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› waveshare 2.13inch E-Paper Display HAT User Manual for Raspberry Pi and Jetson Nano

waveshare 2.13inch E-Paper Display HAT

waveshare 2.13inch E-Paper Display HAT User Manual

For Raspberry Pi and Jetson Nano

1. PRODUCT OVERVIEW

The waveshare 2.13inch E-Paper Display HAT is an E-Ink display module designed for use with Raspberry Pi series boards and Jetson Nano. It features a 250x122 pixel resolution with black and white display colors and an embedded controller. Communication is established via an SPI interface, and it supports partial refresh functionality.

This display offers advantages such as ultra-low power consumption, a wide viewing angle, and the ability to retain the last displayed content for an extended period even when power is removed. These characteristics make it suitable for applications like electronic shelf labels, industrial instrumentation, and various display projects where power efficiency and persistent display are crucial.

2.13inch e-Paper HAT



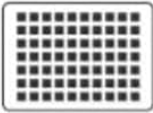
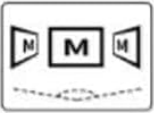
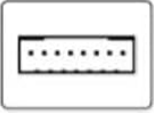
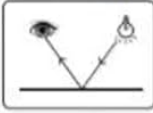
Size  2.13"	Resolution  250×122	Viewing Angle  >170°	Display Color  Black and White	Grey Scale  2
Communication  SPI	Display Panel  E-paper	Experience  Paper-like	Environment  Ambient Light Required	Display Type  Passively Reflective

Figure 1: The 2.13inch E-Paper HAT, illustrating its size, 250x122 resolution, >170° viewing angle, black and white display, and 2 grey levels.

2. FEATURES

- **No Backlight:** The display retains its content indefinitely without power, offering excellent readability in ambient light.
- **Ultra-Low Power Consumption:** Power is primarily required only during display refreshes, making it highly energy-efficient.
- **Standard Raspberry Pi 40PIN GPIO Header:** Directly compatible with Raspberry Pi series boards (4B/3B+/3B/2B/Zero/Zero W/Zero WH) and Jetson Nano.
- **SPI Interface:** Communicates via SPI, with preserved solder pads for connecting to other controller boards such as Arduino or STM32.
- **Onboard Voltage Translator:** Ensures compatibility with both 3.3V and 5V microcontrollers (MCUs).
- **Development Resources:** Includes comprehensive development resources and a manual with examples for Raspberry Pi, Jetson Nano, Arduino, and STM32.

3. PACKAGE CONTENTS

The following items are included in your package:

- 1 x 2.13inch e-Paper HAT
- 1 x RPi screws pack (2pcs)
- 1 x PH2.0 20cm cable

4. SETUP AND INSTALLATION

This section outlines the general steps for setting up your 2.13inch E-Paper Display HAT. For detailed, platform-specific instructions and code examples, please refer to the official online documentation.

4.1 Connecting to Raspberry Pi / Jetson Nano

1. Align the 40-pin GPIO header of the E-Paper HAT with the corresponding GPIO pins on your Raspberry Pi or Jetson Nano board.
2. Gently press down to ensure a secure connection. The HAT should sit firmly on the GPIO header.
3. Secure the HAT using the provided RPi screws, if desired, for added stability.

Standard Raspberry Pi 40PIN GPIO extension header
supports Raspberry Pi series boards, Jetson Nano

