E71-2G4M10S1A User Manual

TL7215D BLE6.0 SOC SMD Wireless Module



Chengdu Ebyte Electronic Technology Co.,Ltd.

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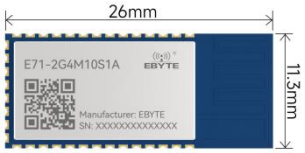
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1. Overview

1.1 Introduction

The E71-2G4M10S1A module is a multi-protocol wireless communication module designed based on the Telink TL7215D SoC. It features long communication distance, low power consumption, excellent anti-interference capability, multiple interface options, powerful processing capabilities, and small size. The E71-2G4M10S1A wireless communication module requires secondary development by the user and can be widely used in the IoT industry.



1.2 Features

- Global license-free ISM 2.4GHz band;
- Supported protocols: BLE 6.0, Zigbee, Thread, Matter, and 2.4GHz proprietary protocol;
- Features a external 24MHz high-precision industrial-grade crystal oscillator for stable module operation;
- Dormant current as low as 1μA;
- Maximum transmit power 10dBm.

1.3 Application Scenarios

- Car keys, access control systems;
- Automotive electronics applications;
- Smart remote control;
- Location services;
- Healthcare;
- Wireless alarm security system ;
- Smart home and industrial sensors , etc.

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2.Specification and Parameter

2.1 Product Selection Comparison

Product Model	Chip Solutions	Carrier Frequency ① GHz	Transmit Power ② dBm	Communication Distance ③ m	Product Size ④ mm	Antenna Type ⑤
E71-2G4M10S1A	TL7215D	2.4	10	150	11.3 * 26.0	PCB

Note:

① Communication channel: User-programmable settings are supported within the channel range;

② Transmit power: 10dBm, adjustable in multiple levels; refer to this document for details of power levels;

③ Communication distance: In clear, open conditions, with the antenna mounted at a height of 2 meters, using BLE and an airspeed of 1 Mbps, the communication distance is approximately 150 meters (for reference only; actual testing is recommended);

④ Product dimensions: tolerance ±0.2mm;

⑤ Antenna type: PCB antenna, equivalent impedance approximately 50Ω.

2.2 Basic Parameters

Conditions: Tc = 25℃, VBAT = 3.3V

Parameter	Description
Chip Model	TL7215D
Kernel	RISC-V
RAM	256 KB
FLASH	1024 KB
Crystal oscillator	24MHz, built-in passive crystal oscillator, no internal 32.768KHz low-frequency crystal oscillator.
Interface	UART, SPI, I²C, GPIO, ADC, PWM It needs to be developed and set by the user.
Package	1.27mm stamp hole spacing
Weight	1.0g±0.1g
Work Environment	
Operating temperature	-40℃~+85℃, industrial-grade standard
Operating humidity	10~95% RH, without condensation
Storage temperature	-40℃~+125℃
RF Parameters	
Transmit power	10dBm, multi-level adjustable power

