深圳大夏龙雀科技有限公司

Shenzhen DX-SMART Technology Co Ltd.

DX-BT16 4.2蓝牙模块

DX-BT16 4.2 Bluetooth Module

Note: English instructions go to page 11
(英文技术手册请跳转到第11页)

技术手册 v 3.4

目录

一． 概述

BT16 4.2 蓝牙透传模组采用 **Airoha** 最新推出的蓝牙 **4.2 BLE** 单芯片 **AB1602**，通过内嵌的数据透传专用 **Service** 实现基于 **GATT** 的蓝牙数据透传。**BT16 4.2** 蓝牙透传模组支持串口命令模式，用于实现外部 **MCU** 与模组的交互。用户可通过串口命令对模组进行参数配置和一些控制，如修改 **UUID**，修改蓝牙名称，控制蓝牙断开连接等。

二． 模块默认参数：

蓝牙协议	Bluetooth Specification V4.2 BLE
工作频率	2.4GHz ISM band
通信接口	UART
供电电源	3.3V
通信距离	10-15M (空旷环境)
外观尺寸	18 (L)mm x 14.5(W)mm x 2(H) mm
蓝牙认证	BQB FCC CE ROHS REACH
蓝牙名称	BT16
串口参数	9600、8数据位、1停止位、无校验、无流控
最大单包字节数	280 Bytes
Service UUID	FFE0 (可联系我司定制修改)
Notify UUID	FFE1 (可联系我司定制修改)
Write UUID	FFE2 (可联系我司定制修改)
Storage temperature	MIN:-55℃ - MAX:+125℃
Work temperature	MIN:-20℃ - MAX:+70℃
定制需求	如有其它特殊功能要求，可以联系我司，对模块进行定制

三． 应用领域：

DX-BT16 模块同时支持 **BT4.2 BLE** 协议，可以同具备 **BLE** 蓝牙功能的 **iOS** 设备直接连接，支持后台程序常驻运行。主要用于短距离的数据无线传输领域。避免繁琐的线缆连接，能直接替代串口线。**BT16** 模块成功应用领域：

※ 蓝牙无线数据传输；

※ 手机、电脑周边设备；
※ 手持 POS 设备；
※ 医疗设备无线数据传输；
※ 智能家居控制；
※ 汽车检测 OBD 设备；
※ 蓝牙外卖打印机；
※ 蓝牙遥控玩具；
※ 共享沙发、共享抓娃娃机

四． 功耗参数

模式	状态	电流	Unit
低功耗模式	Discoverable	200	uA
	Connected	1	mA
正常工作模式	Discoverable	4	mA
	Connected	4	mA

