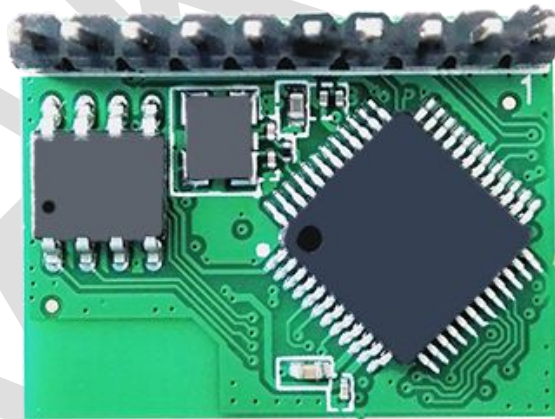
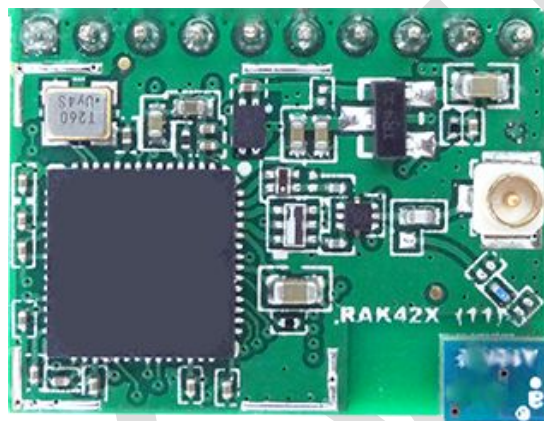


# RAK423 UART WIFI Module

## Specification V1.4



Shenzhen Rakwireless Technology Co.,Ltd [www.rakwireless.com](http://www.rakwireless.com)

Mail: [info@rakwireless.com](mailto:info@rakwireless.com)

# Content

|   |    |
|---|----|
| RAK423 UART WIFI Module.....                | 1  |
| Content.....                                | 2  |
| 1 Overview.....                             | 1  |
| 1.1 Module Overview.....                    | 1  |
| 1.2 Key Application.....                    | 1  |
| 1.3 Device Features.....                    | 1  |
| 1.4 RAK423 System Diagram.....              | 2  |
| 2 Functional Description.....               | 3  |
| 2.1 HW Interface.....                       | 3  |
| 2.2 Wireless Driver.....                    | 3  |
| 2.3 TCP/IP.....                             | 3  |
| 2.4 Power Consumption.....                  | 3  |
| 3 Hardware Introduction.....                | 4  |
| 3.1 Module type.....                        | 4  |
| 3.2 Module height.....                      | 5  |
| 3.3 Pin Definition.....                     | 5  |
| 3.4 Design Reference.....                   | 6  |
| 3.5 RAK423 PCB Mechanical Size.....         | 7  |
| 3.6 Reflow Soldering Temperature Graph..... | 7  |
| 3.7 Baking Instructions.....                | 8  |
| 4 Electrical Characteristics.....           | 9  |
| 4.1 Absolute Maximum.....                   | 9  |
| 4.2 Recommended Operating Parameters.....   | 9  |
| 4.3 RF Electrical Characteristics.....      | 10 |

|                          |    |
|--------------------------|----|
| 4.4 MCU Reset.....       | 11 |
| 5 Order Information..... | 12 |
| 5.1 Products.....        | 12 |
| 5.2 Description.....     | 12 |
| 5.3 Size.....            | 12 |
| 6 Sales and Service..... | 14 |
| 7 Revision History.....  | 15 |

RAK423 Datasheet

# 1 Overview

## 1.1 Module Overview

RAK423 module is a Wi-Fi module that fully compliant with IEEE 802.11b/g/n wireless standards, with internally integrated TCP / IP protocol stack, supporting numerous protocols such as ARP, IP, ICMP, TCP, UDP, DHCP CLIENT, DHCP SERVER, DNS and other etc. It supports AP mode, Station mode and Ad-hoc and mode. Users can easily and quickly use it to networking and data transmission. The baud rate of module serial port is up to 921600bps, which can fully meet the low-rate applications.

