RAK425
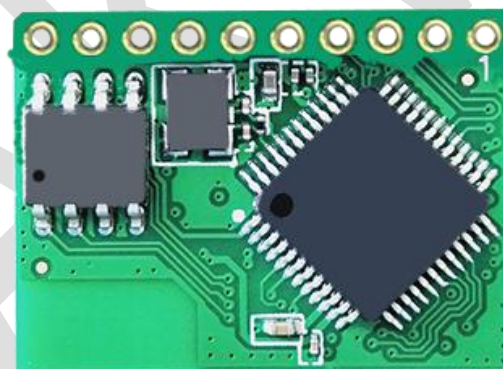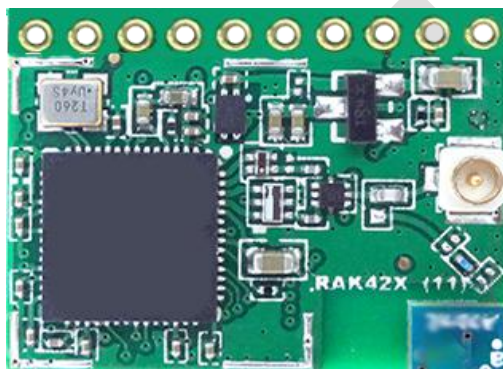
WIFI Module

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Content

1 Overview

1.1 Module Overview

RAK425 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.

RAK425 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.

RAK425 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 / DHCPCLIENT

- Support OPEN, WEP, WPA-PSK, WPA2-PSK and WPS encryption

- 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 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

- S mall package size: Length x width = 20.5mm × 15.5mm
  (curved needle height： 6.4mm，vertical needle height： 8.7mm)

- FCC, RoHS and CE compliant

2 Functional Description

2.1 HW Interface

➢ Baud rate: 9600~921600bps

➢ Interface actual throughput up to600kbps

➢ 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 encryption

➢ 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:

➢ Full speed 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
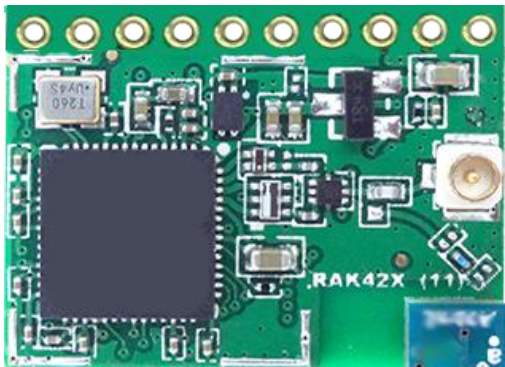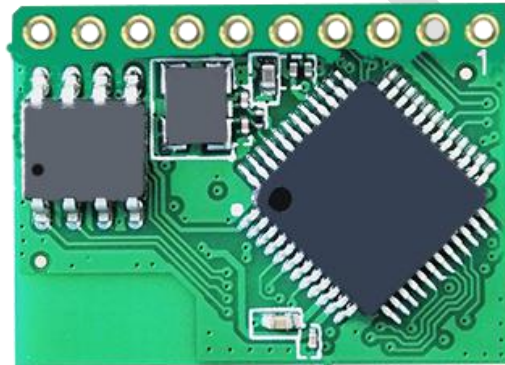
3 Hardware Introduction

3. 1 Module type

Figure 3-5 RAK425   Top View   Figure 3-6 RAK425   Bottom View

3.2 Pin Definition

Table 3-7: 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, 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　　　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