五． 射频特性

Rating	Value	Unit
BLE 发射功率	0	dBm
BLE 灵敏度	-93	dBm

六． 透传参数

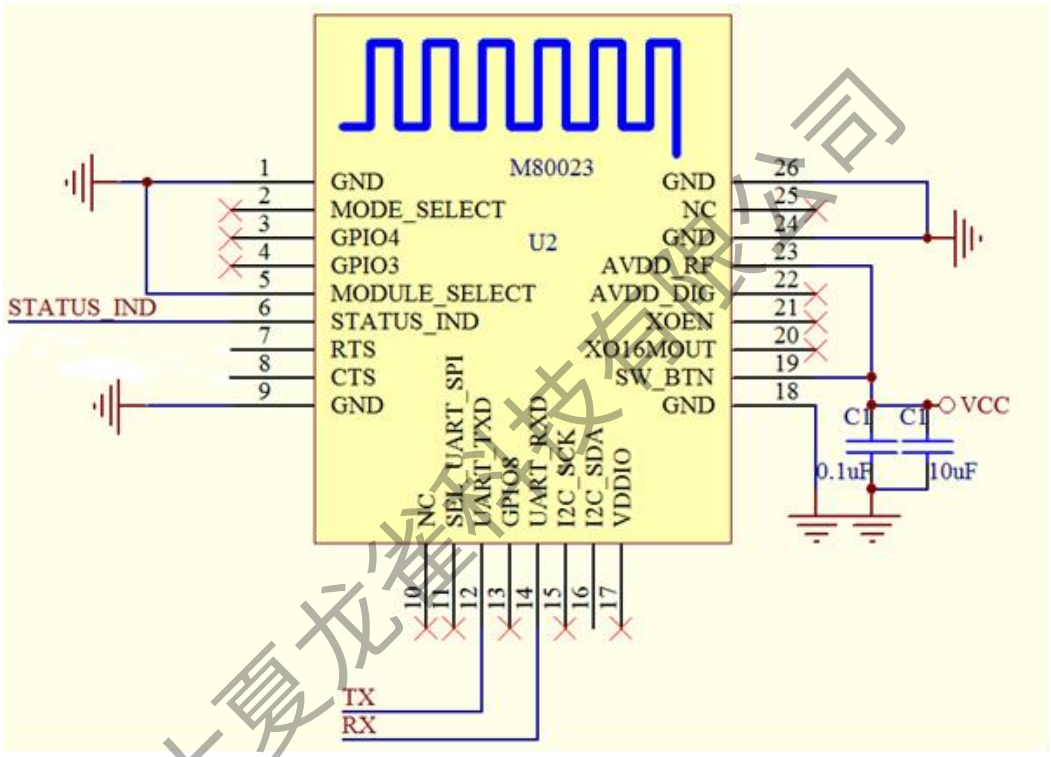
数据吞吐量：

Android ->BT16 -> UART		UART ->BT16 -> Android	
波特率	115200	波特率	115200
连接间隔时间(ms)	30	连接间隔时间(ms)	20
APP 数据包大小(bytes)	100	串口数据包大小(bytes)	200
发送间隔(ms)	50	发送间隔(ms)	70
吞吐量(bytes/s)	1916	吞吐量(bytes/s)	2800
Characteristic 写方式	Write without Response	Characteristic 通知方式	Notify
iPhone ->BT16 -> UART		**UART ->BT16 -> iPhone**	
波特率	115200	波特率	115200
连接间隔时间(ms)	18.75	连接间隔时间(ms)	18.75
APP 数据包大小(bytes)	100	串口数据包大小(bytes)	255

发送间隔(ms)	100	**发送间隔(ms)**	100
吞吐量(bytes/s)	1000	**吞吐量(bytes/s)**	2550
Characteristic 写方式	Write without Response	**Characteristic 通知方式**	Notify

注：此表格参数仅做参考，不代表模组能支持的最大数据吞吐量。

七. 模块引脚说明及最小电路图：



八. 管脚功能描述：

管脚序号	管脚名称	管脚说明
1	GND	GND
2	NC	NC
3	GPIO4	Reserved
4	GPIO3	Reserved
5	MODULE_SELECT	正常工作模式：输入低电平； 低功耗模式 ：输入高电平； （注：当模组进入低功耗模式时，无法向外发送数据，但仍可接收手机数据并通过串口发送给单片机）
6	STATUS_IND	蓝牙连接状态指示： 高电平 - 蓝牙已连接

		低电平 - 蓝牙未连接
7	RTS	SCL
8	CTS	SDA
9	GND	GND
10	NC	NC
11	SEL_UART_SPI	NC
12	UART_TXD	串口发送端
13	GPIO8	Reserved
14	UART_RXD	串口接收端
15	I2C_SCK	Reserved
16	I2C_SDA	Reserved
17	VDDIO	内部拉高为 3.3V（无需再外部拉高）
18	GND	GND
19	SW_BTN	高电平 – 开机 低电平 – 关机 (注：使用模组时，此脚拉高开机，拉低则关机)
20	XO16MOUT	16M 时钟输出
21	XOEN	XO16MOUT 输出使能控制，高电平或悬空有效
22	AVDD_DIG	NC
23	AVDD_RF	VCC 默认 3.3V
24	GND	GND
25	NC	NC
26	GND	GND

