JN5168 /ZigBee Wireless Module

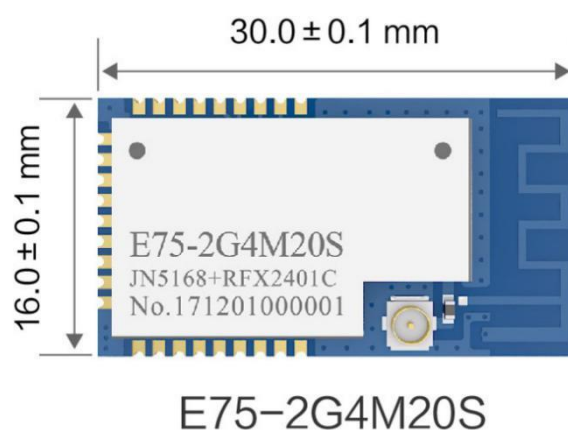# E75 Series

User Manual

Version	Date	Description	Issued by
1.00	2017/12/11	Initial version	huaa

Brief Introduction

E75−2G4M20S

E75 series designed by Chengdu Ebyte is a high-performance and low-consumption ZigBee wireless transceiver module, which is based on NXP JN5168. It provides a complete application integration scheme at ISM(2.4-2.5GHz) based on IEEE802.15.4. It supports protocols like FastZigBee, ZNET, JenNet-IP, ZigBee-PRO, RF4CE and etc. It can be widely applied in industrial control, industrial data collection, agriculture control, personnel location in mine lot, and intelligent furniture & temperature controller.

E75 series integrates a complete transmitting and receiving circuit of RF on the module and is embedded with complicated wireless communication protocols in the internal MCU. It greatly simplifies the developing process which enables the users to put their products on the market in a shorter time and makes them more competitive.

E75 series is without factory firmware. Users need to conduct a secondary development based on their own demands.

Model	Frequency	Transmitting power	Distance(PCB)	Packing	Antenna
E75-2G4M20S	2.4GHz	20dBm	1000m	SMD	IPEX/PCB

CONTENTS

1. Technical Parameters

Model	IC	Size	Net weight	Operating temperature	Operating humidity	Storage temperature
E75-2G4M20S	JN5168	16 * 30 mm	1.2±0.1g	-40 ~ 85℃	10% ~ 90%	-40 ~ 125℃

1.1 E75-2G4M20S

| Parameter	Min	Typ	Max	Unit
Transmitting current	136	145	160	mA
Receiving current	24	26	29	mA
Turn-off current	1	2	3	μA
Transmitting power	19	20	21	dBm
Receiving sensitivity	-98	-100	-102	dBm
Recommended working frequency	2405	2400	2480	MHz
Voltage supply	2.0	3.3	3.6	V
Communication level	2.0	3.3	3.6	V

1.2 Parameters Notes

- When designing current supply circuit, 30% margin is recommended to be remained so as to ensure long-term stable operation of the whole module.

- The current at the instant of transmitting may be high, but the total energy consumed may be lower due to very short transmitting time.

- When using external antenna, the impedance matching degree at different frequency points between antenna and module may affect the transmitting current at different levels.

- The current consumed when the RF chip is only working at receiving mode is called as receiving current. The tested receiving current may be higher for some RF chips with communication protocol or when the developers have loaded their own protocol to the whole module.

- The current at pure receiving mode is at mA level. To achieve μA level receiving current, the users need to manage it through firmware development.

- The turn-off current is always lower than the current consumed when the power supply source of the whole module is at no-load status.

- Each LRC component has ±0.1% error, and the error will accumulate since multiple LRC components are used in the whole RF circuit, and the transmitting current will be different at different modules.

- The power consumption can be lowered by lowering the transmitting power, but the efficiency of the internal PA will be decreased by lowering transmitting power due to various reasons.

