E75-2G4M20S User Manual

JN5168 Zigbee SMD Wireless Module



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1 Product Overview

1.1 Brief Introduction



E75-2G4M20S 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.

E75-2G4M20S 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.

E75-2G4M20S is without factory firmware. Users need to conduct a secondary development based on their own demands.

1.2 Feature

- Communication distance tested is up to 1km in ideal condition;
- Maximum transmitting power of 100mW, adjustable via software;
- Support ZNET, JenNet-IP, ZigBee-PRO, RF4CE;
- Support the global license-free ISM 2.4GHz；
- With built-in 32-bit high-performance and low power MCU;
- With abundant resources, 256KB FLASH，32KB RAM
- Support 2.0V~3.6V power supply, power supply over 3.3V can guarantee the best performance；
- Industrial grade standard design, support -40 ~ +85 °C for working over a long time；
- PCB and IPEX antenna optional, good for secondary and embedded development.

1.3 Application

- Smart Home and Industrial Sensors;
- Wireless toy and remote control;

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- Wireless alarm security system；
- Building automation solutions；
- Tire pressure monitoring;
- Health care products；
- Wireless audio and wireless earphone.

2. Technical Parameters

2.1 Limit parameter

Main parameter	Performance		Note
	Min	Max	
Voltage supply [V]	0	3.6	Voltage over 3.6V will cause permanent damage to module
Blocking power [dBm]	-	10	Chances of burn is slim when modules are used in short distance
Operating temperature [℃]	-40	+85	-

2.2 Operating parameter

Main parameter		Performance			Note
		Min	Typ	Max	
Voltage supply [V]		2.0	3.3	3.6	≥3.3 V ensures output power
Communication level [V]			3.3		For 5V TTL, it may be at risk of burning down
Operating temperature [℃]		-40	-	85	
Frequency [MHz]		2405	-	2480	ISM band
Power consumption	Transmitting current（mA）		145		Instant power consumption
	Receiving current（mA）		26		
	Stand-by current（μA）		2		Software is shut down
Transmitting power [dBm]		19.6	20.0	20.5	
Receiving sensitivity [dBm]		-98.5	-100	-102	

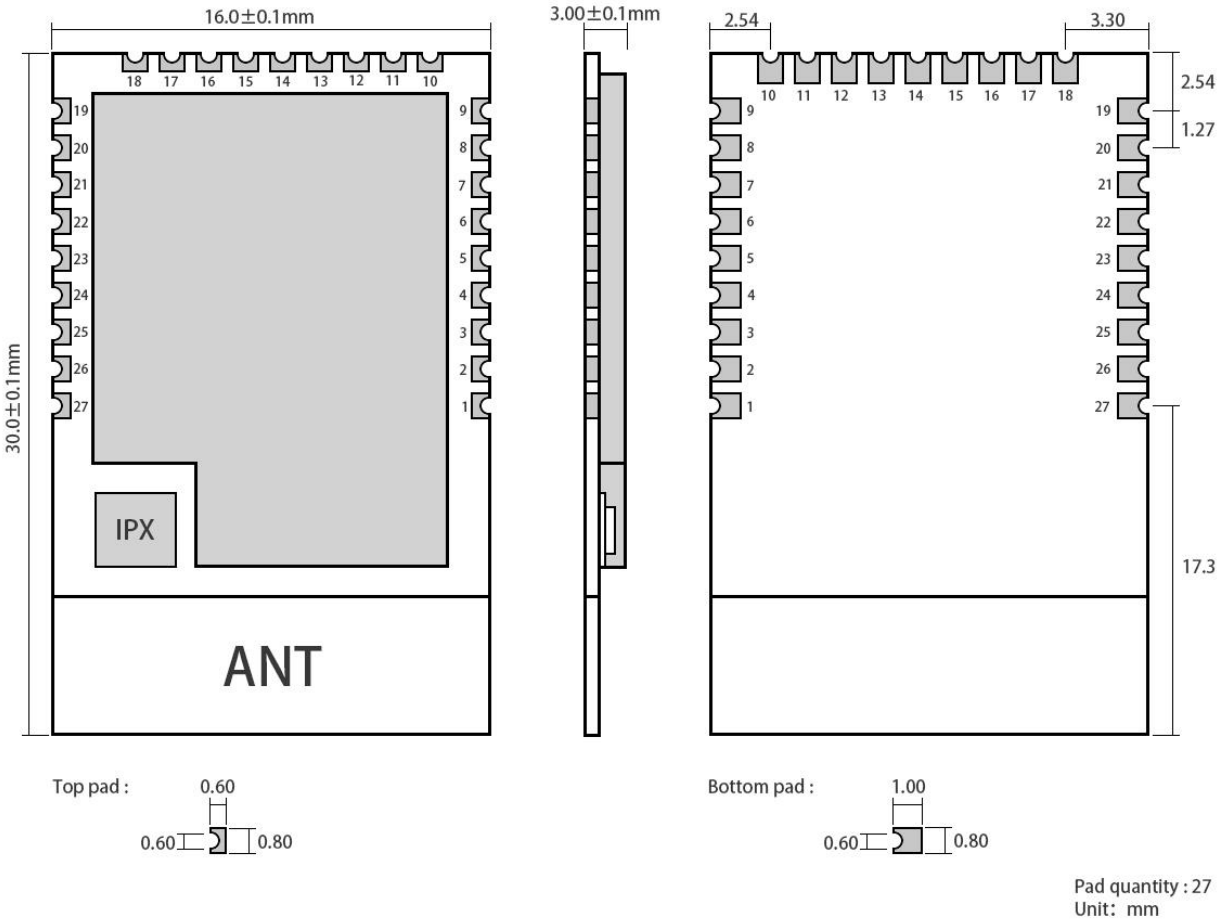
Main parameter	Description	Note
Distance	1000m	Test condition：clear and open area, antenna gain: 5dBi, antenna height: 2.5m

