



HJ-840 Hardware Design Manual

Based on Nordic NRF52840

6.2x7x0.9mm ultrathin, built-in long-range antenna

Ultra-low power consumption

chip-level BLE5.4 high-performance module

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Preface

Thanks for using the Bluetooth module provided by HJSIP. HJ-840 series standard Bluetooth module, is a high-performance iot Bluetooth transceiver. The module adopts LGA64 package and supports both external and internal antennas. The product also has the characteristics of low power consumption, small size, strong anti-interference ability, etc., suitable for a variety of application scenarios.

This module is mainly used for data communication, and the company does not assume responsibility for property losses or personal injuries caused by improper operations of users. Please develop the product according to the technical specifications and reference design in the manual. At the same time, pay attention to the general safety matters that should be concerned about when using mobile products.

Before the announcement, the company has the right to modify the content of this manual according to the needs of technological development.

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Version History

Version	Date	Change Description	Reviser	Reviewer
V1.0	2020/03/28	Initial Version	LMY	LJH
V1.0.1	2020/04/29	Update the pin function	LMY	ZYP
V1.0.2	2020/05/17	updated parameter	FJW	LMY
V1.1.0	2023/02/27	Adjust the format, update feature parameters, and add hardware precautions	LMY	LJH
V1.1.1	2023/03/02	Added the antenna part design reference	LMY	LJH
V1.1.2	2023/03/03	Electrical parameters added VDDH and VBUS	LMY	LJH
V1.2	2023/07/28	Modify VCC	LMY	LJH
V1.3	2023/09/06	Added supply information model definition	LMY	LJH
V1.5	2025/02/26	1) Unified manual format; 2) Correct the presentation.	WYW	LMY
V1.6	2025/04/27	1) 3.2.1: To achieve the best effect when using the internal antenna, a PI circuit needs to be added; 2) 3.2.2: When using the external PCB antenna, the PCBA board needs to be sent to our company for PI circuit matching; 3) Add the "2.6 Power Supply Reference Circuit" section; 4) Cover page, preface: Add the description of the core chip.	WYW	LMY
V1.7	2026/06/29	Added contact information.	WYW	LMY

Applicable module selection

No.	Module type	Type	Description
1	HJ-840	standard edition	Standard bare modules that need to be developed and used by customers according to Nordic's SDK.

1 Introduction

The HJ-840 series standard Bluetooth module, is a high-performance IOT Bluetooth transceiver. Module adopts LGA64 package, based on NRF52840, supports internal antenna and external antenna. The product also has the characteristics of low power consumption, small size, strong anti-interference ability, etc., suitable for a variety of application scenarios.

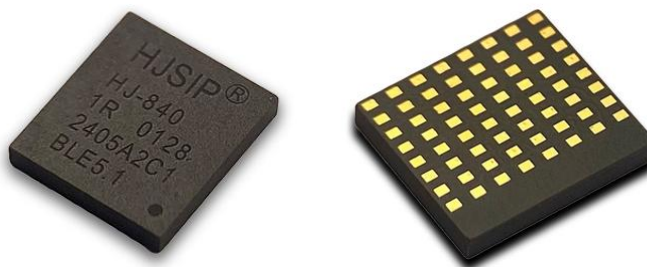


Figure 1.1: HJ-840 Top and bottom view

2 Product overview

2.1 Key features

Table 2-1: HJ-840 key characteristics

Characteristic	Description
Function	- Supports BLE 5.4, embedded Bluetooth Low Energy stack, and GATT services; - Support BLE master-slave integration (master and slave work at the same time without affecting each other);
supply voltage	1.7V-5.5V
RF characteristics	- Operating frequency 2.4GHz, support ISM free band - Transmit power:-20dBm - +8dBm - High receiving sensitivity:-95dBm@1Mbps - Peak transmit-receive current TX: 4.8mA @0dBm RX: 4.6mA - Built-in long range high performance antenna, open range:50-80m@+8dBm - Expandable external antenna
Size	6.2mm * 7mm * 0.9mm (Ultra-thin ,with built-in antenna)
Package	LGA64 Package, 0.65mm Pad spacing, Suitable for two layer board design
Weight	0.3g
power consumption	- Sleep current<2uA - 1 second interval broadcast current 15uA - 2 second interval broadcast current 8uA
Operation Temperature	-40 ~ +85°C
Storage Temperature	-40 ~ +85°C
GPIO Port	48 PCS (Max)
Product standards	Products have passed BQB FCC CE IC SRRC ROHS REACH and other certifications

2.2 Application Scenarios

- 2.4GHz Bluetooth Low Energy system;
- Smart home, wireless remote control;
- Consumer electronics products such as sports and healthcare;
- Industrial monitoring;
- Intelligent transportation, etc.

