

# (KW2541A) User Manual

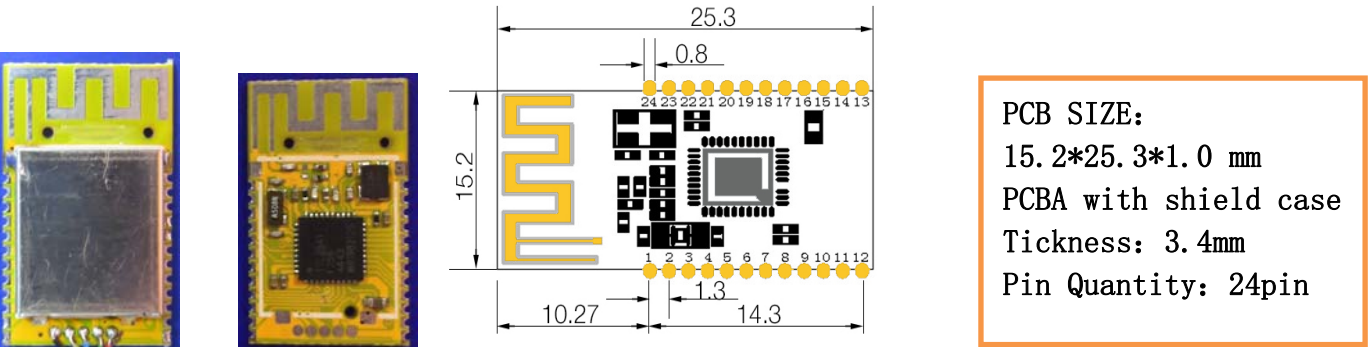
24 pin BLE Bluetooth module (with shield case) specifications



(1):BLE 4.0 Bluetooth module and protocol

1. Dimensions and block diagram

(1-1) .DIMENSION SIZE :



(1-2). block diagram :

confidentiality

## 2. BLE applications and solution



### (2-1).Fitness categories :

sports bracelet, pedometer, exercise metering (running, cycling, golf).

### (2-2).Smart home categories:

socket transformation, remote control switch, dimmer lighting, hygrometer, Smart scales , environmental tobacco smoke detectors, pet supervision.

### (2-3).Health care categories:

medical testing / tracking (heart rate, blood pressure, blood oxygen, pulse, temperature).

### (2-4).Infant Care:

Real-time temperature detection, intelligent crib, loss prevention.

### (2-5).Toys:

interactive remote control toys, robots, aircraft, toy cars, anti-lost.

### (2-6).Automotive:

tire pressure monitoring, automatic car lock, parking records, data collection monitoring.

### (2-7).HMI:

HID keyboard, mouse, remote control, game pad:

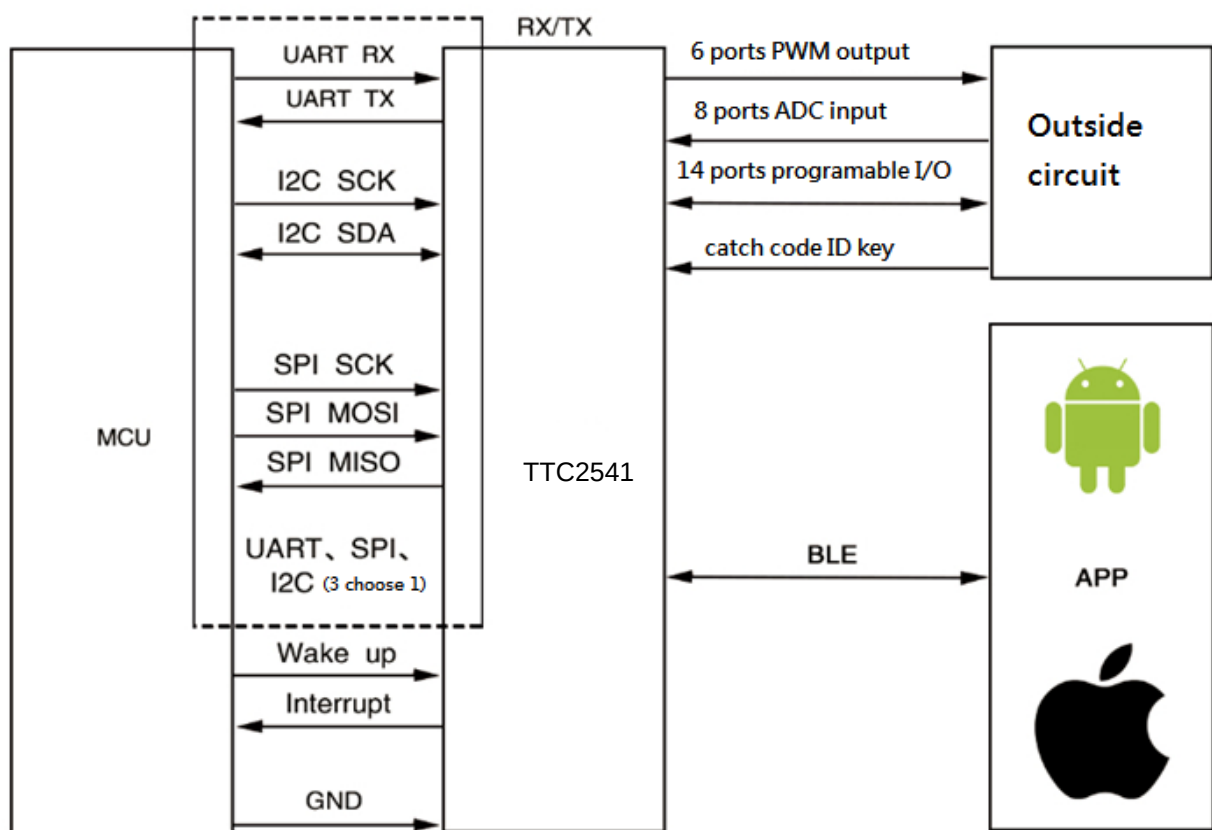
### (2-8).Project example:

Count collection (Pedometer, Bouncing balls, Heart rate meter), Sports and Fitness, Power outlet transformation, Remote control switch, Dimmer lighting, Medical testing [Blood pressure, Oxygen, Temperature], [Interactive remote control toys, Analog/Digital input/output], Robots, Toy Helicopters, Toy Cars, Anti-lost finder for things, Power collection, Charge management, Hygrometer, Bluetooth watch, (Smart devices) Remote control interface, Alarms, Access control attendance (Bluetooth lock), Patrol unit roots anti-control

(intelligent Device) applications (Emergency dialing, Remote shooting), Bluetooth printing, Air controllers, Set-top box controller, Logistics management statistics, Tire pressure monitoring, Automotive automatic locks, Remote massager, Parking records, Outdoor advertising, Motion measureme

[Running, Cycling, Golf], Timer switch, Pet supervision, Infant child care (In real-time temperature detection, Anti-lost), Toys (with mobile phone), proximity sensor trigger the application, speed application, smart home (remote Control) , Instrumentation wireless interface, Device wireless configuration interface, Regional house arrest control, Quantitative timing, Wearable devices, Bluetooth card reader, Portable instrumentation, Equipment, remote firmware upgrade interface .....

### 3、Working mode schematic



### 4. Electrical characteristics

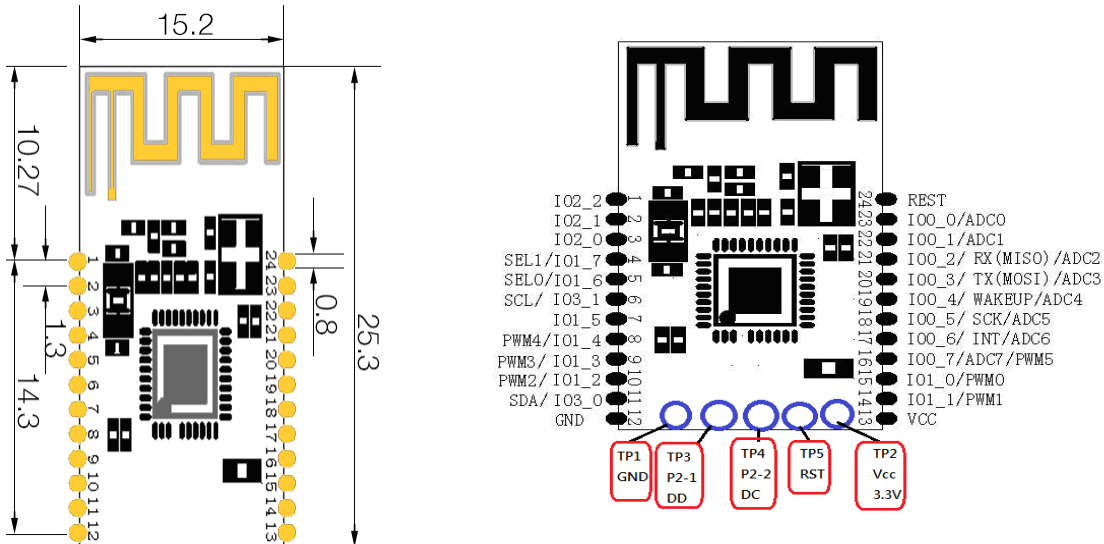
(With  $T_a = 25\text{ }^{\circ}\text{C}$ ,  $V_{DD} = 3.3\text{V}$ , standard measure: 1Mbps , 250KHz GFSK modulation , Bluetooth low energy mode.)

