Technical Description

The Equipment Under Test (EUT) is a Smartphone Controller which operates at frequency range of 2402MHz to 2480MHz. There are total 40 channels with 2MHz channel spacing. When the EUT pairs with a smartphone, the user can play game on the smartphone remotely. The EUT is powered by a 3.0VDC (2 X 1.5V size "AAA" batteries. The applicant declared that Bluetooth 4.0 BLE is used only.

2.4GHz Bluetooth Module:
Modulation Type: GFSK
Antenna Type: Integral, Internal (PCB Trace)
Frequency Range: 2402MHz - 2480MHz, 2MHz channel spacing, 40 channels

EIRP range is -2dBm to 4dBm
Antenna gain is 0Bi

The main components are described below:

1. U2 BK3231S is the 2.4GHz Bluetooth RF radio core
2. X2 16MHz crystal is master clock for U2

Bluetooth 4.0 BLE Channel Table

Channel	Frequency (MHz)
1	2402
2	2404
3	2406
4	2408
5	2410
6	2412
7	2414
8	2416
9	2418
10	2420
11	2422
12	2424
13	2426
14	2428
15	2430
16	2432
17	2434
18	2436
19	2438
20	2440
21	2442
22	2444
23	2446
24	2448
25	2450
26	2452
27	2454
28	2456
29	2458
30	2460
31	2462
32	2464
33	2466
34	2468
35	2470
36	2472
37	2474
38	2476
39	2478
40	2480

F-9688

V3.2.0 MANUAL

Shen Zhen Shi Xin Zhong Xin Technology Co., Ltd

14th July 2017

目录

1. PRODUCT OVERVIEW

1.1 DESCRIPTION

F-9688 is BLE Single mode data transmission module (Suitable for small data and low power consumption, does not support voice, it is mainly used for control) , Now, we give our customer serial port module as sample customer, other programs, applications need to be customized (You can find the design conventions and reference circuit in the end of the specification manual"《15, custom program rules and reference circuit"》

1.2 MODULE FEATURE

1、Xin zhong xin has been the first to deal with Android system (Android 4.4 can be perfectly compatible, 4.3 system only supports one - way), also IOS system and F - 9688 Bluetooth module two - way transparent transmission problem.

2、User interface using a universal serial port design, full duplex two-way communication, baud rate range 9600 ~ 115200bps.

3、Default 20ms connection interval, fast connection.

4、Support AT command software reset module, access to MAC address.

5、Support AT commands to adjust the Bluetooth connection interval, control the different forwarding rate. (Dynamic power adjustment).

6、Support the AT command to adjust the transmit power, modify the broadcast interval, custom broadcast data, set the data delay (user CPU serial port access time), modify the serial baud rate, modify the module name, all power-down save.

7、The length of Serial data packet is 20byte .

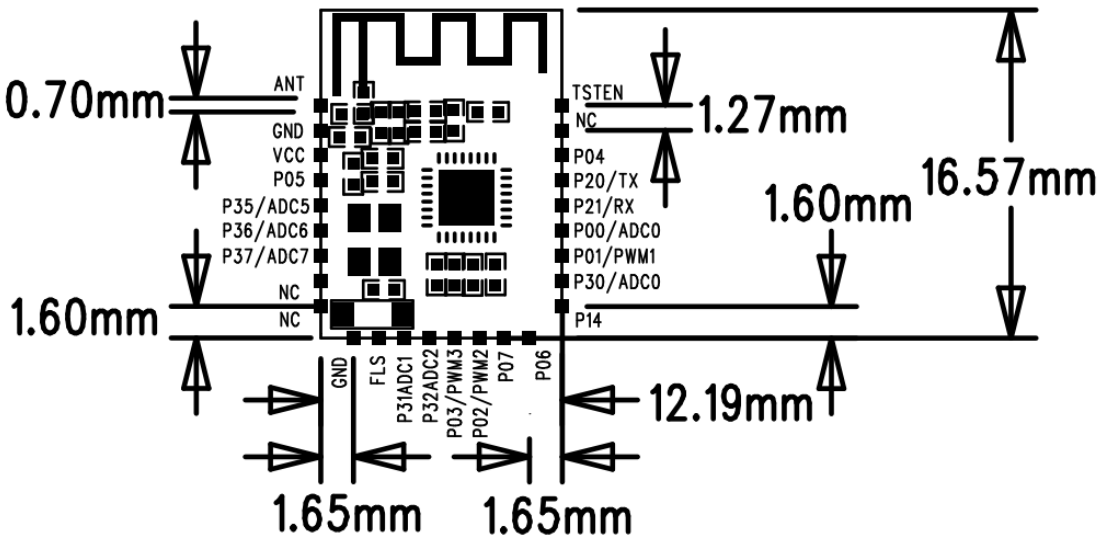
8、Very low-power standby mode, the module power consumption is as follows: :

Status	Average	Test condition
dormant	2uA	
broadcast	800uA	Broadcast interval is100ms
Connection	300uA	The connection interval is500ms

1.3 PARAMETER

MODULE:	F-9688
BLUETOOTH:	BluetoothV4.0
SUPPLY VOLTAGE:	2.0-3.6V
SUPPORT BLUETOOTH	ATT,GATT,SMP,L2CAP,GAP
WORKINGCURRENT	≤10mA(SIMPLE APPLICATION 200uA~1mA)
STANDBY CURREN	Less than 2uA
TEMPERATURE RANGE	-40°Cto+80°C
WIRELESS TRANMISSION	0~100M
TRANSMISSION POWER	MAX 4dBm
SENSITIVITY:	-93dBm<0.1%BER
FREQUENCY RANGE:	2.4GHz-2.480GHz
INTERFACE:	IO,UART,SPI,PWM,ADC,IIC
MODULE SIZE:	16.57mm*12.19mm*1.8
IO FEATURE	INPUT6ma，OUTPUT3.9ma，Internal pull-down 50k

1.4OUTLINE DEMENSION



1.5PIN DEFINITION

Pin	Symb	I/O	Description
1	ANT	----	The input of RF
2	GND	----	GND
3	VDD	----	VCC2.0-3.6v
4	P0.5	I/O	General I/O, or MOSI for SPI, SO_FLA
5	P3.5	I/O	General I/O，or input of ADC1
6	P3.6	I/O	General I/O，or input of ADC1
7	P3.7	I/O	General I/O，or input of ADC1
8	NC	----	
9	NC	----	
10	GND	----	GND
11	FLS	I/O	The output of boost
12	P3.1	I/O	General I/O，or input of ADC1
13	P3.2	I/O	General I/O，or input of ADC2
14	P0.3	I/O	General I/O, or 3DS_PWM[3],I2C1.SDA, WP_FLA
15	P0.2	I/O	General I/O, or 3DS_PWM[2], I2C1.SCL, HOLD_FLA
16	P0.7	I/O	General I/O, or SPI_NSS, CSN_FLA
17	P0.6	I/O	General I/O,or MISO for SPI,SCK_FLA
18	P1.4	I/O	General I/O，or enable for PWM4
19	P3.0	I/O	General I/O，or input of ADC0
20	P0.1	I/O	General I/O, or 3DS_PWM[1]
21	P0.0	I/O	General I/O, or 3DS_PWM[0]
22	P2.1	I/O	General I/O, or UART RX
23	P2.0	I/O	General I/O, or UART TX
24	P0.4	I/O	General I/O, or SPI_SCK, SI_FLA
25	NC	----	
26	TSTEN	----	Enable the testting function of memory

2. APPLICATION

2.1AOOLICATION FIELD

》SPORT
》SECURITY
》SMART HOME
》INDUSTRIAL AUTO-CONTROL
》MOBILE PHONE ACCESSORIES
》INDOOR LOCATING
》MEDICAL AND HEALTH CARE

2.2APPLICATION EXAMPLE

》SMART WATCH
》ANTI-LOST DEVICE
》HEART RATE MONITOR
》WEIGHT SCALE
》ELECTRONIC PEDOMETER
》BLOOD PRESSURE AND BLOOD GLUCOSE METER

2.3LOW POWER CONSUMPTION APPLICATION

F-9688 Two working mode: (1) Low Power Mode (2) Not Low Power Mode

1) **Low Power Mode:**

Under Low Power Mode, Module has very low power consumption, So low power mode suitable for in the design of circuit with low power consumption requiremen,at the same time in low power mode has two enable P0^0 and P0^1, P0^0 is module enable, P0^1 is transmission enable.When in dormant mode, Only need to give P0 ^ 0 a falling edge, BLE module start to work, P0^1is Low level usually enable serial transmission。

(NOTIC: The default is not to open low-power mode)

(2) **Non Low Power Mode**

The non-low power mode has automatic power-up broadcast, And can be directly used serial transmission, There is no need to control P0 ^ 0 and P0 ^ 1, So the use of non-low-power mode is more convenient

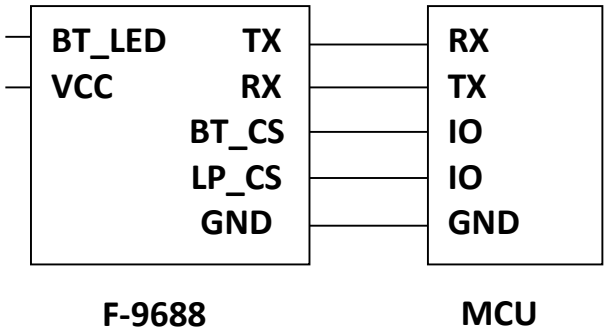
Note: In the low power state, the AT command can not be set normally. Before setting the AT command, set LP_CS to low level

3. COMMUNICATION MODE

The working mode of the module is transparent transmission mode.

Under transparent transmission mode, User CPU can be realized two-way communication through the module's universal serial port and mobile devices, The user can also use a specific serial AT command, control Some of the communication parameters .The meaning of the user data is defined by the upper application .The mobile device can write to the module through the APP, Written data will be sent to the user CPU through the serial port。After Module receives the data packet from the user's CPU serial port, Will be automatically forwarded to the mobile device。The development of this mode, The user must be responsible for the main CPU code design, As well as smart mobile device APP code design.

3.1TRANSPARENT TRANSMIT MODULE CONNECTED WITH MCU



3.2MCU HOST TRANSPARENT TRANSMISSION CONTROL AND PROGRAM REFERENCE

3.2.1PIN DESCRIPTION

P21/RX : SERIAL DATA RECEIVER

P20/TX :SERIAL PORT TRANSMISSION

P00/MOUDLE_CS :MODULE ENABLE

P01 /UART_CS:SERIAL ENABLE

P06/BT_IN :BLUETOOTH STATUS INDICATOR PIN

BT_IN is bluetooth connect, Bluetooth connection on the output high, disconnect the output low。MOODLE CS is the MCU control BLE module status pin,Low enable module, High level is not enabled。UART_CTS Serial Port Enable, Low level stop low power, High-level enter to low power.

Special Note: BT_CS, LP_CS, BT_LED function requires AT command to enable the function

COMMUNICCATION PROCESS

For different serial baud rate and BLE connection interval, As well as different contracting intervals, Modules will have different data throughput capabilities。In order to coordinate the use of low-speed CPU, The default baud rate is 115200bps, In a large amount of data transmission, On real-time applications, it is recommended to set for high speed serial baud rate 115200bps, Support power-down save。When the module BLE connection interval is 20ms, When the serial baud rate is 115200bps, The module has the most strong forwarding capability(4K/S)。This is the level enable mode, This configuration is an example, For the transparent transmission protocol to do a detailed introduction.

1）、Serial hardware protocol: The baud rate is 115200bps, Data length 8, No check bit, Stop bit length 1.
（2）、In low power mode, MOODLE CS is high level, The Bluetooth module is in full sleep。MOODLE CS is low level, The module begins to work, The default broadcast interval is 100ms, Until connecting and mobile phone success, This module will pull down BT_IN.

（3）、The Bluetooth default connection interval for the module is 20ms, If you need to save power, use low-speed forwarding mode, Need to adjust the connection by the AT command (the longest connection interval 2000ms), Up to 40 bytes can be transmitted per connection interval, The connection interval is T (unit: ms),Then the maximum forwarding rate per second V (in bytes / s) is:
V= 40*1000/T(V only related to T)
If the Bluetooth connection interval of the module is 20ms, And each interval is up to 40 byte, So the most strong transmission capacity (forwarding rate) is4 0*50 = 2K byte/s。Tests show, The forwarding rate is below 2K / s, Leakage packet probability is very low. For safety, both low-speed and high-speed data forwarding applications, are recommended to do the check re-transmission processing in the upper layer

MCU REFERENCE CODE

```
void main(void)
{
halMcuWaitMs(1);//delay1ms
    while(1)            //Loop send and receive test
    {
        //Waiting for the end of the transmission, but also can wait

        if(UARTRead(uartBuffer)== SUCCESS)   //Serial read data
        {...//data processing
        ...}
      halMcuWaitMs(2);                    //delay2ms
      send_TX("12345678901234567890");    //Send any data（20byte）
      halMcuWaitMs(50);              //Delay 50ms (different baud rate,
      connection gap, different time)
    }
```

4. AT COMMAND TEST

（1）、Do not use "AT +" (hex 41542B) as a transparent data header when transmitting data. Transparent format, need to define their own. Whether or not it contains a communication header. Each pass through 20 bytes to send. The module is subject to the main module, the relevant UUID as follows

SeviceUUID:0xFFF0

CharacteristicUUID:0xFFF4

（2）、Command mode, the "AT +" string hexadecimal code is 41542B, \ CR \ LF hexadecimal 0D0A, please note that customers. Each time you set up a project, because the basic power-saving items are saved, so need to restart the module or use the AT command reset. (Special reminder: AT command end character must be a newline)

4.1COMMAND SET

	COMMAND	FUNCATION
BASIC COMMAND	AT+RSET	Restore factory settings
	AT+CONB	Disconnect
	AT+REST	Reset
QUERY INSTRUCTION	AT+GCTO	Query - connection timed out
	AT+VERS	Query - software version
	AT+GADD	Query - module address
	AT+GNAM	Query - Module name
	AT+GCMA	Query - maximum connection interval
	AT+GPWR	Query - transmit power
	AT+GSLA	Query - slave latency
	AT+GCMI	Query - minimum connection interval
	AT+GURT	Query - baud rate
	AT+GAVI	Query - broadcast interval
	AT+GPAC	Query - match password
	AT+GPAE	Query - Pair Password Enable
Set instruction	AT+UART	Set - serial baud rate
	AT+SNAM	Settings - Module name
	AT+SCMA	Settings - Maximum connection interval

	AT+SPWR	Set - transmit power
	AT+GCMI	minimum connection interval
	AT+GPAC	match password
	AT+SPAE	Pair Password Enable
	AT+SSLA	slave latency rate
	AT+SCTO	Connection timed out
	AT+SAVI	Broadcast interval
	AT+ ENLP	Low power control enabled
	AT+ NOLP	Low power consumption is disabled
	AT+ ELED	Bluetooth LED enabled
	AT+ DLED	Bluetooth LED is not enabled
	AT+ ESLP	Module switch control enabled
	AT+ DSLP	The module switch control is disabled
	AT+ DPWM	SET - PWM always enabled
	AT+ EPWM	- PWM Always enabled to open
	AT+ FREQ+XXX	- PWM frequency
	AT+ PWM0+XXX(reserve)	- PWM0 Duty cycle
	AT+ PWM1+XXX(reserve)	- PWM1 Duty cycle
	AT+ PWM2+XXX	- PWM2 Duty cycle
	AT+ PWM3+XXX	- PWM3 Duty cycle
	AT+ PWM0+0(reserve)	- PWM0 turn off
	AT+ PWM1+0(reserve)	- PWM1 turn off
	AT+ PWM2+0	- PWM2 turn off
	AT+ PWM3+0	- PWM3 turn off

PWM use Description:
1, AT + EPWM Turn on the PWM master switch

2, AT + FREQ + XXX set the frequency, the unit HZ, greater than 20hz, less than 200Khz

3, AT + PWM3 + XXX set the duty cycle, greater than 0, less than 101, when the duty cycle is equal to 0 turn off the channel

