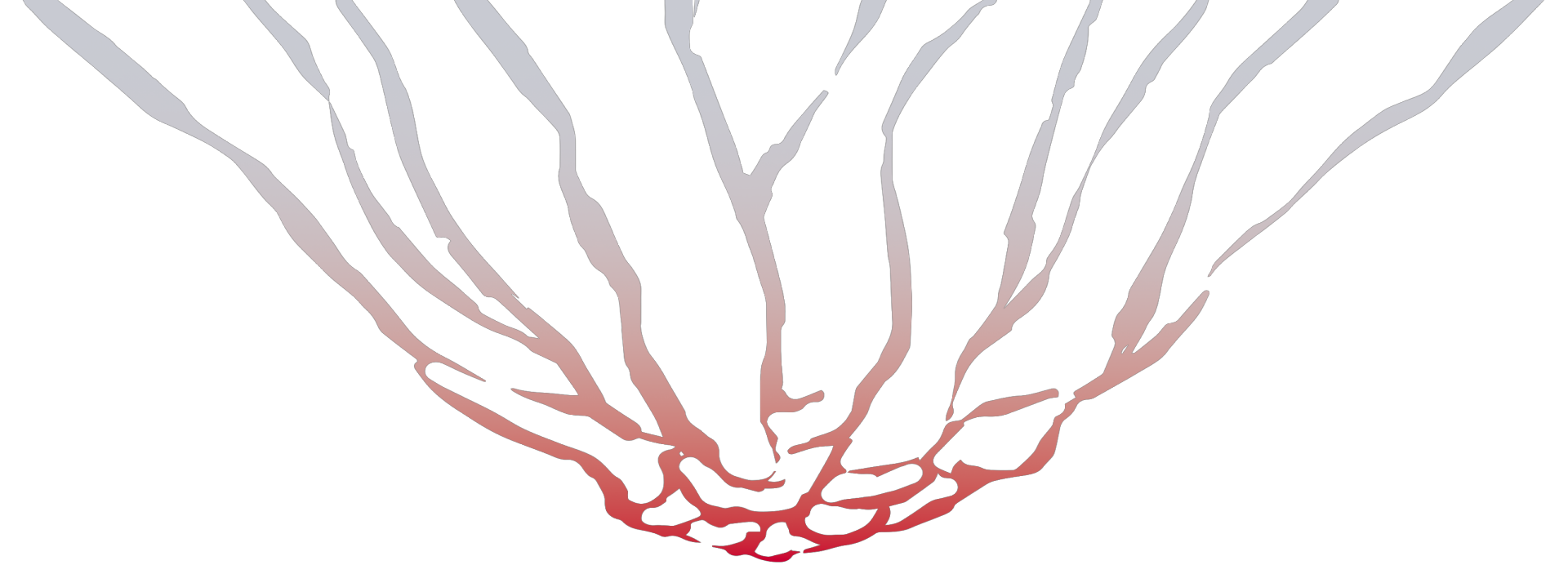


ESPRESSIF

TRAINING

Overview

Objective

- Company Overview
- Hardware Overview
- Software Overview

Company Overview

Espressif

Espressif Systems is a fabless IC design company, founded in 2008, with 200 employees, headquartered in Shanghai, China; we design and manufacture low power, highly integrated and small form factor short range wireless connectivity chips.