2.3 Functional block diagram

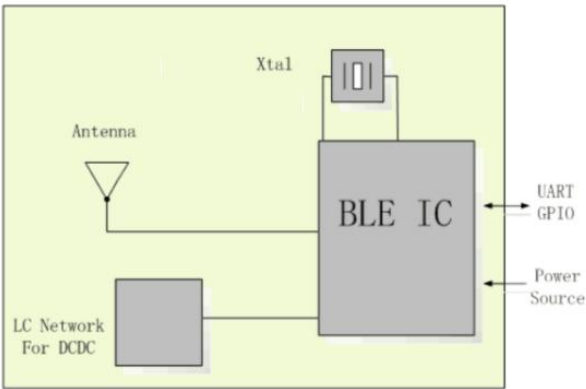


Figure 2.1: HJ-840 functional block diagram

2.4 Pins distribution diagram

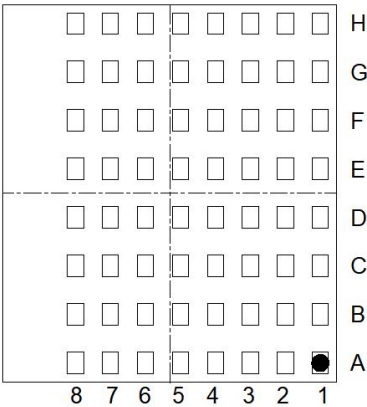


Figure 2.2: HJ-840 Pins distribution diagram(front view)

