User manual

Product Name:ESP Module
Model Name:0037

Manufacture:Syrp Limited

Contents

1, Overview

ESP32-0037-7002 is a wireless product, which mainly includes an ESP32-PICO-D4, a 32768Hz crystal and a 2.4GHz antenna. See the block diagram as Figure 1. 0037-7002 provides the WIFI and Blue Tooth (BLE) functions.
The ESP32-PICO-D4 is a System-in-Package (SIP) module that is based on ESP32, providing complete Wi-Fiand Bluetooth functionalities. The module integrates a 4-MB SPI flash.
At the core of this module is the ESP32 chip, which is a single 2.4 GHz Wi-Fi and Bluetooth combo chip. ESP32-PICO-D4 integrates all peripheral components seamlessly, including a crystal oscillator, flash, filter capacitors and RF matching links in one single package.

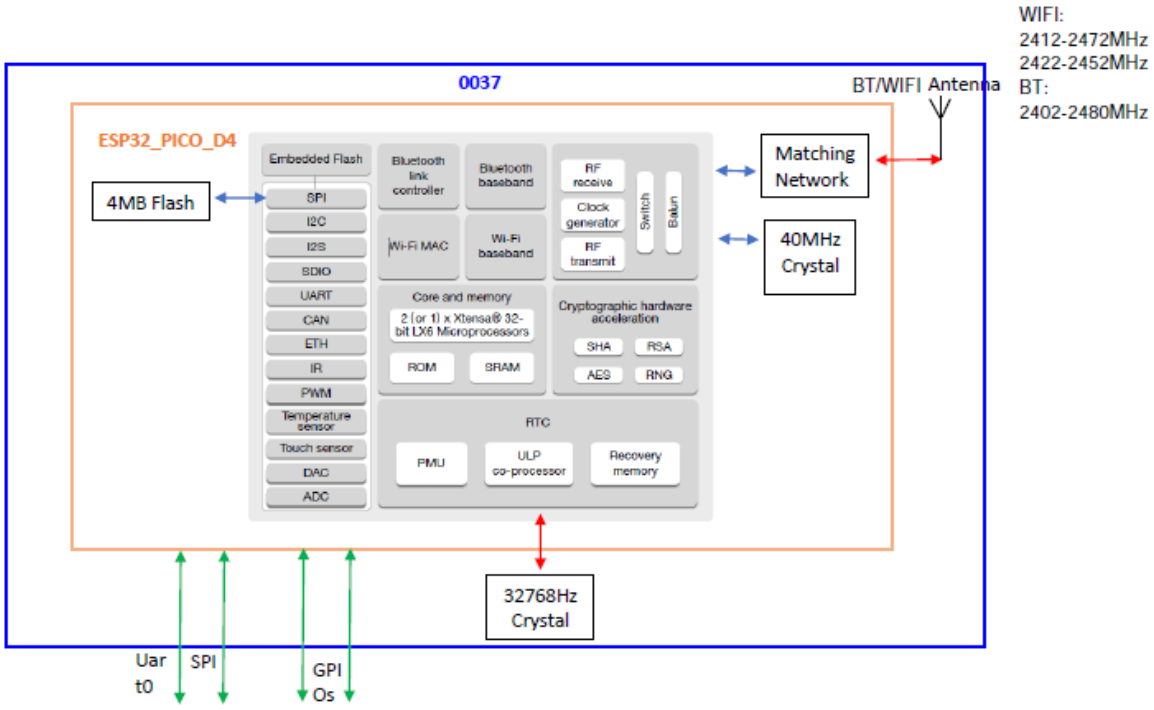


Figure 1 Block diagram of ESP32-0037-7002

2 Pin Definitions

2.1 Pin Layout

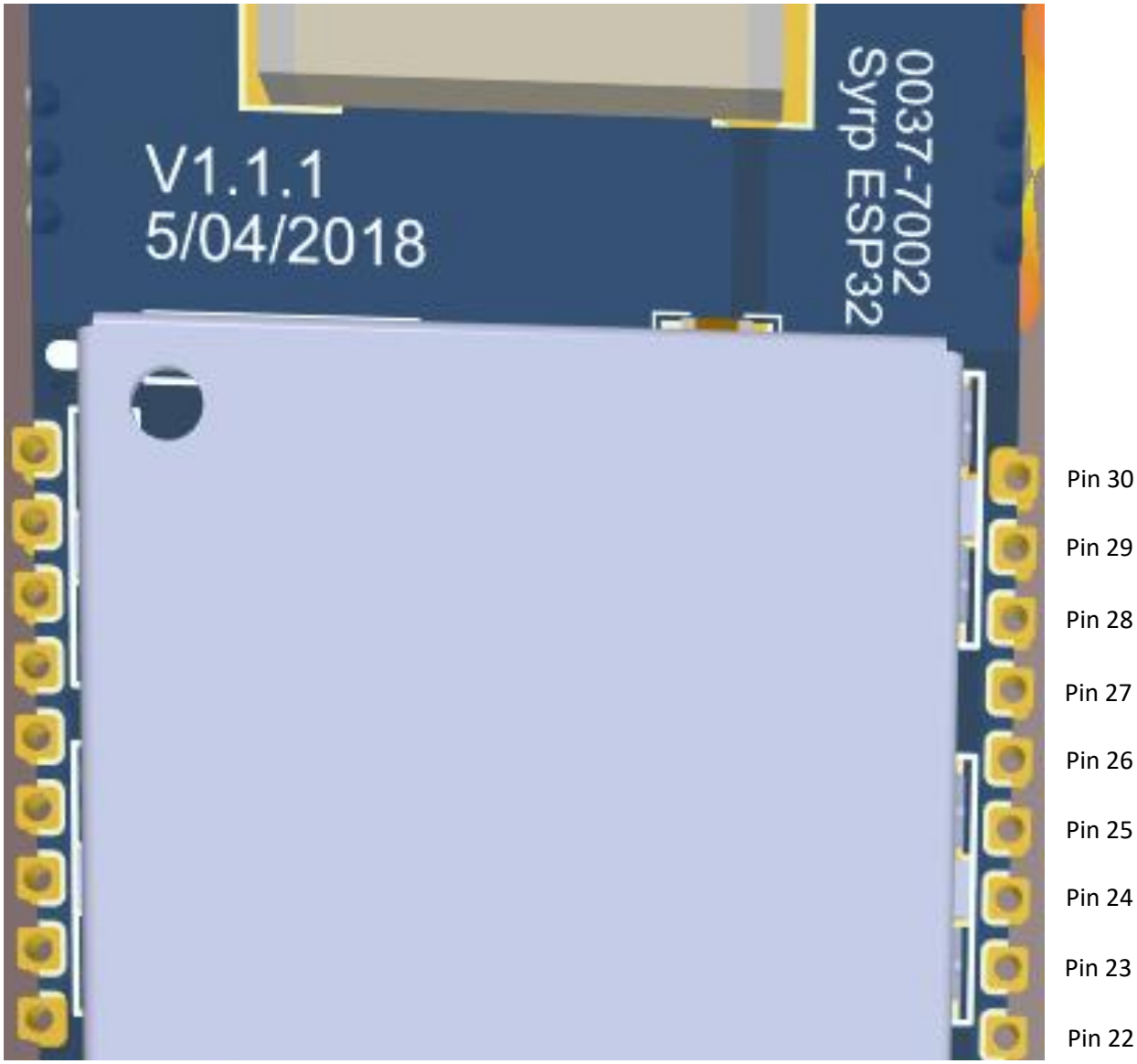


Figure 2 Pin Layout of ESP32-0037-7002

Pin	Pin	Pin	Pin	Pin	Pin	Pin	Pin	Pin	Pin	Pin	Pin

2.2 Pin Description

Table 2: Pin Description

No.	Name	Type	Function
1	EN	I	Chip-enable signal. Active high.
2	IO34	I	GPIO34, ADC1_CH6, RTC_GPIO4
3	IO35	I	GPIO35, ADC1_CH7, RTC_GPIO5
4	IO25	I/O	GPIO25, DAC_1, ADC2_CH8, RTC_GPIO6, EMAC_RXD0
5	IO26	I/O	GPIO26, DAC_2, ADC2_CH9, RTC_GPIO7, EMAC_RXD1
6	IO27	I/O	GPIO27, ADC2_CH7, TOUCH7, RTC_GPIO17, EMAC_RX_DV
7	IO14	I/O	GPIO14, ADC2_CH6, TOUCH6, RTC_GPIO16, MTMS, HSPICLK,HS2_CLK, SD_CLK, EMAC_TXD2
8	IO12	I/O	GPIO12, ADC2_CH5, TOUCH5, RTC_GPIO15, MTDI, HSPIQ, HS2_DATA2, SD_DATA2, EMAC_TXD3
9	GND	P	Ground
10	VDD	P	Power supply (2.3V ~ 3.6V)
11	IO13	I/O	GPIO13, ADC2_CH4, TOUCH4, RTC_GPIO14, MTCK, HSPID, HS2_DATA3, SD_DATA3, EMAC_RX_ER
12	IO15	I/O	GPIO15, ADC2_CH3, TOUCH3, MTDO, HSPICS0, RTC_GPIO13,HS2_CMD, SD_CMD, EMAC_RXD3
13	IO2	I/O	GPIO2, ADC2_CH2, TOUCH2, RTC_GPIO12, HSPIWP, HS2_DATA0, SD_DATA0