# 2. Mechanical Characteristics

2.1 E75-2G4M20S

2.1.1 Dimension
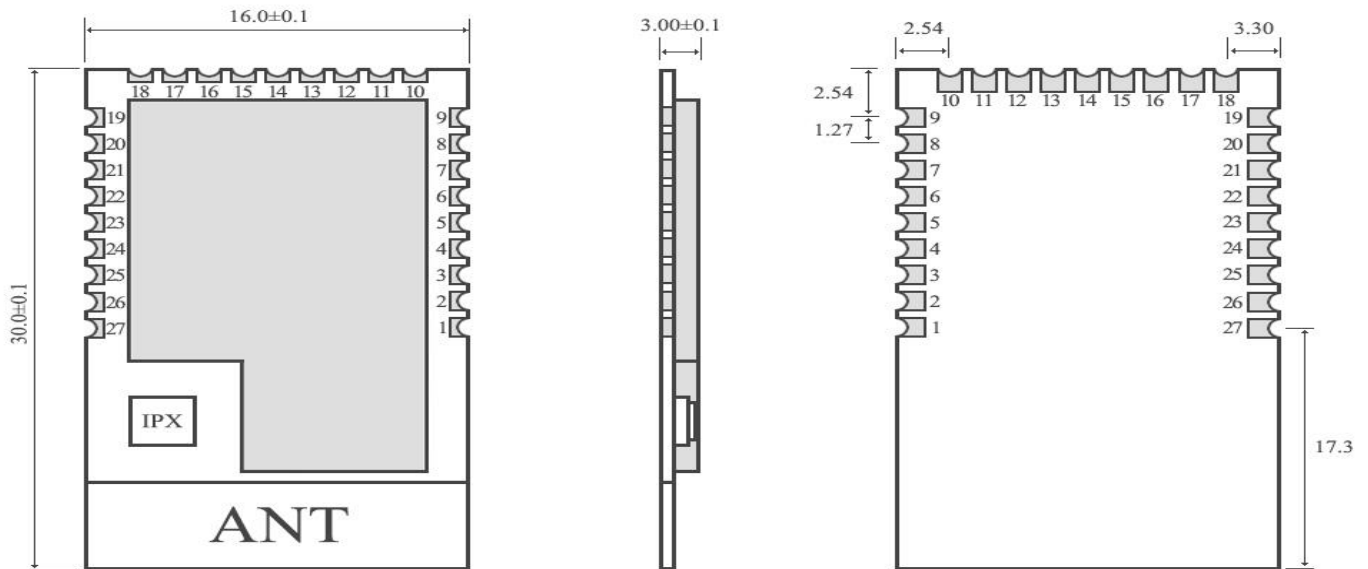
2.1.2 Pin Definition

Pin No.	Pin Item	Pin Direction	Pin Application
1	ADC1	I	JN5168 input ADC pin（Refer to JN5186 Datasheet for more details）
2	SPI-CLK	I	JN5168 SPI communication clock pin
3	SPI-MISO/ISP	I/O	JN5168 SPI output. When ISP is used for burn via UART, it's burn mode after pulling down and powering on.
4	SPI-MOSI	I/O	JN5168 SPI input
5	SPI0-SE	I	SPI CS pin. It's used to start a SPI communication.
6	DIO0	I/O	It can be configured as general IO port.（Refer to JN5186 Datasheet for more details）
7	DIO1	I/O	It can be configured as general IO port.（Refer to JN5186 Datasheet for more details）
8	NC	--	NC
9	NC	--	NC
10	DIO4	I/O	It can be configured as general IO port.（Refer to JN5186 Datasheet for more details）
11	DIO5	I/O	It can be configured as general IO port.（Refer to JN5186 Datasheet for more details）
12	DIO6	I/O	It can be configured as general IO port.（Refer to JN5186 Datasheet for more details）
13	DIO7	I/O	It can be configured as general IO port.（Refer to JN5186 Datasheet for more details）
14	DIO8	I/O	It can be configured as general IO port.（Refer to JN5186 Datasheet for more details）
15	DIO9	I/O	It can be configured as general IO port.（Refer to JN5186 Datasheet for more details）
16	DIO10	I/O	It can be configured as general IO port.（Refer to JN5186 Datasheet for more details）
17	VDD	Power positive	Power supply 2.0V ~ 3.6V DC（3.3V and an added external ceramic filter capacitor are recommended.）
18	GND	Ground	Ground electrode. It connects to the power reference place.
19	DIO11	I/O	It can be configured as general IO port.（Refer to JN5186 Datasheet for more details）

20	DIO12	I/O	It can be configured as general IO port.（Refer to JN5186 Datasheet for more details）
21	DIO13	I/O	It can be configured as general IO port.（Refer to JN5186 Datasheet for more details）
22	REST	I	It is reset pin.
23	DIO14	I/O	It can be configured as general IO port.（Refer to JN5186 Datasheet for more details）
24	DIO15	I/O	It can be configured as general IO port.（Refer to JN5186 Datasheet for more details）
25	DIO16	I/O	It can be configured as general IO port.（Refer to JN5186 Datasheet for more details）
26	DIO17	I/O	It can be configured as general IO port.（Refer to JN5186 Datasheet for more details）
27	ADC2	I	It can be configured as general IO port.（Refer to JN5186 Datasheet for more details）
For more details like pin definition, software drivers, and communication protocol, please refer to <JN5186 Datasheet > from NXP.			