2.5 Pins description table

Table 2-2: HJ-840 Pins 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

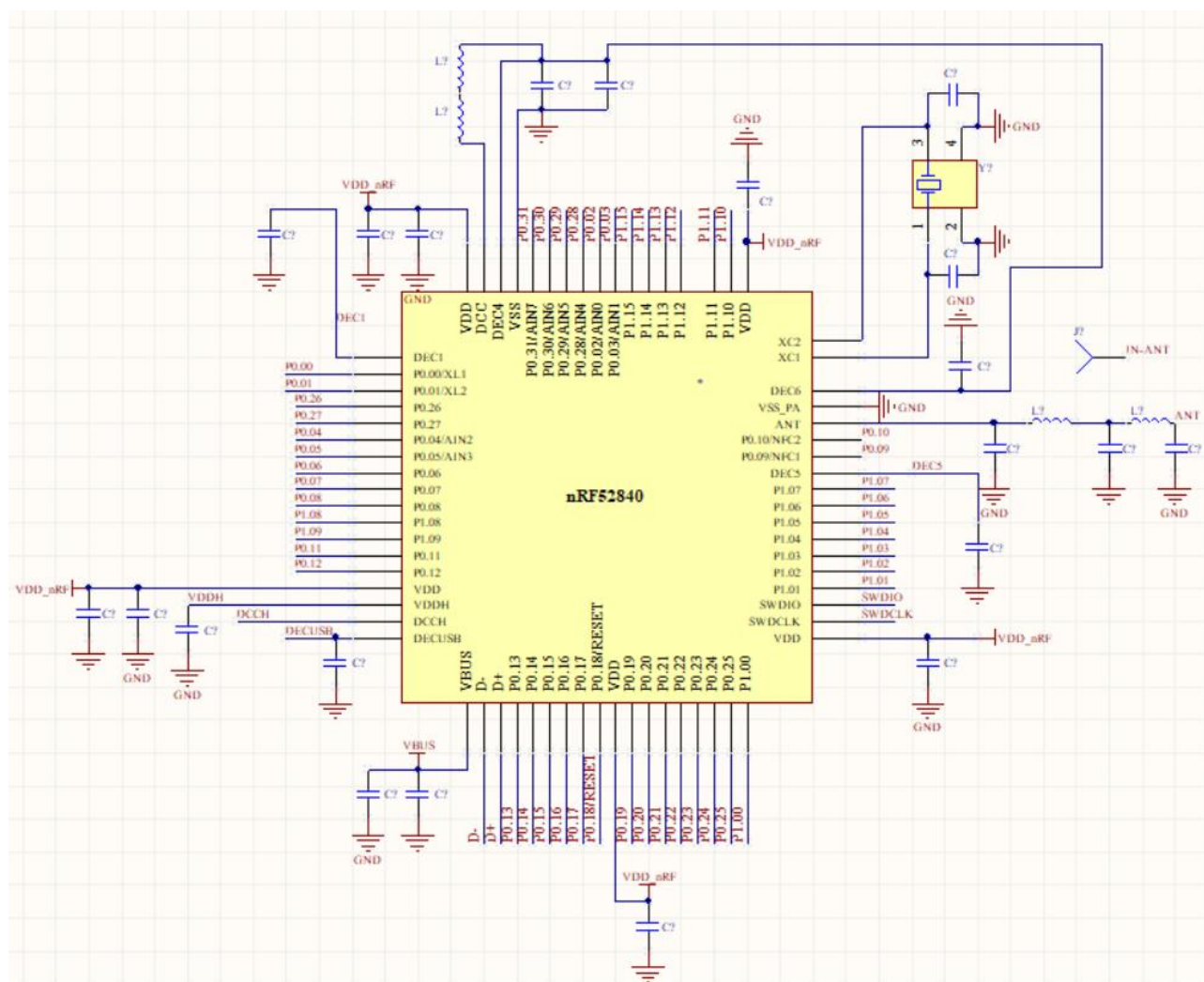


Figure 2.3: Internal schematic diagram

2.6 Power supply reference circuit

2.6.1 Normal voltage mode

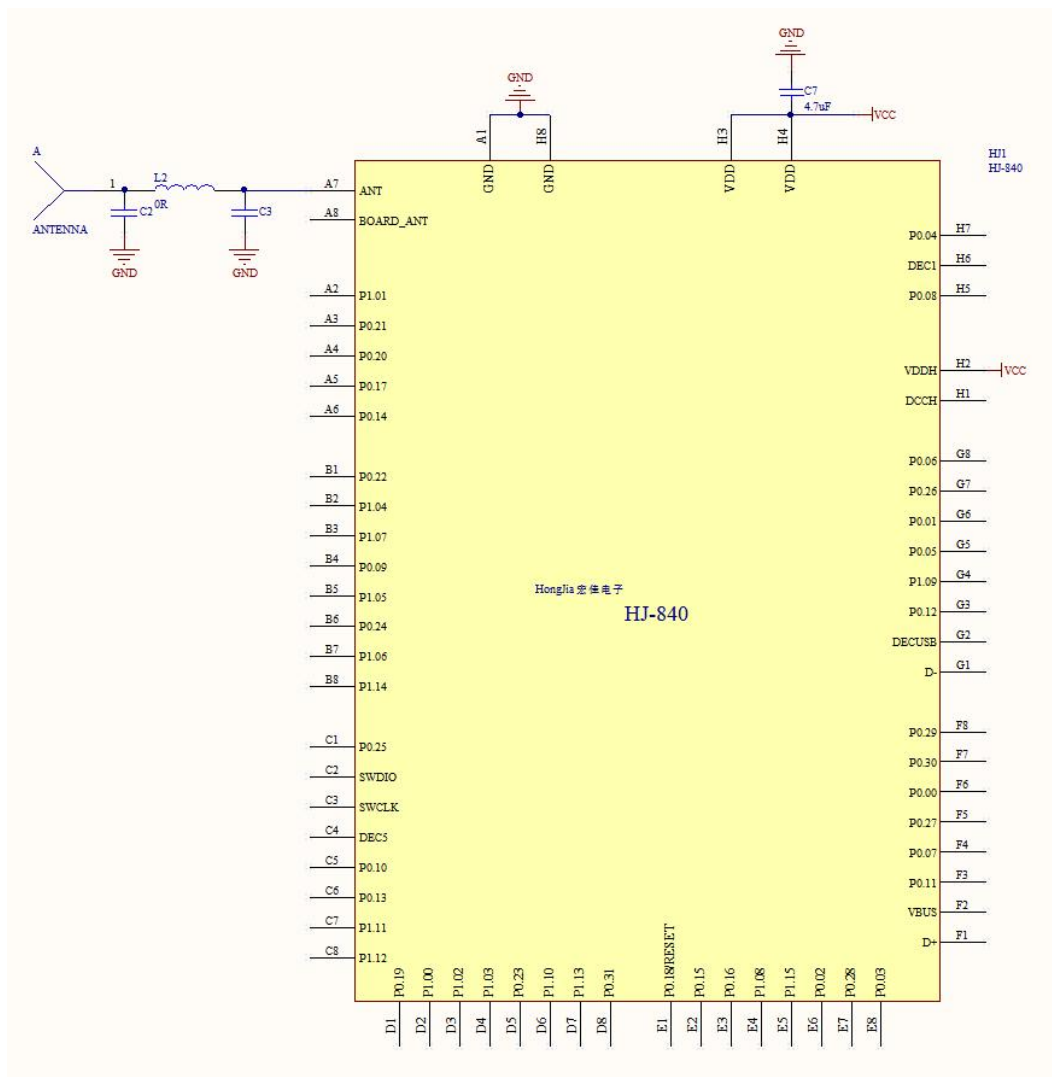


Figure 2.4: Normal voltage mode

Power range: 1.7-3.6V

When the power supply voltage is simultaneously connected to the VDD and VDDH pins (with the VDD pin and VDDH pin short-circuited), the system enters the normal voltage mode. For the range of power supply voltages that can be applied to the VDD and VDDH pins, please refer to Table 4-1.