Our Journey

ESP8089 RELEASED

Highly integrated Wi-Fi chip with optimal performance

ESP32 RELEASED

Realizing developers' dream, ESP32 is engineered for the future of IoT and wearable tech

FOCUS ON TECHNOLOGICAL PROGRESS

Over 100 engineers from across the world are employed and committed to technological innovation and progress

2013

2014

2016

FOUNDED IN 2008

NEXT MILESTONE

ESP8266 RELEASED

Game-changer in the IoT industry

Honors & Recognition

2015

Red Herring

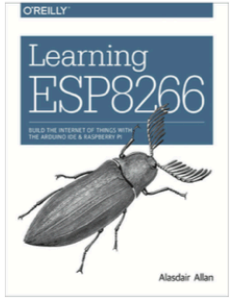
全球知名投资风向媒体
《红鲱鱼》科技创新
2015年亚洲TOP 100

RED HERRING

2016

O'Reilly

世界知名科技出版商
O'Reilly 将 ESP8266
加入动物书选题



2016

Gartner Cool Vendor

全球知名信息技术咨询公司
Gartner 将乐鑫评选为
2016 物联网领域
“最酷供应商”

Gartner 2016 CoolVendor

2016

Best IC Design

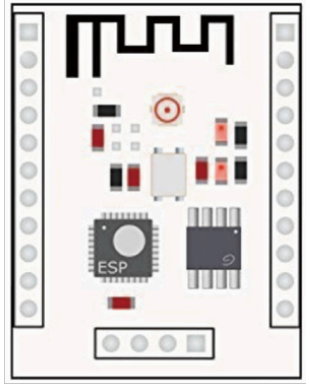
ESP8266 荣获 EETimes
《电子工程专辑》2016年
大中华IC 设计成就奖之
最佳无线 IC 奖

EET 电子工程专辑

Ecosystem

POPULAR DEVELOPMENT PLATFORMS

Arduino IDE, Smart.JS, NodeMCU, MicroPython, Mongoose OS



THIRD-PARTY CLOUD PLATFORMS

Up to 30 mainstream cloud platforms support Espressif Products

http://www.espressif.com/en/ecosystem/cloud-platform

STRONG COMMUNITY ENGAGEMENT

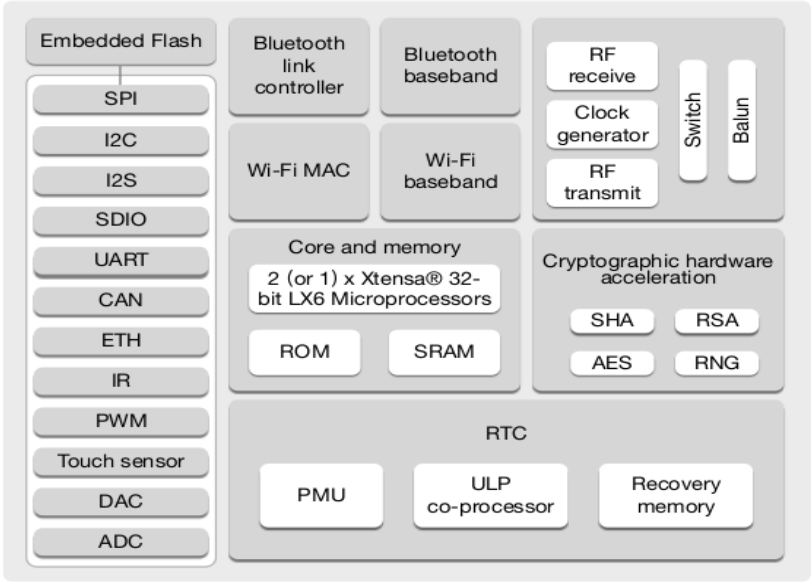
- >8,000 open source projects on GitHub. Arduino ESP8266 is one of the most popular open source projects on GitHub with >1,700 forks
- More than 40 books have been written about ESP8266 and ESP32 in English, German, Italian, Japanese, Chinese, and Urdu.
  http://espressif.com/en/support/iot-college/books-new
- www.ESP8266.com is ranked 40,000 in the world.

