LUX-32

OEM/Integrator Installation Manual

Version 0.1

About This Guide

ThisuserguideintroduceshowtousetheLUX32

Reference Documents

You may find the following documents helpful.

- ESP32 Datasheet : http://www.espressif.com/sites/default/files/documentation/ esp32_datasheet_en.pdf
- ESP-IDF Getting Started Guide : http://www.espressif.com/sites/default/files/documentation/esp-idf_getting_started_guide_en.pdf

Product introduction

LUX-32 is a powerful, generic WiFi-BT-BLE MCU module that targets a wide variety of applications like low power sensor networks

At the core of this module is the ESP32 chip, which is designed to be scalable and adaptive. There are 2 CPU cores that can be individually controlled or powered, and the clock frequency is adjustable from 80 MHz to 240 MHz. The user may also power off the CPU and make use of the low power coprocessor to constantly monitor the peripherals for changes or crossing of thresholds.

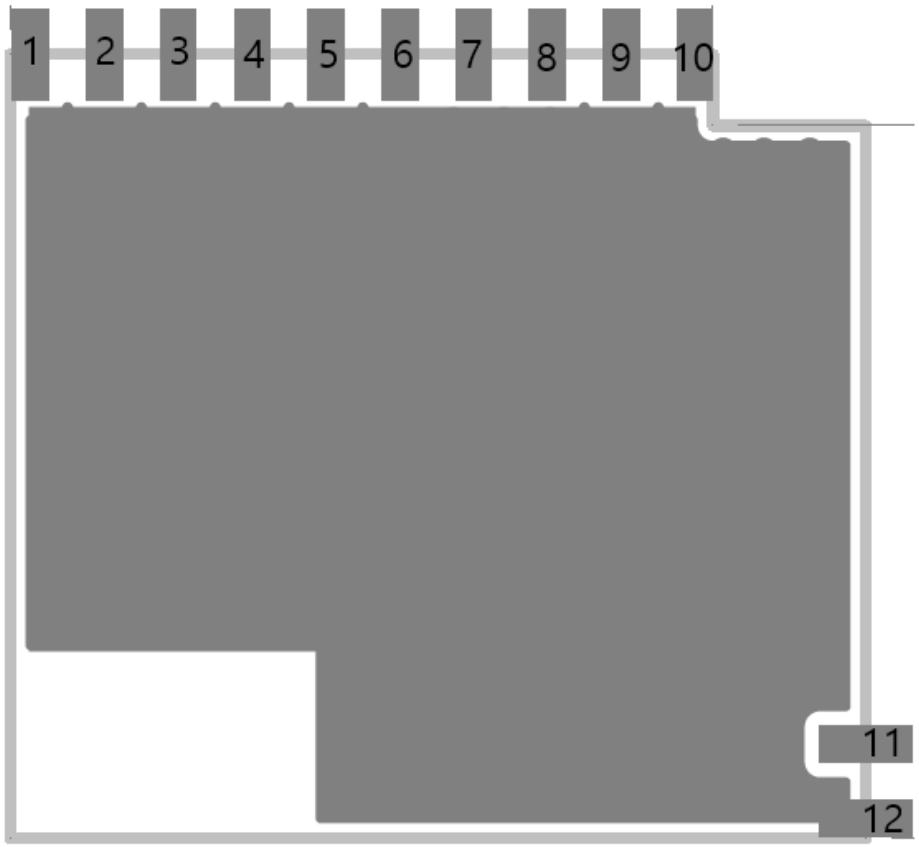
The integration of Bluetooth, Bluetooth LE and Wi-Fi ensures that a wide range of applications can be targeted, and that it is future proof: using Wi-Fi allows a large physical range and direct connection to the internet through a Wi-Fi router, while using Bluetooth allows the user to conveniently connect to the phone or broadcast low energy beacons for its detection. The sleep current of the ESP32 chip is less than 5 μA, making it suitable for battery powered and wearable electronics applications. LUX-32 supports data rates up to 150 Mbps, and 18 dBm output power at the PA to ensure the widest physical range. As such the chip does offer industry leading specifications and the best optimized performance for electronic integration, range and power consumption, and connectivity.

