HJ-840

Chip-level High Performance Ultra-small (6.2mmx7mmx0.9mm Ultra-thin, Built-in Long-distance antenna) Ultra-low Power BLE5.2 Module Data Sheet V1.3

Module model: HJ-840 (based on NRF52840)

CATALOG

1 Overview

1.1 Characteristics

●Operating Frequency: 2.4GHz, Support ISM free Frequency band

●Support BLE 5.2, embedded low energy Bluetooth protocol stack and GATT service

●Transmitting Power: -20 - +8dBm

●Receiver sensitivity: -95dBm

●Transmit peak current < 4.8mA @0dBm

●**Built-in long-distance high-performance antenna (can also be select externally)**

●Supply voltage range: 1.7V-5.5V

●Support BLE master-slave integration (Master and slave work at the same time without affecting each other)

●Ultra-low power consumption：

- ✓ Sleep current < 2μA
- ✓ 1 Second broadcast current: 15uA
- ✓ 2 Second broadcast current: 8uA

●GPIO max: 48

●**Built-in *long-distance high-performance antenna Open ground distance: 50-80 meters @ +8dBm***

●Support connect to an external antenna

●Size: 6.2mm * 7mm * 0.9mm (Ultra-thin, built-in antenna inside) ,Weight:0.3g

●BQB FCC CE SRRC REACH RoHS compliant

●Pad pitch: 0.65mm， Package: LGA64

●Operating temperature range: -40 - +85℃

1.2 Electrical Parameters

●**Absolute Maximum Range**

Table 1-1 Absolute maximum ratings

Parameter	MIN	MAX	Unit
Power Supply Voltage (VCC)	1.7	3.6	V
VDDH	0	5.5	V
VBUS	0	5.5	V
IO Supply Voltage	0	VCC	V
Operating Temperature	-40	+85	℃
Storage Temperature	-40	+85	℃

●Recommended Operating Conditions

Table 1-2 Recommended operating conditions

Parameter	MIN	TYP	MAX	Unit
Power Supply Voltage (VCC)	1.8	3.3	3.6	V
VDDH	2.5	3.7	5.5	V
VBUS	4.35	5	5.5	V
IO Supply Voltage	0	3.3	VCC	V
Dormant working current		<2.0		μA
Maximum Operating Current		6.0		mA
Operating Temperature	-40	+25	+85	℃

●I/O DC Characteristics

Table 1-3 I/O DC Characteristics

I/O Pin	Driving Capability	MIN	MAX	Unit
Input low voltage		0	0.4	V
Input high voltage		0.7	VCC	V
Output low voltage	5mA	0	0.6	V
Output high voltage	5mA	3.3	VCC	V

●Power Dissipation

Table 1-4 Power Dissipation

Test conditions @0dBm	TYP	Unit
Dormancy mode	2.0	μA
20ms Interval Broadcasting in Slave Mode	55	μA
1S Interval Broadcasting in Slave Mode	15	μA
20ms Connection Gap Holding Connection in Slave Mode	190	μA
Scanning in Host Mode	4.5	mA
20ms Connection Gap Holding Connection in Host Mode	180	μA

●RF Features

Table 1-5 RF Features

Attribute	Value	Remarks
Modulation	GFSK	
Frequency range	2.402 ~ 2.480GHz	Bandwidth: 2MHz
Number of channels	40	
Air speed	1Mbps、2Mbps	
RF Port Impedance	50Ω	
Transmit Power	MAX: +8 dBm	
TX Current consumption	TYP: 4.8 mA@0dBm	
RX Current consumption	TYP: 4.6 mA	
Receive sensitivity	TYP: -95dBm, MAX: -95dBm	
Antenna	Built-in long distance Antenna	External antenna can be used

2 Hardware specification

2.1 Package and dimensions

LGA64 package, pad pitch 0.65mm.Detailed dimensions as shown in Figure 2-1, Figure 2-2, Figure 2-3 and Figure 2-4.