Note: All channels pwm must be the same frequency

4.2Instruction specification

AT+ROLE

AT+ROLE\CR\LF：Query - module master-slave mode		
Query command： AT+ROLE\CR\LF	response	ROLE:SLAVE
	Description	None
Example: Send a query command：AT+ROLE，return：ROLE:SLAVE		

AT+VERS

AT+VERS：Query - software version		
Query command： AT+VERS\CR\LF	response	Version:5.0
	Description	None
Example: Send a query command：AT+VERS，Returns the software version information：Version:5.0		

AT+GADD

AT+GADD：Query - module address		
Query command： AT+GADD\CR\LF	response	BLEADDRESS: Para
	Description	Para:12Bluetooth address
Example: Send a query command：AT+GADD，Returns 12-bit address： BLEADDRESS:0xB85FF98FC320		

AT+GNAM

AT+GNAM: Query - Module name		
Send a query command: AT+GNAM\CR\LF	response	NAME:Para
	Description	Para: Module name
Example: Send a query command:AT+GNAM,Returns the current name: NAME:BK3231S_SPP		

AT+SNAM

AT+SNAM: Settings - Module name		
Setting command: AT+SNAM+Para\CR\LF	response	Ok
	Description	Para:String name, up to 20 bytes
Example: Set the name to xinzhongxin to send an instruction: AT+SNAM+xinzhongxin, Set to return successfully ok		

AT+GCMA

AT+GCMA: Query - maximum connection interval		
Send a query command: AT+GCMA\CR\LF	response	CONNECTIONINTERVAl:Para
	Description	Para: Connection interval (range: 8~1600, unit 1.25 millisecond)
Example: Send command AT + GCMA to return to the current connection interval: CONNECTIONINTERVAl:16 (default 16)		

AT+SCMA

AT+SCMA: Settings - Maximum connection interval		
Setting command: AT+SCMA+Para\CR\LF	response	Ok
	Description	Para:Connection interval (range: 8 ~ 1600, unit 1.25 milliseconds)
Example: Set the connection interval to 100ms. Then send the setup command: AT + SCMA + 80, after the success of the return: ok		

AT+GPWR

AT+GPWR: Query - transmit power		
Query command: AT+GPWR\CR\LF	response	Tx_power:ParadBm
	Description	Para: 0,1,6 one of three
Example: Send query command: AT + GPWR, return to the current transmit power: Tx_power:6dB		

AT+SPWR

AT+SPWR: Set - transmit power		
Setting command: AT+SPWR+Para\CR\LF	response	Tx_power:ParadBm
	Description	Para: Input, 0,1,6 one of three
Example: Set the transmit power to 6 dBm. Then send the setup command: AT + SPWR + 6, set successfully after the return: Tx_power: 6dBm		

AT+ GURT

AT+ GURT：Set - serial baud rate		
Set the command: AT+ GURT\CR\LF	response	UARTBAUDRATE:Para
	Description	Para: The serial port baud rate is one of the following five numbers. （1）：9600 （2）：19200 （3）：38400 （4）：57600
Example: Send query command: AT + GURT, return Back: UARTBAUDRATE: 9600		

AT+UART

AT+ UART：Set - serial baud rate		
Set the command: AT+UART+Para\CR\LF	response	Ok
	Description	Para: The serial port baud rate is one of the following five numbers （2）：19200 （3）：38400 （4）：57600 （5）：115200
Example: Set the baud rate to 38400. Then send the command set AT + UART +38400, set up successfully after the return ok. (Note: set a new baud rate, the serial debugging assistant baud rate should also be adjusted accordingly, in this case to tune to 38400),		

AT+GCMI

AT+GCMI：Query - minimum connection interval		
Set the command： AT+GCMI\CR\LF	response	Ok
	Description	Para: connection interval (range: 8 ~ 1600, unit 1.25 milliseconds
Example: Send query command: AT + GCMI, return: OK		

AT+SCMI

AT + SCMI: set - minimum connection interval		
Set the command： AT+SCMI+Para\CR\LF	response	Ok
	Description	Para: connection interval (range: 8 ~ 1600, unit 1.25 milliseconds
Example: Set the connection interval to 100ms. Then send the setup command: AT + SCMA + 80, after the success of the return: ok		

AT+CONB

AT+CONB：Disconnect		
Set the command： AT+CONB\CR\LF	response	CONNTIONISBROKEN
	Description	None
Example: Send Disconnect Command: AT + CONB Returns: Connectionisbroken		

AT+REST

AT+RSET：Module reset		
Reset command： AT+REST\CR\LF	response	None
	Description	None
Example: Directly send command: AT + REST, it can be reset		

AT+RSET

AT+RSET：Restore factory settings		
Set the command： AT+RSET\CR\LF	response	None
	Description	None
Example: Directly send command: AT + REST, is ok		

4.3 AT command test

4.3.1Build test environment

（1）Tools to be needed:

Serial debugging assistant sscom32 (version 1.0.0.1),use Baidu direct search and download "serial debugging assistant sscom32", after download directly use the application, do not need to install
Android system phone: equipped with BLE reader and other Bluetooth test software, (BLE reader can use Baidu search "BLE reader" there are many online download connection) Apple system tools: installed "LightBlu" and other Bluetooth test software, LightBlue can be downloaded from Apple's "APPStore" software.
Step 1: Open the Apple phone "APPStore" software.

Step 2: Click Search

Step 3: Enter the Light Store in the search and click Search

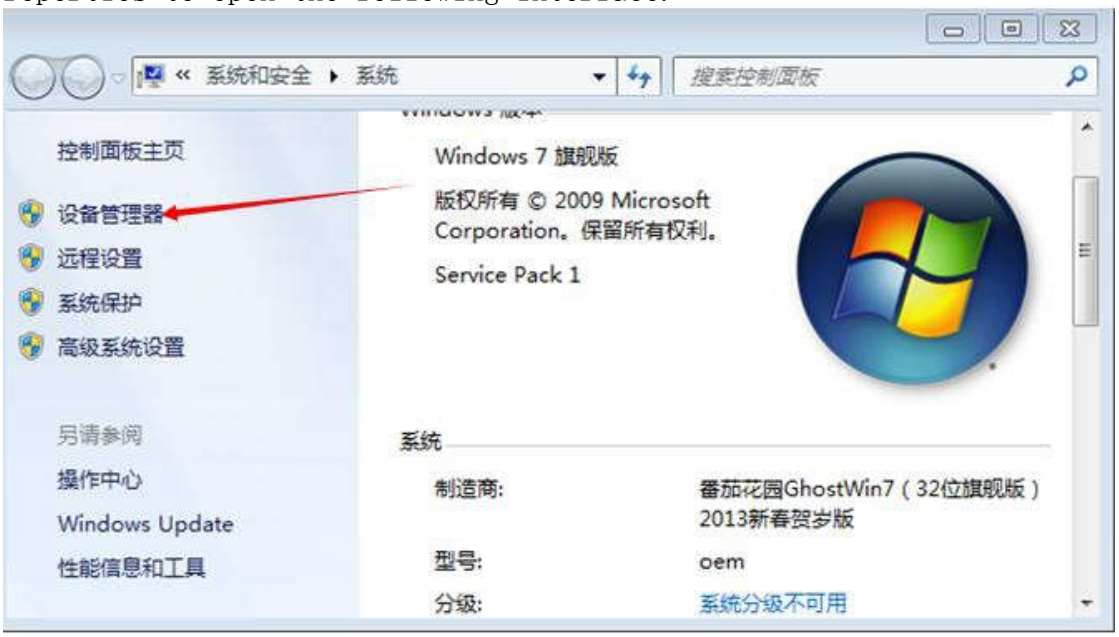
Step 4: Download and install LightStore

（2）Environment building

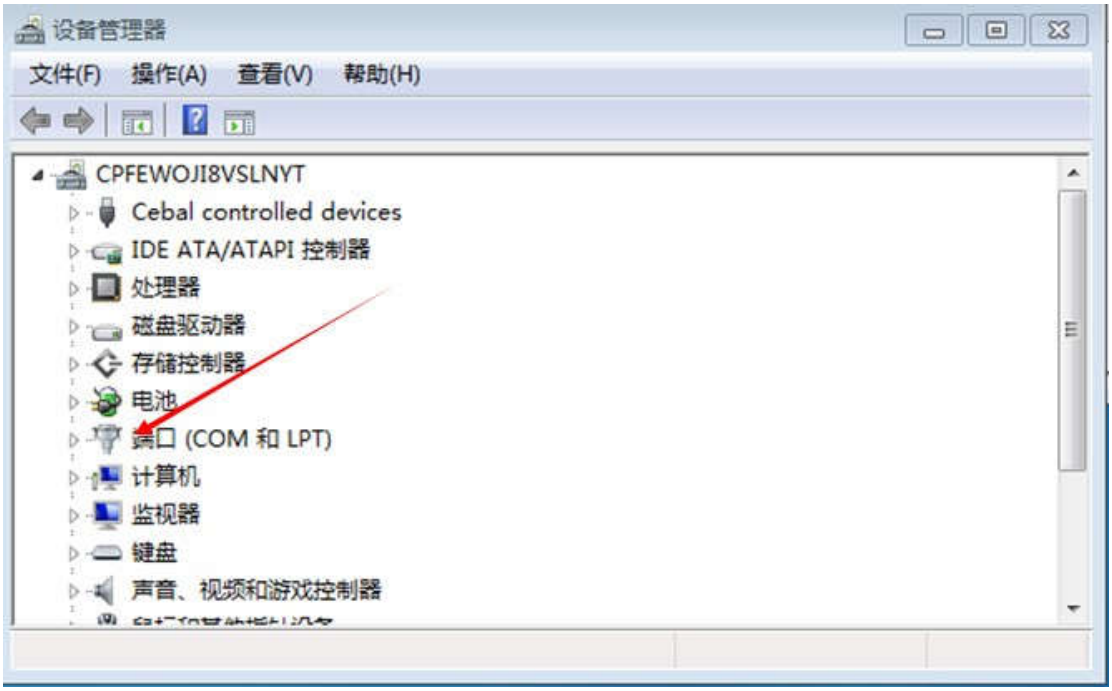
》Connect the serial port module, F-9688 module pin diagram as above

》Query the serial number：

Step 1: win7 system, click the computer , select Properties , click Properties to open the following interface.

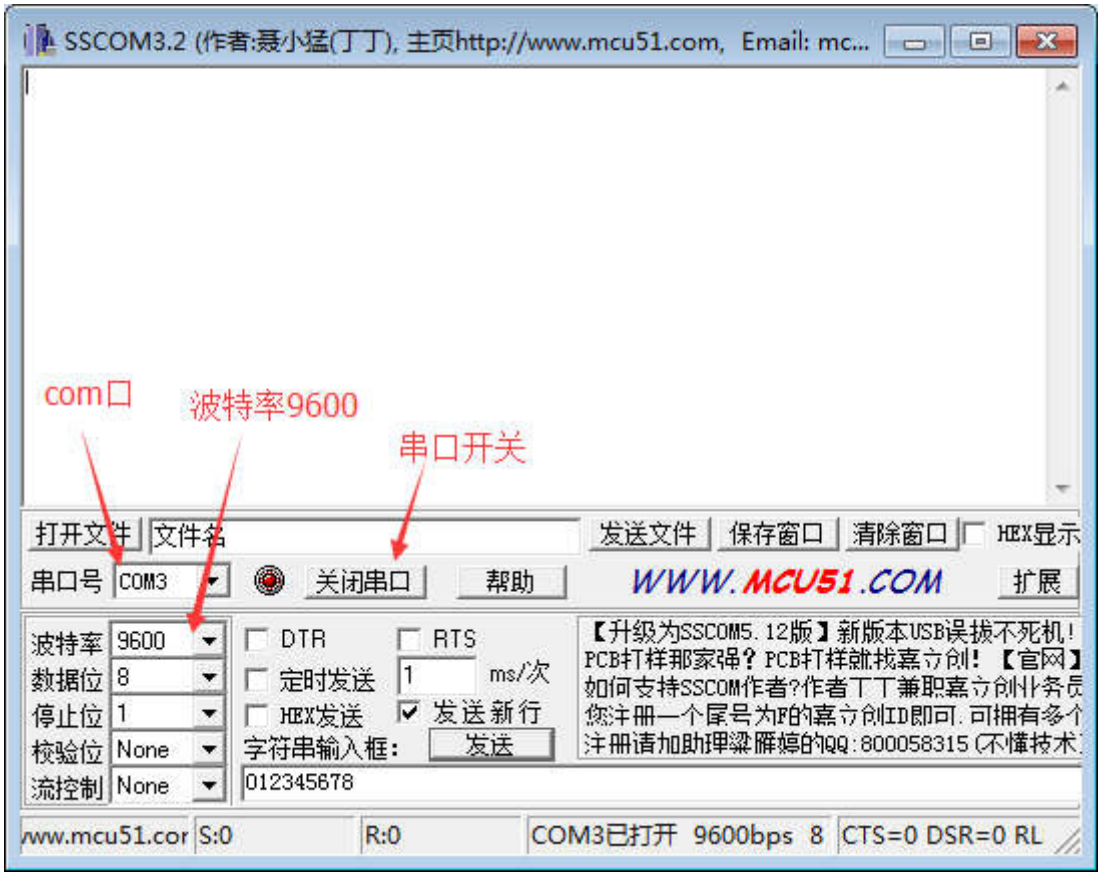


Step 2: Click "Device Manager" to enter the interface shown below.



Step 3: Click the "Port" option, you can see CP210xUSBtoUARTBridgeController (COM3), COM3 is the port number, note: it is a variable number, so different device port number is not the same, so according to their own so found Please note the port number you found

Step 4: Open the serial port in the attachment to help sscom32, set the baud rate to 115200 (Note: F_9688 transparent default baud rate is 9600), in the serial port number select the port number you just find, and click to open Serial port button, so the environment is completed, the serial debugging assistant environment settings as shown below

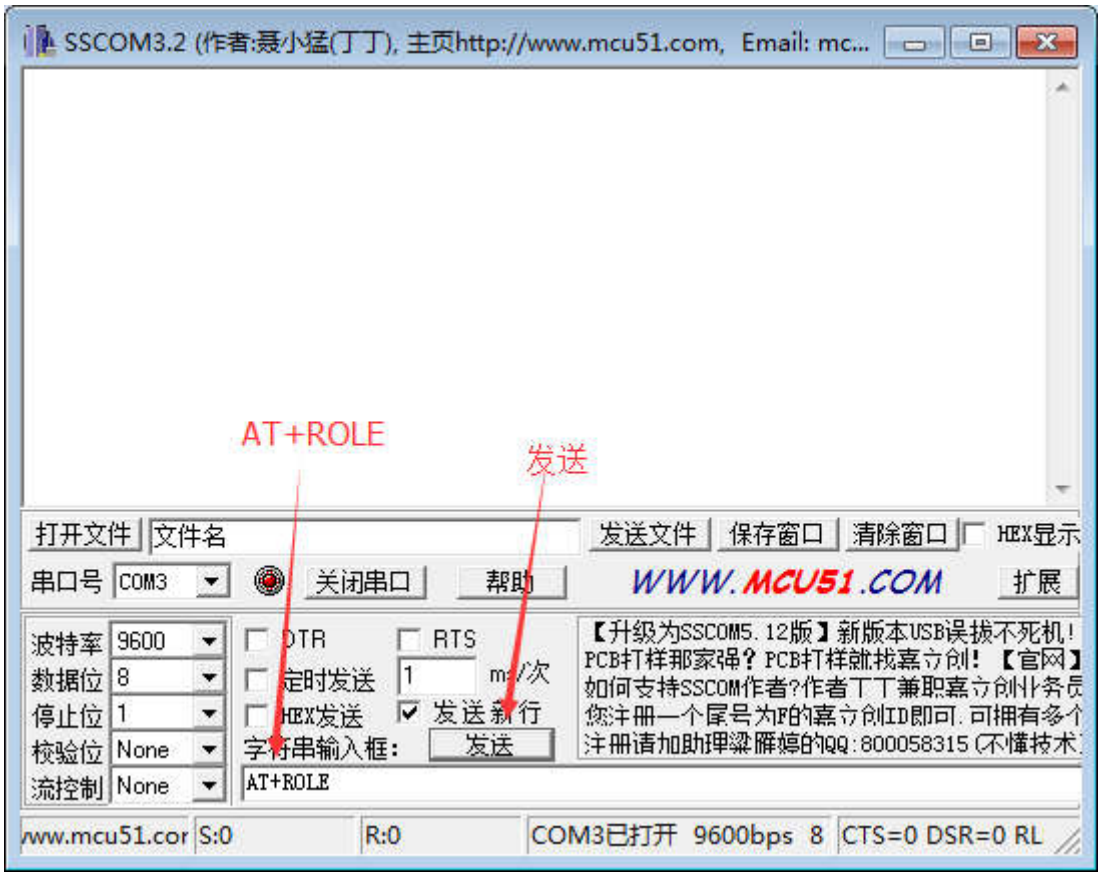

SSCOM3.2 (作者:聂小猛(丁丁), 主页http://www.mcu51.com, Email: mc...
com口
波特率9600
串口开关
打开文件
文件名
发送文件
保存窗口
清除窗口
HEX显示
串口号
COM3
关闭串口
帮助
WWW.MCU51.COM
扩展
波特率
9600
数据位
8
停止位
1
校验位
None
流控制
None
DTR
RTS
定时发送
1
ms/次
HEX发送
发送新行
字符串输入框:
发送
012345678
【升级为SSCOM5.12版】新版本USB误拔不死机!
PCB打样那家强? PCB打样就找嘉立创! 【官网】
如何支持SSCOM作者?作者丁丁兼职嘉立创业务员
您注册一个尾号为P的嘉立创ID即可,可拥有多个
注册请加助理梁雁婷的QQ:800058315 (不懂技术
www.mcu51.cor
S:0
R:0
COM3已打开 9600bps 8
CTS=0 DSR=0 RL

4.3.2 Query instruction test

Because the various query instructions and basic instructions are used in the same way as the steps, so here only to explain the use of the query-module master-slave mode instructions, the use of the rest of the query instructions and the basic instructions reference module From the use of mode instructions.

