ZETA LPWAN Module

High Performance

User Manual

Version 2.6

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Content

1. Introduction

ZETA is an industrial IoT networking technology that was developed by ZiFiSense with its distinctive concept of highly integrated LPWAN. It allows high data collection and extensive wireless sensors control by using a SINGLE ultra narrow band (UNB) channel. The UART transparent interfaces provide simple and friendly secondary development command sets. Based on this module, users can deploy large scale coverage of IoT network applications, while keeping the development costs and risks to the minimum.

2. Applications

- ➢ Wireless metering and smart meters
- ➢ Supply chain – smart logistics tracking system, warehouse management, ESL (Electronic Shelf Label)
- ➢ Industrial devices and instruments - wireless data collection and control
- ➢ Consumer electronic with wireless remote control
- ➢ Smart home
- ➢ Security – wireless alarm
- ➢ WSN(Wireless Sensor Network)
- ➢ Some other low power and small data applications

3. Dimensions
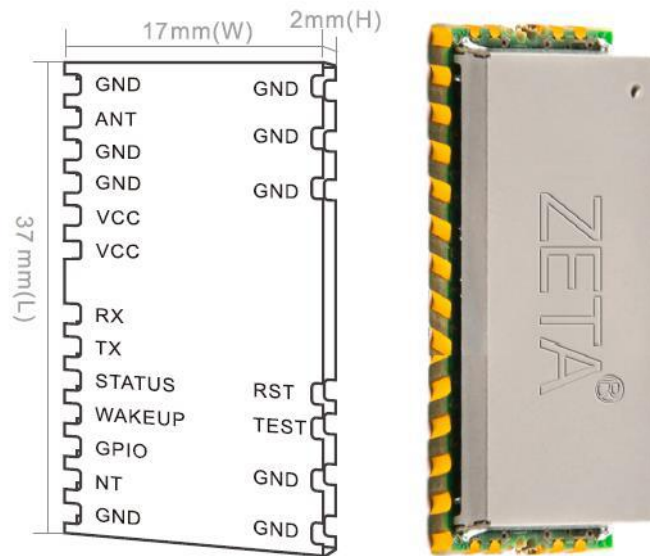
4. PCB Size
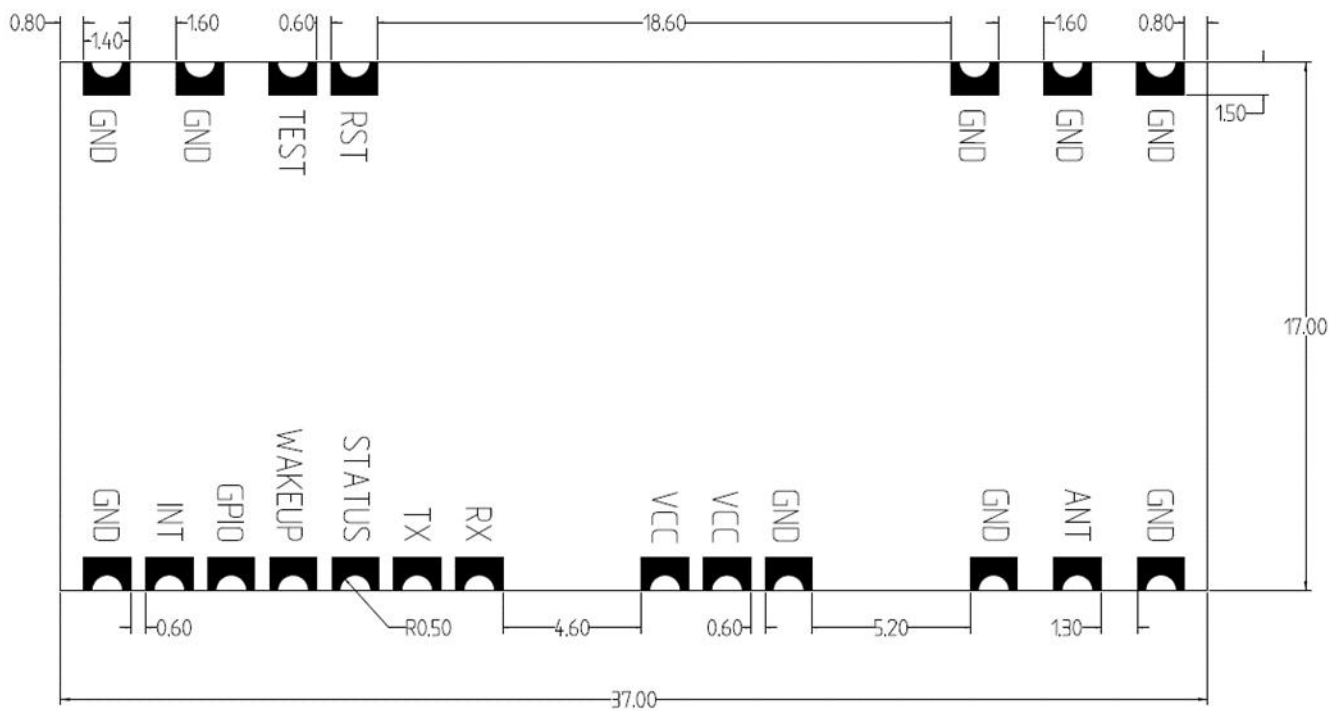
Unit：mm

5. Basic Features

- Transparent transmission between end-devices and cloud
- Own clock system output
- Support several timers
