User manual

STM32F407_SHIELD

Introduction

The STM32F407 Shield is a compact development board designed to work with the STM32F407 discovery boards. It combines essential IoT features like wireless connectivity, sensors, display, storage, and user controls in one shield.

With a built-in ESP32-C6 (AT firmware) and other onboard components, it helps developers quickly build and test IoT, sensor-based, and interactive embedded applications.
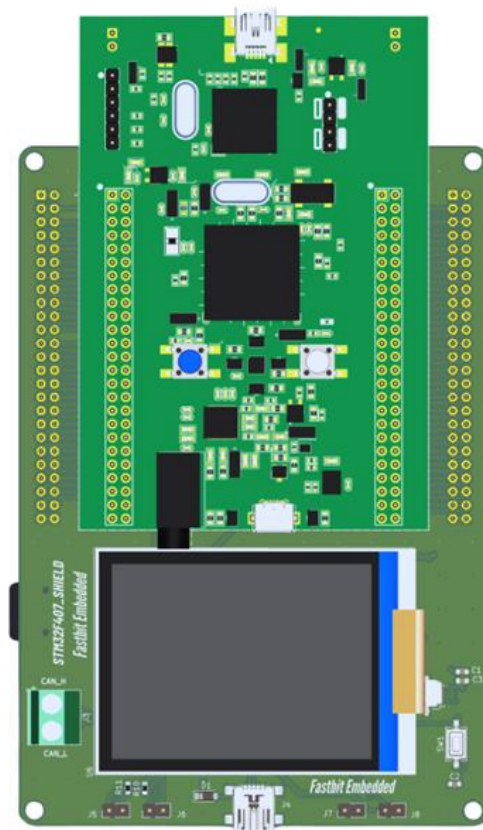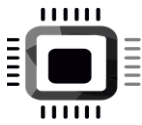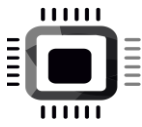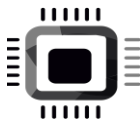

Figure 1. STM32F407_Shield

Contents

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Features:

Wireless Module

- ESP32-C6 with:
    - Wi-Fi 6 (802.11ax)
    - Bluetooth 5 (BLE)
    - Zigbee and Thread protocol support
- Preloaded with AT firmware for UART communication
- Can be re-flashed with custom firmware via USB

Compatibility

- STM32F407 disc board

Sensors

- HDC1080 (I2C): Temperature and humidity sensor
- MPU6050 (I2C): 3-axis accelerometer and 3-axis gyroscope

Display

- 2.4inch TFT LCD, 240×320 resolution
- Capacitive touch panel with FT6336 touch controller
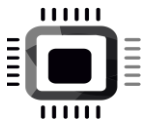- SPI interface, driven by ILI9341 display controller

Storage

- microSD card slot (SPI interface)
- 16 MB SPI NOR Flash memory (W25Q128JVSIQ)
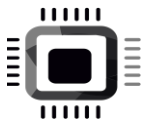
User Interface

- 1 Boot button

CAN Module

- CAN transceiver onboard for Controller Area Network communication
- Enables reliable communication in industrial or automotive applications