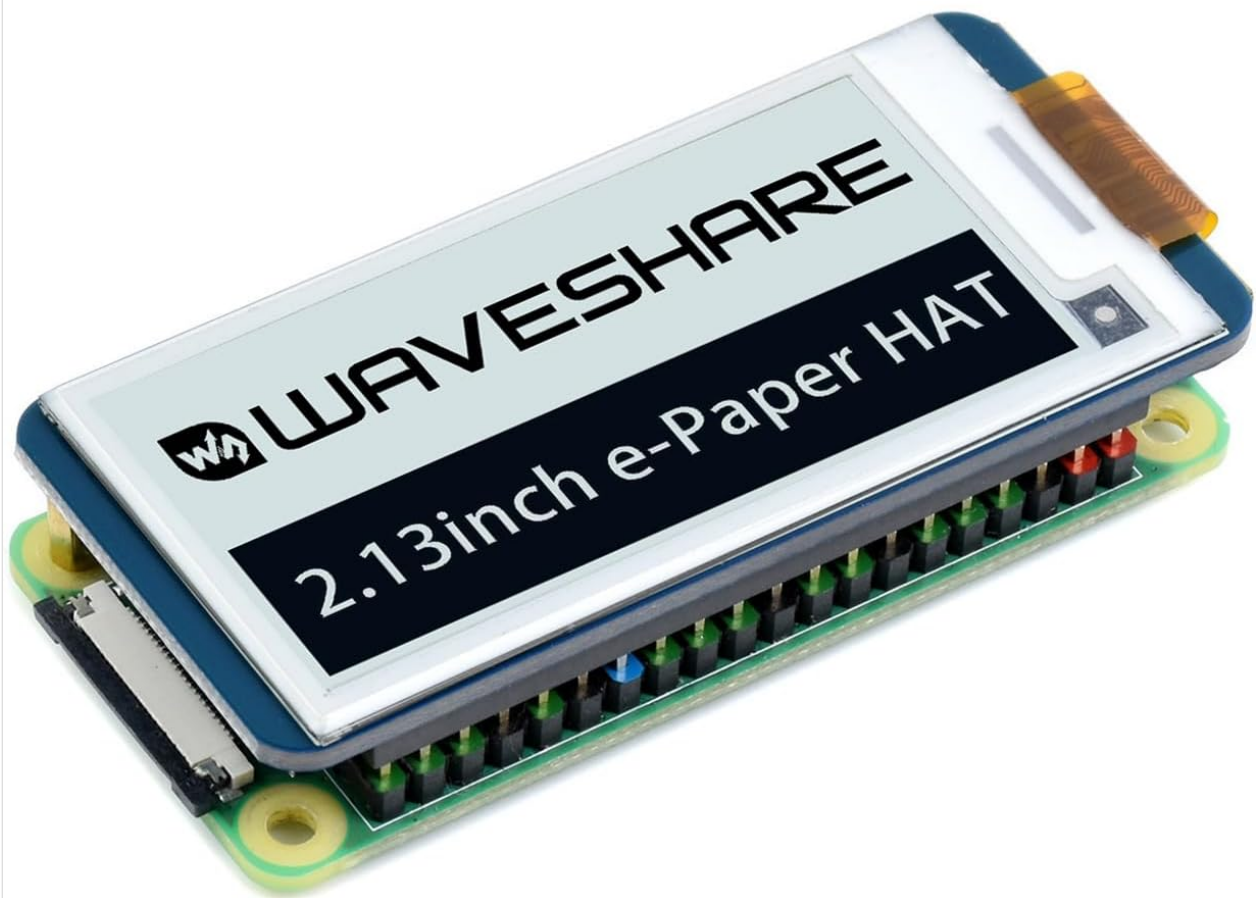


Figure 2: The 2.13inch E-Paper HAT featuring the standard 40PIN GPIO extension header for direct connection to compatible boards.



Figure 3: The 2.13inch E-Paper HAT correctly installed on a Raspberry Pi board, demonstrating its compact integration.

4.2 Connecting to Other MCUs (e.g., Arduino, STM32)

For other microcontrollers, utilize the preserved solder pads for the SPI interface. Connect the appropriate SPI pins (MOSI, MISO, SCK, CS, DC, RST, BUSY) from your MCU to the HAT. The onboard voltage translator ensures compatibility with 3.3V/5V logic levels.