3. Recommended Circuit Diagram

Please visit the official website of NPX to get the downloading tool (FlashGUI.exe).
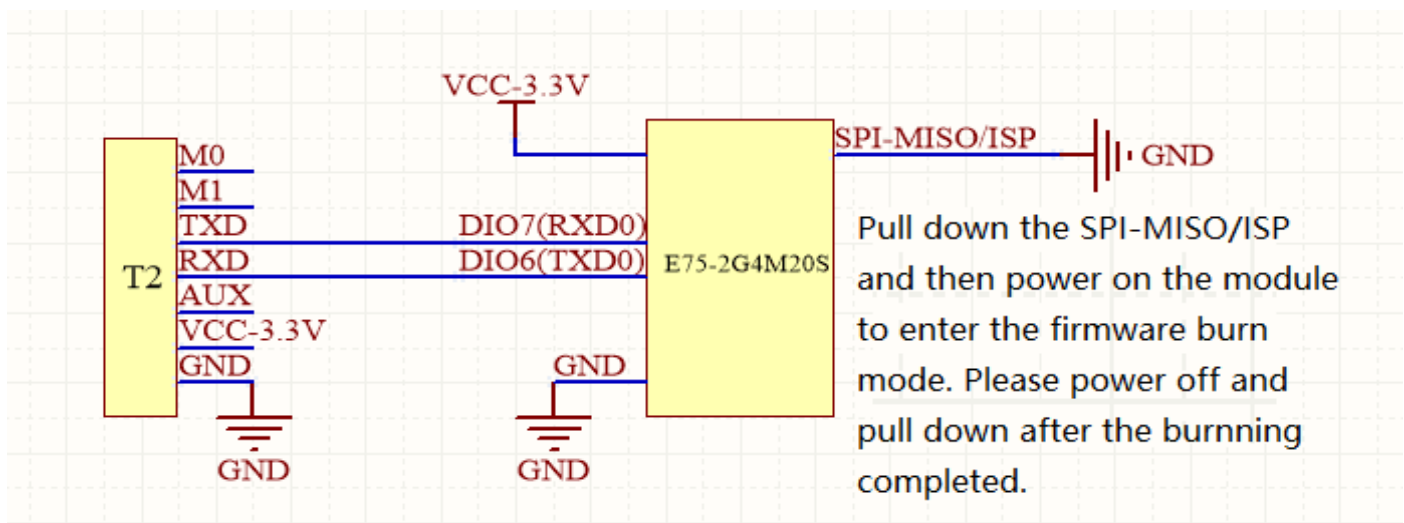
Notes: The diagram shows that the module needs to be connected to the USB to UART module to download the firmware.

4. Notes

4.1 Antenna Layout Rules

4.1.1 PCB Antenna Layout

   Some of the E75 series adopt PCB antenna or ceramic antenna which enables vertical polarization and nearly omnidirectional radiation. The module can achieve the performance of wireless signal radiation without added ground electrode. Please note that the users need to follow the rules when installing the module on other PCBs.

   The antenna needs to be placed at least 20mm away from the wire lead or metals, not only at the top layer but also every layer of the PCB. The communication performance will be greatly influenced when the PCB or ceramic antenna is close to any conductive materials. In the diagram below, the first three layouts are for the rules and the other three layouts are against the rules.

