

# HC-08 BLUETOOTH UART COMMUNICATION MODULE V2.0 USER MANUAL



## Version

HC-08 V2.0

## Date

2014-09-16

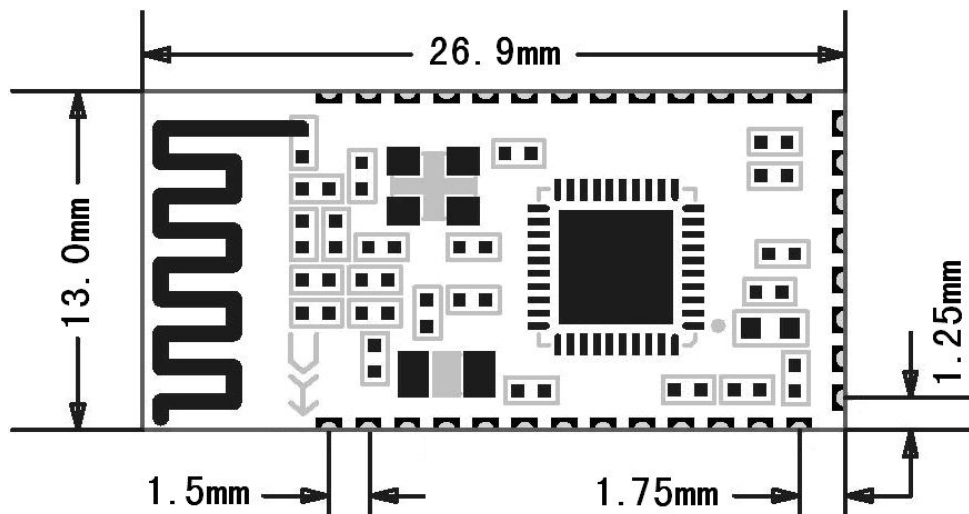
## Product introduction

HC-08 Bluetooth UART communication module is a new generation of Bluetooth specification V4.0 BLE Bluetooth protocol based on the transmission module. Wireless working frequency is 2.4GHz ISM, modulation is GFSK. The maximum transmit power module 4dBm, the receiving sensitivity is -93dBm, and iphone4s can achieve 80 meters of super long distance communication under open environment.

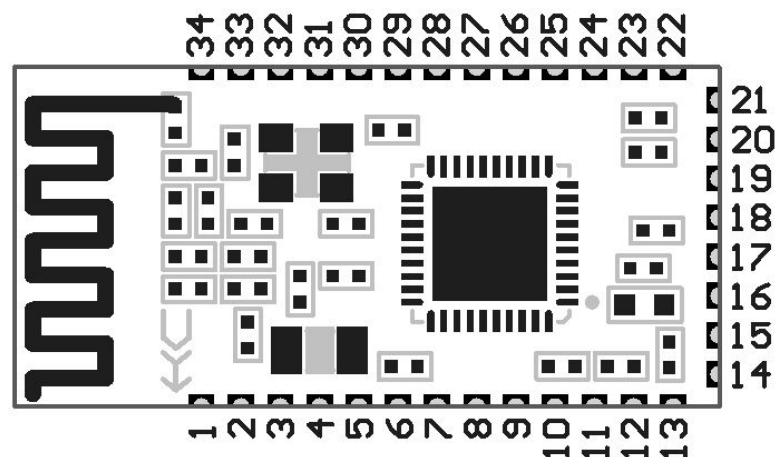
The module uses the stamp hole encapsulation, can patch welding, module size is 26.9mm \* 13mm \* 2.2mm, very convenient to the customer within the embedded application system.

The module uses the CC2540 chip, the configuration of the 256K Byte space, supports AT command, the user can according to need to change role and the serial baud rate, equipment name and other parameters, the use of flexible.