Package and dimensions（Scale 1:1）

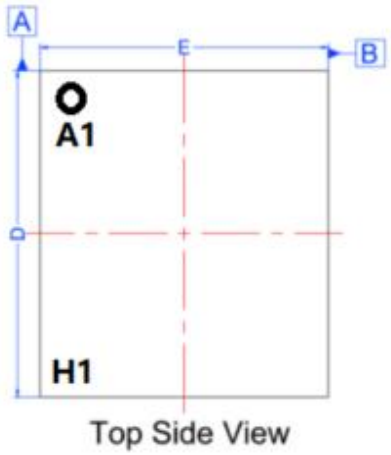

Figure 2-1 Top view

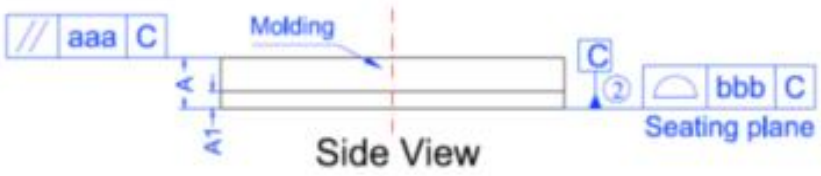

Figure 2-2 Side view

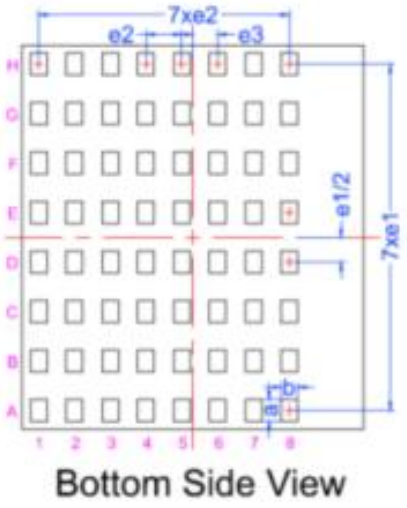

Figure 2-3 Bottom view

DIMENSIONAL REFERENCES Units:mm

SYMBOL	DIMENSIONAL REQMTS			SYMBOL	Tolerance of Form &Position
	MIN	NOM	MAX	aaa	0.10
A	0.86	0.90	0.94	bbb	0.10
A1	0.27	0.30	0.33		
D	6.90	7.00	7.10		
E	6.10	6.20	6.30		
a	0.35	0.40	0.45		
b	0.25	0.30	0.35		
e1	0.90 REF				
e2	0.65 REF				
e3	0.45 REF				

Figure 2-4 Dimensions picture

2.2 Pin specification

Table 2-1 Pin definition table

	1	2	3	4	5	6	7	8
A	GND	P1.01	P0.21	P0.20	P0.17	P0.14	ANT	BOARD_ANT
B	P0.22	P1.04	P1.07	P0.09	P1.05	P0.24	P1.06	P1.14
C	P0.25	SWDIO	SWCLK	DEC5	P0.10	P0.13	P1.11	P1.12
D	P0.19	P1.00	P1.02	P1.03	P0.23	P1.10	P1.13	P0.31
E	P0.18/RESET	P0.15	P0.16	P1.08	P1.15	P0.02	P0.28	P0.03
F	D+	VBUS	P0.11	P0.07	P0.27	P0.00	P0.30	P0.29
G	D-	DECUSB	P0.12	P1.09	P0.05	P0.01	P0.26	P0.06
H	DCCH	VDDH	VDD	VDD	P0.08	DEC1	P0.04	GND

