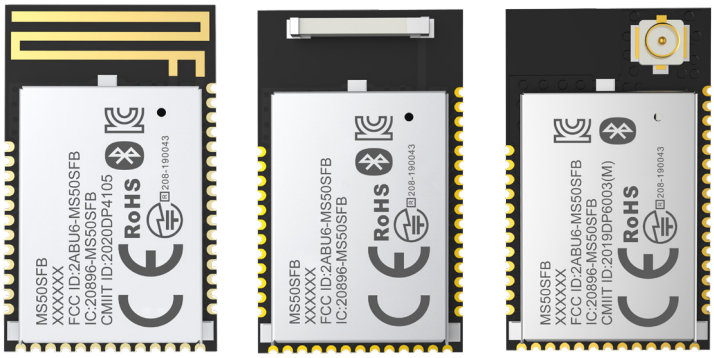
MINEWSEMI

# BLE Module
# MS50SFB




## Datasheet

V 1.0.0

# Version Note

| Version | Details | Contributor(s) | Date | Notes |
|---|---|---|---|---|
| 1.0.0 | First edit | Michelle | 2024.05.07 | |
| | | | | |
| | | | | |

# Part Numbers

| Model | Hardware Code |
|---|---|
| MS50SFB1 | 1Y32AI |
| MS50SFB2 | 2Y32AI |
| MS50SFB3 | 3Y32AI |

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# MS50SFB-nRF52832

## Bluetooth transparent slave module that supports serial port command configuration, power supply voltage detection, and iBeacon broadcast mode

The MS50SFB is a master slave module that can be switched into master/slave mode through instructions. Master and never can work simultaneously and can only be connected one-on-one. The device defaults to host mode. In main mode, devices can be scanned and connected through instructions. Scanning can set broadcast name filtering and MAC address filtering to obtain relevant devices. The connection can only be initiated by specifying a MAC address. The device communicates with the MCU through the UART interface. In command mode, the UART can send commands to modify the scan interval, scan timeout, connection interval, broadcast interval, broadcast custom data, baud rate, etc. MCU sends switching commands to the slave through UART, which has broadcast and connection status and can be connected by the host, serving as a bridge between the host and MCU for transparent data transmission.

## FEATURES

- The fastest transmission rate can reach 11kB/s
- Support serial port instruction configuration
- Support power supply voltage detection
- Support iBeacon broadcast mode

## KEY PARAMETER

| MS50SFB-nRF52832 | | | |
|---|---|---|---|
| **Chip Model** | Nordic nRF52832 | **Antenna** | PCB/Ceramic/IPEX |
| **Module Size** | 20×12×2mm | **GPIO** | 30 |
| **Flash** | 512kB | **RAM** | 64KB |
| **Receiving Sensitivity** | -96dBm | **Transmission Power** | -40~ +4dBm |
| **Current(TX)** | 0dBm-5.3mA | **Current(RX)** | 5.4mA |
| **Firmware** | Master slave switch transparent firmware | | |

## APPLICATION

Smart Buildings

Consumer Electronics

Intelligent Medical care

Smart Agriculture

Security Equipment

Automotive Equipment

## CERTIFICATION

Bluetooth® CE FC IC UKCA REACH RoHS

IC WPC RCM EN50498 WEEE SRRC TELEC

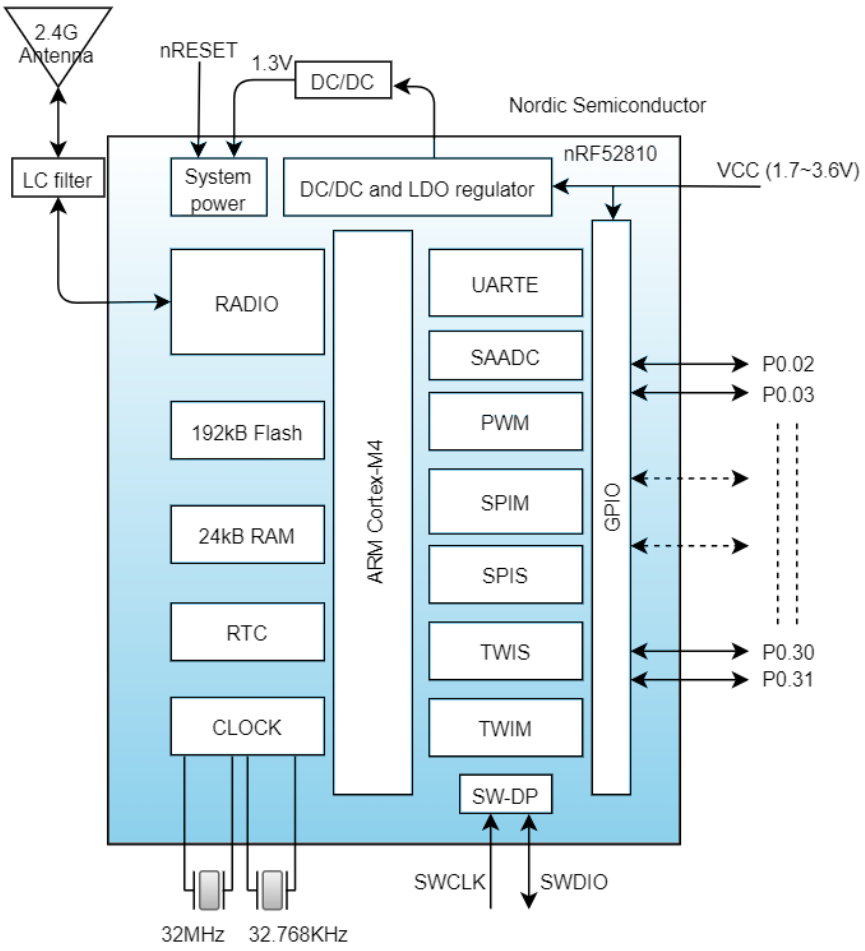
 

# INDEX



# 1 BLOCK DIAGRAM




# 2 ELECTRICAL SPECIFICATION

| Parameters | Value | Notes |
|---|---|---|
| Working Voltage | 1.7V-3.6V | To ensure RF work, supply voltage suggest not lower than 2.3V |
| Working Temperature | -40℃~+85℃ | Storage temperature is -40℃~+125℃ |
| Transmission Power | -40 ~ +4dBm | Configurable |
| Current(RX) | 5.4mA | RF receiving current under 1Mbps pattern |
| Current(TX) | 5.3mA | RF transmission current under 0dBm pattern |
| Module Dimension | 20*12*2mm | |
| Quantity of IO Port | 30 | |

# 3 CURRENT CONSUMPTION CHARACTERISTICS

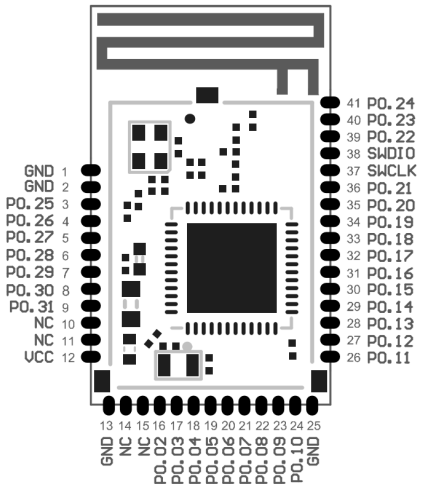
The following power consumption test is conducted at room temperature with a power supply voltage of 3.3V. The broadcast interval is 1s, and the maximum and minimum connection interval is 20-40ms. The calculation of service life is generally based on the average power consumption (Avg).

| Status / Consumption | Peak(mA) | Avg(mA) |
|---|---|---|
| Average current in sleep state (SLP pulled high、BTDATA pulled low) | 0.079 | 0.0002 |
| Broadcast average current (SLP pin is connected to GND, BTDATA is pulled high) | 5.997 | 0.0152 |
| Connection state average current (SLP pin is connected to GND, BTDATA is pulled high) | 6.179 | 0.118 |
| Transparent transmission average current (SLP, BTDATA pins are connected to GND, connected to mobile phones) | 6.634 | 0.4954 |

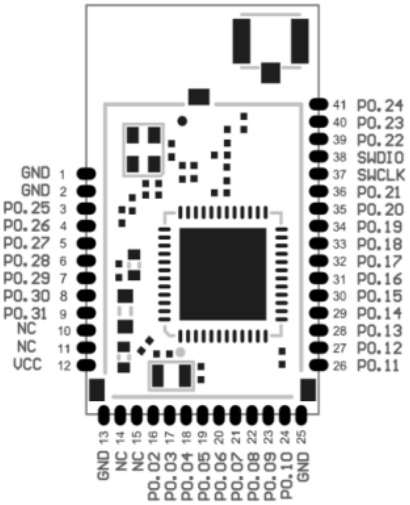
When in host mode, the power consumption is as follows: (The maximum and minimum connection interval is 20-40ms)

| Status / Consumption | Peak(mA) | Avg(mA) |
|---|---|---|
| Average current in sleep state (SLP pulled high、BTDATA pulled low) | 0.6085 | 0.0013 |
| Transparent transmission average current (SLP, BTDATA pins are connected to GND) | 6.6506 | 1.847 |

