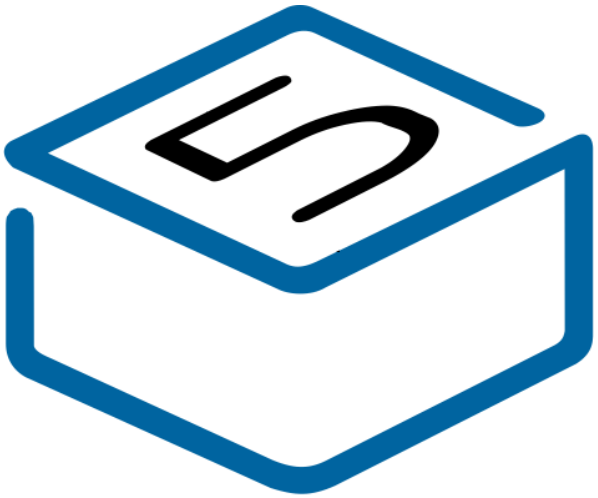
M5STACK-POECAM



M5STACK

2022

V0.01

TABLE OF CONTENTS

1.OUTLINE

M5Station is a general-purpose IoT workstation in the M5Stack development kit series. It integrates rich interfaces and peripherals and is highly expandable. Large space reserved inside, flexible customization, and more likely to be applicable to various industrial acquisition and control application scenarios.

2. SPECIFICATIONS

Specifications	Parameters
ESP32-D0WDQ6-V3	240MHz dual core, 600 DMIPS, 520KB SRAM, Wi-Fi, dual mode Bluetooth
Flash	16MB
PSRAM	8MB
Image Sensor	OV2640
Maximum Resolution	2MegaPixel
OV2640 supports the maximum image transmission rate	YUV(422/420)/YCbCr422, 8-bit compressed data, RGB565/555, 8-/10-bit Raw RGB data
DFOV	65°
PoE specification	PoE IEEE802.3 AF specification / maximum power 6W
Ethernet Controller	W5500, built-in 32Kbytes buffer area, SPI interface
Support protocols	TCP, UDP, IPv4, ICMP, ARP, IGMP and PPPoE protocols
Ethernet interface specifications	RJ45
Basic Peripherals	1x programmable buttons, 2x work indicator lights
Net weight	38g
Gross weight	45g
Product size	64 * 24 * 18mm
Packing size	80 * 37 * 32mm

3. FUNCTIONAL DESCRIPTION

This chapter describes the ESP32-D0WDQ6-V3 various modules and functions.

1.1. CPU AND MEMORY

Xtensa®single-/dual-core32-bitLX6microprocessor(s), upto600MIPS (200MIPSforESP32-S0WD/ESP32-U4WDH, 400 MIPS for ESP32-D2WD):

- 448 KB ROM
- 520 KB SRAM
- 16 KB SRAM in RTC
- QSPI supports multiple flash/SRAM chips

1.2. STORAGE DESCRIPTION

1.2.1. External Flash and SRAM

ESP32 support multiple external QSPI flash and static random access memory (SRAM), having a hardware-based AES encryption to protect the user programs and data.

- ESP32 access external QSPI Flash and SRAM by caching. Up to 16 MB external Flash code space is mapped into the CPU, supports 8-bit, 16-bit and 32-bit access, and can execute code.
- Up to 8 MB external Flash and SRAM mapped to the CPU data space, support for 8-bit, 16-bit and 32-bit access. Flash supports only read operations, SRAM supports read and write operations.

1.3. CRYSTAL

External 2 MHz~60 MHz crystal oscillator (40 MHz only for Wi-Fi/BT functionality)

1.4. RTC MANAGEMENT AND LOW POWER CONSUMPTION

ESP32 uses advanced power management techniques may be switched between different power saving modes. (See Table 5).

- *Power saving mode*

  - Active Mode: RF chip is operating. Chip may receive and transmit a sounding signal.

