1 Product Introduction

1.1 Product Overview

The WT5169P0-M1 series Zigbee module development by WITSTEC based on NXP-JN516 microcontroller, with low-cost, low-power, but high performance. These Zigbee Modules can work in 2.4GHz common band and up to the protocol of IEEE802.15.4, also support Zigbee3.0, Zigbee Home Automation, Zigbee Light Link, Zigbee Smart Energy, Zigbee Green Power, IEEE082.15.4. Widely used in Home Automation, automatic message record, energy management, industrial automation, wireless sensor networks. The modules integrate with all of the RF components required, end user don't need to spend additional expensive charge for RF design and test. WITSTEC to provide a full set of development kit, to ensure end user can bring the product to the market with the shortest time and lowest cost.
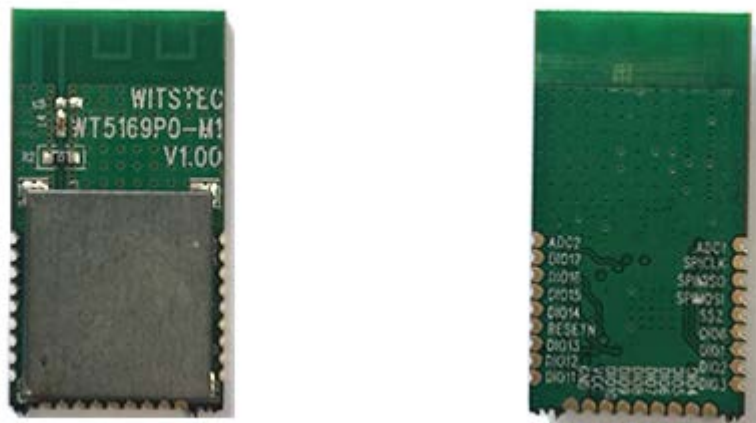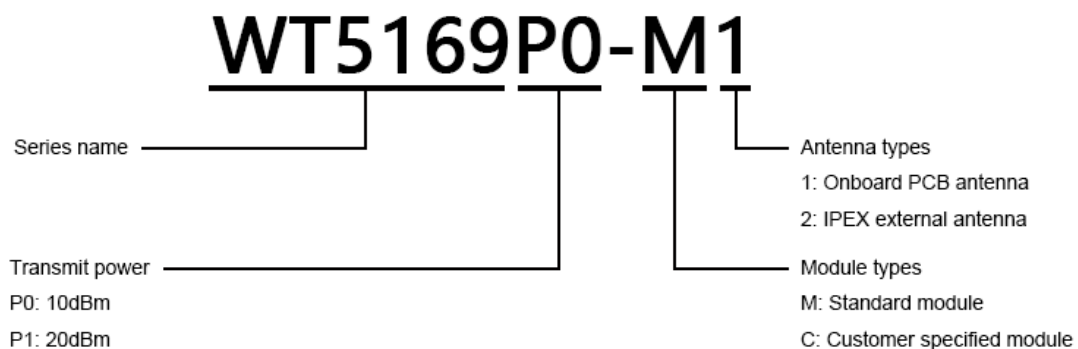

Figure 1.1

1.2 Module naming rules

Figure 1.2

2 Features and Superiority

2.1 Superiority

- Microminiature module solution
- Ready for product development quickly

- Minimizes product development time
- FCC certification passed, No RF test required for product development .

2.2 WT5169 Key Features

- Working on 2.4 GHz frequency band, supporting the application on IEEE802.15.4, ZigBee 3.0, ZigBee PRO stack, Home Automation, Light Link and Smart Energy development, etc.
- Dimensions: 30mm*16mm
- Integrated on board antenna
- TX power:8.5dBm/10dBm
- Current 23.6mA at TX power 8.5dBm
- Current 27.2mA at TX power 10dBm
- Current 16.2mA at RX power 0dBm
- Current 17.8 mA at RX power 10 dBm
- Operation voltage 2.0V~3.6V
- Received power: –96dBm
- Actual measured distance reach at 150m

