Dadoutek BB840F S Ultra Low Power Bluetooth 5.4 Module

Dadoutek BB840F S Ultra Low Power Bluetooth 5.4 Module User Manual

Contents

Dadoutek BB840F S Ultra Low Power Bluetooth 5.4 Module

Product Information

Specifications

- **SN**: 2024-0105A V1.0
- **Manufacturer**: Best Of Best Holdings
- **Model**: BB840F(S)
- **Bluetooth Version**: 5.4
- **Frequency Band**: BLE: 2402-2480MHz
- **Power Consumption**:
  - **VDD**: 1.7-3.6V
  - **VBUS**: 4.35-5.5V
- On-chip DC-DC Buck Converter
- **Peak Current in TX**:
  - < 4.8 mA at 0dBm
  - < 14.8 mA at +8dBm
- **Ram Retention**: No
- Wake on RTC
- **Sensitivity:** -95dBm at 1Mbps PER

Product Usage Instructions

Module Connections

The BB840F module provides various interfaces for connection:

- **UART**: Universal Asynchronous Receiver-Transmitter

- **USB**: Universal Serial Bus
- **SPI**: Serial Peripheral Interface
- **I2S**: Integrated Inter-IC Sound
- **I2C**: Inter-Integrated Circuit
- **ADC**: Analog-to-Digital Converter
- **PWM**: Pulse Width Modulation

Power Supply

The BB840F module requires two power supplies:

- **VDD**: Supply voltage range of 1.7V to 3.6V
- **VBUS**: Supply voltage range of 4.35V to 5.5V

DC-DC Buck Converter

The module is equipped with an on-chip DC-DC buck converter, which helps regulate the power supply and reduces power consumption.

Transmission Power

The peak current in TX mode depends on the transmission power level:

- **0dBm**: Peak current is less than 4.8mA
- **+8dBm**: Peak current is less than 14.8mA

RAM Retention and Wake on RTC

The BB840F module does not have RAM retention. It supports wake-on-real-time-clock (RTC) functionality, allowing it to wake up from sleep mode based on RTC events.

Sensitivity

The module has a high sensitivity level of -95dBm at a data rate of 1Mbps and a Packet Error Rate (PER).

FAQ

- **Q: What is the frequency band of the BB840F module?**
  - **A**: The BB840F module operates in the BLE frequency band of 2402-2480MHz.
- **Q: What are the power supply requirements for the module?**
  - **A**: The module requires a VDD supply voltage ranging from 1.7V to 3.6V and a VBUS supply voltage ranging from 4.35V to 5.5V.
- **Q: Does the module have RAM retention?**
  - **A**: No, the BB840F module does not have RAM retention.
- **Q: Can the module wake up based on RTC events?**
  - **A**: Yes, the BB840F module supports wake-on-real-time-clock functionality.

- **Q: What is the sensitivity level of the module?**
  - **A**: The module has a high sensitivity level of -95dBm at a data rate of 1Mbps and a Packet Error Rate (PER).

Ultra-Low-Power Bluetooth 5.4 module

Introduction

- BB840F is a high-performance,industrial,ultra low-power BLE 5.4 module,which based on Nordic SoC nRF52840.It provides rich interfaces such as UART, USB, SPI, I2S, I2C, ADC, PWM. At the same time,it adopts a small stamp package and convenient for engineers to develop.

Key features

- **Frequency band**
  - **BLE**: 2402 2480MHz
- **Ultra low-power consumption**
  - VDD 1.7 3.6V & VBUS 4.35~5.5V
  - On-chip DC-DC buck converter
  - < 4.8 mA peak current in TX (0dBm)
  - < 14.8mA peak current in TX(+8dBm)
  - 0.4 µA at 3V in System OFF mode,
  - no RAM retention
  - 1.5 µA at 3V in System ON mode,
  - no RAM retention, wake on RTC

High sensitivity

- 95dBm sensitivity(1Mbps,PER<30.8%)
- 103dBm sensitivity(125kbps,PER<30.8%)
- 20 to +8 dBm TX power, configurable in 4 dB steps
  - ARM®TrustZone® Cryptocell 310 security subsystem

Applications

- n Advanced computer peripherals and I/O devices
  - Mouse / keyboard / Multi-touch trackpad
- Interactive entertainment devices
  - Gaming controllers
  - Remote controls