RAK423 supports storing parameters, and by the customer commands it determines whether to enable automatic networking to realize easy networking and reduce time for system to networking. The module has built-in WEB server, supporting wireless network parameters configuration, supporting wireless firmware upgrade. It also supports WPS and EasyConfig one-key networking, significantly reducing software development effort.

RAK423 has four power management modes, among which the minimum standby power consumption is <math>2\mu\text{A}</math>, fully meet customer's requirement for low power design.

## 1.2 Key Application

- Portable products
- Home appliances and electrical appliances
- Industrial sensors
- Sales terminals
- Buildings automation
- Logistics and freight management
- Home security and automation
- Medical applications, such as patient monitoring, medical diagnostics
- Metering (stop timing, measuring instruments, meters, etc.)

## 1.3 Device Features

- Support IEEE 802.11b/g/n wireless standards
- Support UART communication with data flow control, with the maximum baud rate of 921600bps
- Minimalist hardware peripheral circuit design

- Support Station, Ad-hoc and AP modes
- Support DHCP SERVER / DHCPCLIENT
- Support OPEN, WEP, WPA-PSK, WPA2-PSK and WPS encryptions
- Support TCP, UDP protocols, with maximum 8 UDP/TCP connections
- Support webpage-based parameter configuration
- Support WPS and EasyConfig one-key to network connection
- Support parameter storage, customer orders loading after boot
- Support parameters store in Deep Sleep State, with connection time as fast as 300ms
- Support wireless upgrade firmware
- On-board ceramic antenna or U.FL antenna connector
- Operating voltage: 3.3V
- 4 kinds power working modes, with minimum power consumption as 1-2uA
- Small package size: Length x width = 20.5mm x 15.5mm  
(curved needle height: 6.4mm, vertical needle height: 8.7mm)
- FCC, RoHS and CE compliant

## 1.4 RAK423 System Diagram

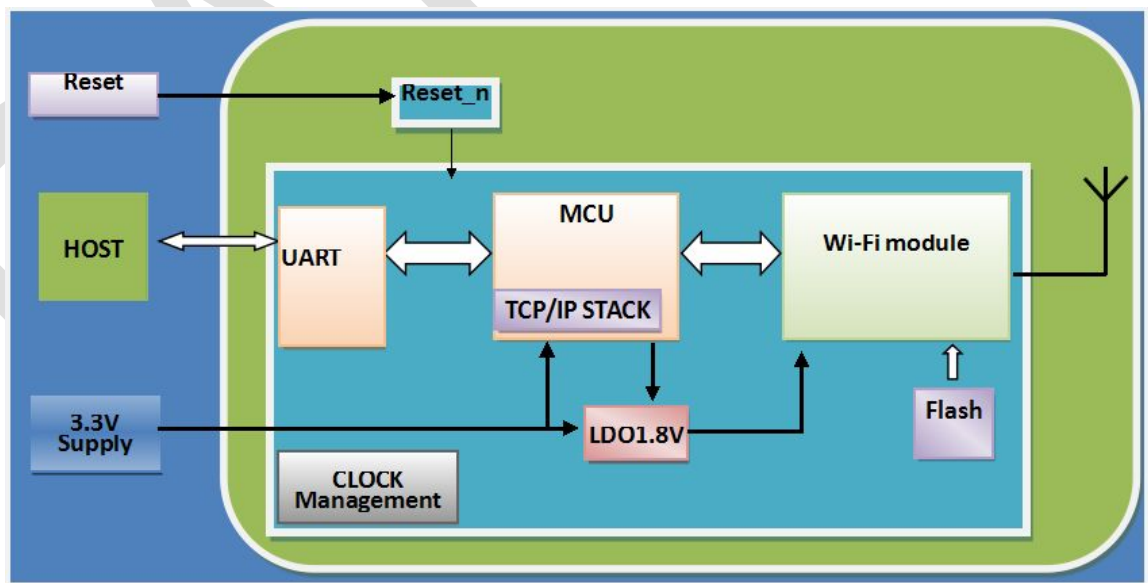


Figure 1-1 RAK423 System Diagram

## 2 Functional Description

### 2.1 HW Interface

- Baud rate: 9600~921600bps
- Interface actual throughput up to 600kbps
- support hardware flow control, ensuring reliability of data transmission