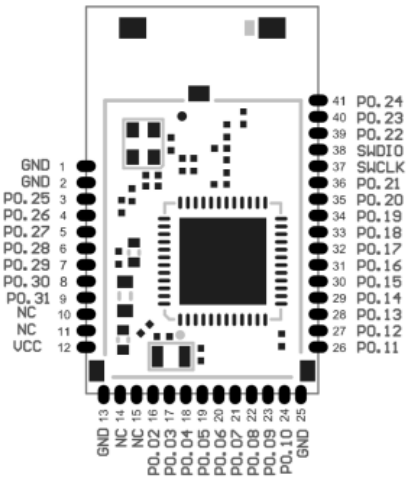
# 4 PIN DESCRIPTION




PCB Antenna




IPEX Antenna




Ceramic Antenna

# 5 PIN DEFINITION

| Pin Number | Symbol | Type | Definition | Notes |
|---|---|---|---|---|
| 1-2 | GND | GND | Ground | |
| 3~9 | P0.25 to P0.31 | | GPIO | Not used in UART, floating |
| 10 | DEC4 | | DCDC modulation input | In DCDC power supply mode, relevant DCDC circuits must be connected externally |
| 11 | DCC | | DCDC modulation output | In DCDC power supply mode, relevant DCDC circuits must be connected externally |
| 12 | VCC | VCC | Power Supply | |
| 13 | GND | GND | Ground | |
| 14~16 | P0.00 to P0.02 | | GPIO | Not used in UART, floating |
| 17 | P0.03 | BTX | UART TX | TX of Bluetooth Module |
| 18 | P0.04 | BRX | UART RX | RX of Bluetooth Module |
| 19~24 | P0.05 to P0.10 | | GPIO | Not used in UART, floating |
| 25 | GND | GND | Ground | |
| 26 | P0.11 | CON_IND | Connection indication | Sleep state: low level; Broadcast status: Low level; Connection status: High level |
| 27 | P0.12 | FIFO_FULL | Transmission space full | Determine if the transmission space is available when it is full<br>0: Bluetooth module has available space for transmission<br>1: Host stops transmitting and waits for free space to be released |
| 28~31 | P0.13 to P0.16 | | GPIO | Not used in UART, floating |
| 32 | P0.17 | SLP | Sleep/Awake | Low level to wake-up,high level to sleep, no floating |
| 33 | P0.18 | BTDATA | Serial port control | Serial port on / off to control pin, no floating<br>0: serial port open, can send and receive serial port data<br>1: Serial port off |
| 34~36 | P0.19 to P0.21 | | GPIO | Not used in UART, floating |
| 37 | SWCLK | | Burn clock pin | Used for burning firmware |
| 38 | SWDIO | | Burn data pin | Used for burning firmware |
| 39~41 | P0.22 to P0.24 | | GPIO | Not used in UART, floating |

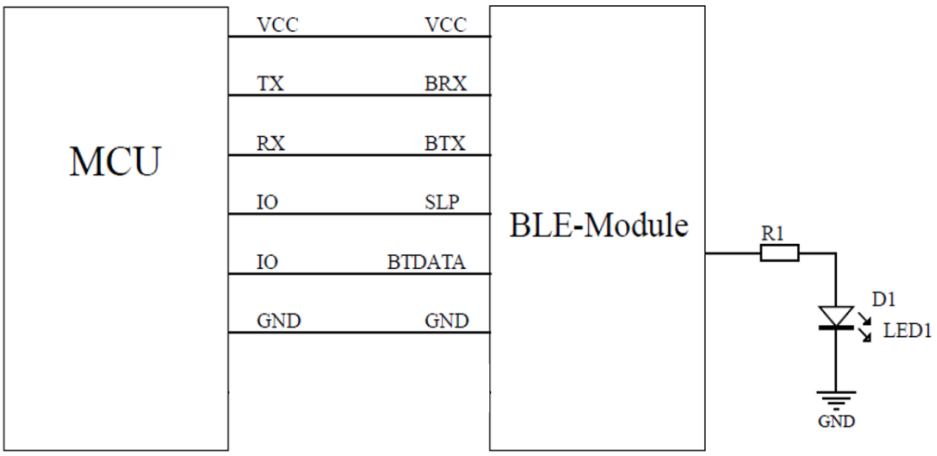
 

# 6 MODULE OPERATION INSTRUCTION

## 6.1 Tool

PC serial port assistant: Baidu "Friendly Serial Port Assistant" can be downloaded. The PC serial port assistant is used to debug the UART interface of the module.

## 6.2 Demonstration of module application




### 6.2.1 Power supply

The SoC working voltage is 1.7V-3.6V, to ensure a stablefunction, supply voltage should be 3.0V-3.6V.

### 6.2.2 SLP(Sleep/Awake)

When pull SLP low, the module in broadcast mode. BLE device can be found by smartphone APP, Device name: Minew_Vxxxxx(default) name, module can be connected with smartphone and enters connection mode. When pull SLP high, device will enter sleep mode.

> ⚠ Note: This pin cannot be left floating to avoid unpredictable errors.

### 6.2.3 BTDATA(UART control)

The BTDATA pin is only valid when SLP is low. SLP is low, BTDATA is low, and when the module is in a broadcast state, all UART data will be considered as instructions. When the module is connected, all data is considered transparent.

> ⚠ Note: This pin cannot be left floating to avoid unpredictable errors.

### 6.2.4 UART interface:TX and RX

When both SLP and BTDATA in low level,UART port will be activated,the module TX and RX should be connected to MCU RX and TX,then start to communicate through UART.
In the test,module TX and RX can be connected with an UART to USB module's RX and TX pin， then send command through Serial Port Utility App from PC.

> Note：The TX and RX of 2 modules can be connected reversed, each module connect with a smart phone, then transfer date over BLE between each smart phone.

### 6.2.5 CON_IND

CON_IND is uded to indicate module status,high level in connection mode, low level in sleep or broadcast mode to wake up MCU and safe power.

### 6.2.6 FIFO_FULL

FIFO_FULL is used to indicate whether the cache is full or not. When sending large amount of data from MCU to module, this pin can be added to judge. If it is high, then the FIFO is full, and you can not continue to send UART data at this time to avoid packet loss.

### 6.2.7 Command instruction

After connecting VCC and GND, the SLP and BTDATA pins are directly grounded. At this time, the module is in an unconnected state, that is, the module is in command mode and the serial port is turned on. Instructions can be sent to set and query parameters.
For all device instructions, the returning result is the same:
54544D3A4F4B0D0A00(TTM:OK\r\n\0) is returned after command sent successfully
54544D3A4552500D0A00 (TTM:ERP\r\n\0) is returned after command failed
After sending the correct setting command, the parameters take effect immediately (the baud rate only takes effect after sending the reset command), and the power outage will not be saved at this time. Only after sending the reset command will it be saved to flash.
Below is the list of setup instructions：

> Note：The first line in the command list should be sent by Hex format, the second line should be sent by ASCII format. When checking the parameter, the returned result are all hexadecimal numbers, so you need to use hexadecimal numbers to parse the command.phone.

After SLP and BTDATA are grounded, the device is in the host state, and the host related parameters include scan timeout, scan interval, and connection interval. The command to set the connection interval is effective for both the host mode and the slave mode. Scan timeout and scan interval are only valid under the host module:

| Function | Command（hex/ASCII） | Description |
|---|---|---|
| Setting the scan timeout | 54544D3A5343542D<Para><br>TTM:SCT-<Para> | Length: 1 Byte, Values: 0-29, Para*5S, 0 means scanning all the time and output scanning result in real time. |
| Query Scan Timeout | 54544D3A5343543F<br>TTM:SCT? | Return TTM:SCT-<Para>\r\n\0, Para: Hexadecimal |
| Setting the scanning interval | 54544D3A5349572D<Para><br>TTM:SIW-<Para> | Length: 1 Byte,Value: 0-100,Para*10S |
| Query Scan Interval | 54544D3A5349573F<br>TTM:SIW? | Return TTM:SIW-<Para>\r\n\0, Para: Hexadecimal |
| Setting up RSSI filtering | 54544D3A5253492D<Para><br>TTM:RSI-<Para> | Value: -120 ~ -30dBm, if less than -100dbm, then disable RSSI filtering. |
| Query RSSI Filtering | 54544D3A5253493F<br>TTM:RSI? | Return TTM:RSI-<Para>\r\n\0, Para: Hexadecimal |
| Setting up broadcast name filtering | 54544D3A404E462D<Para><br>TTM:AVF-<Para> | Length: 16 Byte, Value: ASCII code |
| Query Broadcast Name Filtering | 54544D3A404E463F<br>TTM:ANF? | Return TTM:ANF-<Para>\r\n\0, Para: Hexadecimal |
| Cancel broadcast name filtering | 54544D3A404E462D<br>TTM:ANF- | Cancel broadcast name filtering |
| Setting up MAC address filtering | 54544D3A4D41462D<Para><br>TTM:MAF-<Para> | Length: 6 Byte, value: hexadecimal number |
| Query MAC Address Filtering | 54544D3A4D41463F<br>TTM:MAF? | Return TTM:MAF-<Para>\r\n\0, Para: Hexadecimal |
| Cancel MAC address filtering | 54544D3A4D41462D | Cancel MAC address filtering |

Note: RSSI, broadcast name and MAC address filtering are added to make it easier to locate the device; only one of MAC address filtering and broadcast name filtering can be effective at the same time; when MAC address filtering is turned on, broadcast name filtering will be turned off automatically; when broadcast name filtering is turned on, MAC address filtering will be turned off automatically.