Protocol support

- BLE4.0 / 4.1 / 4.2 / 5.4 compatible

- BLE: 1Mbps/ 500kbps /125kbps
- Microprocessor & Memory
- ARM®Cortex®-M4 32-bit processor with
- FPU, 64 MHz
- 1MB Flash and 256kB RAM

Interface

- 46*General purpose I/O pins
- 1*USB2.0 full speed (12 Mbps) controller
- 2* UART / 4*SPI / 2*I2C / 4*PWM
- 1*I2S / 1*PDM
- 1*high-speed 32MHz SPI
- 8*12bits ADC
- 1*WDT

Dimension

- 13.9mm×23mm×1.75mm(BB840F)
- 13.9mm×23mm×2.1mm(BB840FS)

Internet of Things (IoT)

- Smart home sensors and controllers
- Industrial IoT sensors and controllers

Ordering information

Part No.	Temperature	Package	MOQ	Shield	Antenna
BB840F	-40°C ~ +85°C	SMD	1000	No	ANT on Board
BB840FS	-40°C ~ +85°C	SMD	1000	Yes	ANT on Board

Introduction

Description

- BB840F(S) is a high-performance,industrial,ultra low-power BLE 5.4 module,which based on Nordic SoC nRF52840.It provides rich interfaces such as UART, USB, SPI, I2S, I2C, ADC, PWM. At the same time,it adopts a small stamp package and convenient for engineers to develop.

Specifications

Function	Description
Flash	1MB
RAM	256kB
Microprocessor	64MHz ARM®Cortex-M4F
Protocol support	BLE4.0/4.1/4.2/5.4 compatible
Frequency Band	2402MHz ~ 2480MHz
TX power	-20 +8dBm
Sensitivity	-95dBm(1Mbps,PER<30.8%) / -103dBm(125kbps,PER<30.8%)
Power consumption	TX peak current: 14.8mA (+ 8dBm) TX peak current: 4.8mA (0dBm) 0.4 µA at 3V in System OFF mode, no RAM retention 1.5 µA at 3V in System ON mode, no RAM retention, wake on RTC
Digital interfaces	4*SPI / 2*I2C / 2*UART / 4*PWM / 1*I2S / 1*PDM
Analog interfaces	12 bit ADC (8 channels)
Timer	5*32-bit timer / 3*RTC / 1*WDT
Peripherals	AES/RNG/PPI
GPIO	46
Operation temperature	-40°C 85°C
Package	SMD (56 pins)
Dimension	13.9mm*23mm*1.75mm(BB840F) / 2.1mm(BB840FS)

- Specifications are shown in the following Table 1.1.

Pin assignments

Top view

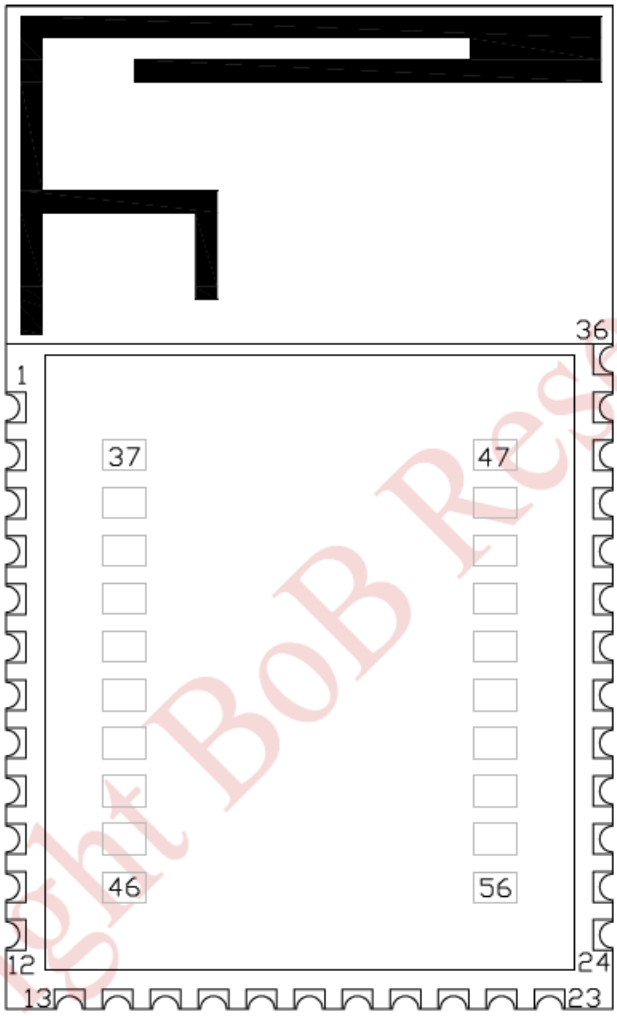

Figure 2.1 BB840F pin assignments, top view

- Top view of BB840F is shown in Figure 2.1.
- PIN37 ~ 46 are at the bottom.