Onboard voltage translator, compatible with 3.3V/5V MCUs

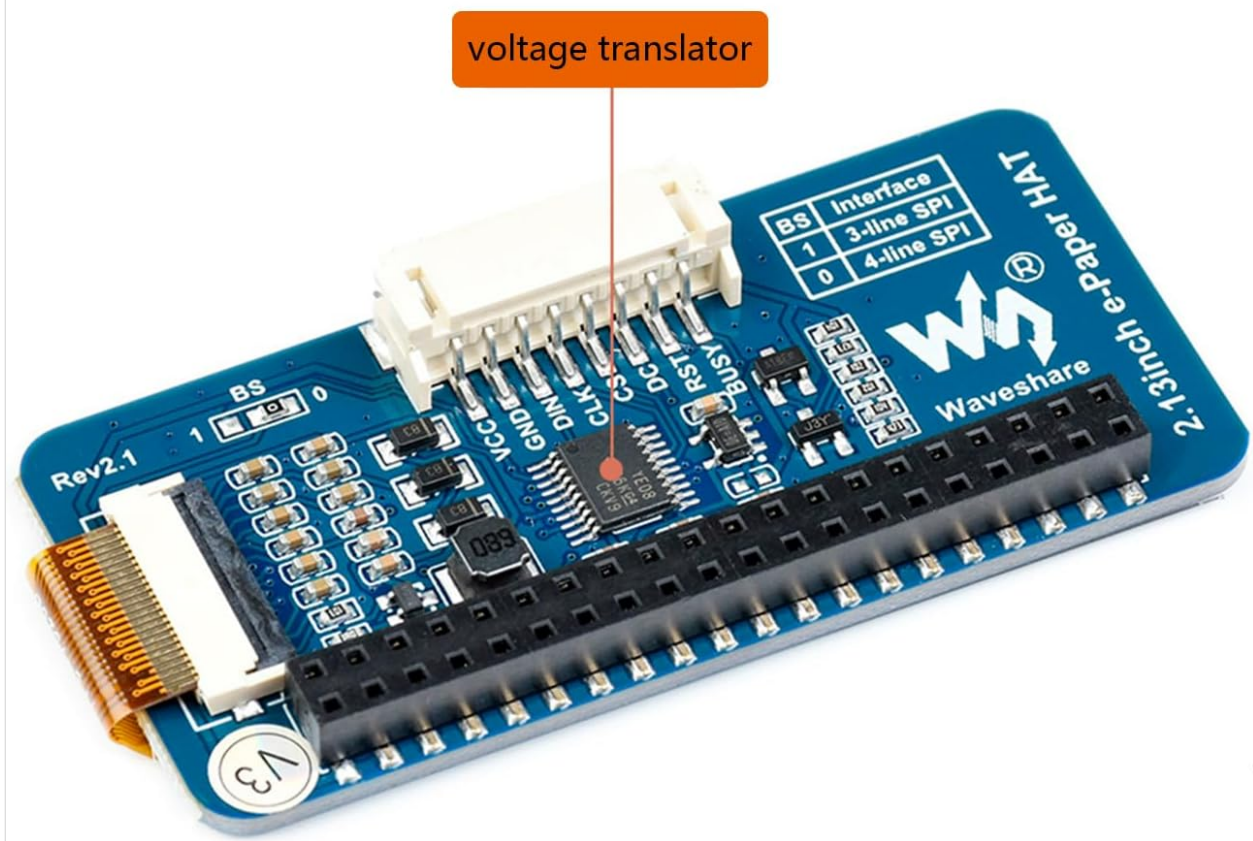


Figure 4: Detailed view of the E-Paper HAT's onboard voltage translator, which facilitates compatibility with 3.3V and 5V MCUs.

5. OPERATING INSTRUCTIONS

The 2.13inch E-Paper Display HAT operates by refreshing its pixels to display content. Due to its E-Ink technology, the display consumes power only during the refresh cycle and maintains the image without continuous power. This characteristic makes it ideal for static displays or applications requiring infrequent updates.

5.1 Display Refresh

The display supports both full and partial refresh modes. Partial refresh is faster (0.3s) and consumes less power, suitable for updating small portions of the screen. Full refresh (2s) ensures a complete screen update and clears any ghosting effects.

5.2 Programming the Display

To control the display, you will need to write code using the provided libraries and examples. These resources cover various programming languages and platforms, including Python for Raspberry Pi/Jetson Nano and C for Arduino/STM32. The SPI interface is used to send display data and commands to the HAT.

Refer to the online documentation for detailed programming guides and sample code to get started with displaying text, images, and graphics.

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Video 1: This video provides an overview of the 2.13inch E-Ink display HAT, demonstrating its features such as partial refresh,

low power consumption, and compatibility with Raspberry Pi and Jetson Nano.

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Video 2: This video showcases the 2.13 inch e-Paper HAT, highlighting its ultra-low power consumption, ability to retain content without power, and its standard Raspberry Pi GPIO header.