（1）Query - Module Master / Slave Mode: Command: AT + ROLE

Step 1: Enter the query in the "String input box" of the serial debugging assistant - AT command of module master-slave mode: AT + ROLE, and click "Send".



Step 2: After clicking the "Send" button, you can see that the serial debugging assistant shows the working mode of the current module: ROLE: SLAVE, the function is correct.

4.3.3Set the instruction test because the use of various settings instructions and steps are basically the same, so only explain the settings - the connection

The use of the interval command, the use of the rest of the set instructions reference settings - the use of the connection interval command. (Note: When setting the baud rate, when the baud rate is set, the baud rate option in the serial debugging assistant New choice of new baud rate.)

(1)Set the connection interval, the command: AT + SCMA + Para Description: Para: to set the connection interval In this, for example, set the module connection interval of 100ms
Step 1: Enter AT + SCMA + 60 in the "String input box" of the serial debugging assistant and click "Send".

Step 2: Click the "Send" button, if the serial debugging assistant shows OK, then reset the 9688 module.

Step 3: After resetting the 9688 module, check the connection interval of the F-9688 module (see 4.3.2 for the query method). The results of this query are shown in the following figure. As shown in the following figure, the connection interval is set to 60 (unit : 1.25ms), that is, 100ms.


SSCOM3.2 (作者:聂小猛(丁丁), 主页http://www.mcu51.com, Email: mc...
CON:60
多条字符串定义
串口资料
HEX
字符串
发送
12 00 FF 88
output string
AT+GURT
AT+ROLE
012345678
AT+GCMA
自动循环发送, 间隔: 1000 ms
打开文件
文件名
发送文件
保存窗口
清除窗口
HEX显示
串口号 COM3
关闭串口
帮助
WWW.MCU51.COM
隐藏
波特率 9600
数据位 8
停止位 1
校验位 None
流控制 None
DTR
RTS
定时发送
1
ms/次
HEX发送
发送新行
字符串输入框:
发送
AT+GCMA
【升级为SSCOM5.12版】新版本USB误拔不死机!
PCB打样那家强? PCB打样就找嘉立创! 【官网】
如何支持SSCOM作者?作者丁丁兼职嘉立创业务员
您注册一个尾号为F的嘉立创ID即可,可拥有多个
注册请加助理梁雁婷的QQ:800058315 (不懂技术)
www.mcu51.cor
S:9
R:8
COM3已打开 9600bps 8
CTS=0 DSR=0 RL

（2）Set the baud rate to the command: AT + UART + Para Description: Para: To set the baud rate Here, for example, set the baud rate of the module to 115200

Step 1: Enter AT + UART + 115200 in the "String input box" of the serial debugging assistant and click "Send"

Step 2: Click the "Send" button, if the serial debugging assistant shows OK, then reset the 9688 module.

Step 2: After resetting the 9688 module, reselect the serial port assistant with a baud rate of 115200.

Step 3: Description: The following example is based on the baud rate of 11 5 2 00.

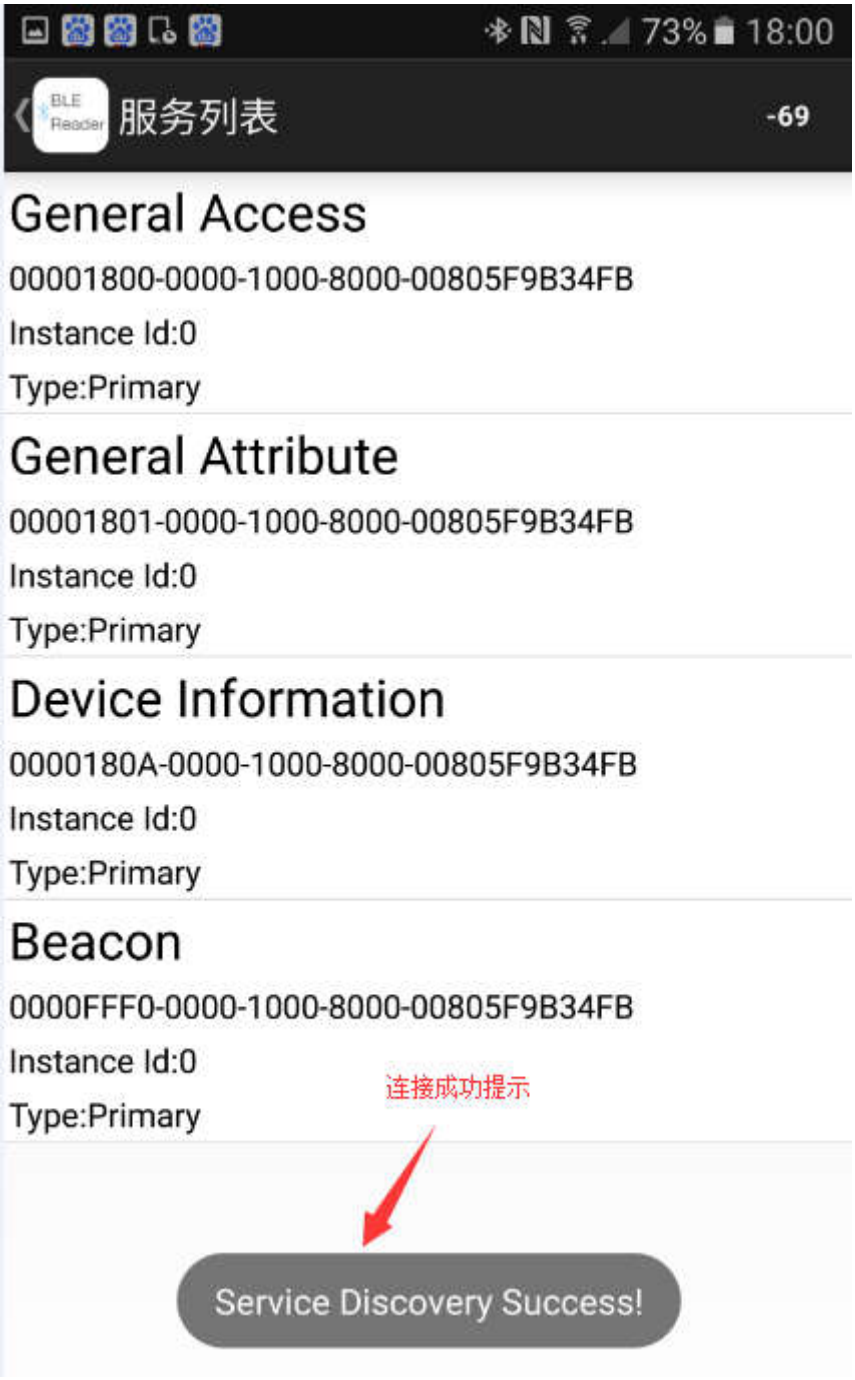
5. Serial transmission

5.1 Serial port to Bluetooth transparent test

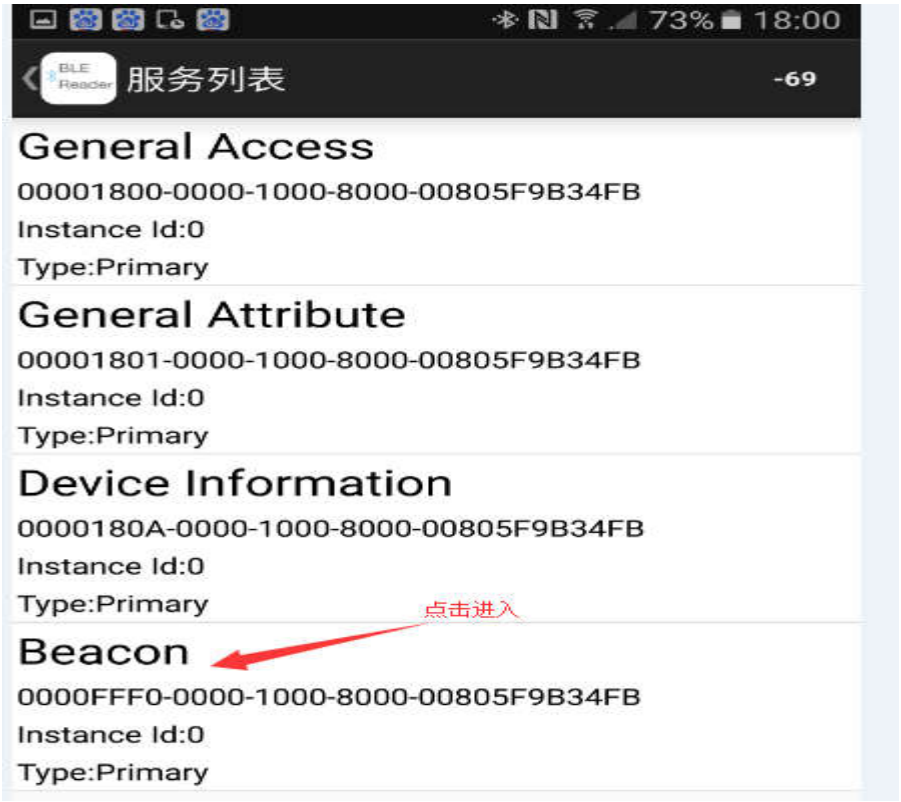
（**1**）Transparent transmission based on Android system

Step 1: first, open the Android mobile phone "BLE reader software to read and write, find your Bluetooth device in BLE (default name: BK3231S_SPP), and click on the connection, if the connection to match the default password is 123456, enter the password and click OK, if you do not need to skip this principle step

Step 2 :: After clicking OK, if the phone screen first shows ConnectSuccess, then Show Service Success, then connected to the Bluetooth.


73% 18:00
BLE Reader
服务列表
-69
General Access
00001800-0000-1000-8000-00805F9B34FB
Instance Id:0
Type:Primary
General Attribute
00001801-0000-1000-8000-00805F9B34FB
Instance Id:0
Type:Primary
Device Information
0000180A-0000-1000-8000-00805F9B34FB
Instance Id:0
Type:Primary
Beacon
0000FFF0-0000-1000-8000-00805F9B34FB
Instance Id:0
Type:Primary
连接成功提示
Service Discovery Success!

Step 3: After connecting to Bluetooth, click the Beacon button to open the service.

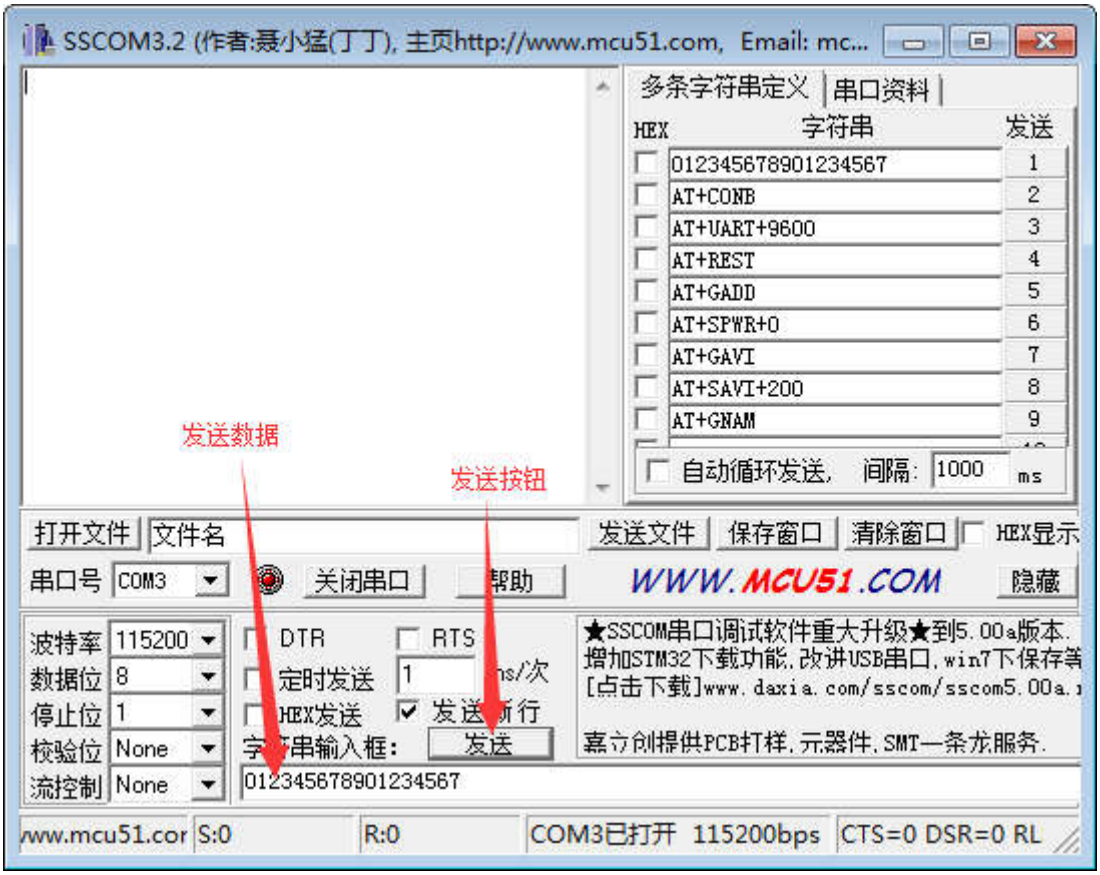


Step 4: Click the Beacon button, open the service will display the following interface. Then click Passconde button,

Step 5: Click the Passconde button will appear after the interface shown below. And then click "Start notification button".

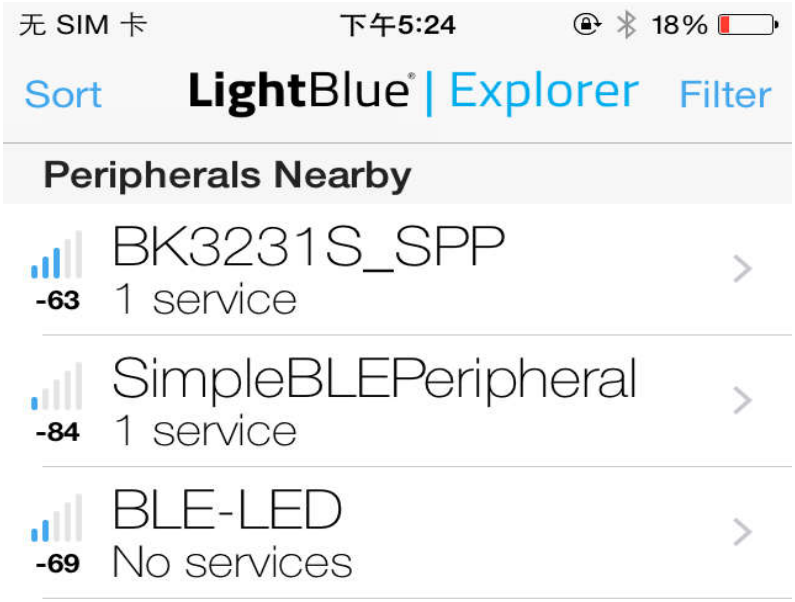
Step 6: Click "Start notification button", the following screen will appear, that is, open the notice.