The operating system chosen for ESP32 is freeRTOS with LWIP; TLS 1.2 with hardware acceleration is built in as well. Secure (encrypted) over the air (OTA) upgrade is also supported, so that developers can continually upgrade their products even after their release.

LUX-32 Specifications

Categories	Items	Specifications
Wifi	Protocols	802.11 b/g/n
		A-MPDU and A-MSDU aggregation and 0.4 μs guard interval support
	Frequency range	2.4 ~ 2.5 GHz
Bluetooth	Protocols	Bluetooth v4.2 BLE
	Radio	NZIF receiver with -98 dBm sensitivity
		Class-1, class-2 and class-3 transmitter
		AFH
Hardware	Module interface	UART, SPI
	On-board clock	40 MHz crystal, 32 kHz crystal
	Operating voltage	3.0V
	Operating current	Average: 80 mA
	Operating temperature range	-5°C ~ 55°C
	Ambient temperature range	Normal temperature
	Package size	*refer to “Package size”
Software	Wi-Fi mode	Station/softAP/SoftAP+station/P2P
	Security	WPA/WPA2/WPA2-Enterprise/WPS
	Encryption	AES/RSA/ECC/SHA
	Firmware upgrade	UART Download / OTA (via network) / download and write firmware via host
	Software development	Supports Cloud Server Development / SDK for custom firmware development
	Network protocols	IPv4, IPv6, SSL, TCP/UDP/HTTP/FTP/MQTT
	User configuration	AT instruction set, cloud server, Android/iOS App

Pin Layout



Pin definitions

Name	No.	Function
UART1 TX	1	UART1 Tx
UART2 RX	2	UART1 Rx
MISO	3	SPI MISO
MOSI	4	SPI MOSI
SCK	5	SPI CLK
CS	6	SPI CS
UART2 RX	7	UART2 RX
UART2 TX	8	UART2 Tx
GPIO0	9	Strapping pin, GPIO, Flash boot mode configuration pin
CHIP PU	10	Chip enable (High on operation, Low power down)
VDD33	11	Power Vdd 3.0V
GND	12	Ground