6. SPECIFICATIONS

Parameter	Value
Operating Voltage	3.3V / 5V
Interface	SPI
Outline Dimension	65mm × 30.2mm
Display Size	23.71mm × 48.55mm
Dot Pitch	0.194 × 0.194
Resolution	250 × 122 pixels
Display Color	Black, White
Grey Level	2
Partial Refresh Time	0.3s
Full Refresh Time	2s
Refresh Power	26.4mW (typical)
Standby Power	<0.017mW
Viewing Angle	>170°

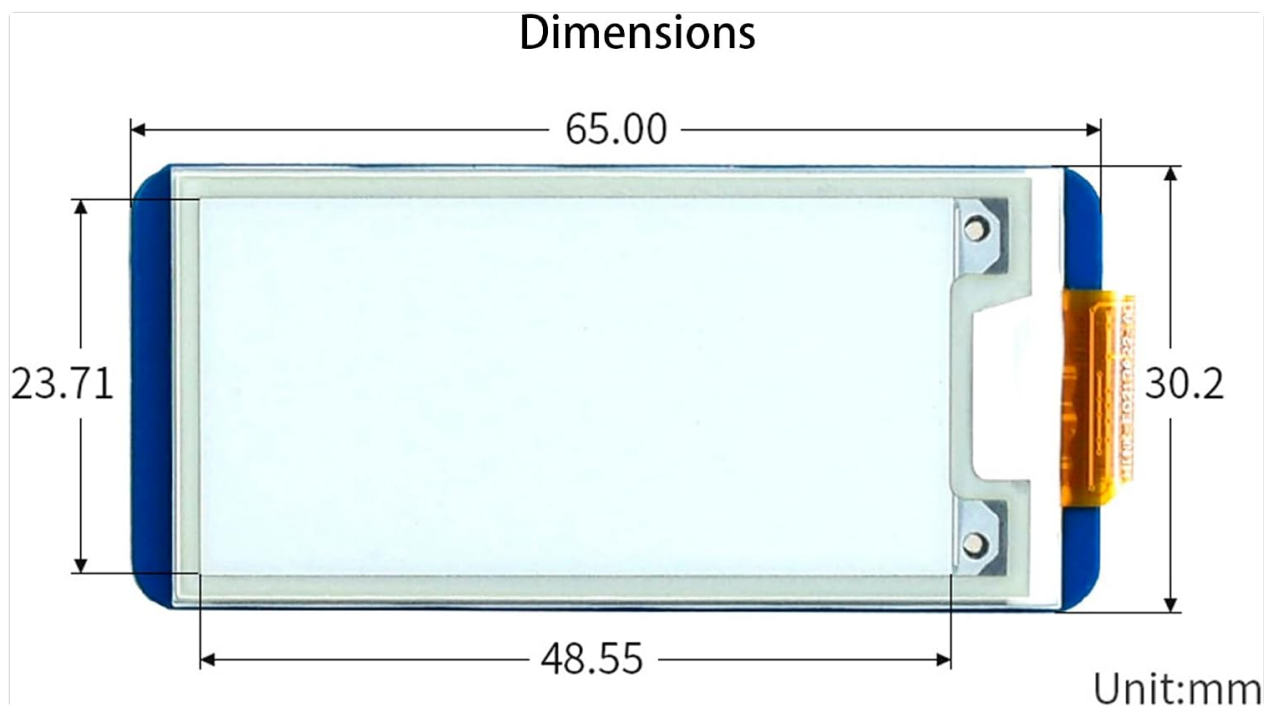


Figure 5: Dimensions of the 2.13inch E-Paper HAT in millimeters.

7. MAINTENANCE

To ensure the longevity and optimal performance of your E-Paper Display HAT, follow these general maintenance guidelines:

- **Handling:** Handle the display carefully to avoid physical damage to the screen or the flexible PCB connector.
- **Cleaning:** Use a soft, dry, anti-static cloth to gently clean the display surface. Avoid using harsh chemicals or abrasive materials.
- **Storage:** Store the HAT in a cool, dry environment, away from direct sunlight and extreme temperatures.
- **Power:** Ensure proper power supply (3.3V/5V) to prevent damage to the onboard components.

8. TROUBLESHOOTING

If you encounter issues with your E-Paper Display HAT, consider the following troubleshooting steps:

- **No Display:** Verify that the HAT is correctly seated on the GPIO header or that all SPI connections are secure if using external wiring. Check the power supply to your main board.
- **Incorrect Display:** Ensure your code is correctly configured for the 2.13inch 250x122 resolution and that the display data is being sent in the correct format.
- **Ghosting/Residual Image:** Perform a full refresh to clear any lingering images. This is a normal characteristic of E-Ink displays and can be resolved with a full refresh cycle.
- **Software Issues:** Double-check your software setup, library installations, and example code. Ensure you are using the correct pins for SPI communication.

For more in-depth troubleshooting and common issues, consult the online documentation and community forums.

