

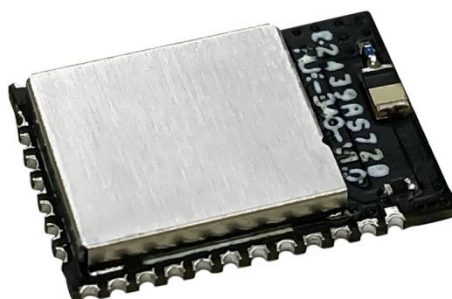


Shenzhen Hi-Link Electronic co.,Ltd

HLK-B40

Master-slave integrated Bluetooth transparent transmission module

User Manual



Contents

Terminology & noun interpretation	2
1. Introduction	3
2. Pin definition	4
3. Typical application circuits	6
4. Basic functional instructions	7
4.1 The principle of transmission	7
4.2 Module operating mode (transmission and AT command mode)	8
4.3 Description of the input and output pin functions	9
4.4 Bluetooth device roles and connections	9
5. A quick start guide	10
5.1. Test the debug base plate	10
5.2. Quickly verify bluetooth serial transmission	11
6. Low power sleep function	13
7. AT command	13
7.1 AT instruction format description	13
7.2 AT instruction list and description	14
8. Wireless settings and queries via Bluetooth	18
9. OTA functionality	18
10. Contact info	19

Chart Index

Table 1	The term name interpretation table.....	4
Table 2	Pin definition Table.....	7
Table 3	Description of the input and output pin functions.....	10
Table 4	Bluetooth transmission service UUID default.....	11
Table 5	A list of configuration items to reduce power consumption.....	14
Table 6	AT command list and description.....	19
Figure 1	Pin position diagram.....	6
Figure 2	Basic minimum circuit (disables low-power sleep function).....	8
Figure 3	Basic minimum circuit (enables low-power sleep function).....	8
Figure 4	One-to-one Bluetooth connection transmission function schematic.....	9
Figure 5	A map of the many-to-one Bluetooth connection transmission function.....	9
Figure 6	A diagram of the conversion logic of the transmission mode and the AT command mode.....	10
Figure 7	The module tests the appearance and functional schematic of the base plate....	12
Figure 8	Figure of transmission test measurement tool.....	13
Figure 9	Data transmission through serial port and app.....	13
Figure 10	Control and state timing after low power function is turned on.....	14

Terminology&noun interpretation

Name.	Instructions
Transmission	Transparent transmission is to forward data as is between Bluetooth and serial port
Bluetooth	A short-range wireless communication technology
BLE	Bluetooth Low Energy, a new Bluetooth technology specification that consumes less power and has a higher transmission and communication distance
GATT	Bluetooth Low Energy (BLE) connections are based on the GATT (Generic Attribute Profile) protocol and are a common specification for sending and receiving data over Bluetooth connections
Bluetooth host	The roles of the device in the Bluetooth connection, the host to scan the device slave and actively initiate the connection to the device, etc. in the Bluetooth connection its leading role
Bluetooth from the machine	One of the roles of the device in a Bluetooth connection, slave to broadcast its own information, passively waiting for the connection
Bluetooth broadcast	Bluetooth from the machine device through periodic broadcasting, so that the surrounding host equipment can scan and identify themselves, the host device according to the scanned slave information can initiate a connection to the computer
Broadcast interval	Bluetooth sends broadcasts slave at intervals that are smaller and faster to scan but the greater the power consumption, the smaller the power consumption
Connection interval	When two Bluetooth devices are connected, the smaller the beat of the data, the smaller the transmission speed, the smaller the delay but the greater the power consumption
Pair the binding	A mechanism of communication security in Bluetooth technology, which realizes the security of Bluetooth link layer
OTA	Air upgrade, i.e., the firmware of the module is wirelessly upgraded via Bluetooth
Re-connect Intervals	When the module is the host, when the Bluetooth connection is not connected or disconnected, the interval is automatically reconnected

Table 1 The term name interpretation table

1. Introduction

HLK-B40 is a kind of Master-Slave serial port transmission Bluetooth module based on BLE5.1, All kinds of devices with serial port can use Bluetooth wireless to send and receive data simply and quickly through this module.

The basic functions and features are as follows ,

- Main frequency 48MHz, 32-bit ARM Cortex M3 core
- Fast and stable Bluetooth-serial port transmission, serial port rate up to 921600
- Master-to-one Bluetooth, which can be set to host or slave mode, supports binding encryption
- Bluetooth from the machine mode can be connected by up to 20 host devices at the same time, supporting custom broadcast data
- Based on BLE5.1, it is faster and has a longer transmission distance and can reach 40 to 100 m in an open environment
- Supports low-power modes, sleep currents of up to 6 μ A and custom connection and broadcast intervals
- Bluetooth transmit power can be adjusted up to 10dBm and receives up to -95dBm
- Support for OTA Bluetooth wireless upgrade module firmware, wireless configuration module parameters
- The default on-board high-quality ceramic antenna increases the transmission distance and includes an external antenna
- Built-in Watchdog, Long and reliable operation time
- Ultra-small size 14mm \times 9.5mm \times 2mm
- Wide operating voltage 1.8 to 4.2V, typical 3.3V
- Rich output pins (UART, I2C, SPI, up to 15 GPIO, up to 4 ADC, up to 6 PWM) provide flexible and in-depth hardware and software custom development services