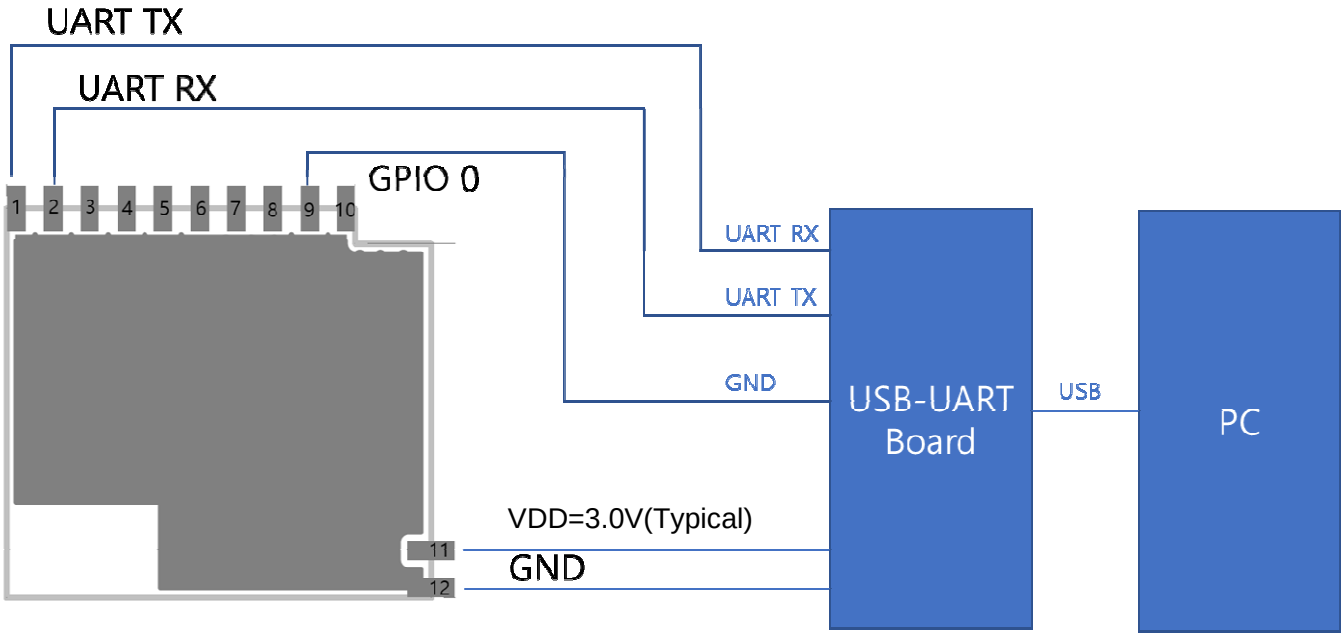
Flash boot mode configuration

Booting Mode			
Pin	Default	SPI Flash Boot	Download Boot
GPIO0	Pull-up	1	0

Serial Communication (UART)

Connect the LUX-32to the PC using the USB-UART board and USB cable. Check the list of identified external COM ports in the Windows Device Manager and confirm the COM port number of the LUX-32.

Serial – communication connection for F/W download



SPI interface

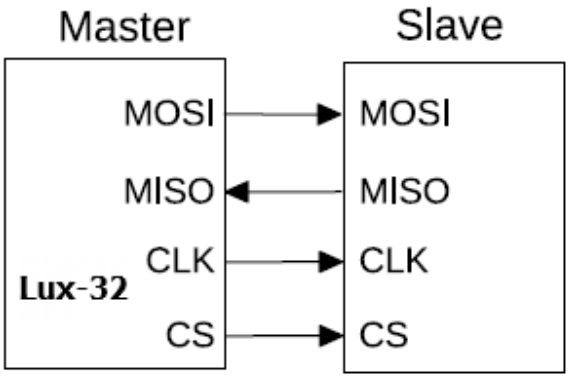
Lux-32 SPI interface pin

Name	No.	Function
MISO	3	SPI MISO
MOSI	4	SPI MOSI
SCK	5	SPI CLK
CS	6	SPI CS

SPI Master Mode

The SPI master mode supports four-line full-duplex communication and three-line half-duplex communication.
The connections needed for four-line full-duplex communications

Connection Examples (Master mode)

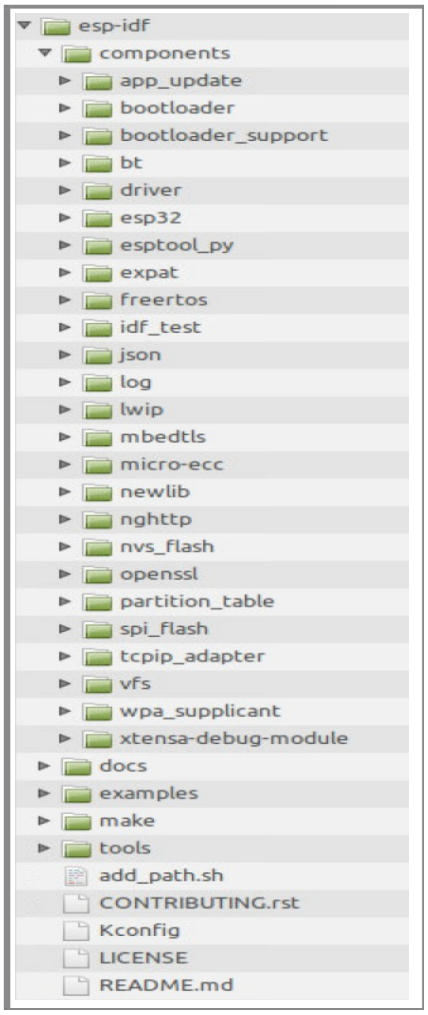


SPI Slave mode

Lux-32 can communicate with other host devices as a slave device. Lux-32 should useparticular protocols when acting as a slave. Data received or sent at one time can be no more than 64 byteswhen not using DMA. During a valid read/write process, the appropriate CS signal must be maintained at a lowlevel. If the CS signal is pulled up during transmission, the internal state of the slave will be reset.

