E65-2G4T12S User Manual

2.4GHz 12dBm

High-speed continuous transmission wireless serial module



Chengdu Ebyte Electronic Technology Co.,Ltd.

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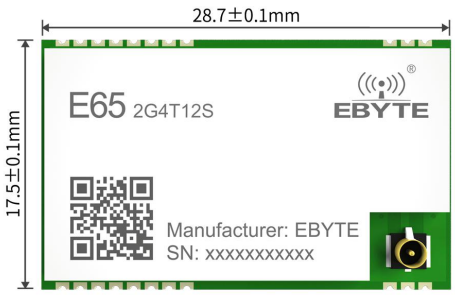
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1. Overview

1.1 Brief introduction



E65-2G4T12S is a 2.4GHz radio frequency wireless transceiver serial module product designed and produced by Ebyte. The product has the characteristics of point-to-point, high-speed continuous transmission, full-duplex communication etc., with frequency hopping algorithm to improve anti-interference ability, and is suitable for complex working environments.

It adopts small size SMD package, and the transmitting power can reach 12dbm. Full duplex continuous transmission, support up to 3 Mbps serial port baud rate, with the product hardware flow control, can realize the transmission of big data or files.

The design of dual antenna is optional (IPEX / stamp hole), which is convenient for user's secondary development and integration.

1.2 Features

- It supports bidirectional big data and file transmission;
- It supports ATcommand configuration;
- It supports hardware flow control;
- It supports up to 3mbps serial port baud rate;
- Air rate 1 ~ 3mbps adaptive;
- It supports communication distance up to 800 m;
- It supports point to point wireless communication;
- It supports ISM 2.4GHz frequency;
- It supports 3.6V power supply, more than 3.3V power supply can ensure the best performance;
- Industry standard design, support long-term use at -40 ~ 85 ℃;
- Stamp hole / IPEX antenna interface.

1.3 Applications

- Smart home and industrial sensors, etc.;
- Security system, positioning system;
- Wireless remote control, UAV;
- Wireless game remote control;
- Medical health products;
- Wireless voice, wireless headset;
- Application in the automotive industry.

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2. Parameters

2.1 Limit parameters

Table 2-1 Limit parameter table

Parameter	Performance		Remark
	Min.	Max.	
Power supply (V)	2.3	3.6	Over 3.6V, the module will be burned
Blocking power (dBm)	-	10	There is a probability of burning out in short distance use
Working temperature (℃)	-40	+85	Industrial grade

2.2 Working parameter

Table 2-2 Working parameter table

Parameter		Performance			Remark
		Min.	Typical	Max.	
Working Voltage (V)		2.3	3.3	3.6	The output power can be guaranteed if it is more than 3.3V
Communication level (V)		-	3.3	-	Risk of burn out when using 5V level
Working temperature (℃)		-40	-	+85	Industrial grade
Working frequency（MHz）		2400	-	2480	ISM frequency band
Power consumption	TX current (mA)	48	49	50	Average current, instantaneous current (Max) 120mA@3.3V
	RX current (mA)	47	48	49	Average current, instantaneous current (Max) 120mA@3.3V
Max TX power (dBm)		11	11.5	12	-
Receiving sensitivity (dBm)		-	-95	-	-
UART baudrate (bps)		1.2K	115.2K	3M	Default 115.2Kbps
Distance (m)		800			-
TX packet length		Continuous transmission			Continuous transmission does not limit packet length, pay attention to flow control and specific baud rate
Communication interface		UART serial port			See pin description for details
Packaging		SMD			See dimension description for details
Size (mm)		28.7 * 17.5			Length * width
RF interface		IPEX/Stamp hole			The equivalent impedance is about 50 Ω

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3. Dimensions and pin definition

