

RAK413 UART WIFI Module

Specification V1.5



Shenzhen Rakwireless Technology Co.,Ltd www.rakwireless.com

Mail: info@rakwireless.com

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RAK413 Datasheet

1 Overview

1.1 Module Overview

RAK413 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.

RAK413 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.

RAK413 has four power management modes, among which the minimum standby power consumption is <2uA, 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 / DHCP CLIENT

- 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 EasyConfigone-key to network connection
- Support parameter storage, customer orders loading after boot
- Support parameters store in Deep Sleep State, with connection time as fastest 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: 28.75mmX23.14mmX3.40mm
- FCC, RoHS and CE compliant

1.4 RAK413 System Diagram

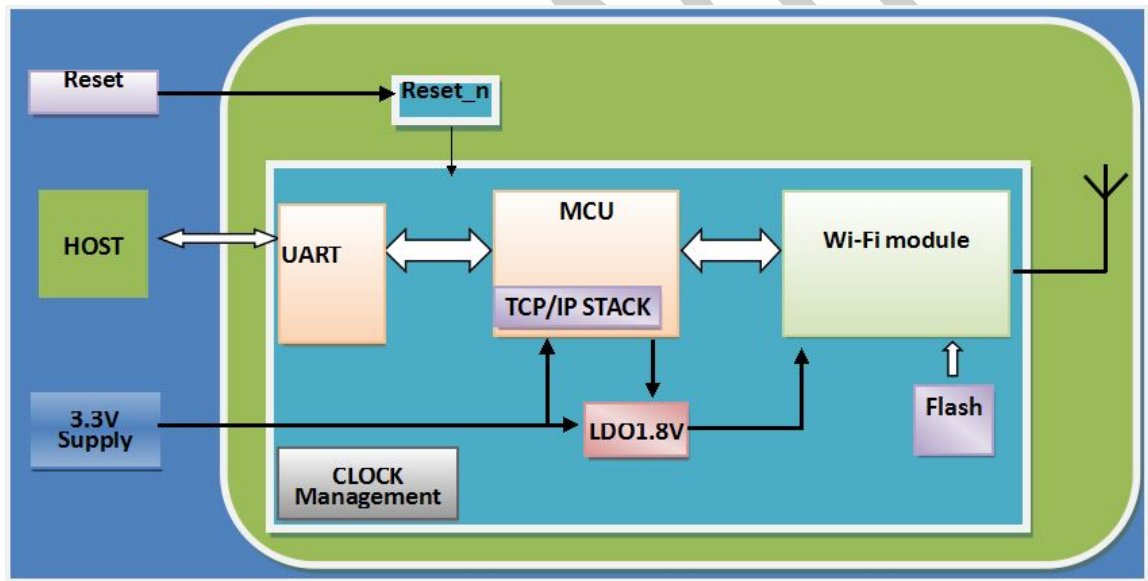


Figure 1-1 RAK413 System Diagram

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 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 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 Top and Bottom View



Figure 3-1 RAK413 Top View



Figure 3-2 RAK413 Bottom View

3.2 Pin Definition

Table 3-1: Pin Definition

Pin Serial No.	Name	Type	Description
1,2,,5,12,13,25,36	GND	Ground	All ground pins are connected to ground pad or the copper
35	VCC3V3	Power	3.3V power supply
18	LINK	O , PU	"0" - STA connected in AP mode, Connected to router in STA mode "1" - disconnected Remain disconnected when no use
19	RESET	I , PU	Module reset pin, low effective
31	TXD	O	Serial data communication interface send
32	RXD	I	Serial flow control pin, ready to receive, low effective
33	RTS	I	Serial flow control pin, ready to receive, low effective
34	CTS	O	Serial flow control pin, clear Send, low effective
Others	NC	NC	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)converselyoff
- EasyConfig, WPS is in one-key configuration——quick flashing