USB to UART Converter 5

- Onboard USB to UART bridge for serial communication and debugging

- Provides easy connection to a PC for monitoring or flashing data

Hardware and layout

The STM32F407 Shield integrates key components such as the ESP32-C6 wireless module, MPU6050, HDC1080, OLED display, microSD card slot, and SPI Flash in a compact layout designed for STM32F407 boards. User interaction is supported through push buttons and LEDs, while USB, SPI, I2C, and UART interfaces provide flexible connectivity options. The figures below show the top and bottom views of the shield with all major components clearly labeled.
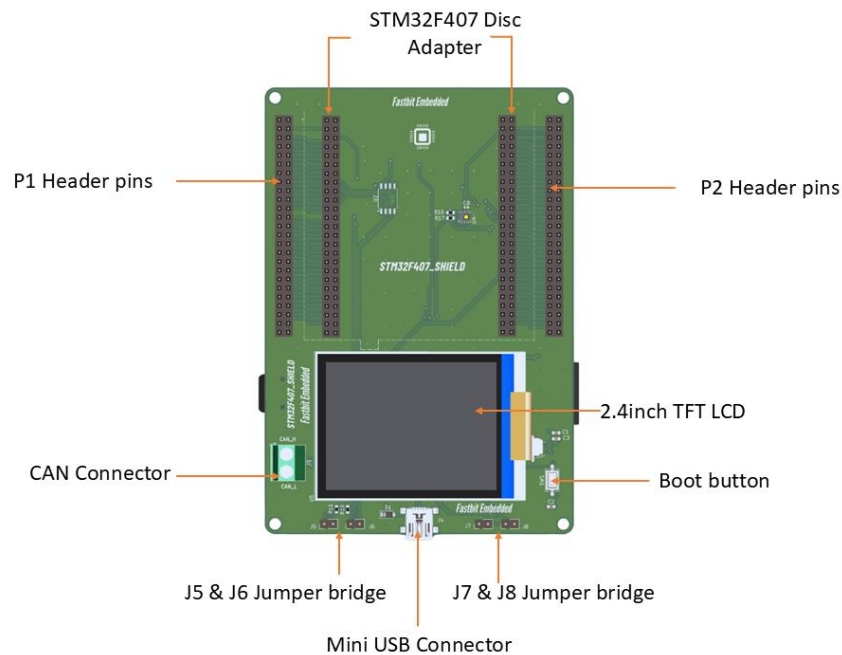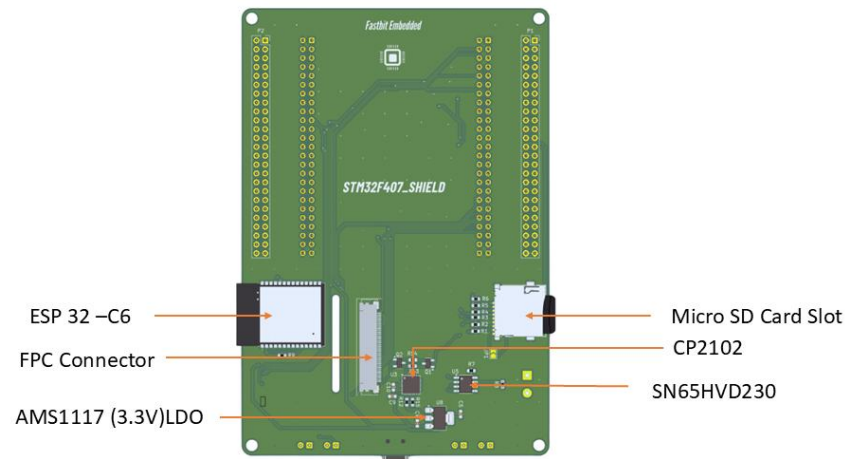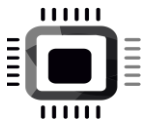

Figure 2: STM32F407 Shield - Top layout

Figure 3: STM32F407_Shield – Bottom layout

Power supply and power selection

- The STM32F407 Shield is typically powered through the 3.3V rail from the STM32F407 development board via header connections.
- Alternatively, the shield can be powered using the mini-USB connector available on the board.
- In this case, 5V from the mini-USB is routed to the VIN pin, which can also be used to power the STM32F407 board if supported.
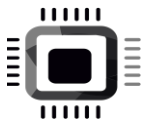
Mini USB connector

- The shield features a mini USB connector (J2) used primarily for ESP32-C6 firmware upgrades.
- It can also serve as a power input, supplying 5V to both the shield and the connected host board via the VIN pin.
- Supports auto boot mode for flashing, eliminating the need for manual BOOT/RESET button sequences in most cases.