2.6.2 High voltage mode

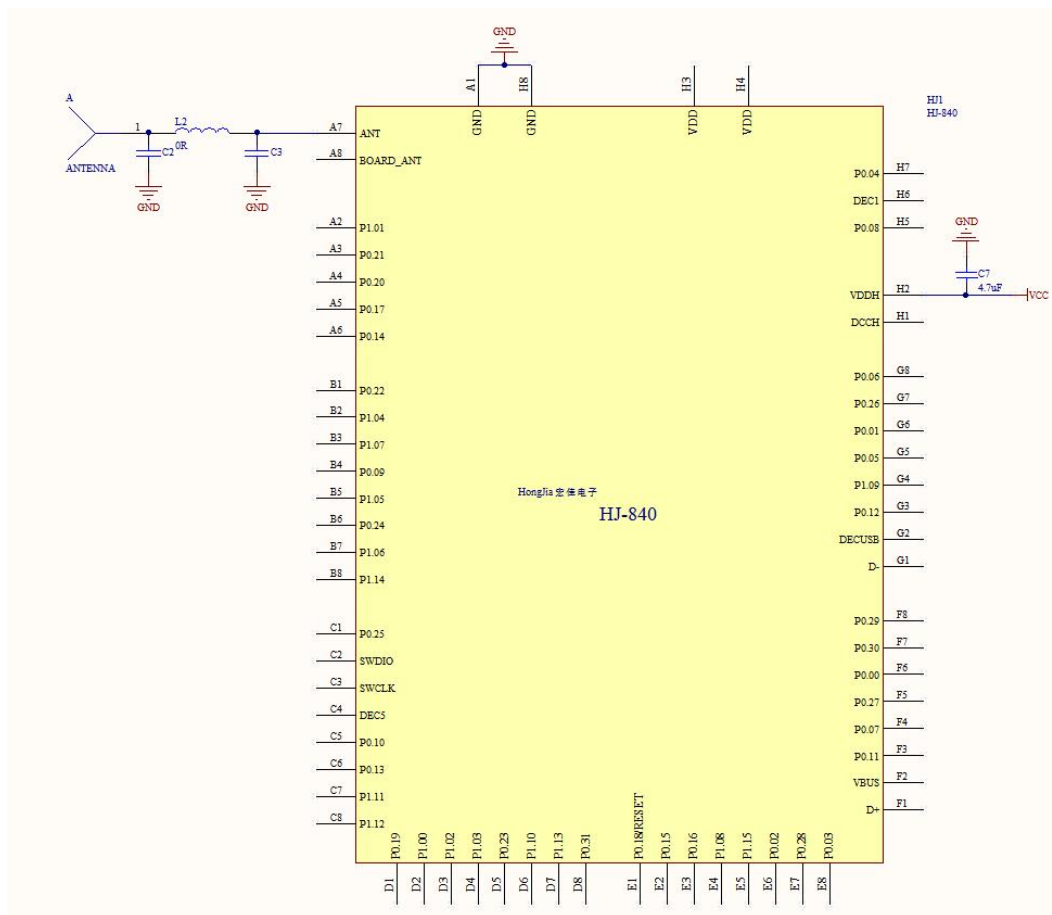


Figure 2.5: High voltage mode

Power range: 2.5-5.5V

When the power supply voltage is only connected to the VDDH pin and the VDD pin is not connected to any power source, the system enters the high-voltage mode. For the range of power supply voltages that can be connected to the VDDH pin, please refer to Parameter Table 4-1.

2.6.3 Other notes

- During program burning, it is necessary to supply power in a normal voltage mode, that is, through VDD + VDDH (TYP. 3.3V), high voltage mode power supply must not be used (only through VDDH for power supply).
- When using USB peripherals, a 5V USB power supply needs to be provided at the VBUS pin. Therefore, when the USB peripheral is running, it must have both VBUS and VDDH or VDD power supply.
- When the P0.18/nRESET (low level effective) pin is configured as the reset function, it must be connected to I/O. If not connected, a 1K strong pull-up resistor must be added.
- The connection methods of DCCH and VDDH, please refer to the NRF52840 datasheet or consult our technical department.

3 RF Features

The module can be configured in two modes: internal antenna and external antenna.

3.1 Antenna interface and operating frequency band

Module antenna interface characteristic impedance 50 ohms.

The radio frequency working band is 2.402 ~ 2.480GHz.

3.2 Antenna application reference

3.2.1 Use module built-in antenna wiring diagram

In the module already has a matching circuit. By directly connecting A7 and A8, the internal antenna can be used. If the antenna wants to achieve the best effect, a π -type filter circuit needs to be connected between the pins of A7 and A8, as shown in Figure 3.1 below. At 8dBm TX power, in the open ground, and 1.5 meters away from the ground, the transmission distance is 50-80 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.