As a host, you need to send relevant commands to let the device enter the Bluetooth state, such as scanning and initiating a connection to a certain device, and after connecting, when transmitting data, you will judge all the data whether it is a disconnect command.

| Function | Command（hex/ASCII） | Description |
|---|---|---|
| Turn on scanning | 54544d3a5343414e<br>TTM:SCAN | Command correctly return: TTM:SCAN-NING\r\n\0, error return TTM:ERP\r\n\0, after scanning to the device serial port output 10 RSSI value of the strongest device, scanning timeout is 0 or MAC address filtering scanning output results format 0xAA + MAC + RSSI + adv_data + 0x0D0A, the rest of the output for MAC + broadcast name |
| stop scanning (computing) | 54544d3a5343414e2d53544f50<br>TTM:SCAN-STOP | The instruction returns correctly: TTM:SCAN-STOP\r\n\0, incorrectly returns TTM:ERP\r\n\0 |
| Connect to the specified MAC | 54544D3A434F4E4E2D <MAC><br>TTM:CONN-<MAC> | Command return: TTM:CONNING\r\n\0, indicating connection in progress TTM:CONN-TOUT\r\n\0, connection timeout TTM:NO-DEVICE\r\n\0, device not found TTM:CONN-MAC-XXXXXXXXXXXX\r\n\0, connected TTM:MAC-DCON-XXXXXXXXXXXX\r\n\0, Disconnect TTM:ERP\r\n\0, Command Error |
| Disconnect all connections | 54544D3A444953432D414C4C<br>TTM:DISC-ALL | Correctly return TTM:DISC-XXXXXXXXXXXX XXX\r\n\0, incorrectly return TTM:ERP\r\n\0 |

> ⚠ Note: The above commands are only valid in host mode, sending these commands when the device role is not host will return TTM:ERP\r\n\0.
> Except for the above four commands, all other device commands, whether in master or slave mode, will return TTM:OK\r\n\0 as long as they fulfill their parameter range requirements, and the parameters will take effect when the corresponding roles are in effect.

A master device can initiate a connection to a slave device with a specified MAC and enter connection mode. When the MAC address of the desired connected device is known, the connection command can be sent directly without scanning.

When the device is switched from master mode to slave mode, it is necessary to first ensure that the device is in the unconnected state, call the set role command, and then call the reset command, which can successfully switch to the slave role, and vice versa.

| Function | Command（hex/ASCII） | Description |
|---|---|---|
| Setting up the rol | 54544D3A524F4C2D <Para><br>TTM:ROL-<Para> | Length: 1 Byte,Values: 0-1, 0 for slave mode, 1 for master mode |
| Query Role | 54544d3a524f4c3f<br>TTM:ROL? | Return to TTM:ROL-<Para>\r\n\0, Para: Hexadecimal |

When in slave mode, you can set and query many parameters of the broadcast process and connection process as follows:

| Function | Command（hex/ASCII） | Description |
|---|---|---|
| Setting the broadcast name | 54544D3A52454E2D <Para><br>TTM:REN-<Para> | Length: 1-16 Byte,Value: ASCII |
| Query broadcast name | 54544d3a52454e3f<br>TTM:REN? | Return TTM:REN-<Para>\r\n\0, Para is ASCII |
| Setting the broadcast interval | 54544D3A4144502D <Para><br>TTM:ADP-<Para> | Length: 1 Byte, value: 1-20, corresponding to broadcast interval 1*100ms. |
| Query broadcast interval | 54544D3A4144503F<br>TTM:ADP? | Return TTM:ADP-<Para>\r\n\0, Para: Hexadecimal |
| Setting the transmit power | 54544D3A54504C2D <Para><br>TTM:TPL-<Para> | Length: 1 Byte, Values: 0-7, corresponding to -40, -20, -16, -12, -8, -4, 0, +4 (unit: dB) |
| Query Transmit Power | 54544D3A54504C3F<br>TTM:TPL? | Return TTM:TPL-<Para>\r\n\0, Para: Hexadecimal |
| Setting the broadcast data | 54544D3A4144442D <Para><br>TTM:ADD-<Para> | Length: 1-16 Byte, value: any hexadecimal number |
| Query Broadcast Data | 54544D3A4144443F<br>TTM:ADD? | Return TTM:ADD-<Para>\r\n\0, Para: Hexadecimal |
| Setting the factory ID | 54544D3A5049442D <Para><br>TTM:PID-<Para> | Length: 2 Byte, value: any hexadecimal number |
| Query Factory ID | 54544D3A5049443F<br>TTM:PID? | Return TTM:PID-<Para>\r\n\0, Para: Hexadecimal |
| Setting the Service UUID | 54544D3A5549442D <Para><br>TTM:UID-<Para> | Length: 6Byte, (2 Byte service uuid+2 Byte rx UUID+2 Byte tx UUID) Values: Any hexadecimal number, service, rx, tx UUID can't be the same. |
| Query Service UUID | 54544D3A5549443F<br>TTM:UID? | Return TTM:UID-<Para>\r\n\0, Para: Hexadecimal |

| Function | Command（hex/ASCII） | Description |
|---|---|---|
| Setting the broadcast mode | 54544D3A4D4F442D <Para><br>TTM:MOD-<Para> | Set device broadcast packet format: 0: pass-through broadcast packet<br>1: iBeacon broadcast packet, you can see the specific broadcast packet format instructions |
| Query broadcast mode | 54544d3a4d4f443f<br>TTM:MOD? | Return TTM:MOD-<Para>\r\n\0,<br>Para: Hexadecimal |
| Setting the UUID | 54544D3A4149442D <Para><br>TTM:AID-<Para> | Length: 16 bytes, value: any hexadecimal number |
| Query UUID | 54544D3A4149443F<br>TTM:AID? | Return TTM:AID-<Para>\r\n\0,<br>Para: Hexadecimal |
| Set Major | 54544D3A4D414A2D<Para><br>TTM:MAJ-<Para> | Length: 2 bytes, value: any hexadecimal number |
| Query Major | 54544D3A4D414A3F<br>TTM:MAJ? | Return to TTM:MAJ-<Para>\r\n\0,<br>Para: Hexadecimal |
| Set Minor | 54544D3A4D494E2D <Para><br>TTM:MIN-<Para> | Length: 2 bytes, value: any hexadecimal number |
| Query Minor | 54544d3a4d494e3f<br>TTM:MIN? | Return TTM:MIN-<Para>\r\n\0,<br>Para: Hexadecimal |
| Setting the connection mode | 54544D3A5057452D <Para><br>TTM:PWE-<Para> | Whether the device requires a password to connect, 0: no password required to connect<br>1: Connection password required |
| Query Connection Mode | 54544D3A5057453F<br>TTM:PWE? | Return TTM:PWE-<Para>\r\n\0,<br>Para: Hexadecimal |
| Setting the connection password | 54544D3A5057442D <Para><br>TTM:PWD-<Para> | Length: 1-8 bytes, value: ASCII, the correct password must be entered within 5s on the connection, otherwise the connection will be disconnected |
| Query connection password | 54544D3A5057443F<br>TTM:PWD? | Return to TTM:PWD-<Para>\r\n\0,<br>Para:ASCII |

Whether it is the host mode or the slave mode, all the setting commands need the reset command to take effect. while the query command will return the relevant parameters, and the command error will return TTM:ERP\r\n\0. For the whole device, the baud rate, and the connection interval commands take effect regardless of whether it is the host mode or the slave mode.

| Function | Command（hex/ASCII） | Description |
|---|---|---|
| Setting baud | 54544D3A4250532D <Para><br>TTM:BPS-<Para> | Length: 1 Byte, Values: 0-4, corresponding to 9600/ 19200/38400/57600/115200 (unit: bps) respectively. |
| Query baud | 54544D3A4250533F<br>TTM:BPS? | Return TTM:BPS-<Para>\r\n\0, P ara: Hexadecimal |
| Setting connection interval | 54544D3A4349542D <Para><br>TTM:CIT-<Para> | Length: 1 Byte, <Para> can only be represented in hexadecimal as 0x01~0x64; The actual connection interval is (<Para>*10~<Para>*10+20)ms |
| Query connection interval | 54544D3A4349543F<br>TTM:CIT? | Return TTM:CIT-<Para>\r\n\0, Para: Hexadecimal |
| Retrieve MAC address | 54544D3A4D4143(2D)3F<br>TTM:MAC-? or TTM:MAC? | Return TTM:MAC-<Para>\r\n\0, Para: Hexadecimal |
| Read version information | 54544D3A564552(2D)3F<br>TTM:VER-? or TTM:VER? | Return to TTM:VER-<Para>\r\n\0, Para:ASCII |
| Restore factory equipment | 54544D3A5253542D464143<br>TTM:RST-FAC | Consistent with the return of the setup command |
| Reset | 54544D3A5253542D535953<br>TTM:RST-SYS | Success will return TTM:OK\r\n\0 |

## 6.3 Example of operation

### 6.3.1 Factory Default Parameters

Broadcast Name: Minew_Vxxxxx
Serial port baud rate: 9600bps,8N1
Transmit power: 0dBm
Minimum and maximum connection interval: 20ms - 40ms
Device Role: Host
**Default parameters related to host mode:**
Scanning timeout: 10s
Scanning interval: 100ms