IDF installation : ESP-IDF Directory Structure

The following figure shows the directory structure of ESP-IDF, including components, examples, make, tools and docs. The components folder contains the core components of ESP-IDF; the examples folder contains the program examples of ESP-IDF; the make folder contains makefiles for ESP-IDF; the tools folder is the toolkit; the docs folder contains ESP-IDF-relevant documentation.



The *hello_world* Example

The *esp-idf/examples/01_hello_world* directory contains a sample code that can be run on the ESP32.

1. Using the command terminal, change the current directory to *example/01_hello_world*:

```
cd examples/01_hello_world/
```

2. Configure *IDF_PATH*:

```
export IDF_PATH=/home/share/esp-idf-driver/esp-idf
```

3. Check the *IDF_PATH* configuration to make sure it is properly lyset. Failing to set the path will cause failure to the linking of dependent files later.

```
echo $IDF_PATH
```

4. Compile the program to generate BIN files. These BIN files have to be downloaded to the ESP32-DevKitC. Please see Sections 2.3.1 and 2.3.2 for detailed instructions.

Using the ESP32 DOWNLOADTOOL

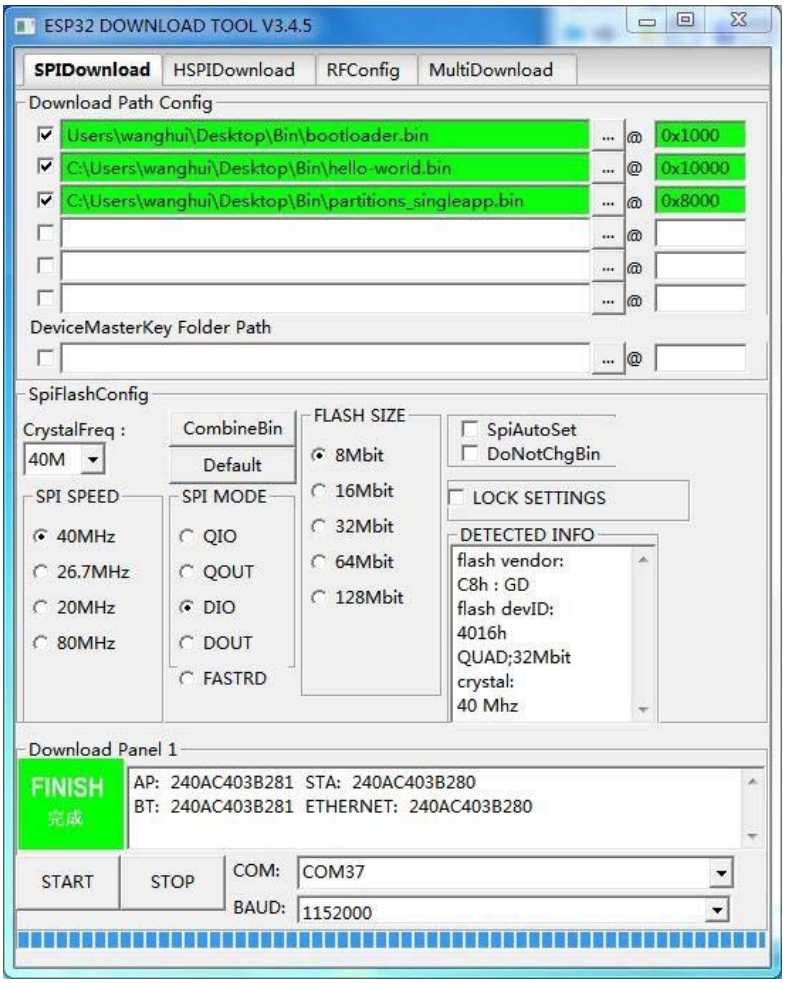
Executethefollowingcommandintheterminaltomaketheexampleprojectandgenerate executable BINfiles:

```
make
```

