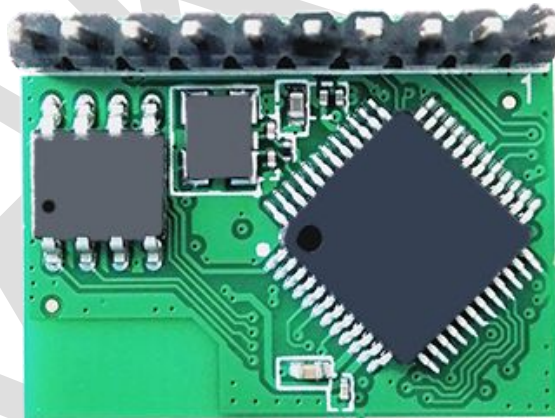
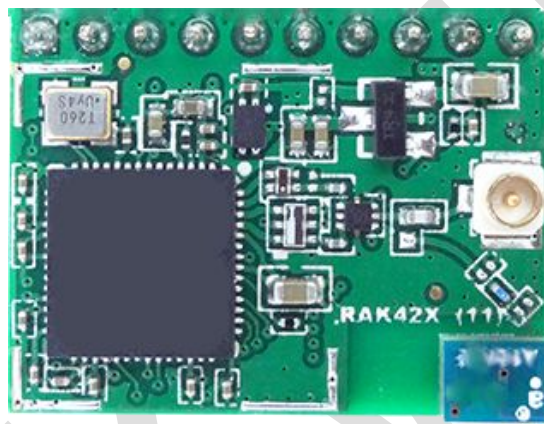


# RAK425 Serial WIFI Module

## Specification V1.2



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RAK425 Datasheet

# 1 Overview

## 1.1 Module Overview

RAK425 module is an ultra-low power WIFI module that fully supports IEEE 802.11b/g/n wireless standards, with a small package and easy-to-use features. The RAK425 is a complete serial pass-through module integrated with TCP / IP protocol stack and drivers, easy to use by simply using the PC, WEB Browser, APPs tool to work individually or in bulk for parameters configuration, and then module connects the serial ports and network for normal usage.

The RAK425 module is characterized by stable performance, low power consumption and flexibility to meet the various needs of customers. It can also provide test reports, allowing customers to get started quickly, shorten the development cycle.

The RAK425 module also provides various types of customized services, such as user webpages, production and configuration tools, mobile phone APPs, etc.

## 1.2 Key Applications

- 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
- Integrated TCP / IP protocol stack
- Support OPEN, WEP, WPA/WPA2-PSK Encryptions
- Support SoftAP, Station modes
- Support TCP, UDP protocols
- Support DHCP SERVER / DHCPCLIENT
- Support AT commands and transparent transmission mode
- Support UART communication with a data flow control, maximum rate of 921600bps
- Support multiple configuration tools for one-step configuration
- Support wireless upgrade firmware
- On-board ceramic antenna or U.FL antenna connector

- Operating voltage: 3.3V
- Support 4 kinds of power operating mode, with the lowest power consumption of 1.1uA
- Small package size: 20.5mm×15.5mm  
(curved needle height: 6.4mm, vertical needle height: 8.7mm)
- FCC, RoHS and CE compliant