1. Modulation Mode: GFSK;
2. Frequency range: 2402~2480MHZ (2.4G ISM band);
3. Transmit power setting:  $-20 \sim -2.68\text{ dBm}$  ;
4. Operating ambient temperature range:  $-20\text{ }^{\circ}\text{C} \sim +60\text{ }^{\circ}\text{C}$  ;

5. The storage temperature range:  $-30\text{ }^{\circ}\text{C} \sim +85\text{ }^{\circ}\text{C}$ ;
6. The power supply voltage:  $2.0 \sim 3.6\text{VDC}$ ;
7. Receiver sensitivity:  $-94\text{dBm}$  typical ( direct test from IC RF out );
8. Receiving mode current (high gain setting):  $20.02\text{ mA}$  (typical);
9. Transmit mode current ( at  $0\text{dBm}$  output setting ):  $18.2\text{ mA}$  (typical);
10. MCU low active current (only  $32\text{MHz}$  operation of X-tal OSC):  
 $6.7\text{ mA}$  (typ);
11. Power mode 1: The current consumption: (under MCU standby mode,  
the wake-up time =  $4\mu\text{S}$ );  $I = 270\mu\text{A}$  (Typical);
12. Power mode 2: THE current consumption in sleep mode.  
timer activate / enable, wake-up time can by the programming  
software setting):  $I = 1\mu\text{A}$  (typ);
13. Power mode 3: The current consumption : ( Low power deep sleep mode,  
via the hardware initiative wake ):  $I = 0.5\mu\text{A}$ (Typical);
14. The module to work average current less than the  $500\mu\text{A}$ , stand by  
current less than  $100\mu\text{A}$ , Sleep current is less than  $1\mu\text{A}$

## 5. Module pin definition and description of input and output ports

### (5-1) pin map



### (5-2) Pin function table (Not shown in the I/O pin functions ,Please see Table(5-4) input and output ports description)

| No. | Function        | Function Descrip. | pin No. | Function corresponds                                                                                  |
|-----|-----------------|-------------------|---------|-------------------------------------------------------------------------------------------------------|
| 1   | UART            | TX                | 20      | Serial data bus output                                                                                |
|     |                 | RX                | 21      | Serial data bus input                                                                                 |
| 2   | SPI             | MOSI              | 20      | Master Out , Slave input                                                                              |
|     |                 | MISO              | 21      | Master input, Slave output                                                                            |
|     |                 | SCK               | 18      | SPI Bus clock signal                                                                                  |
| 3   | IIC             | SDA               | 11      | IIC serial Data (SDA)                                                                                 |
|     |                 | SCL               | 6       | IIC serial Clock (SCL)                                                                                |
| 4   | Common port     | INT               | 17      | Interrupt output pin                                                                                  |
| 5   |                 | WAKEUP            | 19      | BLE wake up pin, Low/ wake up, High / BLE module automatically sleep                                  |
| 6   | Channel select. | SELO              | 5       | MCU communication mode select, See table(5-3) Communication protcol mode selection, I/O setting Table |
|     |                 | SEL1              | 4       |                                                                                                       |
| 7   | Reset           | REST              | 24      | BLE hardware reset pin (Low: reset)                                                                   |
| 8   | Power           | VCC               | 13      | BLE module power supply pin, voltage range of 2.0 ~ 3.6V                                              |
| 9   | Ground          | GND               | 12      | BLE module grounding pin                                                                              |

Pin Function Description (The module following collectively "BLE"):

- a. UART: serial bus, the default baud rate 9600bps, a single packet transmission is less than 17 bytes, package transmission intervals greater than 20ms.
- b. SPI: SPI bus interface, support for less than 2M / S data transmission rate, a single packet transmission is less than 17 bytes, package transmission intervals greater than 20ms.
- c. IIC: IIC bus interface, support more than 22K / S, less than 400K / S data transmission rate, a single packet transmission is less than 8 bytes, package transmission intervals greater than 20ms.
- d. RX: serial bus data input.
- e. MOSI: Master output, Slave input.
- f. MISO: Master input, Slave output.
- g. SCK: SPI bus clock signal.
- h. SDA: IIC data.
- i. SCL: IIC clock.
- j. WAKEUP: BLE wake up pin, Low \_wake up, High/ BLE module automatically sleep.
- k. SEL0 ~ SEL1: MCU and BLE communication mode selection pin. Specific details, see "(5-3) communication protocol mode selection, I/O setting table".
- l. REST: BLE hardware reset pin, Low\_reset.
- m. VCC: BLE module power supply pin voltage range DC 2.0~3.6V.
- n. GND: BLE module ground pin.

