ZigBee Module Datasheet

ZBee3

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VERSION HISTORY

V1.0.0   2019/08/04   1st issue of preliminary document

Content

1. Introduction

1.1. Summary

ZBee3 is an ultra-compact, low-power, high-sensitivity 2.4 GHz IEEE 802.15.4/ ZigBee module, which can be used for wireless sensing, control and data acquisition applications.

1.2. Applications

ZBee3 module is compatible with IEEE 802.15.4/ ZigBee stack that supports a self-healing, self-organizing mesh network, while optimizing network traffic and minimizing power consumption.

The applications include but not limited to:

- Building automation & monitoring
- Environmental monitoring
- Security
- Industrial monitoring
- Automated meter reading (AMR)

1.3. Key Features

- Size: 19.3 x 13.6 x 3.0mm
- Output power: MAX 20dBm
- High RX sensitivity : -102dBm
- Outperforming link budget : 122dB
- Communication distance : SMA antenna: 800~1000m (Visual distance); Ceramic antenna：200~300m (Visual distance)
- Low power consumption

  - Sleep mode : <5.0μA
  - RX mode: 9.4mA@2.4 GHz (250 kbps O-QPSK DSSS)
  - TX mode: 33.8mA@10dBm；185mA@20dBm

- Ample memory resources:

  - Flash: 1024K bytes；RAM: 96K bytes

■ Wide range of interfaces (both analog and digital):

- 20 x GPIO
- 12-bit 1 Msps SAR ADC
- 3 x USART transceiver
- 2 x I^{2}C
- IEEE 802.15.4 compliant transceiver
- Optional antenna reference designs

1.4. Advantage

■ Small package for small devices

■ Leading link budget

■ 4 PCB board, good ESD/EMC protection ability.

■ Ample memory for software application

■ Mesh networking capability

■ ISM worldwide license-free operation

1.5. Abbreviations and Acronyms

ADC	Analog-to -Digital Converter
API	Application Programming Interface
DC	Direct Current
DTR	Data Terminal Ready
DIP	Duap In-line package
EEPROM	Electrically Erasable Programmable Read-Only Memory
ESD	Electrostatic Discharge
GPIO	General Purpose Input/Output
HAL	Hardware Abstraction Layer
HVAC	Heating, Ventilating and Air Conditioning
HW	Hardware
TWI	Inter-Integrated Circuit
IEEE	Institute of Electrical and Electrionics Engineers
IRQ	Interrupt Request
ISM	Industrial, Scientific and Medical radio band
JTAG	Digital interface for debugging of embedded device, also known as IEEE 1149.1 standard interface
MAC	Medium Access Control layer
MCU	Microcontroller Unit. In this document it also means the processor, which is

	the core of ZigBee module
NWK	Network layer
OEM	Original Equipment Manufacturer
OTA	Over-The-Air upgrade
PCB	Printed Circuit Board
PER	Package Error Ratio
PHY	Physical layer
RAM	Random Access Memory
RF	Radio Frequency
RTS/CTS	Request to Send/ Clear to Send
RX	Receiver
SMA	Surface Mount Assembly
SPI	Serial Peripheral Interface
SW	Software
TX	Transmitter
UART	Universal Asynchronous Receiver/Transmitter
USART	Universal Synchronous/Asynchronous Receiver/Transmitter
USB	Universal Serial Bus
ZigBeePRO	Wireless networking standards targeted at low-power applications
802.15.4	The IEEE 802.15.4-2003 standard applicable to low-rate wireless PAN

1.6. Related Documents

[1] IEEE Std 802.15.4-2003 IEEE Standard for Information technology - Part 15.4 Wireless Medium Access Control (MAC) and Physical Layer (PHY) Specifications for Low-Rate Wireless Personal Area Networks (LR-WPANs)

[2] ZigBee Specification. ZigBee Document 053474r17, October 19, 2007

2. Specifications

2.1. Electrical Characteristics

2.1.1. Absolute Maximum Ratings

Table 2-1. Absolute Maximum Ratings

Parameters	Min	Max
Power supply range (VCC)	1.75V	3.8V
Pin working voltage range(exclude ADC pin)	-0.3V	VDD_PADS+0.3
Max driving current of all I/O		200 mA
Max RX RF level		+10 dBm

Note:

Absolute Maximum Ratings are the values beyond which damage to the module may occur. Under no circumstances must the absolute maximum ratings given in this table be violated. Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the module.

