

LoRa-E5 STM32WLE5JC Module, embedded SX126X and MCU for LoRaWAN Wireless Sensor Network & IoT devices - EU868 & US915



Features

- **Ultra-low Power Consumption:** as low as 2.1uA sleep current (WOR mode)
- **Extremely Compacted Size:** 12mm * 12mm * 2.5mm 28 pins SMT
- **High Performance:** TXOP=22dBm@868/915MHz; -136.5dBm sensitivity for SF12 with 125KHz BW
- **Long Distance Use:** 158dB link budget
- **Wireless Connectivity:** Embedded LoRaWAN® protocol, AT command, support global LoRaWAN® frequency plan
- **Worldwide Compatibility:** wide frequency range; EU868/US915/AU915/AS923/KR920/IN865
- **Great Flexibility:** For customers who want to develop software on the MCU of the module, other GPIOs of the MCU can be easily manipulated, including UART, I2C, ADC, etc. These rich GPIO interfaces are useful for users who need to expand peripherals.
- **FCC and CE Certified**

This LoRa E5 module is designed with industrial standards, hence it's highly suitable to be used in designing industrial IoT products, with a wide working temperature at -40°C ~ 85°C.

LoRa-E5 is a low-cost, ultra-low power, extremely compact, and high-performance LoRaWAN Module designed by Seeed Technology Co., Ltd. It contains ST system-level package chip STM32WLE5JC, and STM32WLE5 is the first SoC integrated with the combo of LoRa RF and MCU chip. This module is also embedded with ARM Cortex M4 ultra-low-power MCU and LoRa SX126X and therefore supports (G)FSK mode and LoRa.

The previous versions of the LoRaWAN module all require additional use of MCU (Microcontroller) to run the application code. Now, you can directly and immediately put the LoRa-E5 STM32WLE5JC Module into use to complete this process without the hustle of additional accessories. With the Stamp Hole form factor, LoRa-E5 enables you to integrate this module on your device's mainboard conveniently. You don't need to waste time and effort on designing your own device from scratch with the use of MCU and LoRa chip. Moreover, the module has already been certificated, so your completed device can be certified and approved by any agency cheaply and rapidly. Thanks to the innovative design, LoRa-E5 has a comparatively lower cost than other LoRaWAN modules. This will greatly save your budget in the whole process of product design.

LoRa-E5 LoRaWAN® module is highly suitable for long-distance, ultra-low-power applications such as smart agriculture, smart city, wireless meter reading, sensor networks, wireless communication, and other low-power wide-area IoT scenarios. If you want a module to design your own LoRaWAN sensor, to construct IoT nodes, or to support any wireless communication applications, LoRa-E5 is the premium choice that provides you with an optimal user experience.

If you are not quite familiar with LoRa and would like to learn more about it including what is LoRa? How does LoRa function? What are the pros and cons of LoRa? LoRa and LoRaWAN, LoRa network architecture, and applications of LoRa, etc., please check out this article [LoRapedia, which introduces LoRa and LoRaWAN in detail.](#)



LoRa-E5 (STM32WLE5JC)

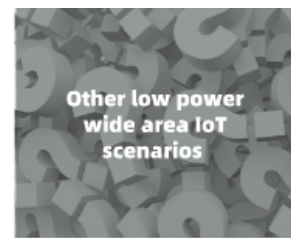
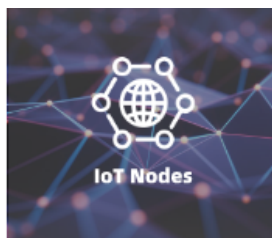


RFM95 and RFM95W

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

Applications

Works for LoRaWAN sensor nodes and any wireless communication application.



Would like to learn more about the application scenarios of LoRa technologies? Please check out the following real-world use cases of Seeed Industrial-grade LoRa devices - the SenseCAP LoRaWAN series.

Since SenseCAP LoRaWAN series products are targeting environmental-monitoring, especially in outdoor scenarios, such as smart agriculture, smart city, etc., the above use cases are mainly in these fields. There are many fields to explore scenarios such as smart metering for water, electricity, & gas; and smart homes, and other applications that need low-power, long-range remote monitoring. After designing your own LoRa devices with this LoRa-E5 module, you can get your designs verified quickly with Seeed Fusion PCB and PCBA services, which can help turn your designs into prototypes in a few days. And when the design is verified, Seeed agile manufacturing services will help you scale up the prototypes into mass production, with services from Design for Manufacturing, procuring raw materials, to mass production and global shipment, and many services in between. Contact us at [iot\[at\]seeed\[dot\]cc](mailto:iot@seeed.cc) should you have any questions or need further info.

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, customers 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.



Attentions:

1. Factory AT Firmware is programmed with RDP(Read Protection) Level 1, customers 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 "BOOT0" 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 "BOOT0" pin doesn't pinout to the module, so customers 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

ITEMs	Parameter	Specifications	Unit
Structure	Size	12(W)*12(L)*2.5(H)	mm
	Package	28 pins, SMT	
Electrical Characteristics	power supply	3.3V type	V
	sleep current	2.1uA(WDT on)	uA
	Operation current (Transmitter+MCU)	50mA @10dBm in 434MHz type	mA
		111mA @22dBm in 470MHz type	
		111mA @22dBm in 868MHz type	
	Operation current (Receiver+MCU)	6.7mA @BW125kHz, 868MHz type	mA
		6.7mA @BW125kHz, 434MHz type	
6.7mA @BW125kHz, 470MHz type			
Output power	10dBm max @434MHz	dBm	
	22dBm max @470MHz		
	22dBm max @868MHz		
Sensitivity	@SF12, BW125kHz	dBm	
	Fr(MHz) min type max		
	434 - -134.5 -136		
	470 - -136.5 -137.5		
	868 - -135 -137		

ITEMs	Parameter	Specifications	Unit
	Harmonics	< -36dBm below 1GHz	dBm
		< -40dBm above 1GHz	dBm
Interface	RFIO	RF port	
	UART	3 group of UART, include 2 pins	
	I2C	1 group of I2C, include 2 pins	
	ADC	1 ADC Input, include 1 pins, 12-bit 1Msps	
	NRST	Manual reset pin input	
	SPI	1 group of SPI, include 4 pins	