Hardware Overview

Hardware Overview

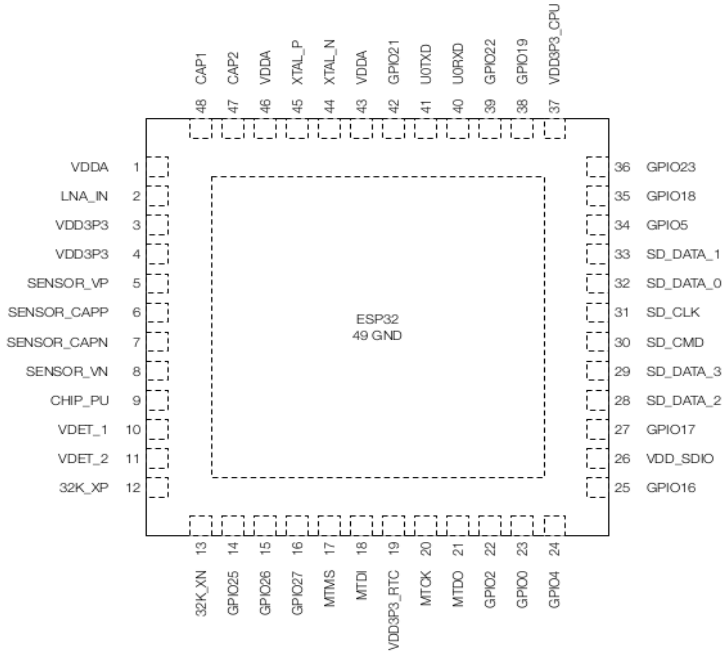
- Single 2.4 GHz Wi-Fi and Bluetooth combo chip
- Xtensa Single-/Dual-core 32-bit LX6 microprocessor(s), up to 600 DMIPS
- 448K ROM, 520K SRAM, 16K RTC Memory
- Peripherals ADC, DAC, Touch, SPI, I2S, I2C, PWM, SDIO, Ethernet, UART, etc.

Hardware Overview



Functional Block Diagram

Hardware Overview



ESP32 Pin Layout (QFN 6*6)

Hardware Overview

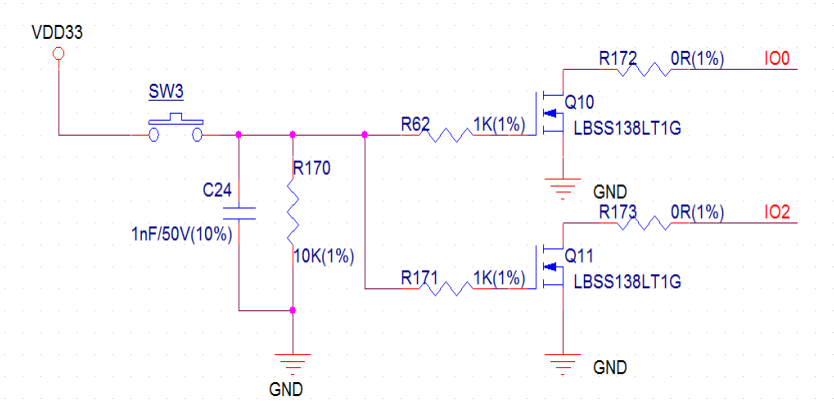
Voltage of Internal LDO (VDD_SDIO)			
Pin	Default	3.3V	1.8V
MTDI	Pull-down	0	1
Booting Mode			
Pin	Default	SPI Boot	Download Boot
GPIO0	Pull-up	1	0
GPIO2	Pull-down	Don't-care	0
Enabling/Disabling Debugging Log Print over U0TXD During Booting			
Pin	Default	U0TXD Toggling	U0TXD Silent
MTDO	Pull-up	1	0

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

Strapping Pins

Hardware Overview

Pull GPIO2 up for normal working mode, pull it down for download mode.
(Picture on the left hand can be a reference design.)