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Xtal	32MHz	
Protocol	Zigbee (Recommended)	ZNET, JenNet-IP, ZigBee-PRO, RF4CE
Package	SMD	
Connector	1.27mm	Stamp hole
RFIC	JN5168ASGU482/QFN40	
FLASH	256 KB	
RAM	32 KB	
Core	32bit RISC CPU	
Size	16 * 30 mm	
Antenna	PCB / IPEX	50Ω Impedance

3 Dimension and Pin Definition



No.	Item	Direction	Application

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1	ADC1	I	JN5168 input ADC pin（Refer to JN5168 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 JN5168 Datasheet for more details）
7	DIO1	I/O	It can be configured as general IO port.（Refer to JN5168 Datasheet for more details）
8	NC	--	NC
9	NC	--	NC
10	DIO4	I/O	It can be configured as general IO port.（Refer to JN5168 Datasheet for more details）
11	DIO5	I/O	It can be configured as general IO port.（Refer to JN5168 Datasheet for more details）
12	DIO6	I/O	It can be configured as general IO port.（Refer to JN5168 Datasheet for more details）
13	DIO7	I/O	It can be configured as general IO port.（Refer to JN5168 Datasheet for more details）
14	DIO8	I/O	It can be configured as general IO port.（Refer to JN5168 Datasheet for more details）
15	DIO9	I/O	It can be configured as general IO port.（Refer to JN5168 Datasheet for more details）
16	DIO10	I/O	It can be configured as general IO port.（Refer to JN5168 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 JN5168 Datasheet for more details）
20	DIO12	I/O	It can be configured as general IO port.（Refer to JN5168 Datasheet for more details）
21	DIO13	I/O	It can be configured as general IO port.（Refer to JN5168 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 JN5168 Datasheet for more details）
24	DIO15	I/O	It can be configured as general IO port.（Refer to JN5168 Datasheet for more details）
25	DIO16	I/O	It can be configured as general IO port.（Refer to JN5168 Datasheet for more details）

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26	DIO17	I/O	It can be configured as general IO port.（Refer to JN5168 Datasheet for more details）
27	ADC2	I	It can be configured as general IO port.（Refer to JN5168 Datasheet for more details）