## 1.4 RAK425 System Diagram

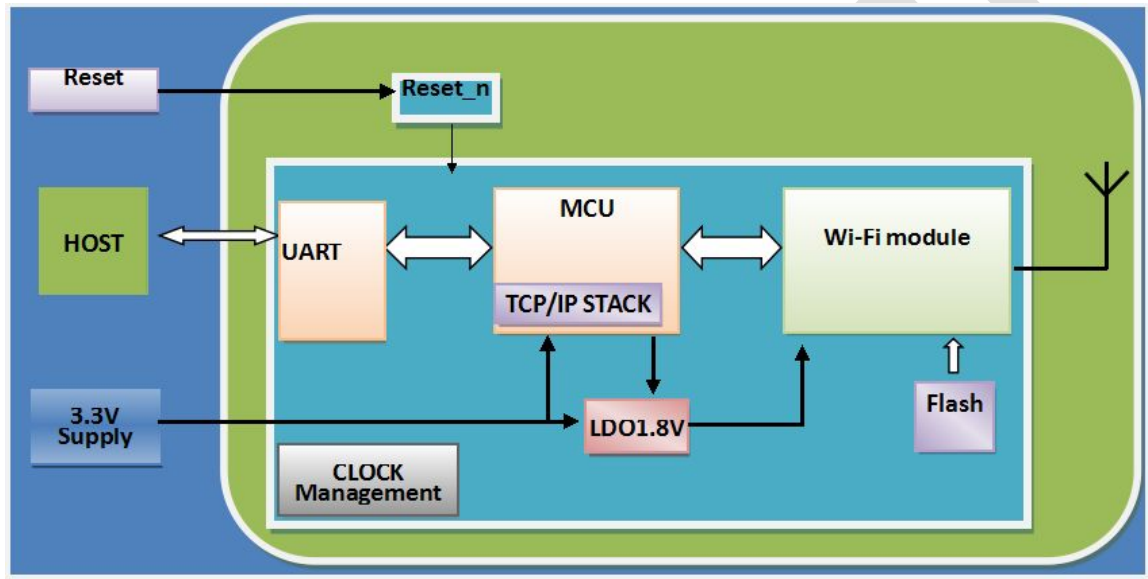


Figure 1-1 RAK425 System Diagram

## 2 Functional Description

### 2.1 HW Interface

- Rate: 9600~921600bps
- Interface actual throughput up to 600kbps
- Support hardware flow control, ensuring the reliability of data transmission
- 485 function settings

### 2.2 Wireless Driver

- Compliant with IEEE 802.11b/g/n standards
- Support AP and STA 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 network and socket automatic reconnection
- Support proactively identifying devices in LAN
- Support wireless configuration and firmware upgrade

### 2.3 TCP/IP Characteristic

- DHCP Client and Server functions
- DNS Client and Server functions
- TCP Client, TCP Server, UDP Client, UDP Server
- Dualsocket transparent transmission of data (via uuid distinction)
- Support HTTP protocol
- TCPC / TCPS keep-alive time setting and TCPC reconnection

### 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
- Automatic power-saving mode, with approx 10mA average power consumption, peak current <200mA DTIM = 100ms
- lowest power mode, with approx 3mA average power consumption, peak current <200mA, DTIM = 100ms (maximum support to 115200bps)
- External cable, ultra-low-power consumption mode, less than 1.1uA