14	IO0	I/O	GPIO0, ADC2_CH1, TOUCH1, RTC_GPIO11, CLK_OUT1, EMAC_TX_CLK
15	IO4	I/O	GPIO4, ADC2_CH0, TOUCH0, RTC_GPIO10, HSPIHD, HS2_DATA1, SD_DATA1, EMAC_TX_ER
16	IO21	I/O	GPIO21, VSPIHD, EMAC_TX_EN
17	IO22	I/O	GPIO22, VSPIWP, U0RTS, EMAC_TXD1
18	IO5	I/O	GPIO5, VSPICS0, HS1_DATA6, EMAC_RX_CLK
19	IO18	I/O	GPIO18, VSPICLK, HS1_DATA7
20	IO23	I/O	GPIO23, VSPID, HS1_STROBE
21	GND	P	Ground
22	VDD	P	Power supply (2.3V ~ 3.6V)
23	VDD	P	Power supply (2.3V ~ 3.6V)
24	IO19	I/O	GPIO19, VSPIQ, U0CTS, EMAC_TXD0
25	NC	-	Not Connected
26	U0RXD	I/O	GPIO3, U0RXD, CLK_OUT2
27	U0TXD	I/O	GPIO1, U0TXD, CLK_OUT3, EMAC_RXD2
28	NC	-	Not connected
29	VDD	P	Power supply (2.3V ~ 3.6V)
30	GND	P	Ground

2.3 Strapping Pins

ESP32 has five strapping pins, which can be seen in Section 5 Schematics:

- MTDI
- GPIO0
- GPIO2
- MTDO
- GPIO5

Software can read the value of these five bits from the register ”GPIO_STRAPPING”.

During the chip power-on reset, the latches of the strapping pins sample the voltage level as strapping bits of ”0” or ”1”, and hold these bits until the chip is powered down or shut down. The strapping bits configure the device boot mode, the operating voltage of VDD_SDIO and other system initial settings.

Each strapping pin is connected with its internal pull-up/pull-down during the chip reset. Consequently, if a strapping pin is unconnected or the connected external circuit is high-impendence, the internal weak pull-up/pull-down will determine the default input level of the strapping pins.
To change the strapping bit values, users can apply the external pull-down/pull-up resistances, or apply the host
MCU's GPIOs to control the voltage level of these pins when powering on ESP32.
After reset, the strapping pins work as the normal functions pins.
Refer to Table 3 for detailed boot modes' configuration by strapping pins.