2.1.2. Test Conditions

Table 2-2. Test conditions (unless otherwise stated), VCC = 3.3V, Tamp = 25°C

Parameters	Range	Unit
TX current (@20dBm)	200	mA
RX current	9.4	mA
Sleeping current	<5.0	μA

2.1.3. RF Characteristics

Table 2-3. RF Characteristics

Parameters	Test Conditions	Range	Unit
Frequency Band		2400~2483.5	MHz
Numbers of Channels		16	
Channel Interval		5	MHz
Transmitter Output Power		-20 to +20	dBm
Receive Sensitivity (90%)		-104	dBm
Max data transmit speed		250	kbps

TX Output/ RX Input Nominal Impedance		50	Ω

2.1.4. Microcontroller Characteristics

Table 2-4. Microcontroller Characteristics

Parameters	Test Conditions	Range	Unit
On-chip Flash Memory size		512K~1024K	bytes
On-chip RAM size		64K~96K	bytes
Operation Frequency		80	MHz

2.1.5. Module Interfaces characteristics

Table 2-5. Module Interfaces characteristics

Parameters	Test Conditions	Range	Unit
UART Maximum Baud Rate		230400	bps
Analog input impedance		>1	MΩ
Analog input current		0 - VREF	V
I2C Maximum Clock		1	MHz
Real Time Oscillator Frequency		32.768	KHz

2.2. Physical/Environmental Characteristics

Table 2-6. Physical/Environmental Characteristics

Parameter	Value	Remark
Size (L*W*H)	19.3x13.6x3.0mm	
Working temp.	-40°C to +85°C	
Operating Relative Humidity Range	<= 95%RH	

2.3. Pin Configuration

Picture 2-1. Size
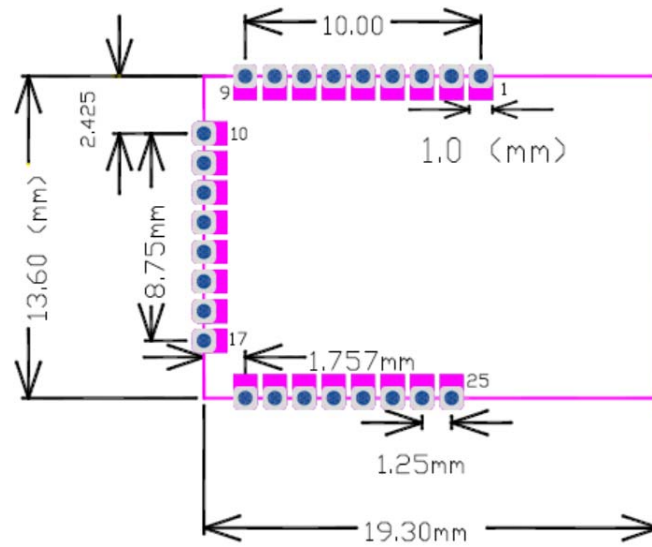
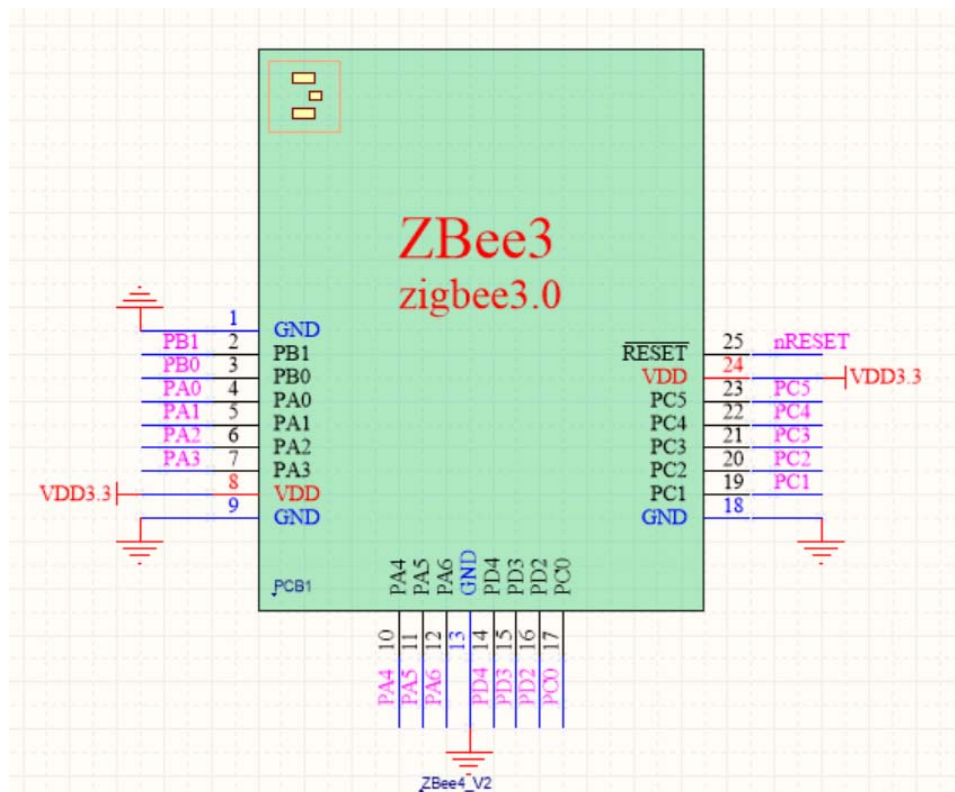Picture 2-1: Size (mm)

