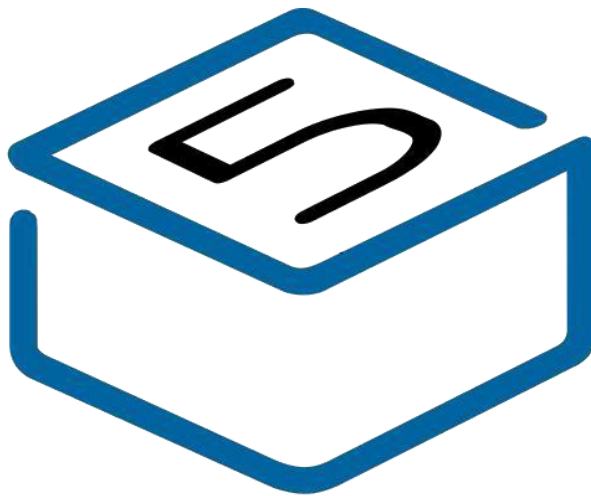


M5StickC-Plus SE



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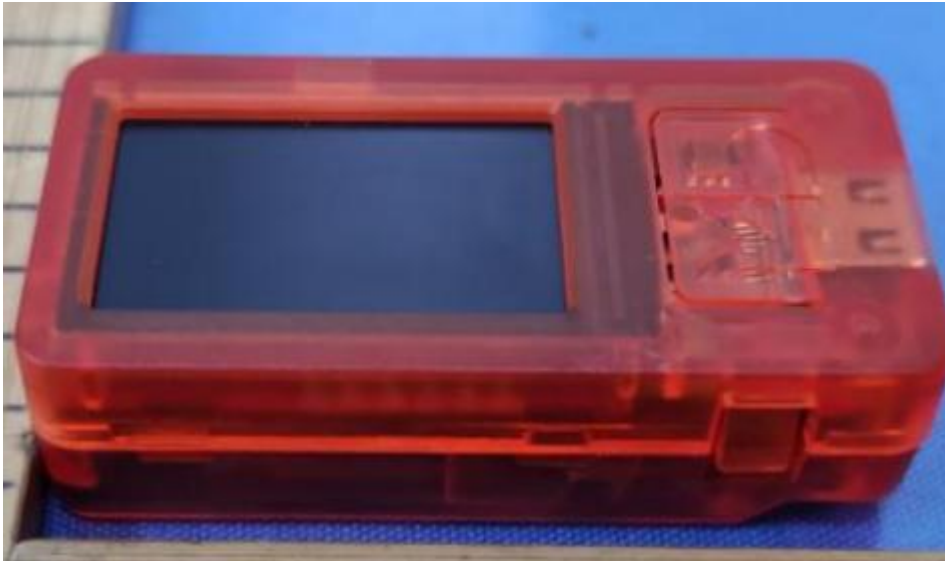
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1.OUTLINE

M5Stick-Plus SE is ESP32 board which based on ESP32-PICO-D4 module, with one LED and one button , The board is made of PC+ABC.



1.1 Hardware Composition

The hardware of M5Stick-Plus SE: ESP32-PICO-D4 module, TFT screen, IR transmitter, Red LED, Button, GROVE interface, TypeC-to-USB interface, Power Management chip and battery.



ESP32- PICO-D4 is a System-in-Package (SiP) module that is based on ESP32, providing complete Wi-Fi and Bluetooth functionalities. The module integrates a 4-MB SPI flash. ESP32-PICO-D4 integrates all peripheral components seamlessly, including a crystal oscillator, flash, filter capacitors and RF matching links in one single package.

TFT Screen is a 1.14-inch color screen driven with a resolution of 135 x 240. Operating voltage range is 2.5~3.3V

Power Management chip is X-Powers's AXP192. The operating voltage range is 2.9V~6.3V and the charging current is 1.4A.

M5Stick-Plus SE equips ESP32 with everything needed for programming, everything needed for operation and development



2. PIN DESCRIPTION

2.1. USB INTERFACE

M5CAMREA Configuration Type-C type USB interface, support USB2.0 standard communication protocol.



2.2. GROVE INTERFACE

4p disposed pitch of 2.0mm M5CAMREA GROVE interfaces, internal wiring and GND, 5V, GPIO32, GPIO33 connected.



3. FUNCTIONAL DESCRIPTION

This chapter describes the ESP32-PICO-D4 various modules and functions.

3.1. CPU AND MEMORY

ESP32-PICO-D4 contains two low-power Xtensa[®] 32-bit LX6 MCU. On-chip memory comprising:

- 448-KB of ROM, and the program starts for the kernel function calls
- For a 520 KB instruction and data storage chip SRAM (including flash memory 8 KB RTC)
- RTC flash memory of 8 KB SRAM, when the RTC can be started in Deep-sleep mode, and for storing data accessed by the main CPU
- RTC slow memory, of 8 KB SRAM, can be accessed by the coprocessor in Deep-sleep mode
- Of 1 kbit of eFuse, which is a 256 bit system-specific (MAC address and a chip set); the remaining 768 bit reserved for user program, these Flash program include encryption and chip ID

3.2. STORAGE DESCRIPTION

3.2.1. 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.

ESP32-PICO-D4 4 MB of integrated SPI Flash, the code can be mapped into CPU space, support for 8-bit, 16-bit and 32-bit access, and can execute code. Pin GPIO6 ESP32 of, GPIO7, GPIO8, GPIO9, GPIO10 and GPIO11 for connecting module integrated SPI Flash, not recommended for other functions.



3.3. CRYSTAL

- ESP32-PICO-D4 integrates a 40 MHz crystal oscillator.

3.4. 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		2462	MHz
Output impedance		50		Ω
Tx Power				
Output power of PA for 11b mode	/	/	21	
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	$F = F_0 + 1 \text{ MHz}$	-	-5	-	dB
	$F = F_0 - 1 \text{ MHz}$	-	-5	-	dB
	$F = F_0 + 2 \text{ MHz}$	-	-25	-	dB
	$F = F_0 - 2 \text{ MHz}$	-	-35	-	dB
	$F = F_0 + 3 \text{ MHz}$	-	-25	-	dB
	$F = F_0 - 3 \text{ MHz}$	-	-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	-	+5	dBm
Adjacent channel transmit power	$F = F_0 \pm 2 \text{ MHz}$	-	-52	-	dBm
	$F = F_0 \pm 3 \text{ MHz}$	-	-58	-	dBm
	$F = F_0 \pm > 3 \text{ MHz}$	-	-60	-	dBm
$\Delta f_{1\text{avg}}$	-	-	-	265	kHz
$\Delta f_{2\text{max}}$	-	247	-	-	kHz
$\Delta f_{2\text{avg}}/\Delta f_{1\text{avg}}$	-	-	-0.92	-	-
ICFT	-	-	-10	-	kHz
Drift rate	-	-	0.7	-	kHz/50 μs
Drift	-	-	2	-	kHz

5. FCC Warning

FCC Caution:

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

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.

IMPORTANT NOTE:

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:

- 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.

FCC Radiation Exposure Statement: 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 between the radiator& your body.