## 3 Hardware Introduction

### 3.1 Module type

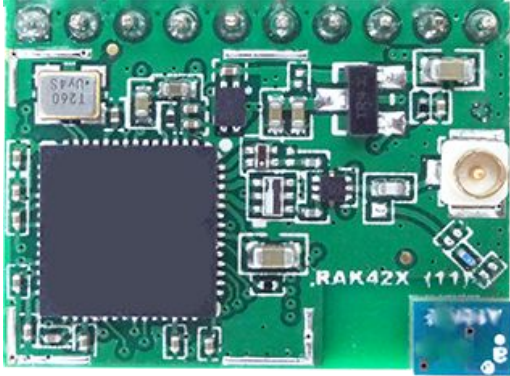


Figure 3-1 RAK425BI Top View

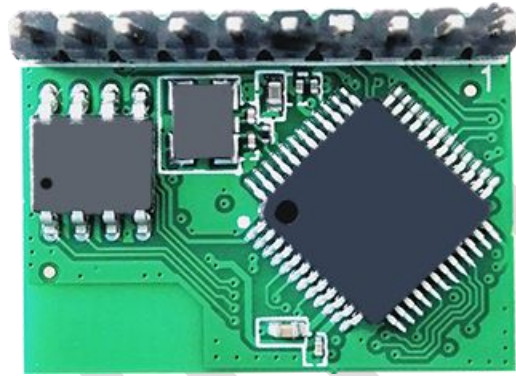


Figure 3-2 RAK425BI Bottom View

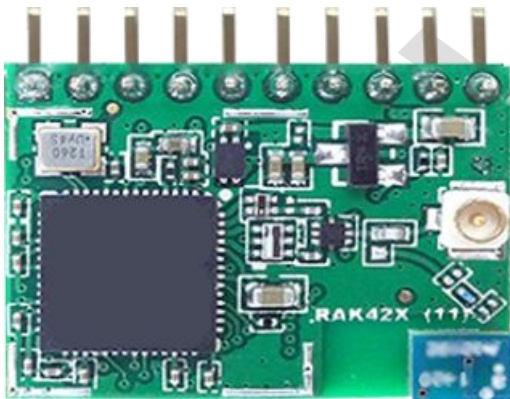


Figure 3-3 RAK425BL Top View

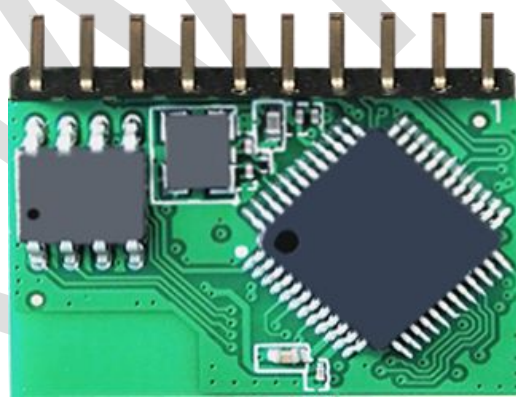


Figure 3-4 RAK425BL Bottom View

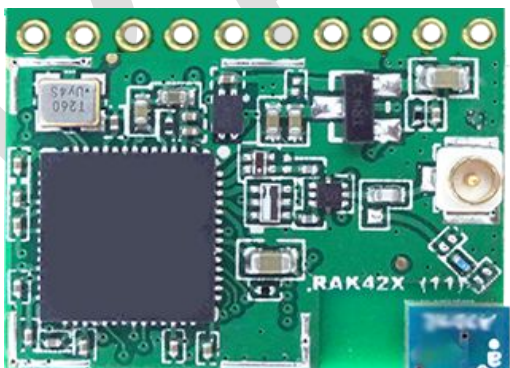


Figure 3-5 RAK425BX Top View

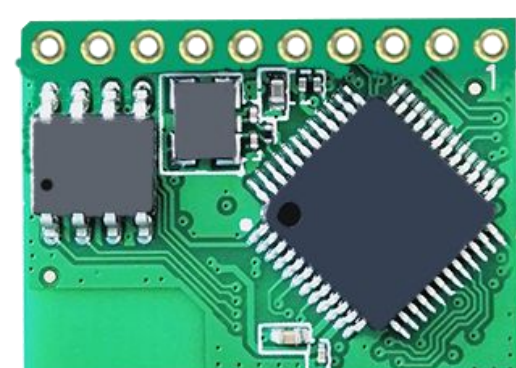


Figure 3-6 RAK425BX Bottom View

### 3.2 Module height

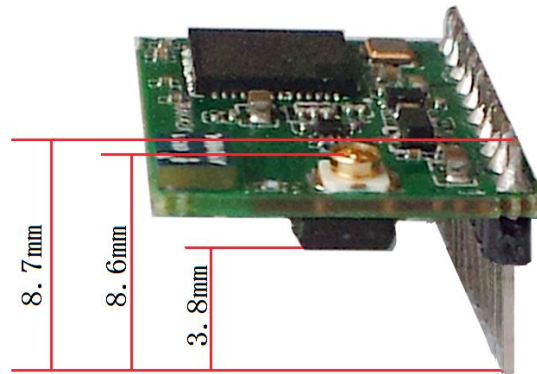


Figure 3-7 RAK4251 Height

### 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	CONFIG	I, PU	Module configuration pin to achieve EasyConfig and DefaultConfig function EasyConfig press (<3S) to enter into one-key configuration network DefaultConfig Press (>= 3S) to restore factory settings
4	RESET	I, PU	Module reset pin, low effective
5	STATUS	O, PU	Normal startup output pin, output low effective
6	RXD	I	Serial flow control pin, ready to receive, low effective
7	TXD	O	Serial data communication interface send
8	SLEEP	I, PU	Power Management Module Pulldown and hold 2S, release - enter ultra-low-power mode Pull down, then release - normal power mode (full, save) Wake up falling edge, remain disconnected



			when no use
9	MODE/WPS	I, PU	WPS function pin (default) Module reuse mode selection (by configuration switching) "0" - open assistant command mode "1" - only data pass-through mode Remain disconnected when no use
10	LINK	O, PU	Module networking indicator "0" - STA connected in AP mode, Connected to router in STA mode "1" - disconnected Remain disconnected when no use