Three BIN files need to be downloaded: *example/01_hello_world/bootloader/ bootloader.bin*, *example/01_hello_world/partitions_singleapp.bin* and *example/ 01_hello_world/hello-world.bin*. Then, users can flash these BIN files by using the ESP32 DOWNLOAD TOOL. Please follow the steps below:

1. OpentheESP32DOWNLOADTOOL.
2. Configurethedownloadtoolandclickon“START“,asshownbelow:

⚠ ***Notice:***
Most computers will automatically reset the ESP32 into download mode when you start uploading. If this doesnotworkonyourcomputer,tryholdingdowntheBootbutton(andpossiblypressingandreleasingthe ENbutton)whenstartingtheupload



3. Opentheserialport.SetthePort,Baudrate=115200,Databits=8,andStopbits=1. Ifthelogbelowisprinted,thenitshowsthatthefirmwarehasbeendownloadedtothe ESP32-DevKitCsuccessfully.

```
ets Jun  8 2016 00:22:57

rst:0xc (SW_CPU_RESET),boot:0x13 (SPI_FAST_FLASH_BOOT)
configsip: 0, SPIWP:0x00
clk_drv:0x00,q_drv:0x00,d_drv:0x00,cs0_drv:0x00,hd_drv:0x00,wp_drv:0x00
mode:DIO, clock div:2
load:0x3ffc0008,len:0
load:0x3ffc0008,len:1964
load:0x40078000,len:3696
ho 0 tail 12 room 4
load:0x40080000,len:260
entry 0x40080034
[0;32mI (805) heap_alloc_caps: Initializing heap allocator:[0m
[0;32mI (806) heap_alloc_caps: Region 19: 3FFB4AAC len 0002B554 tag 0[0m
[0;32mI (815) heap_alloc_caps: Region 25: 3FFE8000 len 00018000 tag 1[0m
[0;32mI (876) cpu_start: Pro cpu up.[0m
[0;32mI (911) cpu_start: Single core mode[0m
[0;32mI (949) cpu_start: Pro cpu start user code[0m
[0;32mI (1469) phy: phy_version: 258, Nov 29 2016, 15:51:07, 0, 0[0m
[0;32mI (1873) cpu_start: Starting scheduler on PRO CPU.[0m
Hello world!
Restarting in 10 seconds...
Restarting in 9 seconds...
Restarting in 8 seconds...
Restarting in 7 seconds...
Restarting in 6 seconds...
Restarting in 5 seconds...
Restarting in 4 seconds...
Restarting in 3 seconds...
Restarting in 2 seconds...
Restarting in 1 seconds...
Restarting in 0 seconds...
Restarting now.
```

