

supports LoRaWAN protocol on the worldwide frequency and (G)FSK, BPSK, (G)MSK, and LoRa modulations. (Learn more about [LoRa-E5](#))



LoRa-E5 (STM32WLE5JC)



RFM95 and RFM95W

Core	32-bit Arm Cortex-M4 CPU, up to 48MHz	NONE
LoRaWAN stack	Built-in with AT Command Firmware; Program with STM32Cube MCU Package	NONE
Package	12*12mm, 28 pins SMD	16*16mm, 16 pins SMD
Interfaces	UART*3, I2C*1, ADC(12-bit)*1, SPI*1, GPIO*6	SPI*1, DIO*6
Sensitivity	-116.5dBm(SF5), -121.5dBm(SF7), -136dBm(SF12)	-111dBm ~ -148dBm
Modulation	LoRa, (G)FSK, (G)MSK and BPSK	LoRa, (G)FSK, (G)MSK and OOK
Certificate	FCC and CE (EU868/US915)	NONE
Power Supply	1.8V ~ 3.6V	1.8V ~ 3.7V
RF Output Power	up to +20.8 dBm at 3.3V	up to +20 dBm

LoRa-E5 mini leads out all GPIOs of LoRa-E5, including UART, ADC, SPI, IIC, and etc. It contains RESET and BOOT buttons and is use-friendly. Supporting LoRaWAN protocol, LoRa-E5 mini features ultra-long-range transmission and ultra-low power consumption: it is able to achieve a transmission range of up to 10 km, and the sleep current of LoRa-E5 modules on board is as low as 2.1 uA(WOR mode). It is designed with industrial standards with a wide working temperature at -40 °C ~ 85°C, high sensitivity between -116.5dBm ~ -136 dBm, and power output up to +20.8 dBm at 3.3V.

Other than the LoRa-E5 mini, we also provide other choices including the LoRa-E5 Development Board carrying more complex interfaces and features to unlock the more powerful performance of the LoRa-E5 module. It provides a broader range of access protocols and superabundant types of interfaces. Thus you are able to test and prototype the module rapidly with RS-485, Grove interfaces, and rich GPIOs. (Learn more about [LoRa-E5 Development Board](#))

Since LoRa-E5 is a LoRaWAN chip with an MCU, there are three main ways to utilize the LoRa-E5 mini:

1. Connect LoRa-E5 mini to PC and control by AT commands

There is a built-in USB to UART function on board, you could connect the LoRa-E5 mini to your PC with a USB type C cable, and use serial communication software to send AT commands and read data from the board.

2. Connect LoRa-E5 mini to another mainboard via UART and control by AT commands

For example, connect LoRa-E5 mini to Seeeduno XIAO and the Expansion Board via UART, and send AT commands and read data from Seeeduno XIAO through Arduino IDE serial monitor.

3. User Application Development by using SDK

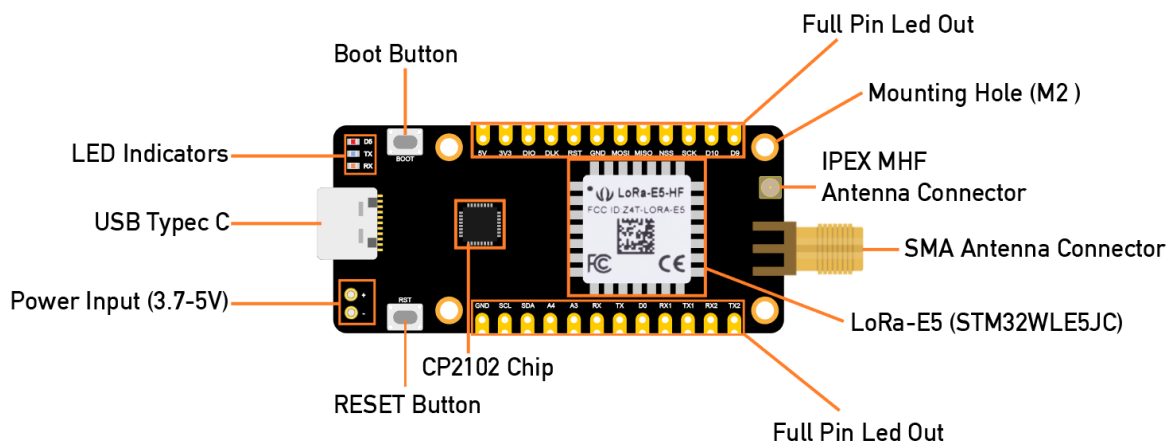
Develop your own LoRa development board with MCU function by using STM32Cube Programmer, which is the SDK officially provided by STMicroelectronics. To download this SDK resource, please find the resources in learning and document down below.

With all the outstanding features listed above, the LoRa-E5 mini will be a superior choice for IoT device development, testing, prototyping, and applications in long-distance, ultra-low power consumption IoT scenarios like smart agriculture, smart office, and smart industry.

