO6

3.6 EPD Interface
The development board has two reserved EPD interfaces: FPC1 and FPC2.

* FPC1 is a 50-pin 0.5 mm pitch FPC connector, supporting 7.3-inch and 4-inch E Ink Spectra 6 series e-paper displays.
* FPC2 is a 24-pin 0.5 mm pitch FPC connector, supporting most 24-pin SPI e-paper displays.

Pin definitions are as follows:

* EPD_MOSI —— IO11
* EPD_CLK —— IO12
* EPD_BUSY —— IO5
* EPD_RST —— IO4

* EPD_DC —— IO3
* EPD_CS —— IO2

3.7 Lithium Battery Interface
The development board uses the IP5306 lithium battery charge/discharge circuit and includes 4 battery indicator LEDs:

* 4 LEDs on: Battery ≥ 75%
* 3 LEDs on: 50% ≤ Battery < 75%
* 2 LEDs on: 25% ≤ Battery < 50%
* 1 LED on: 3% ≤ Battery < 25%
* 1 LED flashing: 0% < Battery < 3% (charging required)

4. Function Description

For the ESP32E6-E01 development board, four functions have been developed:

1) Update images via UART communication between the web application and the development board.

2) Update images by connecting the mobile phone to the development board through Bluetooth, then using the web application.

3) Update images by connecting the mobile phone to the development board through Wi-Fi, then using the web application.

4) Update images by placing dithered images on the SD card, which the MCU automatically detects and parses.

Note: The above four functions can be freely switched through the four functional buttons. One development board can support all four image updating methods simultaneously.

Functional Button Instructions

1. When pressing button SW2, the development board executes the SD card pre-stored image method, and the MCU automatically detects and parses the images for update.

2. When pressing button SW3, the development board executes the UART communication method between the web application and the development board to update images.

3. When pressing button SW11, the development board executes the Wi-Fi connection between the mobile phone and the development board, using the web application to update images.

4. When pressing button SW12, the development board executes the Bluetooth connection between the mobile phone and the development board, using the web application to update images.

5. Operation Instructions

The following operation instructions use the GDEP073E01 E Ink Spectra™ 6 series display as an example.

Image transmission through USB web application.
Open the link: [https://www.e-paper-display.com/usb2epd.html]
1. First, connect the development board to the EPD. Use a USB data cable to connect the USB-C port labeled as UART on the development board to the computer's USB-A port. Press SW3 to enable operation. Power can be supplied either via USB or a lithium battery, and can be switched through the power switch. Open the web application link, as shown in the figure below:
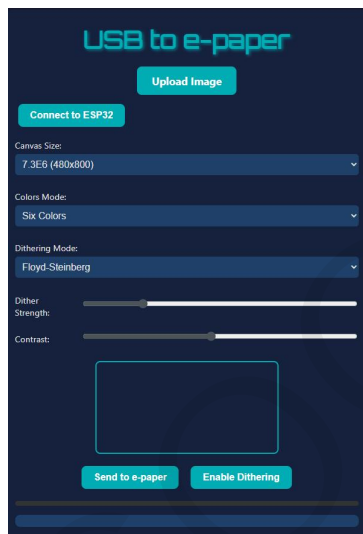

2. On the webpage, first click "Connect to ESP32" to locate the serial port COMX of the ESP32-E01, then click Connect.
3. Set the options for "canvas size, color mode, and dithering mode." The default settings are: screen size: 7.3E6; color mode: six-color; dithering mode: Floyd-Steinberg. Users can switch these modes according to the screen size and type.
4. After completing the above settings, click "Upload Image." The image will be displayed in the box below according to the selected settings. By default, the image is shown without dithering. To enable dithering, click "Enable Dithering."

5. After uploading the image, there are two convenient functions available: the dithered image can be enabled and downloaded for saving, or it can be downloaded as a binary data array.

6. Click "Send to E-Paper" and wait for the image to be uploaded.
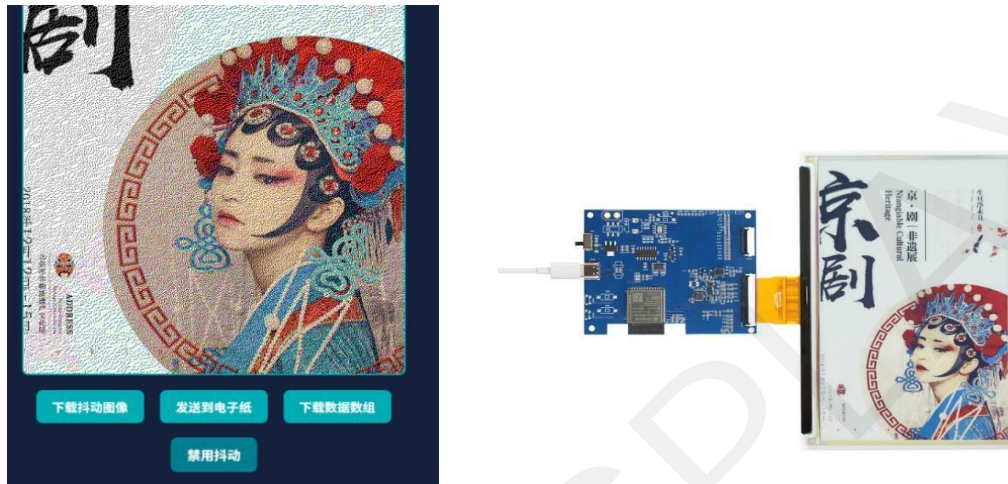
● Image transmission via Bluetooth