**Note:**

1. I - input O - output PU – pulling up PD - pulling down
2. Pin in NC, remain disconnected

**Status indicator:**

- Module started properly — On (Output Low)
- Module failed to start — Off
- Module firmware is in upgrade — quick flashing
- Module is ready to enter factory mode — quick flashing
- Module Upgrade Error — slow flashing

**Link indicator :**

- module is connected to router in STA mode,
- module has STA connection under AP mode — On (Output Low) Conversely off
- EasyConfig, WPS is in one-key configuration — Quick flashing

### 3.4 Design Reference

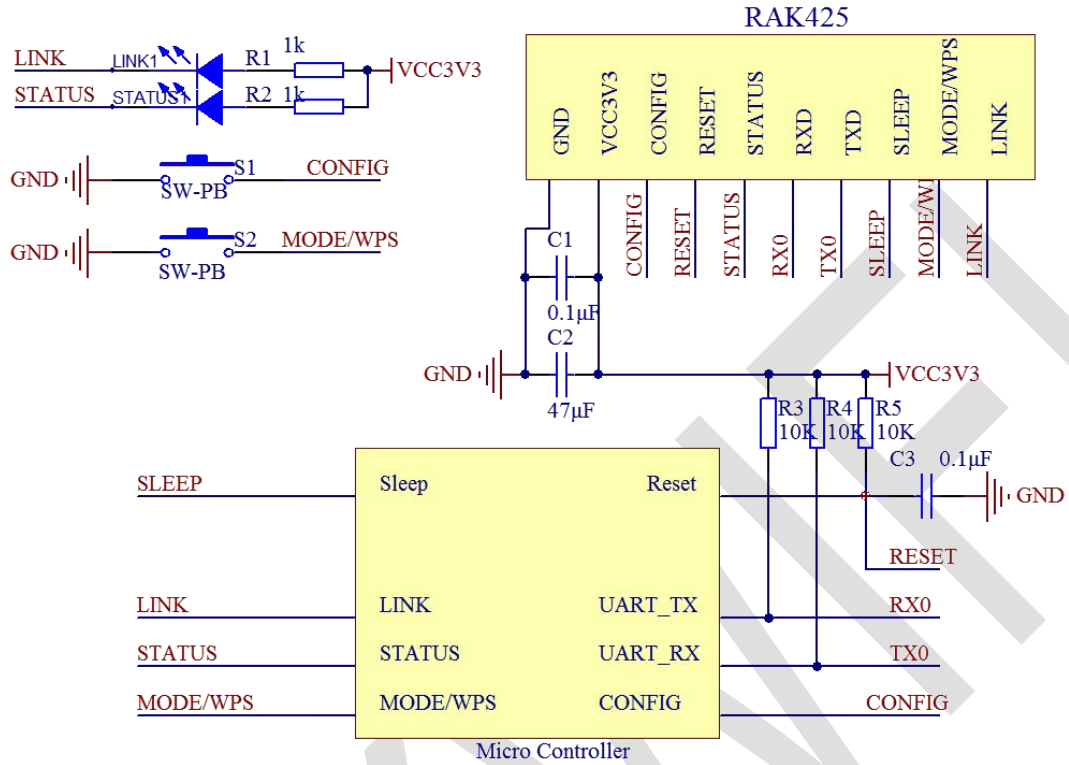


Figure 3-8 Module Typical Design Reference

## 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)	RFin	+10	dBm
When voltage is 3.3V, IO Max voltage	3V3VinIOMax	VCC+0.3	V
When voltage is 3.3V, IO Min voltage	3V3VinIOMin	-0.3	V
Storage ambient temperature	Tstore	-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 <sub>tx</sub>	Frequency range	--	2.4	GHz
P <sub>out</sub>	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	Parameter	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 suppression	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.