## Product size



## Pin definition



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The HC-08 module has 34 pins, on board PCB antenna, pin specific definitions are listed in the following table:

pin	definition	I/O	explain
1	TXD	output	URAT output, 3.3V TTL level
2	RXD	input,weak pull up	URAT input, 3.3V TTL level
3	NC	NC	
4	NC	NC	
5	NC		
6	DC	input	Debug clock
7	DD	Input/output	Debug data
8	PIO20	input,weak pull up	NC
9	PIO17	input,weak pull up	NC
10	PIO16	input,weak pull up	NC
11	RST	input,pull up	Module reset pin, a low level of not less than 5ms reset
12	VCC	input	Power pin, the requirements of 3.3V DC power supply, the supply current is not less than 100mA
13	GND		Ground
14	NC		
15	USB_D-	NC	
16	NC		
17	NC		
18	PIO15	input,weak pull up	NC
19	PIO14	input,weak pull up	NC
20	USB_D+	NC	
21	GND		Ground
22	GND		Ground
23	NC		
24	PIO13	output	LED output (Note①)
25	PIO11	input,weak pull up	NC
26	PIO12	input,weak pull up	The master module clear memory (Note②)
27	PIO10	input,weak pull up	NC
28	PIO07	input,weak pull up	NC
29	NC		
30	NC		
31	PIO06	input,weak pull up	NC
32	PIO01	input,weak pull up	NC
33	NC		
34	PIO00	input,weak pull up	NC

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**Note①:**Module indicating LED output pin, high level output, please use the resistance and LED connection.

The connection before,

From the slave module address the master module does not record, bright 100ms per second;

From the slave module address master module records, bright 900ms per second;

The slave module, LED light 1second very 2 seconds.

After connection, LED lights always.

**Note②:**Input pin, internal pull-down. This pin is connected with the high level, the master module to clear the slave module address have been recorded.

### **Electrical characteristics:**

parameter	test condition		representative value
working voltage	-		DC2.0V~3.6V
working current (not LED)	master	not connected / connection	21mA/9mA
	slave	MODE0, not connected / connection	8.5mA/9mA
		MODE1, not connected / connection	340μA/1.6mA
		MODE2, not connected / connection	0.4μA/1.6mA
		MODE3, not connected / connection	1.2μA-160μA/1.6mA

**AT COMMAND**

The AT command to setting module parameter. Connection before, module can operating AT command. Connection after entering serial transparent transmission mode.

Module start is about 150ms, so the best after power on 200ms AT command operation. Unless otherwise indicated, the parameter setting of AT command is effective immediately. At the same time, parameters and functions of modification, the power down will not be lost.

After the success of AT command modify unified returns OK ("AT+RX,AT+VERSION" and so on the view of information command class except), no success does not return any information.

**(1) AT COMMAND LIST**

	<b>AT Command</b> ( <b>"x"</b> - parameter)	<b>Function</b>	<b>Default</b>	<b>Role</b>
1	AT	Test command	-	M/S
2	AT+RX	Check the basic parameters	-	M/S
3	AT+DEFAULT	Restore factory setting	-	M/S
4	AT+RESET	Reset the module	-	M/S
5	AT+VERSION	Check version and date	-	M/S
6	AT+ROLE=x	Change master/slave role	S	M/S
7	AT+NAME=xxxxxxxxxxxx	Revise name	HC-08	M/S
8	AT+ADDR=xxxxxxxxxxxx	Revise address	Hardware address	M/S
9	AT+RFPM=x	Revise RF power	0(4dBm)	M/S
10	AT+BAUD=x,y	Revise UART baud	9600,N	M/S
11	AT+CONT=x	Set connectability	0(Can be connected)	M/S
12	AT+MODE=x	Set working mode	0	S
13	AT+AVDA=xxxxxxxxxxxx	Change the broadcast data	-	S
14	AT+TIME=x	Mode 3 broadcast cycle	5(s)	S

Note:

1. The AT command behind no newline; if no special instructions, all AT commands are not transmitted using newline.

2. The last 4 senior commands, must be used in combination, can play its due role BLE Bluetooth low energy. Using a Bluetooth low energy, there will be special instructions and program introduced in the following sections.

### (2) COMMAND EXPLAIN

#### ① Test command

Command:AT

Return:OK。

#### ② Check the basic parameters

View the basic parameters such as bluetooth name, master/slave role, UART baud rate, address and password.

Command:AT+RX

Return:Name:HC-08

----->>>> bluetooth name

Role:Slave

----->>>> master/slave role

Baud:9600,NONE

----->>>> UART baud rate

Addr:xx,xx,xx,xx,xx,xx

----->>>> bluetooth address

PIN :000000

----->>>> bluetooth password

Note: Temporarily does not support change password!