Strapping pins

Hardware Overview

Ordering code	Core	Embedded flash	Connection	Package
ESP32-D0WDQ6	Dual core	No embedded flash	Wi-Fi b/g/n + BT/BLE Dual Mode	QFN 6*6
ESP32-D0WD	Dual core	No embedded flash	Wi-Fi b/g/n + BT/BLE Dual Mode	QFN 5*5
ESP32-D2WD	Dual core	16-Mbit embedded flash	Wi-Fi b/g/n + BT/BLE Dual Mode	QFN 5*5
ESP32-S0WD	Single core	No embedded flash	Wi-Fi b/g/n + BT/BLE Dual Mode	QFN 5*5

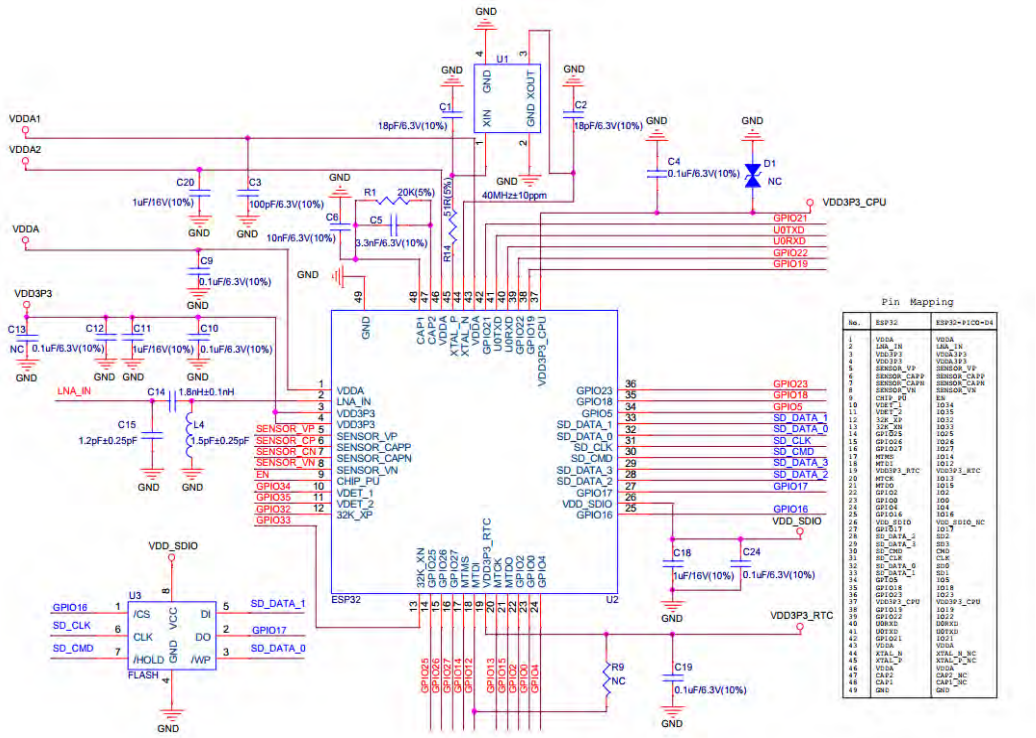
ESP32 Chip Family

Hardware Overview

ESP32 Module

ESP32-PICO-D4

- System in package, 7mmx7mm
- Integrates 4 MB flash (3.3V)
- Integrates 40 MHz crystal