Pin assignments

Pin No.	Pin name	Description
1	GND	Power ground
2	SWCLK	Serial wire debug clock input for debug and programming
3	SWDIO	Serial wire debug I/O for debug and programming
4	P0.03 / AIN1	Analog input / Digital I/O (low frequency I/O only) [Note]①,②
5	P0.28 / AIN4	Analog input / Digital I/O (low frequency I/O only)
6	P1.08	Digital I/O

7	P0.07	Digital I/O
8	P0.05 / AIN3	Analog input / Digital I/O
9	VDD	VDD Power supply, 1.7 ~ 3.6V (recommended voltage range)
10	P0.26	Digital I/O
11	P0.04 / AIN2	Analog input / Digital I/O
12	P0.06	Digital I/O
13	P0.08	Digital I/O
14	P1.09	Digital I/O
15	P0.12	Digital I/O
16	P0.25	Digital I/O
17	P0.23	Digital I/O / Options for QSPI-I/O
18	P0.21	Digital I/O / Options for QSPI-I/O
19	P0.19	Digital I/O / Options for QSPI-SCK
20	P0.18 / nRESET	Reset mode default(soft reset,active low) [Note]③ Digital I/O Options for QSPI-CSN
21	VBUS	USB 5V Power supply 4.35 ~ 5.5V (recommended voltage range)
22	DM	USB Data-
23	DP	USB Data+
24	P0.14	Digital I/O
25	P0.16	Digital I/O
26	P0.13	Digital I/O

27	P0.15	Digital I/O
28	P0.17	Digital I/O
29	P0.20	Digital I/O
30	P0.22	Digital I/O / Options for QSPI-I/O

The BB840F pin assignment is shown in Table 2.1.

- Top view of BB840F is shown in Figure 2.1.
- PIN37 ~ 46 are at the bottom

1. Any GPIO can be mapped to a peripheral for layout flexibility analog signal can be mapped to analog input pin only.
2. Low frequency I/O is a signal with a frequency up to 10 kHz.
3. The nRESET pin of BB840F can be used according to the product requirements.

31	P0.24	Digital I/O
32	P1.00	Digital I/O Serial wire output (SWO)
33	P1.06	Digital I/O (low frequency I/O only)
34	P0.09 / NFC IN1	Digital I/O (low frequency I/O only) [Note]④ NFC ANT input1
35	P0.10 / NFC IN2	Digital I/O (low frequency I/O only) NFC ANT input2
36	GND	Power ground
37	P1.11	Digital I/O (low frequency I/O only)
38	P1.10	Digital I/O (low frequency I/O only)
39	P1.12	Digital I/O (low frequency I/O only)
40	P1.13	Digital I/O (low frequency I/O only)

41	P1.15	Digital I/O (low frequency I/O only)
42	P1.14	Digital I/O (low frequency I/O only)
43	P0.31 / AIN7	Analog input / Digital I/O (low frequency I/O only)
44	P0.29 / AIN5	Analog input / Digital I/O (low frequency I/O only)
45	P0.02 / AIN0	Analog input / Digital I/O (low frequency I/O only)
46	P0.30 / AIN6	Analog input / Digital I/O (low frequency I/O only)
47	P1.04	Digital I/O (low frequency I/O only)
48	P1.02	Digital I/O (low frequency I/O only)
49	P1.07	Digital I/O (low frequency I/O only)
50	P1.05	Digital I/O (low frequency I/O only)
51	P1.01	Digital I/O (low frequency I/O only)
52	P1.03	Digital I/O (low frequency I/O only)
53	P0.11	Digital I/O
54	P0.27	Digital I/O
55	VDDH	High voltage power supply NC default.
56	DCCH	DC/DC converter output NC default.