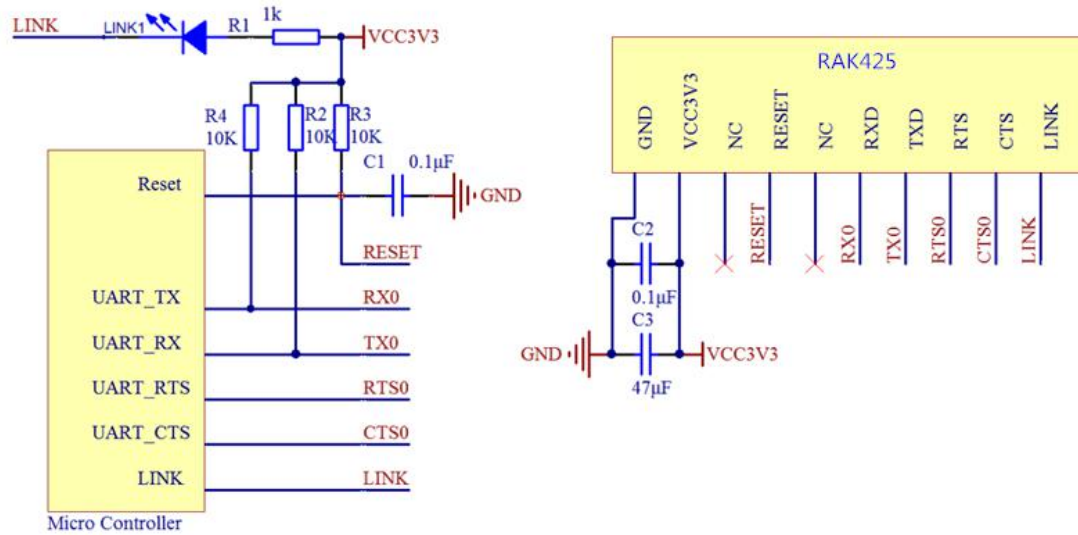EasyConfig, WPS is in one-key configuration——quick flashing