- Support several frequency channels, at 429MHz;
- High sensitivity, -130dBmat 300bps
- Low power consumption, <5uA standby current
- Industrial stability
- SMD (Surface Mounted Devices)

6. Technical Parameters

Parameters	Value(T_A=25℃ , V_{cc}=3.3V)
Frequency Channel	429MHz
Frequency	1ppm
Modulation	2-FSK/2-GFSK
Data Rate	0.3-2.4kbps
Transmit Power	<=17dBm
Working Current	<=75mA
Receive Sensitivity	-130dBm(@300bps)
Standby Current	<=5uA (ack downlink mode) <=25uA (real-time downlink mode)
Antenna Impedance	50ohm
Supply Voltage	2.4-3.6V
Working Temperature	-20℃ ~ +70℃
Storage Temperature	-40℃ ~ +125℃
Size	37*17*2mm

Note:
1. Receiver sensitivity and transmission range can be affected by the data rate, i.e., the higher the data rate, the lower the sensitivity.
2. Transmit power can be affected by the supply voltage, i.e., the lower the voltage, the lower the transmit power. If it does not exceed the working temperature range, the application will not be affected.
3. Central frequency will change if the working temperature changes. If it does not exceed the working temperature range, the application will not be affected.
4. Antenna has a great influence on the transmission range. Kindly use the matching antenna and installed it according to the guidelines.
5. Mounting method can affect the transmission range.