3.3 Design Reference

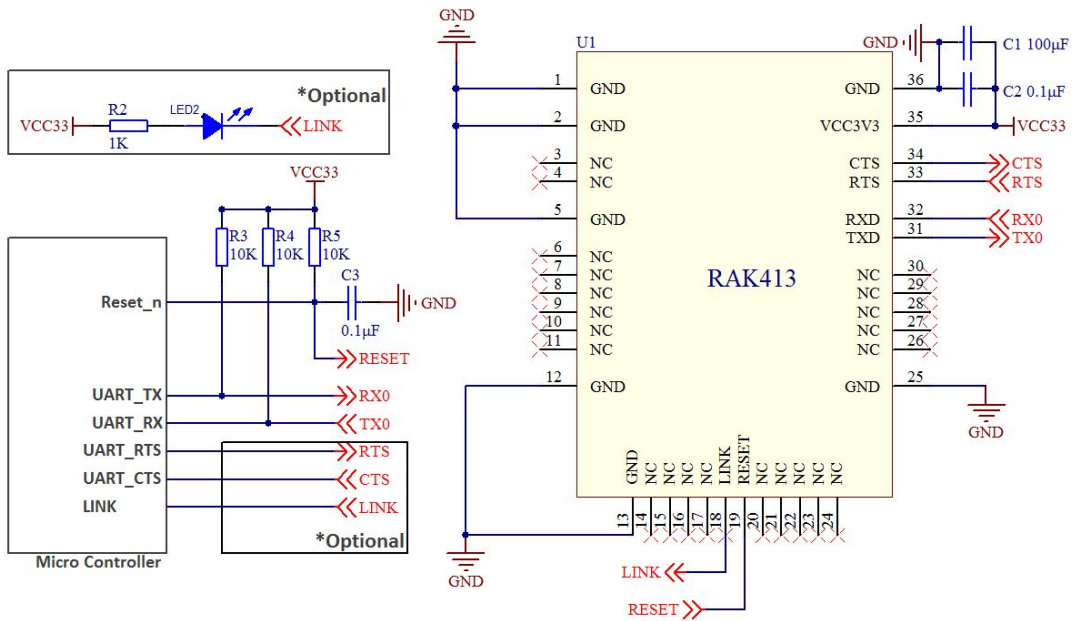


Figure 3-3 Module Typical Design Reference

3.4 RAK413 PCB Mechanical Size

PCB TOP VIEW

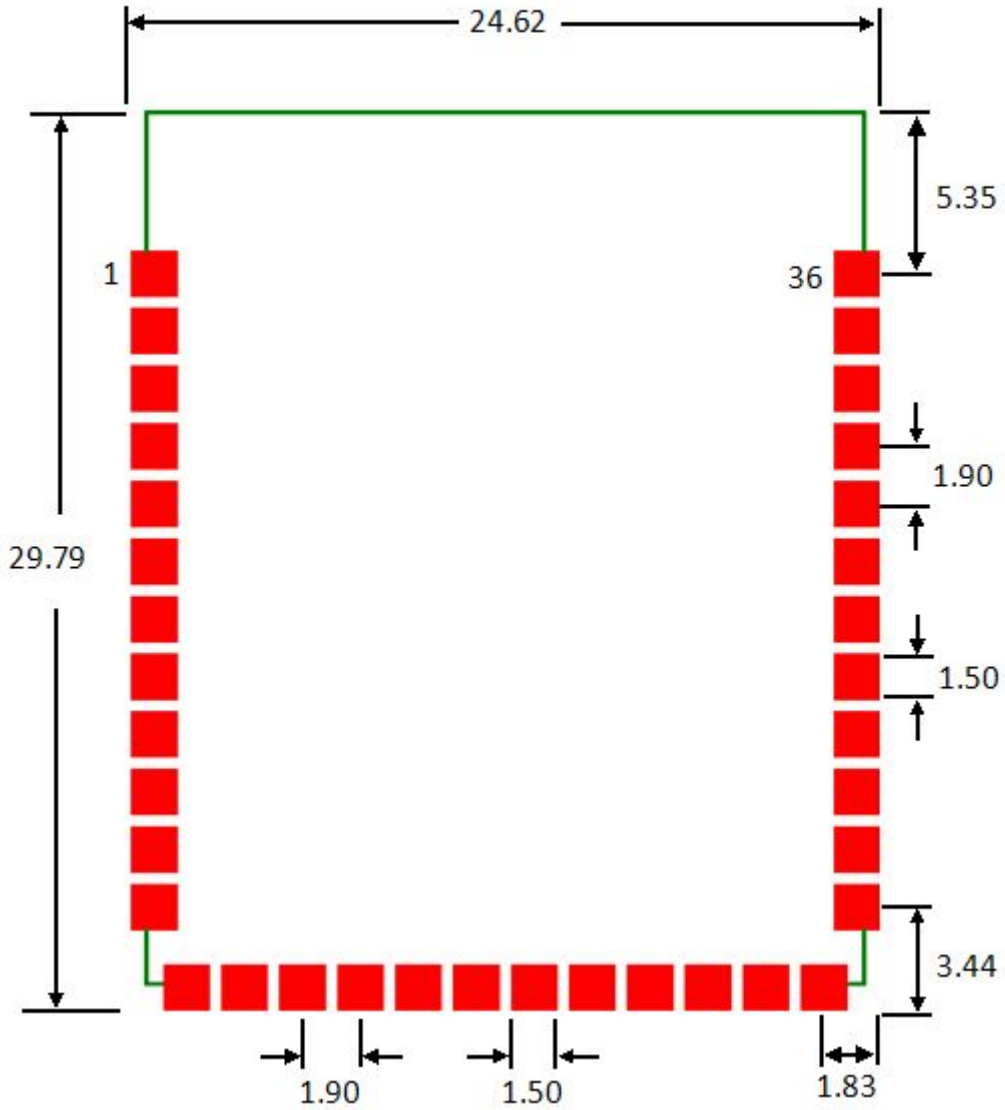


Figure 3-4 Module Pin Size (mm)