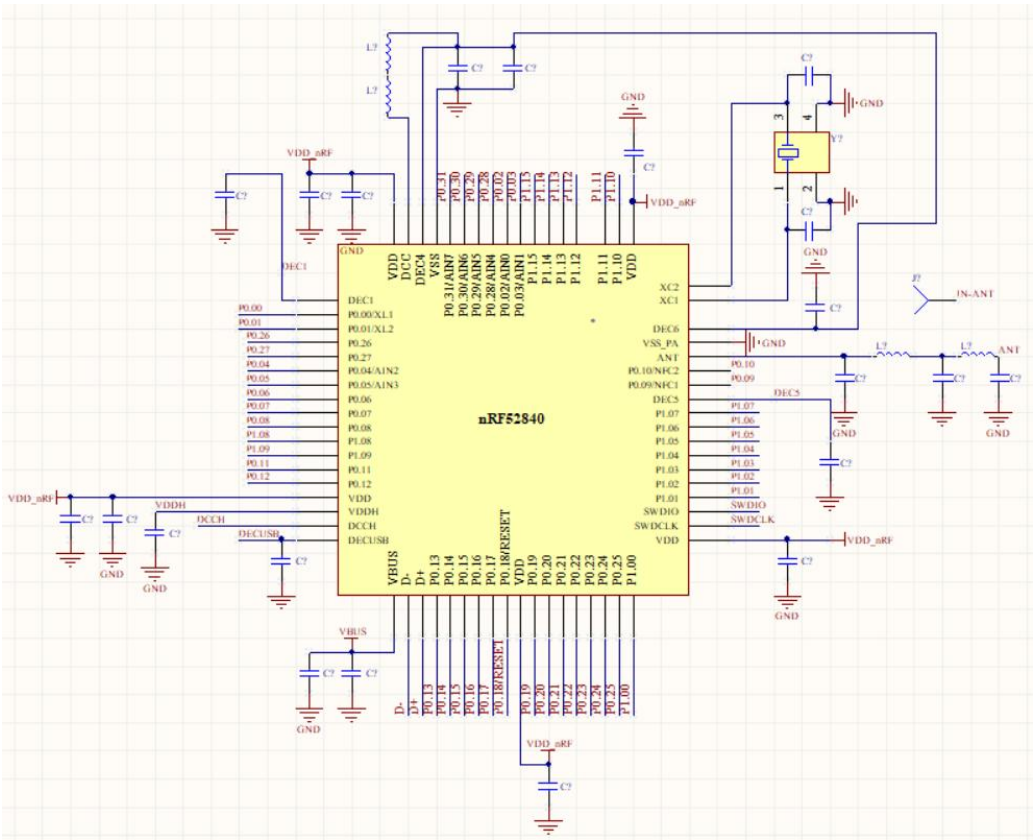

Figure 2-5 Internal schematic

2.3 Internal Structure

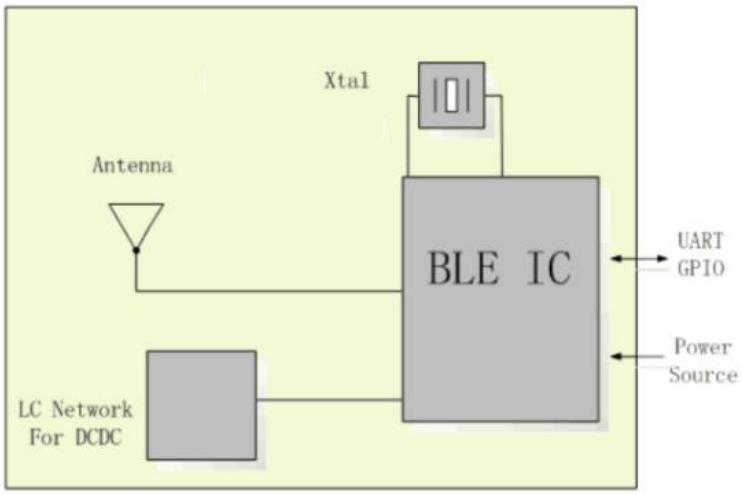

Figure 2-6 Internal structure diagram

2.4 Customer self-developed program reference design

2.4.1 Utilizing the internal 32.768KHZ low frequency clock

A、The connection method of using internal antenna

We recommend the use of internal antennas. The internal antennas at 0dBm, 1.5 meters from the ground, and a transmission distance of 80 meters, which has met most application requirements.

