

RAK413 UART WiFi Module

Datasheet v1.8

© 2015 Rakwireless all rights reserved .

Mentioned in this document , the actual company and product names, trademarks are their respective owners.

After update the new version, this document without prior notice.

Content

RAK413 UART WiFi Module.....	1
Datasheet V1.8.....	1
1 Overview.....	1
1.1 Module Overview.....	1
1.2 Key Application.....	1
1.3 Device Features.....	2
1.4 RAK413 System Diagram.....	3
2 Functional Description.....	4
2.1 HW Interface.....	4
2.2 Wireless Driver.....	4
2.3 TCP/IP.....	4
2.4 Power Consumption.....	5
3 Hardware Introduction.....	6
3.1 Top and Bottom View.....	6
3.2 Pin Definition.....	6
3.3 Design Reference.....	8
3.4 RAK413 PCB Mechanical Size.....	9
3.5 Reflow Soldering Temperature Graph.....	10
3.6 Baking Instructions.....	10
4 Electrical Characteristics.....	11
4.1 Absolute Maximum.....	11
4.2 Recommended Operating Parameters.....	11
4.3 RF Electrical Characteristics.....	12
4.4 MCU Reset.....	13
5 Order Information.....	14

5.1 Products.....	14
5.2 Description.....	14
5.3 Size.....	14
6 Sales and Service.....	16
7 Revision History.....	17

RAKWIRELESS

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 <math><2\mu 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 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
- FCC, RoHS and CE compliant

1.4 RAK413 System Diagram

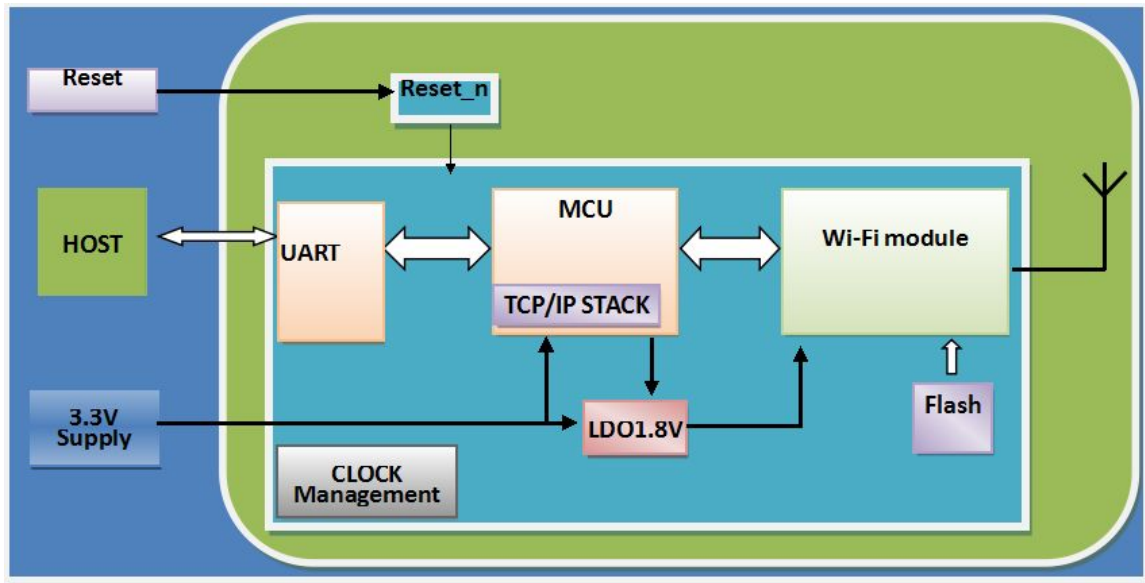


Figure 1-1 RAK413 System Diagram

2 Functional Description

2.1 HW Interface

- Baud rate: 9600~921600bps
- Interface actual throughput up to600kbps
- 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 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 310mA
- Power-saving mode, with approx 10mA average power consumption, peak current <310mA, DTIM = 100ms
- Deep sleep mode, with approx 5mA average power consumption, peak current <310mA, DTIM = 100ms (maximum support to 115200bps)
- Standby mode, with power consumption <2uA

3 Hardware Introduction

3.1 Top and Bottom View



Figure 3-1 RAK413BS Top View

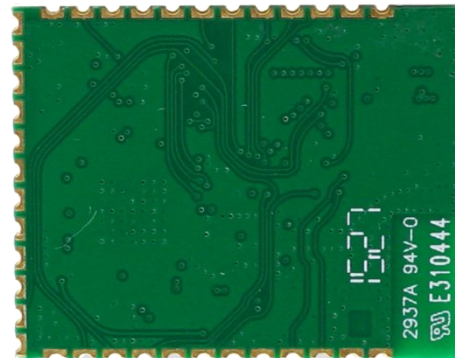


Figure 3-2 RAK413 Bottom View

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	O	Serial flow control pin, The default outputlow. Active low, ready to receive data /request the other party to send data.
34	CTS	I	Serial flow control pin, Input pull. Activelow, ready to send data/request each otherto send data. High level cannot send data, low level can send data.
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)conversely off