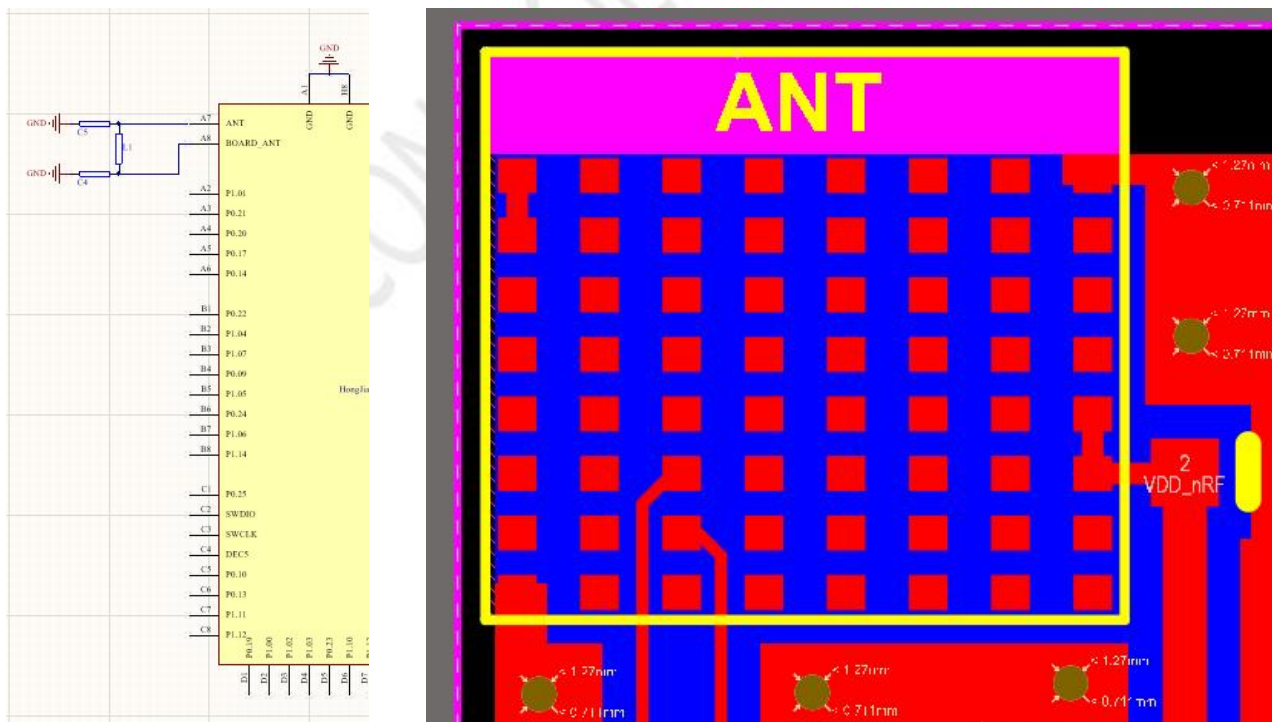


Figure 3.1: Use the module's built-in antenna

3.2.2 Use the external antenna wiring diagram

The A8 pin is suspended, and the A7 pin is connected to the PCB antenna through a π filter circuit, as shown in Figure 3.2 below, and the communication distance in open ground can reach 50~90 meters.

*** Special attention ***

- 1) If you have requirements for the distance of the product and the external π circuit needs to be matched, please send the PCBA circuit board to our company to complete this task.
- 2) When designing the circuit, no devices or wires should be placed near the antenna, and no devices should be placed on the back of the module. The copper cladding should cover the module and the π -shaped filter circuit, avoiding the PCB antenna.

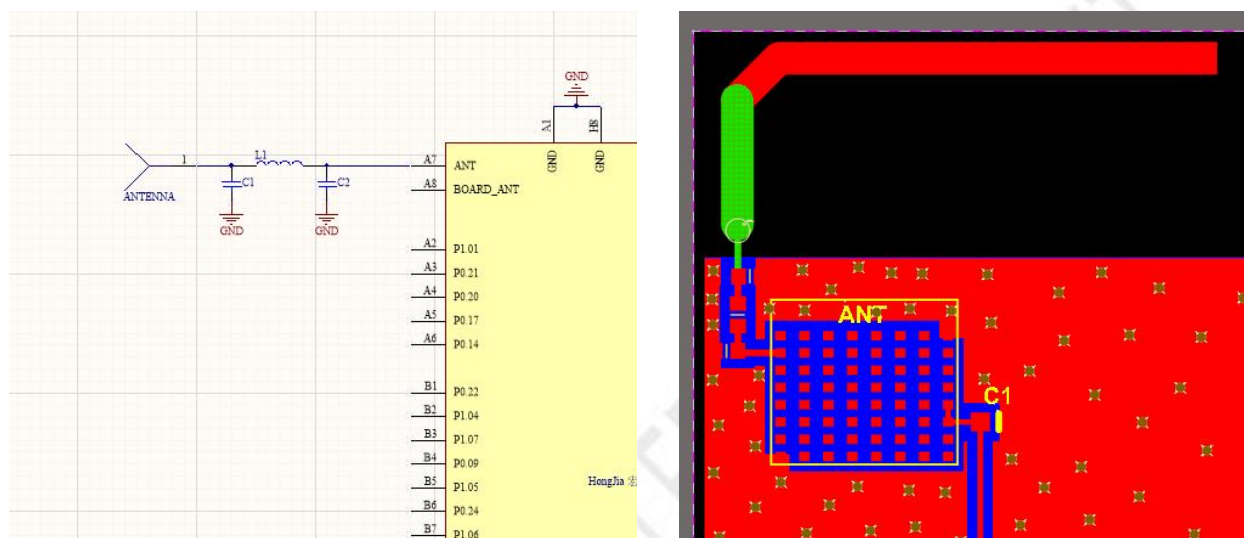


Figure 3.2: Use external antenna

3.3 RF features

Table 3-1: RF features

Attribute	Value	Remarks
Wireless modulation mode	(G)FSK	/
Frequency range	2.402 ~ 2.480GHz	bandwidth: 2MHz
Number of channels	40	/
Air speed	1Mbps、2Mbps、500kbps、125kbps	/
Rf port impedance	50Ω	/
Transmission power	Max: +8dBm	/
Emission current	TYP: 4.8mA@0dBm	/
Receive current	TYP: 4.6mA	/
Receiving sensitivity	TYP. -95dBm@1Mbps	/
antenna	Built in antenna	Can also be connected to an external antenna