### 2.2 Wireless Driver

- Compliant with IEEE 802.11b/g/n standards
- Support AP 、 STA 、 AD-Hoc Mode
- Support WEP, WPA/WPA2-PSK encryptions
- Fast networking, allowing module to be added to network within 1 sec after power up
- Support WPS and EasyConfig one-key to network connection
- Support wireless configuration and firmware upgrade

### 2.3 TCP/IP

- DHCP Client and Server features
- DNS Client and Server functions
- TCP Client, TCP Server, UDP Client, UDP Server and Multicast functions
- 8-way socket applications

### 2.4 Power Consumption

- The module supports four power consumption modes:
- Fullspeed working mode, with approx 80mA average power consumption, peak current less than 200mA
- Power-saving mode, with approx 10mA average power consumption, peak current <200mA, DTIM = 100ms
- Deep sleep mode, with approx 5mA average power consumption, peak current <200mA, DTIM = 100ms (maximum support to 115200bps)
- Standby mode, with power consumption <2uA



# 3 Hardware Introduction

## 3.1 Module type

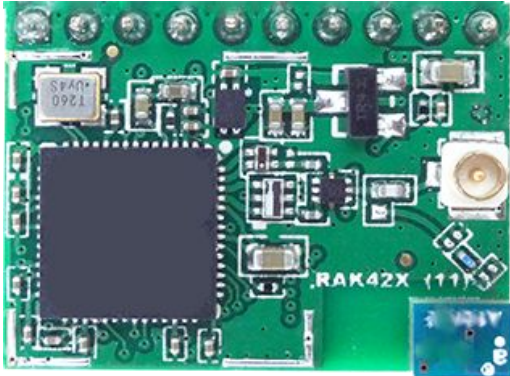


Figure 3-1 RAK423BI Top View

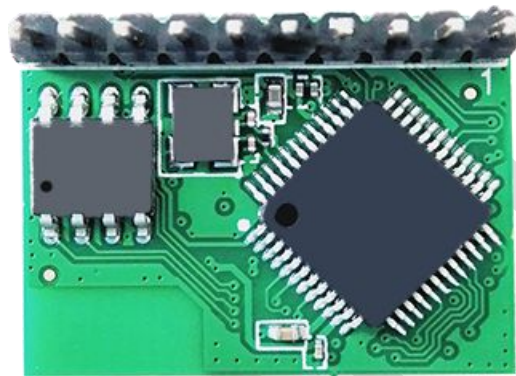


Figure 3-2 RAK423BI Bottom View

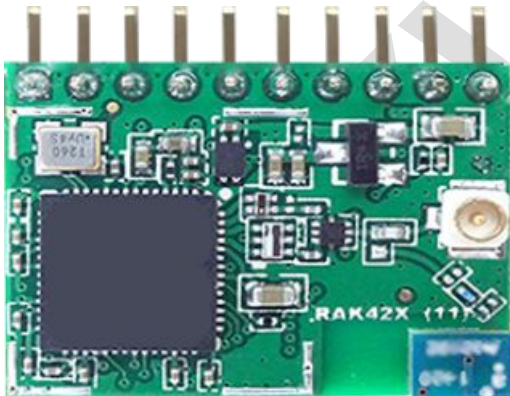


Figure 3-3 RAK423BL Top View

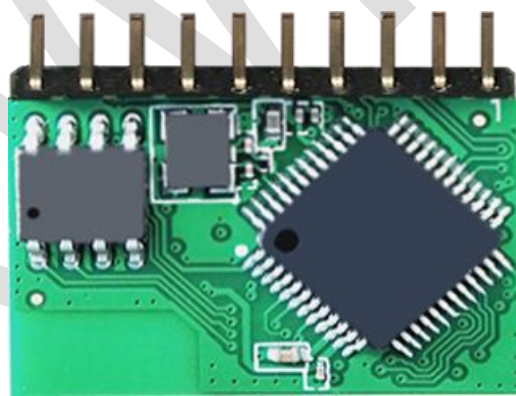


Figure 3-4 RAK423BL Bottom View

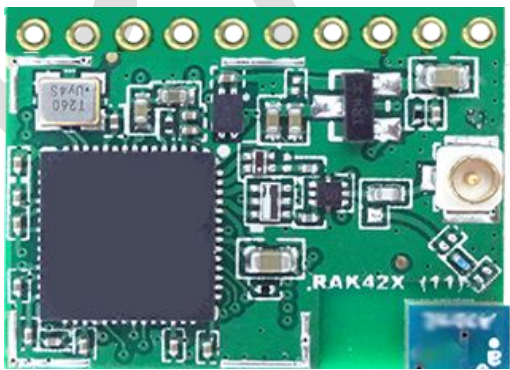