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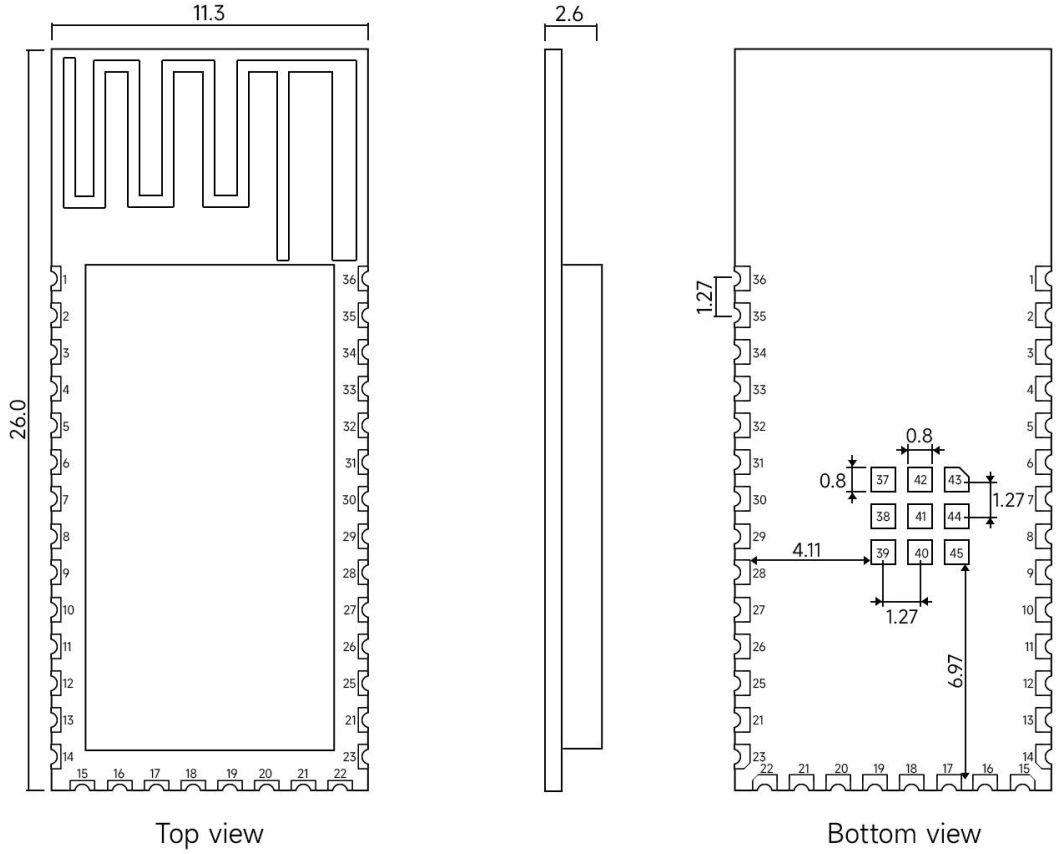
Parameter	Description
Operating frequency band	2.4GHz
Receiving sensitivity	-104.5 dBm @Long Range 125 Kbps
	-96 dBm @Bluetooth LE 1 Mbps
	-93 dBm @Bluetooth LE 2 Mbps
Electrical Parameters	
Power supply voltage	VBAT: 1.8V~4.3V, with a minimum of 3.3V power supply recommended (≥3.7V can guarantee transmission power). Supplying over 4.3V may burn out the module.
	VBUS: 4.5V~5.5V. Supplying over 5.5V may burn out the module.
Communication level	3.3V or 1.8V optional (there will be limitations when using VBAT power supply, please refer to the TL7215D datasheet for details)
Emission current	≈22mA, instantaneous power consumption
Receiving current	≈9mA
Dormant current	≈1μA, software shutdown

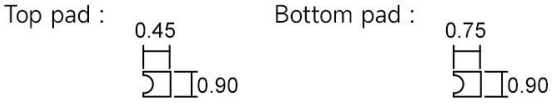
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3. Size and Pin Definitions

3.1 Size and Pin Definitions





Unit : mm
Pad quantity : 45
Tolerance value : X.X±0.2mm
X.XX±0.05mm

Pin No.	Pin Name	Pin Direction	Pin Applications
1	GND	-	Ground electrode, connected to power reference ground
2	PA4	Input/Output	Configurable general-purpose IO ports (refer to TL721X manual for details)
3	PA3	Input/Output	Configurable general-purpose IO ports (refer to TL721X manual for details)
4	PA2	Input/Output	Configurable general-purpose IO ports (refer to TL721X manual for details)
5	VIO_PE	Input	IO power supply pins for ports PE1~PE5, PE7, PA2~PA4, with DC 1.8V or 3.3V
6	PA5	Input/Output	Configurable general-purpose IO port/USB_DM (refer to TL721X manual for details)