CP2102 – USB to UART Bridge

- Enables USB to Serial communication between the PC and microcontrollers like STM32F407 or ESP32-C6
- Plug-and-play, supported on Windows, Linux, and macOS without extra drivers
- Supports baud rates up to 1 Mbps for fast and reliable data transfer
- Integrated on the shield to connect the UART (PA2/PA3) or ESP32-C6 to the PC
- Works at 3.3V logic and accepts 5V USB input
- Allows easy firmware flashing and debugging without any external programmer

STM32F407_SHIELD

Jumper Configuration Modes

Figure 4: Firmware Update Mode (J5 & J6 Open, J7 & J8 Closed)

Figure 5: UART TTY Mode (J5 & J6 Closed, J7 & J8 Open)

Mode	J5 & J6	J7 & J8	USB Status
UART Communication Mode	Open	Close	UART connector for PA2 (TX) and PA3 (RX) pins.
Firmware Update Mode	Close	Open	Firmware upgrade for ESP32-C6

Temperature and humidity sensor

- The HDC1080DMBR is a high-accuracy, low-power digital humidity and temperature sensor with a compact footprint.

- It provides 14-bit temperature and humidity measurements with factory calibration.

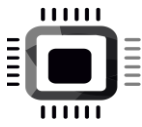- The Host communicates with the HDC1080 sensor via the I2C interface.

MicroSD card slot

- The shield includes a microSD card slot (J1) connected via the SPI interface.

- It allows for data logging, such as saving sensor values, configuration files, or system logs.

- Ensure the card is inserted properly before powering the board to avoid read/write errors.

Push buttons

- SW1 BOOT: Push button connected to the BOOT pin of the ESP32-C6, used to enter firmware download (bootloader) mode.

NOR flash memory

- The shield includes onboard SPI NOR Flash memory (W25Q128JVSIQ) with 16 MB

- (128 Mbit) capacity for non-volatile data storage.

- Useful for storing firmware, configuration files, sensor logs, or lookup tables.

- Communicates over the SPI interface with support for high read/write speeds.

- Offers reliable long-term data retention and supports use cases where data must persist across power cycles or reboots.

AT firmware upgrade modes

1. Auto Boot Mode

- Simply connect a USB cable to the mini-USB connector (J2) on the IoT Shield.

- The onboard circuitry will automatically set the ESP32-C6 into bootloader mode.

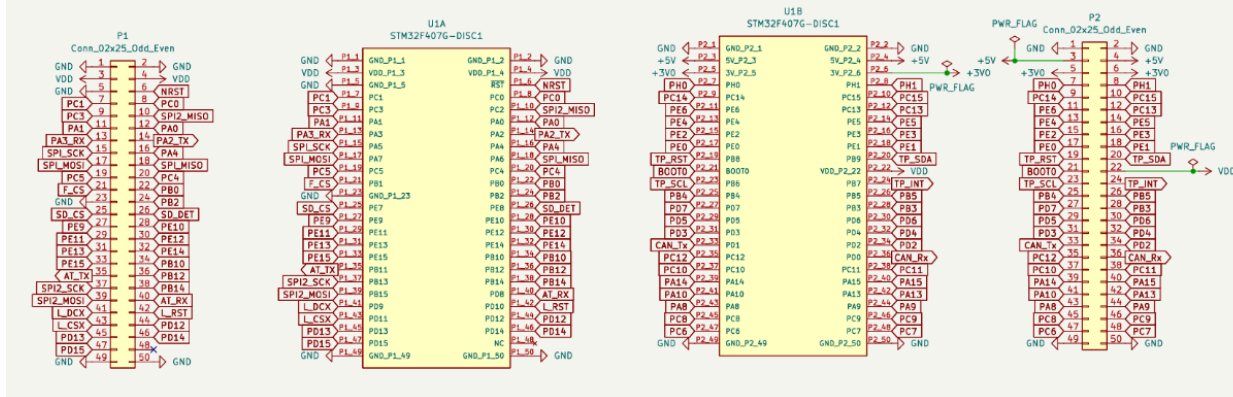- No manual button press is required.
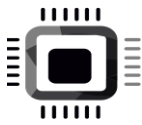
2. Manual Boot Mode (Using BOOT and RESET Buttons)

- Press and hold the BOOT button, then

- Press and release the RESET button Disc board.

