E-paper Display

TCON Board User Manual

GooDisplay

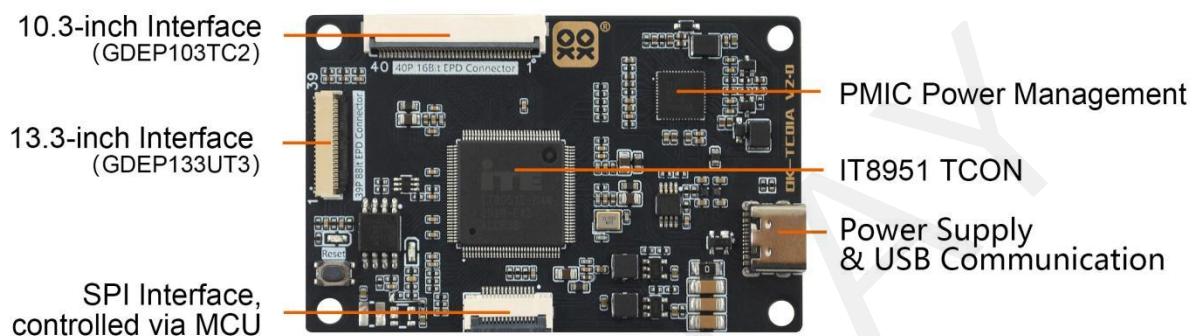**DEJA-TC103**

1. Overview

The DEJA-TC103 is a TCON board based on the IT8951, specifically designed to drive TTL parallel interface e-paper displays. It features two built-in e-paper interfaces for driving the GDEP133UT3 and GDEP103TC2 screens. A reserved 14-pin 0.5 mm-pitch FPC connector is provided for SPI communication and external power supply with other MCUs. The onboard USB interface can be used to connect with a PC host for image transfer testing, allowing customers to get started quickly and experience an optimized image update process.
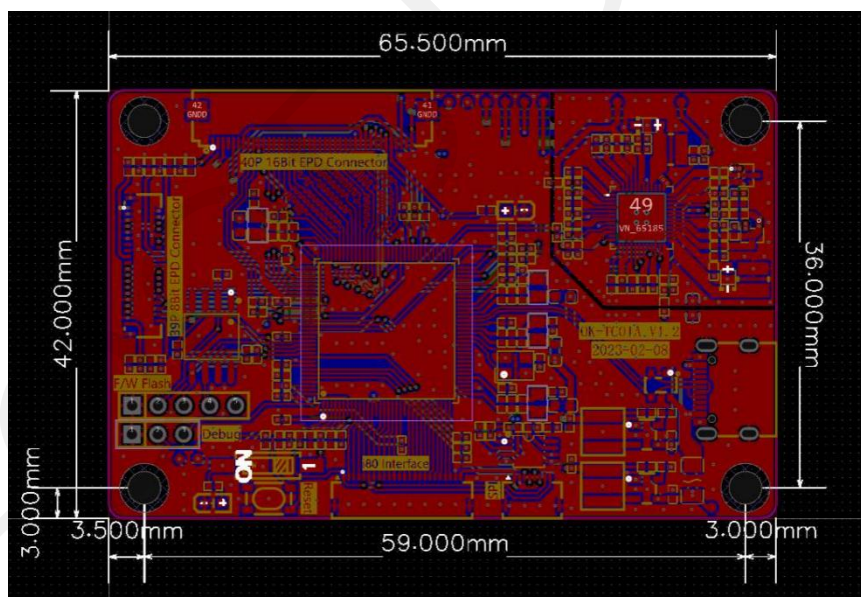
2. Specifications