4 Electrical Parameters

4.1 Absolute Maximum Ratings

Table 4-1: Absolute Maximum Ratings

Parameter	MIN	MAX	Unit
VDD	1.7	3.9	V
VDDH	2.5	5.8	V
VBUS	4.35	5.8	V
IO Supply Voltage	0	VCC	V
Operating Temperature	-40	+85	°C
Storage Temperature	-40	+85	°C

4.2 DC Characteristics

Table 4-2: Recommended Operating Conditions

Parameter	MIN	TYP	MAX	Unit
Supply voltage VCC	1.7	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	/	μA
Maximum Operating Current	/	<6.0	/	mA
Operating Temperature	-40	+25	+85	°C

Table 4-3: Dc features of I/O ports

IO Pin	Drive capability	Min	Max	Unit
Input low level	/	0	0.4	V
Input high level	/	0.7	VCC	V
Output low level	Max. 5mA	0	0.4	V
Output high level	Max. 5mA	VCC-0.4	VCC	V

Table 4-4: Electricity consumption

Test condition@0dBm	TYP	Unit
sleep mode	2.0	μA
Broadcast at 20ms interval in slave mode	55	μA
Broadcast at 1s interval in slave mode	15	μA
Maintain the connection in slave mode with a 20ms connection gap	190	μA
Scan in host mode	4.5	mA
In host mode, the connection is maintained at a 20ms interval	180	μA

5 Reference design for users to develop their own programs

5.1 Utilize the internal 32.768KHZ low frequency clock

To use the internal clock, you need to modify the sdk_config.h file in NRF52 SDK17.1 as follows:

- Unfold "nRF_Drivers"->"NRF_CLOCK_ENABLED"Please modify as shown in Figure 5.1:

☒ NRFX_CLOCK_ENABLED - nrfx_clock - CLOCK peripheral driver	☒
NRFX_CLOCK_CONFIG_LF_SRC - LF Clock Source	RC
NRFX_CLOCK_CONFIG_IRQ_PRIORITY - Interrupt priority	6
☒ NRFX_CLOCK_CONFIG_LOG_ENABLED - Enables logging in t...	☐

Figure 5.1:NRFX_CLOCK_ENABLED

- unfold”nRF_Drivers”->”NRF_CLOCK_ENABLED”Please modify as shown in Figure 5.2:

☒ NRF_CLOCK_ENABLED - nrf_drv_clock - CLOCK peripheral driver ...	☒
CLOCK_CONFIG_LF_SRC - LF Clock Source	RC
CLOCK_CONFIG_LF_CAL_ENABLED - Calibration enable for L...	☒
CLOCK_CONFIG_IRQ_PRIORITY - Interrupt priority	6

Figure 5.2:NRF_CLOCK_ENABLED

- Unfold”nRF_SoftDevice”->”NRF_SDH_ENABLED”->”Clock - SoftDevice clock configuration”Please modify as shown in Figure 5.3:

☒ nRF_Segger_RTT	
☒ nRF_SoftDevice	
☒ NRF_SDH_BLE_ENABLED - nrf_sdh_ble - SoftDevice BLE event ha...	☒
☒ NRF_SDH_ENABLED - nrf_sdh - SoftDevice handler	☒
☒ Dispatch model	
☒ Clock - SoftDevice clock configuration	
NRF_SDH_CLOCK_LF_SRC - SoftDevice clock source.	NRF_CLOCK_LF_SRC_RC
NRF_SDH_CLOCK_LF_RC_CTIV - SoftDevice calibration ti...	16
NRF_SDH_CLOCK_LF_RC_TEMP_CTIV - SoftDevice calibra...	2
NRF_SDH_CLOCK_LF_ACCURACY - External clock accura...	NRF_CLOCK_LF_ACCURACY_500_PPM
☒ SDH Observers - Observers and priority levels	

Figure 5.3:NRF_SDH_ENABLED

5.2 Utilize external 32.768KHZ low frequency clock

Simply connect the XL1 and XL2 to an external clock based on the two designs in Section 3.2.Figure 5.4 shows.