1. Refer to the nRF52840 datasheet for NFC hardware design.

Specifications and parameters

Absolute maximum ratings

Table 3.1 Absolute maximum ratings

Item	Parameter		Description
	Min	Max	
VDD (V)	-0.3	3.9	Exposure to absolute maximum ratings for pro longed periods of time may affect the reliability of the device.[Note]⑤
VBUS (V)	-0.3	5.8	
I/O pin voltage (V)	-0.3	VDD+0.3	VDD voltage≤3.6V
RF input level (dBm)	–	10	
Reference transmission distance (m)	–	80	Module to module, @0dBm[Note]⑥
Operating temperature (℃)	-40	+85	
Storage temperature (℃)	-40	+125	Normal temperature storage is recommended

ESD parameters

Item		Minimum	Maximum
ESD	Human Body Model	–	2000V
	Human Body Model Class	–	2
	Charged Device Model	–	750V

1. Either VBUS mode or VDD mode can be selected.
2. The reference communication distance is closely related to hardware construction, test site environment, etc, which is for reference only.

Operating conditions

Item	Min	Typical	Max
Operating temperature (℃)	-40	+25	+85
VDD V	1.7	3.3	3.6
VBUS V	4.35	5	5.5
tPOR,10us ms [Note]⑦	–	1	–
tPOR,10ms ms	–	9	–
tPOR,60ms ms	–	23	–
tPOR ms @0→1.7V	–	–	60

Power consumption

Item	Typical	Unit	Description	Conditions
Itx,peak	14.8	mA	TX only run current (DC/DC),@ +8 dBm	VDD=3V, temperature=25 ℃ [Note]⑧
Itx,peak	4.8	mA	TX only run current (DC/DC),@0 dBm	
ISleep	2.4	μA	RF off,CPU WFI (wait for interrupt)/WFE (wait for event) sleep	
IDeep sleep	1.5	μA	System OFF, no RAM retention, wake on RTC	
IPower-down	0.4	μA	System OFF, no RAM retention, wake on reset	
IBroadcast@1s	28	μA	DC-DC mode, +8dBm, 31 bytes, external 32.768kHz crystal/±20ppm	
IBroadcast@1s	17	μA	DC-DC mode, 0dBm, 31 bytes, external 32.768kHz crystal/±20ppm	

1. tPOR,10us means the module power supply VDD to rise from 0V to 1.7V, the power-on reset active at 1ms. The module power-on reset circuitry may not function properly for rise times longer than the specified

maximum.

2. The dynamic power consumption of BB840F may be affected by the software operating mode, sleeping mode and RF activity interval,etc. Users can use the official simulation tool (Online Power Profiler) to calculate the current caused by software modification or configuration for special requirements **https://devzone.nordicsemi.com/nordic/power**

RF parameters

Item	Typical	Unit	Conditions
Frequency band	2402 2480	MHz	BLE mode
TX Power	-20 +8	dBm	Configurable in 4 dB steps
Receiving sensitivity	-95	dBm	BLE mode, 1Mbps, PER≤ 30.8%
Receiving sensitivity	-103	dBm	BLE mode, 125kbps, PER≤ 30.8%
Maximum RF input level	10	dBm	Exposure to absolute maximum ratings for prolonged periods of time may damaging it permanently