Table 3: Strapping Pins

Voltage of Internal LDO (VDD_SDIO)			
Pin	Default	3.3V	1.8V
MTDI	Pull-down	0	1
Booting Mode			
Pin	Default	SPI Boot	Download Boot
GPIO0	Pull-up	1	0
GPIO2	Pull-down	Don't-care	0
Debugging Log on U0TXD During Booting			
Pin	Default	U0TXD Toggling	U0TXD Silent
MTDO	Pull-up	1	0

Timing of SDIO Slave					
Pin	Default	Falling-edge Input Falling-edge Output	Falling-edge Input Rising-edge Output	Rising-edge Input Falling-edge Output	Rising-edge Input Rising-edge Output
MTDO	Pull-up	0	0	1	1
GPIO5	Pull-up	0	1	0	1

Note:
Firmware can configure register bits to change the settings of "Voltage of Internal LDO (VDD_SDIO)" and "Timing of SDIO Slave", after booting.

3 functionalDescription

This chapter describes the modules integrated in ESP32-0037-7002, and their functions.

3.1 CPU and Internal Memory

ESP32 contains two low-power Xtensa® 32-bit LX6 microprocessors. The internal memory includes:
• 448 KB of ROM for booting and core functions.
• 520 KB (8 KB RTC FAST Memory included) of on-chip SRAM for data and instruction.
– 8 KB of SRAM in RTC, which is called RTC FAST Memory and can be used for data storage; it is accessed by the main CPU during RTC Boot from the Deep-sleep mode.
• 8 KB of SRAM in RTC, which is called RTC SLOW Memory and can be accessed by the co-processor during the Deep-sleep mode.
• 1 kbit of eFuse, of which 256 bits are used for the system (MAC address and chip configuration) and the remaining 768 bits are reserved for customer applications, including Flash-Encryption and Chip-ID.

3.2 External Flash and SRAM

The ESP32-PICO-D4 module integrates 4 MB of external SPI flash. The 4-MB SPI flash can be memory-mapped onto the CPU code space, supporting 8, 16 and 32-bit access. Code execution is supported.

Note:
The operating voltage of ESP32-PICO-D4's integrated external SPI flash is 3.3V. Therefore, the strapping pin MTDI should hold bit "0" during the module power-on reset.

3.3 Crystal Oscillators

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

3.4 RTC and Low-Power Management

With the use of advanced power-management technologies, ESP32 can switch between different power modes (see Table 5).

• Power modes
– Active mode: The chip radio is powered on. The chip can receive, transmit, or listen.
– Modem-sleep mode: The CPU is operational and the clock is configurable. The Wi-Fi/Bluetooth baseband and radio are disabled.
– Light-sleep mode: The CPU is paused. The RTC memory and RTC peripherals, as well as the ULPcoprocessor are running. Any wake-up events (MAC, host, RTC timer, or external interrupts) will wake up the chip.
– Deep-sleep mode: Only RTC memory and RTC peripherals are powered on. Wi-Fi and Bluetooth connection data are stored in RTC memory. The ULP-coprocessor can work.
– Hibernation mode: The internal 8-MHz oscillator and ULP-coprocessor are disabled. The RTC recovery memory is powered down. Only one RTC timer on the slow clock and some RTC GPIOs are active. The RTC timer or the RTC GPIOs can wake up the chip from the Hibernation mode.

• Sleep Patterns
– Association sleep pattern: The power mode switches between the Active mode, Modem- and Lightsleep mode, during this sleep pattern. The CPU, Wi-Fi, Bluetooth, and radio are woken up at predetermined intervals to keep Wi-Fi/BT connections alive.
– ULP sensor-monitored pattern: The main CPU is in the Deep-sleep mode. The ULP-coprocessor takes sensor measurements and wakes up the main system, based on the data collected from sensors.

Table 5: Functionalities Depending on the Power Modes

Power mode	Active	Modem-sleep	Light-sleep	Deep-sleep	Hibernation
Sleep pattern	Association sleep pattern			ULP sensor-monitored pattern	-
CPU	ON	ON	PAUSE	OFF	OFF
Wi-Fi/BT baseband and radio	ON	OFF	OFF	OFF	OFF
RTC memory and RTC peripherals	ON	ON	ON	ON	OFF
ULP-coprocessor	ON	ON	ON	ON/OFF	OFF

The power consumption varies with different power modes/sleep patterns and work statuses of functional modules.Please see Table 6 for details.

Table 6: Power Consumption by Power Modes

Power mode	Description	Power consumption
Active (RF working)	Wi-Fi Tx packet 14 dBm ~ 19.5 dBm	Please refer to Table 10 for details.
	Wi-Fi / BT Tx packet 0 dBm	
	Wi-Fi / BT Rx and listening	
	Association sleep pattern (by Light-sleep)	1 mA ~ 4 mA @DTIM3
Modem-sleep	The CPU is powered on.	Max speed 240 MHz: 30 mA ~ 50 mA
		Normal speed 80 MHz: 20 mA ~ 25 mA
		Slow speed 2 MHz: 2 mA ~ 4 mA
Light-sleep	-	0.8 mA
Deep-sleep	The ULP-coprocessor is powered on.	150 μA
	ULP sensor-monitored pattern	100 μA @1% duty
	RTC timer + RTC memory	10 μA
Hibernation	RTC timer only	5 μA
Power off	CHIP_PU is set to low level, the chip is powered off	0.1 μA

Note:

- During Deep-sleep, when the ULP-coprocessor is powered on, peripherals such as GPIO and I2C are able to work.
- When the system works in the ULP sensor-monitored pattern, the ULP-coprocessor works with the ULP sensor periodically and ADC works with a duty cycle of 1%, so the power consumption is 100 μA.