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Pin No.	Pin Name	Pin Direction	Pin Applications
7	PA6	Input/Output	Configurable general-purpose IO ports/USB_DP (refer to TL721X manual for details)
8	PA7	Input/Output	Configurable general-purpose IO ports/SWS (refer to TL721X manual for details)
9	PB4	Input/Output	Configurable general-purpose IO ports (refer to TL721X manual for details)
10	VIO_PB	Input	IO power supply pins for ports PB4~PB7, PC0, PA7, with DC 1.8V or 3.3V
11	PE7	Input/Output	Configurable general-purpose IO ports (refer to TL721X manual for details)
12	PE5	Input/Output	Configurable general-purpose IO ports (refer to TL721X manual for details)
13	PE4	Input/Output	Configurable general-purpose IO ports (refer to TL721X manual for details)
14	GND	-	Ground electrode, connected to power reference ground
15	PE3	Input/Output	Configurable general-purpose IO ports (refer to TL721X manual for details)
16	PE2	Input/Output	Configurable general-purpose IO ports (refer to TL721X manual for details)
17	PE1	Input/Output	Configurable general-purpose IO ports (refer to TL721X manual for details)
18	PB5	Input/Output	Configurable general-purpose IO ports (refer to TL721X manual for details)
19	PB6	Input/Output	Configurable general-purpose IO ports (refer to TL721X manual for details)
20	PB7	Input/Output	Configurable general-purpose IO ports (refer to TL721X manual for details)
21	PC0	Input/Output	Configurable general-purpose IO ports (refer to TL721X manual for details)
22	VO1V8	Output	Module 1.8V output pin
23	GND	-	Ground wire, connected to power reference ground
24	VBUS	Input	Power input, DC 4.5V~5.5V
25	VBAT	Input	Power input, DC 1.8V~4.3V
26	VO3V3	Output	Module 3.3V output pin
27	RESET	Input	Reset pin, low level reset
28	PD0	Input/Output	Configurable general-purpose IO ports (refer to TL721X manual for details)
29	PD2	Input/Output	Configurable general-purpose IO ports (refer to TL721X manual for details)
30	PD3	Input/Output	Configurable general-purpose IO ports (refer to TL721X manual for details)
31	NC	-	Empty pin
32	NC	-	Empty pin
33	VIO_PD	Input	IO Power supply pins for ports PD0, PD2~PD3, with DC 1.8V or 3.3V
34	NC	-	Empty pin
35	NC	-	Empty pin
36~45	GND	-	Ground electrode, connected to power reference ground

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4. Basic Operation

4.1 Hardware Design

- It is recommended to use a DC regulated power supply to power this module, with the power supply ripple coefficient as small as possible, and the module must be reliably grounded;
- Please ensure the correct connection of the positive and negative power terminals. Reversing the connection may cause permanent damage to the module;
- Please check the power supply and ensure it is within the recommended voltage range. Exceeding the maximum value will cause permanent damage to the module;
- Please check the power supply stability; the voltage should not fluctuate significantly and frequently;
- When designing power supply circuits for modules, it is often recommended to retain a margin of more than 30% to ensure long-term stable operation of the entire device;
- The module should be kept as far away as possible from parts with high electromagnetic interference such as power supplies, transformers, and high-frequency traces;
- High-frequency digital traces, high-frequency analog traces, and power traces must avoid the area under the module. If it is absolutely necessary to run the traces under the module, assuming the module is soldered on the Top Layer, lay ground copper on the Top Layer of the module contact area (all covered by copper and well grounded), and run the traces close to the digital part of the module on the Bottom Layer;
- Assuming the module is soldered or placed in the Top Layer, it is also wrong to arbitrarily route traces in the Bottom Layer or other layers, as this will affect the module's stray emissions and reception sensitivity to varying degrees;
- If there are devices around the module that cause significant electromagnetic interference, it will greatly affect the module’s performance. Depending on the intensity of the interference, it is recommended to keep them away from the module. If possible, appropriate isolation and shielding can be implemented;
- If there are large electromagnetic interference lines (high-frequency digital, high-frequency analog, power lines) around the module, it will also significantly affect the performance of the module. Depending on the intensity of the interference, it is recommended to keep them away from the module. If possible, appropriate isolation and shielding can be implemented;
- If 5V power supply is used, the module must be powered by the VBUS port;
- If 3.3V power supply is used, the module must be powered by the VBAT port (with certain limitations; please refer to the TL721X datasheet for details);
- If the communication line uses 3.3V or 1.8V, the VIO_P (A, B, C, D, E...) needs to be shorted to the power supply with the required communication voltage;
- Do not install the antenna inside a metal housing, as this will significantly reduce the transmission range.
- It is recommended to add a 200R protection resistor to the RXD/TXD of the external MCU.

4.2 Software Programming

- This module has a built-in RF chip , TL7215D , and users can operate it completely according to the datasheet of the TL721X chip.
- It should be noted that the three pins PA5, PA6, and PA7 are special pins, which have no other functions besides

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their specific functions; for example, PA5 & PA6 are USB function pins and PA7 is a Telink download pin, and they cannot be reused as other function pins;

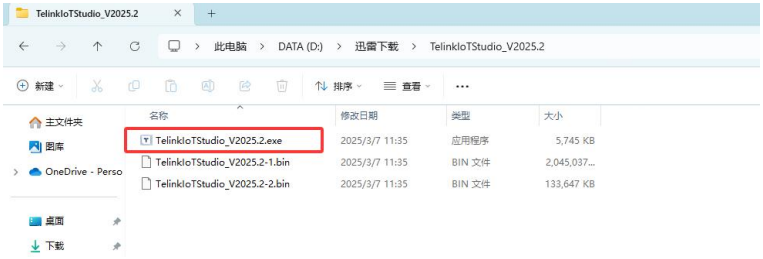
- For more details, please refer to the SDK program provided by Telink Microelectronics:Telink | TL721x series;
- For more details, please refer to the sample program provided by Ebyte.