Typical application

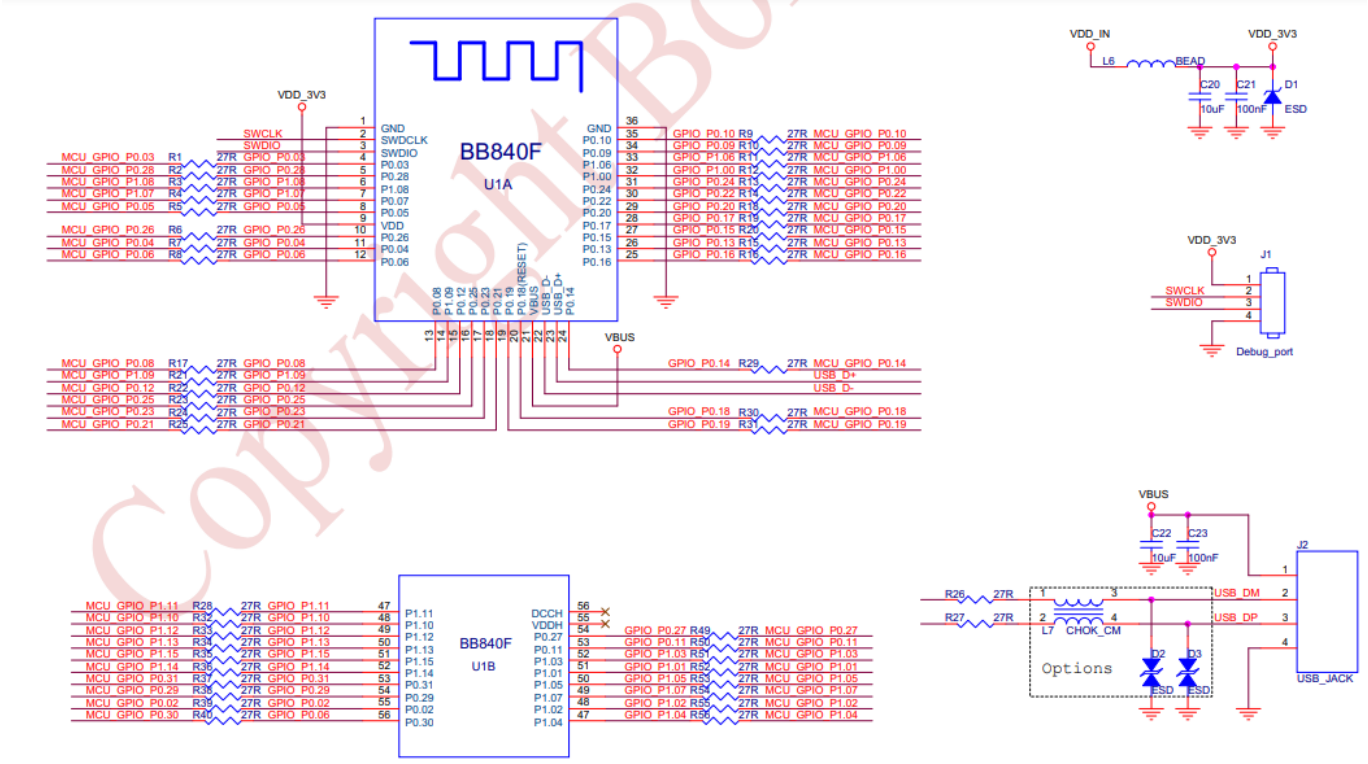

Figure 4.1 Typical application circuit

- The typical application circuit of BB840F is shown in Figure 4.1.