2. Pin definition

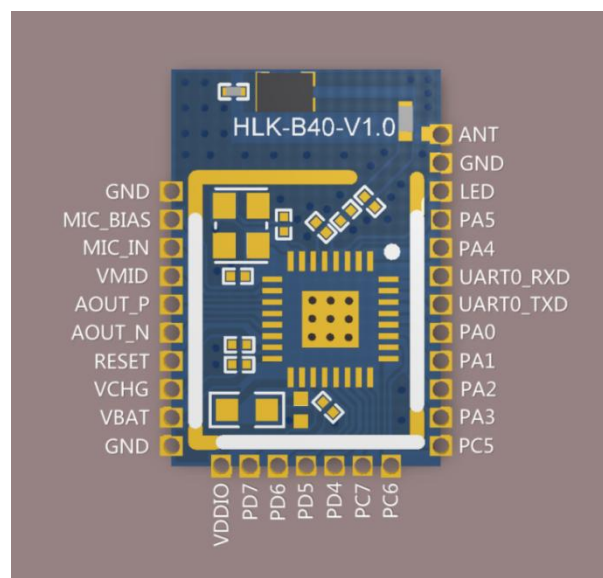


Figure 1 Pin Position Diagram

Pins	Symbol.	IO Type	Functions
1	GND	GND	Power source
2	MIC_BIA	-	Keep the functionality
3	MIC_IN	-	Keep the functionality
4	VMID	-	Keep the functionality
5	AOUT_P	-	Keep the functionality
6	AOUT_N	-	Keep the functionality
7	RESET	I	Reset restart module, high level is effective, cannot be suspended, need external 10K drop-down resistance
8	VCHG	PWR	Charger input, prohibited without battery power supply
9	VBAT	PWR	Power supply is DC3.3V input and the battery is connected when it is powered
10	GND	GND	Power source
11	VDDIO	-	Keep the functionality
12	PD7	-	Keep the functionality
13	PD6	-	Keep the functionality
14	PD5	-	Keep the functionality
15	PD4	-	Keep the functionality
16	PC7	O	Module sleep state output, High: Full speed, Low: Hibernate
17	PC6	I	Module hibernation Control input high: Go into hibernation, Low: Exit hibernation, suspend as high
18	PC5	I	Function key input, low level is valid, suspension is high
19	PA3	-	Keep the functionality
20	PA2	-	Cannot be left dangling, requires a 10K resistor pull-up connection to the VDDIO
21	PA1	-	Keep the functionality
22	PA0	-	Keep the functionality
23	UART0_	O	Module serial output
24	UART0_	I	Module serial input
25	PA4	O	Bluetooth connection status output, high: not connected, low: connected
26	PA5	O	Current operating mode output, high: master, low: slave
27	LED	-	Keep the functionality
28	GND	GND	Power source
29	ANT		External antenna output

Table 2 Pin definition Table



Below is the basic application circuit reference of this module, if you need more functions, please refer to the module manual or contact our engineers to assist.



The enable and disable of the module's low-power sleep function can be set by the AT command, which is disabled by default.

If the low-power sleep function is enabled, the module is controlled by the level of the sleep control input pin, which is used to enter or exit hibernation, and the module outputs the current sleep state by the sleep state output pin.

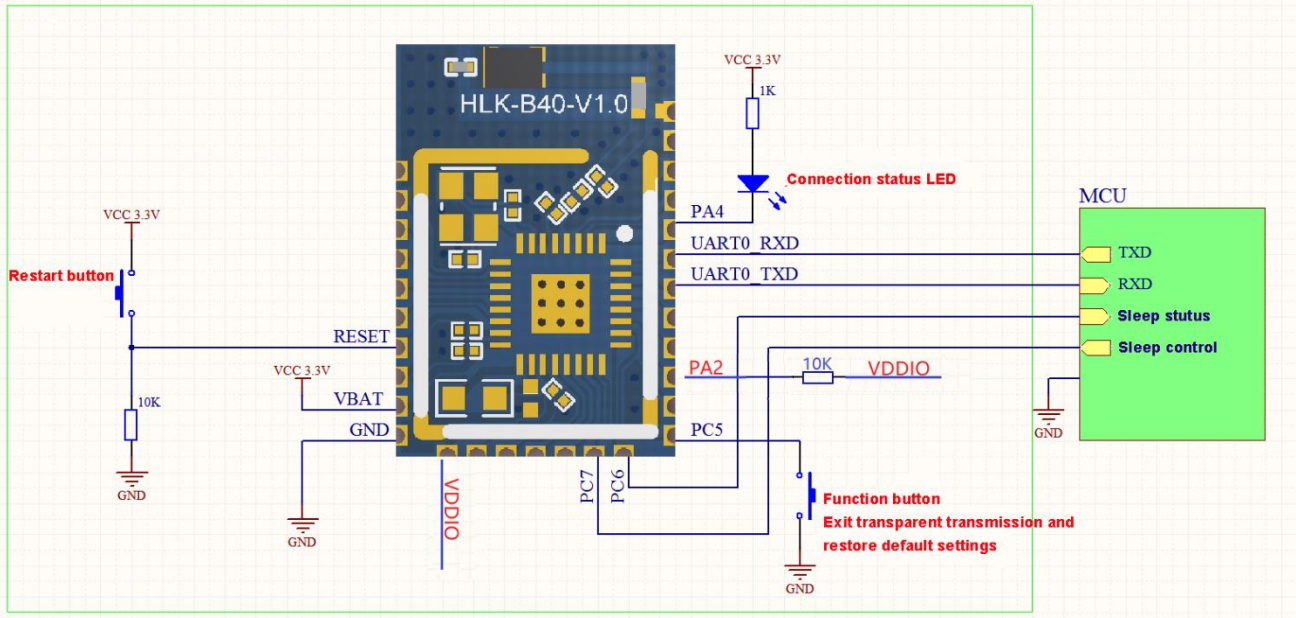


Figure 3 Basic minimum circuit (enables low-power sleep function)