4.3 Environment Setup

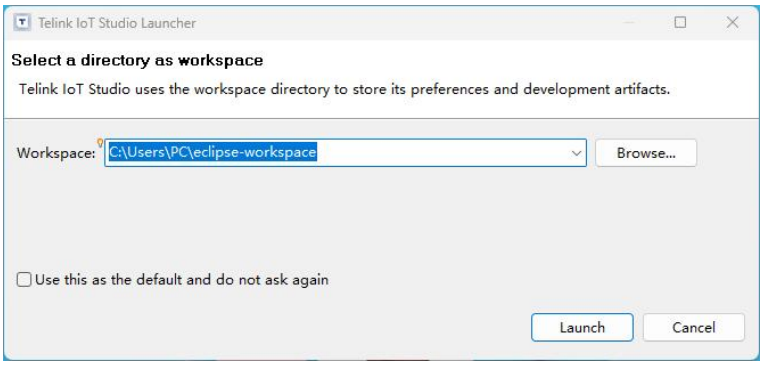
1. Click the link to visit the Telink official website (Telink | Development Tools).
2. Download the Burning and Debugging Tool.
3. Download Telink IoT Studio



4. Double-click the exe file to install (just keep clicking next).



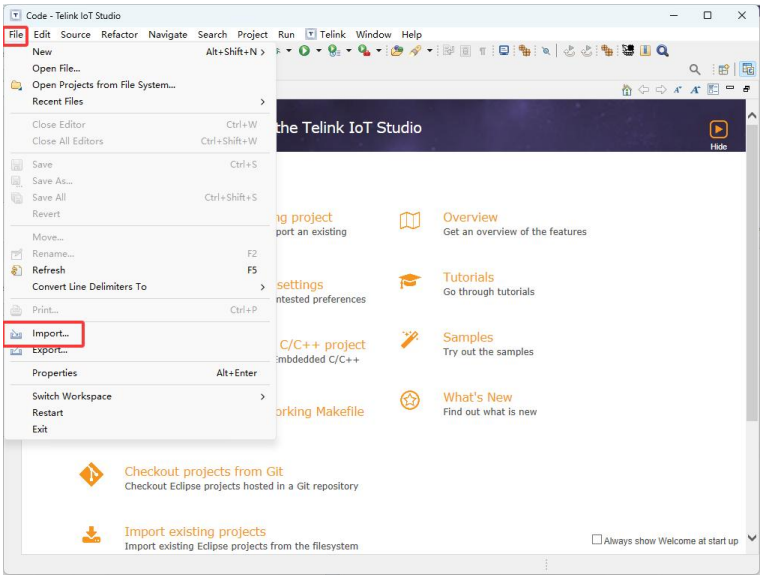
5. Open Telink IoT Studio and select a path as workspace, depending on your needs.



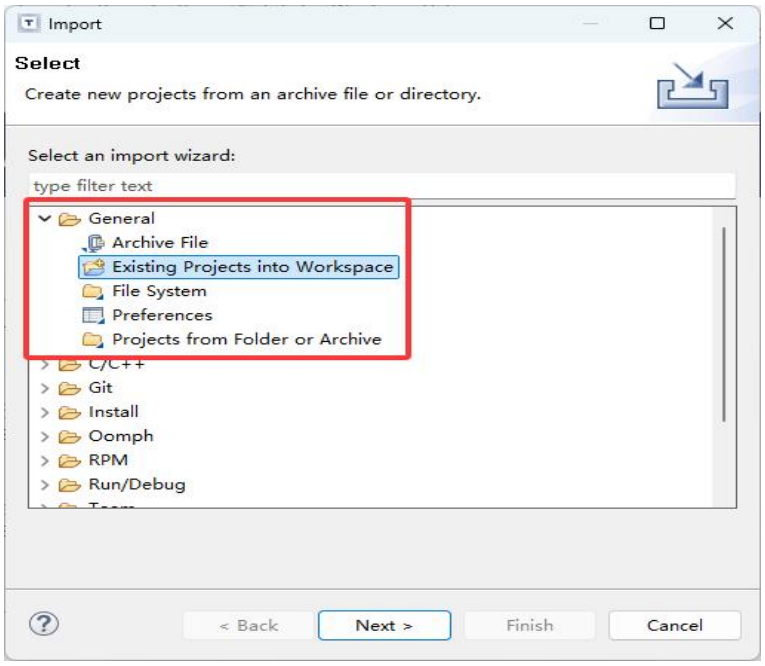
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6. Find File in the top left corner and then select Import...