九． 功能引脚详细说明

1、 P19 脚（SW_BTN）：模块开关机脚

引脚状态	模块状态
输入低电平	关机
输出高电平	开机

2、 P6 脚(STATUS_IND)： 连接状态指示脚

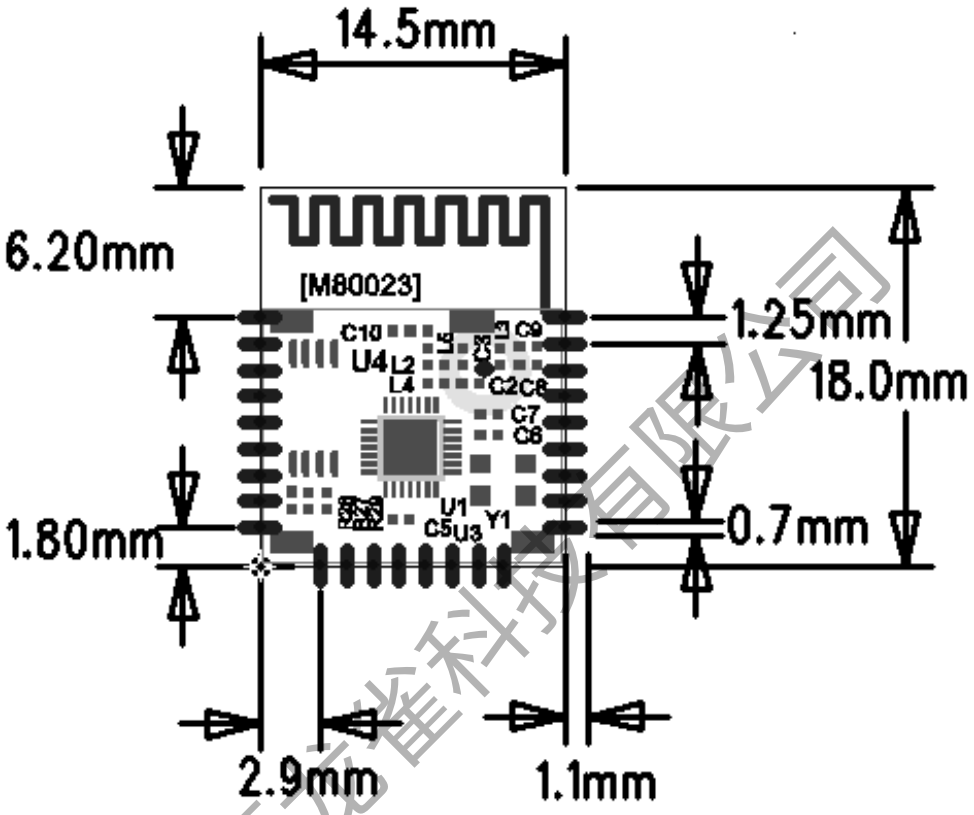
引脚状态	模块状态
输出低电平	待机状态
输出高电平	连接状态

3、 P5 脚（MODULE_SELECT）：模式选择脚

引脚状态	模块状态

输入低电平	正常工作模式
输入高电平	低功耗模式

十．外形尺寸：



十一．LAYOUT 注意事项

DX-BT16 蓝牙模块工作在2.4G无线频段，应尽量避免各种因素对无线收发的影响，注意以下几点：

1、包围蓝牙模块的产品外壳避免使用金属，当使用部分金属外壳时，应尽量让模块天线部分远离金属部分。

2、产品内部金属连接线或者金属螺钉，应尽量远离模块天线部分。

3、模块天线部分应靠载板PCB 四围放置，不允许放置于板中，且天线下方载板铣空，与天线平行的方向，不允许铺铜或走线。直接把天线部分直接露出载板，也是比较好的选择。

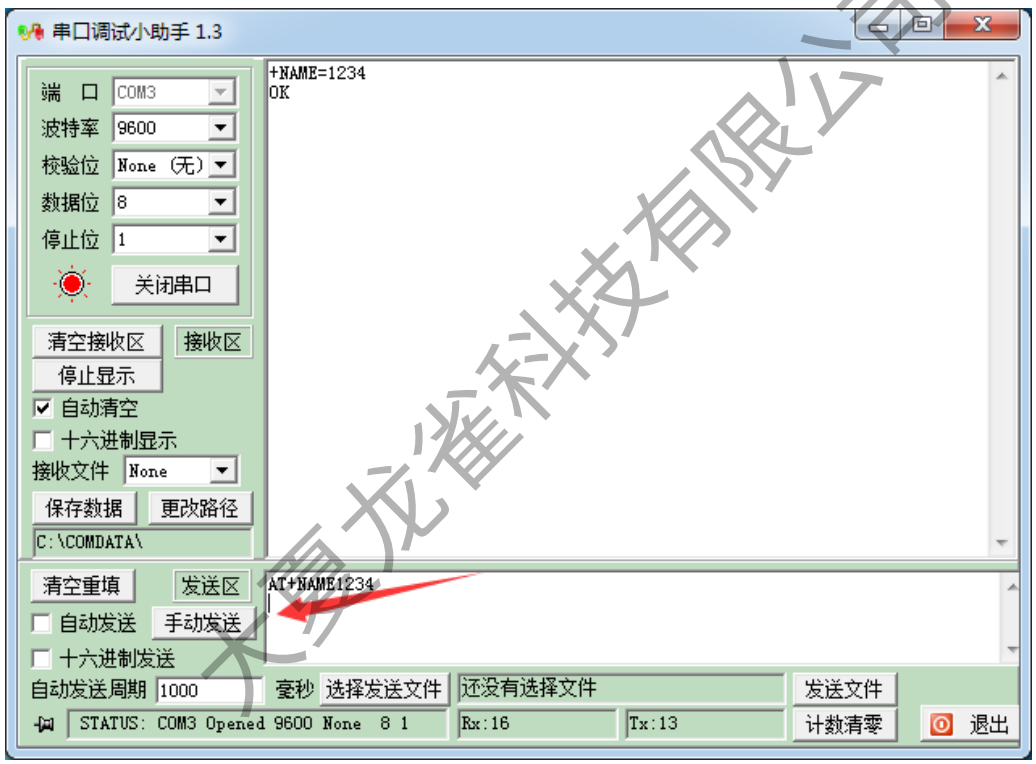
4、建议在基板上的模块贴装位置使用绝缘材料进行隔离，例如在该位置放一个整块的丝印（TopOverLay）