Mobile phone connects to the development board via Bluetooth and updates images through the web application

1. While the mobile phone is connected to the internet, use WeChat or a browser to scan the QR code shown in the figure below or directly visit: [https://e-paper-display.com/ble.html]

2. The mobile page will enter the "Image Processing and Bluetooth Communication" operation interface.
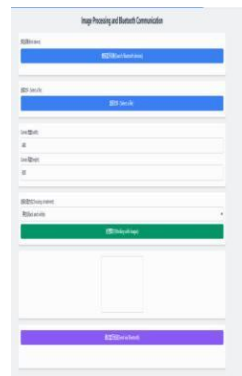

2. After powering on, press button SW12 and search for Bluetooth devices. The page will display ESP32-E01 as the Bluetooth name. Click to pair, and the device

will be successfully connected.

3. First, set the screen resolution width and height, and select the image processing method. Users should modify these settings according to the screen size and type. Then click "Choose File" to select the image to be uploaded. Click "Process Image," and the image will be processed as required.

4. Finally, click "Send via Bluetooth" and wait for the image to be uploaded (during upload, LED3 will flash every 2 seconds).

5. After a successful upload, the result will be displayed.
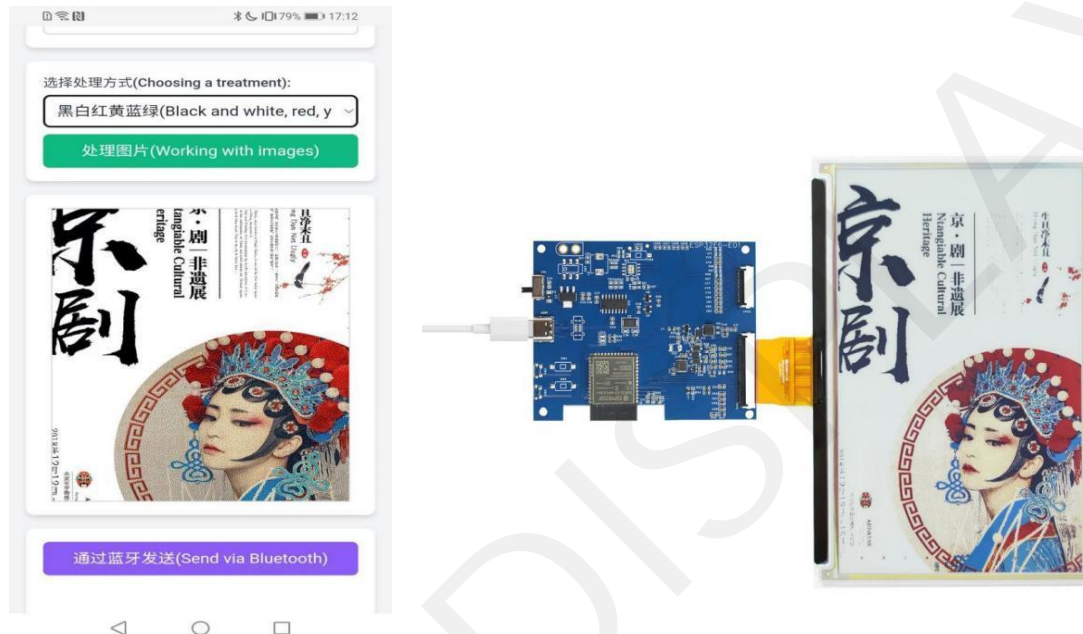

● Image transmission via Wi-Fi

Mobile phone connects to the development board via Wi-Fi and updates images through the web application

1. Press button SW11. While the mobile phone is connected to the internet, use WeChat or a browser to scan the QR code shown in the figure below.

2. The mobile phone will enter the NeoFrame operation page, as shown in the figure below.

The actual URL is einkapp.com/neoframe.html. You can also bookmark this URL in your browser for direct access when needed.
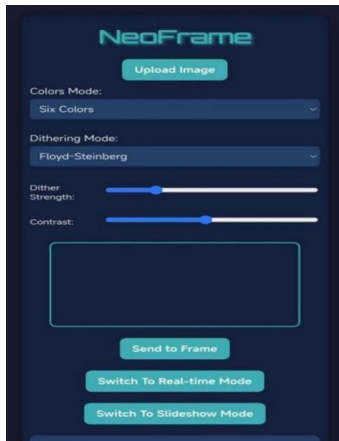
3. While the development board is powered via USB or battery, it will create a Wi-Fi network named "NeoFrame." On the mobile phone, go to WLAN settings, find the "NeoFrame" Wi-Fi network, click to connect, and enter the password "123456789." Make sure the phone is connected only to this network.