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

3.3 Design Reference

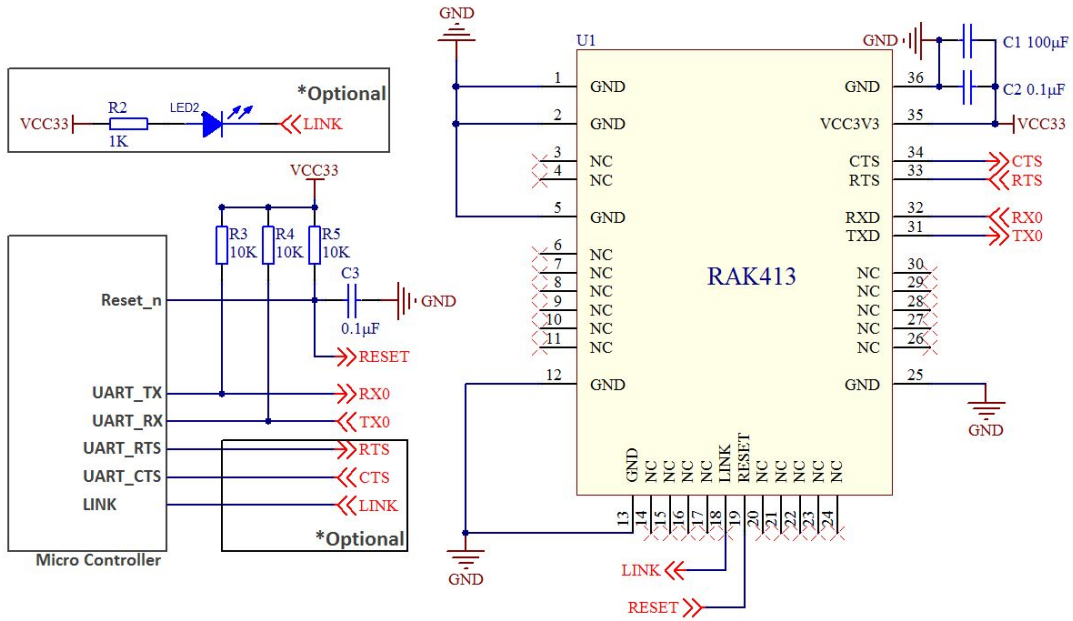


Figure 3-3 Module Typical Design Reference

3.4 RAK413 PCB Mechanical Size

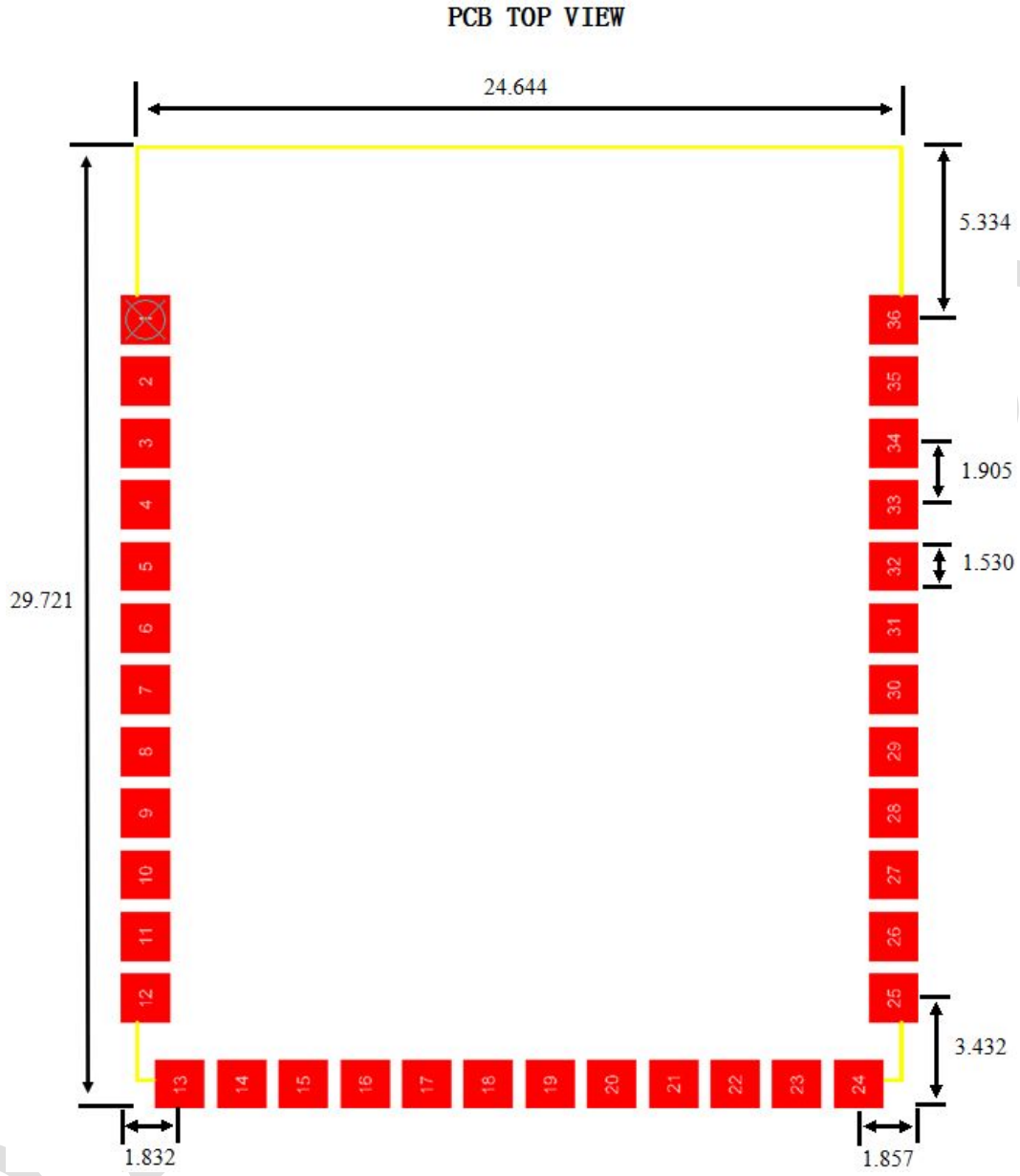


Figure 3-4 Module Pin Size (mm)

3.5 Reflow Soldering Temperature Graph