Note:

1. RESET pin can not be suspended, it need to connect 10K drop-down resistance.
2. PA2 can not be suspended, need to connect 10K resistor connected to the VDDIO pin.
3. Metal object blocking will affect Bluetooth signal sending and receiving, use should make the module as far away from metal objects as possible, PCB design requires modules No copper can be laid under the antenna section.

4. Basic functional instructions

4.1 The principle of transmission

HLK-B40 is a cost-effective Master-slave integrated Bluetooth transparent transmission module introduced by Hi-Link, designed to enable only serial user devices to quickly and easily use Bluetooth for wireless transmission, with the help of serial transmission, users do not need to care about complex Bluetooth protocol stack and RF circuit, just a simple serial port transmission, data can be transmitted directly on the Bluetooth wireless connection. Transmission is short for transparent transmission, means the role of the module is equivalent to the serial port and Bluetooth connection between the establishment of a transparent transmission pipeline, the user in the serial port issued data will be forwarded to the device connected through Bluetooth, data sent through Bluetooth will also be forwarded to the serial port, the

entire process users do not need to care about complex Bluetooth connection how to achieve, HLK-B40 module from beginning to end is only the original data transfer and transmission of data without the user's convenience and transmission.

The principle schematic of the Bluetooth-serial port transmission function is as follows, see the quick start guide for the specific test verification method.



Figure 4 One-to-one Bluetooth connection transmission function schematic

This module can be connected by multiple Bluetooth host devices when acting as a Bluetooth accessor, including other B40 modules as hosts. Under a multi-to-one connection, the data received from the serial port of the machine module is forwarded via Bluetooth to each connected host device, each Data from connected host devices is also forwarded to the serial port from the machine module.

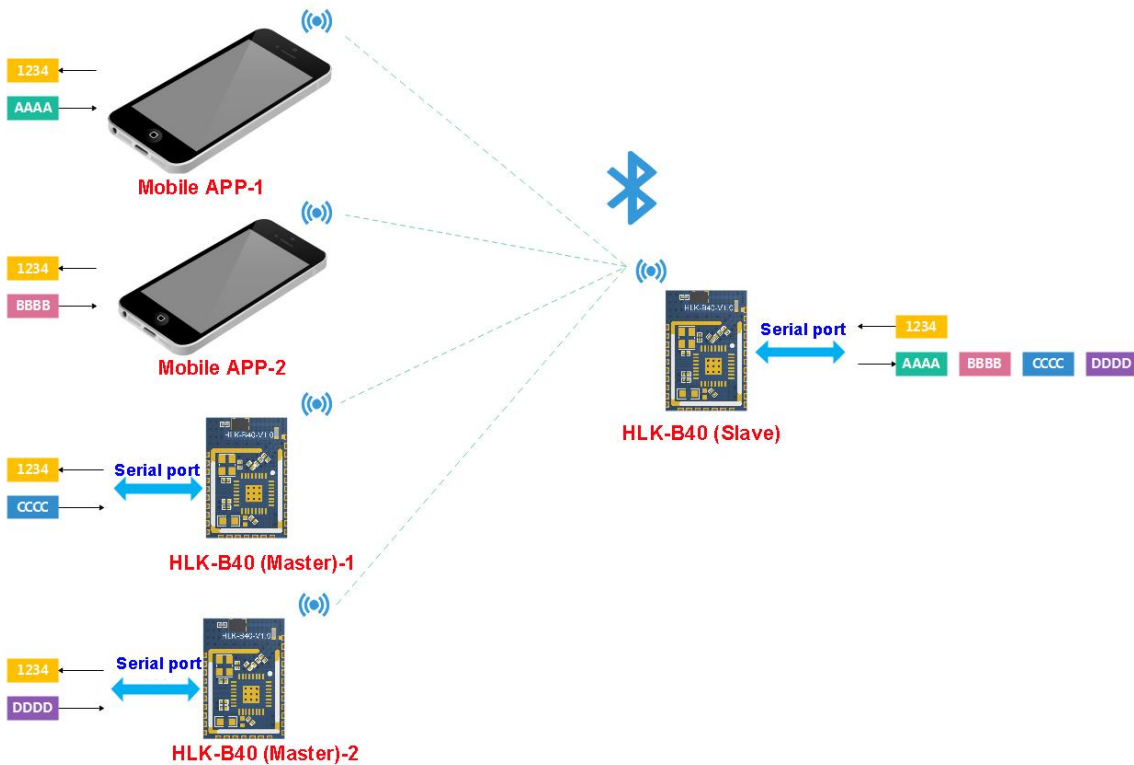


Figure 5 A map of the many-to-one Bluetooth connection transmission function

4.2 Module operating mode (transmission and AT command mode)

HLK-B40 module has both **transmission** mode and **AT** command mode.