#### ③ Restore factory setting

Command:AT+DEFAULT

Return:OK

The module will automatically restart, please carry out new operation on the restart 200ms!

#### ④ Reset the module

Command:AT+ RESET

Return:OK

The module will automatically restart, please carry out new operation on the restart 200ms!

#### ⑤ Check version and date

Command:AT+ VERSION

Return:HC-08V2.0,2014-08-22

#### ⑥ Change master/slave role

Set command:AT+ROLE=x

Query command:AT+ROLE=?

X:role(M or S), M:master, S:slave。

Default setting is S(slave)。

Send:AT+ROLE=M

Return:OK

Set master role,the module will automatically restart!

Send:AT+ROLE=?

Return:Master

You can view the role is the master module.

### ⑦ Revise name

Set command:AT+ NAME=xxxxxxxxxxxx

Query command:AT+ NAME=?

**Default setting is HC-08**, You can set the other name (12 characters limit, support the visual ASCII code and part of the escape character. The module supports chinese, but android devices must be converted to "UTF8 code" to normal display. To send more than 12 characters, then only the first 12 characters). Setup is complete, effective after module automatically reset!

Example:

Send:AT+NAME=HCKJ

Return:OKsetNAME

Send:AT+NAME=?

Return:HCKJ

### ⑧ Revise address

Set command:AT+ADDR=xxxxxxxxxxxx

Query command:AT+ADDR=?

The address must be 12 bit "0~F" uppercase characters, namely hexadecimal characters.

Example:

Send:AT+ADDR=1234567890AB

Return:OKsetADDR

Setup is complete, effective after module automatically reset!

Send:AT+ADDR=?

Return:1234567890AB

Send:**AT+ADDR=000000000000**

Return:OKsetADDR

Send "000000000", module to restore the default hardware address. Module factory default is hardware address.

### ⑨ Revise RF power

Set command:AT+RFPM=x

Query command:AT+RFPM=?

X:RF power,as shown in the following table:

Parameter	RF power
?	View the current RF power
<b>0</b>	<b>4dBm (default)</b>
1	0dBm
2	-6dBm
3	-23dBm

Example:

Send:AT+RFPM=2

Return:OK

RF power modified -6dBm.

Send:AT+RFPM=?

Return:-6dBm

RF power is -6dBm.

The peak current is more than 30mA (when RF power is 4dBm). Because the small discharge current button batteries, such as to use the button battery powered, the best setting for -6dBm or -23dBm.

#### ⑩ Revise UART baud

Set command:AT+BAUD=x (Only modified the UART baud rate)

AT+BAUD=x,y (Modify the UART baud rate and parity bit)

Query command:AT+BAUD=?

x:UART baud rate,y: parity bit, As shown in the following table:

Parameter	UART baud :x	Parameter	parity bit :y
?	View the current baud rate		
1200	1200bps	N	No parity
2400	2400bps	E	Even parity
4800	4800bps	O	Odd parity
9600	9600bps (default)		
19200	19200bps		
38400	38400bps		
57600	57600bps		
115200	115200bps		

Example:

Send:AT+BAUD=19200

Return:OK19200

UART baud rate modified for 19200bps.

Send:AT+BAUD=4800,E

Return:OK4800,EVEN

UART baud rate modified for 4800bps,and even parity.

Send:AT+BAUD=?

Return:4800,EVEN

View UART baud rate and parity bit.

9600bps baud rate following each packet please do not exceed the maximum number of bytes to 500 bytes, 19200bps baud rate above each packet please refer to the following table, have a certain time interval between data packets. The following table is a variety of communication baud rate, the time interval of reference value:



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baud rate (bps)	1200	2400	4800	9600	19200	38400	57600	115200
500 bytes time interval (ms)	6800	3600	2000	1000				
300 bytes time interval (ms)	4200	2400	1200	600	400			
100 bytes time interval (ms)	1500	800	400	160	100	120		
80 bytes time interval (ms)	1000	650	320	120	80	60	100	
60 bytes time interval (ms)	800	500	250	100	60	60	60	100
20 bytes time interval (ms)	200	100	50	20	20	20	20	20

Note:

1. The above is the measured data, the fastest speed transceiver theory total:2500 bytes/sec, suggested that the speed control in the 2000 bytes/sec.
  2. Bytes of each packet, suggestion is an integer multiple of 20.
  3. Module sends data automatically subcontracting is an integer multiple of 20 bytes.
- Is to send a 100 bytes packet, will receive a plurality of packets at another end, each data packet is an integer multiple of 20, the total number of bytes for the full 100 bytes.