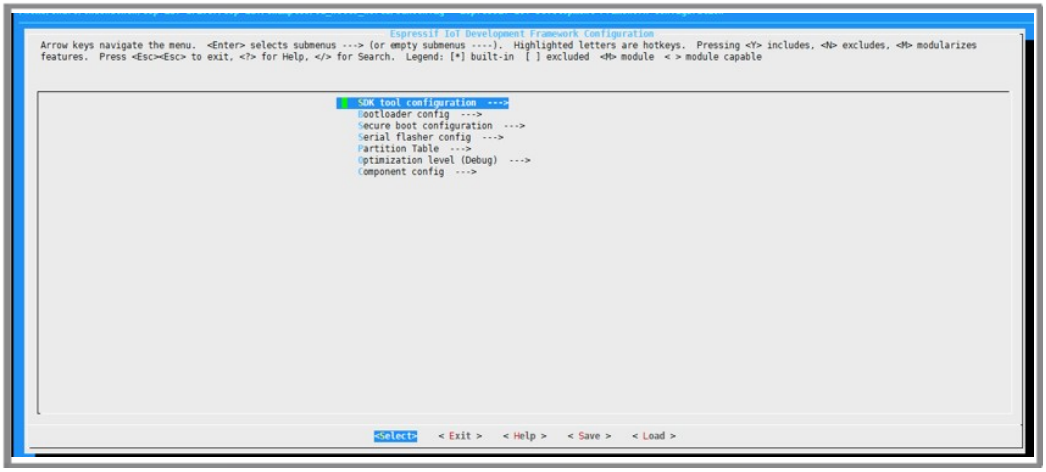
Manueconfig

Users need to configure the serial port before compiling and downloading BIN files.Serial port configuration is not required if the Flash Download Tool is used to flash the BIN files on to the ESP32-DevKitC. However,other important system parameters maybe setvia menuconfig. Please complete this step before generating BIN files.

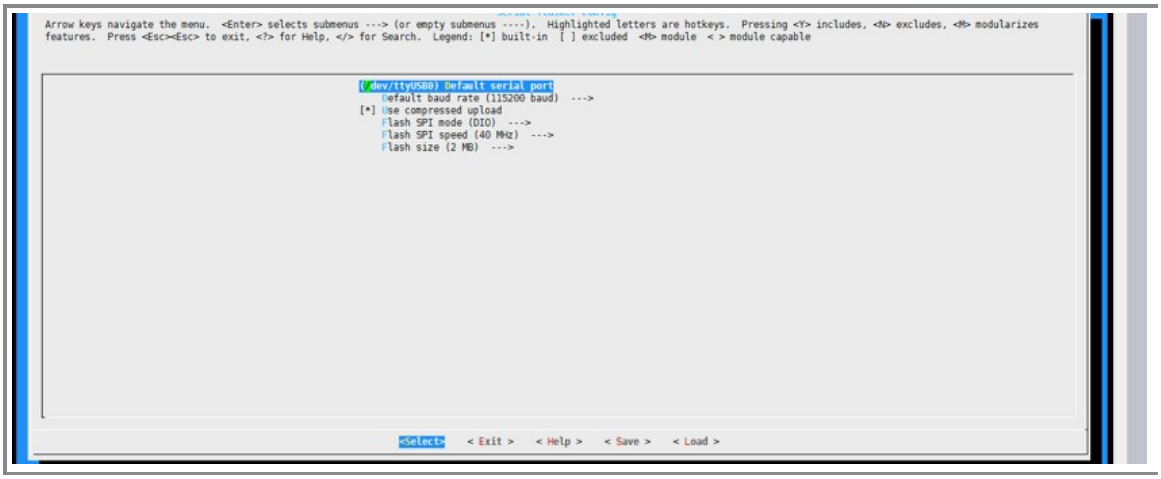
1. Enter make menuconfig:

```
make menuconfig
```

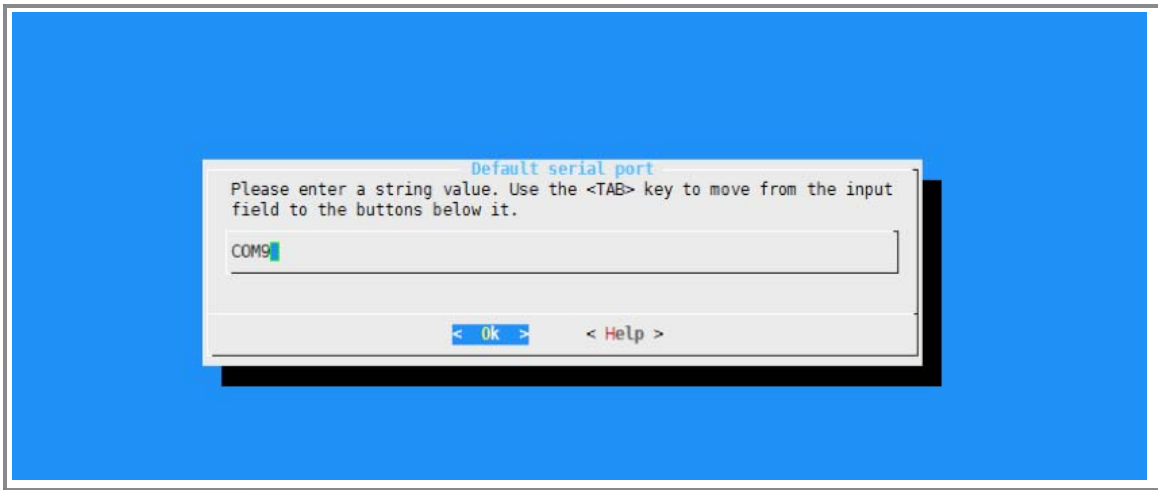
Then, the following interface is displayed:



2. Select *Serial flasher config* to configure the serial port, as shown below:



3. Configure the serial port, as shown below:



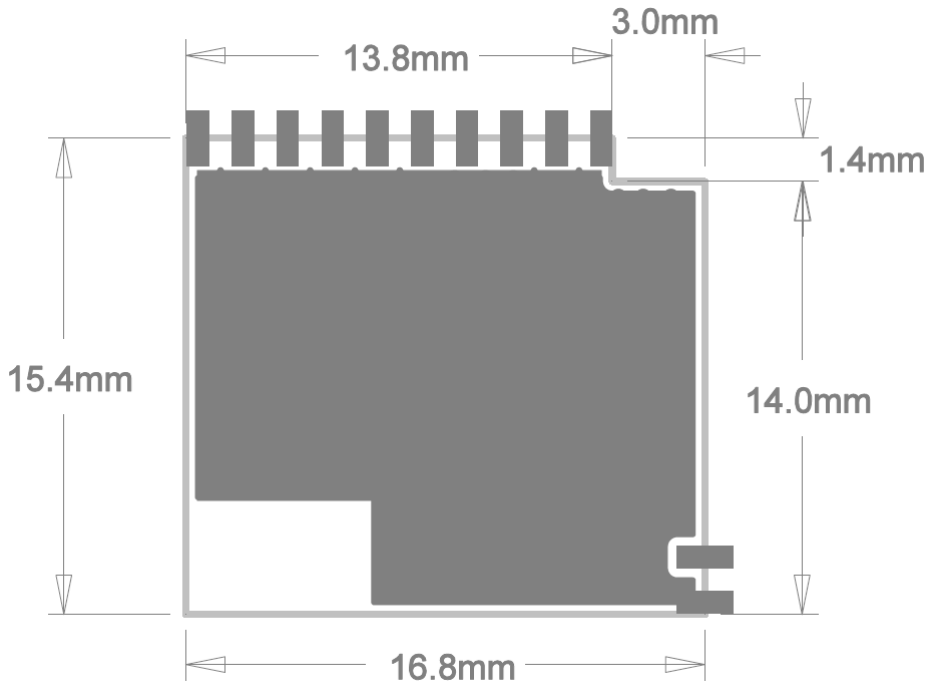
4. Click “OK” and exit make menuconfig.
5. Flash BIN files directly via the command line below:

```
make flash
```