In AT command mode, you can query and set the parameters of the module by sending the AT command to the module through a serial port.

In transmission mode, the module transfers serial data and Bluetooth-connected data in both directions.

When the module starts, the default is transmission mode. Exiting transmission mode into AT mode will not affect the Bluetooth connection state, string Mouth-Bluetooth pivot is paused, the data received by the serial port is processed by the current AT instruction;

In transmission mode, the 18th pin PC5 is entered with a short low level (0.5 to 3s) and the module switches out of transmission to AT command mode.

In AT command mode, the AT-TS-1 command is sent to restore the exit AT command mode to transmission mode.

The conversion logic for transmission mode and AT command mode is as follows:

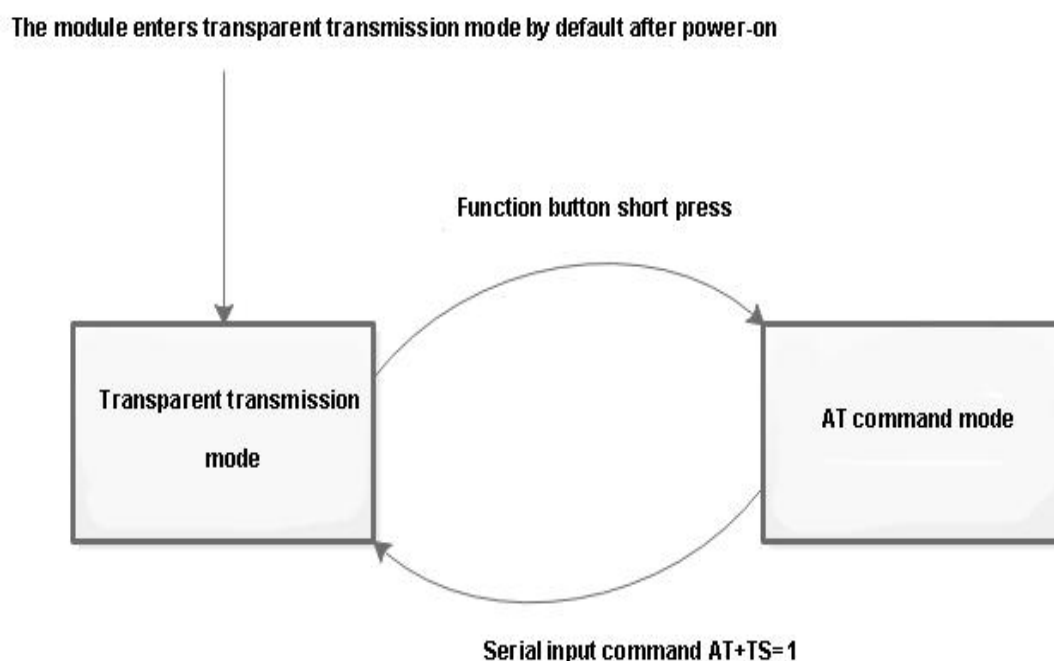


Figure 6 A diagram of the conversion logic of the transmission mode and the AT command mode

4.3 Description of the input and output pin functions

Name.	Chip pin	Description
Reset key input	RESET	High level is effective and requires an external 10K drop-down resistor Enter the high-level module to restart the module

Function button input	PC5	The inside is pulled up and the action is pulled down Pull down 0.5 to 3 seconds: exit transmission and switch to AT command mode; Pull down 8 to 20 seconds: restore the factory default settings
The module sleep control input	PC6	Internal pull-up, suspension or input high-level module automatically into hibernation, input low normal full-speed operation; Valid only if the low-power sleep function is enabled
The module hibernate state output	PC7	High level - full speed work, low level - hibernation
Bluetooth connection status output	PA4	High level - not connected, low level - connected, transmission channel has been established; When the pairing binding feature enables, the pairing encryption is successfully represented on the connection
The operating mode output	PA5	High level = master, low level = slave

Figure 3 Description of the input and output pin functions

4.4 Bluetooth device roles and connections

Devices at both ends of the Bluetooth connection have fixed roles, one is the host role, the other is the slave role. Different roles of equipment define the corresponding operations and responsibilities.

The host discovers the slave device by scanning the slave broadcast and actively initiates a connection to the selected slave device (identified by the MAC address) and Maintain the connection and play a leading role in a Bluetooth connection

The slave broadcasts its own information, such as the device name, etc. The slave passively waits for the connection request initiated by the master and accepts the request to connect to Bluetooth Successfully established. This module can be connected to multiple host devices at the same time as a slave.

The B40 module defaults to the slave mode and the settings can be switched through the AT+ROLE command.

After the two devices establish a Bluetooth connection, they can send data to each other via Bluetooth (GATT).

The Bluetooth GATT service and feature UUID of this module can be modified by AT command, the default values are as follows:

Service UUID: 0000fff0-0000-1000-8000-00805f9b34fb

Feature UUID	Action permissions	The function definition
0000fff1-0000-1000-8000-00805f9b34fb	Read/Notify	Module send, APP receive
0000fff2-0000-1000-8000-00805f9b34fb	Write Without Response	APP send, module receive

Figure 4 Bluetooth transmission service UUID default

You can choose to turn on the pairing and binding function of the Bluetooth connection. After it is turned on, the security can be increased, but the operation steps are increased accordingly. It is valid in slave or master mode. The pairing method is PASSKEY ENTRY, 6-digit Ping Code. After the binding function is turned on, Bluetooth data can be sent and received only after pairing and binding. Unpaired devices cannot transparently transmit data through Bluetooth and the module.