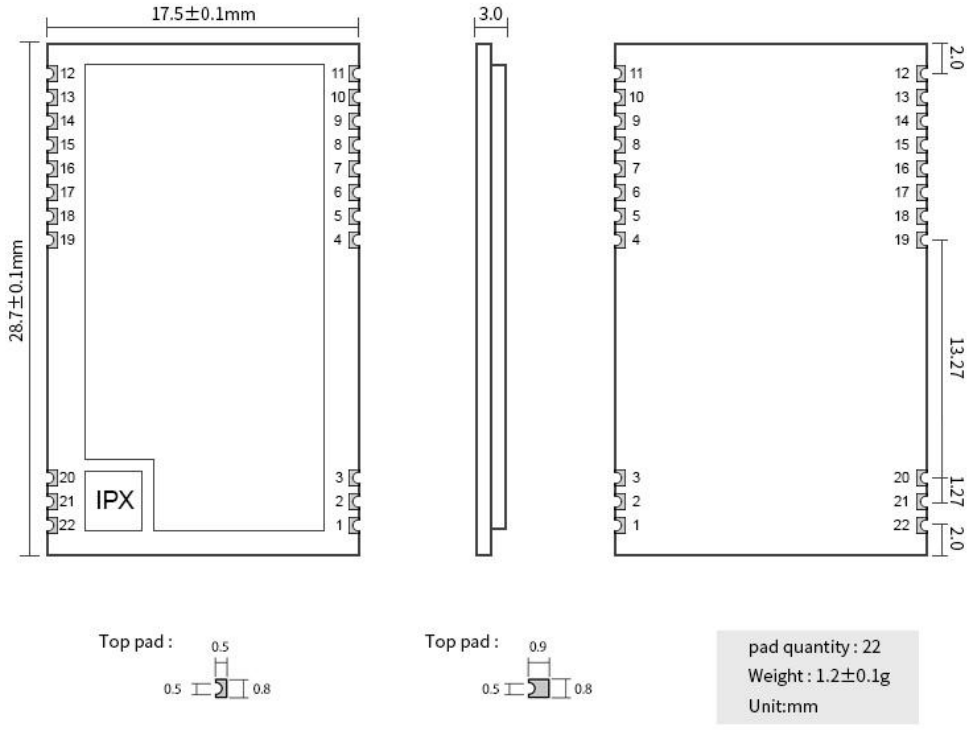


Figure 3-1 Dimensions and pin definitions

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Table 3 Pin definition table

No.	Pin	Direction	Description
1	GND	-	Ground
2	GND	-	Ground
3	GND	-	Ground
4	GND	-	Ground
5	RTS	Output	Send request, low level valid
6	CTS	Input	Send permission, low level valid
7	RXD	Input	TTL serial input, connected to external TXD output pin
8	TXD	Output	TTL serial output, connected to external RXD input pin
9	DATA	Output	Sending and receiving data indication pin, low level (Has data), high level (No data)
10	VCC	-	2.5 ~ 3.6V DC, 3.3V recommended
11	GND	-	Ground
12	NC	-	Reserved, suspended
13	GND	-	Ground
14	NC	-	Reserved, suspended
15	NC	-	Reserved, suspended
16	NRST	Input	Reset pin, low level valid
17	LINK	Output	Connection indicator pin: low level (connected), high level (not connected)
18	Mode	Input	Mode configuration pin: low level (transparent mode), high level (configuration mode)
19	GND	-	Ground
20	GND	-	Ground
21	ANT	-	Antenna
22	GND	-	Ground

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4. Basic operation

4.1 Hardware design

- It is recommended to use a DC stabilized power supply. The power supply ripple factor is as small as possible, and the module needs to be reliably grounded.;
- Please pay attention to the correct connection of the positive and negative poles of the power supply. Reverse connection may cause permanent damage to the module;
- Please check the power supply to ensure it is within the recommended voltage otherwise when it exceeds the maximum value the module will be permanently damaged;
- Please check the stability of the power supply, the voltage cannot be fluctuated frequently;
- When designing the power supply circuit for the module, it is often recommended to reserve more than 30% of the margin, so the whole machine is beneficial for long-term stable operation.;
- The module should be as far away as possible from the power supply, transformers, high-frequency wiring and other parts with large electromagnetic interference.;
- High-frequency digital routing, high-frequency analog routing, and power routing must be avoided under the module. If it is necessary to pass through the module, assume that the module is soldered to the Top Layer, and the copper is spread on the Top Layer of the module contact part(well grounded), it must be close to the digital part of the module and routed in the Bottom Layer;
- Assuming the module is soldered or placed over the Top Layer, it is wrong to randomly route over the Bottom Layer or other layers, which will affect the module's spurs and receiving sensitivity to varying degrees;
- It is assumed that there are devices with large electromagnetic interference around the module that will greatly affect the performance. It is recommended to keep them away from the module according to the strength of the interference. If necessary, appropriate isolation and shielding can be done;
- Assume that there are traces with large electromagnetic interference (high-frequency digital, high-frequency analog, power traces) around the module that will greatly affect the performance of the module. It is recommended to stay away from the module according to the strength of the interference. If necessary, appropriate isolation and shielding can be done.
- If the communication line uses a 5V level, a 1k-5.1k resistor must be connected in series (not recommended, there is still a risk of damage);
- Try to stay away from some physical layers such as TTL protocol at 2.4GHz , for example: USB3.0;
- The antenna installation structure has a great impact on the performance of the module. Be sure to ensure that the antenna is exposed, preferably vertically.When the module is installed inside the case, a high-quality antenna extension cable can be used to extend the antenna to the outside of the case;
- Do not install the antenna inside the metal case,it will greatly reduce the transmission distance;
- The on-board PCB antenna should avoid conductors or other sources of interference.