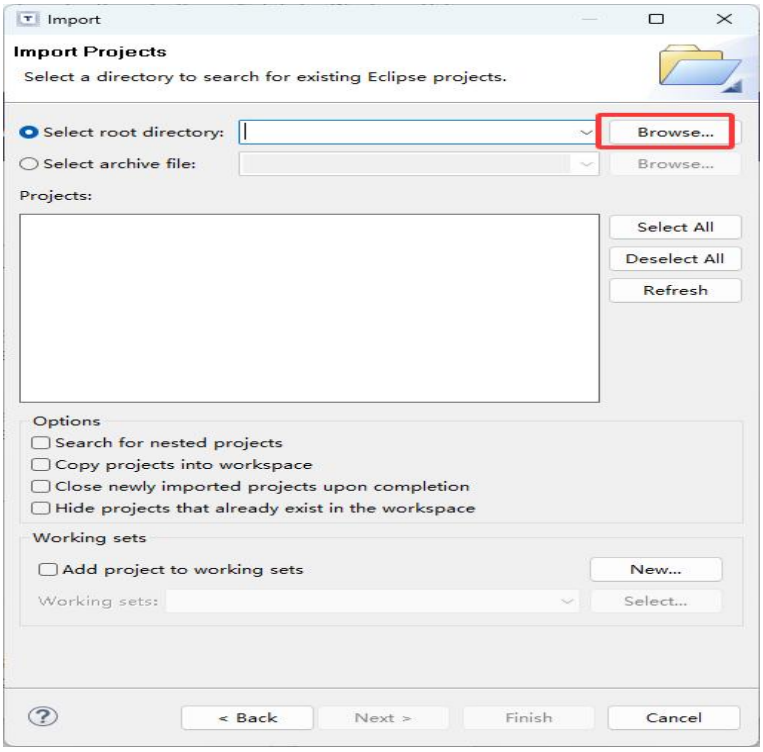
7. Select General, then Expeditions..., and click next.



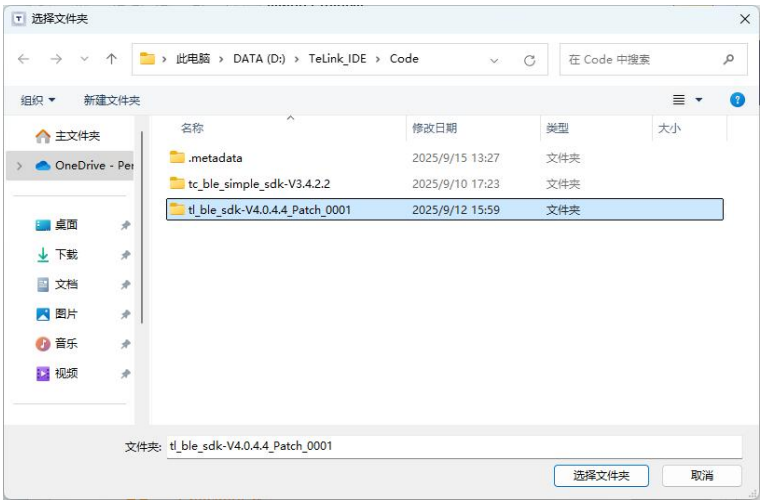
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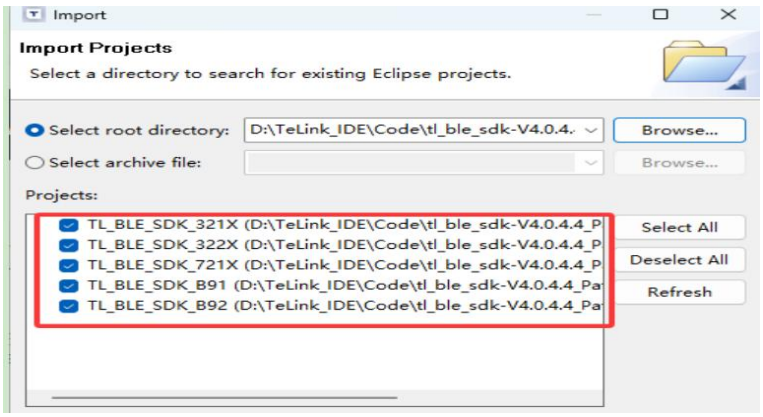
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8. After entering, click Browse... and select the SDK from the official website or the provided demo.