  - Modem-sleep mode: CPU can run, the clock may be configured. Wi-Fi / Bluetooth baseband and RF

  - Light-sleep mode: CPU suspended. RTC and memory and peripherals ULP coprocessor operation. Any wake-up event (MAC, host, RTC timer or external interrupt) will wake up the chip.

  - Deep-sleep mode: only the RTC memory and peripherals in a working state. Wi-Fi and Bluetooth connectivity data stored in the RTC. ULP coprocessor can work.

  - Hibernation Mode: 8 MHz oscillator and a built-in coprocessor ULP are disabled. RTC memory to restore the power supply is cut off. Only one RTC clock timer located on the slow clock and some RTC GPIO at work. RTC RTC clock or timer can wake up from the GPIO Hibernation mode.

- *Deep-sleep mode*

  - related sleep mode: power save mode switching between Active, Modem-sleep, Light-sleep mode. CPU, Wi-Fi, Bluetooth, and radio preset time interval to be awakened, to ensure connection Wi-Fi / Bluetooth.

  - Ultra Low-power sensor monitoring methods: the main system is Deep-sleep mode, ULP coprocessor is periodically opened or closed to measure sensor data. The sensor measures data, ULP coprocessor decide whether to wake up the main system.

Functions in different power consumption modes: TABLE 5

Power consumption mode	Active	Modem-sleep	Light-sleep	Deep-sleep	Hibernation
Sleep mode	Associated sleep mode			Ultra low-power Sensor measures data	-
CPU	open	open	pause	close	close
Wi-Fi/Bluetooth Radio	open	open	close	close	close
RTC memory	open	open	open	open	close
ULP coprocessor	open	open	open	open/close	close

4. ELECTRICAL CHARACTERISTICS

4.1. LIMIT PARAMETERS

Table 8: Limiting values

Symbol	Parameter	Min	Max	Unit
VDD33	Power supply voltage	–0.3	3.6	V
I_{output} [1]	Cumulative IO output current	-	1,100	mA
T_{store}	Storage temperature	–40	150	°C

1. VIO to the power supply pad, Refer ESP32 Technical Specification Appendix IO_MUX, as SD_CLK of Power supply for VDD_SDIO.

4.2. WIFI RADIO FREQUENCY

Table 9: Wi-Fi RF characteristics

Description	Min	Typical	Max	Unit
Input frequency	2412	-	2484	MHz
Output impedance	-	50	-	Ω
Tx power				
Output power of PA for 72.2 Mbps	13	14	15	dBm
Output power of PA for 11b mode	19.5	20	20.5	dBm
Sensitivity				
DSSS, 1 Mbps	-	–98	-	dBm
CCK, 11 Mbps	-	–91	-	dBm
OFDM, 6 Mbps	-	–93	-	dBm
OFDM, 54 Mbps	-	–75	-	dBm
HT20, MCS0	-	–93	-	dBm
HT20, MCS7	-	–73	-	dBm
HT40, MCS0	-	–90	-	dBm
HT40, MCS7	-	–70	-	dBm
MCS32	-	–89	-	dBm
Adjacent channel rejection				
OFDM, 6 Mbps	-	37	-	dB
OFDM, 54 Mbps	-	21	-	dB
HT20, MCS0	-	37	-	dB
HT20, MCS7	-	20	-	dB

4.3. LOW-POWER BLUETOOTH RADIO

4.3.1. receiver

Table 10: Low-power Bluetooth receiver characteristics

Parameter	Conditions	Min	Typ	Max	Unit
Sensitivity @30.8% PER	-	-	–97	-	dBm
Maximum received signal @30.8% PER	-	0	-	-	dBm
Co-channel C/I	-	-	+10	-	dB
Adjacent channel selectivity C/I	F = F0 + 1 MHz	-	–5	-	dB
	F = F0 – 1 MHz	-	–5	-	dB
	F = F0 + 2 MHz	-	–25	-	dB
	F = F0 – 2 MHz	-	–35	-	dB
	F = F0 + 3 MHz	-	–25	-	dB
	F = F0 – 3 MHz	-	–45	-	dB
Out-of-band blocking performance	30 MHz ~ 2000 MHz	–10	-	-	dBm
	2000 MHz ~ 2400 MHz	–27	-	-	dBm
	2500 MHz ~ 3000 MHz	–27	-	-	dBm
	3000 MHz ~ 12.5 GHz	–10	-	-	dBm
Intermodulation	-	–36	-	-	dBm