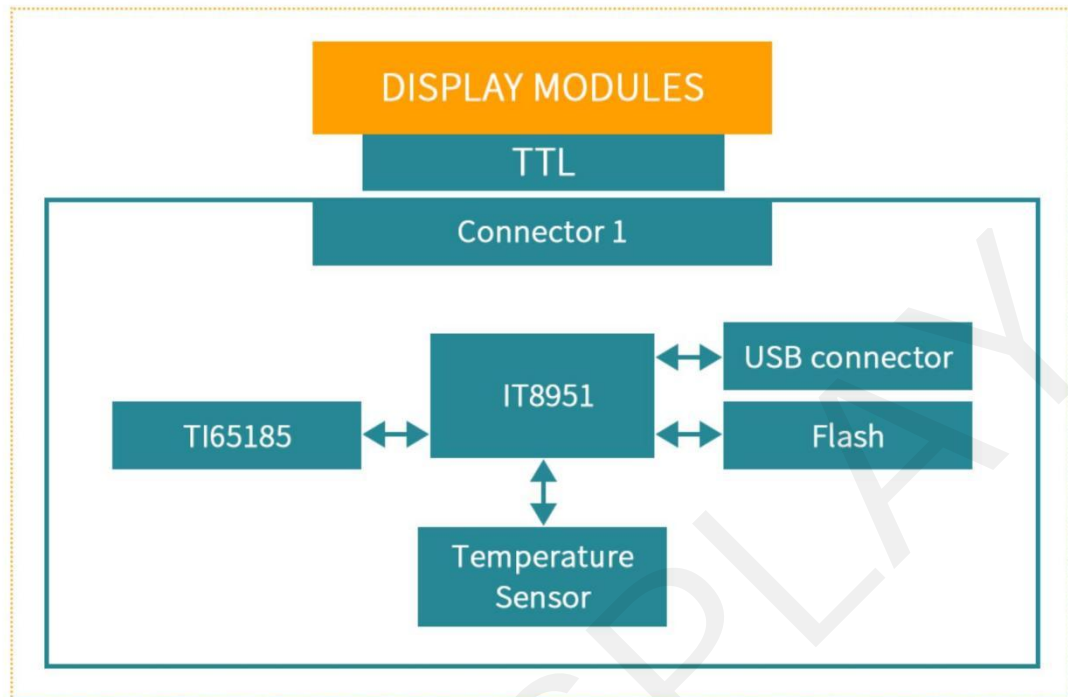|	
Model	DEJA-TC103
Program Platform	Arduino
Dimensions	65.5*42mm
Compatible Displays	GDEP133UT3, GDEP103TC2
Power Supply	Type-C interface
Example Program	Example program available for SPI communication based on ESP32E6-E01 development
Operating Temperature	-20℃+70℃
Main Functions	1. Drives the GDEP133UT3 and GDEP103TC2 displays 2. Can be paired with other MCUs for further function expansion

3. Main Functions

DEJA-TC103

10.3-inch Interface
(GDEP103TC2)

13.3-inch Interface
(GDEP133UT3)

SPI Interface,
controlled via MCU

PMIC Power Management

IT8951 TCON

Power Supply
& USB Communication
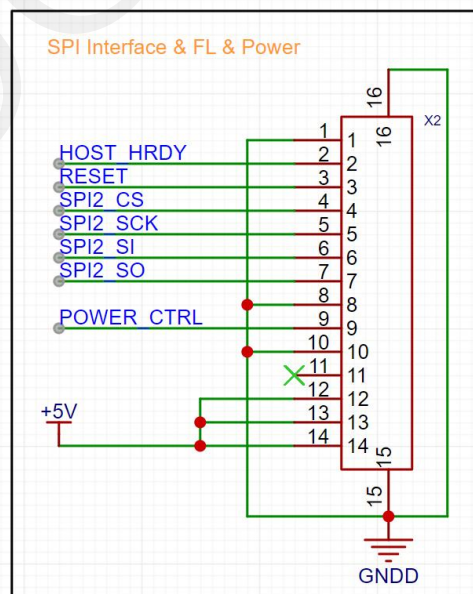
Dimensions Diagram:

4. Function Description

For the DEJA-TC103 TCON board, there are two methods to update images:

1. Updating images via USB communication with a PC host

2. Updating images via SPI communication with another MCU

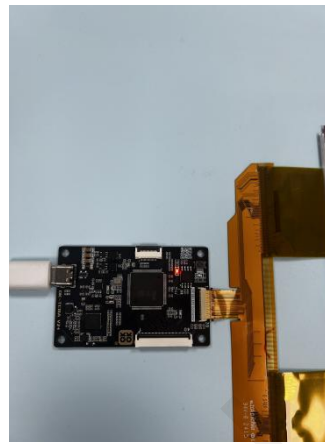Onboard interface diagram for SPI communication with another MCU:

4.1 PC Host Image Update Operation

1. Hardware connection: Connect the development board and the display via USB as shown below.
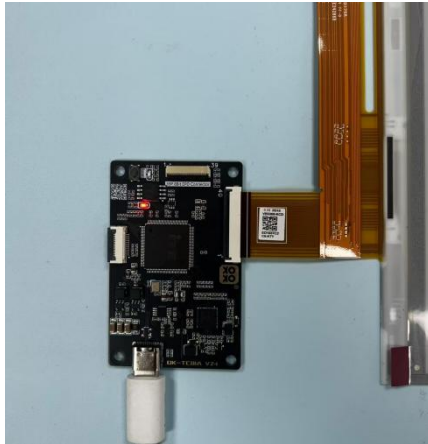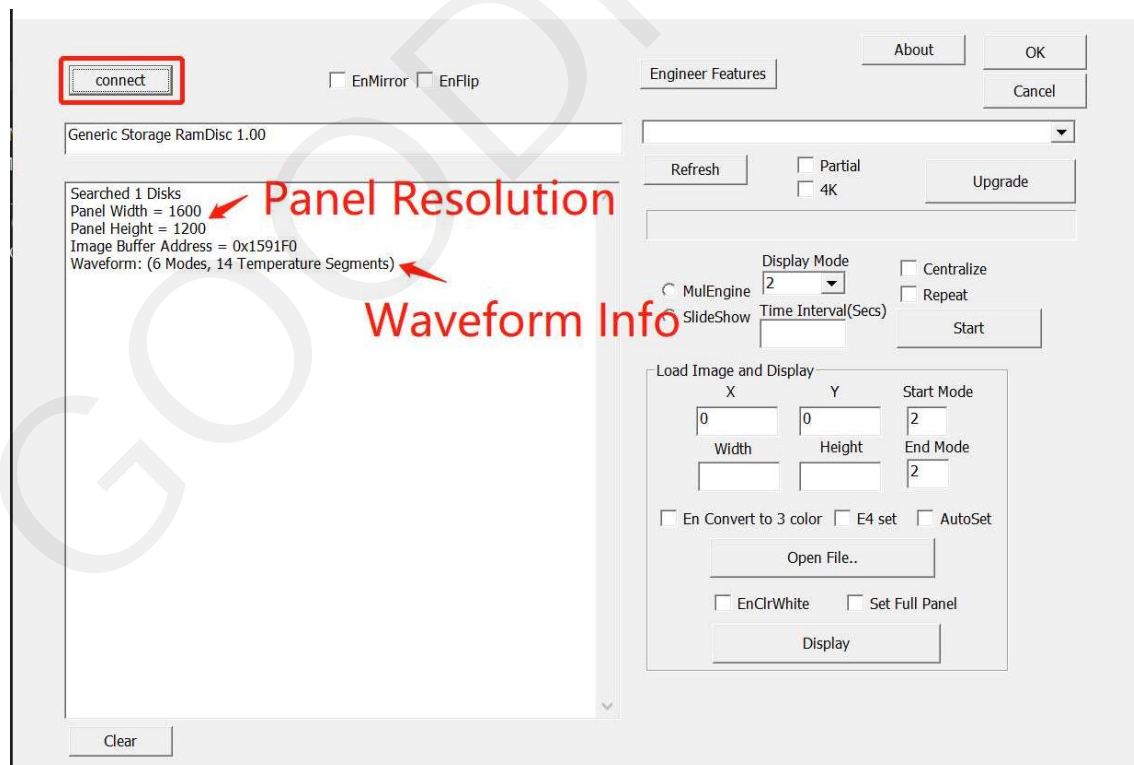