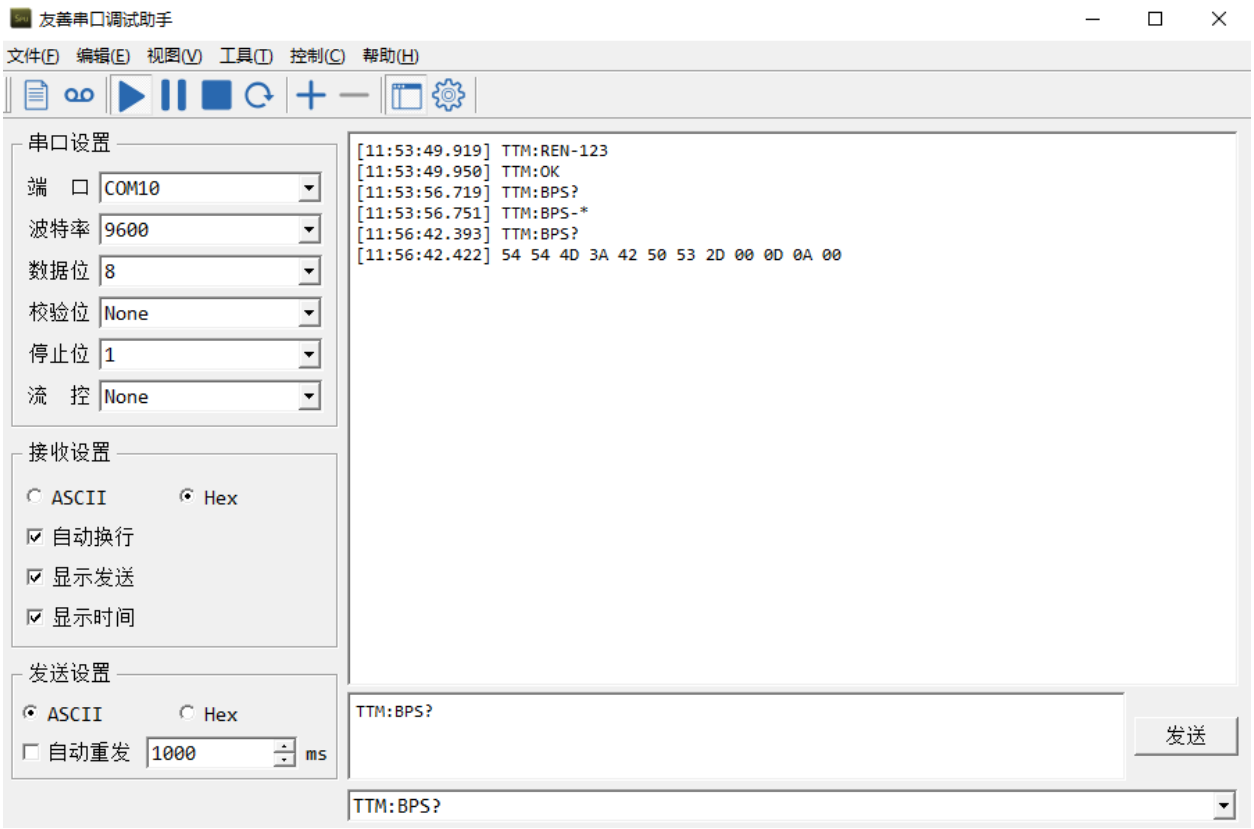
**Default parameters related to slave mode:**
Broadcast interval: 1s
Broadcast mode: transparent broadcast package
Custom data: Minew Tech
Connection password enable: not enabled
Connection password: minew123
Major: 0x1234
minor: 0x1235
UUID: 74278BDA-B644-4520-8F0C-720EAF059935
DC_ RC: No DCDC, internal 32k

## 6.3.2 Example of Modifying Parameters

Connect all the pins according to the wiring, ground SLP and BTDATA, the device enters the unconnected state, at this time you can set the parameters, whether it is the host mode or the slave mode, all the parameters can be set, the parameters take effect immediately. Parameters after taking effect can only be reflected under the corresponding role. For example, if the broadcast name of the device is changed in the host mode, the parameters will take effect, but only when the device is switched to the slave mode will you see that the broadcast name has been changed. After sending the reset command, all the parameters are powered down and saved.

> Note: When you need to modify multiple parameters, you can send all the setting commands first and then send the reset command.

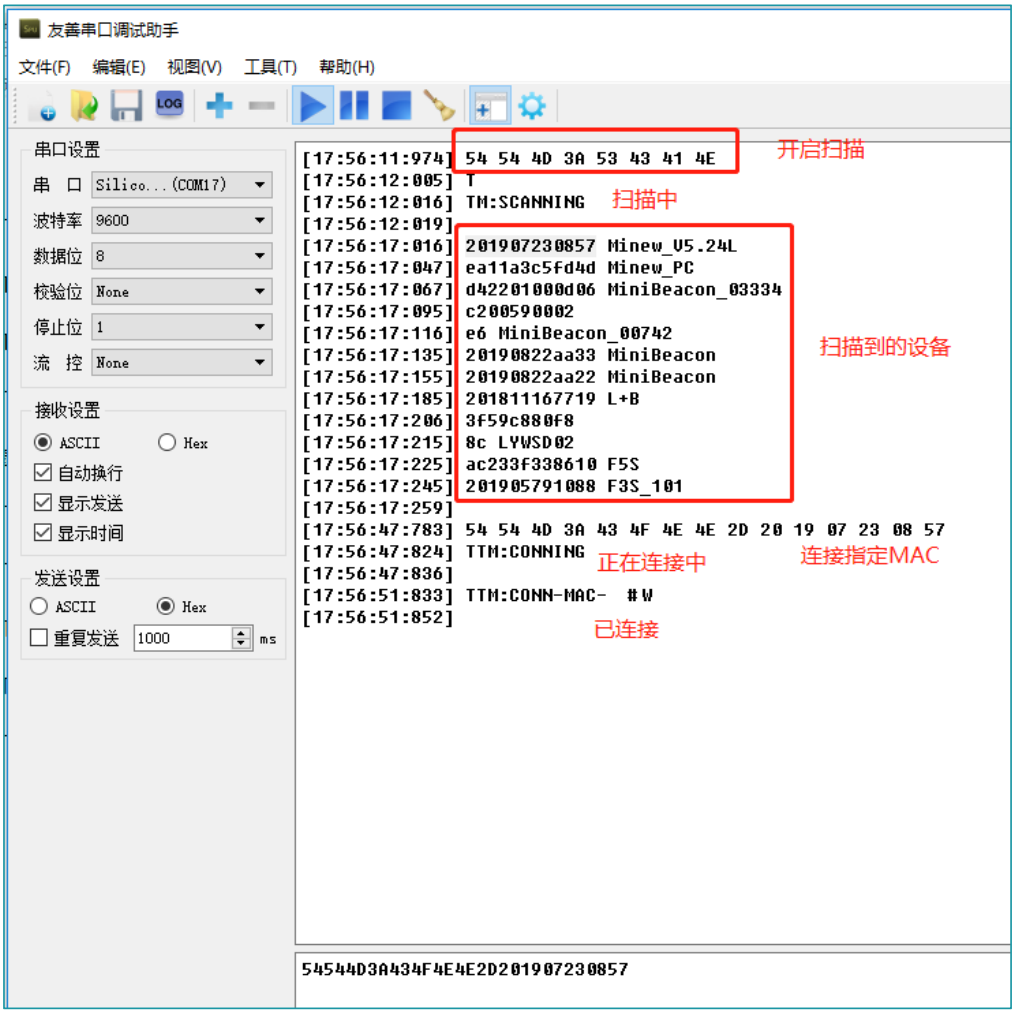



When querying the device parameters, because the parameters are hexadecimal numbers, when selecting the ASCII display, the parameter position may be garbled, at this time, you need to set to HEX display, the parameters correspond to the position after 2D, see the above figure, query the baud rate, you need to use the HEX display to view the specific parameters.

## 6.3.3 Scanning devices and connections

Send the 54544D3A5343414E (TTM:SCAN) command to scan for a device and obtain its MAC address. The scanned device returns MAC + broadcast name information. Send the 54544D3A434F4E4E2D201907230857 command and the module will connect the device with MAC address 20:19:07:23:08:57. The device connected will return TTM:CONN-MAC-XXXXXXXXXXXX\r\n\0. Since MAC is a hexadecimal number, the entire command is sent as a hexadecimal number. Once connected you can perform data passthrough.




## 6.3.4 Mainframe Transmission

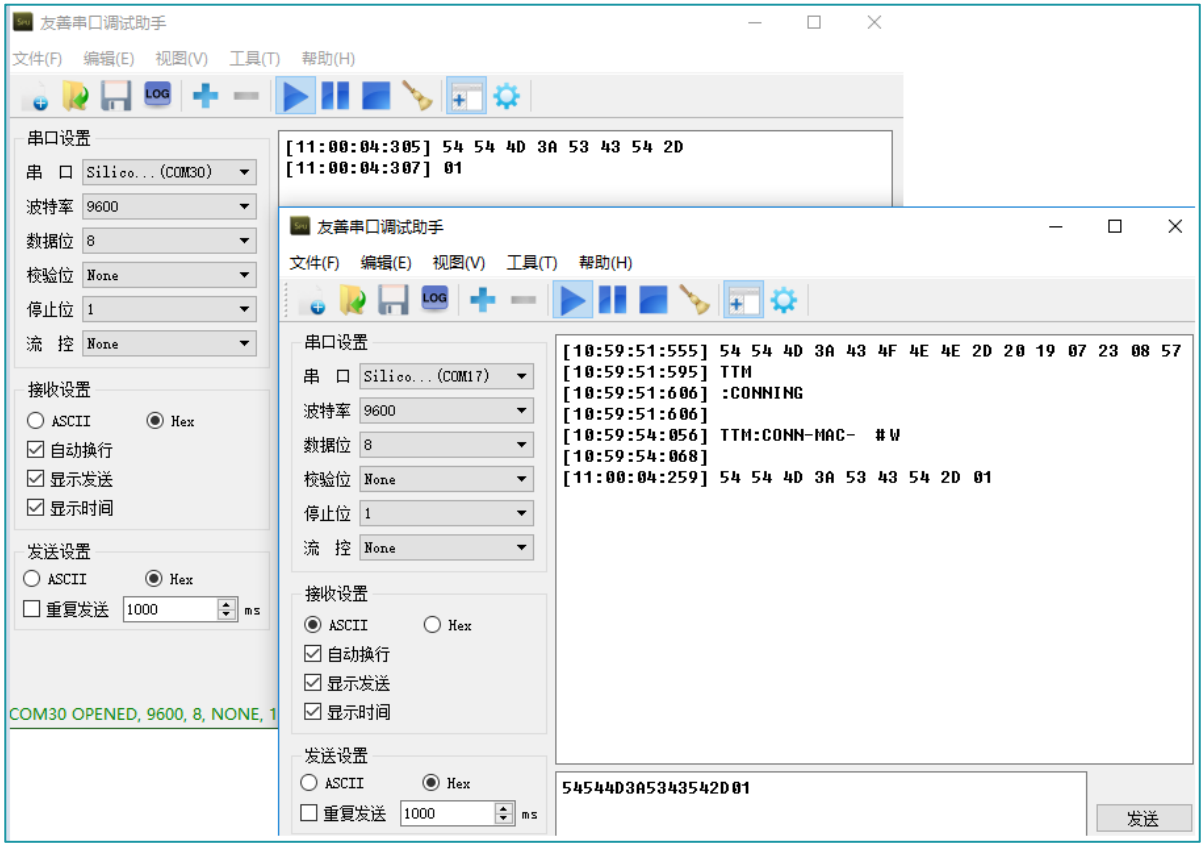
Data passthrough is possible after the connected command is returned in step 7.3 The prerequisite for correct communication between the module and the slave device is that the slave device must have the same services, features, and their UUIDs and attributes as the module.