4 Basic Operation

4.1 Hardware design

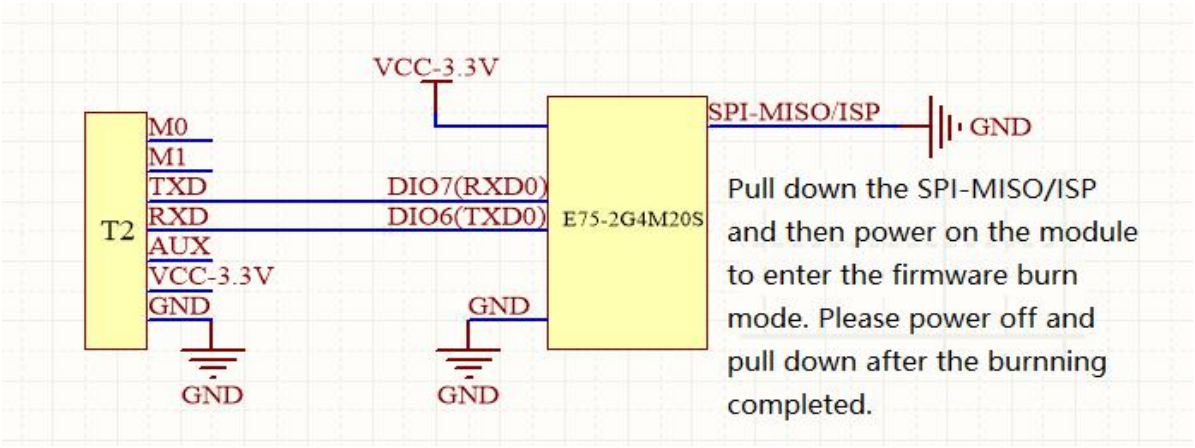
- It is recommended to use a DC stabilized power supply. The power supply ripple factor is as small as possible, and the module needs to be reliably grounded.；
- Please pay attention to the correct connection of the positive and negative poles of the power supply. Reverse connection may cause permanent 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 can not be fluctuated frequently；
- 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 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 position has a great influence on the performance of the module. Make sure that the antenna is exposed, preferably vertically. When the module is installed inside the shield, a high-quality antenna extension cable can be used to extend the antenna outside;
- The antenna must not be installed inside the metal case, which will greatly reduce the transmission distance.

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4.2 Programming

- With JN5168 as core ic, the module has similar drive method to JN5168, please refer to official chipset datasheet for details.
- Please visit the official website of NPX to get the downloading tool (FlashGUI.exe), connect via E15-USB-T2.



Notes: The diagram shows that the module needs to be connected to the USB to UART module to download the firmware.

5. FAQ

5.1 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.

5.2 Module is easy to damage

- Please check the power supply and ensure it is within the recommended range. Voltage higher than the peak will

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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 limited range for some parts are sensitive to humidity.
- Please avoid using modules under too high or too low temperature.

5.3 Bit error rate is too high

- When there are co-channel signal interference nearby, 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 should not be too long.
- Unfavorable power supply may cause messy code. Make sure that the power supply is reliable.
- Extension line and feeder with poor quality or too long ones will cause high bit error rate.