十二． AT 指令集

指令集详细说明(注：模块未连接时即为 AT 指令模式)

1、AT 指令，属于字符行指令，按行解析（即发 AT 指令时必须以回车换行或者\r\n、16 进制为 0D0A 结尾）
3、AT 指令支持大小写，指令前缀为 AT+，可分为参数设置指令和读取指令。
4、设置指令格式：AT+<CMD><PARAM>操作成功返回：+<CMD>=<PARAM>\r\n OK\r\n 失败不返回字符。
5、读取指令格式：AT+<CMD>操作成功返回：+<CMD>=<PARAM>\r\n 失败不返回字符。

AT 命令格式举例(本图为将蓝牙名称改为 1234)：



1、获取软件版本号：

功能	指令	响应	说明
查询版本号	AT+VERSION\r\n	+VERSION=<version>\r\n	<version >软件版本号

注：依据不同的模块与定制需求，版本会有区别。

2、设置/查询设备名称：

功能	指令	响应	说明
查询模块蓝牙名	AT+NAME\r\n	+NAME=<name>\r\n	<name>蓝牙名，最长为
设置模块蓝牙名	AT+NAME<name>\r\n	+NAME=<name>\r\n OK	20 个字节 默认名称：BT16

示例：

1. 发送设置：

AT+NAMEDX-BT16\r\n ——设置模块设备名为：“DX-BT16”

返回：

+NAME=DX-BT16\r\n ——设置模块设备名为：“DX-BT16”成功
OK

2. 发送查询：

AT+NAME\r\n ——查询模块名

返回：

+NAME= DX-BT16r\n ——返回模块设备名为：“DX-BT16”

3、设置/查询—串口波特率：

功能	指令	响应	说明
查询模块波特率	AT+BAUD\r\n	+BAUD=<baud>\r\n	<baud>波特率对应序号
设置模块波特率	AT+BAUD<baud>\r\n	+BAUD<baud>\r\n OK\r\n	0:9600 1:19200 2:38400 3:57600 4:115200 默认值：0 (9600)

注：模块设置波特率后需重新上电，启用新波特率进行数据通信和 AT 指令解析。

示例：设置串口波特率：38400

1. 发送设置：

AT+BAUD2\r\n

返回：

+BAUD=2\r\n
OK\r\n

2. 发送查询：

AT+BAUD\r\n

返回：

+BAUD=2\r\n

4、软件重启：

功能	指令	响应	说明
软件重启	AT+RESET\r\n	OK\r\n	

5、设置蓝牙 UUID:（设置成功后需要从手机设置里面将蓝牙关掉重新打开，手机才会生效）

功能	指令	响应	说明
设置蓝牙 UUID	AT+UUID<Param>\r\n	OK\r\n	<Param>：UUID 默认 UUID： FFE0FFE1FFE2 SERVICE UUID：FFE0 NOTIFY UUID：FFE1 WRITE UUID：FFE2

示例：修改 SERVICE UUID 为：FF00、NOTIFY 为：FF11、WRITE UUID 为:FF22

1. 发送设置：

AT+UUIDFF00FF11FF22\r\n ——设置模块 UUID 为：
服务 UUID：FF00
读数据通道：FF11
写数据通道：FF22

返回：OK\r\n ——设置模块 UUID 成功

十三．联系我们

深圳大夏龙雀科技有限公司

地址：深圳市宝安区固戍二路裕兴科技园(裕兴创谷)C 栋 511

电话：0755-2997 8125

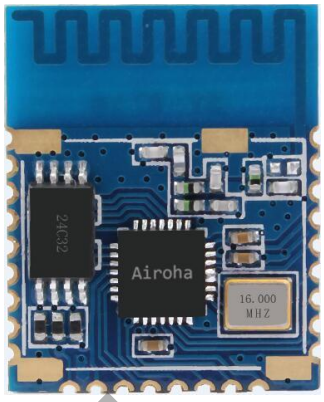
传真：0755-2997 8369

网址：http://www.szdx-smart.com/

Table Of Contents

1. Overview

The BT16 4.2 Bluetooth transparent transmission module adopts the latest Bluetooth 4.2 BLE single chip AB1602 from Airoha, and realizes GATT-based Bluetooth data transmission through the embedded data transparent transmission service. BT16 4.2 Bluetooth transparent transmission module supports serial command mode, which is used to realize the interaction between external MCU and module. The user can perform parameter configuration and some control on the module through serial port commands, such as modifying the UUID, modifying the Bluetooth name, and controlling the Bluetooth disconnection..