Relevant information is provided below:

| Eigenvalue UUID | Executable operation | Packet length | Note |
|---|---|---|---|
| FFF1 | notify | 244 | Module data reception, the data sent from the device to the module shall not exceed 244 Byte per packet. |
| FFF2 | write | 244 | Module data sending, the module has to do automatic packetization, data more than 244 Byte will be automatically divided into 244 packets sent to the slave device. |

As an example, the master module connects to the passthrough slave module, and then sends the data after connecting.



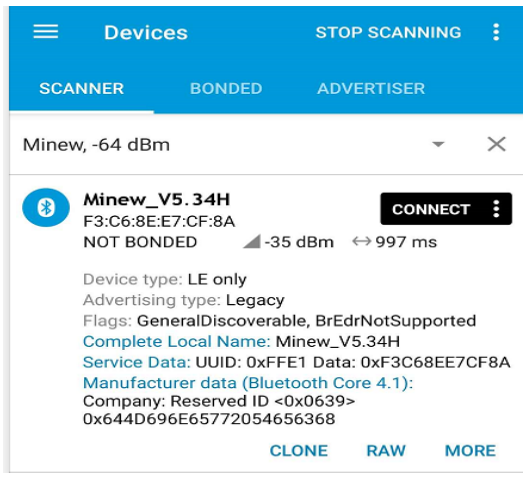

## 6.3.5 Slave Radio

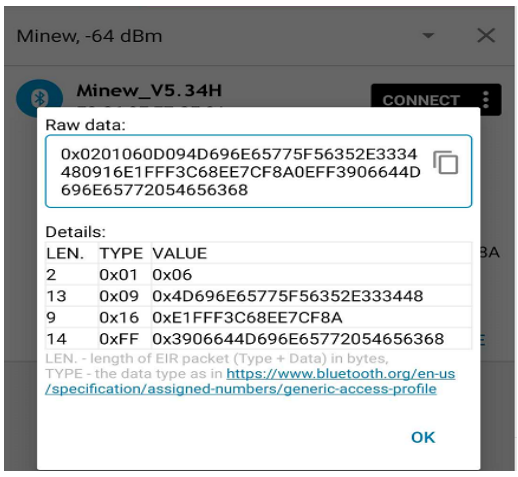
After setting the device role to slave mode with the command TTM:ROL-0, data can be transmitted to and from the cell phone. With the SLP pin low, the device is in broadcast state. Use nrf connect to scan the device, click Raw after scanning to the device, Raw data is the unparsed data of the scanned device. After parsing the data according to BLE data type, see Detail section, BLE broadcast data has a certain format: length + type + content.

The content is changeable, the type is fixed and the length is determined by the content. There are two broadcast formats for the device, the pass-through broadcast packet and the iBeacon broadcast packet. Both formats contain four types: flag(0x01), broadcast name(0x09), service data(0x16), and manufacturer data(0xFF).

The following figure shows the transmitting broadcast packet: flag, broadcast name, service data is put in the broadcast packet, manufacturer data is put in the reply packet. The service data content is: service data UUID(E1FF) + MAC address. manufacturer data content consists of company id(3906) + battery level information(1 byte) + custom data.

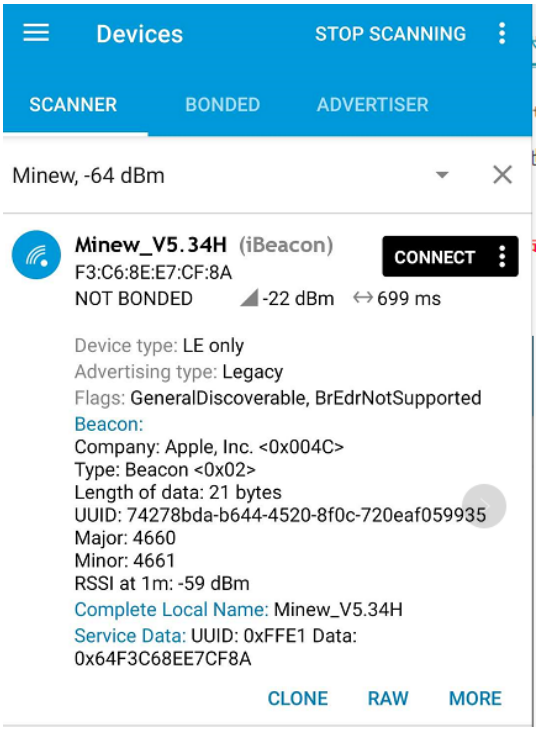


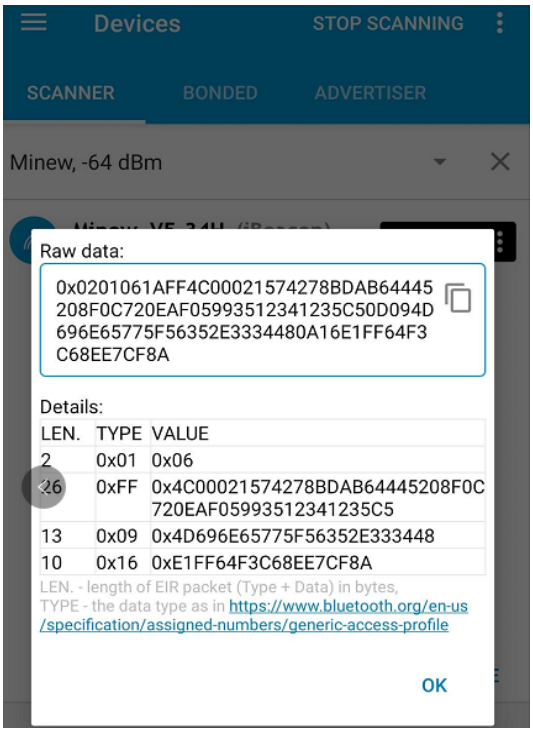




Note: The IOS side can not get the content of the MAC address field, so the MAC address is put back into the broadcast packet to ensure that the IOS side can get the device MAC address. In addition, the WeChat applet can't get the reply packet, so the MAC is put into the service data of the broadcast packet to ensure that the IOS side can also get the device MAC address using the WeChat applet connection.

The following figure shows the iBeacon broadcast packet: flag, manufacturer data is put in the broadcast packet, service data and broadcast name are put in the reply packet. The broadcast packet must follow this fixed format to fulfill the iBeacon protocol definition. In manufacturer data data, 4C 00 is Apple's company id, 02 15 is iBeacon's fixed format, Proximity uuid(16 bytes)+Major(2 bytes)+Minor(2 bytes)+Measured power(1 byte). In iBeacon broadcast mode, manufacturer data can only change the value of Proximity uuid, Major, Minor.

service data= service data UUID(FFE1) + battery level information + MAC address.



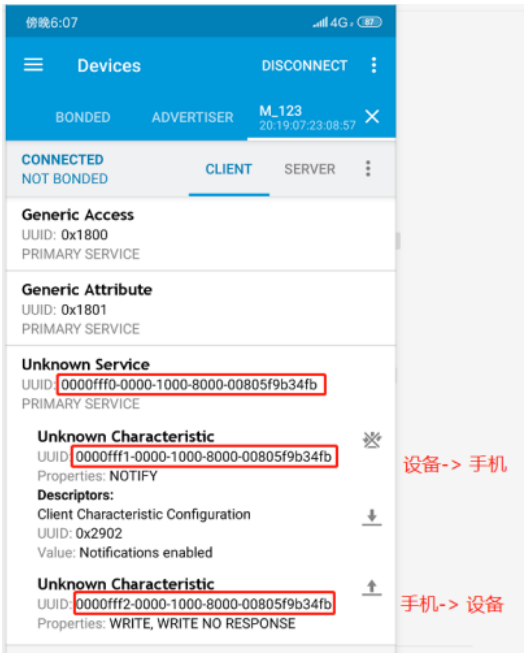

 

### 6.3.6 Slave transponder

Based on 7.2, connect to the device using the mobile app and keep the BTDATA pin low to perform data passthrough. when BTDATA is not low, it does not affect the broadcasting and connecting of the device, just that passthrough is not possible. Using nRF connect, you can see the specific service, characteristic and corresponding properties.

The UUID consists of the alias UUID (2 byte, 3.4 byte on the left in the figure) + the base UUID (the remaining 14 byte).

The base UUID used for services, features in the passthrough program is standard and is illustrated below with the alias UUID.