GDEP103TC2

GDEP133UT3

2. Connect the development board's USB port to the PC, then open the host software "ITE_TCon_DemoAP."

3. After opening, click "Connect." Once connected successfully, the interface will appear as shown below:

4. Check AutoSet and set the full panel. Click "Open File" to select an image corresponding to the EPD resolution.
The log window will display the relevant information, indicating that the image has been sent to the TCon. Click "Display" to have the EPD show the corresponding image.
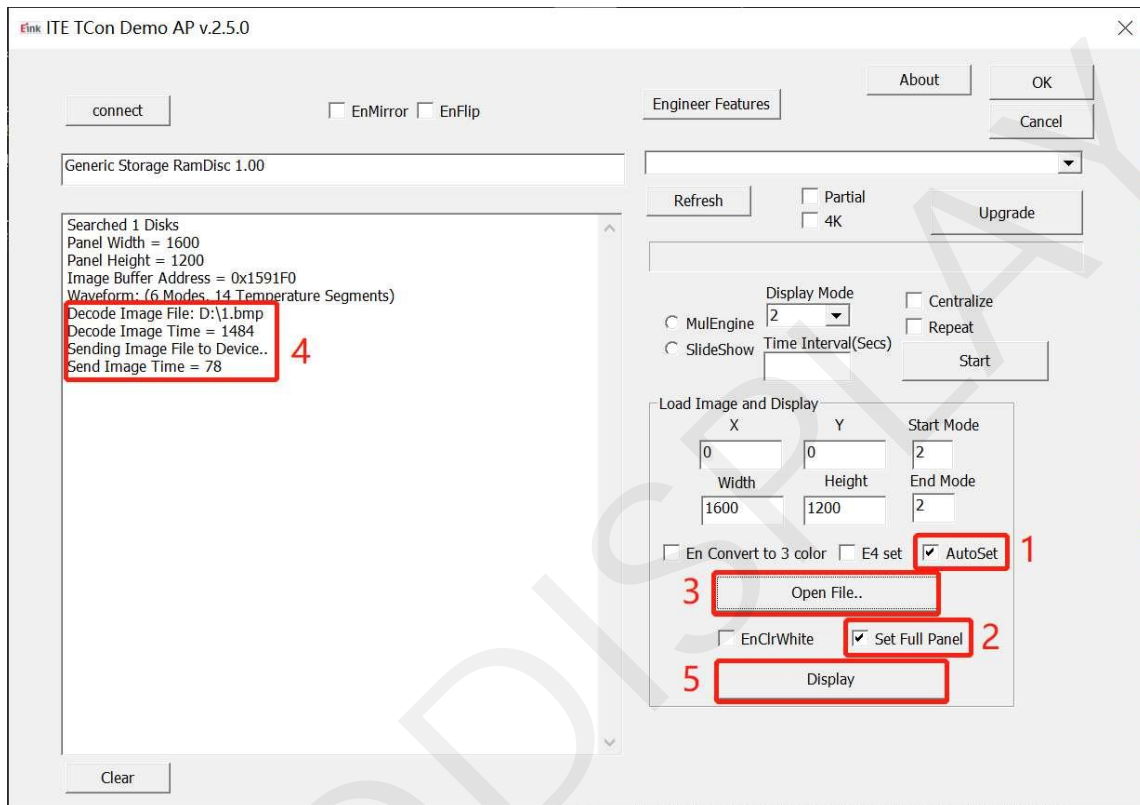
4.2 V-com Voltage Adjustment Method

Each e-paper display has a slightly different VCOM value, which is indicated on the FPC cable of the display. Before running the program each time, make sure to use the correct VCOM value. Otherwise, if the e-paper display operates with an incorrect VCOM value for a long time, its display quality will deteriorate. The DEJA-TC103 is set to a default V-com voltage of -2.50 V at the factory. Users can adjust the V-com using dedicated software. The adjustment method is as follows:

1. Connect the USB interface of the driver board to the USB port of the PC.
2. Open the "ITE_TCon_DemoAP_v.2.5.4" test software.
3. Click connect. If successful, the display will appear as shown below:
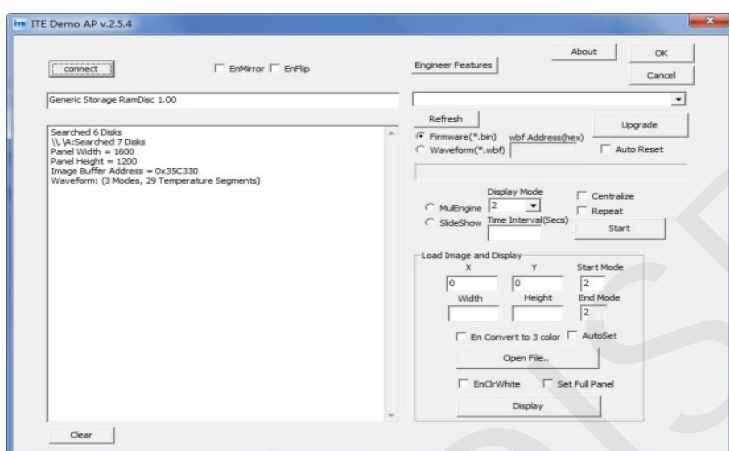
4. Click "EngineerFeatures" as shown below.
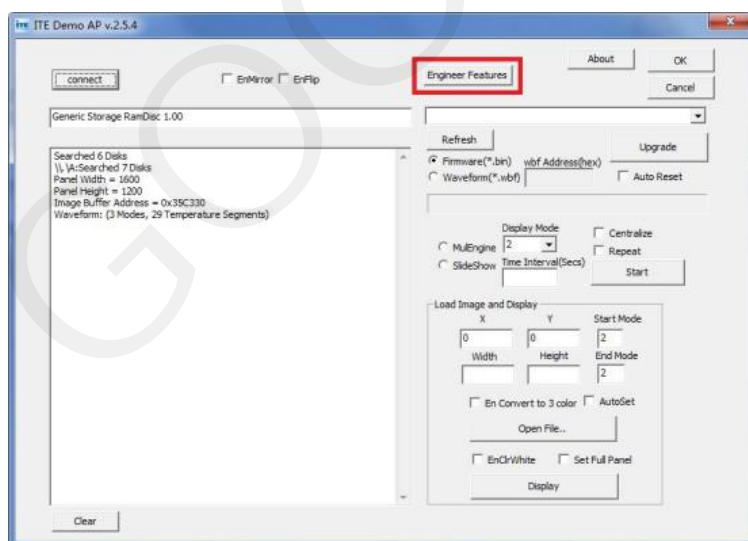
5. In the "VComSetting (mV)" input box, enter the V-com voltage value to be set (note: the input value is negative, and the unit is mV). For example, to set the V -com value to -2.6 V, simply enter 2600 in the input box. After setting the value, choose either Set VCom (this option will not be saved after power-off) or Set VCom Flash (this option will be saved after power-off), then click "Execute" to complete the setting, as shown below:
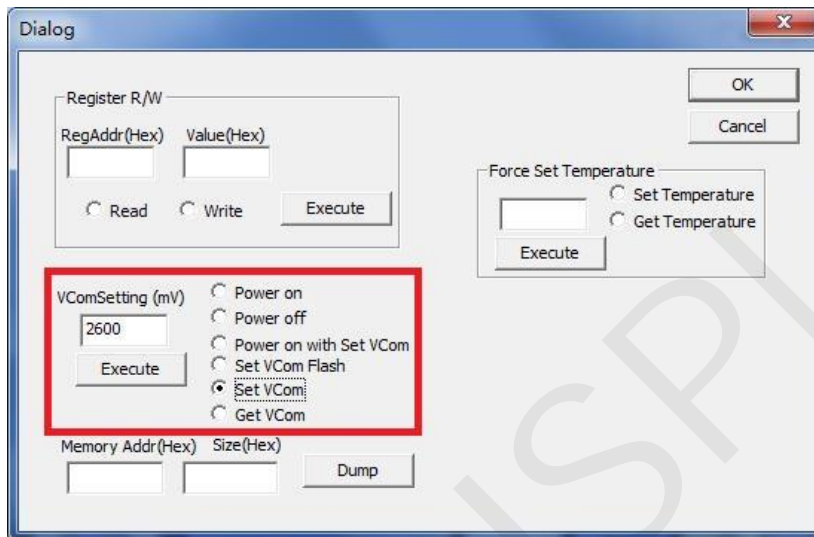

6. After the V-com voltage value is set, the software interface will display the current V-com voltage. This indicates that the V-com voltage has been successfully set, as shown below:
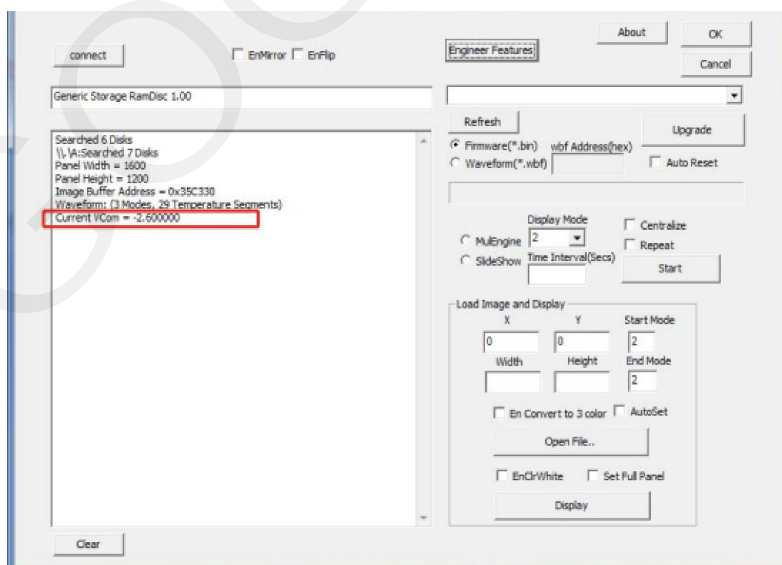
4.3 Updating the waveform file

1. Copy the firmware to be updated into the same directory as the DemoAP.
(Please contact the sales representative to obtain the firmware.)