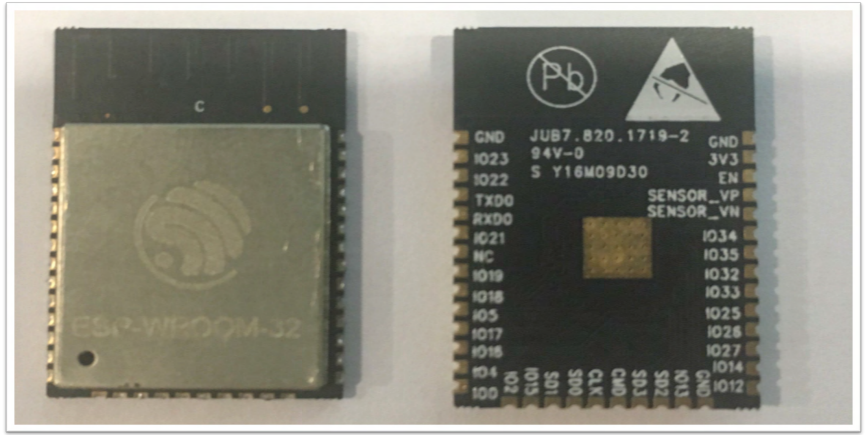


Hardware Overview

ESP32 Module

ESP-WROOM-32

- 25.5mm x 18.0mm
- PCB antenna
- External 4MB flash

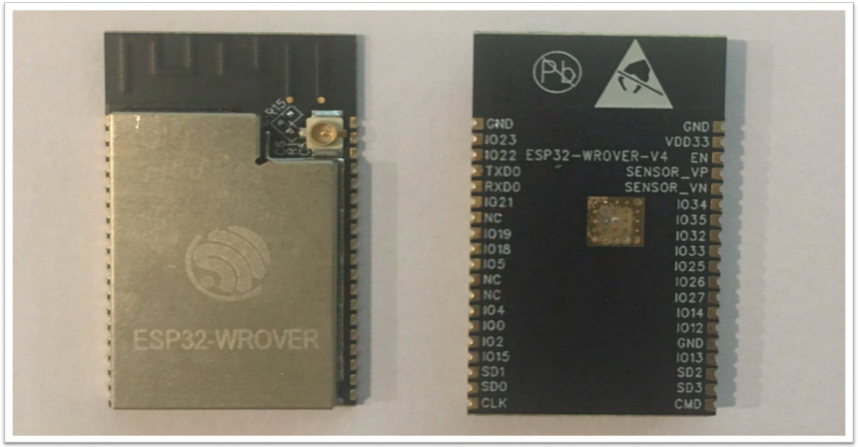


Hardware Overview

ESP32 Module

ESP32-WROVER

- 31.4mmx18.0mm
- PCB antenna or IPEX
- External 4 MB flash and 4 MB PSRAM

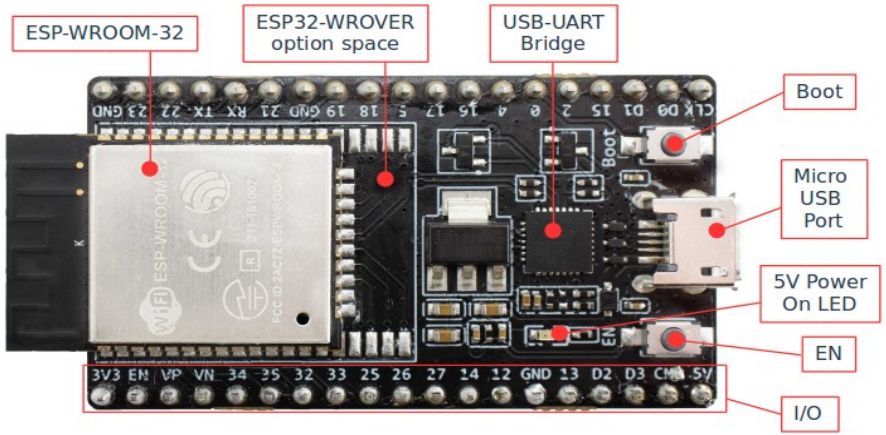


Hardware Overview

ESP32 Dev. Board

ESP32-DevKitC

- ESP-WROOM-32 module
- CP2102:USB<->UART
- NCP1117:5V to 3.3V LDO
- Auto-download circuit
- All available pins extended to pin header