2.3   Features of microcontroller

- 32-bit RISC CPU
- 1 MHz~32 MHz clock speed
- 512 kB Flash
- 32 kB RAM
- 4 kB EEPROM
- Multi-stage instruction pipeline
- Variable instruction width for high coding efficiency
- EEPROM support 100K times write operations
- Up to 20 DIO
- 6-Chan 10-bit ADC, 1 comparator
- 5×PWM (4×timer ,1×timer/counter)
- SPI-bus Master & Slave port with 3 selects
- 2 UARTs
- 2-wire I²C serial interface （master or slave）
- Two low-power sleep counters
- Watchdog timer and POR
- Supply Voltage Monitor (SVM)
- Internal temperature sensor

3 Hardware description

3.1 Pin description

Pins layout for WT5169P0-M1 module as shown on below picture 3.3, module designed with three rows of stamp hole patch interface with 27 pins, and pin spacing is 1.27mm. Complete pin-to-pin compatibility with NXP JN5169 series module, pin definitions as showed on figure 3.1
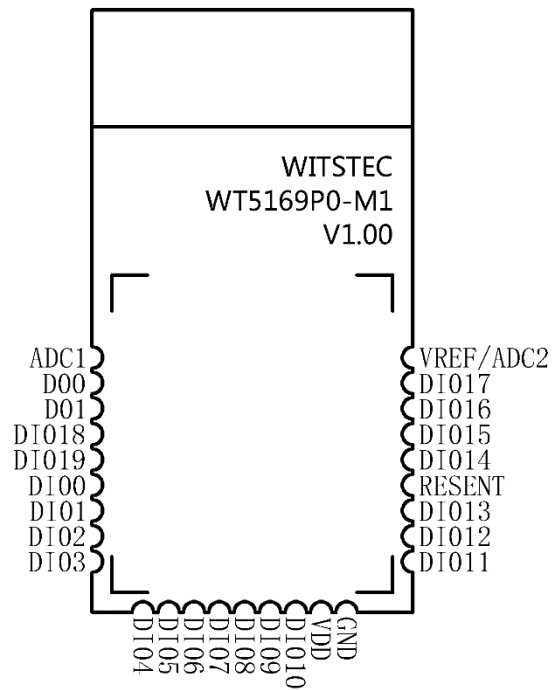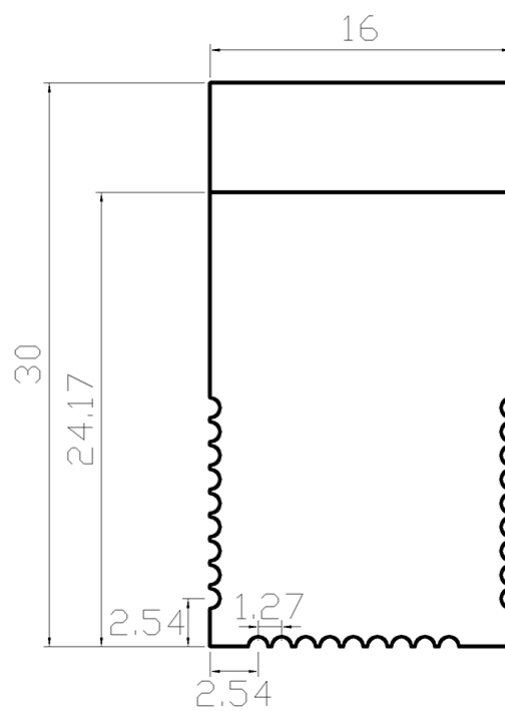
Figure 3.1.1