3.3 Design Reference

Figure 3-8 Module Typical Design Reference

3.4 RAK425 PCBMechanical Size
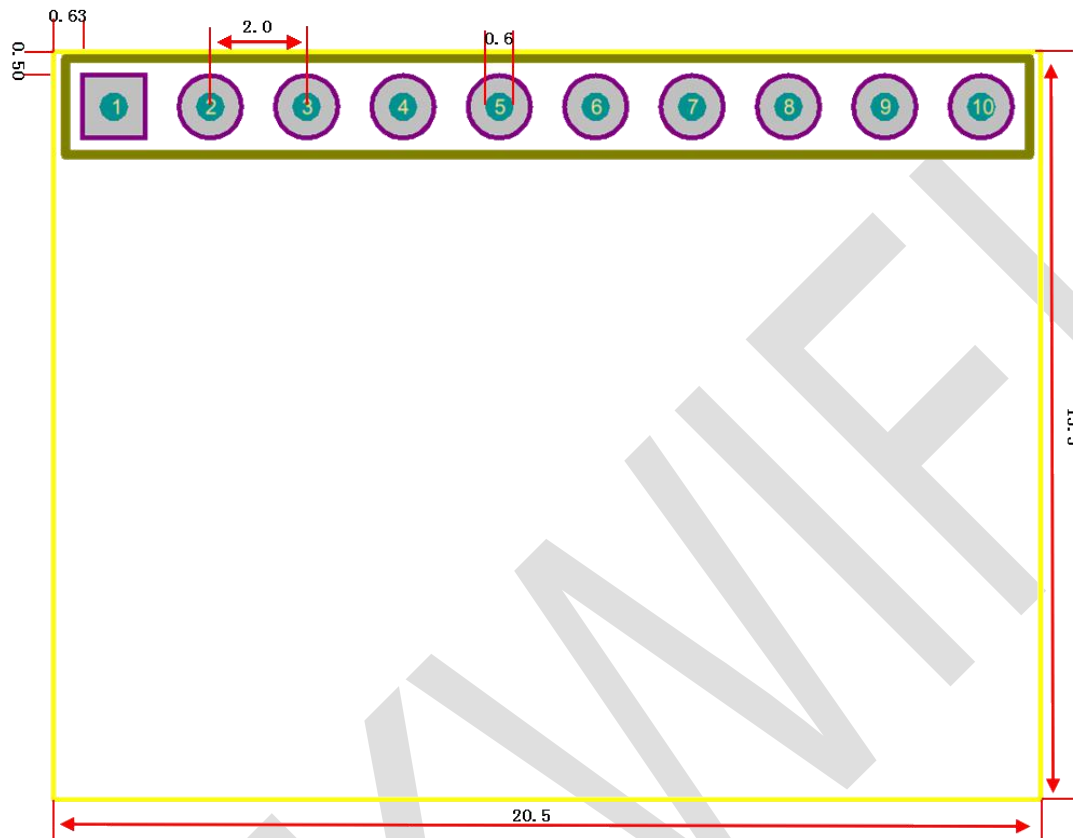
Figure 3-9 Module Pin Size (mm)

3.5 Reflow Soldering Temperature Graph
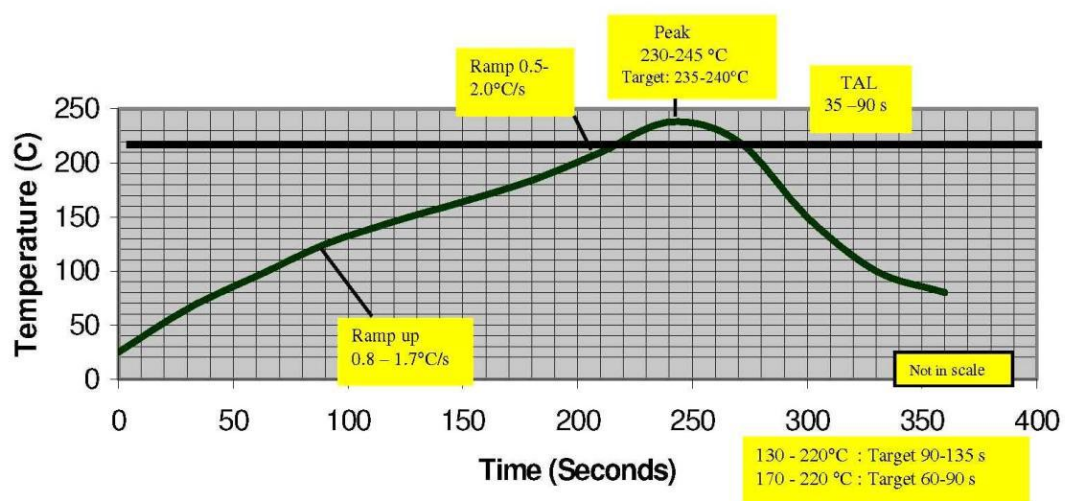
Figure 3-10 Temperature Graph

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.

3.6 Baking Instructions

The RAK425 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 RAK425 must be processed with a 9-hour baking in the environment of 125 ℃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 avoiddamages 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_{in}	+10	dBm
When voltage is 3.3V, IO Max voltage	$3V3V_{in}IOMax$	VCC+0.3	V
When voltage is 3.3V, IO Min voltage	$3V3V_{in}IOMin$	-0.3	V
Storage ambient temperature	T_{store}	-65~+135	℃
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	V_{cc}	3.14	3.3	3.46	V
Ambient temperature	$T_{ambient}$	-40	--	+85	℃

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	14.53	dBm
	802.11g	6Mbps	16.84	dBm
	802.11n,HT20	MCS0	12.81	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.