Note: If the phone prompts "The current WLAN cannot access the internet, other WLANs are available, do you want to switch?" be sure to select "Stay Connected."

4. Uploading Images

   (1) Click "Upload Image" to select a photo taken with the phone or an image from the phone's gallery.

   (2) There are two options to choose from:

   ① Color Mode: SixColors / FourColors / Black & White / Three Colors

Since the selected screen is an E Ink Spectra 6 display, choose "SixColors."

② Select Dithering Mode: Floyd-Steinberg / Atkinson / Stucki / Jarvis-Judice-Ninke.

You can adjust the Dithering Strength and Contrast by sliding on the screen.

   (3) After the image has been processed, click "Send to Frame" to send the image. Wait for the e-paper display to refresh.

●SD Card Image Parsing

1. First, insert the SD card into a card reader and connect it to the computer.

2. Copy the dithered images to the SD card using file names such as image0.bmp, image 1.bmp, etc.

名称 ∧	修改日期
image0.bmp	2025/3/25 16:28
image1.bmp	2025/3/26 8:55
image2.bmp	2025/3/26 8:56
image3.bmp	2025/3/26 8:57
image4.bmp	2025/3/26 8:59
image5.bmp	2025/3/26 9:00
image6.bmp	2025/3/26 9:30
image7.bmp	2025/3/26 9:32
image8.bmp	2025/3/26 9:33
image9.bmp	2025/3/26 9:34
image10.bmp	2025/3/26 8:59

3. Insert the SD card into the development board slot and press button SW2. It takes about 2 minutes to update one image.

Note: Since different users have different storage requirements, the SD card is not included and should be provided by the user to avoid unnecessary costs.

6. Dithering Process

When refreshing an E Ink Spectra 6 series e-paper display, RGB images must be dithered into a six-color scatter pattern consisting of black, white, red, yellow, blue, and green before being converted into an array. To facilitate this, we have developed a web application for customers: E-Paper Dithering Tool.

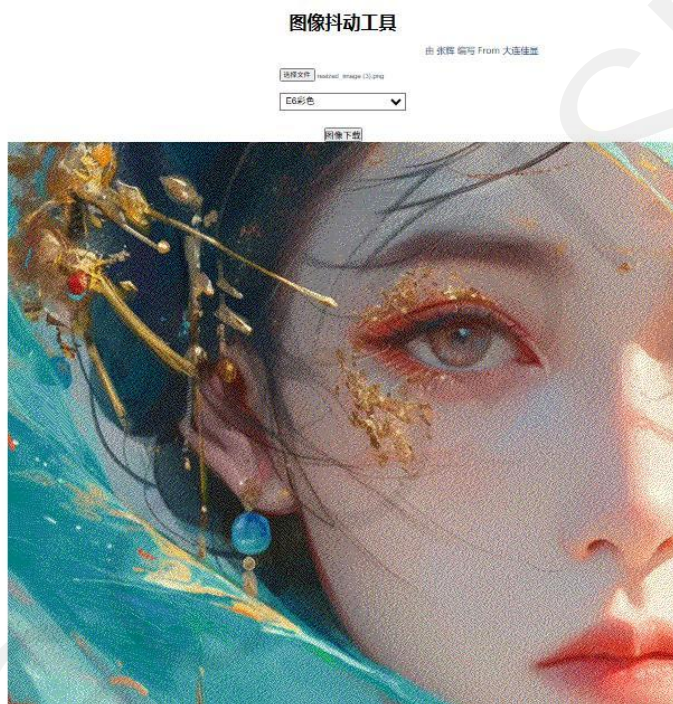1) First, open the web application and select "E6 Color."

2. Next, click "Choose File" to select the image to be processed. Make sure the image resolution matches the e-paper display's resolution. Then click "Download Image" to obtain the processed file.

7. Precautions

1. Do not keep the screen powered on for long periods when it is not refreshing. Set the screen to sleep mode or turn off the power. Otherwise, prolonged high-voltage states may damage the film, which is irreversible.

2. When using the e-paper display, it is recommended to refresh at intervals of at least 180 seconds and perform at least one refresh every 24 hours.

3. If the e-paper display will not be used for an extended period, store it with the screen cleared (white). Refer to the datasheet for specific storage requirements.

4. After the screen enters sleep mode, it will ignore any sent image data. Only reinitialization allows normal refreshing.

5. If the uploaded image data displays incorrectly on the screen, check whether the image dimensions are correct and try swapping the width and height settings.

6. The e-paper display operates at 3.3V. If you purchased a bare panel and need to work in a 5V environment, it is recommended to implement level shifting in the circuit design.

7. The screen's FPC cable is fragile. Please take care:

   * Do not bend the cable vertically along the screen to avoid tearing.
   * Do not repeatedly bend the cable excessively to prevent breakage.
   * Do not bend the cable toward the screen front, which may disconnect it from the panel.

8. During debugging and development, it is recommended to fix the FPC cable before use. The e-paper screen is delicate—avoid dropping, collisions, or pressing forcefully.