(5-3) .Communication protocol mode selection, I/O setting Table

| No. | Channel Select<br>PIN status |      | Communication<br>interface state |     |     | Remark                                                                                     |
|-----|------------------------------|------|----------------------------------|-----|-----|--------------------------------------------------------------------------------------------|
|     | SEL1                         | SEL0 | UART                             | SPI | IIC |                                                                                            |
| 1   | 0                            | 0    | OK                               | X   | X   | 1. Command mode<br>Please contact the<br>Vendor.<br>2. Description:<br>0 is Low, 1 is high |
| 2   | 0                            | 1    | OK                               | X   | X   |                                                                                            |
| 3   | 1                            | 0    | X                                | OK  | X   |                                                                                            |
| 4   | 1                            | 1    | X                                | X   | OK  |                                                                                            |
| 5   | X                            | X    | OK                               | X   | X   |                                                                                            |

UART mode: SEL1=0, SEL0=0 or SEL1=0, SEL0=1 or SEL0, SEL1 floating.

SPI mode: SEL1=1, SEL0=0

IIC mode: SEL1=1, SEL0=1

Table (5-4) : Input and output ports Description

| Input / utput Register pin No. |    |    |    |    |    |    |    |    |
|--------------------------------|----|----|----|----|----|----|----|----|
| I/O Port register              | 7  | 6  | 5  | 4  | 3  | 2  | 1  | 0  |
| I00                            | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 |
| I01                            | 4  | 5  | 7  | 8  | 9  | 10 | 14 | 15 |
| I02                            | NC | NC | NC | NC | NC | 1  | 2  | 3  |
| I03                            | NC | NC | NC | NC | NC | NC | 6  | 11 |

Note: BITx=0, Low level out ; BITx=1 Highlevel out

| Direction Register pin No. |    |    |    |    |    |    |    |    |
|----------------------------|----|----|----|----|----|----|----|----|
| Direction Register         | 7  | 6  | 5  | 4  | 3  | 2  | 1  | 0  |
| DIR0                       | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 |
| DIR1                       | 4  | 5  | 7  | 8  | 9  | 10 | 14 | 15 |
| DIR2                       | NC | NC | NC | NC | NC | 1  | 2  | 3  |
| DIR3                       | NC | NC | NC | NC | NC | NC | 6  | 11 |

Note: BITx = 0 is corresponds port input , BITx = 1 is corresponds port output .

| PWM port pin No. |      |      |      |      |      |
|------------------|------|------|------|------|------|
| PWM5             | PWM4 | PWM3 | PWM2 | PWM1 | PWM0 |
| 16               | 8    | 9    | 10   | 14   | 15   |

| ADC port pin No. |      |      |      |      |      |      |      |
|------------------|------|------|------|------|------|------|------|
| ADC7             | ADC6 | ADC5 | ADC4 | ADC3 | ADC2 | ADC1 | ADC0 |
| 16               | 17   | 18   | 19   | 20   | 21   | 22   | 23   |

Note: The Blue Numbers of the corresponding port pin No. applications of all kinds, For example:I00/bit0 or ADC0 pin is corresponding module pin No.23

(OEM) Integrator has to assure compliance of the entire end-product incl. the integrated RF Module. Additional measurements and/or equipment authorizations may need to be addressed depending on co-location or simultaneous transmission issues if applicable.

Integrator is reminded to assure that these installation instructions will not be made available to the end-user of the final host device.

With the low output power, this RF Module meets the FCC/IC SAR exemption and can be therefore integrated into any (portable, mobile, fixed) host device that powered by battery.

The final host device, into which this RF Module is integrated" has to be labelled with an auxiliary label stating the FCC ID of the RF Module, such as "Contains FCC ID: 2AH7AKW2541A ".

The final host device, into which this RF Module is integrated" has to be labelled with an auxiliary label stating the IC of the RF Module, such as "Contains transmitter module IC:21416-KW2541A"

"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 to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment."

This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions:

- (1) this device may not cause interference, and
- (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :

- (1) l'appareil ne doit pas produire de brouillage, et
- (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.