In the master mode, you need to set the MAC address of the target slave to be connected. After the module starts, it will automatically scan and connect to the target slave device and will automatically reconnect and reconnect if the slave is not found or the connection is disconnected. The interval time can be set by the AT+RECONNI command, the default is 5s, that is, when it is not connected, it will try to reconnect every 5 seconds until it is connected.

5. A quick start guide

5.1. Test the debug base plate

In order to enable users to quickly verify and debug the module, our company has developed a dedicated B40 test board. It is recommended that you choose to use this test board when you use this module for the first time.

The test board is directly powered by USB and comes with a USB-to-serial function. After connecting to the computer through the USB cable, you can connect to the module's serial port through the USB-to-serial port. No additional serial cable is required, which is easy to use.

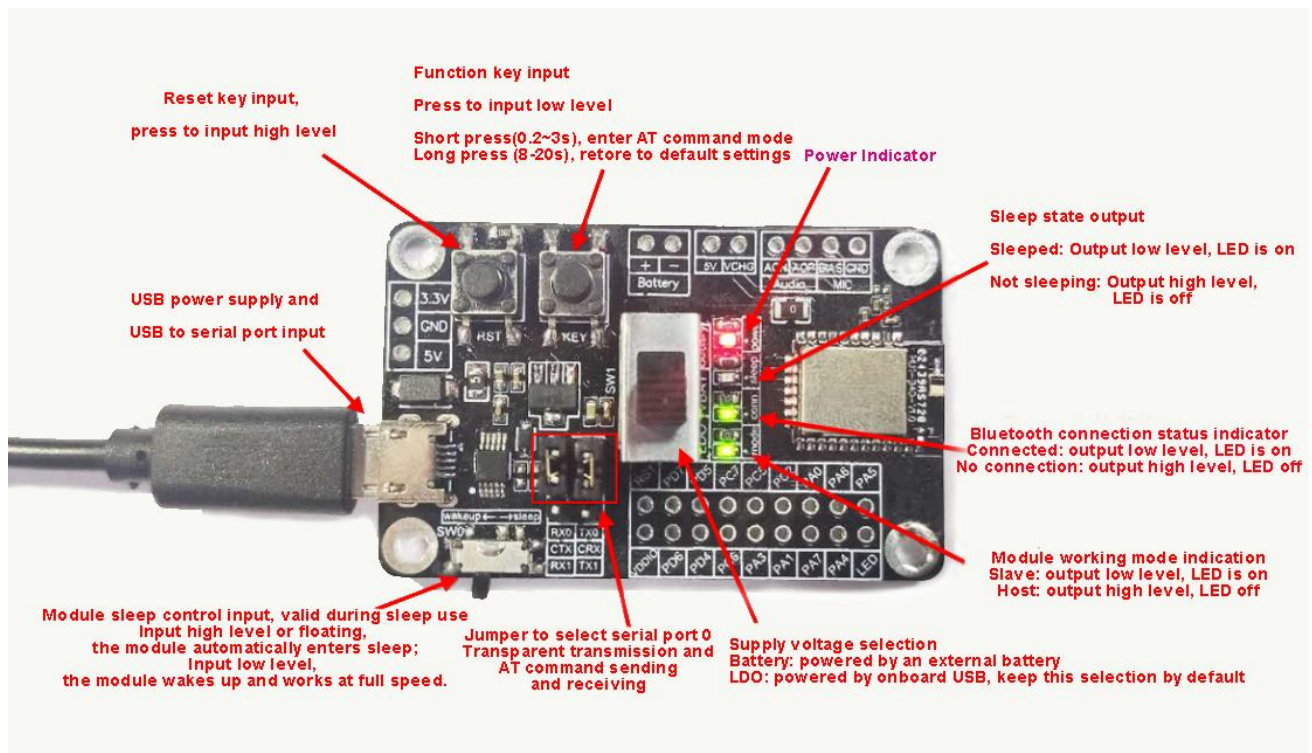


Figure 7 The module tests the appearance and functional schematic of the base plate

5.2. Quickly verify bluetooth serial transmission

Our company has developed a special mobile phone Bluetooth transparent transmission test APP for this module for users to use. For APP introduction and instructions, please refer to ***HLK-B40 Bluetooth Transparent Transmission Module Mobile APP Instructions***.

Use the module test bottom board and the mobile phone Bluetooth transparent transmission test APP to immediately start to test and verify the module's serial port-Bluetooth transparent transmission function.

The specific test procedures are as follows:

Connect the module to the test board correctly and connect the test board to the computer through a USB cable.

Open the corresponding serial port on your computer with the serial debugging tool.

Open the transparent transmission test APP on the mobile phone, the APP will automatically search for surrounding Bluetooth devices and display them in a list.

Click the Bluetooth device name corresponding to the module in the device list to connect. The default name of the B40 module is HLK_B40_**** and the suffix is the last four digits of the MAC address.



Figure 8 Figure of transmission test measurement tool

After the app is successfully connected to the module, the connection status LED on the test board will turn on, means the connected state.