4.2 Quick start

(1) USB Connection

Connect the USB-to-serial device to the computer and confirm whether it has been recognized. Under the win10

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operating system, from the control panel -> Device Manager -> Port (COM and LPT), it will display the connected port number; or directly open the serial port assistant software to see if there are optional port numbers. As shown below:

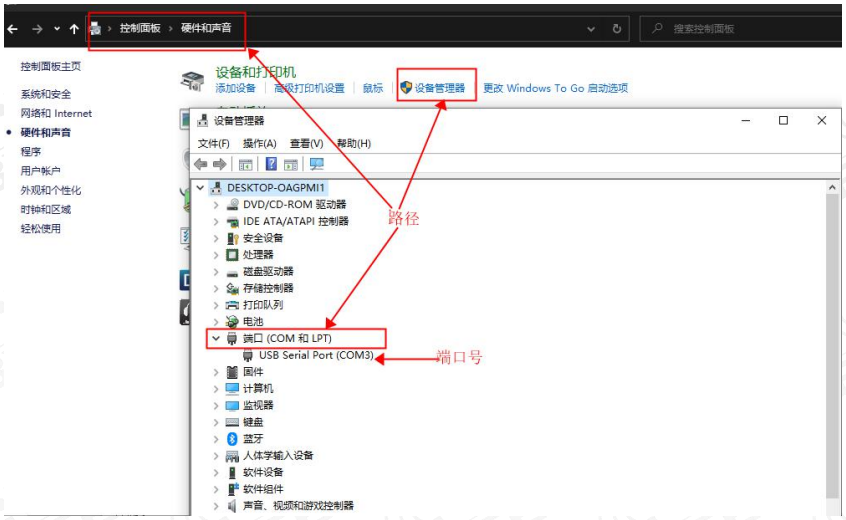


Figure 4-1 Device manager identification port

If the computer does not recognize the USB to serial port hardware, you need to download the corresponding driver.

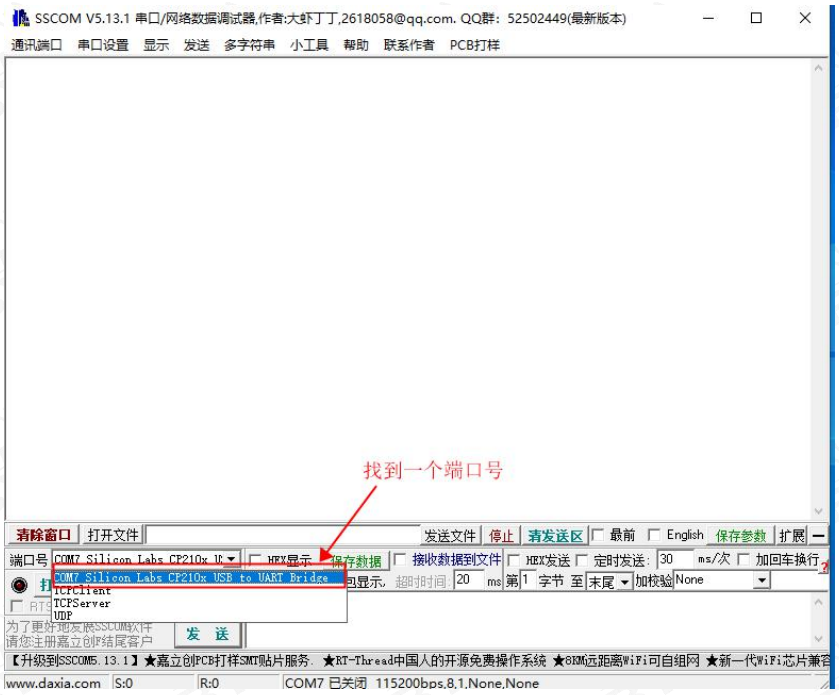


Figure 4-2 Serial port assistant software identification port

(2) Use the serial port assistant to open the serial port

Open the serial port assistant software to automatically find the connected port. If multiple USB to serial devices have been connected, you need to manually select the correct port, as shown in the following figure:

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Figure 4-3 Use the serial port assistant to open the serial port

(3) Configure the serial port

The module default setting serial port parameters are: baud rate 115200bps, data bit 8 bits, stop bit 1 bit, no parity; no flow control, the communication link defaults to 1, and the connection can be established by itself without operation after power on.

The serial port configuration of module A and module B is shown in the figure below:

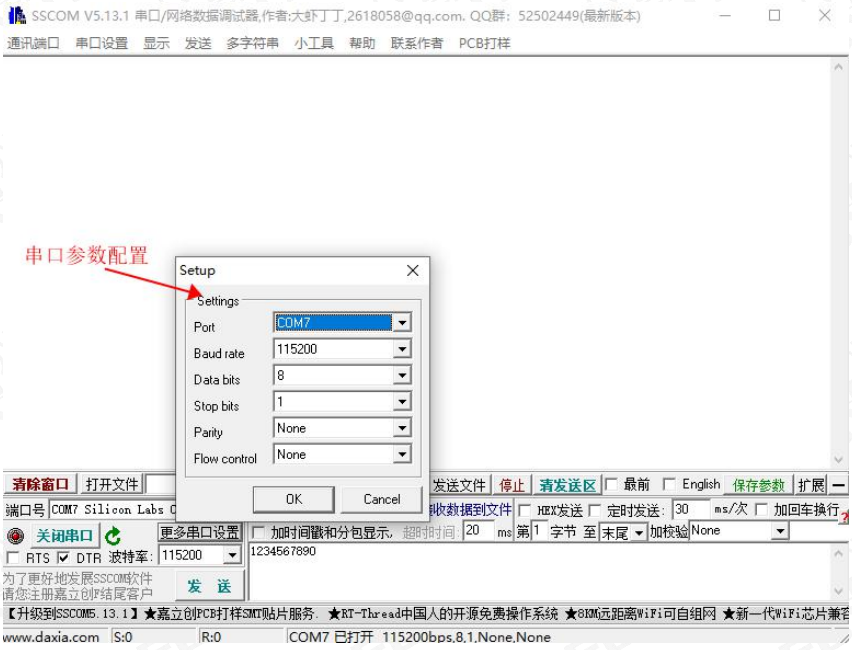


Figure 4-4 Serial port parameter configuration

Power on module A and module B, and after the connection is established, data can be sent and received, as shown in the following figure:

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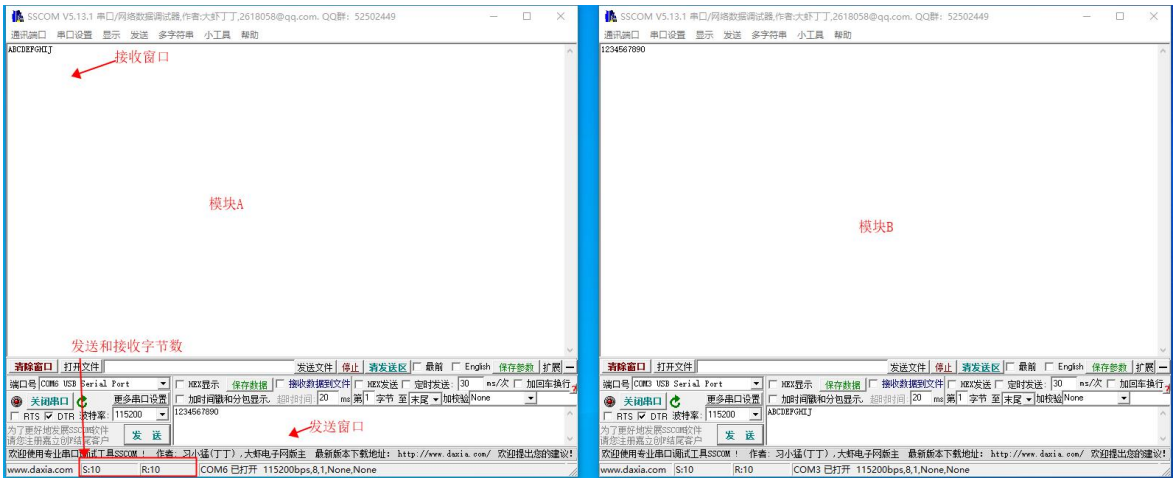