### ⑪ Set connectability

Set command:AT+CONT=x

Query command:AT+CONT=?

The X parameter functions are as follows:

Parameter	Master role	Slave role
0 (default)	<b>Central</b> Can be connected, the connection after entering ordinary transparent transmission mode	<b>Peripheral</b> Can be connected, the connection after entering ordinary transparent transmission mode
1	<b>Observer</b> The module can not be connected to other equipment, but will automatically scan the HC-08 from the broadcast datamachine package, fixed 2sec refresh time.	<b>Broadcaster</b> Not connected with the master role, but can be combined with low power mode 3, the realization of broadcast packets send.

Example:

Send:AT+CONT=1

Return:OK

Setup is complete, effective after module automatically reset!

Send:AT+CONT=?

Return:Non-Connectable

The command please with "AT+MODE", "AT+AVDA" and "AT+TIME" command with the use of.

Note:

1. The master/slave module "CONT=1" is masterly used for transmitting broadcast data. From the slave role to send broadcast data, broadcast master module will receive the corresponding data, and through the serial output.

2. This model is only for the user can grab this broadcast data package yourself.

The specific communication protocol is not described here, the intention to please the following official website consultation online customer service: <http://www.wavesen.com/>

⑫ **Set working mode (Only slaver)**

Set command:AT+MODE=x

Query command:AT+MODE=?

Command	Parameter	Return	Function
AT+ MODE	=?	0/1/2/3	Gets the current mode.
	=0	OK	Full power mode (default), LED open.
	=1		Level 1 power saving mode, LED close. No connection the current is 340μA, the connection speed like mode0.
	=2		Level 2 power saving mode, LED close. No connection the current is 0.4μA. Can not be found, not connected to wake up before, after awakening can be connected.
	=3		Level 3 power saving mode, LED close. No connection the current is <b>1.2μA~160μA (about 32μA default)</b> . Combined with "AT+TIME" to set the broadcast time, thus to reduce power consumption. The use of specific methods please refer to the "AT+TIME" command.

Note:

1. Mode 3 is mainly used for:

A. Used to reduce the power consumption.

B. The slave module send the broadcast data to the master module, can be achieve one to many one-way communication (theory can be from a slave module to infinite master module).

C. As anti-lost alarm, attendance card, heart rate meter or other wireless device.

2. Mode 1/2/3 are available through the UART port to send 1 byte data to wake up, but front few bytes of data may be garbled after wake up. Therefore we recommend sending 10 bytes hexadecimal code of "0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF" to awaken the module, avoid the front several may be garbled byte. Since then, modules work on the full speed mode, the UART port can be normal to send

and receive data.

In non connected state, module after awakening into full speed mode and maintained for 5 minutes, and then return to the original mode. As long as 5 minutes in the UART has received data, then retiming.

If the module is in the connected state, then after awakening will remain in the full speed mode, before disconnecting, module will return the original power mode.

3. In addition to mode0, the other mode are closing LED, but after connection, LED will be light.

Example:

Send:AT+MODE=?

Return:0

View the current mode.

Send:AT+MODE=2

Return:OK

Setting mode 2, effective immediately.

### ⑬ Change the broadcast data (Only slave module)

Command:AT+AVDA=xxxxxxxxxxxx

Parameter “xxxxxxxxxxxx” can be any 1~12 bytes user data. If at this point the master module state of AT+CONT=1, then the master module UART port will output the “xxxxxxxxxxxx” data. The broadcast data will not be preserved permanently, will be deleted after the restart.

Example:

Slave role send:AT+AVDA=1234567890AB

Return:OK

If at this point the master module state of AT+CONT=1, UART port will output:1234567890AB.

### ⑭ Mode 3 broadcast cycle (Only slaver)

Set command:AT+TIME=x

Query command:AT+TIME=?

Parameter x setting range is as follows:

x	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
time/ sec	1	2	3	4	5 (default)	6	7	8	9	10	20	30	40	50	60
x	F	G	H	I	J	K									
time/ min	1	2	5	10	30	60									

Example:

Send:AT+TIME=F

Return:OK

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Setting mode3 of the broadcast cycle for 60 seconds. Every 60 seconds, is sending a broadcast data.