7. Hardware Interfaces Circuit

7.1   Interfaces Circuit
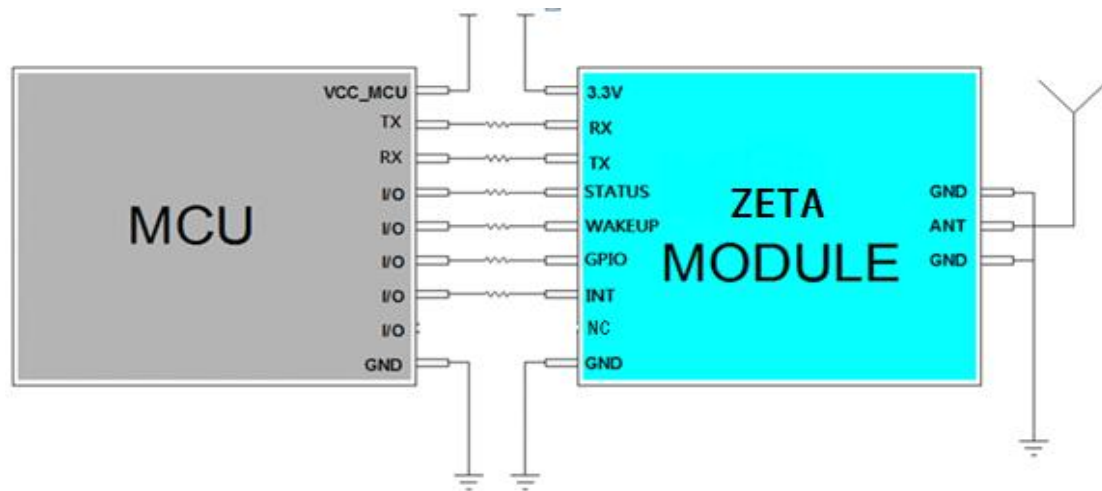
Note:
1.   The pin array in figure is not the actual array. Kindly refer to the pin definition.
2.   Connect the UART and data I/O interfaces to correspond pins on MCU.
3.   Use ESD protection to prevent damage caused by pin input.
4.   Kindly note the circuit layout, GND position and antenna installation to ensure transmission performance.

7.2   Pin Definition

Pin	Type/direction	Description
VCC	Power	DC 2.4-3.6V
GND	Ground	Ground
RX	Digital Input	Serial data in
TX	Digital Output	Serial data out
STATUS	Digital Output	Status indicator, HIGH indicates Operable
WAKEUP	Digital Input	Wakeup wireless module on the failing edge
GPIO	Digital Input/Output	General purpose I/O
INT	Digital Output	Wakeup users' MCU on the rising edge
ANT	Antenna Interfaces	50 ohm impedance
NC	None	Do no connect

8. Module Manual

8.1   Module Status

There are three status while using the module:

➢   STATUS: HIGH indicates operable, LOW indicates inoperable

➢   WAKEUP: Falling edge triggered, after STATUS goes HIGH from LOW, wait for1ms to operate the module.

➢   INT: There is downlink data or interruption of timer. WAKEUP user MCU on the rising edge.

8.2   Sequence Chart

UpLink:
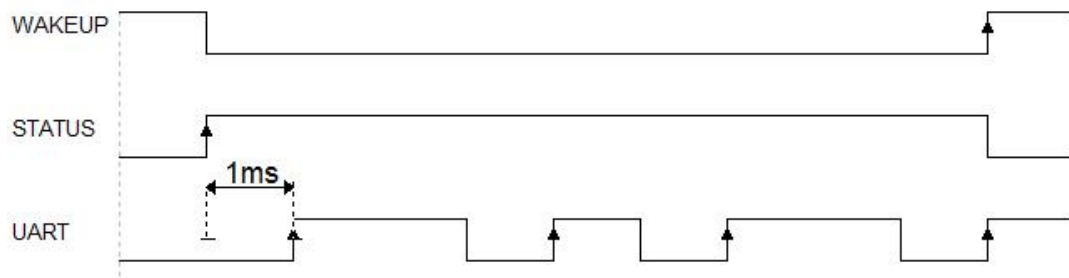
DownLink or Timed Wake-up:
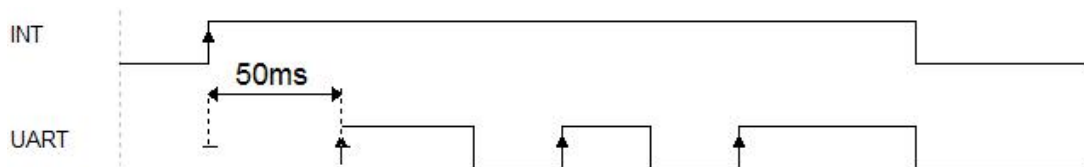
8.3   Serial Port Parameters