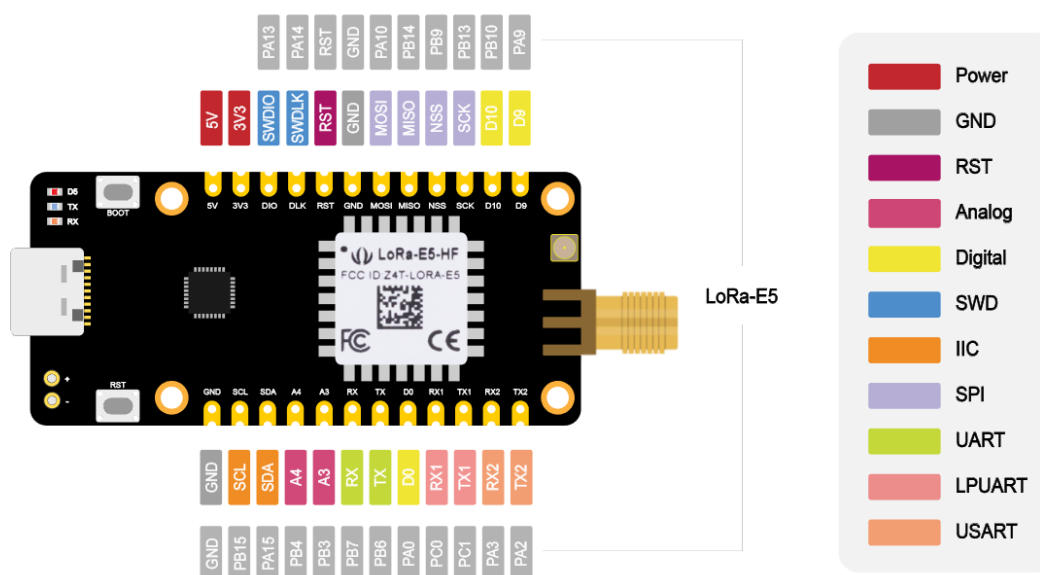
If you are unfamiliar with LoRa and LoRaWAN technology, please check out this blog [LoRapedia](#) in detail.

Hardware Overview

LoRa-E5 mini Hardware Specification

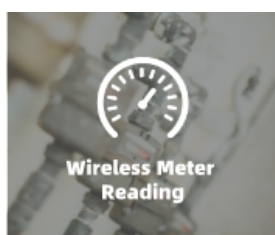


LoRa-E5 mini Pinout



Applications

- LoRa-E5 module Easy testing
- Rapid small-dimension prototyping of LoRa devices with LoRa-E5
- Any long-distance wireless communication application development
- LoRa and LoRaWAN application learn and research



Application Note

For more detailed information about how to use LoRa-E5, please visit [LoRa-E5 \(STM32WLE5JC\) Module Wiki](#).

1. Factory AT Firmware

LoRa-E5 series has a built-in AT command firmware, which supports LoRaWAN Class A/B/C protocol and a wide frequency plan: EU868/US915/AU915/AS923/KR920/IN865. With this AT command firmware, users can easily and quickly build their prototype or application.

The AT command firmware contains a bootloader for DFU and the AT application. The "PB13/SPI_SCK/BOOT" pin is used to control LoRa-E5 to stay in the bootloader or jump to the AT application. When PB13 is HIGH, the module will jump to AT application after reset, with a default baud rate of 9600. When PB13 is LOW (press the "Boot" button on LoRa-E5 Dev Board or LoRa-E5 mini), the module will stay in the bootloader, and keep transmitting "C" character every 1S at baud rate 115200.



Attention

1. Factory AT Firmware is programmed with RDP(Read Protection) Level 1, developers need to remove RDP first with STM32Cube Programmer. Note that regression RDP to level 0 will cause a flash memory mass to erase and the Factory AT Firmware can't be restored again.
2. The "PB13/SPI_SCK/BOOT" pin on the LoRa-E5 module is just a normal GPIO, not the "BOOTo" pin of the MCU. This "PB13/SPI_SCK/BOOT" pin is used in the bootloader of the Factory AT firmware, to decide to jump to APP or stay in bootloader(for DFU). The real "BOOTo" pin doesn't pinout to the module, so developers need to be careful when developing low-power applications.

2. Clock Configuration

2.1 HSE

- 32MHz TCXO
- TCXO power supply: PBo-VDD_TCXO

2.2 LSE

32.768KHz crystal oscillator

3. RF Switch

LoRa-E5 module ONLY transmits through RFO_HP:

- Receive: PA4=1, PB5=0
- Transmit(high output power, SMPS mode): PA4=0, PB5=1

Specifications

Parameters

Specifications

Parameters	Specifications
size	50*23mm
voltage - supply	3.7V - 5V
power - output	up to +20.8 dBm at 3.3V
working frequency	868/915MHz
protocol	LoRaWAN
sensitivity	-116.5 dBm ~ -136 dBm
interfaces	USB Type C / 2P-2.54mm Hole / 1*12P-2.54mm Header*2 / SMA-K / IPEX
modulation	LoRa, (G)FSK, (G)MSK, BPSK
working temperature	-40°C ~ 85°C
current	LoRa-E5 module sleep current as low as 2.1uA (WOR mode)

Part List:

LoRa-E5 mini *1

Antenna(EU868/US915) *1

USB TypeC (20cm) *1

Sticker *1

1X12pin male pin headers *2

Dimension