3.5 Reflow Soldering Temperature Graph

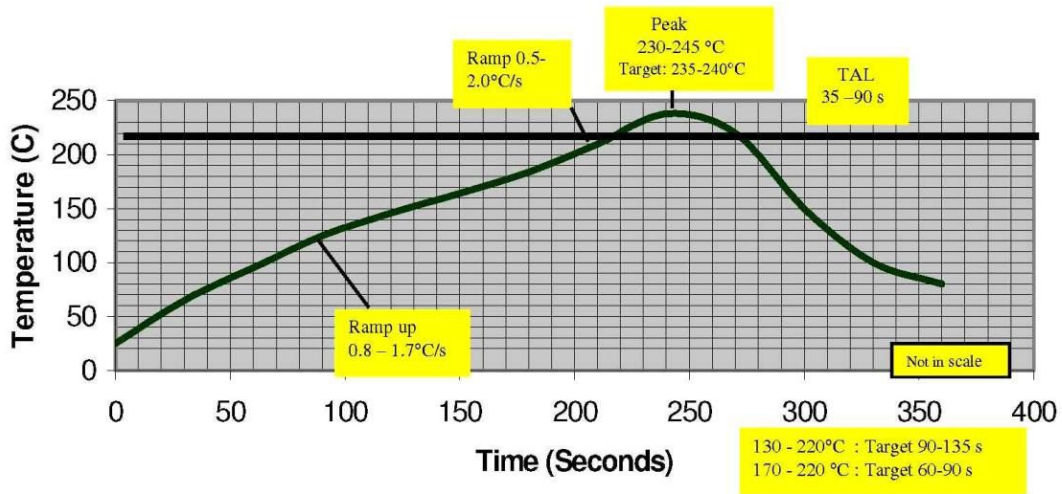


Figure 3-5: Temperature Graph

Note:

As shown in Figure 3-5, 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.