4. Peripherals and Sensors

4.1 Peripherals and Sensors Description

Table 7: Peripherals and Sensors Description

Interface	Signal	Pin	Function
ADC	ADC1_CH0	SENSOR_VP	Two 12-bit SAR ADCs
	ADC1_CH3	SENSOR_VN	
	ADC1_CH4	IO32	
	ADC1_CH5	IO33	
	ADC1_CH6	IO34	
	ADC1_CH7	IO35	
	ADC2_CH0	IO4	
	ADC2_CH1	IO0	
	ADC2_CH2	IO2	
	ADC2_CH3	IO15	
	ADC2_CH4	IO13	
	ADC2_CH5	IO12	
	ADC2_CH6	IO14	
	ADC2_CH7	IO27	
	ADC2_CH8	IO25	
	ADC2_CH9	IO26	
Ultra Low Noise Analog Pre-Amplifier	SENSOR_VP	IO36	Provides about 60 dB gain by using larger capacitors on PCB
	SENSOR_VN	IO39	
DAC	DAC_1	IO25	Two 8-bit DACs
	DAC_2	IO26	
Touch Sensor	TOUCH0	IO4	Capacitive touch sensors
	TOUCH1	IO0	
	TOUCH2	IO2	
	TOUCH3	IO15	
	TOUCH4	IO13	
	TOUCH5	IO12	
	TOUCH6	IO14	
	TOUCH7	IO27	
	TOUCH8	IO33	
	TOUCH9	IO32	
SD/SDIO/MMC Host Controller	HS2_CLK	MTMS	Supports SD memory card V3.01 standard
	HS2_CMD	MTDO	
	HS2_DATA0	IO2	
	HS2_DATA1	IO4	
	HS2_DATA2	MTDI	
	HS2_DATA3	MTCK	

Interface	Signal	Pin	Function
Motor PWM	PWM0_OUT0~2	Any GPIOs*	Three channels of 16-bit timers generate PWM waveforms; each has a pair of output signals. Three fault detection signals. Three event capture signals. Three sync signals.
	PWM1_OUT_IN0~2		
	PWM0_FLT_IN0~2		
	PWM1_FLT_IN0~2		
	PWM0_CAP_IN0~2		
	PWM1_CAP_IN0~2		
	PWM0_SYNC_IN0~2		
	PWM1_SYNC_IN0~2		
LED PWM	ledc_hs_sig_out0~7	Any GPIOs*	16 independent channels @80 MHz clock/RTC CLK. Duty accuracy: 16 bits.
	ledc_ls_sig_out0~7		
UART	U0RXD_in	Any GPIOs*	Two UART devices with hardware flow-control and DMA
	U0CTS_in		
	U0DSR_in		
	U0TXD_out		
	U0RTS_out		
	U0DTR_out		
	U1RXD_in		
	U1CTS_in		
	U1TXD_out		
	U1RTS_out		
	U2RXD_in		
	U2CTS_in		
	U2TXD_out		
	U2RTS_out		
I2C	I2CEXT0_SCL_in	Any GPIOs*	Two I2C devices in slave or master modes
	I2CEXT0_SDA_in		
	I2CEXT1_SCL_in		
	I2CEXT1_SDA_in		
	I2CEXT0_SCL_out		
	I2CEXT0_SDA_out		
	I2CEXT1_SCL_out		
	I2CEXT1_SDA_out		

Interface	Signal	Pin	Function
I2S	I2S0I_DATA_in0~15	Any GPIOs*	Stereo input and output from/to the audio codec, and parallel LCD data output
	I2S0O_BCK_in		
	I2S0O_WS_in		
	I2S0I_BCK_in		
	I2S0I_WS_in		
	I2S0I_H_SYNC		
	I2S0I_V_SYNC		
	I2S0I_H_ENABLE		
	I2S0O_BCK_out		
	I2S0O_WS_out		
	I2S0I_BCK_out		
	I2S0I_WS_out		
	I2S0O_DATA_out0~23		
	I2S1I_DATA_in0~15		
	I2S1O_BCK_in		
	I2S1O_WS_in		
	I2S1I_BCK_in		
	I2S1I_WS_in		
	I2S1I_H_SYNC		
	I2S1I_V_SYNC		
	I2S1I_H_ENABLE		
	I2S1O_BCK_out		
	I2S1O_WS_out		
	I2S1I_BCK_out		
	I2S1I_WS_out		
	I2S1O_DATA_out0~23		
Remote Controller	RMT_SIG_IN0~7	Any GPIOs*	Eight channels of IR transmitter and receiver for various waveforms
	RMT_SIG_OUT0~7		

Interface	Signal	Pin	Function
Parallel QSPI	SPIHD	SHD/SD2	Supports Standard SPI, Dual SPI, and Quad SPI that can be connected to the external flash and SRAM
	SPIWP	SWP/SD3	
	SPICS0	SCS/CMD	
	SPICLK	SCK/CLK	
	SPIQ	SDO/SD0	
	SPID	SDI/SD1	
	HSPICLK	IO14	
	HSPICS0	IO15	
	HSPIQ	IO12	
	HSPID	IO13	
	HSPIHD	IO4	
	HSPIWP	IO2	
	VSPICLK	IO18	
	VSPICS0	IO5	
	VSPIQ	IO19	
	VSPID	IO23	
	VSPIHD	IO21	
	VSPIWP	IO22	
General Purpose SPI	HSPIQ_in/_out	Any GPIOs*	Standard SPI consists of clock, chip-select, MOSI and MISO. These SPIs can be connected to LCD and other external devices. They support the following features: • both master and slave modes; • 4 sub-modes of the SPI format transfer that depend on the clock phase (CPHA) and clock polarity (CPOL) control; • CLK frequencies by a divider; • up to 64 bytes of FIFO and DMA.
	HSPID_in/_out		
	HSPICLK_in/_out		
	HSPI_CS0_in/_out		
	HSPI_CS1_out		
	HSPI_CS2_out		
	VSPIQ_in/_out		
	VSPID_in/_out		
	VSPICLK_in/_out		
	VSPI_CS0_in/_out		
	VSPI_CS1_out		
	VSPI_CS2_out		
JTAG	MTDI	IO12	JTAG for software debugging
	MTCK	IO13	
	MTMS	IO14	
	MTDO	IO15	