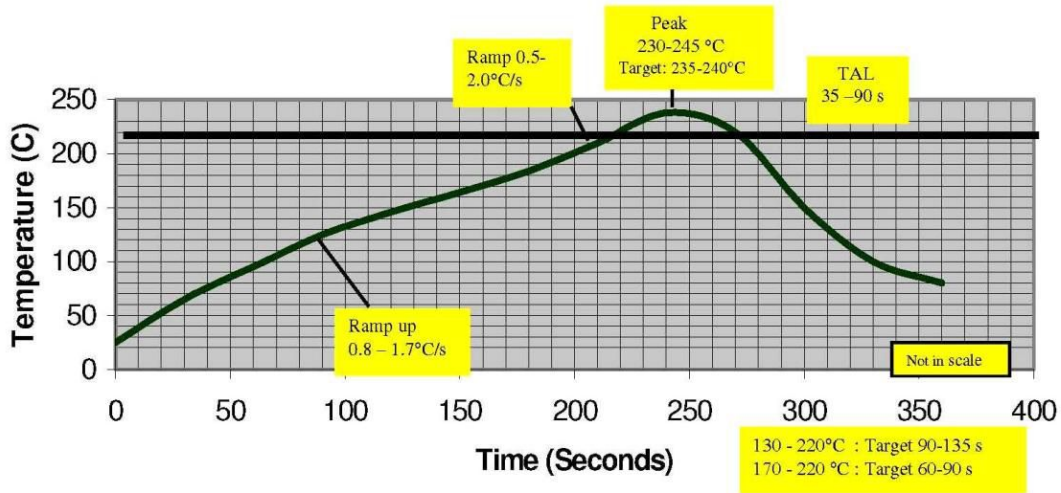


Figure 3-5: Temperature Graph

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	ESDHBM	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
Ftx	Frequency range	--	2.4	GHz
Pout	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.