Figure 3.1.2

Definition of module pin

Pin No.	Pin Function		Description
	Primary	Alternate function	
1	ADC1	ADC1	ADC1 Input
2	DO0	DO0/SPICLK/PWM2	High level will enter JTAG programming mode when reset
3	DO1	DO1/SPIMISO/PWM3	High level will enter UART programming mode when reset
4	DIO18	DIO18/SPIMOSI	
5	DIO19	DIO19/SPISEL0	
6	DIO0	DIO0/ADO/SPISEL1/ADC3	ADC3 Input
7	DIO1	DIO1/ADE/SPISEL2/ADC4/PC0	ADC4 Input
8	DIO2	DIO2/RFRX/TIM0CK_GT/ADC5	ADC5 Input
9	DIO3	DIO3/RFTX/TIM0CAP/ADC6	ADC6 Input
10	DIO4	DIO4/CTS0/JTAG_TCK/TIM0OUT/PC0	
11	DIO5	DIO5/RTS0/JTAG_TMS/PWM1/PC1	
12	DIO6	DIO6/TXD0/JTAG_TDO/PWM2	
13	DIO7	DIO7/RXD0/JTAG_TDI/PWM3	
14	DIO8	DIO8/TIM0CK_GT/PC1/PWM4	
15	DIO9	DIO9/TIM0CAP/32KXTALIN/RXD1/32KIN	
16	DIO10	DIO10/TIM0OUT/32KXTALOUT	
17	VDD	V_{DD}	Supply Voltage
18	GND	V_{SS}	Digital Ground
19	DIO11	DIO11/PWM1/TXD1	
20	DIO12	DIO12	
21	DIO13	DIO13	
22	RESENT	RESET_N	Reset input
23	DIO14	DIO14	
24	DIO15	DIO15	
25	DIO16	DIO16/SPISMOSI/SIF_CLK/COMP1P	
26	DIO17	DIO17/SPISMISO/SIF_D/COMP1M/PWM4	
27	VREF/ADC2	VREF/ADC2	ADC2 Input

Table 3.1

3.2 Operating conditions

To ensure normal work of the module, operating condition must be complied with following table 3.2

Module operating conditions

Symbol	Parameter	Min	Max	Unit	Description
V_{DD}	Input Voltage	2	3.6	V	To reach the maximum TX power, 2.8 V is the minimum.
Tamb	Ambient temperature	-40	+85	°C	

Table 3.2

3.3 Module characteristics

Typical DC characteristics of module is showing on below table 3.3.1

Module DC characteristics

Test conditions: VDD:3.3V,Tamb:25°C

Symbol	Conditions	Min	Typ	Max	Unit
I_{DD}	Deep sleep mode	-	100	-	nA
	Sleep mode	0.5	0.7	0.9	uA
	Rx mode :10dBM	-	17.8	-	mA
	Rx mode:0dBm	-	16.1	-	mA
	Tx mode:10dBm	-	25	-	mA
	Tx mode:8.5dBm	-	22.7	-	mA

Table 3.3.1

Typical RF characteristics of module is showing on below table 3.3.2

Module RF characteristics

Test conditions: VDD:3.3V,Tamb:25°C

Specialty	Data
Received sensitivity	-96dBm
Transmit power	10dBm
Maximum Received power	10dBm
RSSI Variation	-96dBm~-10dBm
Center frequency shift	+/-25ppm
Outlet impedance	50Ω

Table 3.3.2

4 Antenna layout specification

The area around the antenna must be kept clear of conductors or other metal objects for an absolute minimum of 20mm. This is true for all layers of the PCB and not just the top layer. Any conductive objects close to the antenna could severely disrupt the antenna pattern resulting in deep nulls and high directivity in some directions. The diagram below shows various possible scenarios. The top 3 scenarios are correct. Ground plane may be placed beneath the module as long as it does not protrude beyond the edge of the top layer ground plane on the module PCB.