Interface	Signal	Pin	Function
SDIO Slave	SD_CLK	IO6	SDIO interface that conforms to the industry standard SDIO 2.0 card specification.
	SD_CMD	IO11	
	SD_DATA0	IO7	
	SD_DATA1	IO8	
	SD_DATA2	IO9	
	SD_DATA3	IO10	
EMAC	EMAC_TX_CLK	IO0	Ethernet MAC with MII/RMII interface
	EMAC_RX_CLK	IO5	
	EMAC_TX_EN	IO21	
	EMAC_TXD0	IO19	
	EMAC_TXD1	IO22	
	EMAC_TXD2	IO14	
	EMAC_TXD3	IO12	
	EMAC_RX_ER	IO13	
	EMAC_RX_DV	IO27	
	EMAC_RXD0	IO25	
	EMAC_RXD1	IO26	
	EMAC_RXD2	TXD0	
	EMAC_RXD3	IO15	
	EMAC_CLK_OUT	IO16	
	EMAC_CLK_OUT_180	IO17	
	EMAC_TX_ER	IO4	
	EMAC_MDC_out	Any GPIOs*	
	EMAC_MDI_in	Any GPIOs*	
	EMAC_MDO_out	Any GPIOs*	
	EMAC_CRS_out	Any GPIOs*	
	EMAC_COL_out	Any GPIOs*	

Note:
Functions of Motor PWM, LED PWM, UART, I2C, I2S, general purpose SPI and Remote Controller can be configured to any GPIO.

5. Electrical Characteristics

Note: The specifications in this chapter have been tested under the following general condition: VDD = 3.3V, T_A = 27°C, unless otherwise specified.

5.1 Absolute Maximum Ratings

Table 8: Absolute Maximum Ratings

Parameter	Symbol	Min	Typ	Max	Unit
Power supply[1]	VDD	2.3	3.3	3.6	V
Minimum current delivered by power supply	I_{VDD}	0.5	-	-	A
Input low voltage	V_{IL}	-0.3	-	$0.25 \times V_{IO}^2$	V
Input high voltage	V_{IH}	$0.75 \times V_{IO}^2$	-	$V_{IO}^2+0.3$	V
Input leakage current	I_{IL}	-	-	50	nA
Input pin capacitance	C_{pad}	-	-	2	pF
Output low voltage	V_{OL}	-	-	$0.1 \times V_{IO}^2$	V
Output high voltage	V_{OH}	$0.8 \times V_{IO}^2$	-	-	V
Maximum output drive capability	I_{MAX}	-	-	40	mA
Storage temperature range	T_{STR}	-40	-	85	°C
Operating temperature range	T_{OPR}	-40	-	85	°C

5.2 Wi-Fi Radio

Table 9: Wi-Fi Radio Characteristics

Description	Min	Typical	Max	Unit
Input frequency	2412	-	2484	MHz
Output impedance	-	30+j10	-	Ω
Input reflection	-	-	-10	dB
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

Description	Min	Typical	Max	Unit
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

5.3 BLE Radio

5.3.1 Receiver

Table 10: Receiver Characteristics – BLE

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

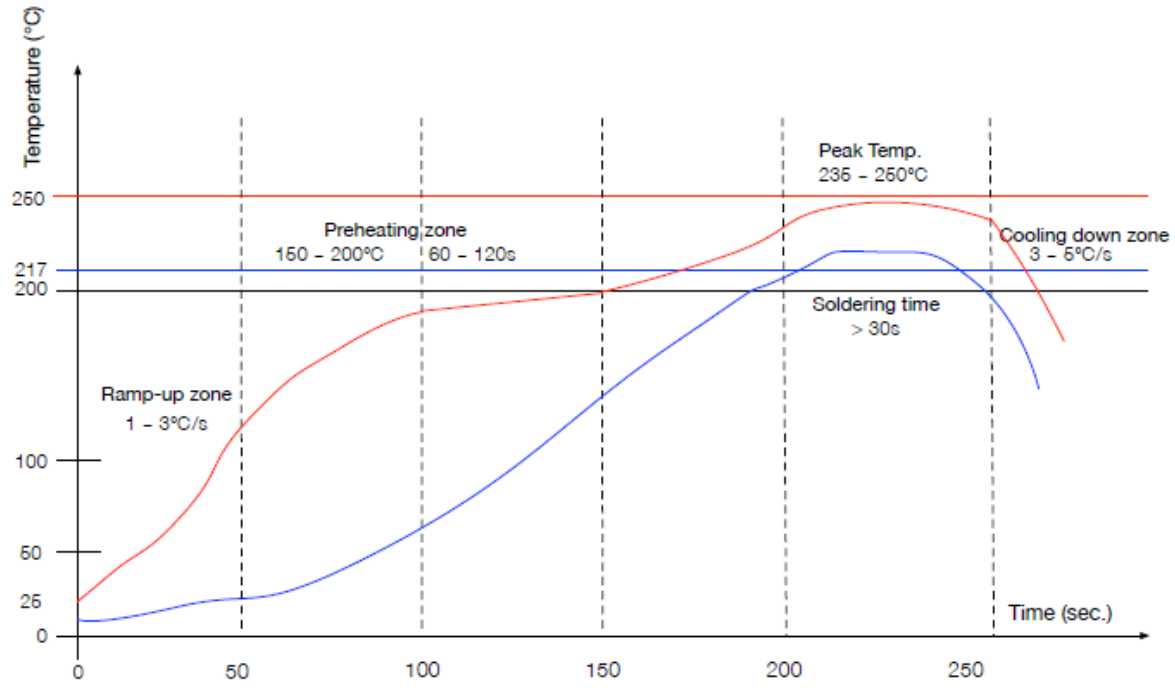
5.3.2 Transmitter

Table 11: Transmitter Characteristics – BLE

Parameter	Conditions	Min	Typ	Max	Unit
RF transmit power	-	-	0	-	dBm
Gain control step	-	-	±3	-	dBm
RF power control range	-	-12	-	+12	dBm