3.6 Baking Instructions

The RAK413 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 RAK413 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)	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 _{HBM}	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	Vcc	3.14	3.3	3.46	V
Ambient temperature	Tambient	-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.

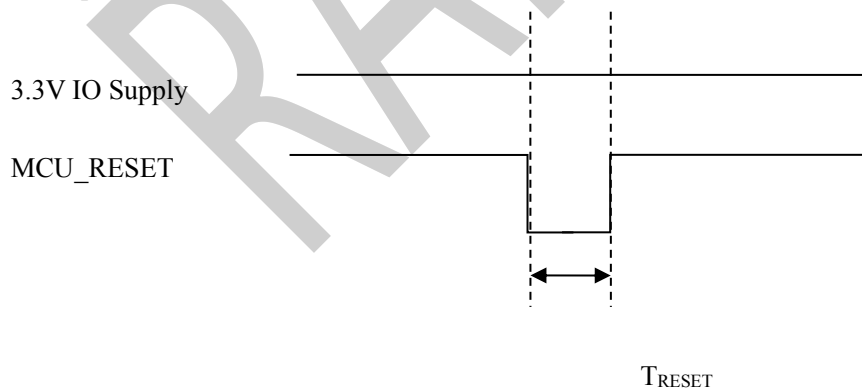


Figure 4-1: MCU Reset Timing

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

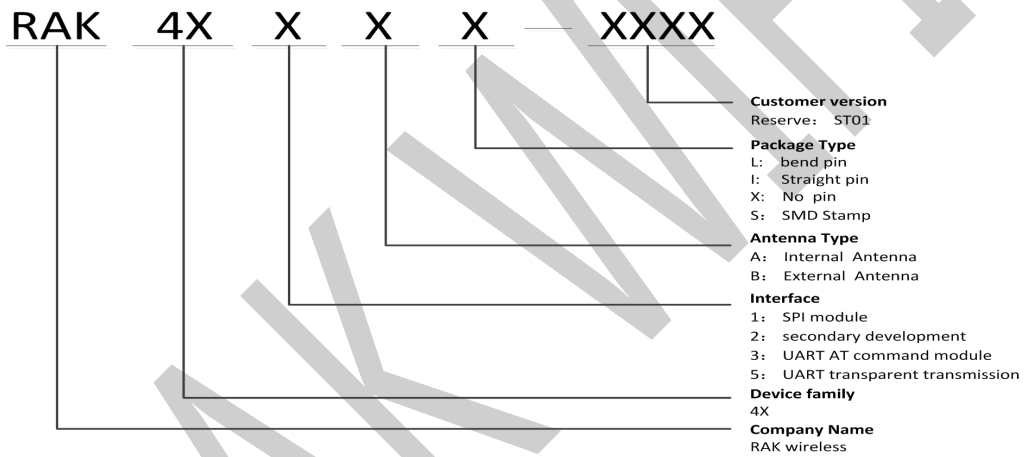
5 Order Information

5.1 Products

Table 5-1: Product Models

Product	Description	Single Tray Packing	Minimum Package	Development board corresponding model
RAK413AS-XXXX	UART interface module, with on-board antenna	27pcs/tray	270pcs	RAK413AS_EVB
RAK413BS-XXXX	UART interface module, with external antenna	27pcs/tray	270pcs	RAK413BS_EVB

5.2 Description



5.3 Size

Packaging: Hard plastic pallets

Weight: <=3.00g/pcs

Table 5-2: Thickness (Height)

RAK413	Thickness (Height)
Without shield holder	2.85±0.05mm
With shield holder	2.95±0.05mm
With shield	3.30±0.15mm

Note: In considering height design of the product, please consider your motherboard thickness error and product fit gap (recommended 0.10-0.15mm).

6 Sales and Service

Beijing

FAE mailbox: 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

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

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 Schematic and packaging(35 interface); Update the Order Information; Correct electric current unit,	2014-09-05
V1.5	Replace back to the original 36 interface schematics and packaging	2014-10-09