Figure 4-5 Data transparent transmission

4.3 Configuration software instructions

The configuration software is used to query and set module parameters, and the module needs to work in configuration mode. The software interface is shown in the figure below:

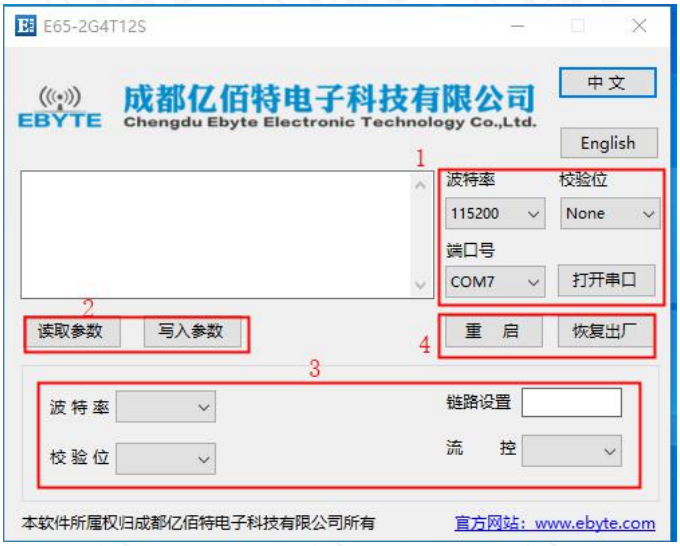


Figure 4-6 Configuration software interfac

Table 4-1 Software window description

No.	Description
1	Serial port parameter area
2	Command execution area
3	Parameter area
4	Special command area

1: Select the current baud rate and check bit of the module, select the corresponding port number, and open the serial port. Must make the module work in configuration mode and select the correct serial port parameters, otherwise the command will be invalid.

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2: If you click read parameter, you will be prompted that it read the parameter successfully. The current parameter of the module is displayed in the parameter area. If you click write parameter, you will be prompted that the parameter is successfully written. The parameter selected or filled in in the parameter area has been written into the module.

3: The parameter area is used with the "read parameter" button to display the current module parameters, or modify the parameters with the "write parameters" button to set the module parameters.

4: The special command for restarting and restoring factory settings are used to reset the module and restore the module parameters to the factory configuration.

4.4 Working mode

The module has two working modes, which are set by the pin MODE (default is 1): the details are shown in the table below:

Table 4-2 Working mode

Working mode	Mode (Input Pin)	Description
Transparent transmission mode	0 (Low level)	Serial port open. It is in the receiving and sending state, transparent transmission (Link is valid at low power level)
Configuration mode	1 (High level)	Wireless receiving and transmitting are off, and users can query / set module parameters through serial port

Note: in transparent transmission mode, wireless data transmission can only be carried out after waiting for low level output of link pin.

4.4.1 Transparent transmission mode

- When the MODE pin is low, the module is in transparent transmission mode. And when the LINK pin outputs low level, it can send and receive wireless data. When the LINK pin outputs high power level, it means that the module is searching for devices with the same communication link, and wireless communication cannot be carried out at this time. When the device with the same communication link is searched and connected successfully, the LINK pin outputs low level to carry out wireless communication.

4.4.2 Configuration mode

- When the MODE pin is set to high level, the module is in configuration mode;
- In configuration mode, the module cannot transmit or receive wireless data through radio frequency. The user can send all AT commands to the module.

4.4.3 Mode switching

- The user can use one GPIO of MCU to control the mode of MODE pin; when the level is maintained within 100ms after the mode is changed, the mode switching is successful and the new mode can be started.

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4.4.4 Mode reset

- After hardware reset or software restart, the LINK pin outputs high level, and after connection, the LINK pin outputs low level, and starts to work normally according to the mode specified working mode. Therefore, user data needs to be transmitted at low level of LINK pin.

4.5 DATA pin explanation

- DATA is used for sending and receiving instructions of serial port data in transparent transmission mode;
- It indicates whether the serial port of the module has data receiving or sending, and it is valid at low level.