At this time, the data can be sent to the serial port of the module in the serial port debugging tool on the computer and the sent content will be received and displayed as it is by the mobile phone app;

Send data from the transparent transmission test app on the mobile phone to the module, the sent content will be received by the module as it is and output to the serial port of the module. The received data can be seen in the serial port debugging tool on the computer. The effect is as follows:

Serial port of module

Mobile APP

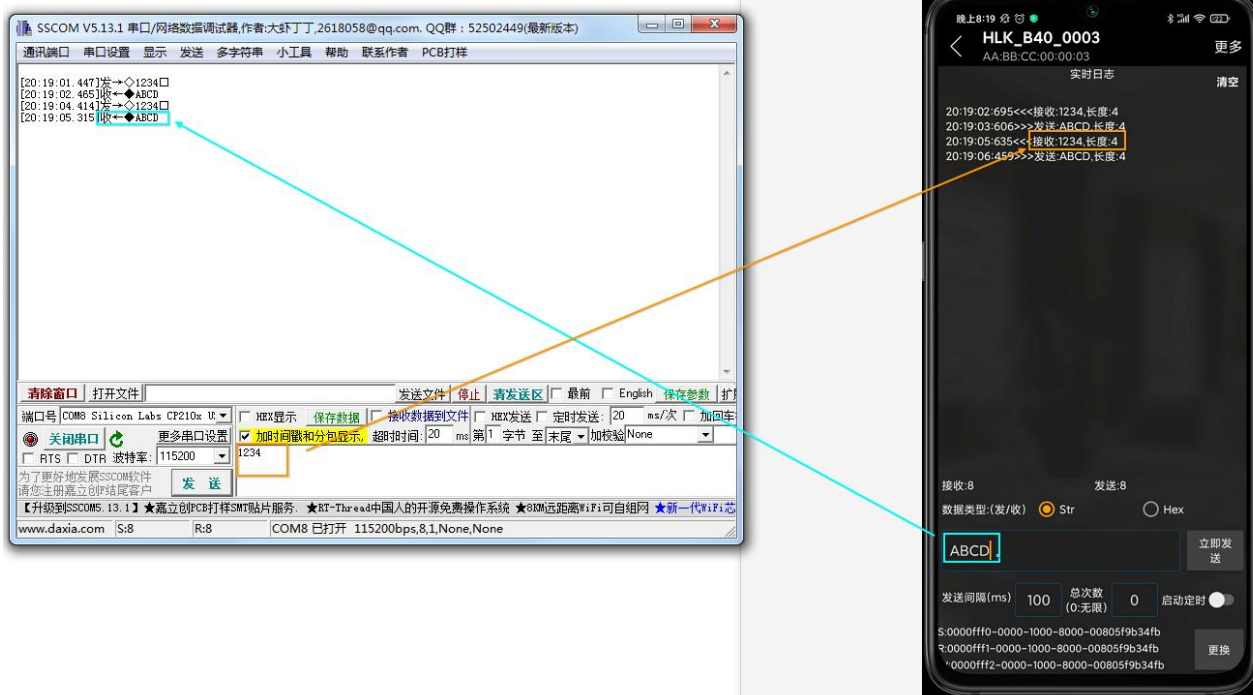


Figure 9 Data transmission through serial port and app

6. Low power sleep function

This module is developed based on BLE 5.1 supporting low power consumption and can be flexibly configured in many aspects to further reduce power consumption.

Configurable items	Description
Adjust transmit power	The lower the transmission power, the lower the power consumption but the shorter the transmission distance
Adjust the broadcast interval and connection interval	The larger the interval, the lower the power consumption but the greater the delay
Turn on auto sleep	After the automatic sleep function is turned on, the module can be controlled by the input level of the external sleep control input pin. High level: the main chip will sleep automatically. Low level: wake up to work at full speed. The minimum operating current can be as low as 6μA during dormancy

Figure 5 A list of configuration items to reduce power consumption

All the above can be modified through the AT command, the user can be flexible according to the actual application scenario and requirements to achieve a balance between power consumption and performance.

When automatic sleep is turned on, the hibernate output outputs different levels to indicate whether the module is currently dormant or wake-up:

High: wake-up, full-speed operation.