Mechanical specifications

Dimensions

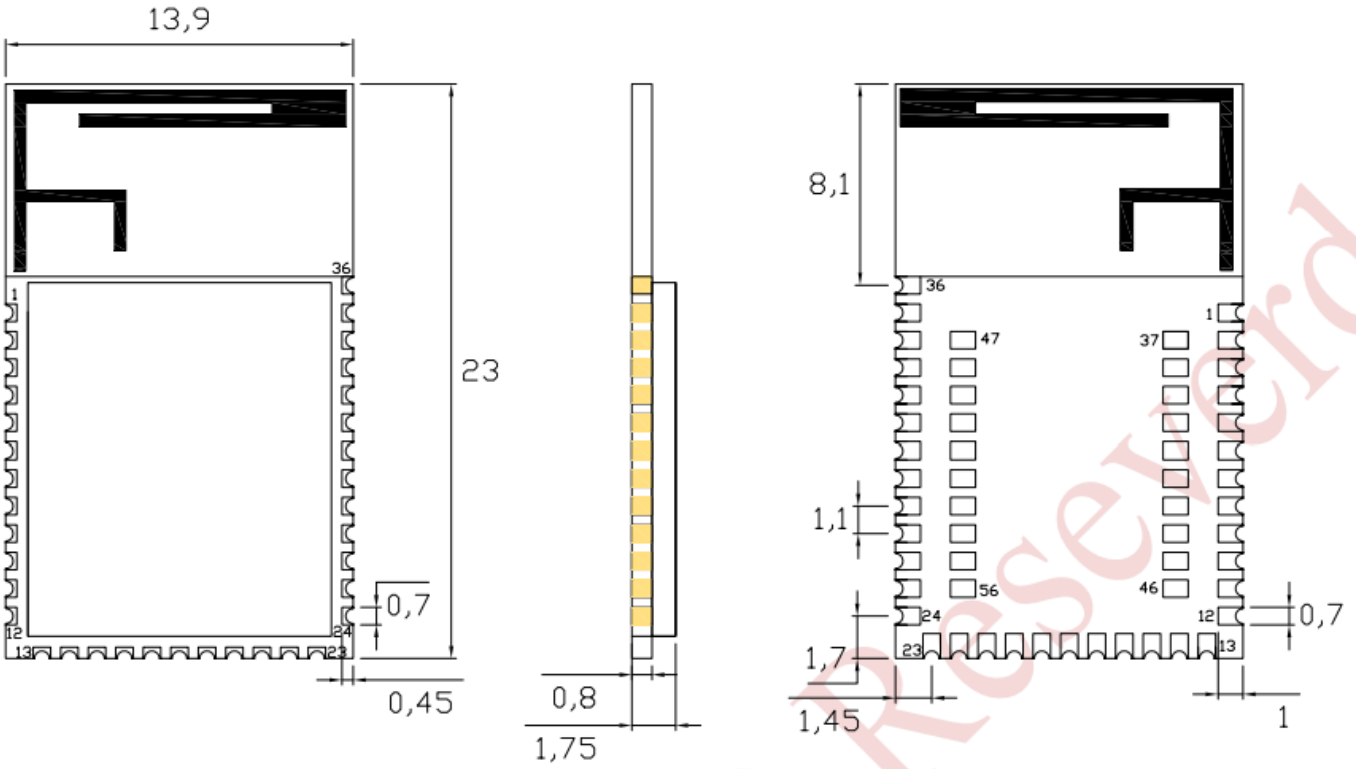

Figure 5.1 Dimensions of BB840F(top view)

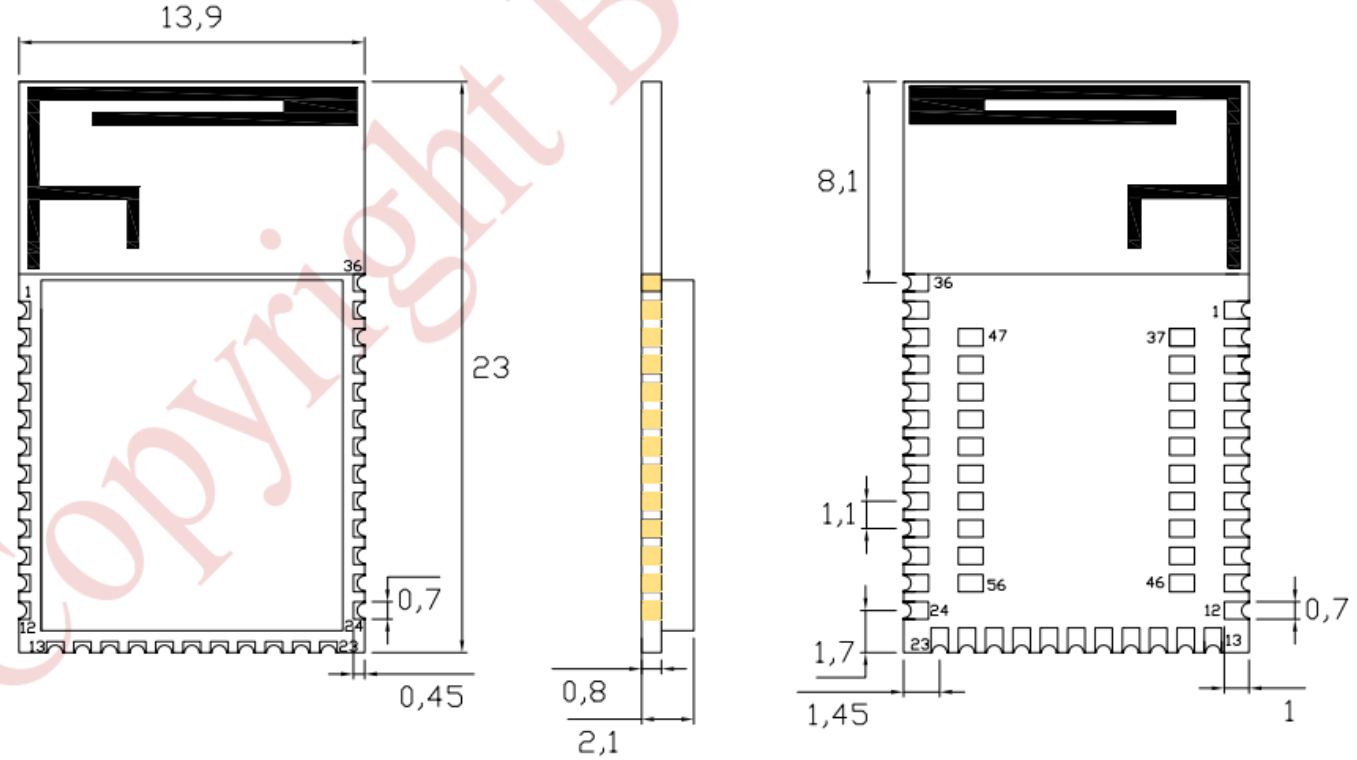

Figure 5.2 Dimensions of BB840FS(top view)