Baud Rate	Data Bit	Stop Bit	Check Bit	Flow Control
115200	8	1	None	None

8.4 UART Frame

User's Module to Standard Module UART Frame							
Frame Type		**Preamble**	**Length**	**Type**	**Payload**		
Send	**Standard data**	0xFF00	0x07	0x01	D2	D1	D0
	Variable data	0xFF00	0x04+n	0x02	n byte (no more than 50 bytes)		
Inquiry	**MAC**	0xFF00	0x04	0x10	None		
	Network Time	0xFF00	0x04	0x11	None		
	Remaining Amount	0xFF00	0x04	0x12	None		
	Network Quality	0xFF00	0x04	0x13	None		
Set	**Set Timer**	0xFF00	0x0F	0x20	Start Time[7]	Interval [3]	Interrupt No.
	Turn off Timer	0xFF00	0x05	0x21	Interrupt No.		

Standard Module to User's Module UART Frame					
Frame Type		**Preamble**	**Length**	**Type**	**Payload**
Receive	**Data Frame's ACK**	0xFF00	0x04	0x01	None
	Buffer Full	0xFF00	0x04	0x02	None
	Length Error	0xFF00	0x04	0x03	None
Inquire Answer	**MAC**	0xFF00	0x08	0x10	mac[4]
	Time	0xFF00	0x0b	0x11	time[7]

	Remaining Amount	0xFF00	0x06	0x12	Remaining Amount[2]
	Network Quality	0xFF00	0x05	0x13	RSSI
Command's ACK	**Set Succeed**	0xFF00	0x04	0x20	None
	Set Failed	0xFF00	0x04	0x21	None
Wakeup Reason	**Downlink Data**	0xFF00	0x04 + n	0x30	n byte (no more than 100 bytes)
	Timed Wakeup	0xFF00	0x05	0x31	Interrupt No.
Module Status	**Invalid Warning**	0xFF00	0x04	0x40	None
	Turnoff Note	0xFF00	0x04	0x41	None
	No Remaining	0xFF00	0x04	0x42	None
	Unregistered	0xFF00	0x04	0x43	None

Note:
1.	Preamble indicates one frame start.
2.	Length indicates whole frame length including preamble.
3.	[7] in Start Time[7] indicates that length of Start Time is 7 Bytes.

8.5   Function Introduction

The frame format is 16 Decimal. "Invalid Warning", "Turn Off Note", "Remaining Amount is 0", "No Registration" and   "Invalid Length" are common error feedback of user command.

8.5.1 Transmit Standard Data

According to chapter 8.1, STATUS maintains HIGH when transmitting.
According to chapter 9.3.2, Web pages will show as below after transmission.

SEND-----------------
FF 00 07 01 11 22 33/*11 22 33 is the transmitted data*/
RECV -----------------
FF 00 04 01   /* Transmission Succeed */
FF 00 04 02   /* The network is busy now; Buffer is full; Transmission failed*/

8.5.2 Transmit Variable Length Data

According to chapter 8.1, STATUS maintains HIGH when transmitting.
According to chapter 9.3.2, Web pages will show as below after transmission.

```
SEND-----------------
FF 00 09 02 11 22 33 44 55/*11 22 33 44 55 is transmitted data*/
RECV -----------------
FF 00 04 01    /* Transmission succeed */
FF 00 04 02    /* The Network is busy now; Buffer is full; Transmission failed */
FF 00 04 03    /* Invalid Data Length */
```

8.5.3 Get MAC

Every module has a 4-Byte MAC address.

```
SEND-----------------
FF 00 04 10    /* Get MAC */
RECV -----------------
FF 00 08 10 FF FF 11 11    /* FF FF11 11 is module's MAC */
```

8.5.4 Get Time

When the module is registered with the network, there will be a standard network time, the default is Beijing time.

```
SEND-----------------
FF 00 04 11    /* Get time */
RECV -----------------
FF 00 0B 11 07 E0 0A 0F 10 1E 00
/*
Get 7 Byte length time：
Year[07E0] Month[0A] Day[0F] Hour[10] Minute[1E] Second[00]
2016(0x07E0) Year 15 Day 16 Hour 30 Minute 0 Second
*/
```

8.5.5 Get Remaining Amount

Inquire the number of remaining messages in a day (24 hours).