Step 7: Enter 18 bytes of transparent data in the "String input box" of the serial debugging assistant. In this example, enter the data of "012345678901234567" and click "Send".

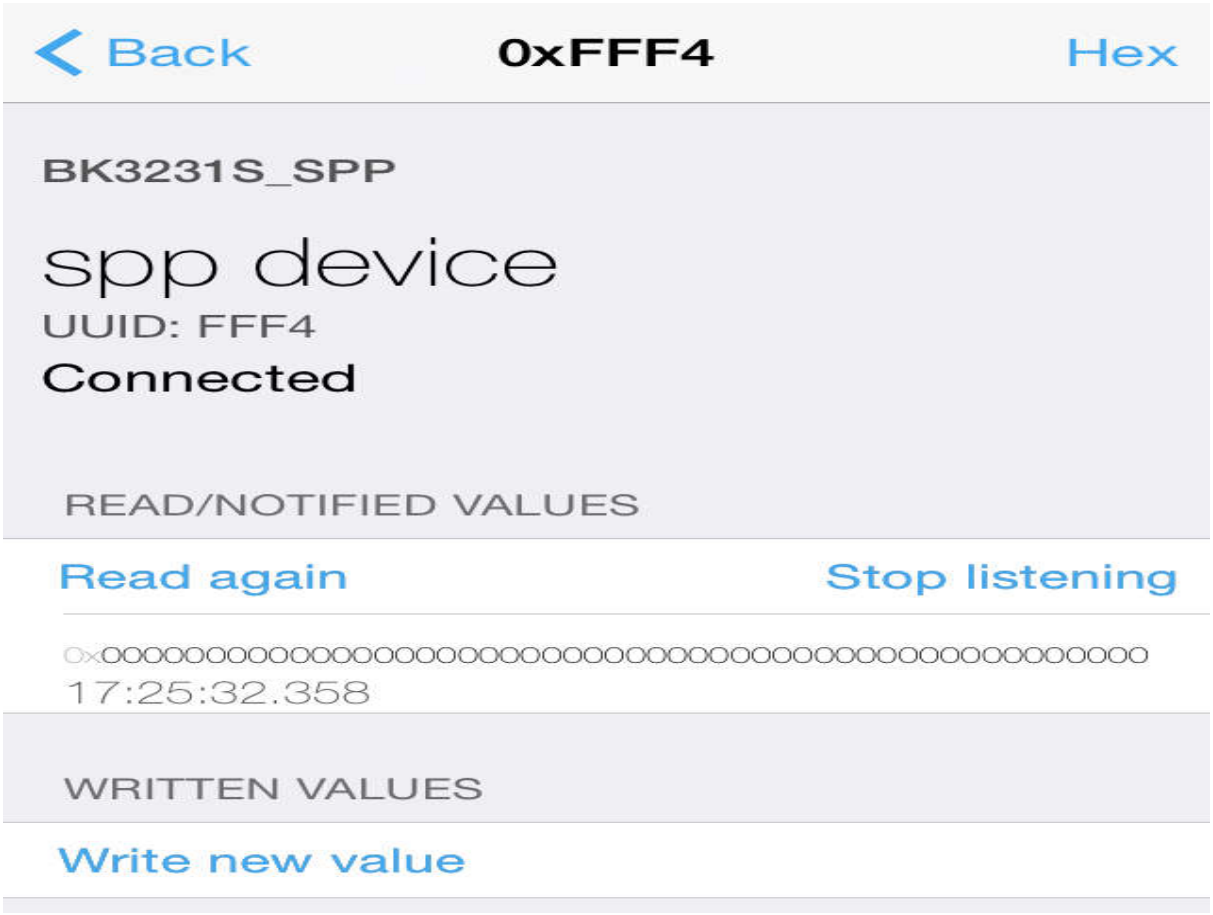


Step 8: click to send, you can see in the Andrews phone through the data.

(2) based on the Apple system of transmission test
Step 1: First, open the Apple phone "Light Blue" software, find your Bluetooth device in LightBlue (silent
Name: BK3231S_SPP), and click on the connection, if you need to enter the connection connection password, the default password is 123456, enter the password and click OK.

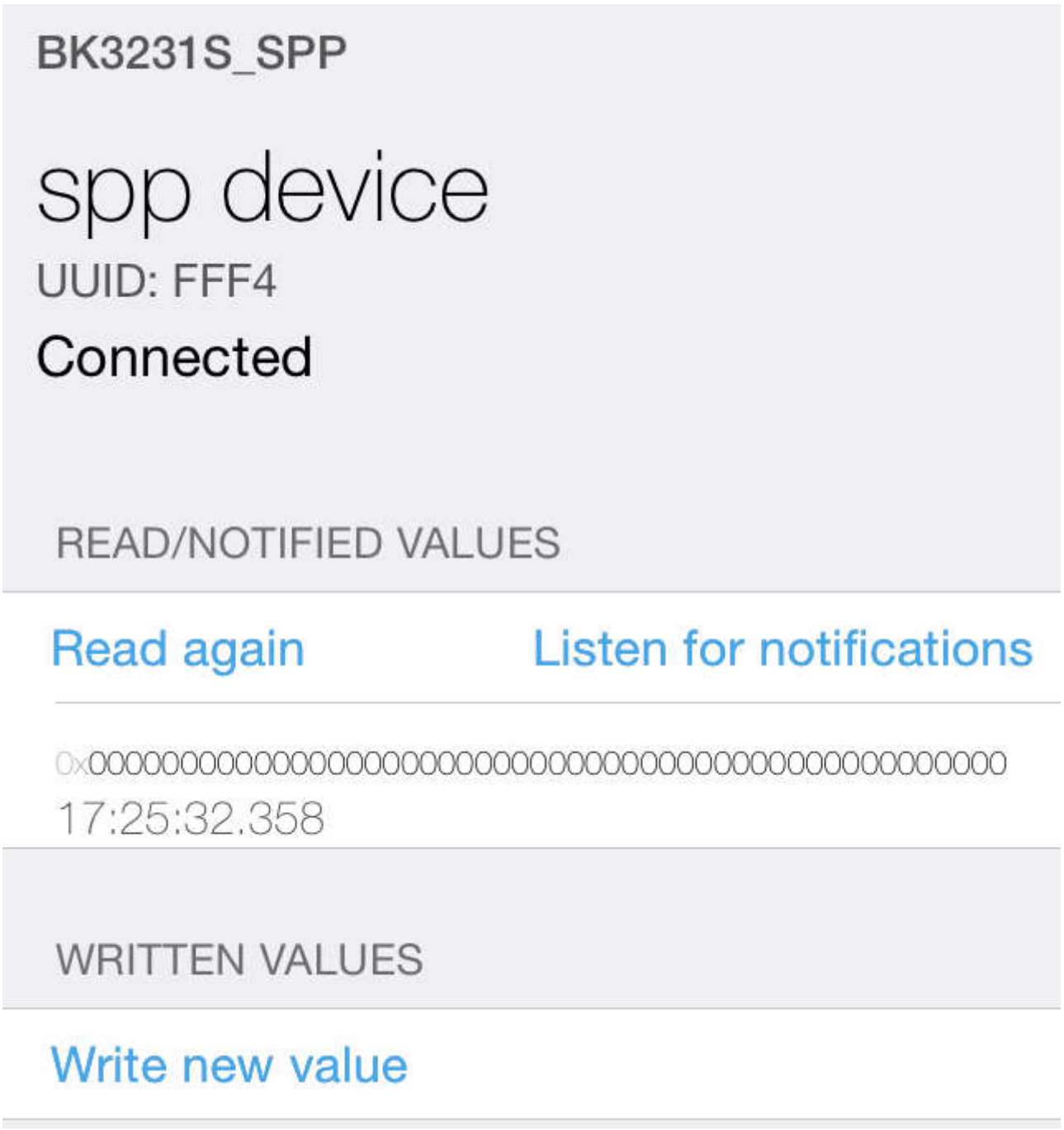


Step 2: Click OK, if the connection is successful will enter the interface shown below.:

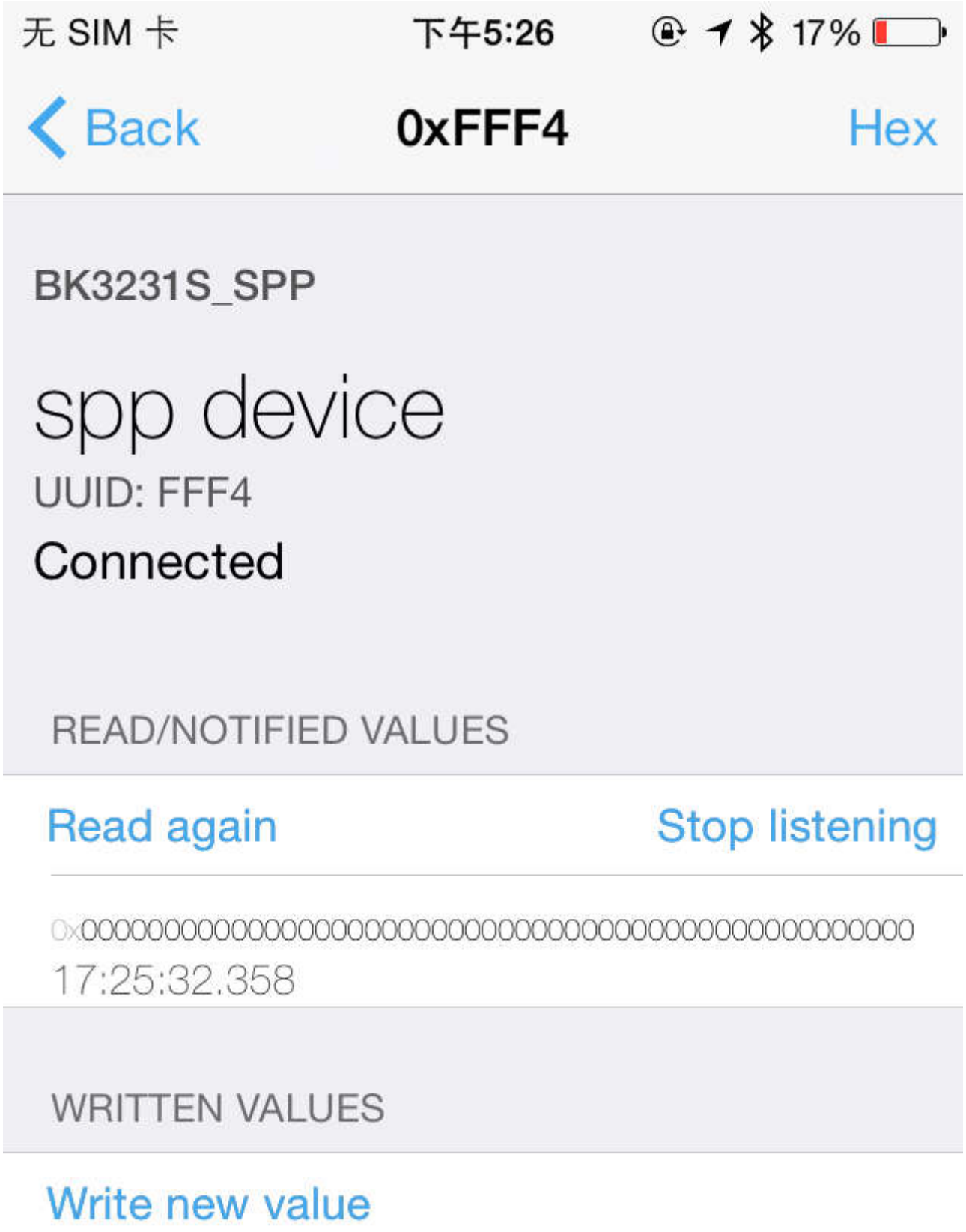


Step 3: In the current interface, pull down, pull to the lowest end, you can see the interface, and click UUID for FFF4 options

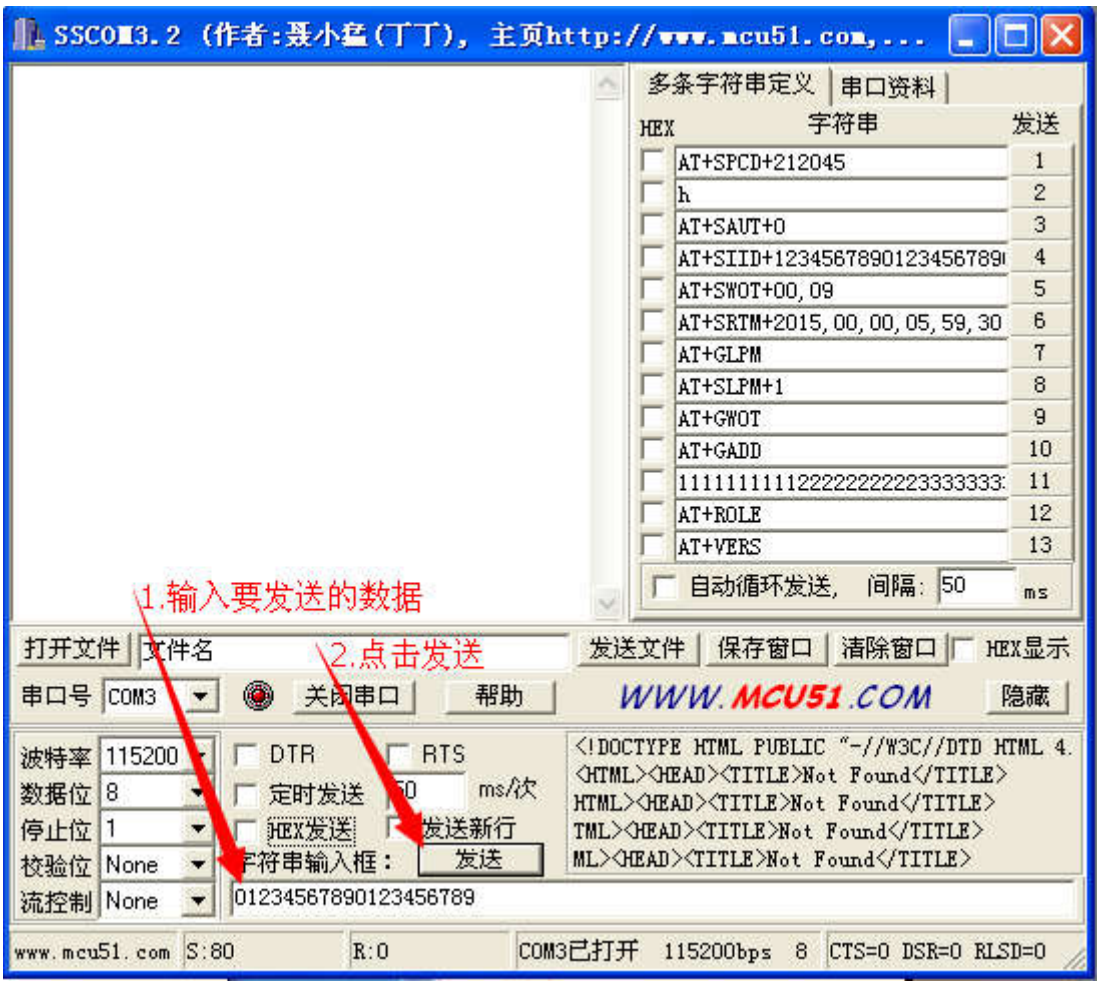
Step 4: Click the SPP device button to enter the interface shown below, and then click the "Listenfor notifications" button to open the notification.