9. APPLICATIONS

The unique characteristics of the E-Paper Display HAT make it suitable for a variety of applications where low power, wide viewing angles, and persistent display are beneficial. Examples include:

- Electronic Shelf Labels (ESL) in retail environments.
- Industrial instruments and control panels.
- Price tags and asset/equipment tags.
- Conference name tags and information displays.
- Low-power IoT display devices.

Application Examples

Suitable For Price Tags, Asset/Equipment Tags, Shelf Labels, Conference Name Tags

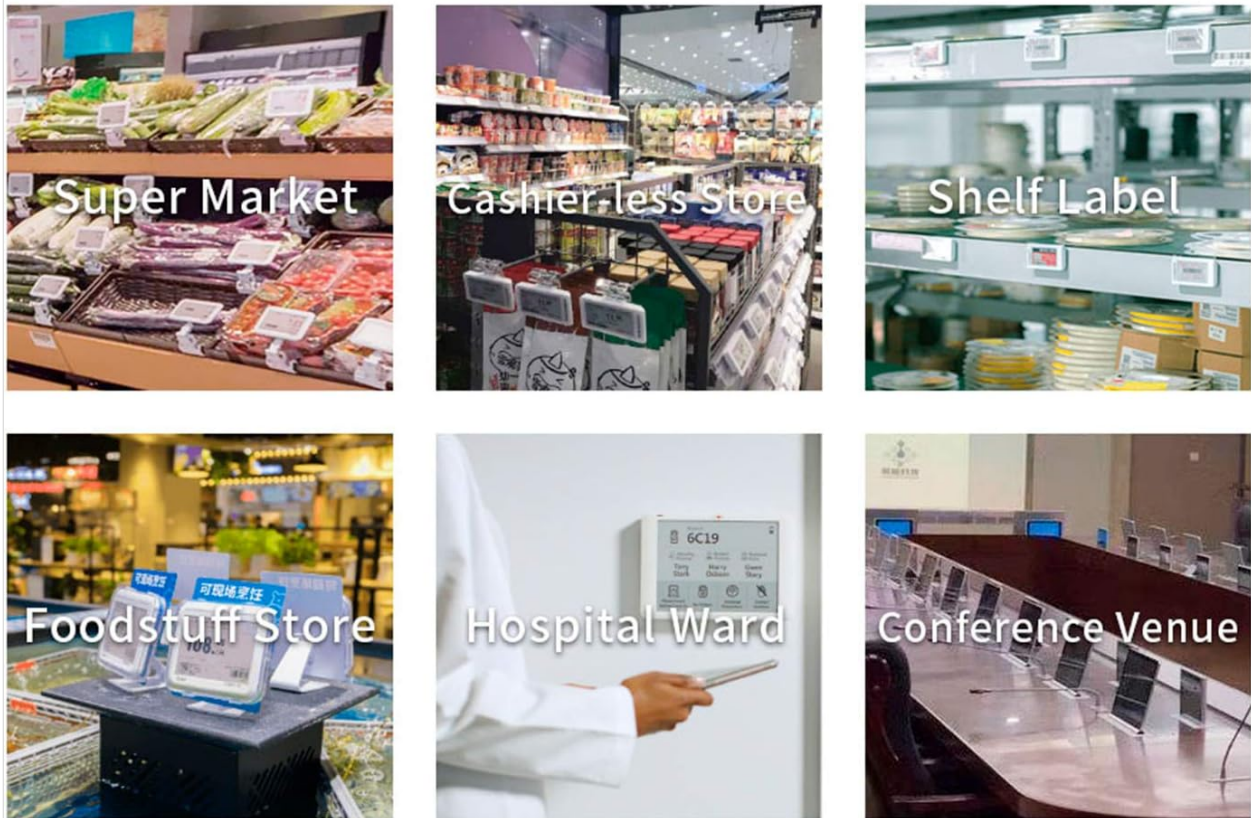


Figure 6: Various application examples demonstrating the versatility of the 2.13inch E-Paper HAT in different settings.

10. SUPPORT AND RESOURCES

For the most up-to-date information, detailed tutorials, driver board circuit diagrams, and programming examples for Raspberry Pi, Jetson Nano, Arduino, and STM32, please visit the official online documentation:

[Online Documentation and Resources](#)

This resource provides comprehensive guides to help you integrate and utilize your E-Paper Display HAT effectively.

11. WARRANTY INFORMATION

Warranty details for the waveshare 2.13inch E-Paper Display HAT are typically provided with your purchase or can be found on the manufacturer's official website. Please retain your proof of purchase for any warranty claims.