2. Module default parameters：

Bluetooth Protocol	Bluetooth Specification V4.0 BLE
Working Frequency	2.4GHz ISM band
Communication Interface	UART
Power Supply	3.3V
Communication distance	10-15M (Open and unobstructed environment)
Physical Dimension	18 (L)mm x 14.5(W)mm x 2(H) mm
Bluetooth Authentication	BQB FCC CE ROHS REACH
Bluetooth Name	BT16
Serial Port Parameters	9600、8 data bits、1 stop bit、No check、No flow control
Maximum single packet number of bytes	280 Bytes
Service UUID	FFE0
Notify\Write UUID	FFE1
Write UUID	FFE2
Storage temperature	MIN:-55℃ - MAX:+125℃
Work temperature	MIN:-20℃ - MAX:+70℃
Customized requirements	If you have other special function requirements, you can contact us to customize the module.

3. Application area:

DX-BT16 module supports BT4 .2 BLE protocol, which can be directly connected to iOS devices that have BLE Bluetooth function, and supports background program resident operation.

Successful application of BT16 module:

※ Bluetooth wireless data transmission;

※ Mobile phones, computer peripherals;

※ Handheld POS device;

※ Medical equipment wireless data transmission;

※ Smart Home Control;

※ Automotive Inspection OBD Equipment;

※ Bluetooth printer;

※ Bluetooth remote control toy;

※ Anti-lost device, LED light control;

4. Power consumption parameters:

Mode	Status	Current	Unit
Low power mode	Discoverable	200	uA
	Connected	1	mA
Normal working mode	Discoverable	4	mA
	Connected	4	mA

5. Radio frequency characteristics:

Rating	Value	Unit
BLE Transmit power	**0**	**dBm**
BLE Sensitivity	**-93**	**dBm**

6. Transparent transmission parameters

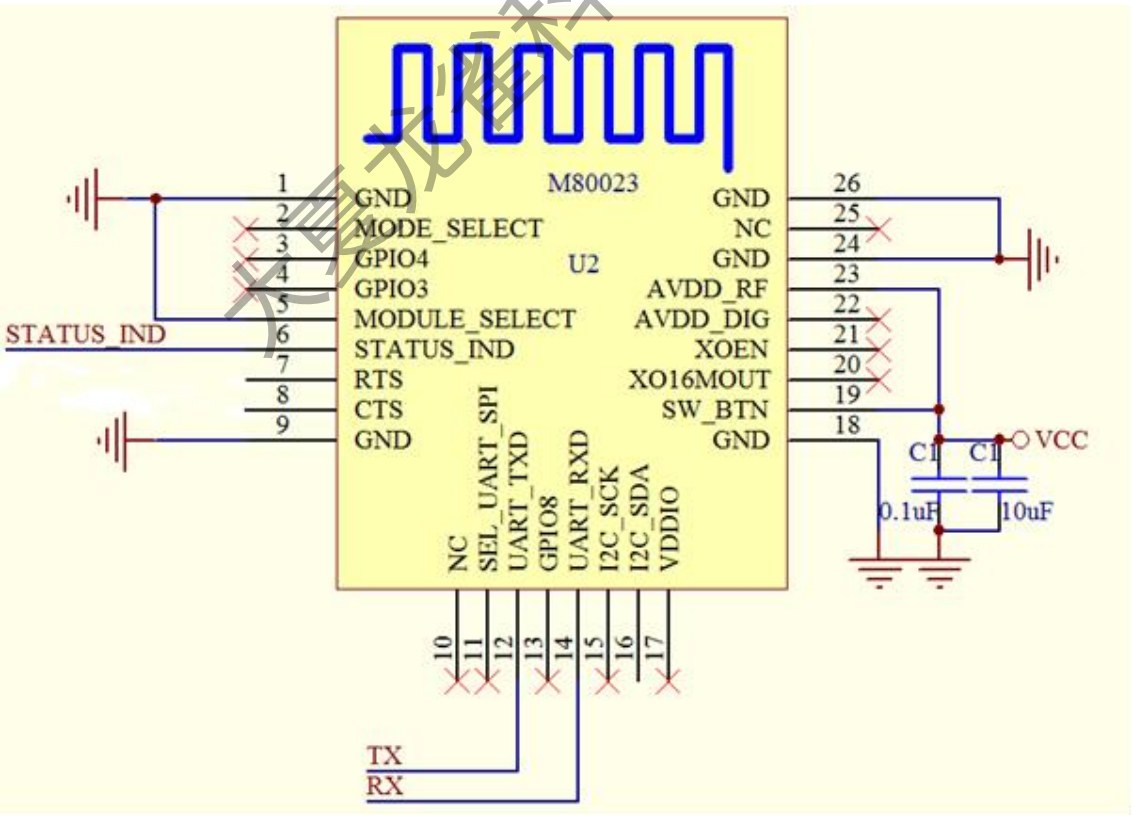
Data throughput:

Android ->BT16 -> UART		UART ->BT16 -> Android	
Baud rate	115200	**Baud rate**	115200
Connection interval (ms)	30	**Connection interval (ms)**	20
Serial packet size (bytes)	100	**Serial packet size (bytes)**	200

Transmission interval (ms)	**50**	**Transmission interval (ms)**	**70**
Throughput (bytes/s)	1916	**Throughput (bytes/s)**	2800
Characteristic Write	Write without Response	**Characteristic Notify**	Notify
iPhone 6 ->BT16 -> UART		**UART ->BT16 -> iPhone 6**	
Baud rate	115200	**Baud rate**	115200
Connection interval (ms)	18.75	**Connection interval (ms)**	18.75
Serial packet size (bytes)	100	**Serial packet size (bytes)**	255
Transmission interval (ms)	100	**Transmission interval (ms)**	100
Throughput (bytes/s)	1000	**Throughput (bytes/s)**	2550
Characteristic Write	Write without Response	**Characteristic Notify**	Notify

Note: This table parameter is for reference only and does not represent the maximum data throughput that the module can support.

7. Module pin description and minimum circuit diagram:



8. Pin function description:

Pin number	Pin name	Pin description
1	GND	GND
2	NC	NC
3	GPIO4	Reserved
4	GPIO3	Reserved
5	MODULE_SELECT	Working mode : input low level; Low power mode: input high level; (Note: When the module enters the low power mode, the data cannot be sent out, but the mobile phone data can still be received and sent to the MCU through the serial port
6	STATUS_IND	Bluetooth connection status indication: High level - Bluetooth is connected Low level - Bluetooth is not connected
7	RTS	SCL
8	CTS	SDA
9	GND	GND
10	NC	NC
11	SEL_UART_SPI	NC
12	UART_TXD	UART_TXD
13	STATUS_IND	Bluetooth connection indicator (not connected low, connection high)
14	UART_RXD	UART_RXD
15	I2C_SCK	Reserved
16	I2C_SDA	Reserved
17	VDDIO	Internal pull-up is 3.3V (no need to pull externally)
18	GND	GND
19	SW_BTN	High level – boot Low level – shutdown (Note: When using the module, this pin is pulled high, and when it is pulled low, it is turned off)
20	XO16MOUT	16M clock output
21	XOEN	XO16MOUT output enable control, active high or floating
22	AVDD_DIG	NC
23	AVDD_RF	VCC voltage: 3.3V

24	GND	GND
25	NC	NC
26	GND	GND

9. Detailed description of function pins:

1、P19 PIN (SW_BTN): module switch pin

Pin state	Module status
Input low level	Shut down
Input high level	Power on

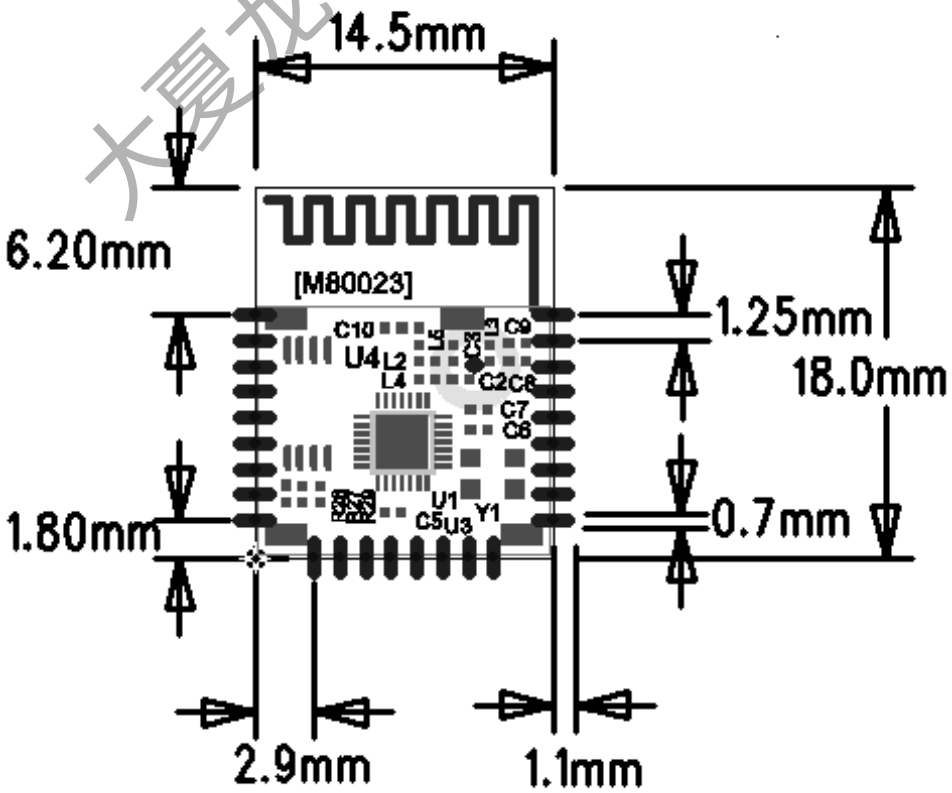
2、P6 PIN (STATUS_IND): connection status indicator pin