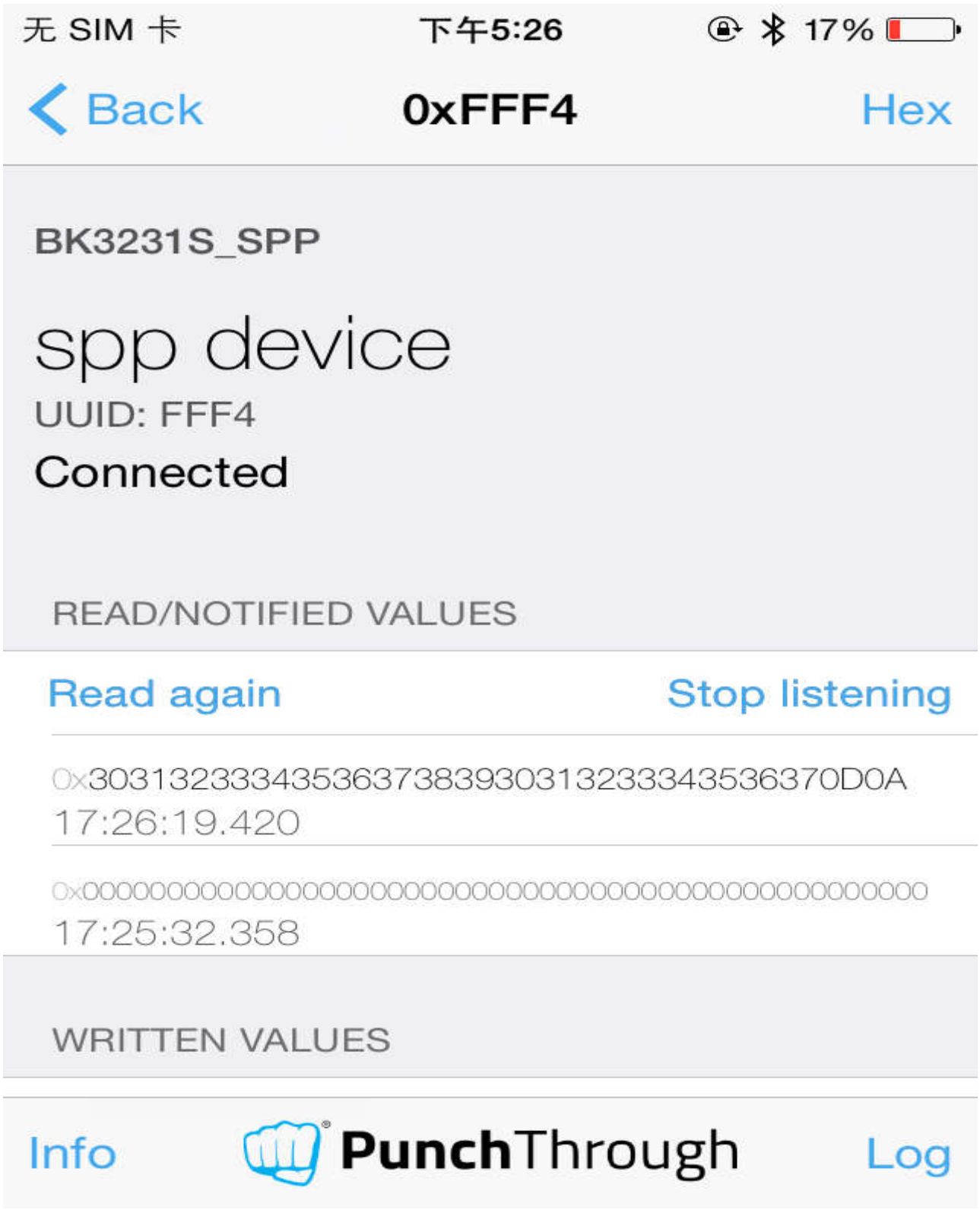
Step 5: Click "Start notification button", will appear as shown below interface, that is, to open the notice.


无 SIM 卡
下午5:26
17%
Back
0xFFF4
Hex
BK3231S_SPP
spp device
UUID: FFF4
Connected
READ/NOTIFIED VALUES
Read again
Stop listening
0x00000000000000000000000000000000000000000000000000
17:25:32.358
WRITTEN VALUES
Write new value

Step 6: Enter 20 bytes of transparent data in the "String input box" of the serial debugging assistant. In this example, enter the 20-byte data of "01234567890123456789" and click "Send".



Step 7: Click to send, you can see on the Apple mobile phone over the data.



Step 8: Click the Log button to view all the transferred data.

5.2Bluetooth to serial transmission test

（**1**）Transparent test based on Android system

Step 1: Open the serial debugging assistant, set the serial debugging assistant according to the method of 4.3.1, and then select "HEX display".

Step 2: Repeat 4.2.13 under the Andrews system under the transmission test steps 1 to 4 of the operation, after the operation to enter the interface shown below, and then click the write button.

Step 2: Click the write button to enter the interface shown below

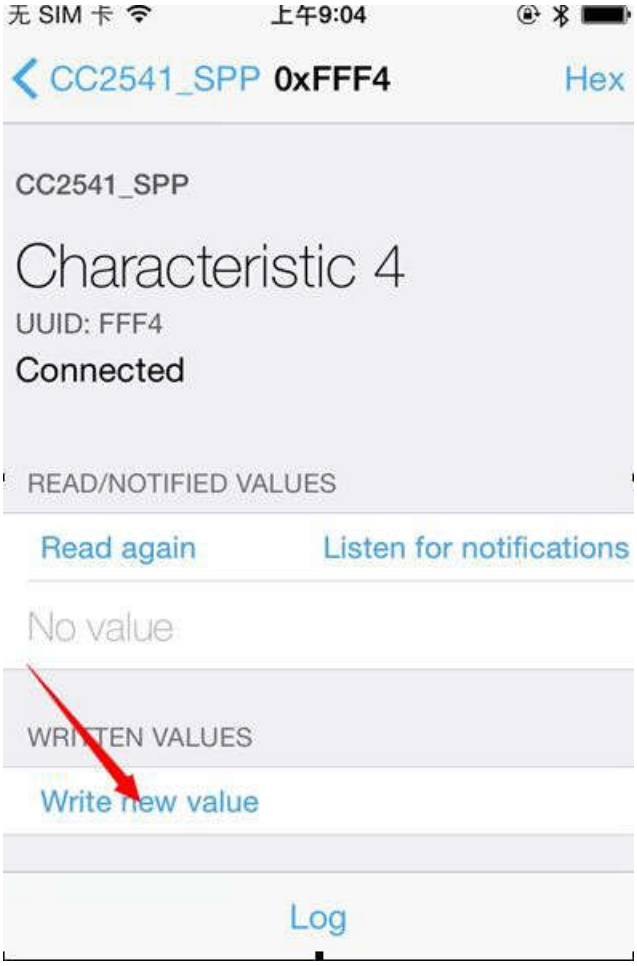
Step 3: Write the data to be transmitted under "Hex: 0x" (note that the written data must be hexadecimal), and the following data is written in this example: "01020304050607080901020304050607080901020304050607080901020304050607 0809", write the data and click OK, it was sent out.

Step 4: Click OK, you can see in the serial debugging assistant just sent the data.

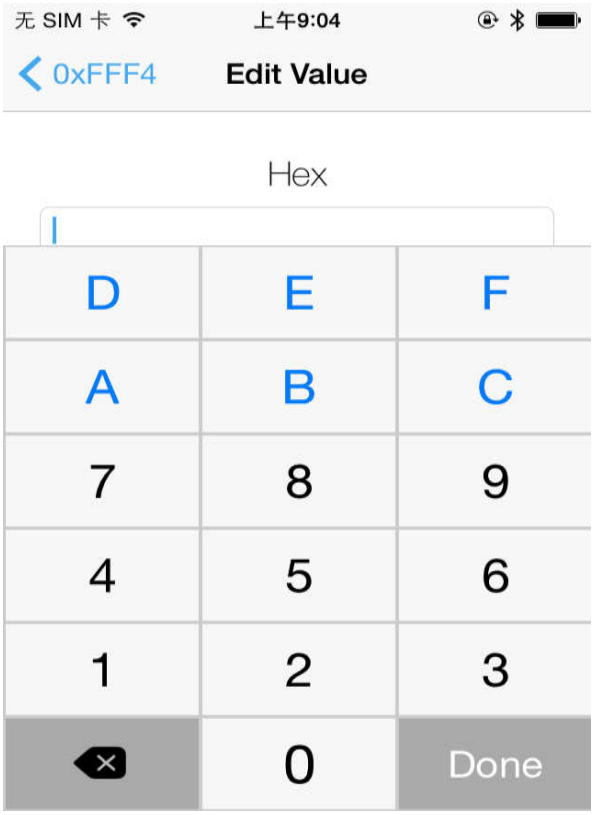
(2) based on the Apple system of transmission test

Step 1: Open the serial debugging assistant, set the serial debugging assistant according to the method of 4.3.1, and then select "HEX display".

Step 2: Repeat 4.2.13 in the Apple system under the transparent test steps 1 to 3 of the operation, after the operation to enter the interface shown below, and then click Write new value button.

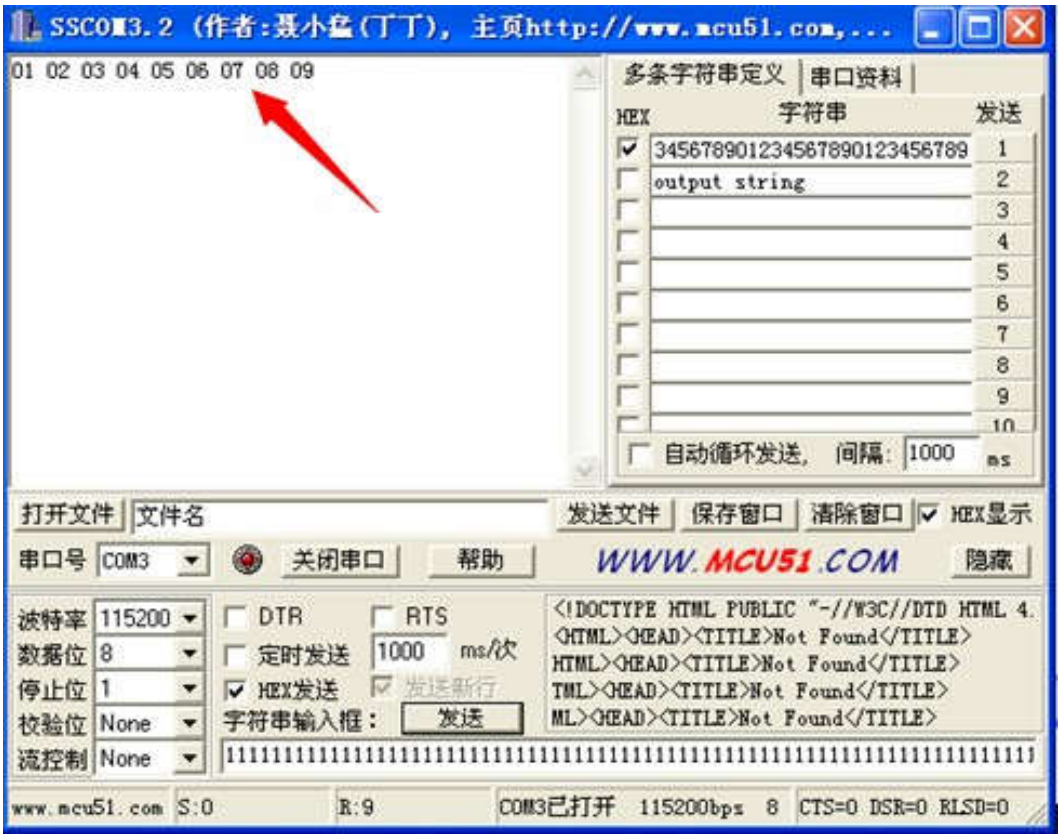


Step 3: Click the Write newvalue button to enter the interface shown below


无 SIM 卡
上午9:04
0xFFF4
Edit Value
Hex
D
E
F
A
B
C
7
8
9
4
5
6
1
2
3
0
Done

Step 4: Enter the hexadecimal data to be transmitted, enter "0102030405060708" here, click Done

Step 5: Click on Done, then the serial debugging assistant can see through the transmission of data.


SSCOM3.2 (作者:聂小猛(丁丁), 主页http://www.mcu51.com,...
01 02 03 04 05 06 07 08 09
多条字符串定义
串口资料
HEX
字符串
发送
34567890123456789012345678 9
output string
自动循环发送, 间隔: 1000 ms
打开文件
文件名
发送文件
保存窗口
清除窗口
HEX显示
串口号 COM3
关闭串口
帮助
WWW.MCU51.COM
隐藏
波特率 115200
数据位 8
停止位 1
校验位 None
流控制 None
DTR
RTS
定时发送 1000 ms/次
HEX发送
发送新行
字符串输入框:
发送
<!DOCTYPE HTML PUBLIC "-//W3C//DTD HTML 4.
<HTML><HEAD><TITLE>Not Found</TITLE>
HTML><HEAD><TITLE>Not Found</TITLE>
TML><HEAD><TITLE>Not Found</TITLE>
ML><HEAD><TITLE>Not Found</TITLE>
www.mcu51.com S:0 R:9 COM3已打开 115200bps 8 CTS=0 DSR=0 RLSD=0

6.Mobile data transmission.

Servic UUID： 0XFFF0
Channel UUID: 0XFFF3

Specification：

HEAD	quantity	CurrenID	Date1	Date2	…	Date…	Date…	Checksum

HEAD Fixed:0XA1
quantity:The number of packets currently being transmitted
Checksum： 0 remove the current packet data
Ex：
Send data01234567890123456789012345678901234567890123456789(Note that the data can not exceed 128 bytes)
Sent by 4 packet， quantity：4

0XA1	4	1	0	1	2	3	4	5	6	7	8	9	**0X2D**

0-(0xa1+4+1+1+2+3+4+5+6+7+8+9)= **0X2D**

0XA1	4	2	0	1	2	3	4	5	6	7	8	9	0X2C

0XA1	4	3	0	1	2	3	4	5	6	7	8	9	0X2B

0XA1	4	4	0	1	2	3	4	5	6	7	8	9	0X2A

Error return：
Profile head error：

0XA1	0XA5	0X05	0X0E	0XE0	0XC7

Check code error：

0XA1	0XA5	0X05	0X0E	0XFF	0XA8

Packet error：

0XA1	0XA5	0X05	0X0E	包 ID	Checksum

7.PP and MCU programming

reference

IOS
Programming
reference

The module always broadcasts from the mode, waiting for the intelligent mobile device to scan as a master device, and to connect. This scan and the connection is usually done by the APP, due to the special nature of the BLE protocol, the Bluetooth connection in the system settings is of no practical significance. Intelligent devices must be responsible for BLE from the device connection, communication, disconnect and other management matters, and all this is usually achieved in the APP.