4.3.2. launcher

Table 11: Characteristics of Low Power Bluetooth transmitter

Parameter	Conditions	Min	Typ	Max	Unit
RF transmit power	-	-	0	-	dBm
Gain control step	-	-	3	-	dBm
RF power control range	-	–12	-	+9	dBm
Adjacent channel transmit power	F = F0 ± 2 MHz	-	–52	-	dBm
	F = F0 ± 3 MHz	-	–58	-	dBm
	F = F0 ± > 3 MHz	-	–60	-	dBm
$\Delta f1_{avg}$	-	-	-	265	kHz
$\Delta f2_{max}$	-	247	-	-	kHz
$\Delta f2_{avg}/\Delta f1_{avg}$	-	-	–0.92	-	-
ICFT	-	-	–10	-	kHz
Drift rate	-	-	0.7	-	kHz/50 μs
Drift	-	-	2	-	kHz

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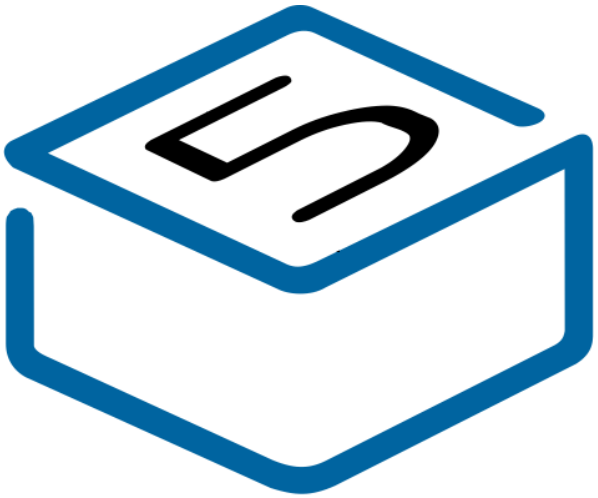

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2022

V0.01

TABLE OF CONTENTS

1.QUICK START

1.1.ARDUINO IDE

Visit Arduino's official website(https://www.arduino.cc/en/Main/Software),Select the installation package for your own operating system to download.

>1.Open up Arduino IDE, navigate to `File`->`Peferences`->`Settings`

>2.Copy the following M5Stack Boards Manager url to `Additional Boards Manager URLs:`

https://raw.githubusercontent.com/espressif/arduino-esp32/gh-pages/package_esp32_dev_index.json