Parameter	Conditions	Min	Typ	Max	Unit
Adjacent channel transmit power	F = F0 + 1 MHz	-	-14.6	-	dBm
	F = F0 - 1 MHz	-	-12.7	-	dBm
	F = F0 + 2 MHz	-	-44.3	-	dBm
	F = F0 - 2 MHz	-	-38.7	-	dBm
	F = F0 + 3 MHz	-	-49.2	-	dBm
	F = F0 - 3 MHz	-	-44.7	-	dBm
	F = F0 + > 3 MHz	-	-50	-	dBm
	F = F0 - > 3 MHz	-	-50	-	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

5.4 Reflow Profile



Ramp-up zone — Temp.: <150°C Time: 60 – 90s Ramp-up rate: 1 – 3°C/s
Preheating zone — Temp.: 150 – 200°C Time: 60 – 120s Ramp-up rate: 0.3 – 0.8°C/s
Reflow soldering zone — Peak Temp.: 235 – 260°C (<245°C recommended) Time: 30 – 70s
Cooling down zone — Temp.: 217 – 170°C Ramp-down rate: 3 – 6°C/s
Solder — Sn&Ag&Cu Lead-free solder (SAC305)

Figure 2: Reflow Profile

6. ESP32-PICO-D4 Schematics

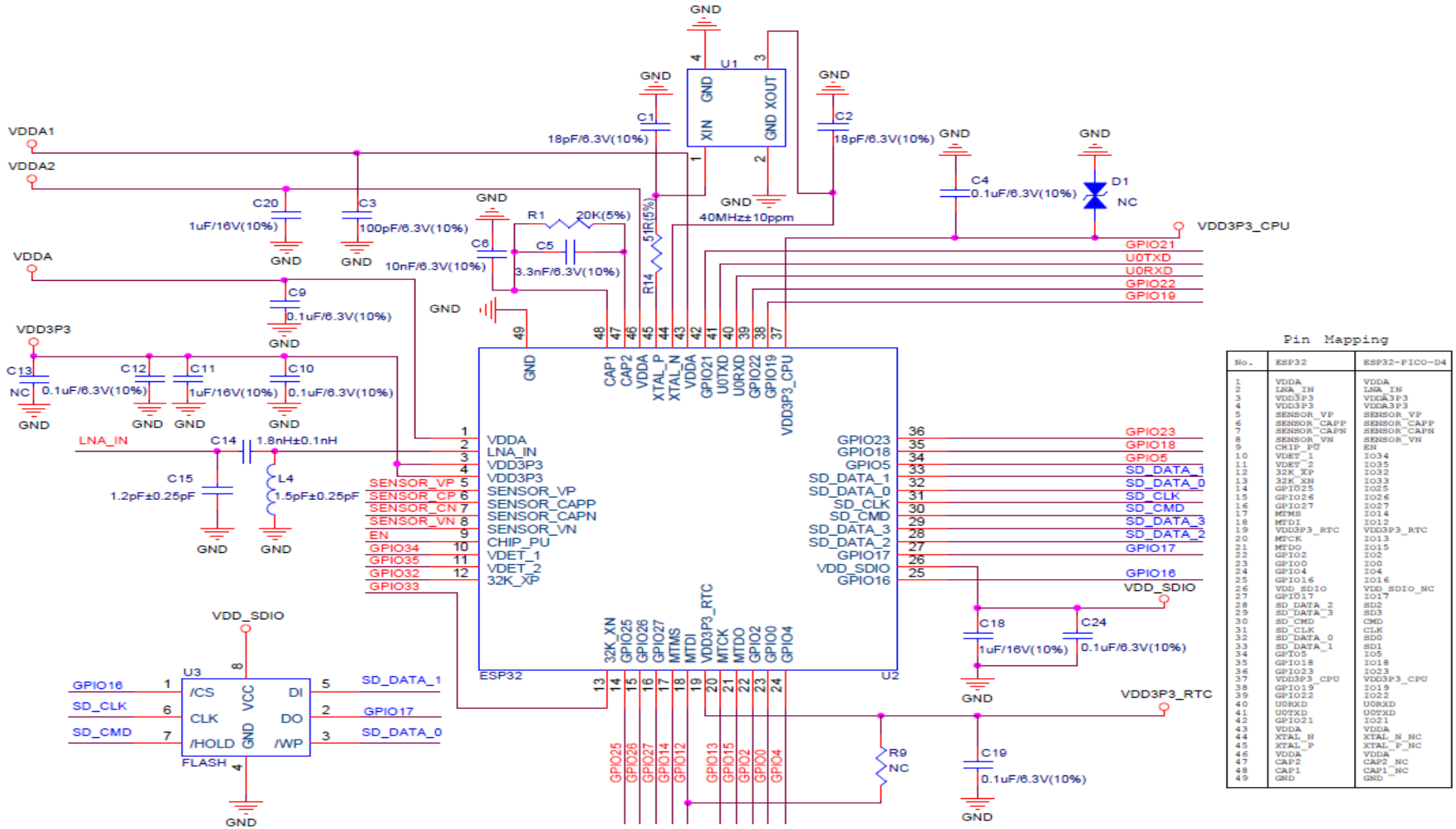


Figure 3: ESP32-PICO-D4 Schematics

7. ESP32-0031-7002 Schematics

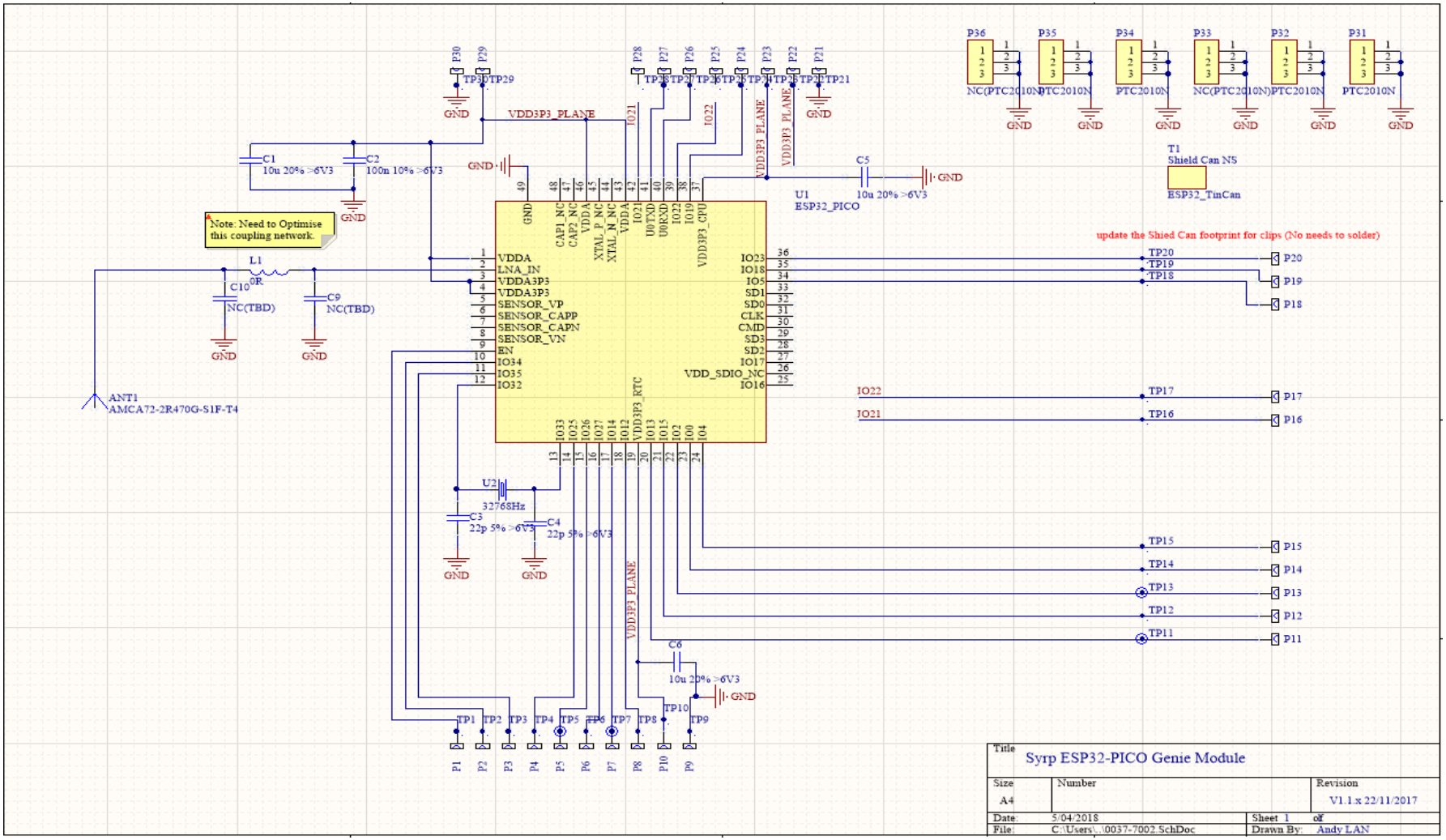


Figure 4: ESP32-0031-7002 Schematics

8. Peripheral Schematics

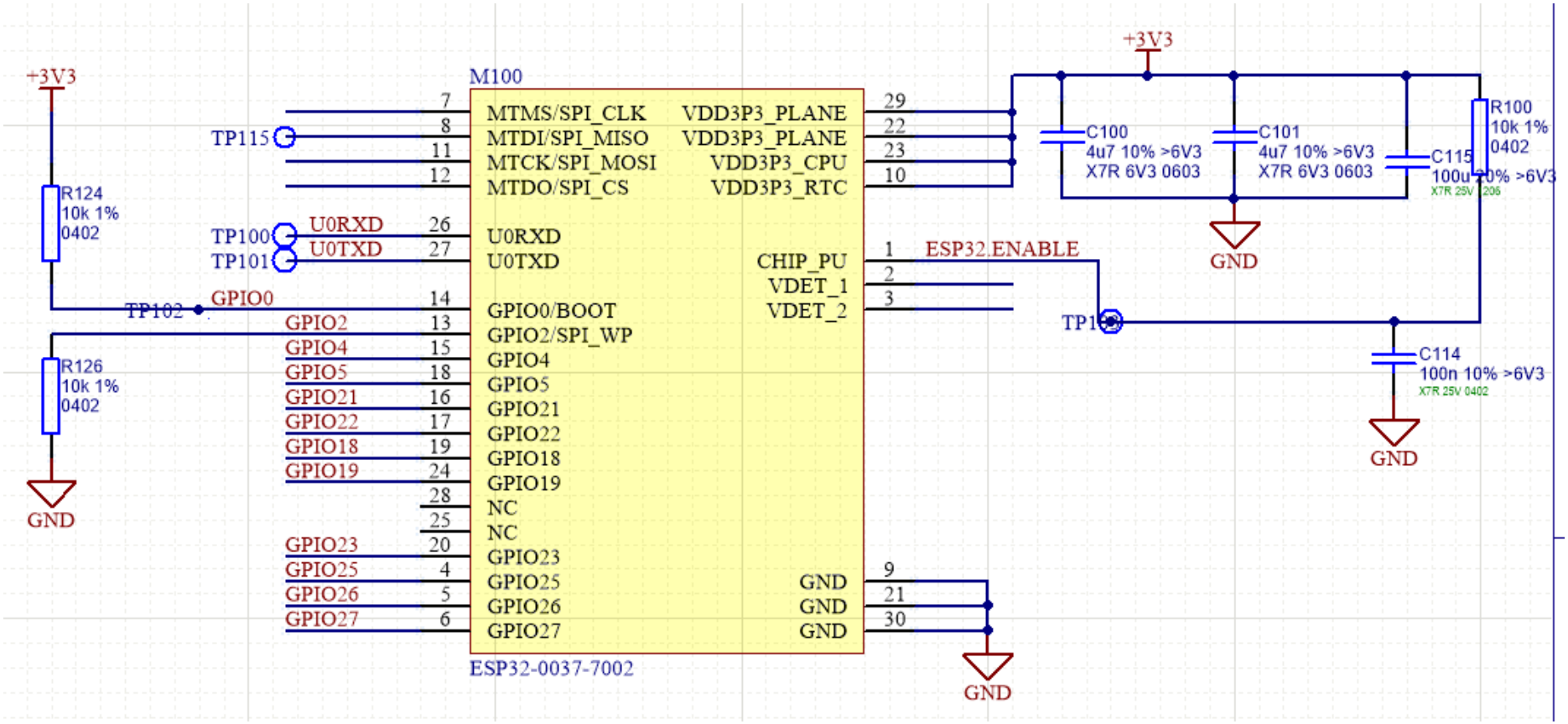


Figure 4: ESP32-0031-7002 Peripheral Schematics

9 Learning Resources

9.1 Must-Read Documents

The following link provides related documents of ESP32.

• ESP32 Datasheet

This document provides introduction to the specifications of the ESP32 hardware, including overview, pin definitions, functional description, peripheral interface, electrical characteristics, etc.

• ESP32-PICO-D4 Datasheet

• ESP32 Technical Reference Manual

The manual provides detailed information on how to use the ESP32 memory and peripherals.

• ESP32 Hardware Resources

The zip files include the schematics, PCB layout, Gerber and BOM list of ESP32 modules and development boards.

• ESP32 Hardware Design Guidelines

The guidelines outline recommended design practices when developing standalone or add-on systems based on the ESP32 series of products, including ESP32, the ESP-WROOM-32 module, and ESP32-DevKitC—the development board.