KEEPOUT – no groundplane, metal objects or conductors in this area

Groundplane

BATTERY
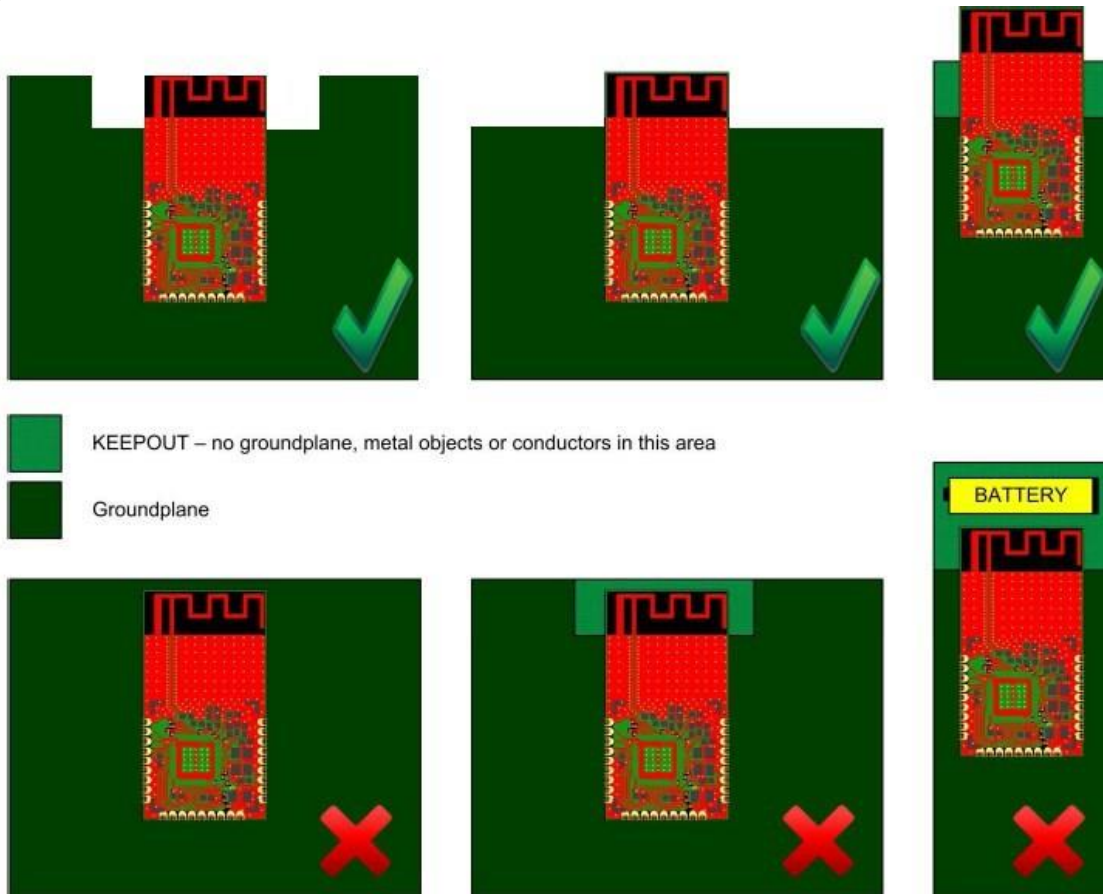
4.1.2 External Antenna Layout

Please note the following points:

- The antenna works at 2.4GHz and the VSWR is recommended to be below 1.5.
- The external antenna is recommended to stay at least 30cm away from the ground, wall, and metal surface.
- Please ensure that sucker antenna sticks to the metal surface properly to achieve the best communication performance.
- If the antenna feeder is found broken, please stop using it.

4.2 Module Using Notes

- DIO is a general I/O port which can be configured for different usage. It can be floated while not using. For more details, please refer to JN5168 datasheet.
- Please note that the grounding should be good in a large area, and the power ripple should be small. Filter capacitor should be added as close as possible to the VCC and GND pin of the module.
- Instead of being set too high, the SPI communication speed rate is recommended to be at 1Mbps.
- To achieve better stability, users can initialize the register configuration when the chip is idle.

5. Production Guidance

5.1 Reflow Soldering Temperature

Profile Feature	Sn-Pb Assembly	Pb-Free Assembly
Solder Paste	Sn63/Pb37	Sn96.5/Ag3/Cu0.5
Preheat Temperature min （Tsmin）	100℃	150℃
Preheat temperature max (Tsmax)	150℃	200℃
Preheat Time (Tsmin to Tsmax)(ts)	60-120 sec	60-120 sec
Average ramp-up rate(Tsmax to Tp)	3℃/second max	3℃/second max
Liquidous Temperature (TL)	183℃	217℃
Time （tL） Maintained Above （TL）	60-90 sec	30-90 sec
Peak temperature （Tp）	220-235℃	230-250℃
Aveage ramp-down rate （Tp to Tsmax）	6℃/second max	6℃/second max
Time 25℃ to peak temperature	6 minutes max	8 minutes max