BLE programming in the IOS, the most critical is the eigenvalue (Characteristic, this article is called the channel) to read, write, and open the switch. By reading and writing to the channel to achieve direct control of the module direct drive function, without additional CPU. This module connectionhandle default is 0, through UUID communication. The following excerpt shows typical function:

:

```
/*!
 *  @method    writeValue:forCharacteristic:withResponse:
 *  @paramdataThevalue towrite.
 *  @paramcharacteristicThecharacteristicon
    whichtoperformthewriteoperation.
 *  @paramtypeThetypeofwritetobeexecuted.
 *  @discussionWritethevalueofacharacteristic.
 *          Thepasseddataiscopiedandcanbedisposedofafterthecall finishes.
 *          The relevant delegatecallbackwillthen beinvokedwiththe
status oftherequest.
 *  @see    peripheral:didWriteValueForCharacteristic:error:
*
/
-(void)writeValue:(NSData*)dataforCharacteristic:(CBCharacteristic*)ch
aracteristictype:(CBCharacteristicWriteType)type;
```

Description: Writes an eigenvalue。

```
NSData*d=[[NSDataalloc]initWithBytes:&datalength:mda
ta.length];
[pwriteValue:dforCharacteristic:ctype:CBCharacteristicWriteWi
thoutResponse];
/*!
 *  @methodreadValueForCharacteristic:
 *  @paramcharacteristicThecharacteristic for whichthevalueneeds
    toberead.
 *  @discussionFetchthevalueofacharacteristic.
 *          The relevant delegatecallbackwillthen beinvokedwiththe
status oftherequest.
 *  @see    peripheral:didUpdateValueForCharacteristic:error:
*
/
-(void)readValueForCharacteristic:(CBCharacteristic*)
 characteristic;
Description:Reads      an
eigenvalue
[preadValueForCharacteri
stic:c];
/*!
 *  @methodsetNotifyValue:forCharacteristic:
 *  @paramnotifyValueThevaluetosettheclientconfigurationdescriptor to.
 *  @paramcharacteristicThecharacteristiccontainingtheclientconfigurati
    on.
 *  @discussionAsktostart/stopreceivingnotificationsforacharacteristic.
 *          The relevant delegatecallbackwillthen beinvokedwiththe
            status ofthe
```

request.

```
 *     @see    peripheral:didUpdateNotificationStateForCharacteristic:error:
 */
-           (void)setNotifyValue:(BOOL)notifyValue                forCharacteristic:(CBCharacteristic
*)characteristic;
Description: open the eigenvalue enable switch
[selfsetNotifyValue:YESforCharacteristic:c];
Open the notification enable switch
[selfsetNotifyValue:NOforCharacteristic:c];
Close the notification enable switch/*
 *     @methoddidUpdateValueForCharacteristic
 *     @paramperipheralPheripheralthatgotupdated
 *     @paramcharacteristicCharacteristicthatgotupdated
 *     @errorerrorErrormessageifsomethingwentwrong
 *      @discussion   didUpdateValueForCharacteristic   is   called when   CoreBluetooth
hasupdateda
 *     characteristicforaperipheral.Allreadsandnotificationscomehere tobeprocessed.
*/
-(void)peripheral:(CBPeripheral                                                    *)peripheral
didUpdateValueForCharacteristic:(CBCharacteristic    *)characteristicerror:(NSError*)error
Note: Each time the read operation is performed, the callback
function is executed. The application layer holds the read data in
this function.
```

Note: IOS best test BLE software is LightBlue, can be downloaded to the source code online.

7.2Android programming reference

Android 4.4 system can fully communicate with Bluetooth module 4. Connectionhandle defaults to 0 by UUID

Communicate. Download the official website of Android BLEdemo.apk, you can communicate with the F-9688 Bluetooth module serial port.

7.3IOS, Andrews, MCU writers need the knowledge of the parameters

Connection interval: connInterval, 1.25ms multiple, the minimum value of 6 (ie 7.5ms), the maximum 3200 (that is, 4.0s). Supervisor timeout: supervisonTimeout, multiple of 10ms, minimum 10 (ie 100ms), maximum 3200 (ie 32.0s). Must be greater than: (1 + slaveLatency) * (connInterval)
Slave latency: slaveLatency, minimum value 0, the maximum value of 499. Must be less than:
((supervisionTimeout/connInterval) - 1)

Characteristics of different connection parameters: two devices will operate with high power consumption

High throughput of data transmission waiting time is connected at intervals of two equipment will be sent in low energy consumption low operation throughput long waiting time

Low or 0 latency: running from the device to high energy consumption

The device can quickly receive a master device to the high number of latent value from the device in the absence of data transmission under the condition of low energy consumption can be run from the main equipment equipment can not receive timely data from main equipment can be received from the data from the device

If the signal is weak or the signal is not stable, the short monitoring time can be "aware" of the connection disconnection long monitoring time

When the signal is not stable when packet loss if the supervision time again received packet, that connection without disconnecting the instructions and advice: the connection interval can be simply understood as the two is connected with the Bluetooth device to send heartbeat interval. Bluetooth devices to determine whether the connection between them is broken, is to see whether the heartbeat packet arrived in time. For example, set up connInterval=100ms, slaveLatency=1, supervisionTimeout=1s. ConnInterval=100ms, refers to

the Bluetooth host every 100ms to send a heartbeat packet from the machine, received from the machine after a reply. SlaveLatency=1, refers to if the machine does not have data to send, you can skip a heartbeat packet reply, let yourself save electricity. SupervisionTimeout=1s, from the machine, when it was found for 1 seconds did not receive a heartbeat package, that even

Disconnect. The host said, when it was made 11 heartbeat package, have not received a reply, that the connection is broken.

According to the BLE4.0 protocol: master devices can always send a connection update request to slave to change the connection parameters. In the link layer, the update of the connection parameters is always initiated by master, but the L2CAP layer allows the slave to master

Send a connection parameter update request. The BLE protocol allows the application layer to dynamically adjust the connection parameters according to the actual needs. When each of the two Bluetooth devices creates a connection, the three connection parameters are given by the host. For example, iPhone4S and iPhone5, set the connection parameters are: 24,0,72. Convert:

ConnInterval=24*1.25ms=30ms;

SlaveLatency=0; supervisionTimeout=72*10ms=720ms;

We see that the iPhone connection interval is relatively short, so the data throughput is large, but the energy consumption is relatively large, probably flat

The average current reaches about 900uA~1000uA, the monitoring time is 720ms, and the connection is disconnected quickly. In addition, the Samsung Galaxy S3 set connection parameter value of 54,0, 42. According to the experience, the set value from the machine is generally a little lower or 0

Timeout is generally not too long, the connection interval can be set according to different application needs. Less data exchange, power sensitive applications, the connection interval can be set a little longer. All in all, for the BLE connection parameter settings, you can do more experiments to get a set of data throughput and power consumption are more satisfied with the value. In addition, when the module is connected with the iOS device, Apple company, iOS device Bluetooth accessories connection interval parameters, in addition to

comply with the provisions of the Sig group, must comply with the provisions of Apple:

connInterval*(slaveLatency+1)≤2seconds

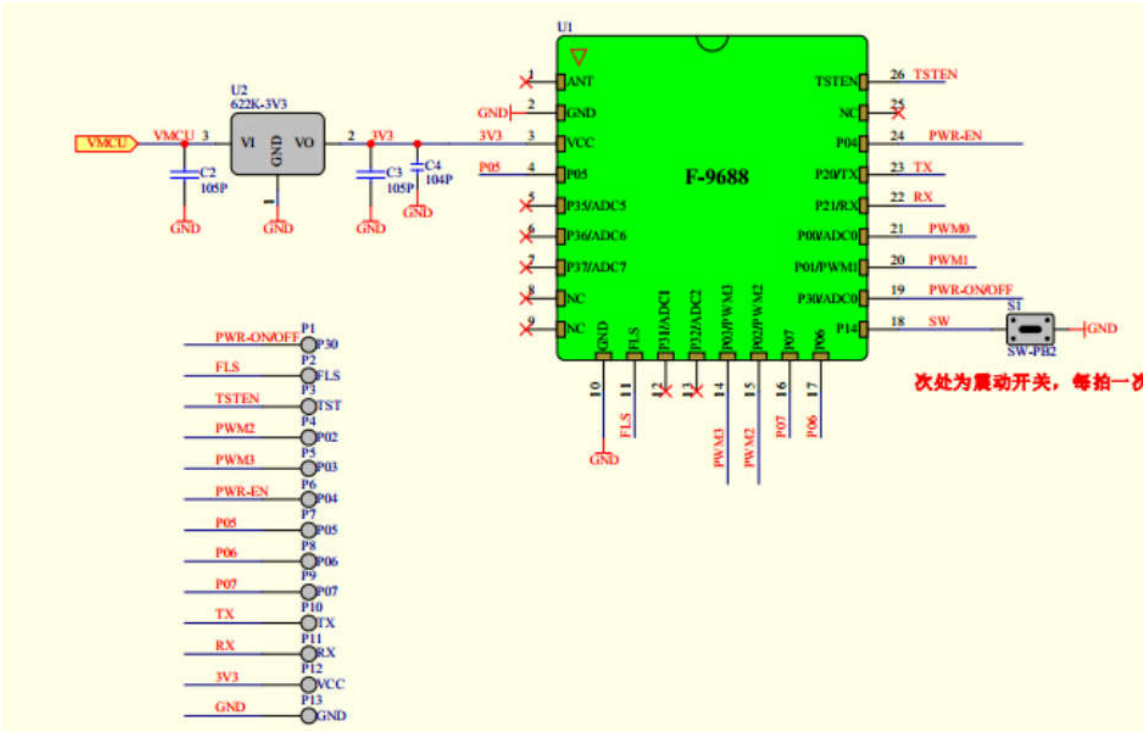
connInterval≥20ms slaveLatency≤4

supervisionTimeout≤6seconds

connInterval*(slaveLatency+1)*3<supervisionTim

eout.

8.Custom program rule conventions and reference circuits



8.Change record

File version	Code version	Change
3.0.1	3.0	Software version changed from 2.5 to 3.0
3.0.2	3.0	IO function change, AT command to add LED, low power control, module control enabled
3.0.3	3.7	Protocol stack version upgrade 3.7, change the device name is too long to increase the problem, increase the phone AT command, increase the error AT command prompt, change the write attribute to without response
3.1.0	3.9	Increase the PWM control, the protocol stack to upgrade to 3.9
3.1.1	3.9	P00 change, change ADC0 into PWM0
3.2.0	4.1	Increase the air upgrade, increase the mobile phone data transmission part, software upgrades 4.1

BK3231S Bluetooth SoC Datasheet

Preliminary Specification

Beken Corporation

Building 41, Capital of Tech Leaders, 1387 Zhangdong Road,
Zhangjiang High-Tech Park, Pudong New District, Shanghai, China
Tel: (86)21 51086811
Fax: (86)21 60871277

This document contains information that may be proprietary to, and/or secrets of, Beken Corporation. The contents of this document should not be disclosed outside the companies without specific written permission.

Disclaimer: Descriptions of specific implementations are for illustrative purpose only, actual hardware implementation may differ.

Revision History

Rev.	Date	Author(s)	Remark
1.0	2015-1-7	Yiming and Guofei	Draft version based on BK3231 datasheet
1.1	2016-02-26	mingsheng	Add the 32PIN SIP package inf
1.2	2016.04.08	Mingsheng.ao	Modified the SIP package removed P22,P23,VPP, added P35,P36,P37 ,which is based on the SIP package
1.3	2016.04.11	Mingsheng.ao	Modified the Description

Table of Contens

List of Figures

List of tables

1 General Description

1.1 Overview

The BK3231S chip is a highly integrated SoC, and it supports two wireless protocols, which are Blueetooth Basic Rate (BR), and Bluetooth Low Energy (BLE). It integrates a high-performance 2.4GHz RF transceiver, rich features baseband, ARM-core MCU and various peripheral IOs. It uses up-to-4Mbit external Flash to excute the programmable protocol and profile to support customized applications such as HID, Bluetooth 3D Glasses shutter, Remote controllers.

1.2 Block Diagram

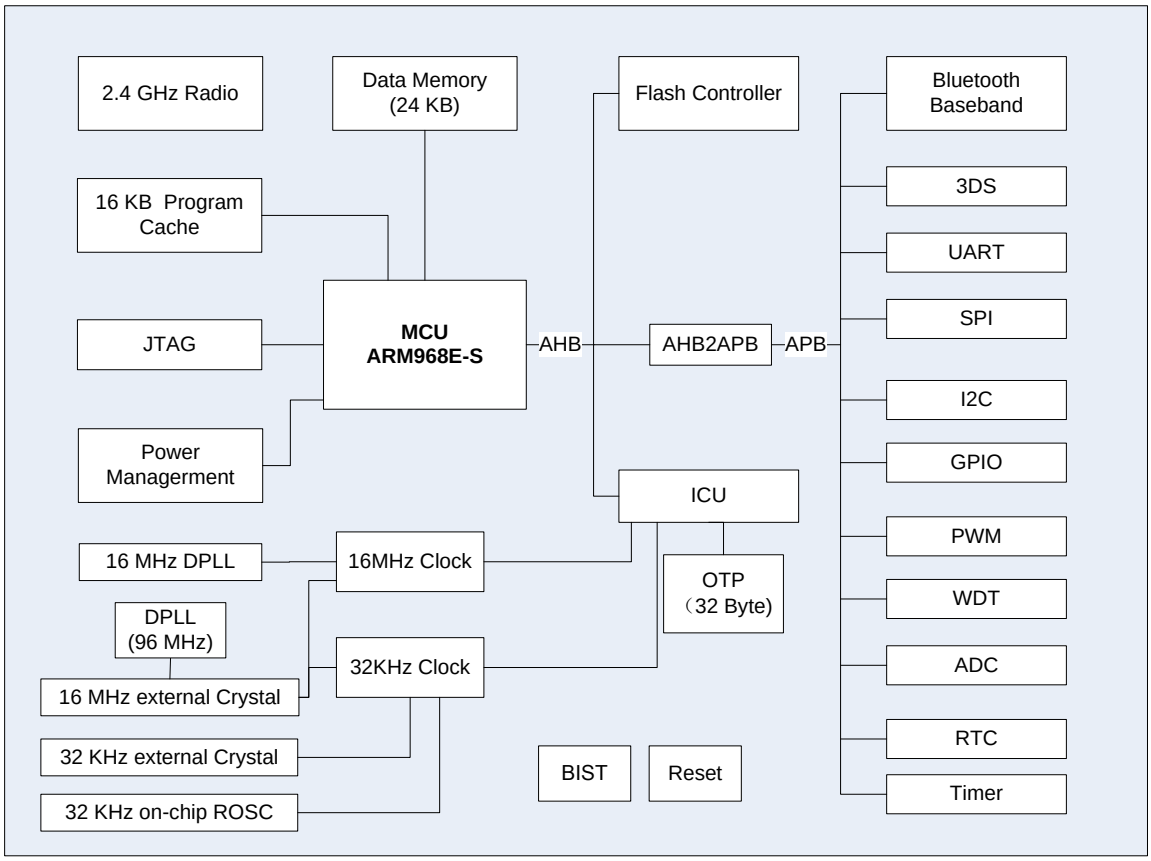


Figure 1 Block Diagram

1.3 Features

- Bluetooth® SIG Bluetooth Dual-Mode compliant
  - Bluetooth 3.0 Basic Rate (BR)
  - Bluetooth 4.0 Low Energy (BLE)
- ARM968 Core MCU integrated
- External Flash up-to-4Mbytes for Program and 24KB RAM for Data
- Low-power 2.4GHz Transceiver
- Operation voltage from 1.8V to 3.6 V
- -89 dBm sensitivity at 1 Mbps data rate and +4dBm transmit power for BLE application
- -86dBm sensitivity for 1 Mbps mode and 2 dBm transmit power for BR application
- External power-amplifier supporting
- Clock
  - 16 MHz crystal reference clock
  - 96MHz optional clock provided by internal DPLL
  - Internal 32kHz low-power oscillator with auto-calibration (±200ppm)
  - External 32kHz crystal oscillator as optional low-power clock source
- Interface and peripheral units
  - FLASH programming, JTAG, Dual I2Cs, SPI and UART interface
  - Integrated OTP for customization
  - On-chip high accurate temperature sensor
  - On-chip 7-channel 10bit general ADC
  - 6-outputs PWM
  - 4-outputs 3D Glasses shutter
  - Real-time counter
- Package Type
  - 56-pin QFN 7mmx7mm package
  - 32-pin QFN 4mmx4mm package

1.4 Application

- Wireless Self-Timer
- Wireless Keyboards

- Wireless Mouse
- Wireless Gamepad
- LED Lighting Remote Control
- Bluetooth 3D Glasses

2 Pin Information

The QFN56 package format for the full functions usage.It can be used as keyboard TX part and total 34 GPIO available. The pin assignment for QFN56 package is shown in Figure 2. Other package type such as QFN32 is also available by request with less GPIO.