• ESP32 AT Instruction Set and Examples

This document introduces the ESP32 AT commands, explains how to use them and provides examples of several common AT commands.

9.2 Must-Have Resources

Here are the ESP32-related must-have resources.

• ESP32 BBS

This is an Engineer-to-Engineer (E2E) Community for ESP32 where you can post questions, share knowledge, explore ideas, and help solve problems with fellow engineers.

• ESP32 Github

ESP32 development projects are freely distributed under Espressif's MIT license on Github. It is established to help developers get started with ESP32 and foster innovation and the growth of general knowledge about the hardware and software surrounding ESP32 devices.

• ESP32 Tools

This is a web-page where users can download ESP32 Flash Download Tools and the zip file "ESP32 Certification and Test".

• ESP32 IDF

This web-page links users to the official IoT development framework for ESP32.

• ESP32 Resources

This webpage provides the links to all the available ESP32 documents, SDK and tools.

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.

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

The modular can be installed or integrated in mobile or fix devices only. This modular cannot be installed in any portable device.

FCC Radiation Exposure Statement

This modular complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter. This modular must be installed and operated with a minimum distance of 20 cm between the radiator and user body.

If the FCC identification number is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. This exterior label can use wording such as the following: “Contains Transmitter Module FCC ID: 2APDW0037 Or ContainsFCC ID: 2APDW0037”

When the module is installed inside another device, the user manual of the host must contain below warning statements;

1. 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.

(2) This device must accept any interference received, including interference that may cause undesired operation.