Figure 3-5 RAK423BX Top View

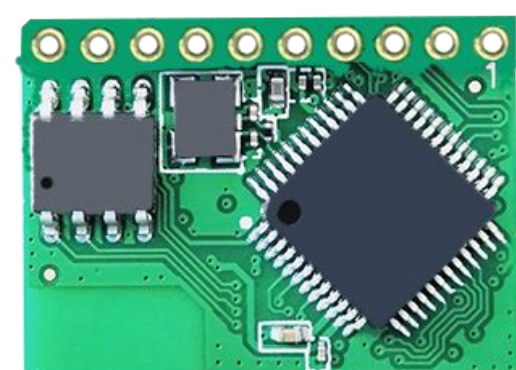


Figure 3-6 RAK423BX Bottom View

### 3.2 Module height

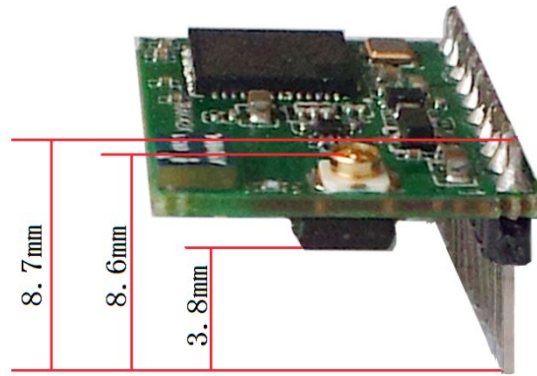


Figure 3-7 RAK423I Height

### 3.3 Pin Definition

Table 3-1: Pin Definition

| Pin Serial No. | Name   | Type   | Description  |
|----------------|--------|--------|--|
| 1              | GND    | Ground | connected to ground pad or the copper  |
| 2              | VCC3V3 | Power  | 3.3V power supply  |
| 3              | NC     | NC     | Remain disconnected when no use  |
| 4              | RESET  | I, PU  | Module reset pin, low effective  |
| 5              | NC     | NC     | Remain disconnected when no use  |
| 6              | RXD    | O      | Serial data communication interface send   |
| 7              | TXD    | I      | Serial flow control pin, ready to receive, low effective   |
| 8              | RTS    | I      | Serial flow control pin, ready to receive, low effective   |
| 9              | CTS    | O      | Serial flow control pin, clear Send, low effective   |
| 10             | LINK   | O, PU  | "0" - STA connected in AP mode,<br>Connected to router in STA mode<br>"1" - disconnected Remain disconnected when no use |

Note:

1. I - input O - output PU – pulling up PD - pulling down NC - not connected



2. Pin in NC, remains disconnected

Status indicator:

connected to router in STA mode,

STA connected in AP mode——on (output low) conversely off

EasyConfig, WPS is in one-key configuration——quick flashing

### 3.4 Design Reference

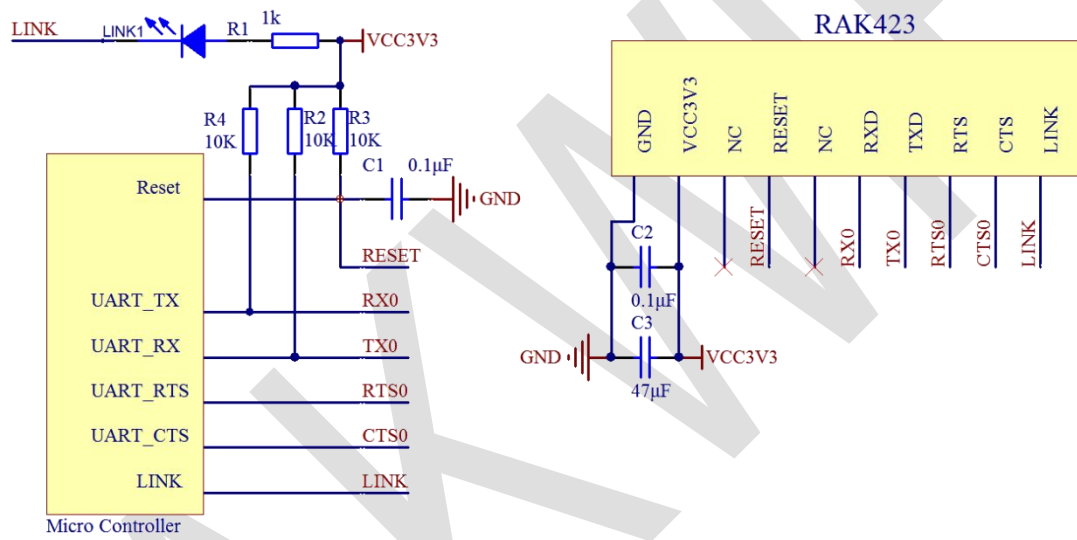


Figure 3-8 Module Typical Design Reference

### 3.5 RAK423 PCB Mechanical Size

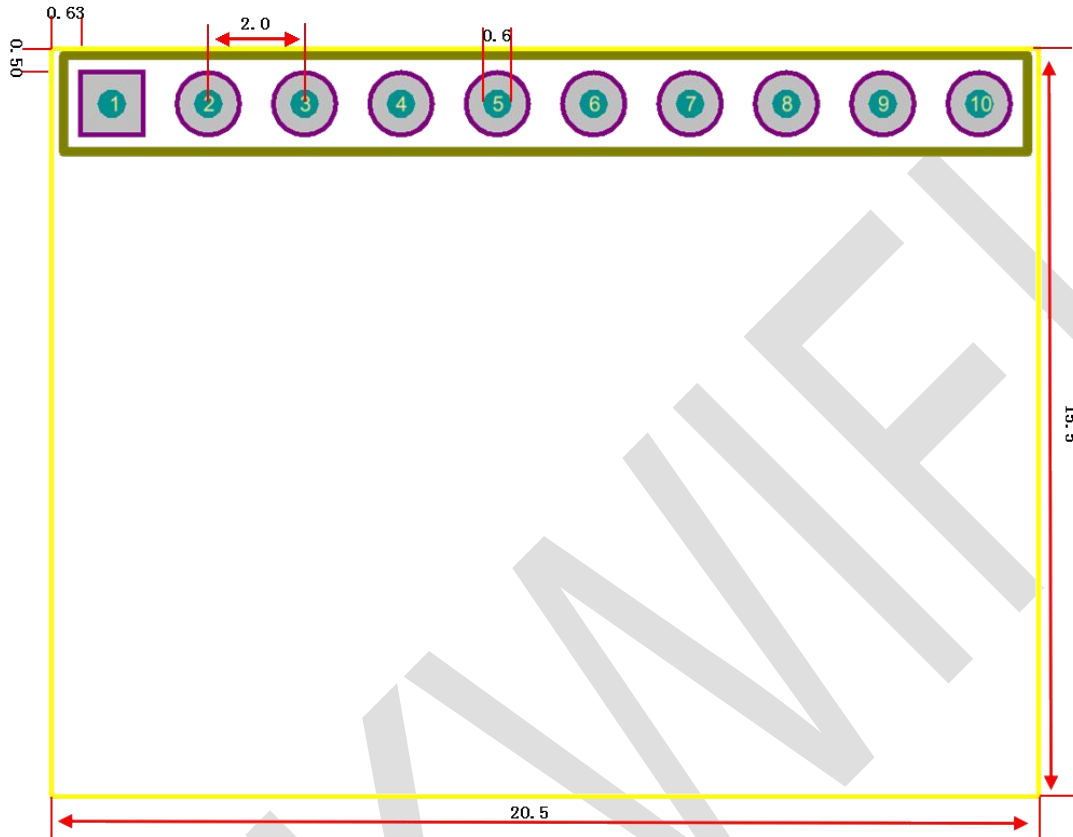


Figure 3-9 Module Pin Size (mm)