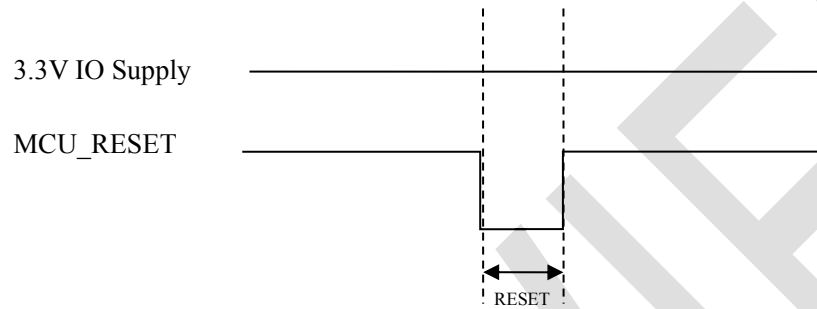


Figure 4-1: MCU Reset Timing

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

Table 4-5: MCU Reset Parameter

Symbol	Description	typical (mS)
T <sub>RESET</sub>	MCU reset pulse length	>10

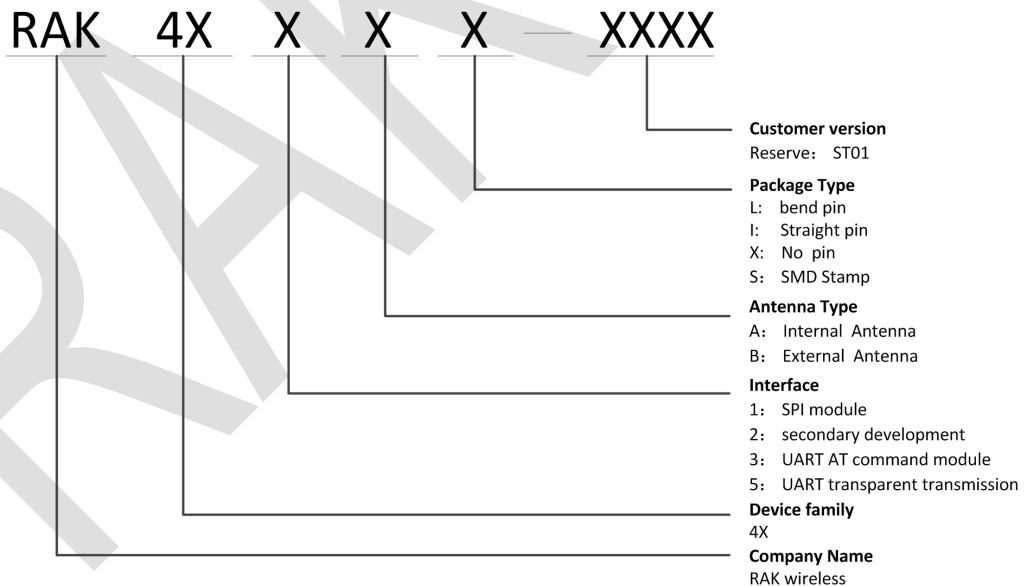
## 5 Order Information

### 5.1 Products

Table 5-1: Product Models

Product	Description	Packaging	Development board corresponding model
RAK425 AI-XXXX	UART interface module, with on-board antenna , use of the straight pin	50pcs/tray	RAK425AI_EVB
RAK425 AL-XXXX	UART interface module, with on-board antenna , use of the bend pin	50pcs/tray	RAK425AL_EVB
RAK425 AX-XXXX	UART interface module, with on-board antenna ,no pin	50pcs/tray	RAK425AX_EVB
RAK425 BI-XXXX	UART interface module, with external antenna , use of the straight pin	50pcs/tray	RAK425BI_EVB
RAK425 BL-XXXX	UART interface module, with external antenna, use of the bend pin	50pcs/tray	RAK425BL_EVB
RAK425 BX-XXXX	UART interface module, with external antenna,no pin	50pcs/tray	RAK425BX_EVB

### 5.2 Description



### 5.3 Size

Packaging: Hard plastic pallets

Weight: <=3.00g/pcs

Table 5-2: Thickness (Height)

RAK425	Thickness (Height)
Length * width	20.5mm×15.5mm
Height	See the 3.2 module height

## 6 Sales and Service

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## 7 Revision History

Version	Modifications	Date
V1.0	Initial Draft	2014-06-13
V1.1	Update the contact way, Update the document format	2014-08-22
V1.2	Update the Physical picture, Correct electric current unit, Update Ordering Information	2014-09-05