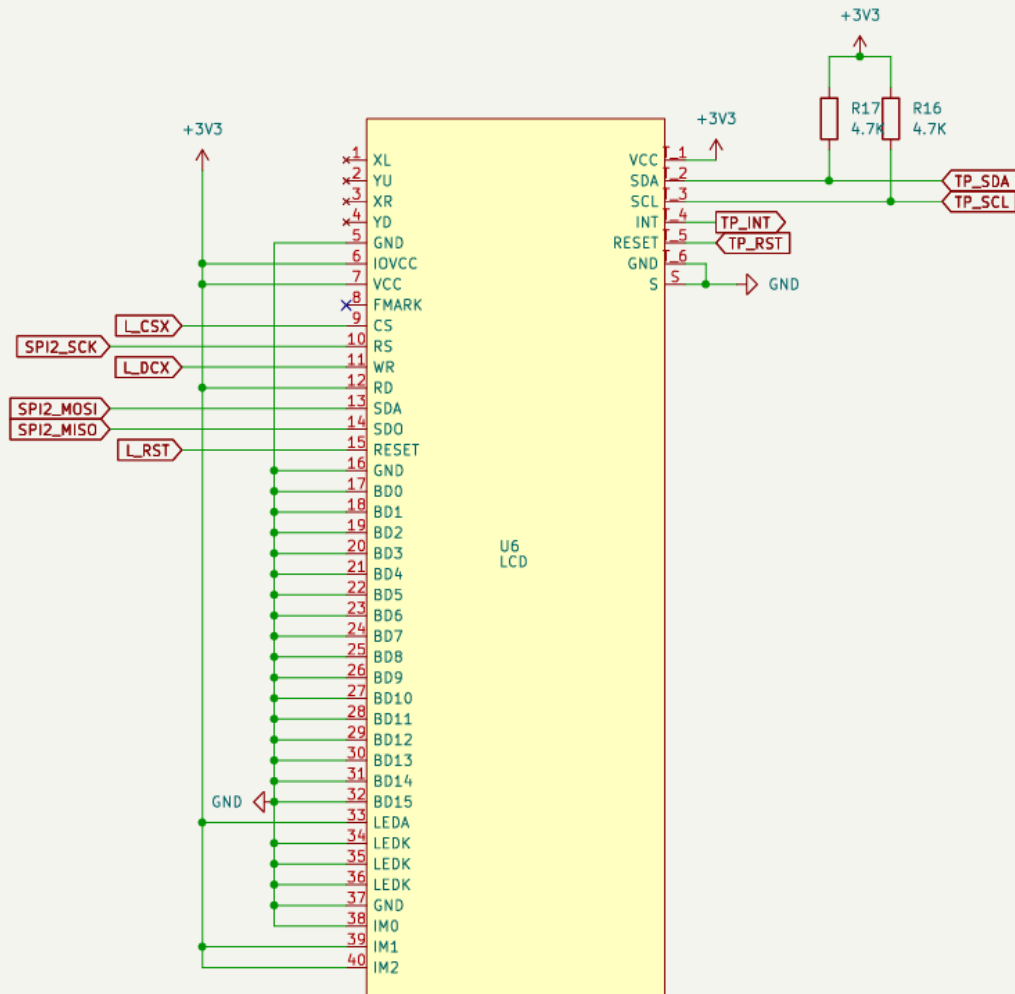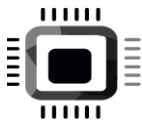- This sequence puts the ESP32-C6 into firmware download (bootloader) mode manually.
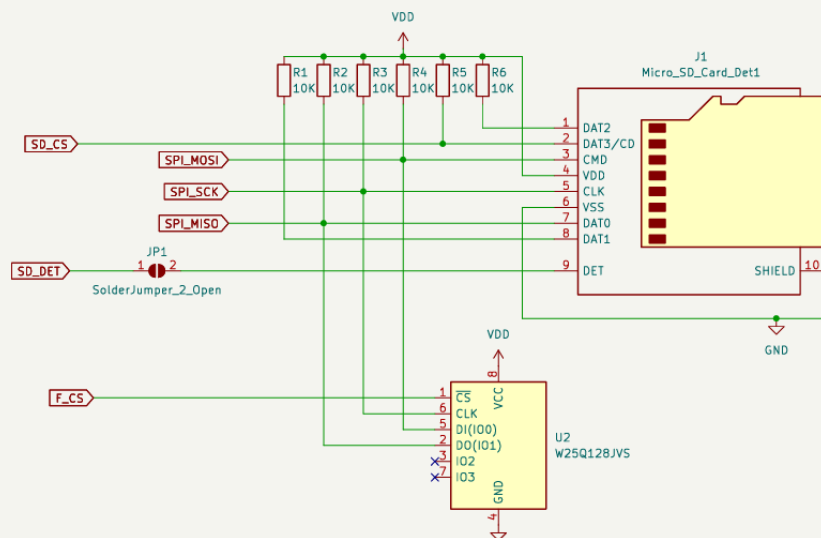
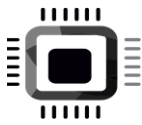## Schematic Overview