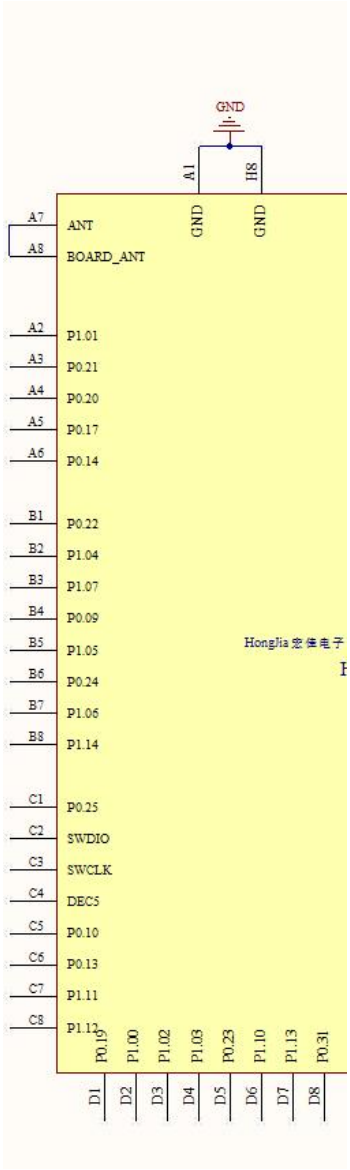

Figure 2-7 Internal clock antenna connection diagram

B、The connection method of using external antenna

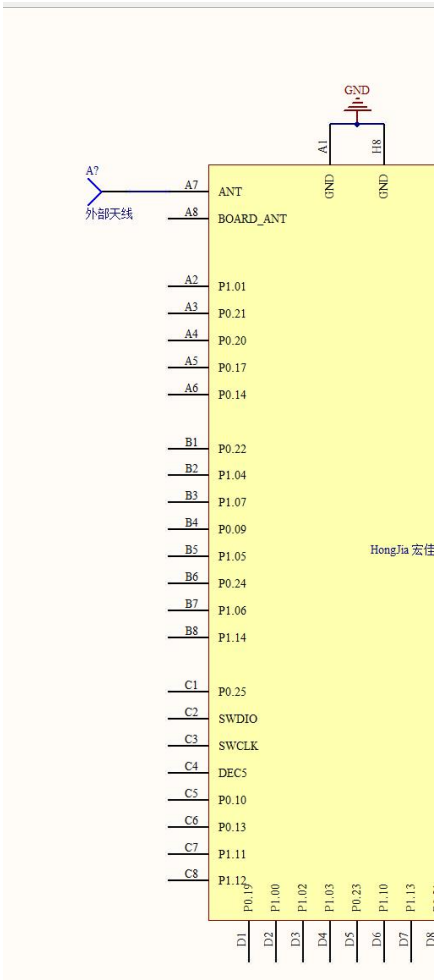

Figure 2-8 Internal clock external antenna connection diagram

C、To use the internal clock, you need to modify the sdk_config.h file in NRF52 SDK 17.1 as follows:

a. Expand ”nRF_Drivers”->”NRFX_CLOCK_ENABLED”.Modify the parameters according to Figure 2-9

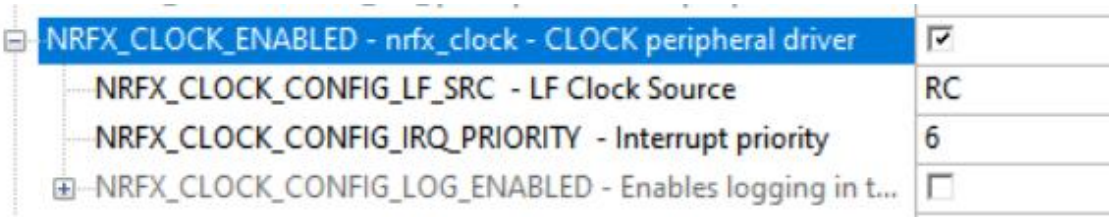

Figure2-9 NRFX_CLOCK_ENABLED

b. Expand ”nRF_Drivers”->”NRF_CLOCK_ENABLED”.Modify the parameters according to Figure 2-10.