4.6 Point to point communication mechanism

- The valid range of communication link value is 1 to 9999, which can be set by using AT command or configuration software. Factory default setting communication link value is "1";
- If the connection is disconnected due to power off, too far distance or strong interference, it is recommended to adjust the distance properly or avoid obstacles. The module will enter the search state again until the equipment with the same link is searched and the connection is established;
- If there are two or more E65 modules with the same communication link and they are powered on at the same time, the connection is established randomly. If multi groups application is involved, it is recommended to configure the link value of each pair of modules in advance to distinguish them.

4.7 Hardware flow control

- The at command or configuration software can be used to set the flow control function on or off, and the hardware flow control is turned off by default;
- It is recommended to use hardware flow control for continuous transmission under high baud rate, such as 921600bps (> 20m data).

4.8 Full duplex / high speed continuous transmission

- In two-way communication, especially when transferring files, the channel resources occupied by both ends are different, which will lead to the transmission rate of one end being slower than that of the other end, it is normal;
- For continuous data transmission, such as sending large files, to make full use of the transmission rate, make sure that the data stream is continuous. Frequent small data frame breaks may reduce the efficiency of wireless transmission.

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4.9 AT command

4.9.1 Default parameters

Baud rate	115200 bps
Check	0 (No check)
Flow control	0 (Off)
Communication link	1

4.9.2 Command description

- AT command is character content.
- AT command ends with“\r\n”, (It will not be emphasized below).
- AT command is not case sensitive.
- Among the parameters that are not specified in the AT command, the numeric type is a decimal string.

4.9.3 AT command error code description

Error Code	Description	Possible causes of error
-1	The parameter length is wrong or empty	Check the command parameter range described in the command table to confirm whether the command has parameters
-2	Parameter data error	Check the command parameter range described in the command table
-3	Command does not exist	Check the command format described in the command table
-4	No terminator (\r\n)	"Send new line" is not checked in the serial port tool

4.9.4 Command table

(1) AT test

Command	Return
AT	+OK
Description: None	

(2) AT+RESET Reset

Command	Return
AT+RESET	+OK
Description: Valid immediately	

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(3) AT+RESTORE Restore factory settings

Command	Return
AT+RESTORE	OK
Description: **After reset, restart automatically;** **In the process of restoring factory settings, it is forbidden to reset in any form, and it is forbidden to power off before the operation is completed.**	

(4) AT+BAUD Serial port baud rate setting

Command		Return
Query	AT+BAUD?	+OK=[baud]
Set	AT+BAUD=[baud]	+OK: Successful +ERR=[NUM]: Error
Parameter	**BAUD**	**Baud rate (bps)**
	0	1200
	1	2400
	2	4800
	3	9600
	4	19200
	5	38400
	6	57600
	7	115200 (Default)
	8	230400
	9	256000
	10	460800
	11	921600
	12	1000000
	13	1500000
	14	2000000
	15	3M
Description	Restart takes effect and save when power off.	
Example	AT+BAUD=0, Set the baud rate to 115200	

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(5) AT+PARITY Serial port check bit setting

Command		Return
Query	AT+PARITY?	+OK=[parity]
Set	AT+PARITY=[parity]	+OK: Successful +ERR=[NUM]: Error
Parameter	**Pariry**	**Description**
	0	No check (default)
	1	Even check
	2	Odd check
Description	Restart takes effect and save when power off.	
Example	AT+PARITY=0	

(6) AT+HWFC Serial port flow control settings

Command		Return
Query	AT+HWFC?	+OK=[para]
Set	AT+ HWFC =[para]	+OK: Successful +ERR=[NUM]: Error
Parameter	**Para**	**Description**
	0	Flow control off (default)
	1	Flow control on
Description	Restart takes effect and save when power off.	
Example	AT+HWFC=0	

(7) AT+LINK Link settings

Command		Return
Query	AT+LINK?	+OK=[para]
Set	AT+ LINK =[para]	+OK: Successful +ERR=[NUM]: Error
Parameter	Para: Communication link. The value range is 1-9999, and the default value is 1	
Description	Take effect immediately (and restart automatically) and save after power off.	