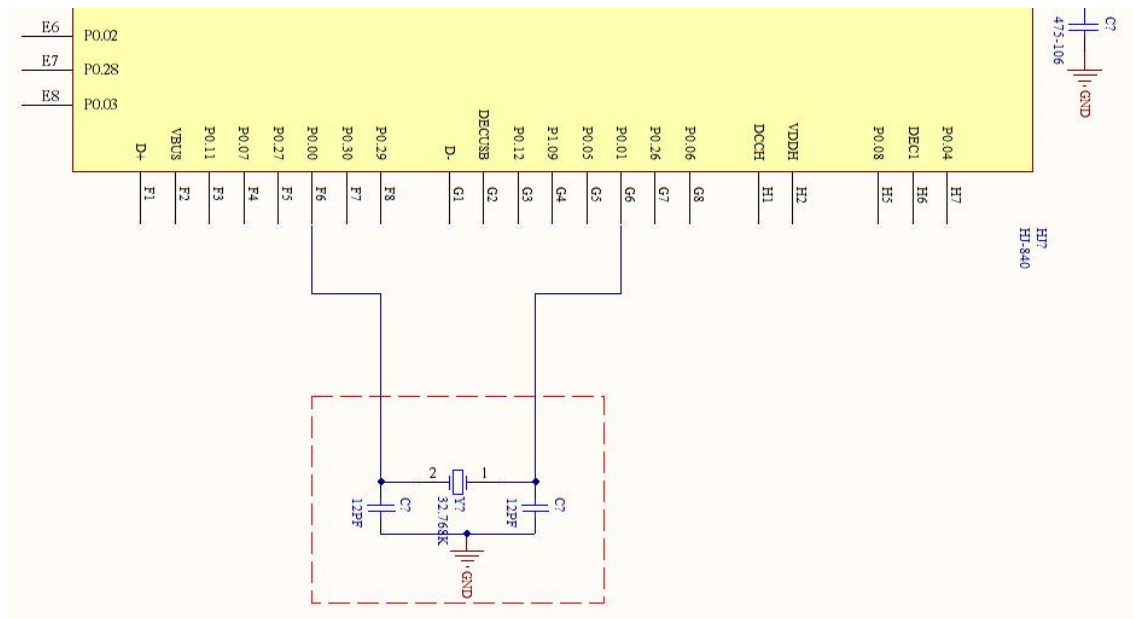


Figure 5.4: External clock connection diagram

5.3 Connected external PA/LNA for power expansion

Developed by users themselves, external access PA/LNA for power expansion and long-distance communication, please refer to the following code and instructions:

5.3.1 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);
}

```

5.3.2 Add the above function to the int main(void) function, please add that behind “ble_stack_init();”, before “advertising_start”, Reference figure 5.5:

```

/**@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 5.5: int main(void) function

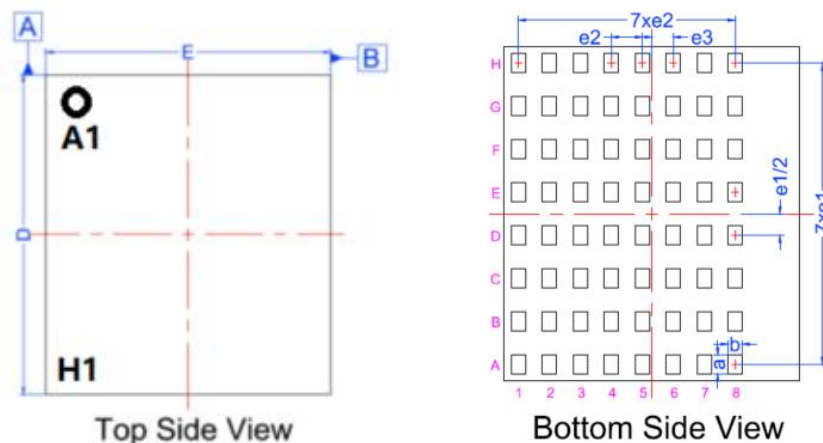
6 Notices for Hardware Design

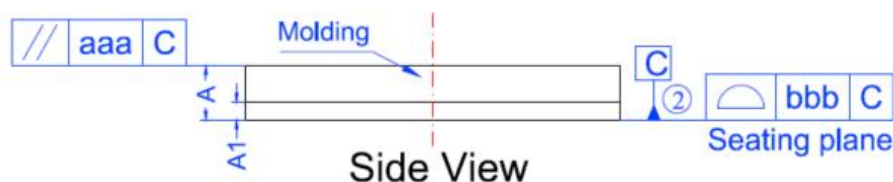
- All I/O ports can be used. Please check the pin diagram for all pins and note the IO mode and status connected to them.
- When not powered by a battery or when the input power is supplied by a DC power stepped down supply, it is recommended to use magnetic beads or inductors for filtering the input power.
- The filter capacitors at the power supply should be placed as close as possible to the power input pins of the module. If it is a capacitor-powered system or there is limited space, the filter capacitors at the power input can be removed. The module already has filter capacitors inside.

- When using the external antenna, be sure to contact us and let us confirm that your external PCB antenna or IPEX outgoing antenna PCB design is reasonable.
- The external 32.768KHz low-frequency crystal oscillator is not necessary, it can be replaced by the internal LF oscillator, just need to change the SDK, see section 5.1 for details, if you have any questions to consult our company.
- Modules should not be placed in a metal housing, and if a metal housing must be used, the antenna must be removed.
- In products that require the wireless module, some metal components such as screws, inductors, etc. should be kept as far away as possible from the RF antenna part of the wireless module.
- Do not place other components near or on the back of the antenna of the Bluetooth module, and do not route cables. Placing devices or wiring will affect Bluetooth performance.
- Module antenna should be placed on the four edges of the circuit board, the antenna part is close to the edge or corner of the main board, it is best to place the module in the corner of the circuit board.
- Each layer of the circuit board should be fully copper-covered and connected to GND. The copper-covered area must be large enough (excluding the antenna part) and properly grounded.
- Holes should be drilled in the copper-covered area of the entire circuit board, especially in the vicinity of the module and antenna, As many holes as possible should be punched.
- If there are high-power devices or high-voltage conversion circuits on the circuit board, the GND copper covering of modules must be isolated from those of other parts, connected in single-point ground mode, and perforations must be drilled as many as possible to reduce interference to radio signals.
- Unnecessary pins can be left hanging.