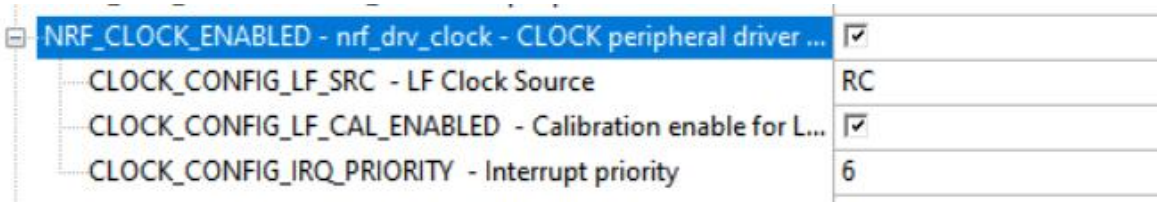

Figure2-10 NRF_CLOCK_ENABLED

c. Expand ” nRF_SoftDevice ” -> ” NRF_SDH_ENABLED ” -> ” Clock - SoftDevice clock configuration” Modify the parameters according to Figure 2-11.

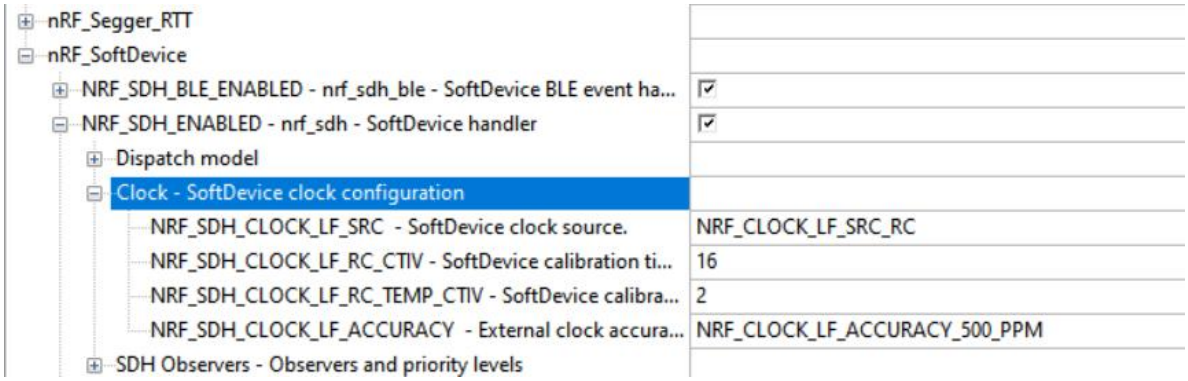

Figure 2-11 NRF_SDH_ENABLED

2.4.2 Utilizing external 32.768KHZ low frequency clock

Simply connect the XL1 and XL2 to an external clock based on the two designs shown in sections A and B of 2.4.1. As shown in Figure 2-12.

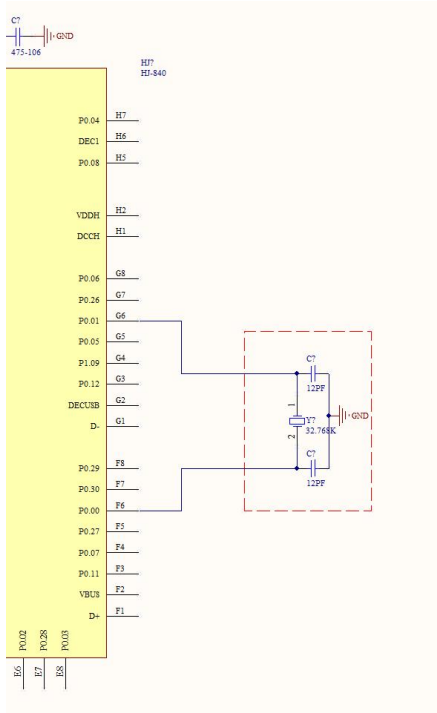

Figure 2-12 External clock connection diagram

2.5 Antenna part design reference

2.5.1 Using internal high-performance antennas

The internal high-performance antenna can be enabled only by short-circuiting A7 and A8, as shown in Figure 2-13 below. At 0dBm transmission power, the open ground is 1.5 meters away from the ground, and the transmission distance is 80 meters, which has met most application requirements.