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5. Basic application

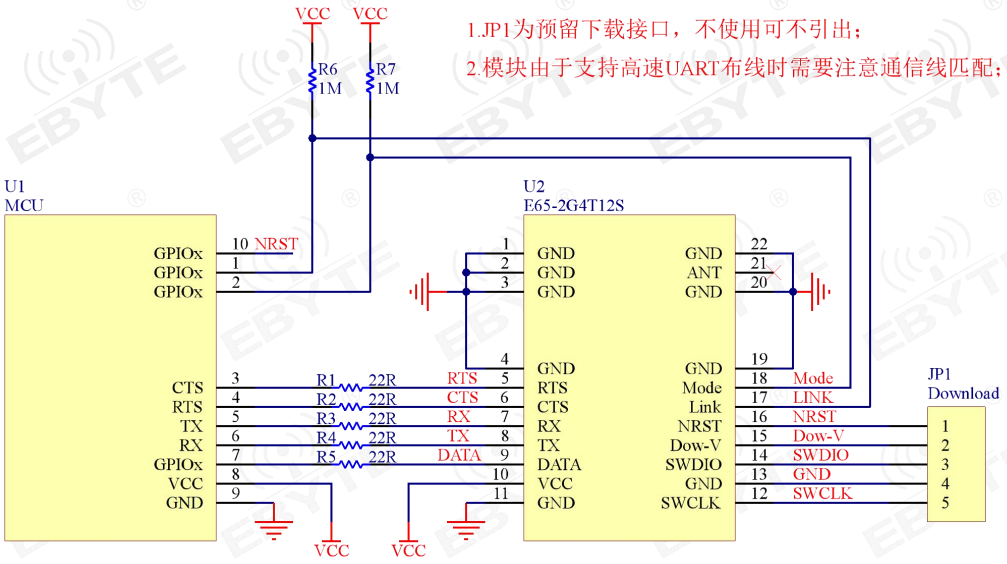


Figure 5-1 Circuit diagram

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6. FAQ

6.1 Communication range is too short

- The communication distance will be affected when obstacle exists.
- Data lose rate will be affected by temperature, humidity and co-channel interference.
- The ground will absorb and reflect wireless radio wave, so the performance will be poor when testing near ground.
- Sea water has great ability in absorbing wireless radio wave, so performance will be poor when testing near the sea.
- The signal will be affected when the antenna is near metal object or put in a metal case.
- Power register was set incorrectly, air data rate is set as too high (the higher the air data rate, the shorter the distance).
- The power supply low voltage under room temperature is lower than 2.5V, the lower the voltage, the lower the transmitting power.
- Due to antenna quality or poor matching between antenna and module.

6.2 Module is easy to damage

- Please check the power supply to ensure that it is between the recommended power supply voltage. If the maximum value is exceeded, the module will be permanently damaged.
- Please check the stability of power source, the voltage cannot fluctuate too much.
- Please make sure anti-static measure are taken when installing and using, high frequency devices have electrostatic susceptibility.
- Please ensure the humidity is within limited range, some parts are sensitive to humidity.
- Please avoid using modules under too high or too low temperature.

6.3 BER(Bit Error Rate) is high

- There are co-channel signal interference nearby, please be away from interference sources or modify frequency and channel to avoid interference;
- The clock waveform on the SPI is not standard. Check whether there is interference on the SPI line. The SPI bus line should not be too long.
- Poor power supply may cause messy code. Make sure that the power supply is reliable;
- The extension line and feeder quality are poor or too long, so the bit error rate is high;