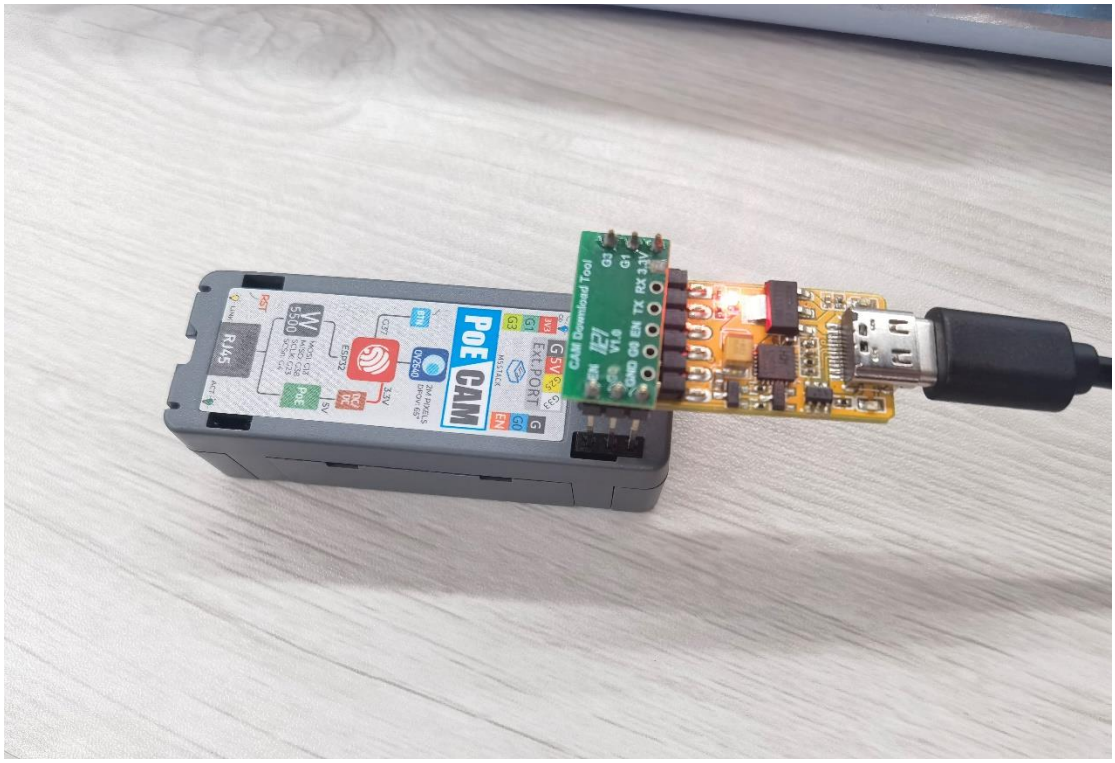
>3.Navigate to `Tools`->`Board:`->`Boards Manager...`

>4.Search `ESP32` in the pop-up window, find it and click `Install`

>5.select `Tools`->`Board:`->`ESP32-Arduino-ESP32 DEV Module

>6Please install CH9102 driver before use esp32 downloader kit burn the firmware:

https://shop.m5stack.com/products/esp32-downloader-kit



1.2.BLUETOOTH SERIAL

Open the Arduino IDE and open the example program `File`->`Examples`->`BluetoothSerial`->`SerialToSerialBT`. Connect the device to the computer and select the corresponding port to burn. After completion, the device will automatically run Bluetooth, and the device name is `ESP32test`. At this time, use the Bluetooth serial port sending tool on the PC to realize the transparent transmission of Bluetooth serial data.


```
#include "BluetoothSerial.h"

#if !defined(CONFIG_BT_ENABLED) || !defined(CONFIG_BLUEDROID_ENABLED)
#error Bluetooth is not enabled! Please run `make menuconfig` to and en
able it
#endif
```