It should be noted that no device or cable should be placed near the antenna, no device should be placed on the back of the module, the copper coating should avoid the internal antenna area, and the copper coating of the module GND should be large enough.

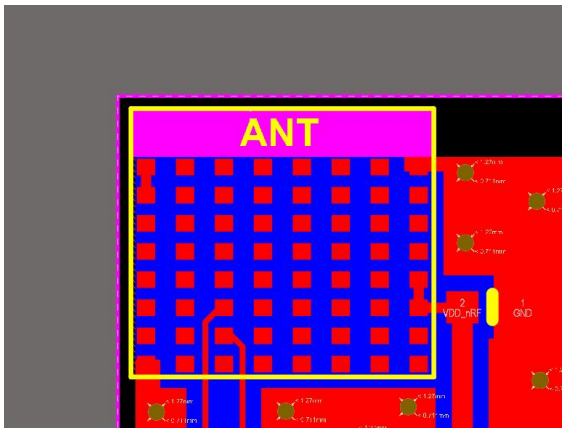

Figure 2-13 Internal antenna circuit design

2.5.2 Using an external PCB antenna

The A8 pin is suspended, and the A7 pin is connected to the PCB antenna through a π filter circuit, as shown in Figure 2-14 below, and the communication distance can reach 50 to 90 meters in the open ground.

It should be noted that the device can not be placed near the antenna, can not be routed, the device can not be placed on the back of the module, the copper coating should cover the module and PI filter circuit, avoid the PCB antenna.

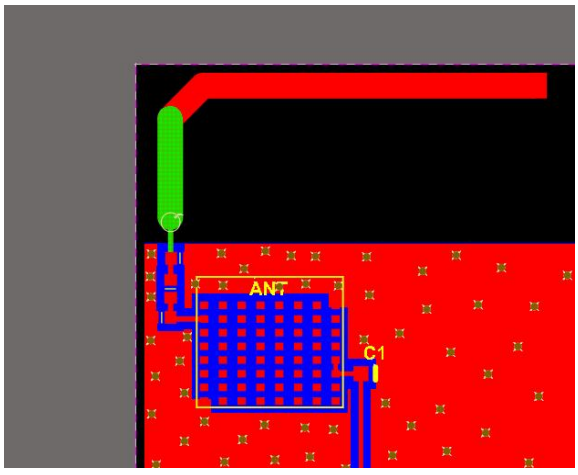

Figure 2-14 External PCB antenna circuit design

2.6 Developed by the user, external access PA/LNA for power expansion and remote communication, please refer to the following code and instructions:

2.6.1 PA/LNA control code

For example, we use P0.00 as the PA send enable control pin; P0.12 as LNA receiving enable control pin;

```
#define PA_CTRL_PIN     0
#define LNA_CTRL_PIN   12

//PA + LNA Ctrl Init
void pa_lna_init(uint32_t gpio_pa_pin, uint32_t gpio_lna_pin)
{
    ret_code_t err_code;

    static const uint32_t gpio_toggle_ch = 0;
    static const uint32_t ppi_set_ch = 0;
    static const uint32_t ppi_clr_ch = 1;

    // Configure SoftDevice PA/LNA assist
    ble_opt_t opt;
    memset(&opt, 0, sizeof(ble_opt_t));
    // Common PA/LNA config
    opt.common_opt.pa_lna.gpiote_ch_id    = gpio_toggle_ch;          // GPIOTE channel
    opt.common_opt.pa_lna.ppi_ch_id_clr = ppi_clr_ch;               // PPI channel for pin clearing
    opt.common_opt.pa_lna.ppi_ch_id_set = ppi_set_ch;               // PPI channel for pin setting
    // PA config
    opt.common_opt.pa_lna.pa_cfg.active_high = 1;                   // Set the pin to be active high
    opt.common_opt.pa_lna.pa_cfg.enable          = 1;                 // Enable toggling
    opt.common_opt.pa_lna.pa_cfg.gpio_pin       = gpio_pa_pin;      // The GPIO pin to toggle

    // LNA config
    opt.common_opt.pa_lna.lna_cfg.active_high    = 1;               // Set the pin to be active high
    opt.common_opt.pa_lna.lna_cfg.enable           = 1;               // Enable toggling
    opt.common_opt.pa_lna.lna_cfg.gpio_pin        = gpio_lna_pin;   // The GPIO pin to toggle

    err_code = sd_ble_opt_set(BLE_COMMON_OPT_PA_LNA, &opt);
    APP_ERROR_CHECK(err_code);
}
```