Low: Sleep state

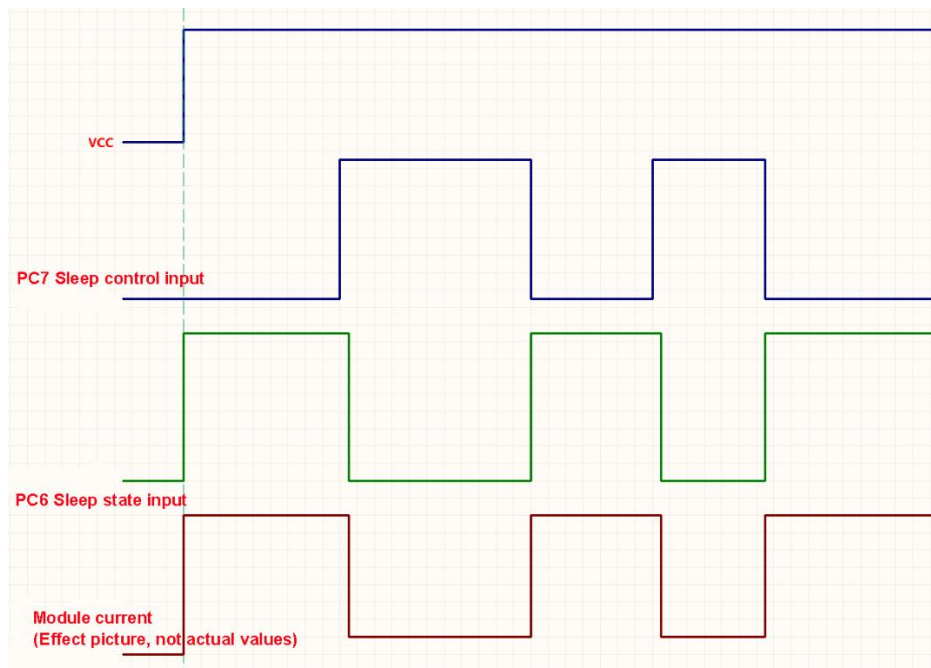


Figure 10 Control and state timing after low power function is turned on

7. AT command

7.1 AT instruction format description

All at instructions are in ASSCII string format and end with carriage return.

Power failure will not be lost after setting. All settings will take effect only after restart.

Query class instructions:

Send	Response
AT+<CMD>=?\r\n	<p>Query successfully:</p> <p>AT+<CMD>=<val>\r\n</p> <p>OK\r\n</p> <p>Or query failed:</p> <p>AT+<CMD>=<val>\r\n</p> <p>ERROR\r\n</p>

Set class instructions:

Send	Response
AT+<CMD>=<val>\r\n	Set successfully: AT+<CMD>=<val>\r\n OK\r\n Or set failure: AT+<CMD>=<val>\r\n ERROR\r\n

For ASCII code: 0x0D 0x0A

7.2 At instruction list and description

Item	command name	Description	Range parameters	Example	
1	VER	Software versions	Read only	send	response
				AT+MAC=?	AT+VER=1.03(20092421) OK
2	MAC	MAC address	Read only	send	response
				AT+MAC=?	AT+MAC=112233445501 OK
3	DEFAULT	Restore the default configuration	1	Send	response
				AT+DEFAULT=1	AT+DEFAULT=1 OK
4	REBOOT	Restart the module	1	Send	Response
				AT+REBOOT=1	AT+REBOOT=1 OK
5	TS	Restore transmission mode	1	Send	response
				AT+TS=1	AT+TS=1 OK
6	NAME	Module. Bluetooth name	Up to 25 characters Default: HLK_B40_****	send	response
				AT+NAME=?	AT+NAME=HLK_B40 OK
				send	response
				AT+NAME=ble_1234	AT+NAME=ble_1234 OK

7	BAND	Serial. Porter rate	1200,2400,4800,9600,14400,19200, 38400,57600,115200,230400,46080 0,921600 Default: 115200	send AT+BAND=?	response AT+BAND=115200 OK
				send AT+BAND=230400	response AT+BAND=230400 OK
8	RFPOWER	Bluetooth. Transmit power	1-18, 18 grades Default value: 8 The smaller the transmission distance, the lower the power consumption; the larger the transmission distance, the greater the power consumption	send AT+RFPOWER=?	response AT+RFPOWER=8 OK
				send AT+RFPOWER=10	response AT+RFPOWER=10 OK
9	SLEEPEN	auto sleep Enable	0 disable sleep 1 enable sleep Default value: 0 After enabling, the module will automatically enter the sleep state according to the control of the level of the SLEEPEN input pin	send AT+SLEEPEN=?	response AT+SLEEPEN=0 OK
				send AT+SLEEPEN=1	response AT+SLEEPEN=1 OK
10	CONNI	Bluetooth Connection interval	6~3200, The unit is 1.25ms, i.e.7.5-4000ms. The default value is 24 The smaller the transceiver, the faster the power consumption; the larger the transceiver, the slower the delay, and the lower the power consumption.	send AT+CONNI=?	response AT+CONNI=24 OK
				send AT+CONNI=8	response AT+CONNI=8 OK
11	ADVI	Bluetooth Broadcast interval	Unit: 625us Recommended value: 80,160,320,800, 1600,3200 Default value: 800	send AT+ADVI=?	response AT+ADVI=800 OK
				send AT+ADVI=1600	response AT+ADVI=1600 OK
12	ADVDATA	Self-define Broadcast data	Hexadecimal number, the number of characters is a multiple of 2, up to 40 hexadecimal numbers Default: none	send AT+ADVDATA=?	response AT+ADVDATA=03FF1A1B OK
				send AT+ADVDATA=68696C6 96E6B	response AT+ADVDATA=68696C696E6B OK

13	ROLE	module BLE role	1 slave 2 host Default value: 1	send	response
				AT+ROLE=2	AT+ROLE=2 OK
				send	response
				AT+ROLE=?	AT+ROLE=1 OK
14	ENCRYPT	Pairing binding Enable	0 does not require pairing binding 1 requires pairing and binding Default value: 0	send	response
				AT+ENCRYPT=?	AT+ENCRYPT=0 OK
				send	response
				AT+ENCRYPT=1	AT+ENCRYPT=1 OK
15	PINCODE	Pairing code	6-bit integer Default value: 000000	send	response
				AT+PINCODE=?	AT+PINCODE=000000 OK
				send	response
				AT+PINCODE=123456	AT+PINCODE=123456 OK
16	SCANMODE	Connection scanning method in host mode	0 Connection via MAC address 1 Connection via Bluetooth name Default value: 0	send	response
				AT+SCANMODE=?	AT+SCANMODE=0 OK
				send	response
				AT+SCANMODE=1	AT+SCANMODE=1 OK
17	PEERMAC	When the module is the master, it automatically goes to the MAC address of the slave	MAC address, 12 hexadecimal numbers	send	response
				AT+PEERMAC=?	AT+PEERMAC=AABBCC000001 OK
				send	response
				AT+PEERMAC=AABB CC000001	AT+PEERMAC=AABBCC000001 OK
18	PEERNAME	Bluetooth name of the slave that automatically goes connected when the module is the master	Up to 25 characters	send	response
				AT+PEERNAME=?	AT+PEERNAME=HLK_B40 OK
				send	response
				AT+PEERNAME=ble_1234	AT+PEERNAME=ble_1234 OK
19	AUTHPWG	OTA and air- configured access passwords	Up to 8 characters Default: Hi- Link	send	response
				AT+AUTHPWG=?	AT+AUTHPWG=HiLink OK
				send	response
				AT+AUTHPWG=686868 68	AT+AUTHPWG=68686868 OK