2. Connect the USB port of the DEJA-TC103 to the computer. The EPD does not need to be connected.

3. Click Connect, then click Refresh. You will see the firmware file in the drop-down menu. Select the firmware to update, then click Upgrade.
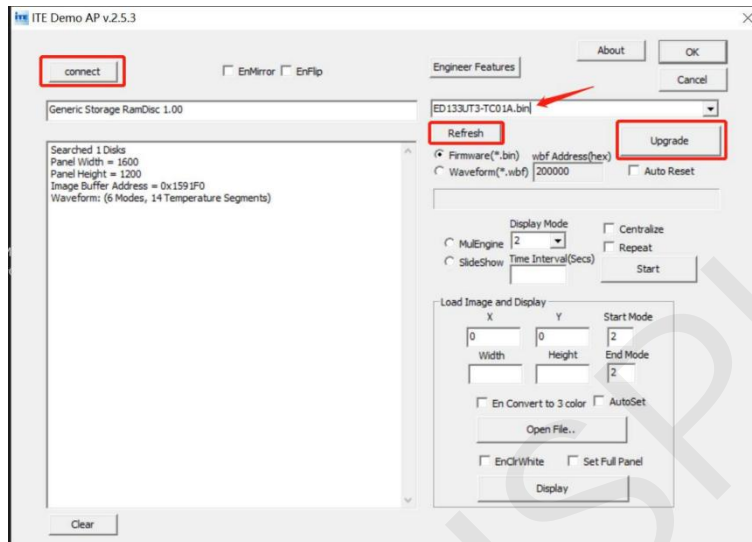
4. After the upgrade is complete, a prompt will appear. Click OK, then press the reset button on the DEJA-TC103 to finish the upgrade.
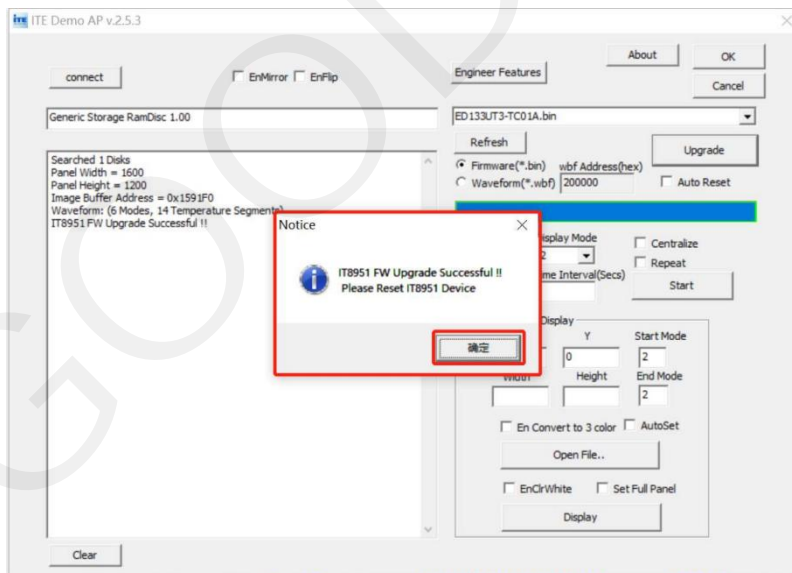
4.4 SPI Communication with Other MCUs

For SPI communication with other MCUs, you can use our ESP32E6-E01 development board. This board includes a reserved 14-pin 0.5 mm-pitch FPC connector for SPI communication and external power supply. It also provides a reserved TOUCH IIC interface and a 27V front-light interface. If you purchase a front-light touch-screen module, this development board can meet the requirements.

4.4.1 EPD interface definition is 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;

4.4.2 TOUCH IIC Interface Definition

TOUCH_SDA------IO39; TOUCH_SCL------IO40; TOUCH_INT------IO8;
TOUCH_RST------IO10。

When using the TOUCH interface, since the touchscreen uses an external GT9110 touch board, the board has a reserved USB communication interface. If using the IIC interface, wiring modifications are required. The board already provides IIC test points for connection. The adapter board between the two can be designed independently and is not provided separately by our company. The schematic is as follows:
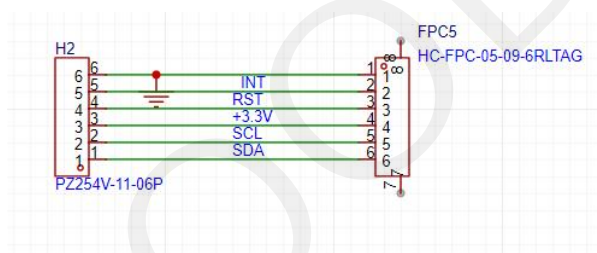

4.4.3 Front Light

The development board provides two front-light interfaces: FPC3 and FPC6. FPC3 is an 8-pin 0.5 mm-pitch FPC connector, with a default lighting voltage of 27V. FPC6 is a 6-pin 0.5 mm-pitch FPC connector, with a default lighting voltage of 3V.