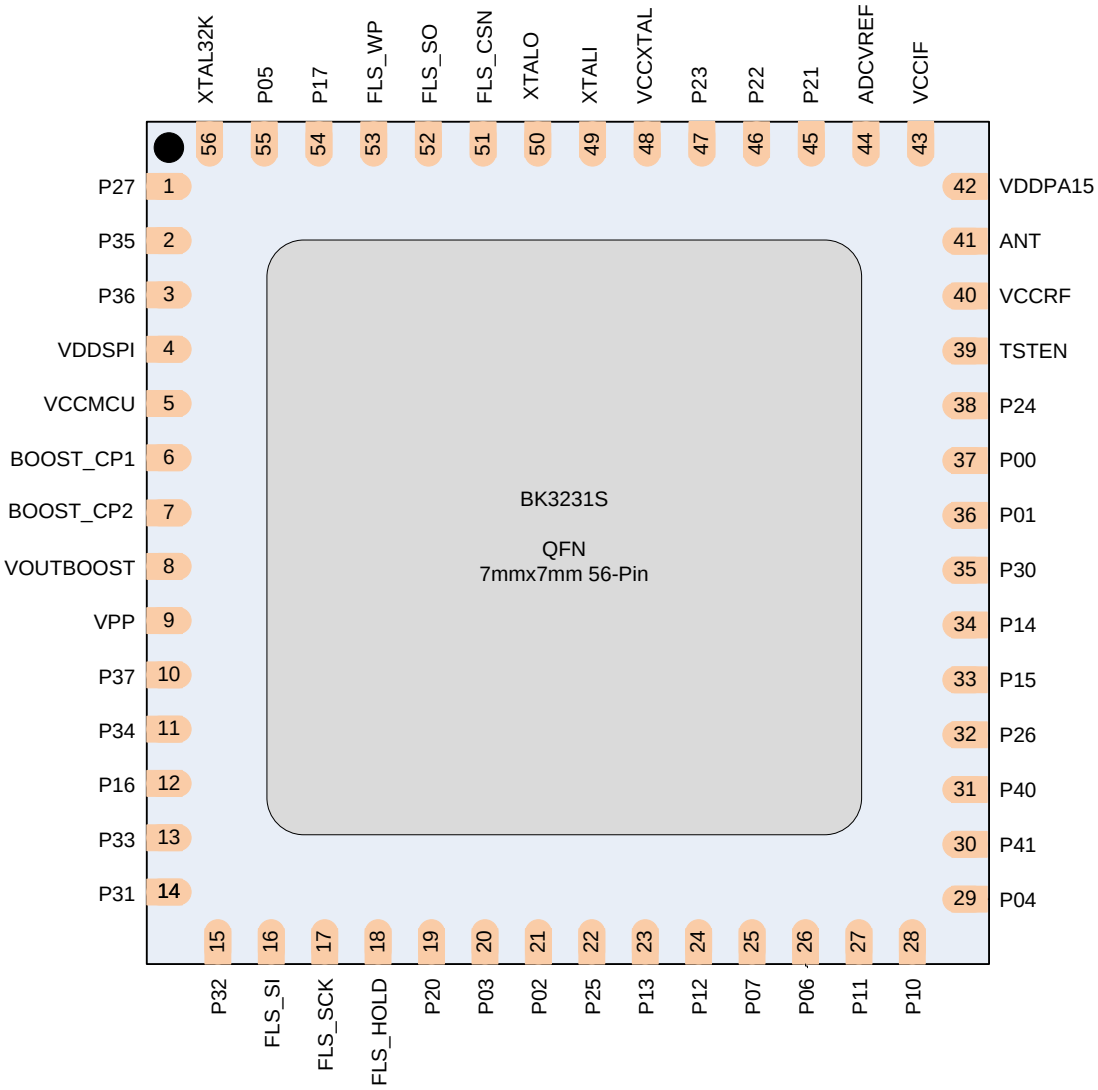


Figure 2 BK3231S QFN56Pin Assignment

Table 1 BK3231S QFN56 Pin Description

NO	Name	Description
1	P27	General I/O
2	P35	General I/O，or input of ADC5
3	P36	General I/O，or input of ADC6
4	VDDSPI	The output of digital LDO
5	VCCMCU	3V power supply
6	boost_cp1	The function PIN of boost,add 100nF cap between boost_cp1 and boost_cp2
7	boost_cp2	The function PIN of boost,add 100nF cap between boost_cp1 and boost_cp2
8	voutboost	The output of boost
9	VPP	The 6V power supply of OTP,it can be used when download
10	P37	General I/O，or input of ADC7
11	P34	General I/O，or input of ADC4
12	P16	General I/O，or clock for I2C1
13	P33	General I/O，or input of ADC3
14	P31	General I/O，or input of ADC1
15	P32	General I/O，or input of ADC2
16	FLS_SI	The function PIN of flash
17	FLS_SCK	The function PIN of flash
18	FLS_HOLD	The function PIN of flash
19	P20	General I/O, or UART TX
20	P03	General I/O, or 3DS_PWM[3]
21	P02	General I/O, or 3DS_PWM[2]
22	P25	General I/O，or enable for TIMER1
23	P13	General I/O，or enable for PWM3
24	P12	General I/O，or enable for PWM2
25	P07	General I/O, or chip select for SPI
26	P06	General I/O,or MISO for SPI
27	P11	General I/O，or enable for PWM1
28	P10	General I/O, or enable for PWM0
29	P04	General I/O, or SCK for SPI
30	P41	General I/O, or PLL enable
31	P40	General I/O, or PA enable
32	P26	General I/O，or enable for TIMER2
33	P15	General I/O，or enable for PWM5
34	P14	General I/O，or enable for PWM4
35	P30	General I/O，or input of ADC0
36	P01	General I/O, or 3DS_PWM[1]
37	P00	General I/O, or 3DS_PWM[0]

38	P24	General I/O，or enable for TIMER0
39	TSTEN	Enable the testting function of memory
40	VCCRF	3V power supply
41	ANT	The input of RF
42	VDDPA15	The output of PA ldo
43	VCCIF	3V power supply
44	ADCVREF	The output of reference voltage of ADC,it can be connected to a cap on the board
45	P21	General I/O, or UART RX
46	P22	General I/O，or clock for I2C0
47	P23	General I/O，or data I/O for I2C0
48	VCCXTAL	3V power supply
49	XTALI	The input of 16M crystal oscillator
50	XTALO	The input of 16M crystal oscillator
51	FLS_CSN	The function PIN of flash
52	FLS_SO	The function PIN of flash
53	FLS_WP	The function PIN of flash
54	P17	General I/O，or data I/O for I2C1
55	P05	General I/O, or MOSI for SPI
56	XTAL32K	The input of 32K crystal oscillator

The pin assignment for QFN32 package is shown in Figure 3.

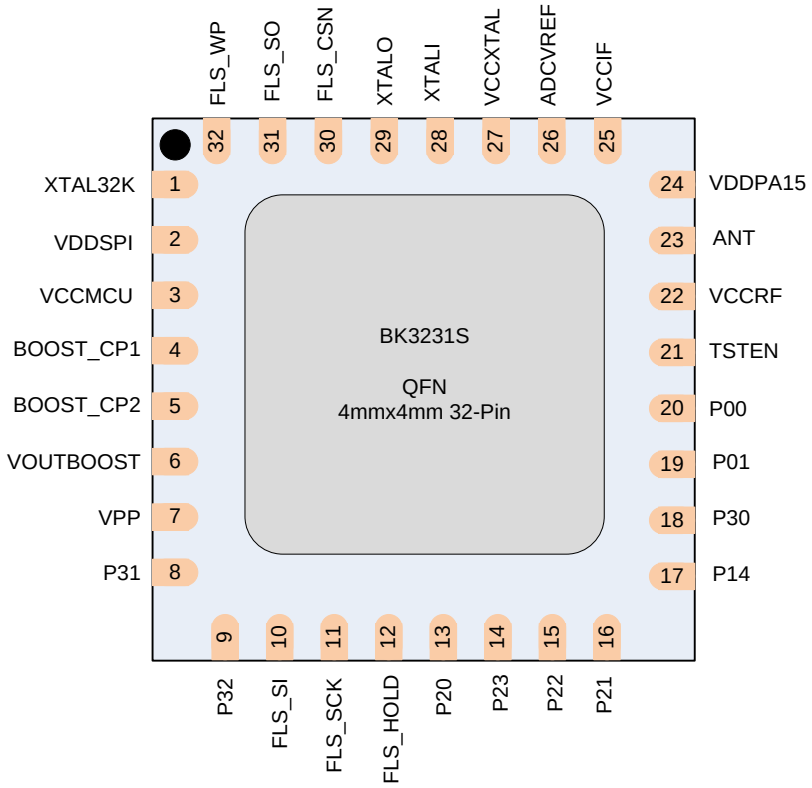


Figure 3 BK3231S QFN32Pin Assignment

Table 2 BK3231S QFN32 Pin Description

NO	Name	Description
1	XTAL32K	The input of 32K crystal oscillator
2	VDDSPI	The output of digital LDO
3	VCCMCU	3V power supply
4	boost_cp1	Boost function PIN. Add 100nF cap between boost_cp1 and boost_cp2
5	boost_cp2	Boost function PIN. Add 100nF cap between boost_cp1 and boost_cp2
6	voutboost	The output of boost
7	VPP	The 6V power supply of OTP,it can be used when download
8	P31	General I/O，or input of ADC1
9	P32	General I/O，or input of ADC2
10	FLS_SI	The function PIN of flash
11	FLS_SCK	The function PIN of flash
12	FLS_HOLD	The function PIN of flash
13	P20	General I/O, or UART TX
14	P23	General I/O，or data I/O for I2C0
15	P22	General I/O，or clock for I2C0
16	P21	General I/O, or UART RX
17	P14	General I/O，or enable for PWM4
18	P30	General I/O，or input of ADC0
19	P01	General I/O, or 3DS_PWM[1]
20	P00	General I/O, or 3DS_PWM[0]
21	TSTEN	Enable the testting function of memory
22	VCCRF	3V power supply
23	ANT	The input of RF
24	VDDPA15	The output of PA ldo
25	VCCIF	3V power supply
26	ADCVREF	The output of reference voltage of ADC. It can be connected to a cap on the board
27	VCCXTAL	3V power supply
28	XTALI	The input of 16M crystal oscillator
29	XTALO	The input of 16M crystal oscillator
30	FLS_CSN	The function PIN of flash
31	FLS_SO	The function PIN of flash
32	FLS_WP	The function PIN of flash

The pin assignment for QFN32 package(SIP with flash) is shown in Figure 4

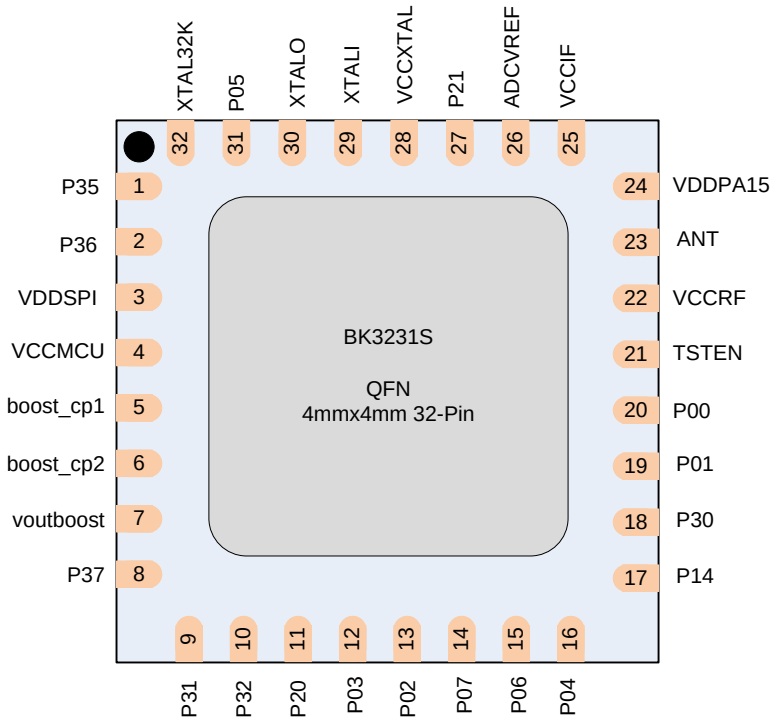


Figure 4 BK3231S QFN32Pin Assignment(SIP with flash)

Table 3 BK3231S QFN32 Pin Description(SIP with flash)

NO	Name	Description
1	**P35**	**General I/O，or input of ADC1**
2	**P36**	**General I/O，or input of ADC1**
3	VDDSPI	The output of digital LDO
4	VCCMCU	3V power supply
5	boost_cp1	Boost function PIN. Add 100nF cap between boost_cp1 and boost_cp2
6	boost_cp2	Boost function PIN. Add 100nF cap between boost_cp1 and boost_cp2
7	voutboost	The output of boost
8	**P37**	**General I/O，or input of ADC1**
9	P31	General I/O，or input of ADC1
10	P32	General I/O，or input of ADC2
11	P20	General I/O, or UART TX

12	P03	General I/O, or 3DS_PWM[3], I2C1.SDA, WP_FLA
13	P02	General I/O, or 3DS_PWM[2], I2C1.SCL, HOLD_FLA
14	P07	General I/O, or SPI_NSS, CSN_FLA
15	P06	General I/O,or MISO for SPI, SCK_FLA
16	P04	General I/O, or SPI_SCK, SI_FLA
17	P14	General I/O，or enable for PWM4
18	P30	General I/O，or input of ADC0
19	P01	General I/O, or 3DS_PWM[1]
20	P00	General I/O, or 3DS_PWM[0]
21	TSTEN	Enable the testting function of memory
22	VCCRF	3V power supply
23	ANT	The input of RF
24	VDDPA15	The output of PA ldo
25	VCCIF	3V power supply
26	ADCVREF	The output of reference voltage of ADC. It can be connected to a cap on the board
27	P21	General I/O, or UART RX
28	VCCXTAL	3V power supply
29	XTALI	The input of 16M crystal oscillator
30	XTALO	The input of 16M crystal oscillator
31	P05	General I/O, or MOSI for SPI, SO_FLA
32	XTAL32K	The input of 32K crystal oscillator

3 Function Description

3.1 Memory Address Mapping

Table 3 The Memory Mapping

	Start Address	End Address	Total (Bytes)
Program Memory			
Flash space	0x00000000	0x0003FFFF	4M maximum
Data Memory			
SRAM	0x00400000	0x00405FFF	24K
AHB Peripheral			
ICU	0x00800000	0x0080FFFF	64K
BK24_BB	0x00810000	0x0081FFFF	64K
FLASH CONTROL	0x00820000	0x0082FFFF	64K
AHB2APB	0x00F00000	0x00FFFFFF	1M
APB Peripheral			
WDT	0x00F00000	0x00F000FF	256B
PWM	0x00F00100	0x00F001FF	256B
SPI	0x00F00200	0x00F002FF	256B
UART	0x00F00300	0x00F003FF	256B
I2C0	0x00F00400	0x00F004FF	256B
GPIO	0x00F00500	0x00F005FF	256B
RTC	0x00F00600	0x00F006FF	256B
ADC	0x00F00700	0x00F007FF	256B
BT 3DS	0x00F00800	0x00F008FF	256B
I2C1	0x00F00900	0x00F009FF	256B
Timer	0x00F00A00	0x00F00AFF	256B
XVR	0x00F10000	0x00F1FFFF	64K
CEVA DM IP	0x00F20000	0x00F2FFFF	64K

3.2 Interrupt and Clock Unit

The MCU core clock can be selected from three clock sources: 32KHz clock, 16 MHz clock and 96 MHz DPLL.

The ARM968E-S supports two interrupt level. The FIRQ has higher priority than nIRQ. In the BK3231S, all peripheral interrupts are nIRQ except the Bluetooth transceiver. All interrupt can be enabled, disabled, and cleared. There are two low power modes: MCU stop and deep sleep, and any interrupt can be configured to be a wake up source to let MCU exit low power mode.

3.3 GPIO

There are totally 40 general purpose input/output ports (GPIO). All the 40 ports can be used for general I/O with selectable direction for each bit, or these lines can be used for specialized functions.

3.4 ADC

An 8bits SAR-ADC is integrated in the BK3231S. Total 8 channels can be selected used for ADC transfer. The ADC supports continue mode and single transfer mode, and the sample rate can be 1 KHz to 32KHz. In single transfer mode, it will generate interrupt every time after transform.

The ADC has four work modes they are sleep mode, single mode, and software mode and continue mode.

IDLE mode(mode==00): ADC is in idle state.