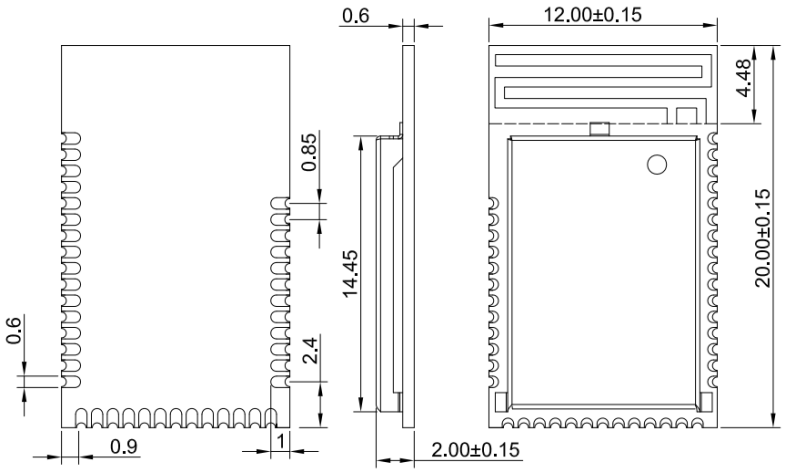

FFF0 is the service UUID, FFF1 is the cell phone receives data and the module sends data; FFF2 is the cell phone sends data and the module receives data.

| Eigenvalue UUID | Executable operation | Maximum Packet Length | Note |
|---|---|---|---|
| FFF1 | notify | 244 | The serial port sends data to the module and forwards it to the phone. Data can only be obtained after the phone is enabled to notify. The maximum number of bytes emitted by a module packet is 244 bytes<br>Note: This process is automatically subcontracted by the firmware, and it is not necessary to subcontract according to the length of a packet. However, the maximum length of each packet cannot exceed 512, and the transmission interval needs to consider the rate, otherwise it may cause packet loss, disconnection, and other situations. |
| FFF2 | write | 244 | The phone sends data to the module and forwards it to the serial port. When using the API interface function to write data, the maximum length of data written at one time is 244 bytes |

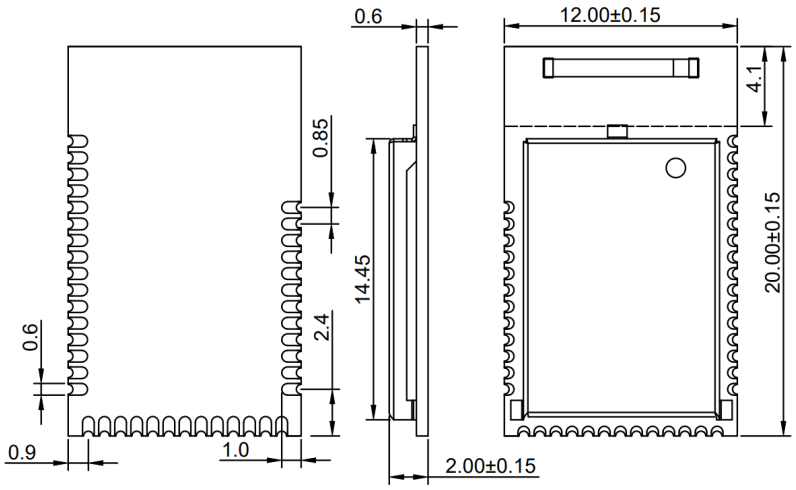
 

# 7 MECHANICAL DRAWING

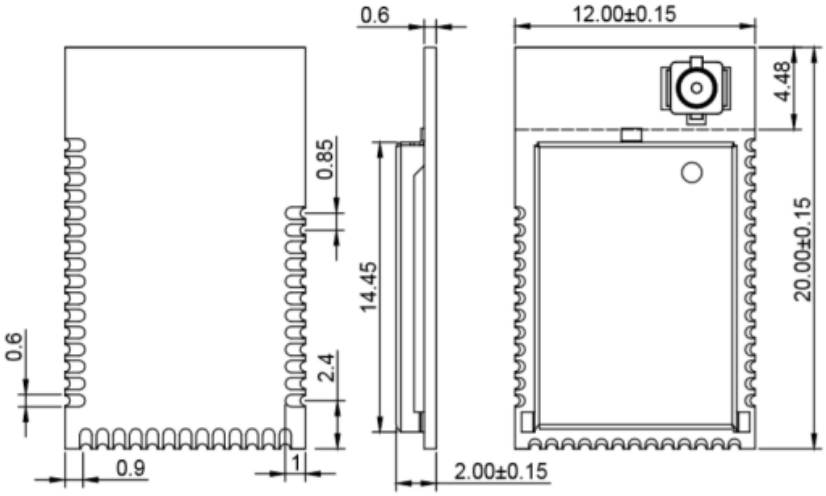
## PCB Antenna




## Ceramic Antenna




## IPEX Antenna

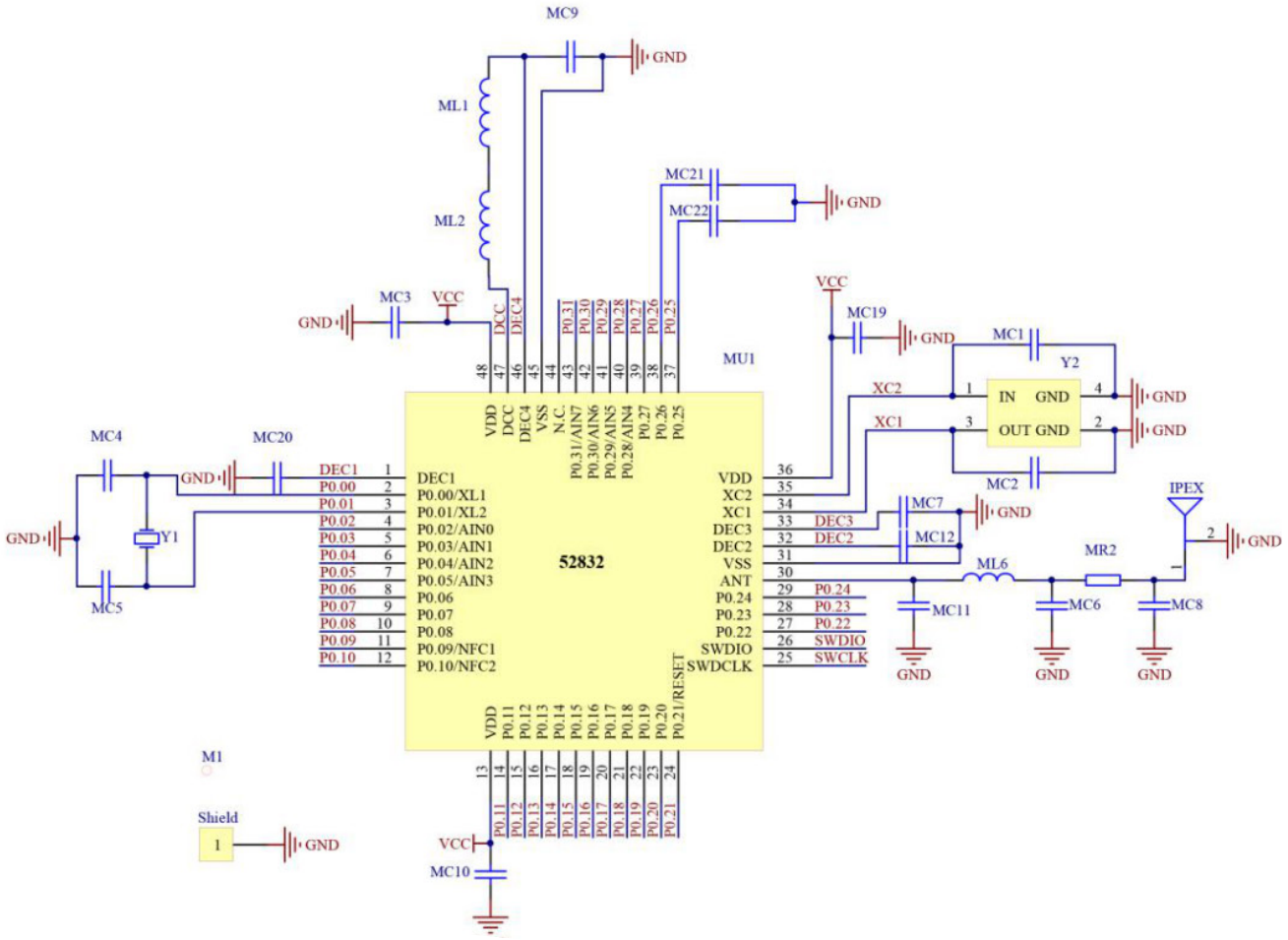


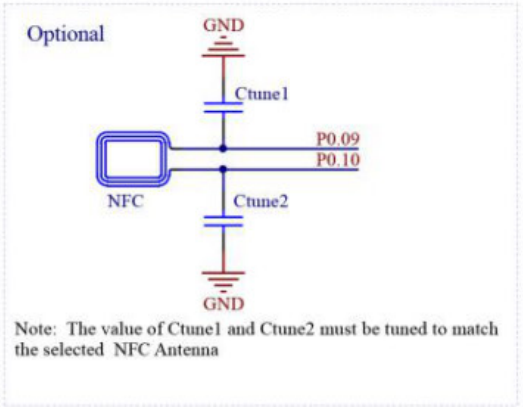

Default unit: mm Default tolerance: ±0.15

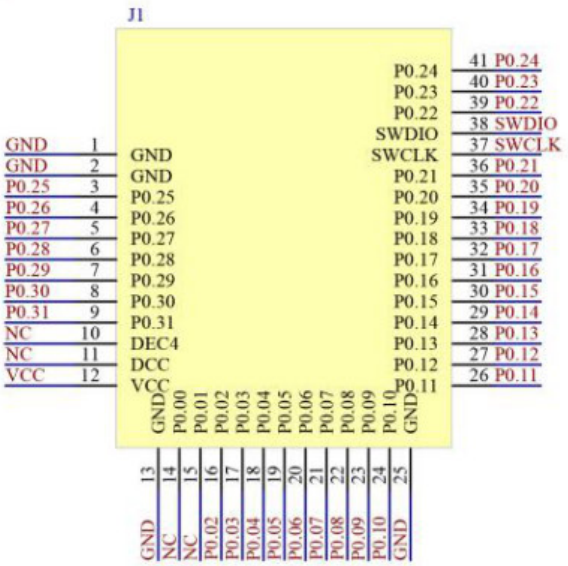
Notice: The recommended pad size is 1.7*0.6mm with a pad extension of 0.5mm

# 8 ELECTRICAL SCHEMATIC




Notice: Before placing an order, please confirm the specific configuration required with the salesperson.