6. Production Guidance

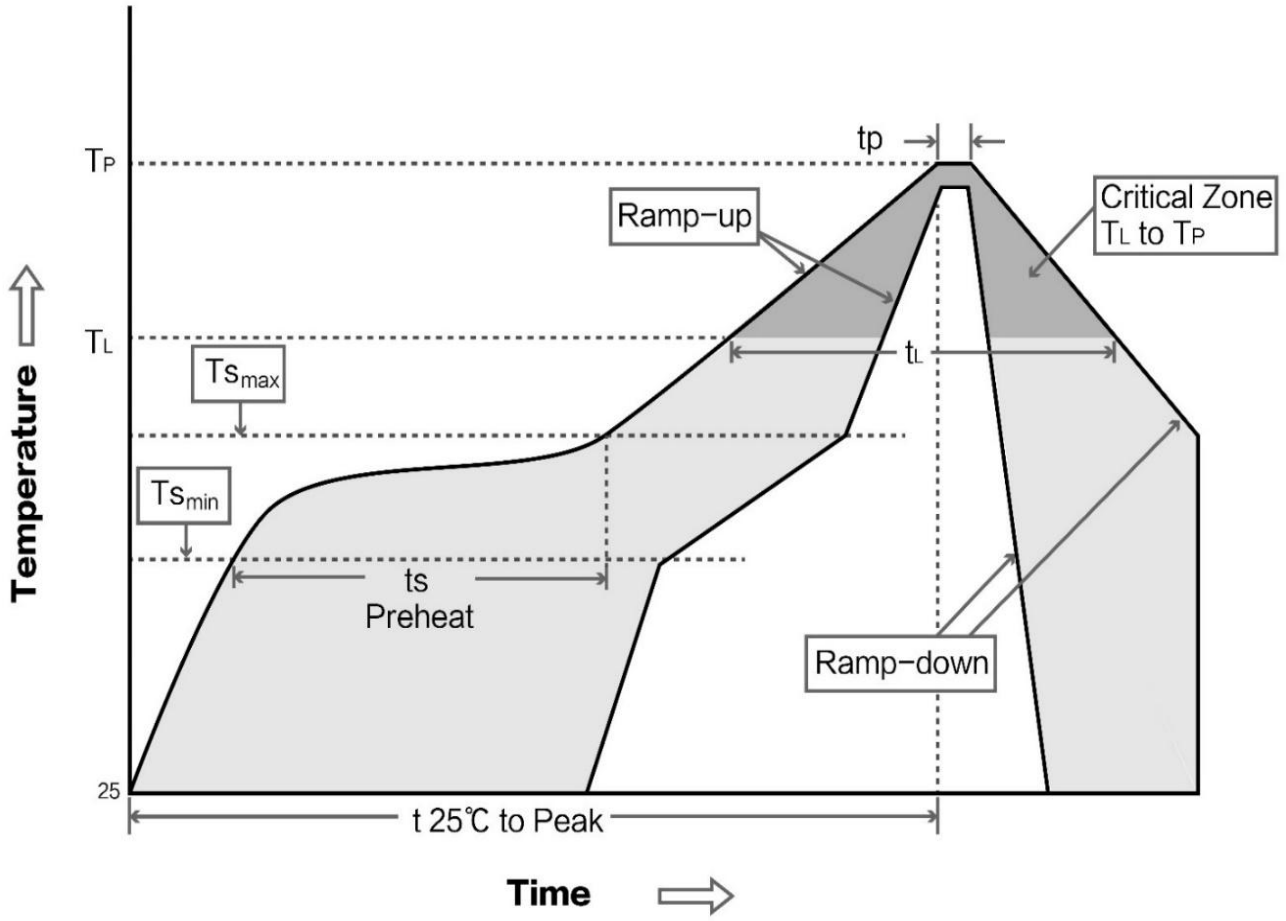
6.1 Reflow Soldering Temperature

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

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6.2 Reflow Soldering Curve



7 E75 Series

Model	IC	Frequency Hz	TX power dBm	Distance km	Package	Size mm	Antenna
E75-2G4M20S	JN5168	2.4G	20	1.0	SMD	16*30	PCB/IPX
E75-2G4M10S	JN5169	2.4G	10	0.5	SMD	16*26	PCB/IPX

8 Related Antenna

8.1 Antenna recommendation

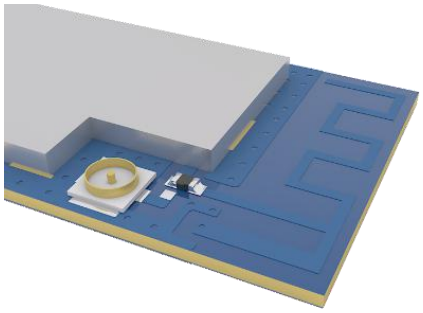
Antenna plays an important role in the communication process. Inferior antennas often have a great impact on the communication system. Therefore, we recommend some antennas that support our wireless modules and have excellent performance and reasonable price.

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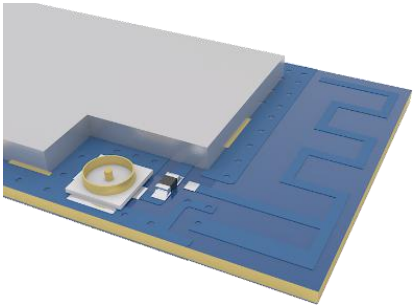
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Model	Type	Frequency	Gain	Size	Feeder	Interface	Feature
		Hz	dBi	mm	cm		
TX2400-NP-5010	FPC	2.4G	2.0	10x50	-	IPEX	FPC antenna
TX2400-JZ-3	Rubber	2.4G	2.0	30	-	SMA-J	Straight antenna,ultra short,omnidirectional
TX2400-JZ-5	Rubber	2.4G	2.0	50	-	SMA-J	Straight antenna,ultra short,omnidirectional
TX2400-JW-5	Rubber	2.4G	2.0	50	-	SMA-J	Fixed bending antenna，omnidirectional
TX2400-JK-11	Rubber	2.4G	2.5	110	-	SMA-J	Flexible antenna，omnidirectional
TX2400-JK-20	Rubber	2.4G	3.0	200	-	SMA-J	Flexible antenna，omnidirectional
TX2400-XPL-150	Sucker	2.4G	3.5	150	150	SMA-J	Small sucker antenna，high gain

8.2 Antenna selection



PCB（default）



IPEX

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Revision history

Version	Date	Description	Operator
1.00	2018/8/30	Initial Version	huaa
1.10	2018/9/28	Model Series separation	huaa

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