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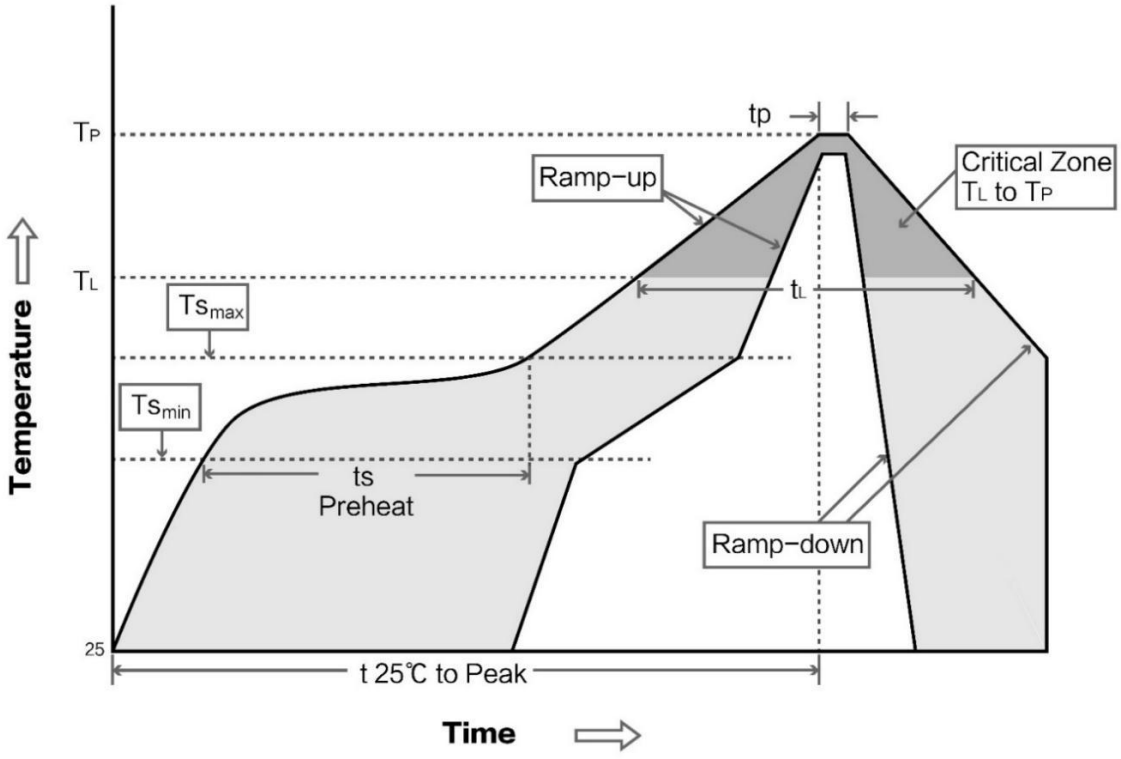
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7. Soldering guidance

7.1 Reflow Soldering Temperature

Profile Feature	Curve feature	Sn-Pb Assembly	Pb-Free Assembly
Solder Paste	Solder paste	Sn63/Pb37	Sn96.5/Ag3/Cu0.5
Preheat Temperature min (Tsmin)	Minimum preheating temperature	100℃	150℃
Preheat temperature max (Tsmax)	Maximum preheating temperature	150℃	200℃
Preheat Time (Tsmin to Tsmax)(ts)	Preheating time	60-120 sec	60-120 sec
Average ramp-up rate (Tsmax to Tp)	Average rising rate	3℃/second max	3℃/second max
Liquidous Temperature (TL)	Liquid phase temperature	183℃	217℃
Time（tL）Maintained Above（TL）	Time above liquidus	60-90 sec	30-90 sec
Peak temperature (Tp)	Peak temperature	220-235℃	230-250℃
Aveage ramp-down rate (Tp to Tsmax)	Average descent rate	6℃/second max	6℃/second max
Time 25℃ to peak temperature	Time of 25 ° C to peak temperature	6 minutes max	8 minutes max

7.2 Reflow Soldering Curve



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8. Related models

Model number	Frequency	TX power	Range	Size	Package	Communication interface
	Hz	dBm	km	mm		
E34-2G4H27D	2.4G	27	5	21*36	DIP	TTL
E34-2G4H20D	2.4G	20	2.5	21*36	DIP	TTL

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9. Antenna guide

Antennas are an important role in the communication process. Inferior antennas will greatly affect the communication system, so we recommend some antennas with excellent antenna performance and reasonable price.

Part number	Type	Fre.	Gain	Size	Cable	Interface	Feature
		Hz	dBi	mm	cm		
TX2400-NP-5010	Flexible	2.4G	2.0	10x50	-	IPEX	Flexible FPC antenna
TX2400-JZ-3	Rubber	2.4G	2.0	30	-	SMA-J	Short, omnidirectional
TX2400-JZ-5	Rubber	2.4G	2.0	50	-	SMA-J	Short, omnidirectional
TX2400-JW-5	Rubber	2.4G	2.0	50	-	SMA-J	Bendable, omnidirectional
TX2400-JK-11	Rubber	2.4G	2.5	110	-	SMA-J	Bendable, omnidirectional
TX2400-JK-20	Rubber	2.4G	3.0	200	-	SMA-J	Bendable, omnidirectional
TX2400-XPL-150	Rubber	2.4G	3.5	150	150	SMA-J	Sucker antenna, high gain

Revision history

Version	Date	Description	Issued by
1.0	2020-8-21	Initial version	Li

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