The front light can be controlled via the IO38 pin: the light turns on when IO38 is high and turns off when IO38 is low. It can be used with function buttons to switch the front light on and off. The slide switch SW10 can adjust between warm light and cool light.

4.4.4 Overall Connection Diagram
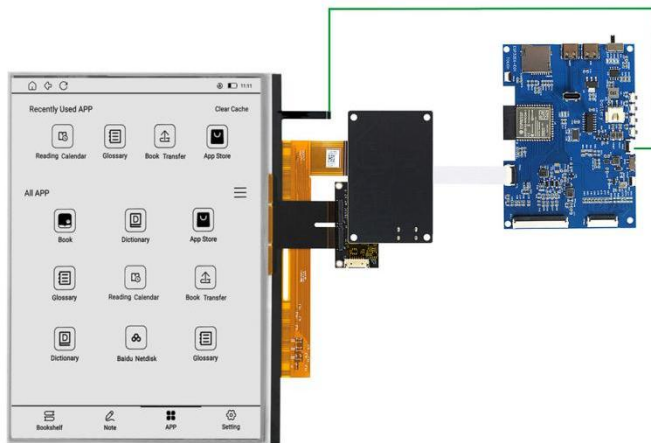
Program Description

1) Clear Screen

Function name: void clearScreen();
Uses INIT MODE to initialize the panel and clear any residual images on the screen.

2) Refresh 1bpp Image

Function name: void display1bpp(const uint8_t* data, uint16_t x, uint16_t y, uint16_t w, uint16_t h);
Can use A2 or 8bpp mode. Combined with algorithms, the screen will display black and white only.

3) Refresh 2bpp Image

Function name: void display2bpp(const uint8_t* data, uint16_t x, uint16_t y, uint16_t w, uint16_t h);
Can use GC16 2bpp mode. The screen will display 4 levels of grayscale only.

4) Refresh 4bpp Image

Function name: void display4bpp(const uint8_t* data, uint16_t x, uint16_t y, uint16_t w, uint16_t h);
Can use GC16 8bpp mode. Combined with algorithms, the screen will display 16 levels of grayscale only.

bpp Description

bpp (Bits Per Pixel) indicates the number of bits used by a single pixel. Currently, all screens support 1bpp, 2bpp, 4bpp, and 8bpp refresh modes.

1bpp

- Each pixel occupies 1 bit
- Can display 2 (2^1 = 2) levels of grayscale, suitable for A2 mode (only updates 2-level black-and-white)
- Each byte can store 8 pixels
- Pixels are stored in RAM in big-endian order within a single byte:
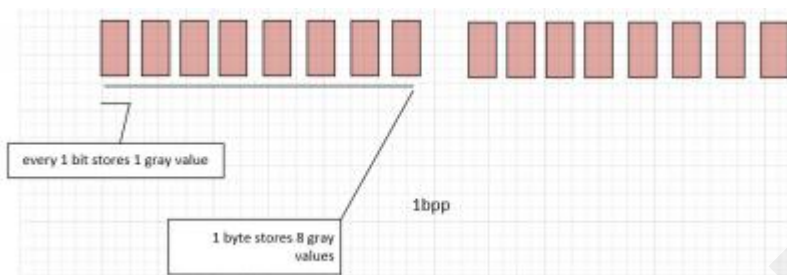
- In the IT8951, little-endian is used by default, so big-endian data must be converted to little-endian.