20	CONNSTATE	Query the device information for the current Bluetooth connection	Read-only Responses includes: Number of devices currently connected Each device's Role, MAC	<table><tr><td>send</td><td>response</td></tr><tr><td>AT+CONNSTATE=?</td><td>AT+CONNSTATE=2 M,4E21FB831492 M,539FD7108A6D OK</td></tr></table>	send	response	AT+CONNSTATE=?	AT+CONNSTATE=2 M,4E21FB831492 M,539FD7108A6D OK				
send	response											
AT+CONNSTATE=?	AT+CONNSTATE=2 M,4E21FB831492 M,539FD7108A6D OK											
21	RECONNI	Bluetooth automatically re-connects when the module is the host	Integer, unit s 0: Represents only one attempt to connect at startup, not reconnect 1 to 60: The connection is automatically reconnected after a specified number of seconds after the connection is disconnected Default:5	<table><tr><td>send</td><td>response</td></tr><tr><td>AT+RECONNI=?</td><td>AT+RECONNI=0 OK</td></tr></table> <table><tr><td>send</td><td>response</td></tr><tr><td>AT+RECONNI=10</td><td>AT+RECONNI=10 OK</td></tr></table>	send	response	AT+RECONNI=?	AT+RECONNI=0 OK	send	response	AT+RECONNI=10	AT+RECONNI=10 OK
send	response											
AT+RECONNI=?	AT+RECONNI=0 OK											
send	response											
AT+RECONNI=10	AT+RECONNI=10 OK											
22	UUIDS	Bluetooth transmission service UUID	32 hexadecimal Default: 0000fff000001000800000805f9b34fb									
23	UIDR	Read feature UUID in transmission service (module send, APP receive)	32 hexadecimal Default: 0000fff100001000800000805f9b34fb									
24	UIDW	White feature UUID in APP transmission (APP send module receive)	32 hexadecimal Default: 0000fff200001000800000805f9b34fb									
25	DISCONN	Proactively disconnect all current Bluetooth connections to the module	1	<table><tr><td>send</td><td>response</td></tr><tr><td>AT+DISCONN=1</td><td>AT+DISCONN=1 OK</td></tr></table>	send	response	AT+DISCONN=1	AT+DISCONN=1 OK				
send	response											
AT+DISCONN=1	AT+DISCONN=1 OK											
26	ADVEN	Module Bluetooth broadcast enable	0 Disable Bluetooth broadcasting for the module 1 Enable Bluetooth broadcasting for the module Default value: 1 When disabled, the module cannot be scanned by cell phones or other Bluetooth hosts	<table><tr><td>send</td><td>response</td></tr><tr><td>AT+ADVEN=?</td><td>AT+ADVEN=0 OK</td></tr></table> <table><tr><td>send</td><td>response</td></tr><tr><td>AT+ADVEN=1</td><td>AT+ADVEN=1 OK</td></tr></table>	send	response	AT+ADVEN=?	AT+ADVEN=0 OK	send	response	AT+ADVEN=1	AT+ADVEN=1 OK
send	response											
AT+ADVEN=?	AT+ADVEN=0 OK											
send	response											
AT+ADVEN=1	AT+ADVEN=1 OK											

27	MAXCONN	Max number of Bluetooth connections allowed when in slave mode, i.e. up to how many hosts can be connected at the same time	Default value: 10	<table><tr><td>send</td><td>response</td></tr><tr><td>AT+MAXCONN=?</td><td>AT+MAXCONN=20 OK</td></tr></table> <table><tr><td>send</td><td>response</td></tr><tr><td>AT+MAXCONN=2</td><td>AT+MAXCONN=2 OK</td></tr></table>	send	response	AT+MAXCONN=?	AT+MAXCONN=20 OK	send	response	AT+MAXCONN=2	AT+MAXCONN=2 OK
send	response											
AT+MAXCONN=?	AT+MAXCONN=20 OK											
send	response											
AT+MAXCONN=2	AT+MAXCONN=2 OK											

Table 6 AT command list and description

8. Wireless settings and queries via Bluetooth

In the mobile phone APP, the module can be queried and set up by Bluetooth wireless, please refer to the *HLK-B40 Bluetooth transmission mode phone APP usage instructions*.

9. OTA functionality

In the mobile phone APP, through Bluetooth wireless upgrade module firmware, the specific operation please refer to the *HLK-B40 Bluetooth transmission module mobile phone APP Instructions* for use.

10. Contact info

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