OLED DISPLAY

HEADER PINS

CP2102 USB to UART Converter

2.4" TFT DISPLAY

SD CARD SLOT AND NOR FLASH

ESP32 C6

IC1
ESP32-C6-WROOM-1U-N4
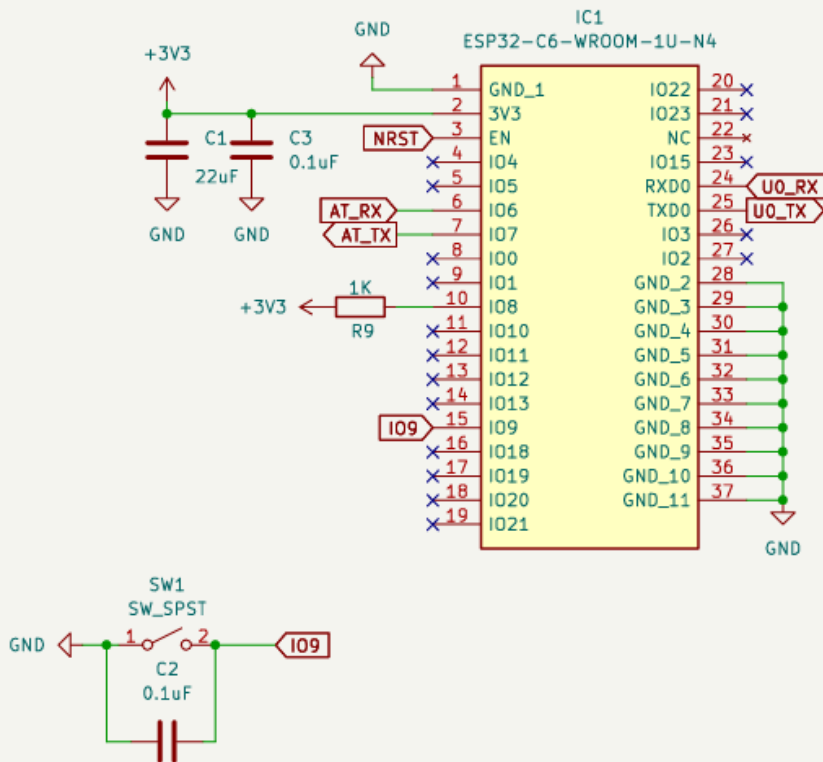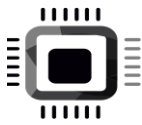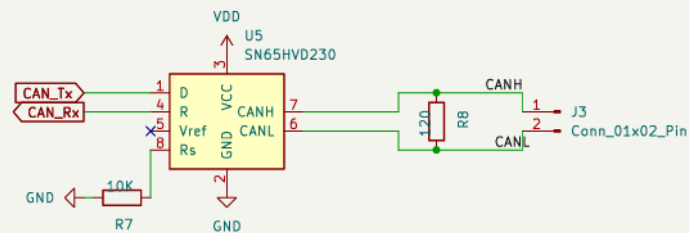
CAN MODULE

TEMPERATURE AND HUMIDITY SENSOR