### 3.6 Reflow Soldering Temperature Graph

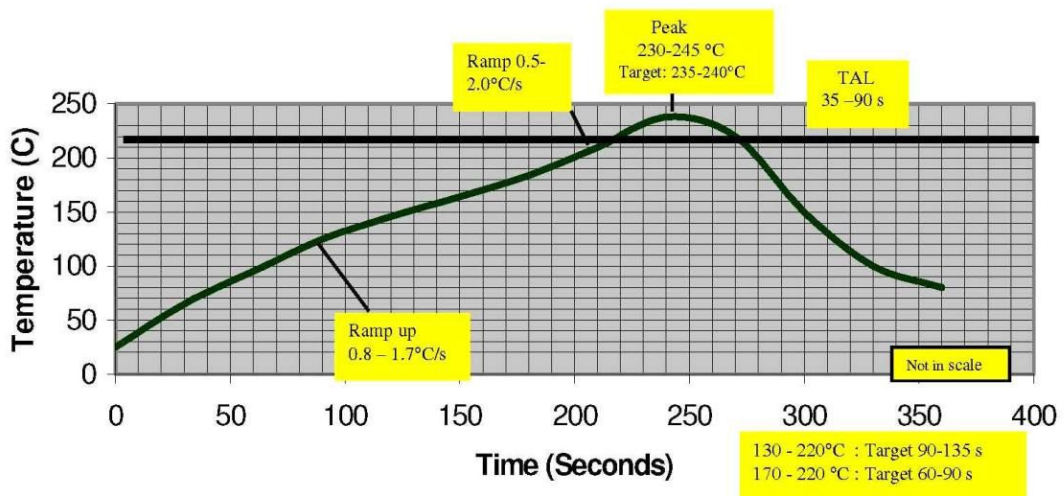


Figure 3-10 Temperature Graph

Note:

As shown in Figure 3-8, it is based on the SAC305 lead-free tin paste (3% silver, 0.5% copper). Alpha OM-338 lead-free cleaning-free flux is recommended. The Figure 6 is mainly used for guidance. The entire process time is subject to thermal pad number of assembly board and device Intensity.

### **3.7 Baking Instructions**

The RAK423 module is very sensitive to water. Be cautious to baking the device. At ambient conditions, it is required that within 168 hours removed from the vacuum packaging, the module should be processed with the circuit board assembly by reflow soldering; Or stored in the environment with a relative humidity below 10%. If the condition is not satisfied, the RAK423 must be processed with a 9-hour baking in the environment of 125 °C before the reflow soldering.

## 4 Electrical Characteristics

### 4.1 Absolute Maximum

The following table shows the absolute maximum. Note that the module device may be damaged when exceeds the maximum. To avoid damages to the module and the device, please operate under specified conditions.

Table 4-1: Parameters and Value Range

| Parameters                           | Symbols                  | Value    | Unit |
|--------------------------------------|--------------------------|----------|------|
| External supply voltage              | VCC3V3                   | -0.3~4.0 | V    |
| Maximum RF Input (Reference: 50Ω)    | RF <sub>in</sub>         | +10      | dBm  |
| When voltage is 3.3V, IO Max voltage | 3V3V <sub>in</sub> IOMax | VCC+0.3  | V    |
| When voltage is 3.3V, IO Min voltage | 3V3V <sub>in</sub> IOMin | -0.3     | V    |
| Storage ambient temperature          | T <sub>store</sub>       | -65~+135 | °C   |
| ESD resistance                       | ESD <sub>HBM</sub>       | 2000     | V    |

### 4.2 Recommended Operating Parameters

Table 4-2: Recommended Operating Parameter Range

| Parameters          | Symbols              | Min Value | Typical Value | Max Value | Unit |
|---------------------|----------------------|-----------|---------------|-----------|------|
| External voltage    | V <sub>cc</sub>      | 3.14      | 3.3           | 3.46      | V    |
| Ambient temperature | T <sub>ambient</sub> | -40       | --            | +85       | °C   |