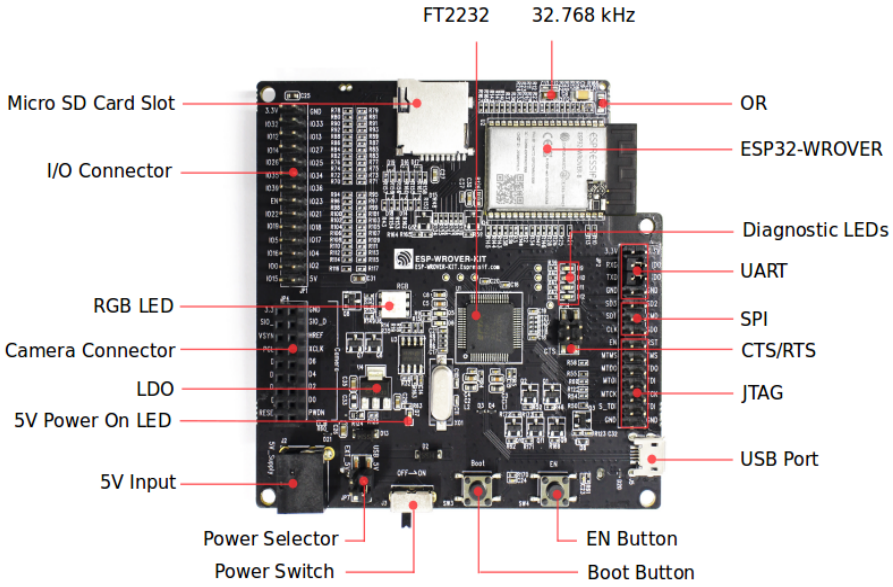


Hardware Overview

ESP32 Dev. Board

ESP32-WROVER-KIT

- ESP-WROOM-32 or ESP32-WROVER module
- FT2232HL: USB<->UART/ USB<->JTAG
- NCP1117:5V to 3.3V LDO
- Auto-download circuit
- MicroSD card
- LCD Display (Rear side)
- 1 x RGB

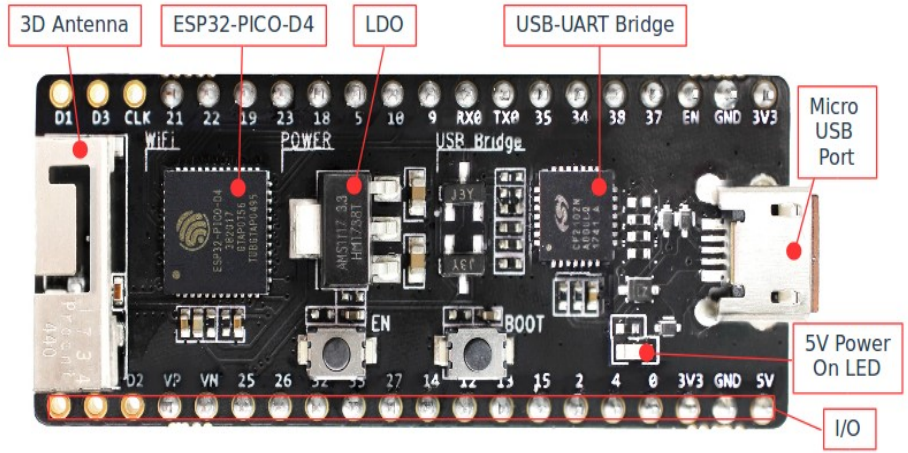


Hardware Overview

ESP32 Dev. Board

ESP32-PICO-KIT

- ESP32-PICO-D4 SiP
- CP2102:USB<->UART
- NCP1117:5V to 3.3V LDO
- Auto-download circuit
- All available pins extended to pin header