2bpp

- Each pixel occupies 2 bits
- Can display 4 (2^2 = 4) levels of grayscale
- Each byte can store 4 pixels
- Pixels are stored in RAM in big-endian order within each byte:
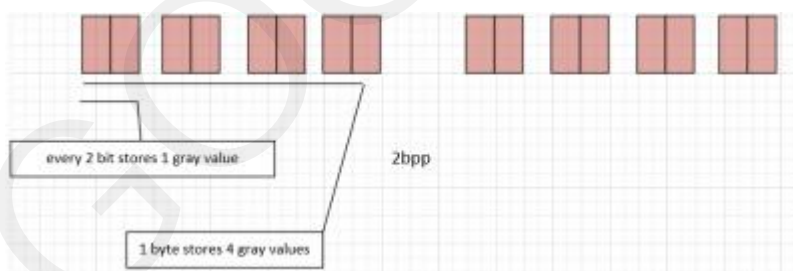
- In the IT8951, little-endian is used by default, so big-endian data must be converted to little-endian.
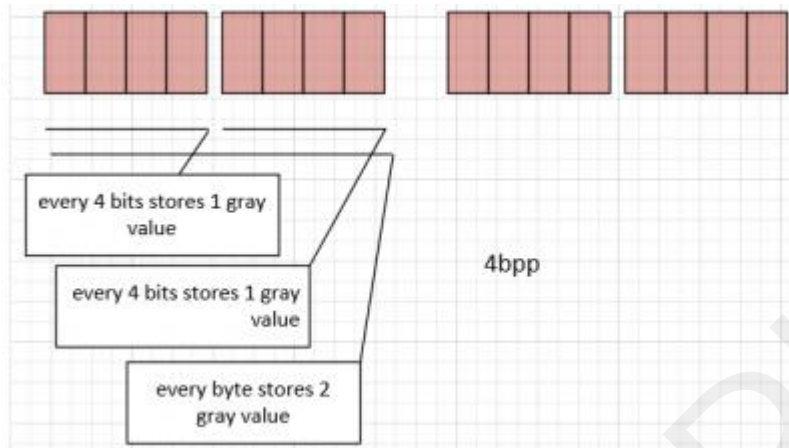
4bpp

- Each pixel occupies 4 bits
- Can display 16 (2^4 = 16) levels of grayscale
- Each byte can store 2 pixels
- Pixels are stored in RAM in big-endian order within each byte:

- In the IT8951, little-endian format is used by default, so big-endian data must be converted to little-endian.
- It is recommended to use 4bpp for refreshing, which can display 16 levels of grayscale. Compared to 8bpp, the data transfer amount is reduced by half, the transfer speed is doubled, and the display quality remains the same.

8bpp

- Each pixel occupies 8 bits
- Can display 256 (2^8 = 256) levels of grayscale, but in the IT8951 only the high 4 bits are used, so only 16 levels of grayscale are displayed
- Each byte can store 1 pixel
- Pixels are stored in RAM in big-endian order within each byte:
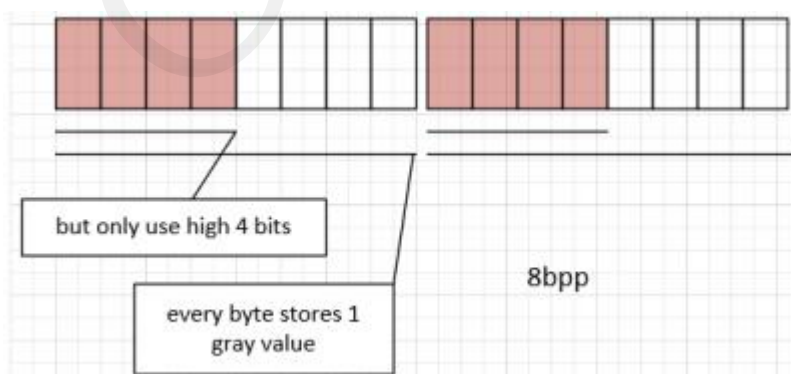
5. Precautions

1) Do not leave the screen powered on for long periods without refreshing. Set the screen to sleep mode or cut off the power. Otherwise, keeping the screen at high voltage for extended periods may damage the film, which is irreparable.

2) When using the e-paper display, it is recommended that the refresh interval be at least 180 seconds, and the screen should be refreshed at least once every 24 hours.

3) If the e-paper display will not be used for a long time, refresh it to white before storage. (Refer to the datasheet for specific storage environment requirements.)

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

5) If the image data displays incorrectly on the screen, check whether the image size settings are correct. Try swapping the width and height settings.

6) The working voltage of the e-paper display is 3.3V. If you purchased a bare panel and plan to operate in a 5V environment, it is recommended to use level conversion in the circuit design.

7) The FPC cable of the screen is fragile. Please note: do not bend the cable vertically along the screen to avoid tearing; do not repeatedly bend the cable excessively to avoid breakage; do not bend the cable toward the front of the screen to avoid disconnecting it from the panel.

8) During development and testing, it is recommended to secure the FPC cable. E-paper screens are fragile, so avoid dropping, collisions, or pressing the screen forcefully.