7 Machine Dimension

Module adopts LGA64 package, 0.65mm pad spacing, detailed dimensions are shown in the figure below.





DIMENSIONAL REFERENCES Units:mm

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

Figure 7.1: HJ-840 machine dimension

8 SMT production

8.1 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 ultrasound welding technology. Keep the module away from the ultrasonic soldering line and the fixing column during the design method to prevent damage to the module!

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

8.2 Soldering Recommendations

HJ-840 module use high temperature resistant materials, manufacturing by Lead-free Process. The maximum temperature resistance is 265°C. Ten continuous reflow soldering has no effect on properties and strength. Specific parameters as shown in Table 8-1.

Table 8-1: Reflow soldering parameters

Parameter	Value
Features	Lead-free process
Average ramp up rate(T_{Smax} to T_p)	max3°C/sec. max
Temperature Min(T_{Smin})	150°C
Temperature Max(T_{Smax})	200°C
Preheat time (Min to Max) (tS)	80~100sec
Peak Temperature (T_p)	250±5°C

Ramp-down Rate	6°C/sec. max
Time 25°C to Peak Temp (T_P)	8 min. max

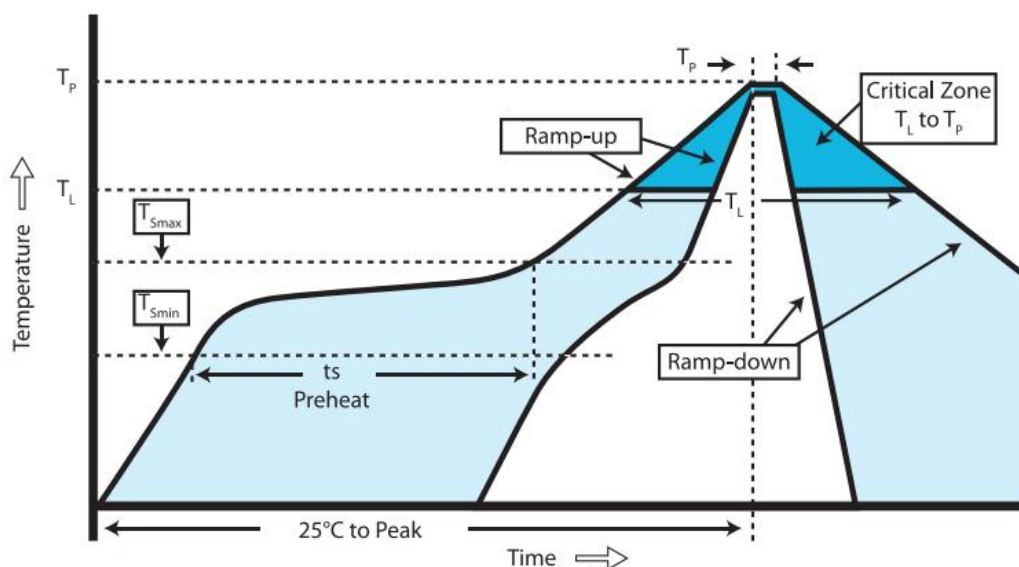


Figure 8.1: Temperature Curve of Reflow Welding

8.3 Humidity sensing properties

The HJ-840 module has a humidity sensitivity of level 3.

If any of the following two conditions are met, the HJ-840 module should be fully baked prior before reflow soldering, otherwise the module may cause permanent damage during reflow soldering.

- After unpacking or vacuum packaging is damaged and air leaks, the module needs to be SMT within 168 hours when the temperature is less than 30 degrees and the relative humidity is less than 60%. If the above conditions are not met, bake.
- Vacuum packaging is not opened, but beyond the shelf life, also need to be baked.

9 Packaging

9.1 Packaging method

Table 9-1: Packaging method

Type	Packaging method	Minimum packing quantity(PCS)
HJ-840_XX	Roll tape	3000

Use chip-grade anti-static aluminum foil bags to seal and pack with braid. Each bag is put in desiccant. Industrial grade vacuum pump ensures no air leakage, moisture, water and dust (IP65). The actual packaging effect is shown in Figure 9.1.



Figure 9.1: package figure

9.2 Label information

All packages are labeled with cargo information, ROHS label, anti-static label, etc.

【A】	Tangshan Hongjia electronic Technology Co., LTD
【B】	HJ-XXX-XXX
【C】	Pb Free Reflow(260°C)
【D】	Date Code:2508 HJ0218
【E】	Note: Must be stored in a vacuum Seal
【F】	Warning: Humidity sensitivity level MSL:XX
【G】	QTY:1500PCS SEAL DATE:20250218

Figure 9.2: Product label drawing

Table 9-2: Module information description

No.	Description
A	company name
B	product model
C	Lead-free reflow mark and reflow temperature setting value
D	Production date Example: 2508 HJ0218 represents the product produced in the 8th week of 2025, on February 18
E	Storage precautions
F	Humidity sensitivity level
G	Quantity of product + date of sale