The bottom 3 scenarios are incorrect. The left hand side example because there is ground plane underneath the antenna, the middle example because there is insufficient clearance around the antenna (it is best to have no conductors anywhere near the antenna. Finally, the right hand example has a battery's metal casing in the recommended keep out area.
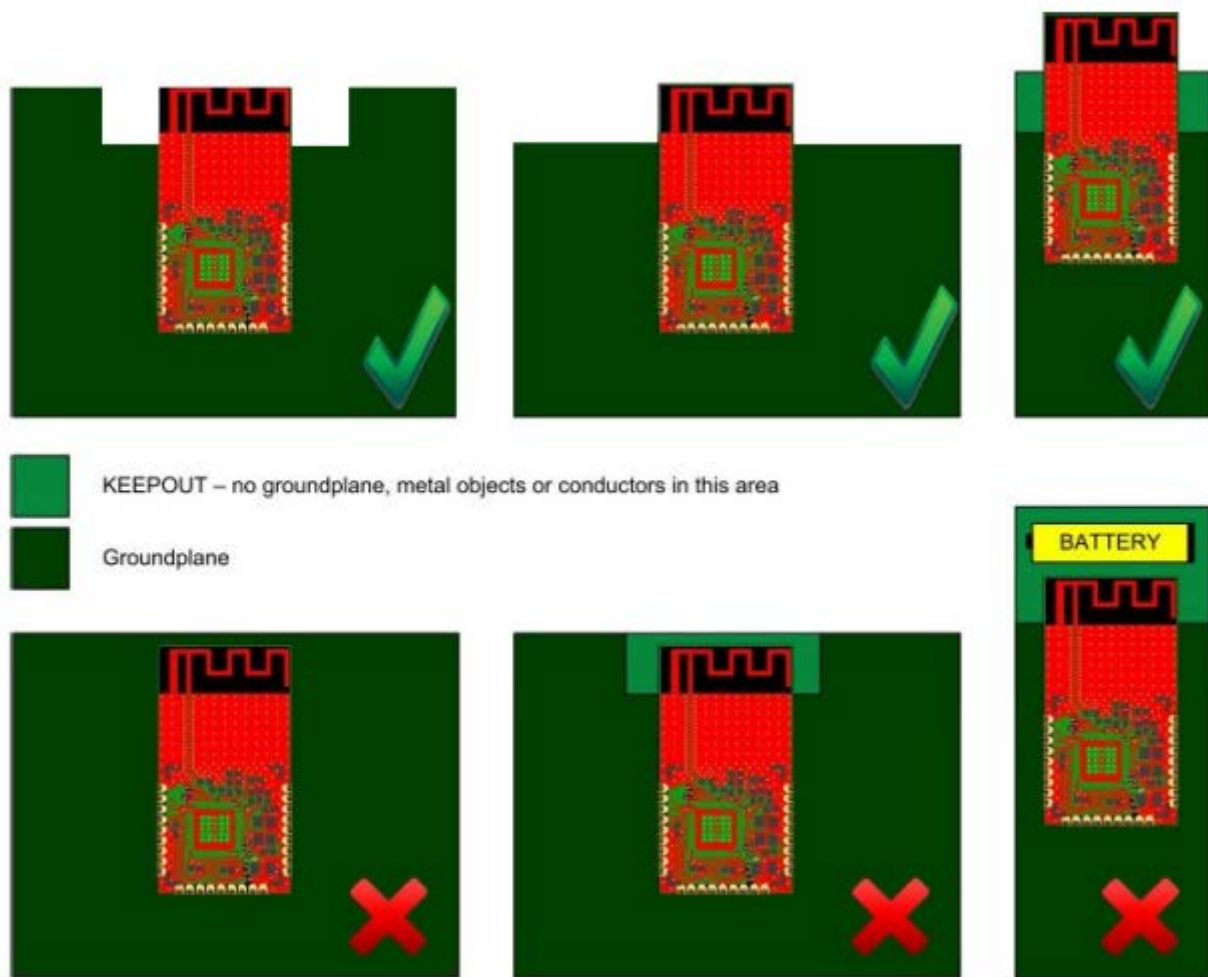

KEEPOUT – no groundplane, metal objects or conductors in this area

Groundplane

BATTERY

Figure 4

5 Development resource provided

WITSTEC provide these modules development resources freely for each customer, including software, data manuals, user guides, reference manuals, reference design. And provide Customized application development services, but not limited to Smart Home, Smart agriculture, industrial control, Automatic message recording, medical care, sensor network, etc.

FCC Statement

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.

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

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.

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: 2AOBN-WT5169P0 Or Contains FCC ID: 2AOBN-WT5169P0 "

when the module is installed inside another device, the user manual of this device 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.

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