Pin state	Module status
Input low level	standby mode
Input high level	Connection Status

3、P5 PIN (MODULE_SELECT): mode selection pin

Pin state	Module status
Input low level	working mode
Input high level	Low power mode

10. Dimensions:



11. LAYOUT Precautions:

The DX-BT16 Bluetooth module works in the 2.4G wireless band. It should try to avoid the influence of various factors on the wireless transceiver. Pay attention to the following points:

1. the product shell surrounding the Bluetooth module to avoid the use of metal, when using part of the metal shell, should try to make the module antenna part away from the metal part.

2. The internal metal connecting wires or metal screws of the product should be far away from the antenna part of the module.

3. The antenna part of the module should be placed around the PCB of the carrier board. It is not allowed to be placed in the board, and the carrier board under the antenna is slotted. The direction parallel to the antenna is not allowed to be copper or traced. It is also a good choice to directly expose the antenna part out of the carrier board.

4. It is recommended to use insulating material for isolation at the module mounting position on the substrate. For example, put a block of screen printing (TopOverLay) at this position.

12. AT COMMAND

(Note: AT command mode when the module is not connected)

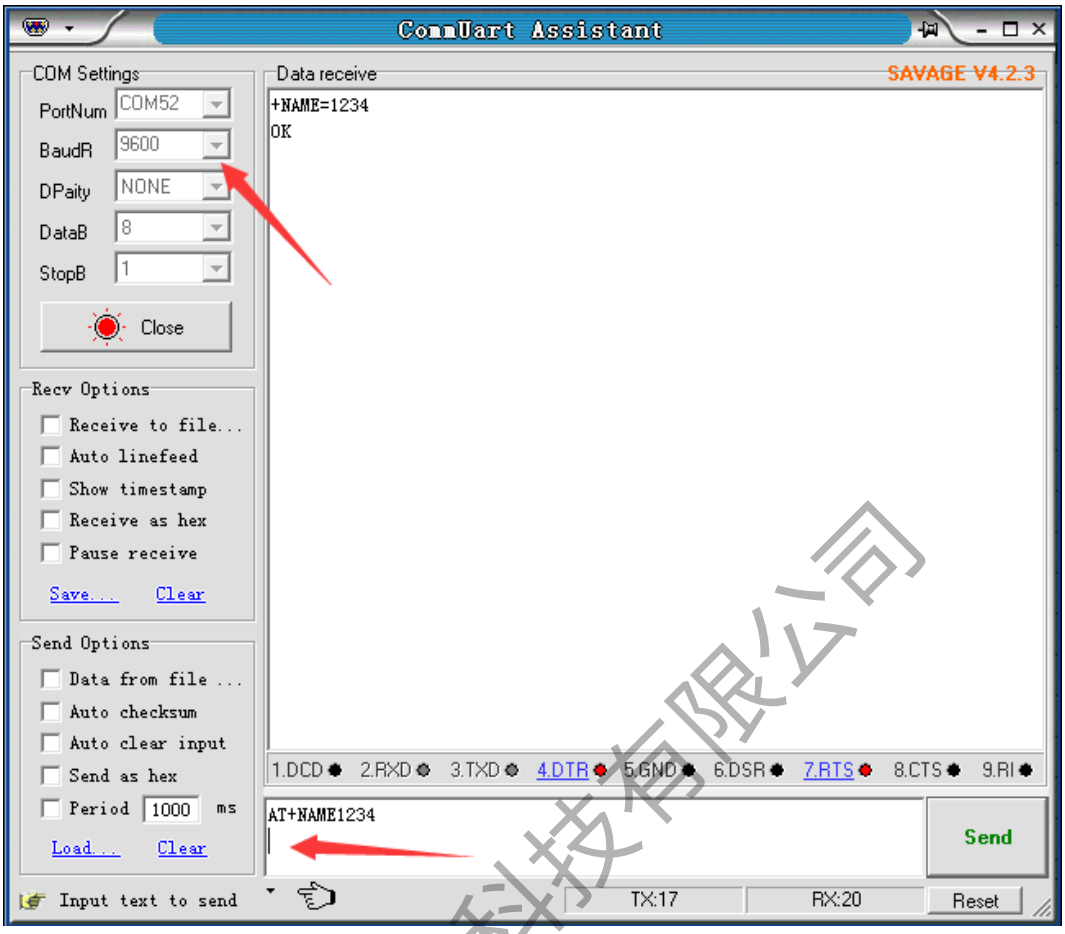
1. AT command, which belongs to the character line instruction, is parsed according to the line (that is, AT command must be returned by carriage return or \r\n, hexadecimal number is 0D0A)