9. Select the SDK file, check the projects box below according to your chip model, and click Finish.

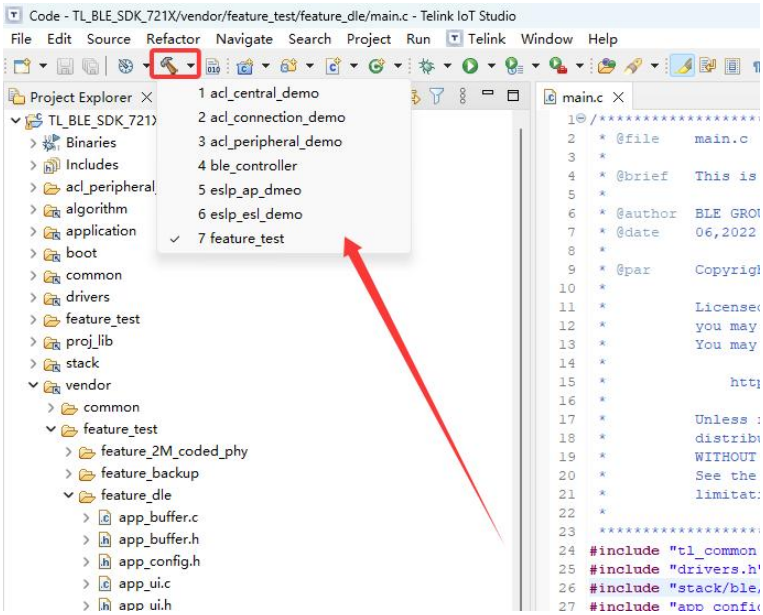




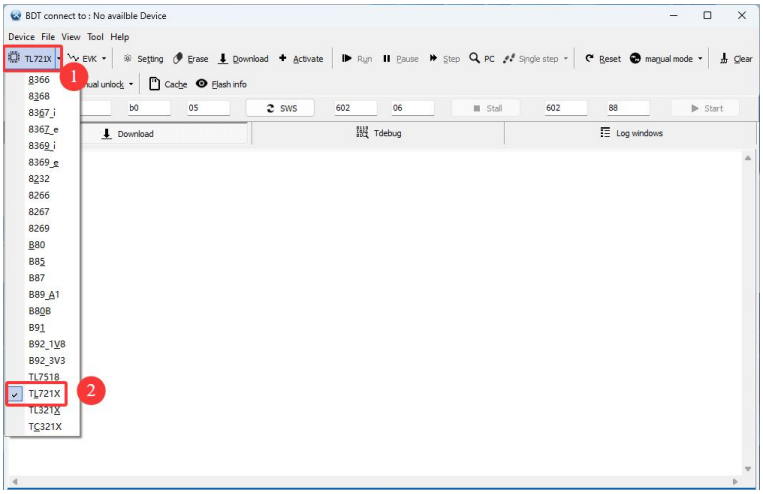
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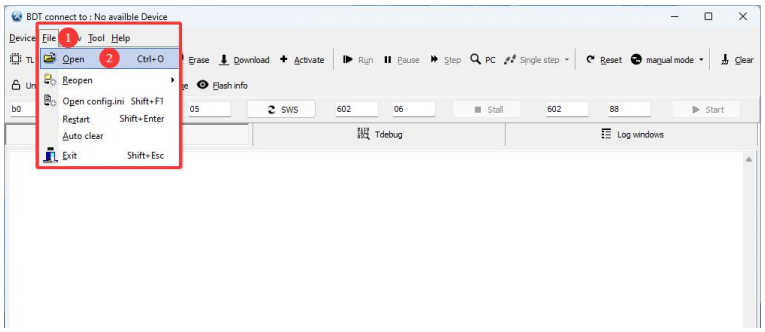
10. Click the dropdown menu next to the hammer icon, select the relevant project demo file, and then click the hammer to build the application.