    SEND-----------------
    FF 00 04 12   /* Get remaining amount */
    RECV -----------------
    FF 00 05 12 01 02   /* Remaining amount is 0x0102（258）in this 24 hours */

8.5.6 Wakeup Reply

According to chapter 8.1, when downlink data arrives or timer produces interrupt, the external interrupt will produce rising edge and transmit serial data after 50ms.

    RECV -----------------
    FF 00 07 30 01 02 03 /* Receive downlink data "01 02 03" */
    FF 00 05 31 03 /*Timer interrupt 3 time up*/

8.5.7 Set Timer

After the module registration on the network, there will be a standard network time where users can use it as a timer interrupt. The users can set up to a total of four timer interrupts, i.e., No. 1, No. 2, No. 3 and No. 4.

    SEND-----------------
    FF 00 0F 20 07 E0 01 01 0A 14 1E 0B 0A 1E 02
    /*
    Start time: Year[07 E0] Month[01] Day[01] Hour[0A] Minute[14] Second[1E]
    2016.1.1, 10:20:30
    Interval：Day[0B] Hour[0A] Minute[1E]
    From the starting time, one interrupt will be generated every 11days 10hours 30minutes.
    Interrupt No.：2
    */
    RECV -----------------
    FF 00 04 20   /* Setting succeed */
    FF 00 04 21   /* Setting failed */

8.5.8 Turn Off Timer

Turn off the specific timer interrupt.

    SEND-----------------
    FF 00 05 21 03 /* Turn off timer interrupt No. 3 */
    RECV -----------------
    FF 00 04 20 /* Setting succeed */
    FF 00 04 21 /* Setting failed */

8.5.9 Turn Off Serial Port

In order to reduce power consumption, after finish using the serial port, user will receive an ACK command (or after 50ms if the ACK command is still not yet received), user can set the WAKEUP to HIGH in order to turn off the serial port.

To send data by using module, combined with Section 8.1, turn on the serial port to send data.

9. Supporting Antenna

ZiFiSense provides antenna that matches the module. We will advise the users of the antenna selection if they have special requirements. Some commonly used antennas are shown below:

Spring Antenna: small size, low cost, easy to embed	
SMA Duck Antenna: middle size, low cost, high gain	
Suction Cup Antenna: high gain, include suction base, suitable for devices with metal box, easy to install	
Fiberglass Antenna: high precision, high efficiency, high gain, anti-corrosion, aging resistance, performance consistency, shape remain unchanged, easy to transport and install	

10. Common Problems and Solutions

Problem	Reasons and Solutions
No Data Transmission	1. Power contact is bad: Test the supply voltage is within the range. 2. The signal line has bad contact. 3. Rx/Tx (Receive/Transmit) module is not matching: Check the register configurations of Rx and Tx modules. 4. Receiving is blocked: If Tx and Rx module is close to each other (<0.5m), and Tx power is high, it might cause the receiving block. Try to place Tx and Rx modules much further apart.
Poor Connectivity Range	1. Poor environment or signal masking: elevate or lead the antenna out, or replace the antenna with higher gain. 2. Co-frequency interference or electromagnetic interference: change the channel and keep away from the sources of interference. 3. Check the working voltage and current.
High BER (Bit Error Rate)	1. Significant power supply ripple: replace the supply power. 2. Check the module register configuration (configure register as recommended). 3. Interference: change the channel and keep away from the interference sources. 4. Unmatched antenna: replace the antenna.

Note: Customers can request more information about the above developing materials from ZiFiSense staff.

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