Picture 2-2. Pin Configuration

Table 2-7. Pin instruction

Module Pin No.	Pin No.	Signal	Direction	Description
1		GND	-	Ground
2	15	PB01	I/O	Digital I/O
		EM4WU3	I	
3	16	PB00	I/O	Digital I/O
4	17	PA00	I/O	Digital I/O
5	18	PA01	I/O	Digital I/O
		SWCLK	I	
6	19	PA02	I/O	Digital I/O
		SWDIO	I/O	
7	20	PA03	I/O	Digital I/O
		SWV	O	
		TDO	O	
		TRACEDATA0		
8		3.3V	-	DC supply，1.8~3.6V
9		GND	-	Ground
10	21	PA04	I/O	Digital I/O
		TDI		
		TRACECLK		
11	22	PA05	I/O	Digital I/O
		EM4WU0		
12	23	PA06	I/O	Digital I/O
13		GND	-	Ground
14	28	PD04	I/O	Digital I/O
15	29	PD03	I/O	Digital I/O
16	30	PD02	I/O	Digital I/O
		EM4WU9	I	
17	1	PC00	I/O	Digital I/O
18		GND	-	Ground
19	2	PC01	I/O	Digital I/O
20	3	PC02	I/O	Digital I/O
21	4	PC03	I/O	Digital I/O
22	5	PC04	I/O	Digital I/O
23	6	PC05	I/O	Digital I/O
		EM4WU7	I	
24		3.3V	-	DC supply，1.8~3.6V
25	9	RESETn	I	Reset Pin

2.4. Antenna Specifications

2.4.1 Use U.FL to connect external antenna:

Picture 2-3. U.FL connector

U.FL connector
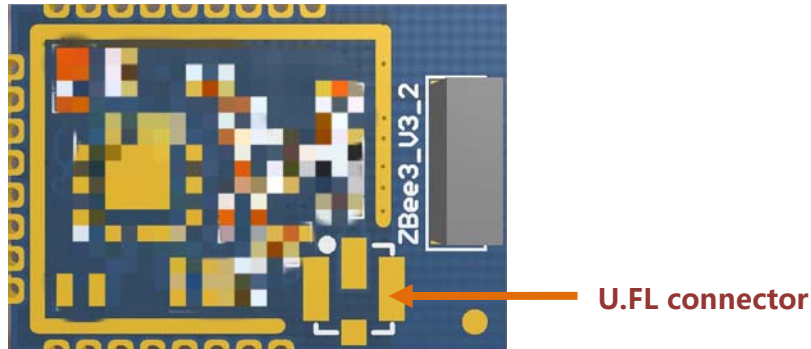
2.4.2 Integrated ceramic antenna:

Picture 2-4. Ceramic antenna
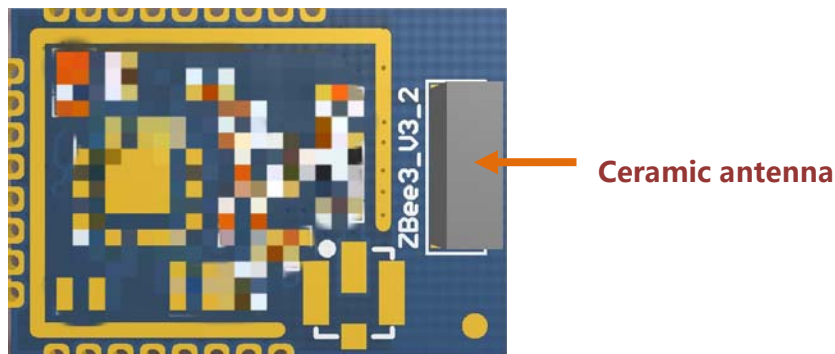
Ceramic antenna

Attention when using ceramic antenna：
1. Please avoid installing the module in a complete metal enclosure.
2. Please avoid placing high profile components/metal next to antenna　(1 cm at least, suggest more than 2.7 cm)．
3. ZigBee module should not be placed next to consumer electronics which might interfere with ZigBee's RF frequency band, like transformer.

　　User should try to avoid other components or line interfere ceramic antenna when designing board：
- Wires or other components avoid surrounding ceramic antenna
- Ceramic antenna should be extended to the board
- Don't use metal shell to cover the PCB antenna

******Soldering way for convert ceramic antenna to U.FL:

U.FL soldering way：C3=2.7nh, R4=NC, R3=2.7pF, C16=2.7nh
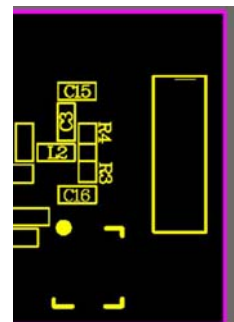
Picture 2-4. Components Location

3. Ordering Information

Product Type

ZBee=Zigbee

ZBee   3   S   2F8   C

Product Serial

3=Zigbee serial（3）

Package Type

S=SMD

Chip Model

1F4 = EFR32MG21A010F512IM32-B

1F6 = EFR32MG21A010F768IM32-B

1F8 =EFR32MG21A010F1024IM32-B

2F4 = EFR32MG21A020F512IM32-B

2F6 = EFR32MG21A020F768IM32-B

2F8 = EFR32MG21A020F1024IM32-B（Default）

Antenna

U=U.FL connector

C=Ceramic antenna   (Default)

4. Contact Us

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FCC Statement
FCC standards: FCC CFR Title 47 Part 15 Subpart C Section 15.247

Chip antenna with Antenna gain 2dBi
Integral antenna(SMA antenna connector)with Antenna gain 2dBi

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.
Any Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.
Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:
—Reorient or relocate the receiving antenna.
—Increase the separation between the equipment and receiver.
—Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
—Consult the dealer or an experienced radio/TV technician for help.

FCC Radiation Exposure Statement
The modular can be installed or integrated in mobile or fix devices only. This modular cannot be installed in any portable device without further certificate (such as C2CP with SAR). This modular complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter. This modular must be installed and operated with a minimum distance of 20 cm between the radiator and user body.

If the FCC identification number is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. This exterior label can use wording such as the following: "Contains Transmitter Module FCC ID: 2AZEG-ZBEE3S2F8C Or Contains FCC ID: 2AZEG-ZBEE3S2F8C "

When the module is installed inside another device, the user manual of the host must contain below warning statements;
1. This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:
(1) This device may not cause harmful interference;
(2) This device must accept any interference received, including interference that may cause undesired operation.
Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications.
However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:
—Reorient or relocate the receiving antenna.
—Increase the separation between the equipment and receiver.
—Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
—Consult the dealer or an experienced radio/TV technician for help.
2. Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.
The devices must be installed and used in strict accordance with the manufacturer's instructions as described in the user documentation that comes with the product.
Any company of the host device which install this modular with modular approval should perform the test of radiated & conducted emission and spurious emission, etc. according to FCC part 15C : 15.247 and 15.209 & 15.207 ,15B Class B requirement, Only if the test result comply with FCC part 15C : 15.247 and 15.209 & 15.207 ,15B Class B requirement，then the host can be sold legally.