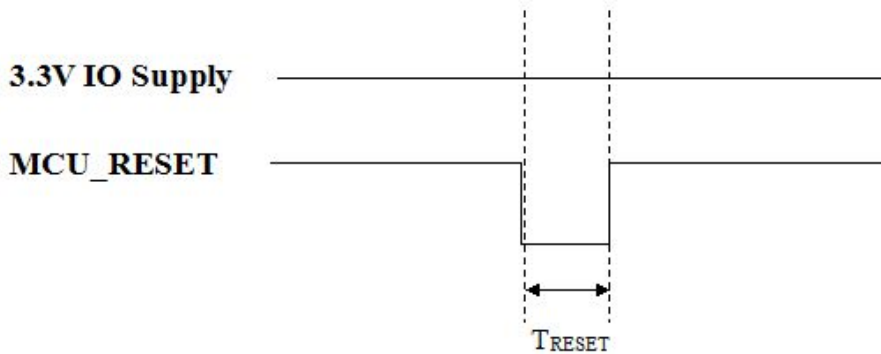


Figure 4-1: MCU Reset Timing

Table 4-5: MCU Reset Parameter

Symbol	Description	typical (mS)
TRESET	MCU reset pulse length	> 10

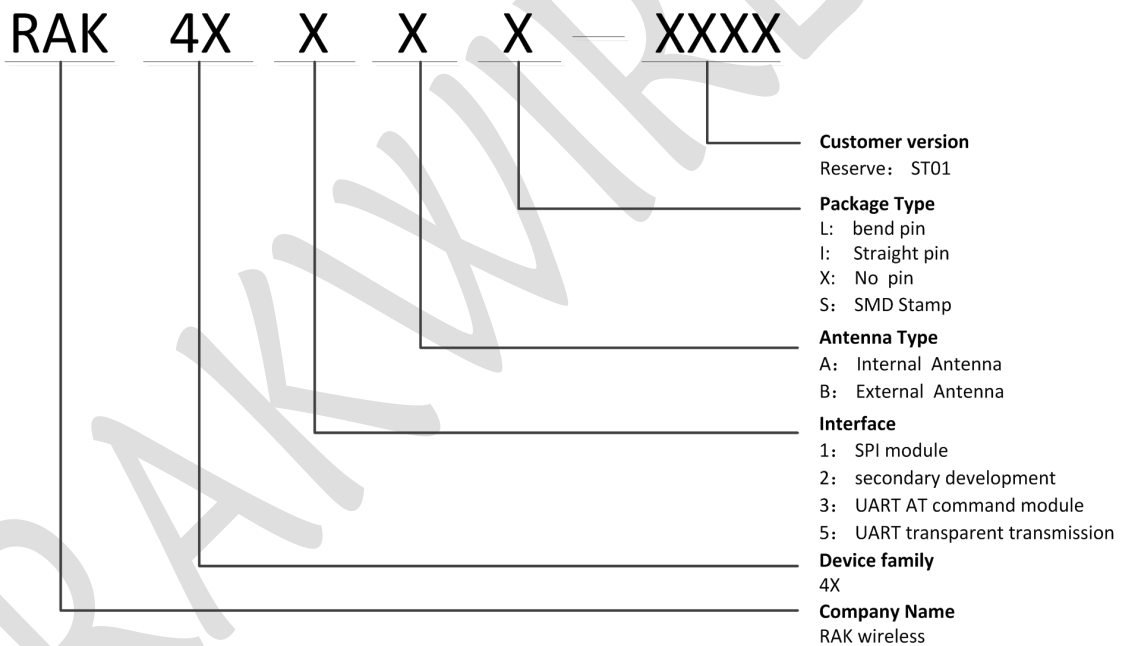
5 Order Information

5.1 Products

Table 5-1: Product Models

Product	Description	Single Tray Packing	Minimum Package	Development board corresponding model
RAK415AS-XXXX	UART interface module, with on-board antenna	32pcs/tray	320pcs	RAK415AS_EVB
RAK415BS-XXXX	UART interface module, with external antenna	32pcs/tray	320pcs	RAK415BS_EVB

5.2 Description



5.3 Size

Packaging: Hard plastic pallets

Weight: <=3.00g/pcs

Table 5-2: Module Size

Module	Length and width	Thickness (Height)	Note
RAK415 Module	28.75mm×23.14mm	2.85±0.05mm	Without shield holder
		2.95±0.05mm	With shield holder
		3.30±0.15mm	With shield

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

Shanghai

FAE mailbox: allan.jin@rakwireless.com

Tel : 021- 61553990

Fax : 021- 54721038

Address: Room B205, Green light kechuang garden, 2588 Lane, Hongmei South road,
Minhang District, Shanghai

Shenzhen

FAE mailbox: steven.tang@rakwireless.com

Tel : 0755-26506594

Fax: 0755-86152201

Address: Room 802, Yongfu building, No.1s06, Yongfu road, Baoan District , Shengzhen

7 Revision History

Version	Author	Modification content	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
V1.6		Modify RTS, CTS functional description. Modify some non-standard phrases intervals. Modify the peak current.	2015-04-07
V1.7	Shi Feifei	Update the contact way, Update the document format. Update Module Image.	2016-02-25
V1.8		Modify PCB package size	2016-03-15