2.6.2 To add the above function to the “int main(void)” function,please add after “ble_stack_init()”, before “advertising_start” , see Figure 2-15:

```
/**@brief Application main function.
 */
int main(void)
{
    bool erase_bonds;

    // Initialize.
    uart_init();
    log_init();
    timers_init();
    buttons_leds_init(&erase_bonds);
    power_management_init();
    ble_stack_init();
    gap_params_init();
    gatt_init();
    services_init();
    advertising_init();
    conn_params_init();

    // Init GPIO's to control PA and/or LNA, must be done before start advertising.
    pa_lna_init(PA_CTRL_PIN , LNA_CTRL_PIN);

    // Start execution.
    printf("\r\nUART started.\r\n");
    NRF_LOG_INFO("Debug logging for UART over RTT started.");
    advertising_start();

    // Enter main loop.
    for (;;)
    {
        idle_state_handle();
    }
}
```

Figure 2-15 int main(void)function

2.7 DCCH or VDDH connection method

For connection of DCCH and VDDH, please refer to NRF52840 datasheet or consult our technicist.

3 Notice

3.1 Notice for Hardware Design

1. All IO ports can be used for export. Please pay attention to the pin diagram for all pins, and pay attention to the IO mode and status of the connected IO.

2. It is recommended to use magnetic beads or inductance filtering for the input power supply.

3. Filter capacitors C1 and C2 should be placed as close as possible to the power input pins of the module.

4. When using an external antenna, be sure to contact our company and let us confirm whether your external PCB antenna or IPEX lead out antenna PCB design is reasonable.

5. An external 32.768KHz low-frequency crystal oscillator is not necessary and can be replaced by an internal LF oscillator. Simply change the SDK, as detailed in Section 2.4.1 C. If you have any questions, please consult our company.

6. The module should not be placed in a metal shell. If a metal shell must be used, the antenna must be led out.

7. In products that require the installation of this wireless module, some metal components such as screws, inductors, etc. should be kept as far away from the RF antenna part of the wireless module as possible.

8. Try to avoid placing other components near and on the back of the Bluetooth module antenna, and avoid wiring. Placing devices or wiring will affect Bluetooth performance.

9. The module antenna should be placed around the edges of the circuit board, with the antenna part close to the edges or corners of the motherboard. It is best to place the module in the corners of the circuit board.

10. Make sure that each layer of the circuit board is covered with copper and GND, and ensure that the module, especially the antenna part, has a large enough copper area and is well grounded.

11. It is necessary to punch through holes in the copper clad area of the entire circuit board, especially in the copper clad area near modules and antennas. As many through holes as possible should be punched.

12. If there are high-power devices or high-voltage conversion circuits on the circuit board, it is necessary to isolate the GND copper coating of the module from the GND copper coating of other parts, connect them using a single point grounding method, and drill as many through holes as possible to reduce interference with the RF signal.

13. Unneeded pins can be suspended for processing.

3.2 Precautions for ultrasonic welding

Warning: Please carefully consider using ultrasonic welding technology. If it is necessary to use ultrasonic welding technology, please use 40KHz high-frequency ultrasonic welding technology. During the design process, please keep the module away from the ultrasonic welding line and fixed column to prevent damage to the module!

For specific ultrasonic welding matters, please contact our technician for consultation.

4 Welding recommendations

It is recommended to use reflow soldering for welding.