2. The AT command supports case and the instruction prefix is AT+, which can be divided into parameter setting instructions and read instructions.

3. Set the instruction format: AT+<CMD><PARAM> Operation returns successfully: +<CMD>=<PARAM>\r\n OK\r\n Failure does not return characters.

4. Read instruction format: AT+<CMD>Operation succeeds: +<CMD>=<PARAM>\r\n Failure does not return a return character.

AT command format example (Figure is to change the Bluetooth name to 1234):



1、Get The Software Version:

Function	Command	Response	Description
Query version number	AT+VERSION\r\n	+VERSION=<version>\r\n OK\r\n	<version > Software version number

Note: The version will be different depending on different modules and customization requirements.

2、Set/Query Device Name:

Function	Command	Response	Description
Query module Bluetooth name	AT+NAME\r\n	+NAME=<name>\r\n	<name> Bluetooth name, up to 18 bytes Default name: BT16
Set the module Bluetooth name	AT+NAME<name>\r\n	+NAME=<name>\r\n OK	

Example:

1. Send Settings:

AT+NAME=DX-BT16\r\n ——Set module device name：“DX-BT16”

return：

+NAME=DX-BT16\r\n ——Set module device name：“DX-BT16” successed

OK\r\n

2. Send inquiry：

AT+NAME\r\n ——Query module name

return：

+NAME=DX-BT16\r\n ——Return module device name：“ BT16”

3、Set/Query - Serial Port Baud Rate:

Function	Command	Response	Description
Query module baud	AT+BAUD?\r\n	+BAUD=<baud>\r\n	<baud> Baud rate corresponding serial number 1:9600 2:19200 3:38400 4:57600 5:115200 Default：0 (9600)
Set the module baud	AT+BAUD=<baud>\r\n	+BAUD=<baud>\r\n OK\r\n	

Note: The module must be re-powered after setting the baud rate, enabling the new baud rate for data communication and AT command resolution.

Example: Setting the Serial Port Baud Rate: 38400

1. Send Settings:

AT+BAUD2\r\n

return：

+BAUD=2\r\n

OK\r\n

2. Send inquiry：

AT+BAUD\r\n

return：

+BAUD=2\r\n

OK\r\n

4、Software restart：

Function	Command	Response	Description
Software restart	AT+RESET\r\n	OK\r\n	

5、Set module UUID：(After the setting is successful, you need to turn off the Bluetooth and re-open it from the phone settings, the phone will take effect)

Function	Command	Response	Description
Set module UUID	AT+UUID<Param>\r\n	OK\r\n	<Param>：UUID DEFAULT UUID： FFE0FFE1FFE2 SERVICE UUID：FFE0 NOTIFY UUID：FFE1 WRITE UUID：FFE2

Example：SET SERVICE UUID：FF00、NOTIFY：FF11、WRITE UUID:FF22

1. Send Settings:

AT+UUIDFF00FF11FF22\r\n ——Set UUID：
SERVICE UUID：FF00
NOTIFY UUID：FF11
WRITE UUID ：FF22

return：

OK\r\n ——Set UUID successed

13. Contact us

Shen Zhen DX-SMART Technology Co., Ltd.

Address：511 ,Building C, Yuxing Technology Park, Yuxing Chuanggu, Bao'an District, Shenzhen, China

Tel: 0755-2997 8125

Fax: 0755-2997 8369

Website: http://www.szdx-smart.com/