### 4.3 RF Electrical Characteristics

#### ● RF Transmit Specifications

Table 4-3: Partial RF Transmit Specifications

| Symbol    | Parameter       | Conditions | Typical Value | Unit |
|-----------|-----------------|------------|---------------|------|
| $F_{tx}$  | Frequency range | --         | 2.4           | GHz  |
| $P_{out}$ | Output power    | --         | --            | --   |
|           | 802.11b         | 1Mbps      | 17            | dBm  |
|           | 802.11g         | 6Mbps      | 17            | dBm  |
|           | 802.11n,HT20    | MCS0       | 17            | dBm  |
|           | 802.11g,EVM     | 54Mbps     | 14            | dBm  |
|           | 802.11n,HT20EVM | MCS7       | 10            | dBm  |

#### ● RF Receiver Specifications

Table 4-4: Partial Receiver Specifications

| Parameter            | Test conditions |            | Typical Value | Unit |
|----------------------|-----------------|------------|---------------|------|
| Receiver sensitivity | 11b,1Mbps       |            | -97           | dBm  |
|                      | 11b,2Mbps       |            | -92           | dBm  |
|                      | 11b,5.5Mbps     |            | -90           | dBm  |
|                      | 11b,11Mbps      |            | -88           | dBm  |
|                      | 11g,9Mbps       |            | -91           | dBm  |
|                      | 11g,18Mbps      |            | -87           | dBm  |
|                      | 11g,36Mbps      |            | -81           | dBm  |
|                      | 11g,54Mbps      |            | -75           | dBm  |
|                      | 11n,MCS1,13Mbps |            | -89           | dBm  |
|                      | 11n,MCS3,26Mbps |            | -82           | dBm  |
|                      | 11n,MCS5,52Mbps |            | -75           | dBm  |
|                      | 11n,MCS7,65Mbps |            | -72           | dBm  |
| Maximum input signal | CH7             | 11g,54Mbps | 10            | dBm  |
| Adjacent channel     | 6Mbps           |            | 37            | dBc  |
|                      | 54Mbps          |            | 21            | dBc  |
|                      | MCS0            |            | 38            | dBc  |
|                      | MCS7            |            | 20            | dBc  |

## 4.4 MCU Reset

Figure 4-1 shows the MCU reset timing diagram and reset pulse length. When power on the module or an exception occurs, the module needs to be reset. RESET pin is internally pulled up, low input is effective.

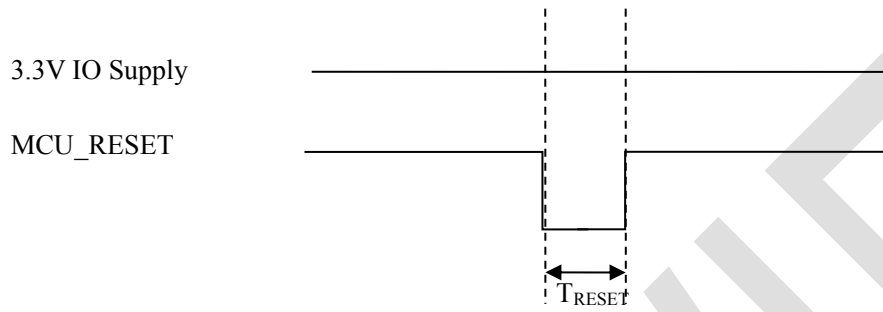


Figure 4-1: MCU Reset Timing

Table 4-5 shows the description of MCU reset parameters.

Table 4-5: MCU Reset Parameter

| Symbol      | Description            | typical (mS) |
|-------------|------------------------|--------------|
| $T_{RESET}$ | MCU reset pulse length | >10          |