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

The devices must be installed and used in strict accordance with the manufacturer's instructions as described in the user documentation that comes with the product.

Any company of the host device which install this modular with Single modular approval should perform the test of radiated emissionand spurious emission according to FCC part 15C : 15.247 requirement,Only if the test result comply with FCC part 15C : 15.247 requirement，then the host can be sold legally.

IC statement

This device complies with Industry Canada’s licence-exempt RSSs. Operation is subject to the following two conditions:

(1) This device may not cause interference; and

(2) This device must accept any interference, including interference that may cause undesired operation of the device.

Cet appareil est conforme aux CNR exemptes de licence d'Industrie Canada . Son fonctionnement est soumis aux deux conditions suivantes :

(1) Ce dispositif ne peut causer d'interférences ; etc

(2) Ce dispositif doit accepter toute interférence , y compris les interférences qui peuvent causer un mauvais fonctionnement de l'appareil.

A separation distance of at least 20 cm is maintained between the transmitter's radiating structure(s) and the body of the user or nearby persons.

Une distance de séparation d'au moins 20 cm est maintenue entre l'émetteur rayonnant structure (s) et le corps de l'utilisateur ou des personnes à proximité.

For a host manufacture's using a certified modular, if (1) the module's IC number is not visible when installed in the host, or (2) if the host is marketed so that end users do not have straightforward commonly used methods for access to remove the module so that the IC number of the module is visible; then an additional permanent label referring to the enclosed module: "Contains Transmitter Module IC: " 23768-0037" or "Contains IC: 23768-0037" must be used.