Single mode(mode==01): The ADC will enter idle mode when transfer is done and waiting MCU to read the result. You should write mode=1 again for another transfer.

Controlled by software (mode==10): In this mode, interrupt will be triggered after transfer and wait MCU to read. The interrupt will be cleared after MCU read, and then the transfer will start again.

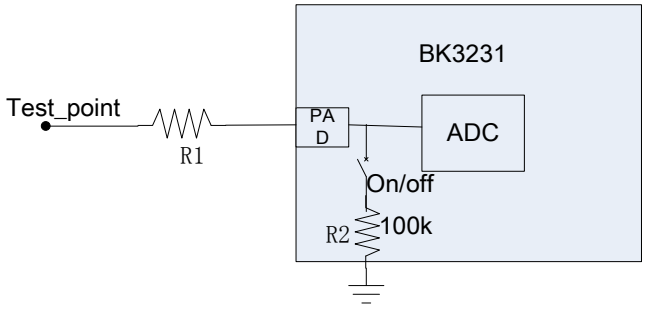
Continue mode(mode==11):The ADC will work at the sample rate set by register. The sample rate can be calculated by the next formula:

F_sample = input ADC clock/(2^(ADC_CLK_RATE+2) / 36(or 18))

The highest sample rate is 32k

The local interrupt flag of ADC need not be cleared by software; it will be set after transform and be cleared after the result has been read out. But the ADC INTstored ICU should be cleared after the ADC INT service finished.

The range of input voltage is from 0v to 1.5V. If the input voltage more than 1.5V, a resistor can be added to decrease the input voltage like the next diagram.



Note: There are eight GPIO can be ADC input. When used as this:

Voltage=data [9:0]/448; the saturate voltage is 1.5 volt.

3.5 UART

The UART interface has 128 bytes FIFO for both TX and RX. It will generate interrupt request when there is risk or event of FIFO underflow or overflow. For the RX, it will generate interrupt if found parity bit check error or stop bit check error.

When the UART RX line goes from idle state (‘HIGH’) to active state (‘LOW’) for a set UART clock cycle, it will generate wake up interrupt to activate MCU clock.

3.6 I2C-SMBus

The I2C I/O interface is a two-wire, bi-directional serial bus. The I2C is compliant with the System Management Bus Specification, version 1.1, and compatible with the I C serial bus. Reads and writes to the interface by the system controller are byte oriented with the I2C interface autonomously controlling the serial transfer of the data.

Data can be transferred at up to 1/10th of the system clock as a master or slave (this can be faster than allowed by the I2C specification, depending on the system clock used). A method of extending the clock-low duration is available to accommodate devices with different speed capabilities on the same bus.

The I2C interface may operate as a master and/or slave, and may function on a bus with multiple masters. The I2C provides control of SDA (serial data), SCL (serial clock) generation and synchronization, arbitration logic, and START/STOP control and generation.

It is assumed the reader is familiar with the I2C-Bus Specification -- Version 2.0 and system Management Bus Specification -- Version 1.1.

The bi-directional SCL (serial clock) and SDA (serial data) lines must be connected to a positive power supply voltage through a pull-up resistor or similar circuit. Every device connected to the bus must have an open-drain or open-collector output for both the SCL and SDA lines, so that both are pulled high (recessive state) when the bus is free.

3.7 SPI

The Enhanced Serial Peripheral Interface (SPI) provides access to a flexible, full-duplex synchronous serial bus. SPI can operate as a master or slave device in both 3-wire or 4-wire modes, and supports multiple masters and slaves on a single SPI bus. The slave-select (NSS) signal can be configured as an input to select SPI in slave mode, or to disable Master Mode operation in a multi-master environment, avoiding contention on the SPI bus when more than one master attempts simultaneous data transfers. NSS can also be configured as a chip-select output in master mode, or disabled for 3-wire operation. Additional general purpose port I/O pins can be used to select multiple slaves.

There are four pins for SPI interface. The master-out, slave-in (MOSI) signal is an output from a master device and an input to slave devices. It is used to serially transfer data from the master to the slave. This signal is an output when SPI is operating as a master and an input when SPI is operating as a slave. Data is transferred most-significant bit first. When configured as a master, MOSI is driven by the MSB of the shift register in both 3- and 4-wire mode.

The master-in, slave-out (MISO) signal is an output from a slave device and an input to the master device. It is used to serially transfer data from the slave to the master. This signal is an input when SPI is operating as a master and an output when SPI is operating as a slave. Data is transferred most-significant bit first. The MISO pin is placed in a high-impedance state when the SPI module is disabled and when the SPI operates in 4-wire mode as a slave that is not selected. When acting as a slave in 3-wire mode, MISO is always driven by the MSB of the shift register.

In slave mode, the data on MOSI are sampled at the middle of period of every bit. In master mode, the data on MISO are sampled at the last clock period to acquire the maximal setup time.

3.8 PWM Timer

There are three timers, two of which is 16 bit and can be works as PWM waveform generator, while the other one is 20bit timer. The PWM waveform can be output to GPIO to drive external device such as LED.

3.9 Watch dog

The watch dog is used to reset the whole chip when the firmware runs out of order.

4 Electrical Specifications

4.1 General Specification

Table 4 General Characteristics

Name	Parameter (Condition)	Min	Typical	Max	Unit	Comment
	Operating Condition					
VCC	Voltage	1.8	3.0	3.6	V	
TEMP	Temperature	-20	+27	+80	ºC	
	Digital input Pin					
VIH	High level	VCC-0.3		VCC+0.3	V	
VIL	Low level	VSS		VSS+0.3	V	
	Digital output Pin					
VOH	High level (IOH=-0.25mA)	VCC- 0.3		VCC	V	
VOL	Low level(IOL=0.25mA)	VSS		VSS+0.3	V	

4.2 BLE mode

Table 5 BLE mode RF Characteristics

Name	Parameter (Condition)	Min	Typical	Max	Unit	Comment
	Normal condition					
IVDD	Deep sleep		TBD		uA	
IVDD	Active RX		TBD		mA	
IVDD	Active TX @ 2 dBm output power		TBD		mA	
	Transmitter					
PRF	Output power		4	5	dBm	
PBW	Modulation 20 dB bandwidth		1		MHz	
	Receiver					
Max Input	1 E-3 BER	0			dBm	
RXSENS	1 E-3 BER sensitivity		-89		dBm	
IIP3	IIP3, Pin=-63 dBm; Punwant=-39 dBm; f0=2f1-f2, f2-f1=3 MHz or 4 MHz or 5 MHz		TBD		dBm	

C/ICO	Co-channel C/I			TBD	dB	
C/I1ST	ACS C/I 1MHz			TBD	dB	
C/I2ND	ACS C/I 2MHz			TBD	dB	
C/I3RD	ACS C/I 3MHz			TBD	dB	
C/I1STI	ACS C/I Image channel			TBD	dB	
C/I2NDI	ACS C/I 1 MHz adjacnet to image channel			TBD	dB	

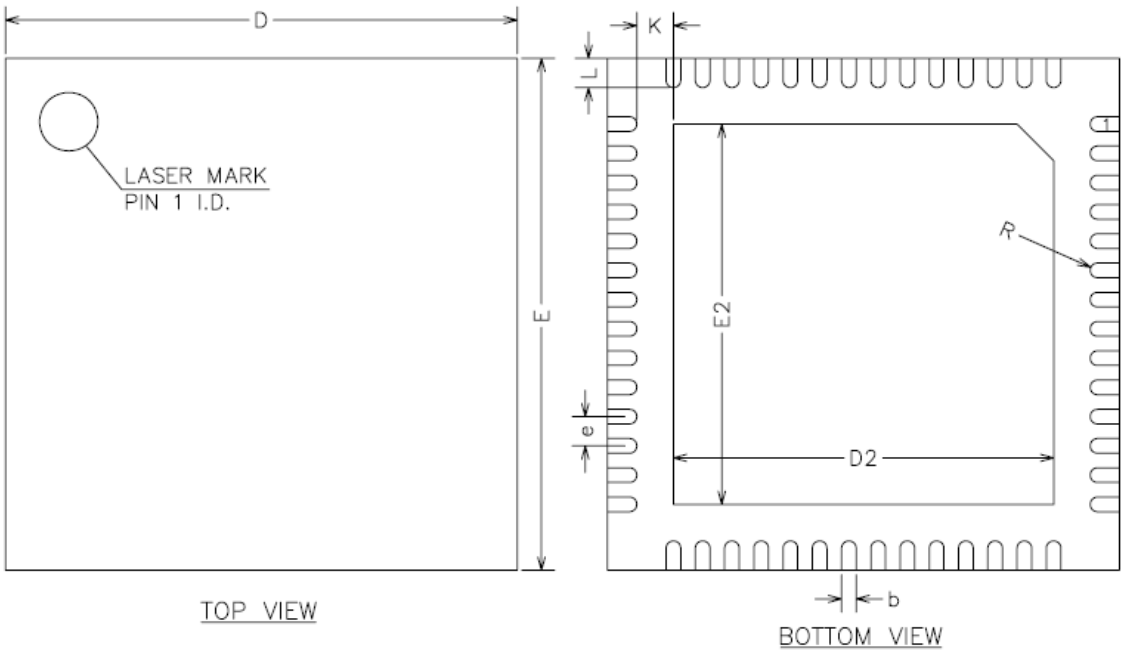
4.3 BR mode

Table 6 BR mode RF Characteristics

Name	Parameter (Condition)	Min	Typical	Max	Unit	Comment
	Normal condition					
IVDD	Deep sleep		TBD		uA	
IVDD	Active RX		TBD		mA	
IVDD	Active TX @ 2 dBm output power		TBD		mA	
	Transmitter					
PRF	Output power		2	5	dBm	
PBW	Modulation 20 dB bandwidth		1		MHz	
	Receiver					
Max Input	1 E-3 BER	0			dBm	
RXSENS	1 E-3 BER sensitivity		-86		dBm	
IIP3	IIP3, Pin=-63 dBm; Punwant=-39 dBm; f0=2f1-f2, f2-f1=3 MHz or 4 MHz or 5 MHz		TBD		dBm	
C/ICO	Co-channel C/I			11	dB	
C/I1ST	ACS C/I 1MHz			0	dB	
C/I2ND	ACS C/I 2MHz			-30	dB	
C/I3RD	ACS C/I 3MHz			-40	dB	
C/I1STI	ACS C/I Image channel			-9	dB	
C/I2NDI	ACS C/I 1 MHz adjacnet to image channel			-20	dB	

5 Package Information

5.1 QFN 7X7 56PIN:



COMMON DIMENSIONS
(UNITS OF MEASURE=MILLIMETER)

SYMBOL	MIN	NOM	MAX
A	0.70	0.75	0.80
A1	0	0.02	0.05
A3		0.20REF	
b	0.15	0.20	0.25
D	6.90	7.00	7.10
E	6.90	7.00	7.10
D2	5.05	5.20	5.35
E2	5.05	5.20	5.35
e	0.30	0.40	0.50
K	0.20	–	–
L	0.35	0.40	0.45
R	0.09	–	–

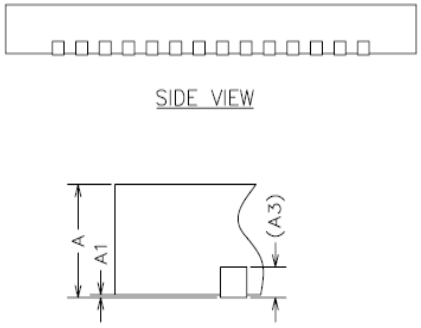
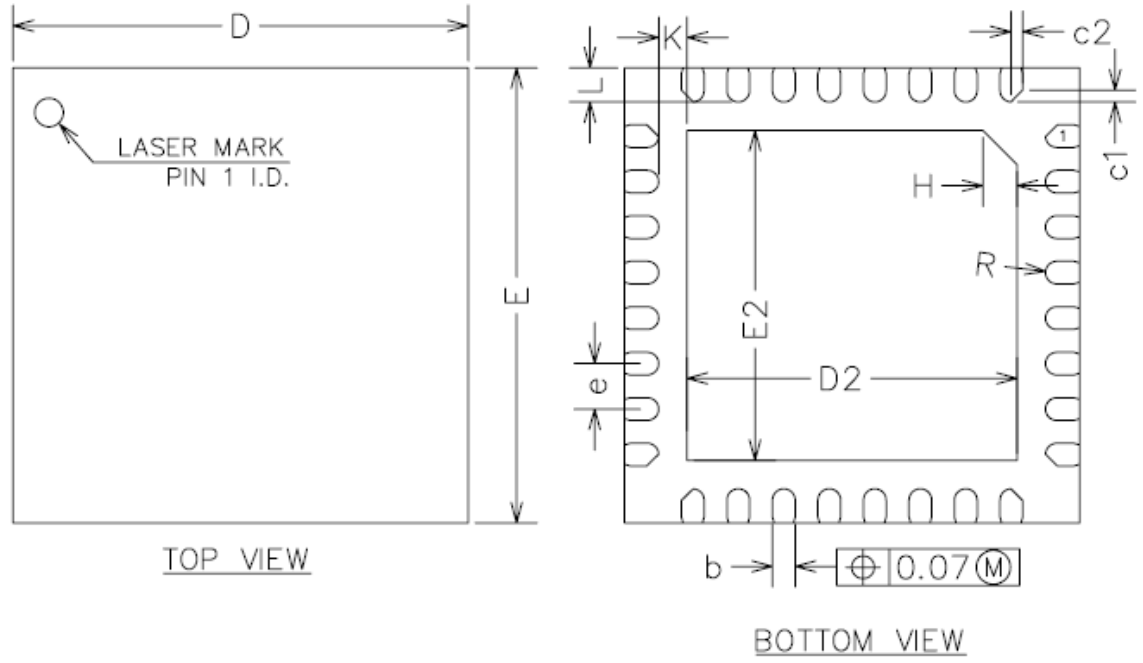


Figure 4 BK3231S QFN56Pin Package Information

5.2 QFN4X4 32PIN:



COMMON DIMENSIONS
(UNITS OF MEASURE=MILLIMETER)

SYMBOL	MIN	NOM	MAX
A	0.80	0.85	0.90
A1	0	0.02	0.05
A2	0.60	0.65	0.70
A3		0.20REF	
b	0.15	0.20	0.25
D	3.90	4.00	4.10
E	3.90	4.00	4.10
D2	2.80	2.90	3.00
E2	2.80	2.90	3.00
e	0.30	0.40	0.50
H		0.30REF	
K		0.25REF	
L	0.25	0.30	0.35
R	0.09	–	–
c1	–	0.10	–
c2	–	0.10	–

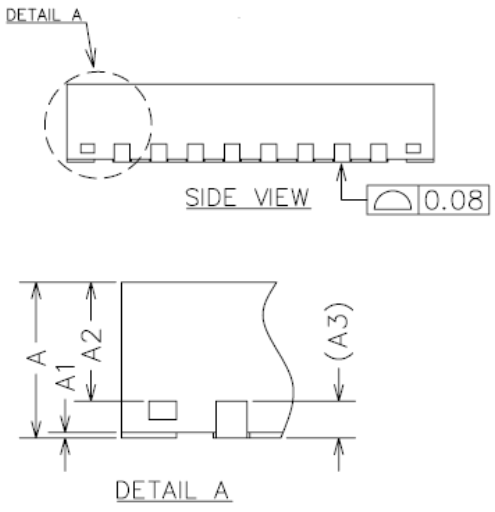


Figure 5 BK3231S QFN32Pin Package Information

6 Application Schematic

6.1 QFN7X7 56PIN:

TBD

6.2 QFN4X4 32PIN:

TBD

7 Order Information

Table 6 Order Information

Part number	Package	Packing	Minimum Order Quantity
BK3231SQB	QFN7x7-56Pin	Tape Reel	3000
BK3231SQ32	QFN 4mmx4mm 32-Pin	Tape Reel	10K

8 Contact Information

Beken Corporation Technical Support Center

Shanghai office
Building 41, 1387 Zhangdong Road, Zhangjiang High-Tech Park, Pudong New District, Shanghai, China Phone: 86-21-51086811 Fax: 86-21-60871089 Postal Code: 201203

Email: info@bekencorp.com
Website: www.bekencorp.com