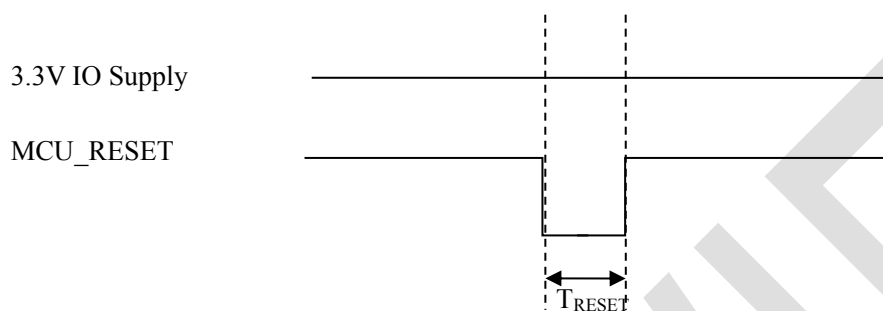

Figure 4-1: MCU Reset Timing

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

Table 4-5: MCU Reset Parameter

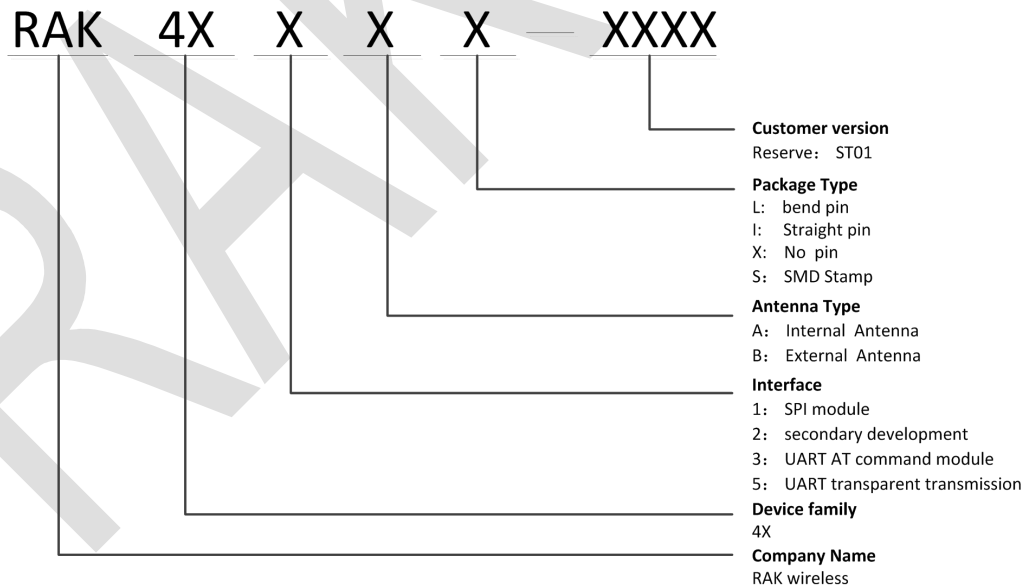| Symbol	Description	typical（mS）
T_{RESET}	MCU reset pulse length	>10

5 Order Information

5.1 Products

Table 5-1: Product Models

Product	Description	Single Tray Packing	Minimum Package	Development board corresponding model
RAK425AI-XXXX	UART interface module, with on-board antenna , use of the straight pin	50pcs/tray	500pcs	RAK425AI_EVB
RAK425AL-XXXX	UART interface module, with on-board antenna , use of the bend pin	50pcs/tray	500pcs	RAK425AL_EVB
RAK425AX-XXXX	UART interface module, with on-board antenna ,no pin	50pcs/tray	500pcs	RAK425AX_EVB
RAK425 BI-XXXX	UART interface module, with external antenna , use of the straight pin	50pcs/tray	500pcs	RAK425BI_EVB
RAK425BL-XXXX	UART interface module, with external antenna, use of the bend pin	50pcs/tray	500pcs	RAK425BL_EVB
RAK425 BX-XXXX	UART interface module, with external antenna,no pin	50pcs/tray	500pcs	RAK425BX_EVB

5.2 Description

```
RAK  4X  X  X  X — XXXX
```

Customer version
Reserve：ST01

Package Type
L: bend pin
I: Straight pin
X: No pin
S: SMD Stamp

Antenna Type
A：Internal Antenna
B：External Antenna

Interface
1：SPI module
2：secondary development
3：UART AT command module
5：UART transparent transmission

Device family
4X

Company Name
RAK wireless

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

5.3 FCC Caution

Any Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.
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.

Radiation Exposure Statement

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

This module is intended for OEM integrator. The OEM integrator is still responsible for the FCC compliance requirement of the end product, which integrates this module,the final end product must be labeled in a visible area with the following" Contains FCC ID: 2AF6B-RAKQMR003

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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
V1.5	Modify some non-standard phrases intervals.	2015-04-15