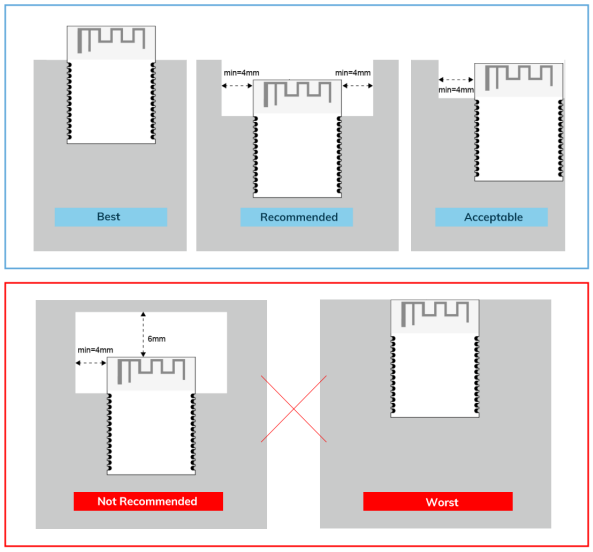
# 9 PCB LAYOUT

There should be no GND plane or metal cross wiring in the module antenna area, and no components should be placed nearby. It is best to make a hollow or clear area, or place it on the edge of the PCB board. The reference example is as follows:

> Notice: It is strongly recommended to use the first design method. The module antenna design is debugged according to the first wiring.

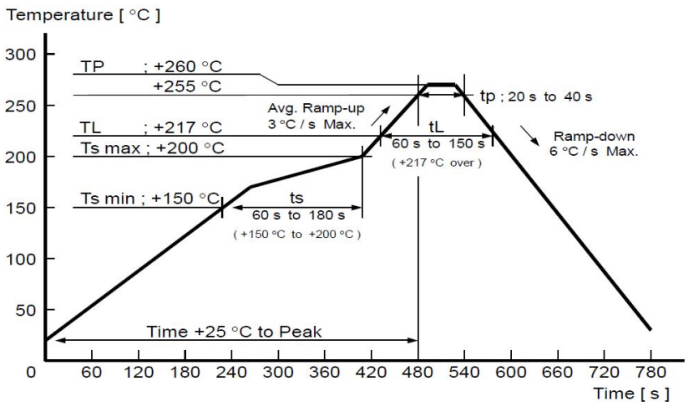
**Layout Notes**:

1)The module's antenna area should be completely clear of any metal obstructions to avoid affecting antenna performance (as shown in the diagram).
2)Outside the module's antenna area, try to maintain a solid copper pour to minimize interference from the mainboard signal lines or other sources.
3)A clear area of at least 4mm should surround the module's antenna (including its casing) to reduce interference with the antenna.
4)Ensure good grounding for components to minimize parasitic inductance.
5)Do not place copper under the module's antenna to prevent interference with signal radiation, which could affect transmission distance.
6)The antenna should be kept away from other circuits to maintain radiation efficiency and avoid impacting the normal operation of other circuits.
7)Position the module as close to the edge of the circuit board as possible, away from other circuitry.
8) It is recommended to use a ferrite bead for isolation when connecting the module to the power supply.



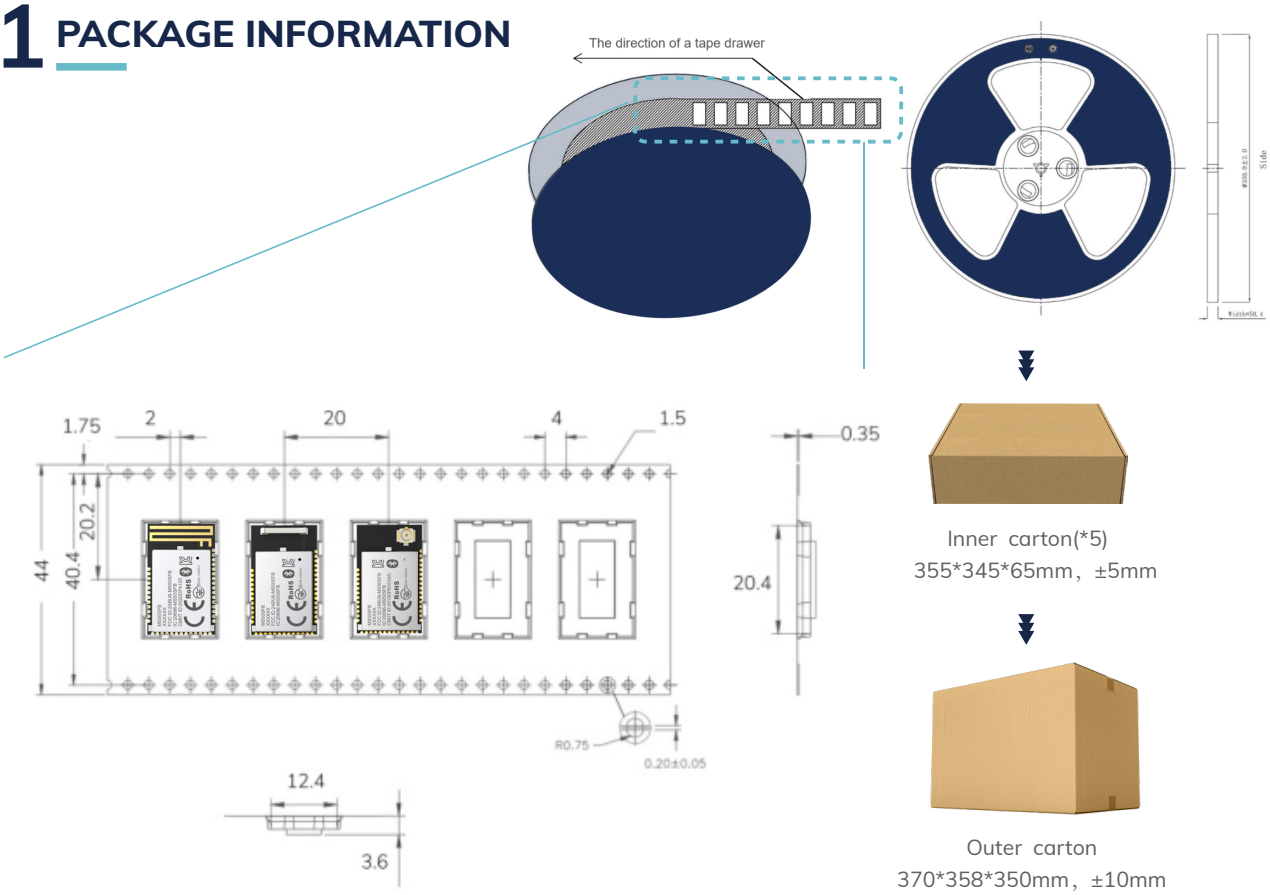

# 10 REFLOW AND SOLDERING

1) Perform SMT according to the reflow oven temperature profile provided below, with a maximum temperature of 260°C;
2) Follow IPC/JEDEC standards; Peak temperature: < 260°C; Number of reflows: ≤2 times; For SMT involving double-sided placement, it is recommended that the module side undergoes reflow soldering only once. For any special processes, please contact our company.
3) For module SMT, it is recommended to make the steel mesh thicker by 0.13-0.15mm, and then the pin length is expanded by 1-1.3mm;
4) After opening, if the entire package is not used at once, it should be stored in a vacuum to prevent long-term exposure to air, which can cause moisture absorption and pad oxidation. If there is a gap of 7 to 30 days before reuse, it is recommended to bake the tape at 65-70°C for 24 hours without unrolling it before returning to SMT.
5) ESD protection measures should be implemented before using SMT.



# 11 PACKAGE INFORMATION



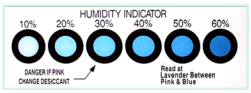

Inner carton(*5)
355*345*65mm，±5mm

Outer carton
370*358*350mm，±10mm

## Remarks

General material list for FCL packaging:

Carrier tape packaging tray




Humidity Indicator
(1 pcs/bag)

Desiccant
(placed in a vacuum bag)

Vacuum bag

Inner carton(*5)
355*345*65mm，±5mm

Outer carton
370*358*350mm，±10mm

**Other:**

Moisture-proof label (attached to the vacuum bag)

Certification label (attached to the vacuum bag)

Outer box label

Default unit：mm Default tolerance：±0.1

| Packing detail | Specification | Net weight | Gross weight | Dimension |
|---|---|---|---|---|
| MS50SFB | 850PCS | 680g | 1438g | W=44mm，T=0.35mm |

Note: Default weight tolerance all are within 10g（except the special notes）

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:
(1) This device may not cause harmful interference
(2) This device must accept any interference received, including interference that may cause undesired operation.