11. Open the BDT tool and select the chip model.



12. After selecting the model, click File and locate the Bin file according to the project path.



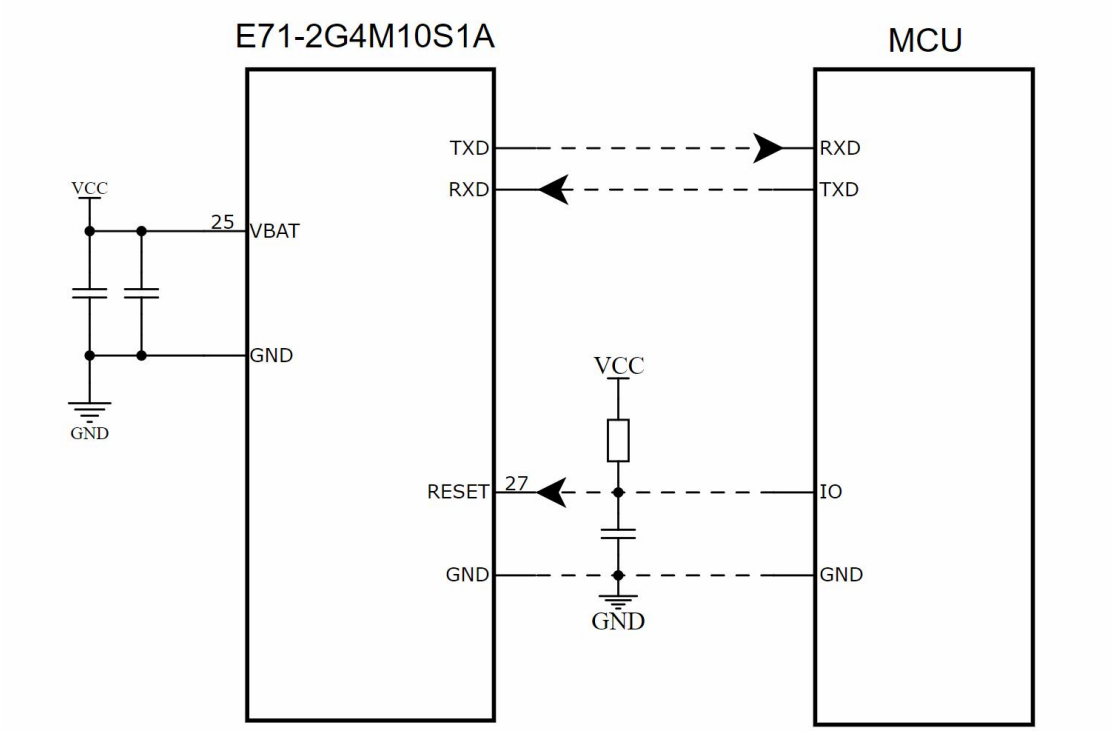
13. Click Activate then click Download only when the MCU is detected.
14. A reset is required for the code to run properly after being flashed.

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5. Recommended Circuits

5.1 Recommended Circuit Diagram



Note: The TXD and RXD pins of this module are defined by the customer according to the chip manual.

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6. FAQ

6.1 Transmission Distance Is not Ideal

- When there are obstacles in line-of-sight communication, the communication distance will be reduced accordingly;
- Temperature, humidity, and co-channel interference can lead to an increased communication packet loss rate;
- Ground absorption and reflection of radio waves result in poor test performance when close to the ground;
- Seawater strongly absorbs radio waves, leading to poor performance in tests conducted near the seashore;
- If there are metal objects near the antenna or it is placed inside a metal casing, the signal attenuation will be extremely severe;
- Power register was set incorrectly, air data rate is set as too high (the higher the air data rate, the shorter the distance);
- When the power supply at room temperature is lower than the recommended voltage, the lower the voltage is, the lower the transmission power is;
- Poor matching between the antenna and the module or problems with the quality of the antenna itself.

6.2 Module Is Easily Damaged

- Please check the power supply and ensure it is within the recommended voltage range. Voltage higher than the peak will lead to a permanent damage to the module.
- Please check the stability of the power supply and ensure the voltage should not fluctuate significantly or frequently.
- Please ensure anti-static operations during installation and use, as high-frequency components are sensitive to static electricity.
- Please ensure that the humidity is not too high during installation and use, as some components are humidity-sensitive.
- Unless there are special requirements, it is not recommended to use it at excessively high or low temperatures.