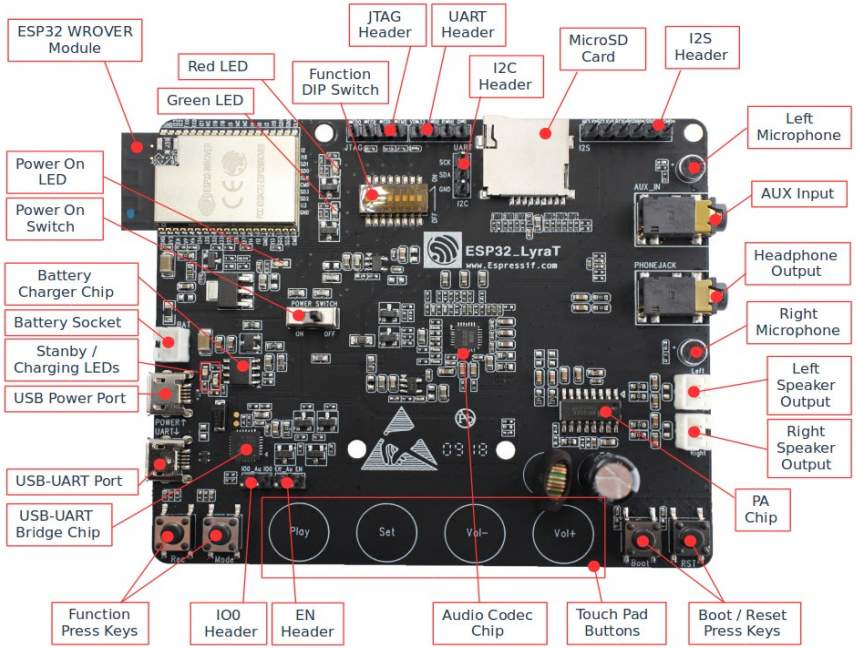


Hardware Overview

ESP32 Dev. Board

ESP32-LyraT (Audio Dev.)

- ESP-WROOM-32 or ESP32-WROVER module
- CP2102:USB<->UART
- NCP1117:5V to 3.3V LDO
- 4 x touch pads
- MicroSD card
- 2 x MIC inputs
- 1 x AUX_IN, 1 x phone jack
- 2 x speakers



Resources

- https://www.espressif.com/sites/default/files/documentation/esp32_datasheet_en.pdf (Datasheet)
- https://www.espressif.com/sites/default/files/documentation/esp32_technical_reference_manual_en.pdf (Technical Reference Manual)
- https://www.espressif.com/sites/default/files/documentation/esp32-wroom-32_datasheet_en.pdf (ESP32 module datasheet)
- https://www.espressif.com/sites/default/files/documentation/espressif_products_ordering_information_en.pdf (Product ordering guide)
- https://www.espressif.com/sites/default/files/documentation/esp32_hardware_design_guidelines_en.pdf (Hardware Design Guidelines)

Software Overview

Software Overview (ESP-IDF)

- Espressif IoT development framework for ESP32 and beyond
- Develop in C and C++, based on (Free)RTOS
- Open source, Apache 2.0 license
- Online documentation and multiple host OS support

Software Overview (ESP-IDF)

- (At high-level) Provides following components

  - Platform software (Bootloader)
  - Device drivers
  - Operating System (FreeRTOS)
  - Networking (WiFi/Ethernet, lwIP)
  - Middleware includes Storage, Security etc.
  - Development/Manufacturing Tools

Software Overview (ESP-IDF)

- ESP-IDF Github repository
  Source code, examples, issue tracker, releases https://github.com/espressif/esp-idf

- ESP-IDF programming guide
  Getting started guides, API reference, API guides
  https://docs.espressif.com/projects/esp-idf/en/stable/

Software Overview (ESP-ADF)

- Espressif Audio Development Framework
- ESP-ADF Github repository
  Source code, examples, issue tracker, releases https://github.com/espressif/esp-adf

Software Overview (ESP-MDF)

- Espressif Mesh Development Framework
- ESP-MDF Github repository
  Source code, examples, issue tracker, releases https://github.com/espressif/esp-mdf

Other Frameworks

- Apple HomeKit
- Amazon FreeRTOS
- Alexa
- Conversational Interfaces: Lex, DialogFlow