# 12 FCC WARNING

Any Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the device.
Note: This device has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This device generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this device does cause harmful interference to radio or television reception, which can be determined by turning the device off and on, the user is encouraged to try to correct the interference by one or more of the following measures:
-Reorient or relocate the receiving antenna.
-Increase the separation between the device and receiver.
-Connect the device into an outlet on a circuit different from that to which the receiver is connected.
-Consult the dealer or an experienced radio/TV technician for help.
The device has been evaluated to meet general RF exposure requirement. It can be used in portable exposure condition without restriction.

## Requirement per KDB996369 D03

### 2.2 List of applicable FCC rules

List the FCC rules that are applicable to the modular transmitter. These are the rules that specifically establish the bands of operation, the power, spurious emissions, and operating fundamental frequencies. DO NOT list compliance to unintentional-radiator rules (Part 15 Subpart B) since that is not a condition of a module grant that is extended to a host manufacturer. See also Section 2.10 below concerning the need to notify host manufacturers that further testing is required.3Explanation: This module meets the requirements of FCC part 15C(15.247).

### 2.3 Summarize the specific operational use conditions

Describe use conditions that are applicable to the modular transmitter, including for example any limits on antennas, etc. For example, if point-to-point antennas are used that require reduction in power or compensation for cable loss, then this information must be in the instructions. If the use condition limitations extend to professional users, then instructions must state that this information also extends to the host manufacturer's instruction manual. In addition, certain information may also be needed, such as peak gain per frequency band and minimum gain, specifically for master devices in 5 GHz DFS bands.

Explanation: The EUT has a PCB Antenna, , and the antenna use a permanently attached
Antenna which is not replaceable.

### 2.4 Limited module procedures

If a modular transmitter is approved as a "limited module", then the module manufacturer is responsible for approving the host environment that the limited module is used with. The manufacturer of a limited module must describe, both in the filing and in the installation instructions, the alternative means that the limited module manufacturer uses to verify that the host meets the necessary requirements to satisfy the module limiting conditions.

A limited module manufacturer has the flexibility to define its alternative method to address the conditions that limit the initial approval, such as: shielding, minimum signaling amplitude, buffered modulation/data inputs, or power supply regulation. The alternative method could include that the limited module manufacturer reviews detailed test data or host designs prior to giving the host manufacturer approval.

This limited module procedure is also applicable for RF exposure evaluation when it is necessary to demonstrate compliance in a specific host. The module manufacturer must state how control of the product into which the modular transmitter will be installed will be maintained such that full compliance of the product is always ensured. For additional hosts other than the specific host originally granted with a limited module,a Class II permissive change is required on the module grant to register the additional host as a specific host also approved with the module.

Explanation: The module is not a limited module.

## 2.5 Trace antenna designs

For a modular transmitter with trace antenna designs, see the guidance in Question 11 of KDB Publication 996369 D02 FAQ – Modules for Micro-Strip Antennas and traces. The integration information shall include for the TCB review the integration instructions for the following aspects: layout of trace design, parts list (BOM), antenna, connectors, and isolation requirements.

a) Information that includes permitted variances (e.g., trace boundary limits, thickness, length, width, shape(s), dielectric constant, and impedance as applicable for each type of antenna);
b) Each design shall be considered a different type (e.g., antenna length in multiple(s) of frequency, the wave-length, and antenna shape (traces in phase) can affect antenna gain and must be considered);
c) The parameters shall be provided in a manner permitting host manufacturers to design the printed circuit (PC) board layout;
d) Appropriate parts by manufacturer and specifications;
e) Test procedures for design verification;
f) Production test procedures for ensuring compliance.

The module grantee shall provide a notice that any deviation(s) from the defined parameters of the antenna trace, as described by the instructions, require that the host product manufacturer must notify the module grantee that they wish to change the antenna trace design. In this case, a Class II permissive change application is required to be filed by the grantee, or the host manufacturer can take responsibility through the change in FCC ID (new application) procedure followed by a Class II permissive change application.

Explanation: Yes, The module with trace antenna designs, and This manual has been shown the layout of trace design,, antenna, connectors, and isolation requirements.

## 2.6 RF exposure considerations

It is essential for module grantees to clearly and explicitly state the RF exposure conditions that permit a host product manufacturer to use the module. Two types of instructions are required for RF exposure information:
(1) to the host product manufacturer, to define the application conditions (mobile, portable – xx cm from a person's body); and (2) additional text needed for the host product manufacturer to provide to end users in their end-product manuals. If RF exposure statements and use conditions are not provided, then the host product manufacturer is required to take responsibility for the module through a change in FCC ID (new application).

Explanation: This module complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. This device should be installed and operated with a minimum distance of 20 centimeters between the radiator and your body." This module is designed to comply with the FCC statement, FCC ID is: 2ABU6-MS50SFB

## 2.7 Antennas

A list of antennas included in the application for certification must be provided in the instructions.

For modular transmitters approved as limited modules, all applicable professional installer instructions must be included as part of the information to the host product manufacturer. The antenna list shall also identify the antenna types (monopole, PIFA, dipole, etc. (note that, for example, an “omnidirectional antenna” is not considered to be a specific “antenna type”).

For situations where the host product manufacturer is responsible for an external connector, for example, with an RF pin and antenna trace design, the integration instructions shall inform the installer that a unique antenna connector must be used on the Part 15 authorized transmitters used in the host product. The module manufacturers shall provide a list of acceptable unique connectors.

Explanation: The EUT has a PCB Antenna, and the antenna uses a permanently attached antenna, which is unique.

## 2.8 Label and compliance information

Grantees are responsible for the continued compliance of their modules to the FCC rules. This includes advising host product manufacturers that they need to provide a physical or e-label stating “Contains FCC ID” with their finished product. See Guidelines for Labeling and User Information for RF Devices – KDB Publication 784748.

Explanation:The host system using this module, should have label in a visible area indicated the following texts: "Contains FCC ID: 2ABU6-MS50SFB

## 2.9 Information on test modes and additional testing requirements

Additional guidance for testing host products is given in KDB Publication 996369 D04 Module Integration Guide. Test modes should take into consideration different operational conditions for a stand-alone modular transmitter in a host, as well as for multiple simultaneously transmitting modules or other transmitters in a host product.

The grantee should provide information on how to configure test modes for host product evaluation for different operational conditions for a stand-alone modular transmitter in a host, versus with multiple, simultaneously transmitting modules or other transmitters in a host.

Grantees can increase the utility of their modular transmitters by providing special means, modes, or instructions that simulates or characterizes a connection by enabling a transmitter. This can greatly simplify a host manufacturer’s determination that a module as installed in a host complies with FCC requirements.

Explanation: Topband can increase the utility of our modular transmitters by providing instructions that simulates or characterizes a connection by enabling a transmitter.

# 13 STORAGE CONDITIONS

- **Please use this product within 6 months after signing the receipt.**
  - This product should be stored without opening the package at an ambient temperature of 5~35°C and a humidity of 20~70%RH.
  - This product should be left for more than 6 months after receipt and should be confirmed before use.
  - The product must be stored in a non-corrosive gas (CI2, NH3, SO2, NOx, etc.).
  - To avoid damaging the packaging material, do not apply any excessive mechanical shocks, including but not limited to sharp objects adhering to the packaging material and product dropping.

- **This product is suitable for MSL2 (based on JEDEC standard J-STD-020).**
  - After opening the package, the product must be stored at ≤30°C/<60%RH. It is recommended to use the product within 3-6 months after opening the package.
  - When the color of the indicator in the package changes, the product should be baked before welding.

- **Baking is not required for one year if exposure is limited to <30°C and 60%RH. Refer to MSL2 for exposure criteria for moisture sensitivity level. If exposed to (≥168h@85°C/60%RH) conditions or stored for more than one year, recommended baking conditions.**
  1. 120 +5/-5°C, 8 hours, 1 time
  Products must be baked individually on heat-resistant trays because the materials (base tape, reel tape, and cover tape) are not heat-resistant, and the packaging material may be deformed at temperatures of 120℃;
  2、90℃ +8/-0℃, 24hours, 1times
  The base tape can be baked together with the product at this temperature. Please pay attention to the uniformity of heat.

# 14 HANDLING CONDITIONS

• Be careful in handling or transporting products because excessive stress or mechanical shock may break products.
• Handle with care if products may have cracks or damages on their terminals. If there is any such damage, the characteristics of products may change. Do not touch products with bare hands that may result in poor solder ability and destroy by static electrical charge.

# 15 QUALITY

Cognizant of our commitment to quality, we operate our own factory equipped with state-of-the-art production facilities and a meticulous quality management system. We hold certifications for ISO9001, ISO14001, ISO27001, OHSA18001, BSCI.

Every product undergoes stringent testing, including transmit power, sensitivity, power consumption, stability, and aging tests. Our fully automated module production line is now in full operation, boasting a production capacity in the millions, capable of meeting high-volume production demands.

# 16 COPYRIGHT STATEMENT

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# 17 RELATED DOCUMENTS

- nRF52832_Chip_Datasheet
  https://en.minewsemi.com/file/nRF52832_Chip_Datasheet_EN.pdf
- MinewSemi_Product_Naming_Reference_Manual
  https://en.minewsemi.com/file/MinewSemi_Product_Naming_Reference_Manual_EN.pdf
- MinewSemi_Connectivity_Module_Catalogue
  https://en.minewsemi.com/file/MinewSemi_Connectivity_Module_Catalogue_EN.pdf

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MINEWSEMI

**SHENZHEN MINEWSEMI CO., LTD.**

0086-755-2801 0353
https://minewsemi.com
minewsemi@minew.com
https://store.minewsemi.com
No.8, Qinglong Road, Longhua District, Shenzhen, China