6.3 High Bit Error Rate

- If there is interference from a co-channel signal nearby, move away from the interference source or change the frequency or channel to avoid the interference;
- Check for interference on the UART line; the UART cable should not be too long;
- Poor power supply may also cause garbled characters, so it is essential to ensure the reliability of the power supply;
- Poor quality or excessive length of extension lines or feeder cables can also lead to a high bit error rate;

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7. Welding Operation Instructions

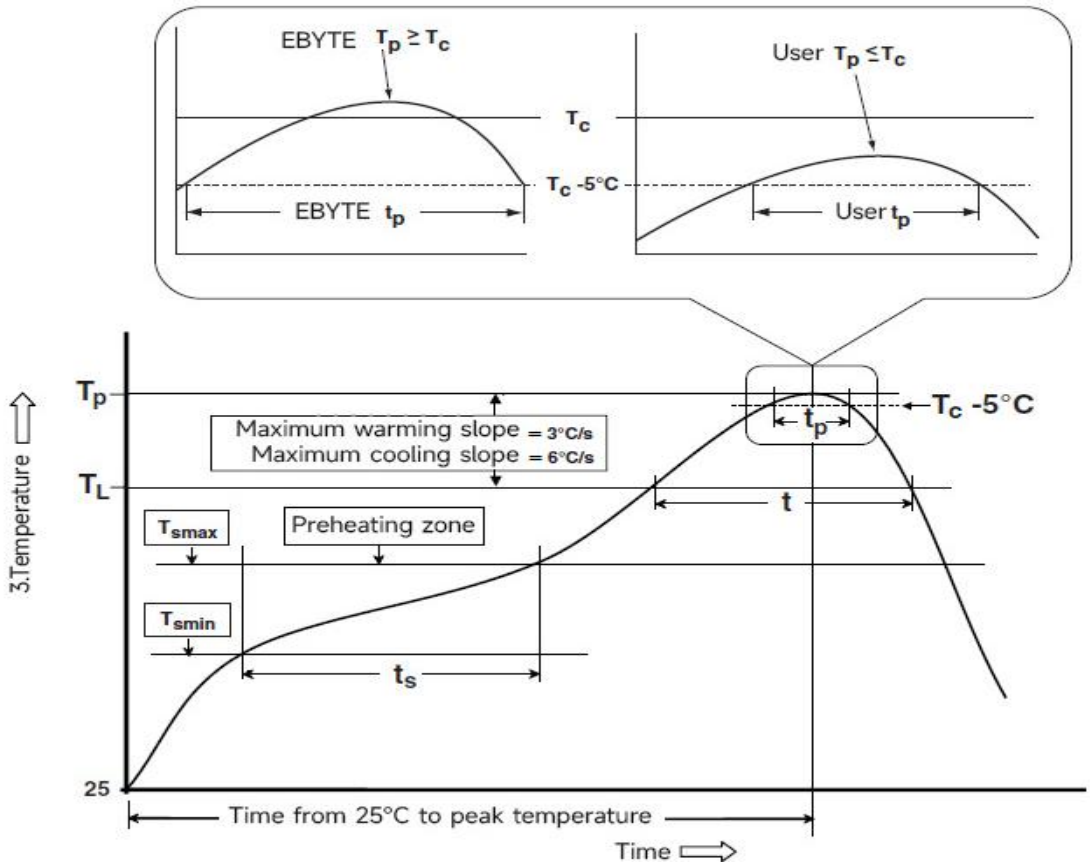
7.1 Reflow Soldering Temperature

Reflow soldering profile characteristics		Pb Assembly	Pb-free Assembly
Preheating/Insulation	Minimum temperature (Tsmin)	100℃	150℃
	Maximum temperature (Tsmax)	150℃	200℃
	Time (Tsmin ~ Tsmin)	60-120 seconds	60-120 seconds
Temperature rise slope (T_L ~ T_P)		3℃/second maximum value	3℃/second maximum value
Liquid phase temperature (T_L)		183℃	217℃
Holding time above T_L		60~ 90 seconds	60~ 90 seconds
Package peak temperature T_P		Users must not exceed the temperature specified on the product's "humidity sensitivity" label.	Users must not exceed the temperature specified on the product's "humidity sensitivity" label.
T_P within 5°C of the specified grading temperature (T_C) is shown in the figure below.		20 seconds	30 seconds
Cooling slope (T_P ~ T_L)		6℃/second maximum value	6℃/second maximum value
Time from room temperature to peak temperature		6 minutes, the longest	8 minutes, the longest
※The tolerance definition for the peak temperature (Tp) of the temperature curve is the user's upper limit.			

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7.2 Reflow Soldering Curve



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Revision History

Version	Revision Date	Revision Notes	Reviser
V1.0	2025-11-12	Initial version	Bin

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