The HJ-840 module plates are all high-temperature resistant plates, all using lead-free technology, with a maximum test temperature resistance of 265 ℃. Performing 10 consecutive reflow welds has no effect on performance and strength. The specific parameters are shown in Table 4-1.

Table 4-1 Reflow soldering parameters

Parameter	Value
Features	Lead-free process
Average ramp up rate(T_{SMAX} to Tp)	3℃/sec. max
Temperature Min($T_S$min)	150℃
Temperature Max(TSmax)	200℃
Preheat time (Min to Max) (tS)	80~100sec.
Peak Temperature (T_P)	250±5℃
Ramp-down Rate	6℃/sec. max
Time 25℃ to Peak Temp (T_P)	8 min. max

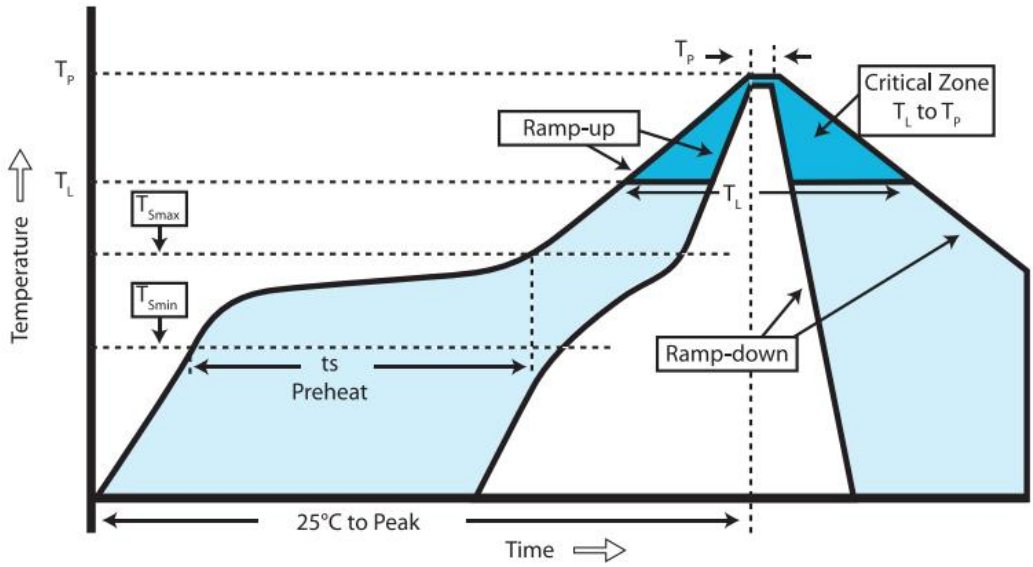

Figure 4-1 Reflow soldering temperature curve

5 Supply information

5.1 Type definition

Table 5-1 Type definition

Type	Model	Description
Standard Edition	HJ-840	Standard NO-FW modules, customers need to use Nordic NRF52840 SDK for development.

5.2 Package specification

(Relevant pictures of tape packaging and the size information of the tape)

Sealed with chip-level anti-static aluminum foil bag, each bag contains desiccant, use industrial grade vacuum machine to ensure airtight, moisture-proof, waterproof and dustproof (IP65). (As shown below)

Figure 5-1 Reflow

All packages will be labeled with goods information. All packages will be marked with the cargo information, including ROHS and anti-static signs. The production batch information in the item number is 15 bits.

TangShan HongJia Electronic Technology Co., Ltd.

HJ-840

Pb Free Reflow(260℃)

DATE CODE:P16aI15bS17c001

QTY:500PCS SEAL DATE:20170504

Remarks:P16a I15b S17c001 represents PCB production in January 2016, IC production in February 2015, and SMT patch in the first time in March 2017.

6 Version history

Table 6-1 Edit history

No.	Version number	Date	Description
1	V1.0	2020-4-30	Official version V1.0
2	V1.1	2021-5-18	Update the picture of Chapter 7
3	V1.2	2023-7-28	Format adjustment, update feature parameters, add hardware considerations, add antenna design references, add VDDH, VBUS for electrical parameters, modify VCC
4	V1.3	2023-9-6	Added supply information model definition