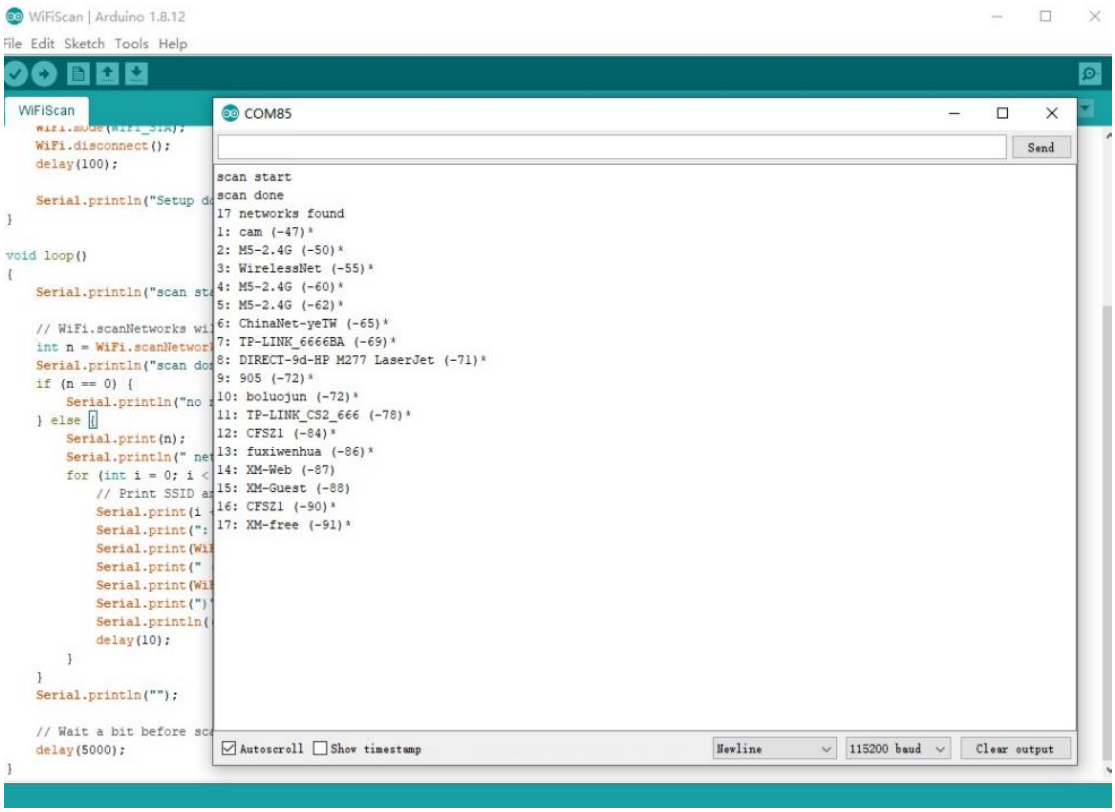
```
BluetoothSerial SerialBT;

void setup() {
  Serial.begin(115200);
  SerialBT.begin("ESP32test"); //Bluetooth device name
  Serial.println("The device started, now you can pair it with bluetoot
h!");
}

void loop() {
  if (Serial.available()) {
    SerialBT.write(Serial.read());
  }
  if (SerialBT.available()) {
    Serial.write(SerialBT.read());
  }
  delay(20);
}
```

1.3.WIFI SCANNING

Open the Arduino IDE and open the example program `File`->`Examples`->`WiFi`->`WiFiScan`. Connect the device to the computer and select the corresponding port to burn. After completion, the device will automatically run the WiFi scan, and the current WiFi scan result can be obtained through the serial port monitor that comes with the Arduino.



```
#include "WiFi.h"

void setup()
{
    Serial.begin(115200);
    // Set WiFi to station mode and disconnect from an AP if it was pre
viously connected
    WiFi.mode(WIFI_STA);
    WiFi.disconnect();
    delay(100);

    Serial.println("Setup done");
}

void loop()
{
    Serial.println("scan start");

    // WiFi.scanNetworks will return the number of networks found
    int n = WiFi.scanNetworks();
    Serial.println("scan done");
    if (n == 0) {
        Serial.println("no networks found");
    } else {
        Serial.print(n);
        Serial.println(" networks found");
        for (int i = 0; i < n; ++i) {
            // Print SSID and RSSI for each network found
            Serial.print(i + 1);
            Serial.print(": ");
            Serial.print(WiFi.SSID(i));
            Serial.print(" (");
            Serial.print(WiFi.RSSI(i));
            Serial.print(")");
            Serial.println((WiFi.encryptionType(i) == WIFI_AUTH_OPEN)?"
 ":"*");
            delay(10);
        }
    }
    Serial.println("");

    // Wait a bit before scanning again
    delay(5000);
}
```


FCC Statement

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

-Reorient or relocate the receiving antenna.
-Increase the separation between the equipment and receiver.
-Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
-Consult the dealer or an experienced radio/TV technician for help.

Any Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment.
This equipment should be installed and operated with minimum distance 20cm etween the radiator & your body.