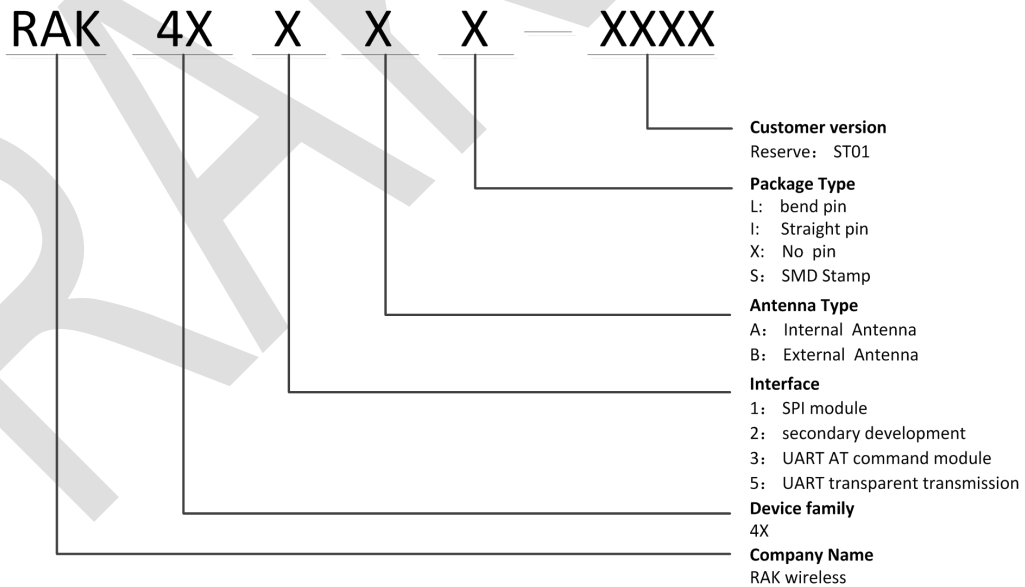
# 5 Order Information

## 5.1 Products

Table 5-1: Product Models

| Product        | Description  | Packaging  | Development board corresponding model |
|----------------|--|------------|---------------------------------------|
| RAK423AI-XXXX  | UART interface module, with on-board antenna , use of the straight pin | 50pcs/tray | RAK423AI_EVB                          |
| RAK423AL-XXXX  | UART interface module, with on-board antenna , use of the bend pin     | 50pcs/tray | RAK423AL_EVB                          |
| RAK423AX-XXXX  | UART interface module, with on-board antenna ,no pin                   | 50pcs/tray | RAK423AX_EVB                          |
| RAK423 BI-XXXX | UART interface module, with external antenna , use of the straight pin | 50pcs/tray | RAK423BI_EVB                          |
| RAK423BL-XXXX  | UART interface module, with external antenna, use of the bend pin      | 50pcs/tray | RAK423BL_EVB                          |
| RAK423 BX-XXXX | UART interface module, with external antenna,no pin                    | 50pcs/tray | RAK423BX_EVB                          |

## 5.2 Description



## 5.3 Size

Packaging: Hard plastic pallets



Weight:  $\leq 3.00\text{g/pcs}$

Table 5-2: Thickness (Height)

| RAK423         | Thickness (Height)        |
|----------------|---------------------------|
| Length * width | 20.5mm×15.5mm             |
| Height         | See the 3.2 module height |

## 6 Sales and Service

### Beijing

FAE mailbox: [allan.jin@rakwireless.com](mailto:allan.jin@rakwireless.com)

Tel : 010-62716015

Fax: 010-62716015

Address: Room 1108, Jin Yanlong Building, Xisanqi Desheng Gate, Haidian District, Beijing

### Shanghai

FAE mailbox: [steven.tang@rakwireless.com](mailto:steven.tang@rakwireless.com)

Tel : 021-54721182

Fax: 021-54721038

Address: Room 306, Ran East Business Center 1 Building, No.150, 2161 Lane, Wanyuan road, Minhang District, Shanghai

### Shenzhen

FAE mailbox: [vincent.wu@rakwireless.com](mailto:vincent.wu@rakwireless.com)

Tel : 0755-26506594

Fax : 0755-86152201

Address: Room 406, Tsinghua information comprehensive building, Nanshan Science Park North District , Shengzhen

## 7 Revision History

| Version | Modifications   | Date       |
|---------|---|------------|
| V1.0    | Initial Draft   | 2014-02-08 |
| V1.1    | Document modification, version release                    | 2014-03-28 |
| V1.2    | Modified PCB pin diagram                                  | 2014-04-06 |
| V1.3    | Update the contact way, Update the document format        | 2014-08-22 |
| V1.4    | Update the Physical picture, Update the Order Information | 2014-08-28 |