Send:AT+TIME=?

Return:60s

### Solution of low power mode (slave module):

1. The need to wake on wireless:

Enter "AT+MODE=1" or "AT+MODE=3", the module will enter a low power mode, until the master module request connection. After the connection the current is 1.6mA, such as data exchange module will automatically enter the full speed mode now, before disconnecting after it returned to the low power mode.

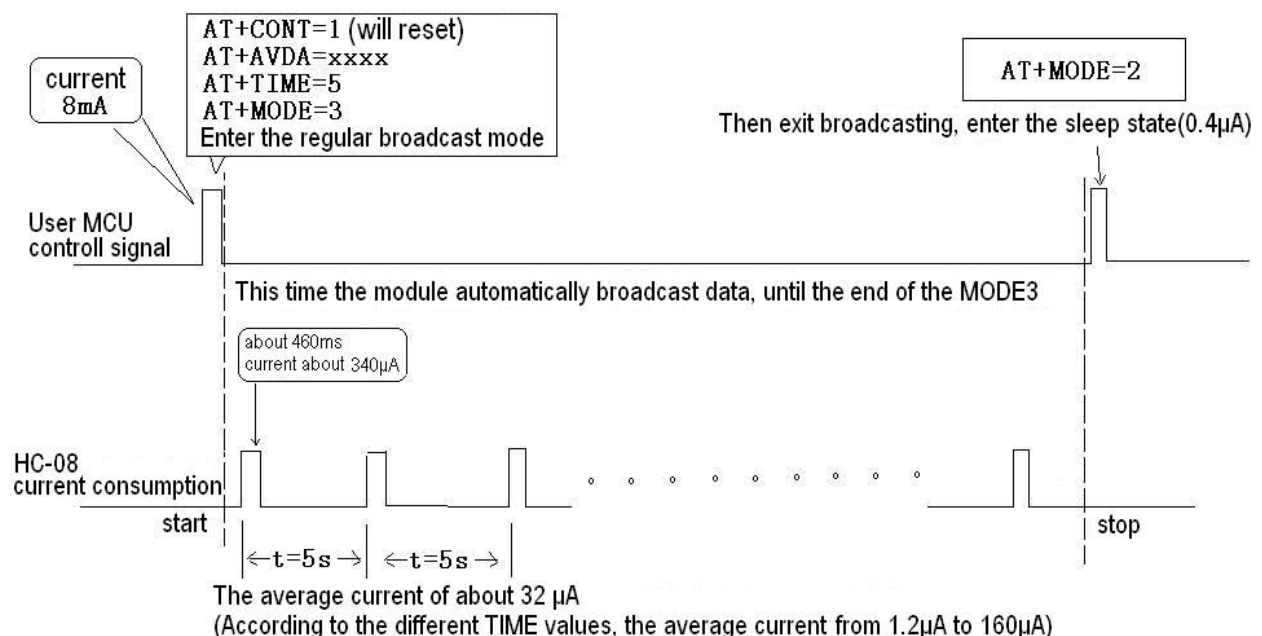
2. Can active connection case:

Enter "AT+MODE=2" to enter a low power consumption mode2, module to enter the deep sleep state, can not be master module discovery. The need to connect when you can send arbitrary data to awaken the module, and then after the connection can send and receive data.

### Solution of low power broadcasting mode:

The first set master role:AT+CONT=1 -> AT+ROLE=M

And then set slave role:AT+CONT=1 -> AT+AVDA=1234 (≤12Bytes data)



The user MCU to the module of UART port to send 10 bytes hexadecimal code of "0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF" to awaken the module, module into the full power mode. At this point the user can reasonably set according to need, the above "AT+CONT=1, AT+AVDA=xxxx, AT+MODE=3, AT+TIME=5" set to: broadcast and can not connected, the broadcast data is XXXX, mode3(period of 5

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seconds). According to the above, let the average current is less than  $4\text{ }\mu\text{A}$ , TIME will be more than 1 minutes. This time is longer, lower power consumption.

The user wants to transmit data frequently, proposed to enter mode2 in idle time, need to transmit data to switch to the corresponding mode.

## Reference schematic