5.2 Reflow Soldering Curve
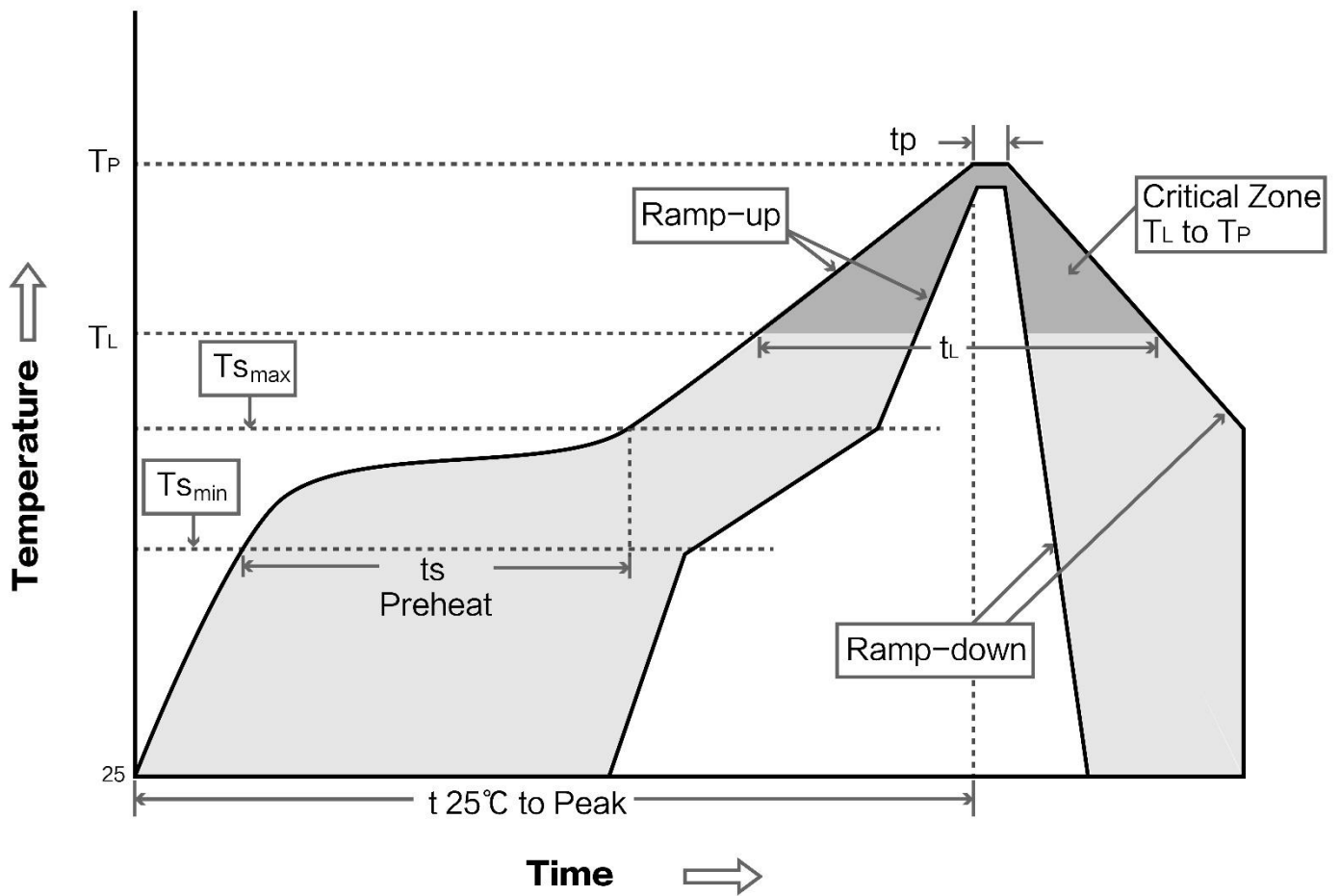
6. FAQ

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.
- Seawater 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).
- When the power supply at room temperature is lower than the recommended low voltage, the lower the voltage is, the lower the transmitting power is.
- Due to antenna quality or poor matching between antenna and module.

6.2 Module is easy to damage

- Please check the power supply and ensure it is within the recommended range. Voltage higher than the peak will lead to a permanent damage to the module.
- Please check the stability of power supply and ensure the voltage not to fluctuate too much.
- Please make sure anti-static measures are taken when installing and using, high frequency devices have electrostatic susceptibility.
- Please ensure the humidity is within range because some parts are sensitive to humidity.
- Please avoid using modules under too high or too low temperature.

7. Important Notes

- All rights to interpret and modify this manual belong to Ebyte.
- This manual will be updated based on the upgrade of firmware and hardware, please refer to the latest version.
- Please refer to our website for new product information.

8. About Us

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