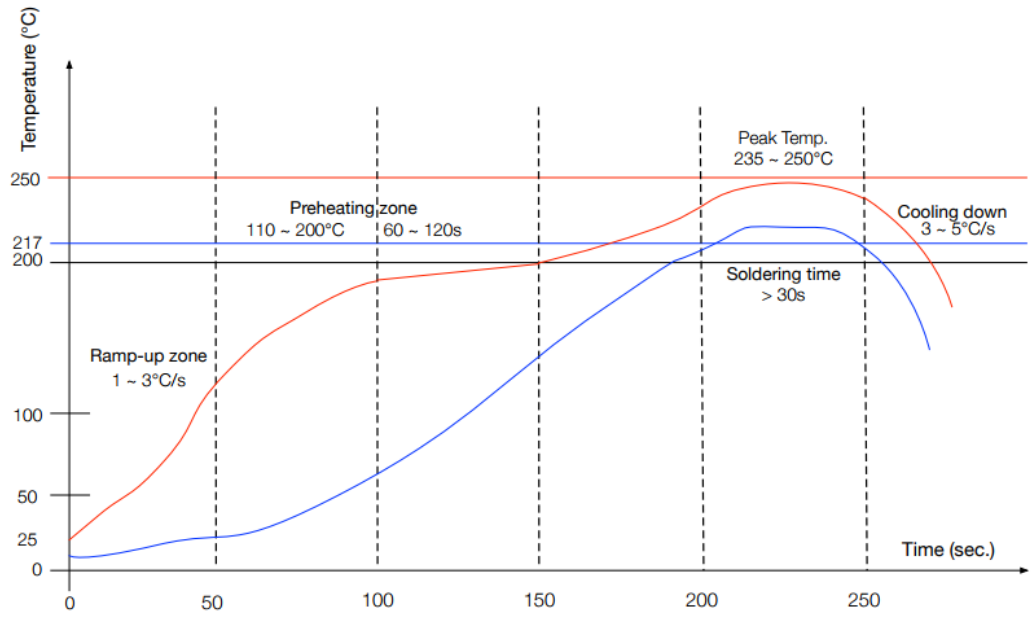
Notes:

- *Please configure the serial port according to actual situation.*
- *Only DIO mode is supported currently. QIO mode would be supported afterwards.*
- *For more information on ESP-IDF, please see ESP-IDF Getting Started Guide.*

Package size



Reflow profile



Ramp-up zone (升温区): Temp. <150°C, Time 60 ~ 90s, Ramp-up rate 1 ~ 3°C/s.
Preheating zone (预热恒温区): Temp. 150 ~ 200°C, Time 60 ~ 120s, Ramp-up rate 0.3 ~ 0.8°C/s.
Reflow soldering zone (回流焊接区): Peak Temp. 235 ~ 250°C (<245°C recommended), Time 30 ~ 70s.
Cooling down zone (冷却区): Temp. 217 ~ 170°C, Ramp-down rate 3 ~ 5°C/s.
Sn&Ag&Cu Lead-free solder (SAC305)/焊料为锡银铜合金无铅焊料

FCC Label: The FCC ID is on the front of the device. It is easily visible. The device FCC ID is 2AL85-LUX-32.

A label with the following statements must be attached to the host end product: This device contains FCC ID: 2AL85-LUX-32.

The manual provides guidance to the host manufacturer will be included in the documentation that will be provided to the OEM.

The module is limited to installation in mobile or fixed applications.

The separate approval is required for all other operating configurations, including portable configurations and different antenna configurations.

The OEM integrators are responsible for ensuring that the end-user has no manual or instructions to remove or install module.

The module is limited to OEM installation ONLY.

Module grantee (the party responsible for the module grant) shall provide guidance to the host manufacturer for ensuring compliance with the Part 15 Subpart B requirements.

The host manufacturer is responsible for additional testing to verify compliance as a composite system. When testing the host device for compliance with the Part 15 Subpart B requirements, the host manufacturer is required to show compliance with the Part 15 Subpart B while the transmitter module(s) are installed and operating. The modules should be transmitting and the evaluation should confirm that the module's intentional emissions are compliant (i.e. fundamental and out of band emissions) with the Radio essential requirements. The host manufacturer must verify that there are no additional unintentional emissions other than what is permitted in the Part 15 Subpart B or emissions are complaint with the Radio aspects.

FCC RF Exposure Requirements

This device complies with FCC RF radiation exposure limits set forth for an uncontrolled enviroment.

The antenna(s) used for this transmitter must not be co-located or operating in conjunction with any other antenna or transmitter and must be installed to provide a separation distance of at least 20cm from all persons.

FCC Regulations

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.

This device 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.

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.

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