- The dimensions of BB840F & BB840FS is shown in the Figure 5.1 & Figure 5.2.

Table 5.1 Dimensions of BB840F(S)

Model	Length	Width	Height	PCB Thickness	PAD Size	PIN Spacing
BB840F	23mm	13.9mm	1.75mm	0.8mm	1mm×0.7mm	1.1mm
BB840FS	23mm	13.9mm	2.1mm	0.8mm	1mm×0.7mm	1.1mm

PCB footprint

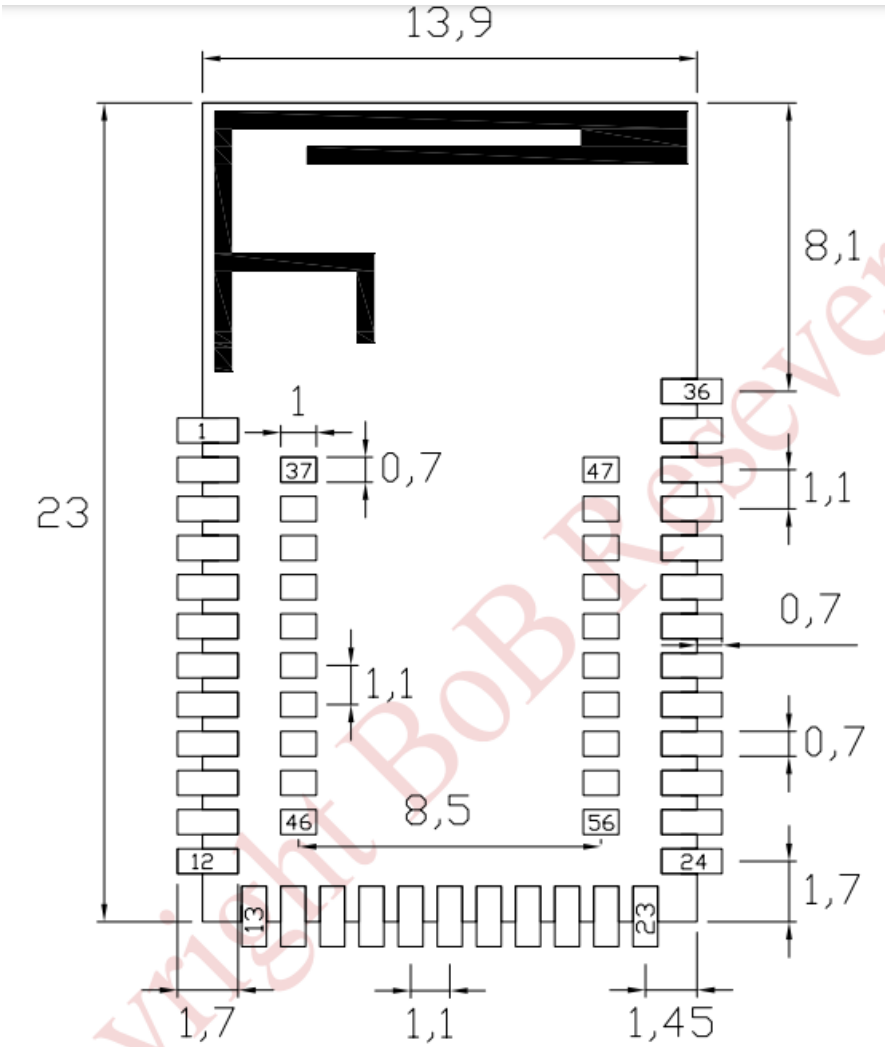

Figure 5.3 Recommended PCB footprint

- The recommended PCB footprint of BB840F(S) is shown in Figure 5.3.

Welding instructions

Recommended temperature reflow profile

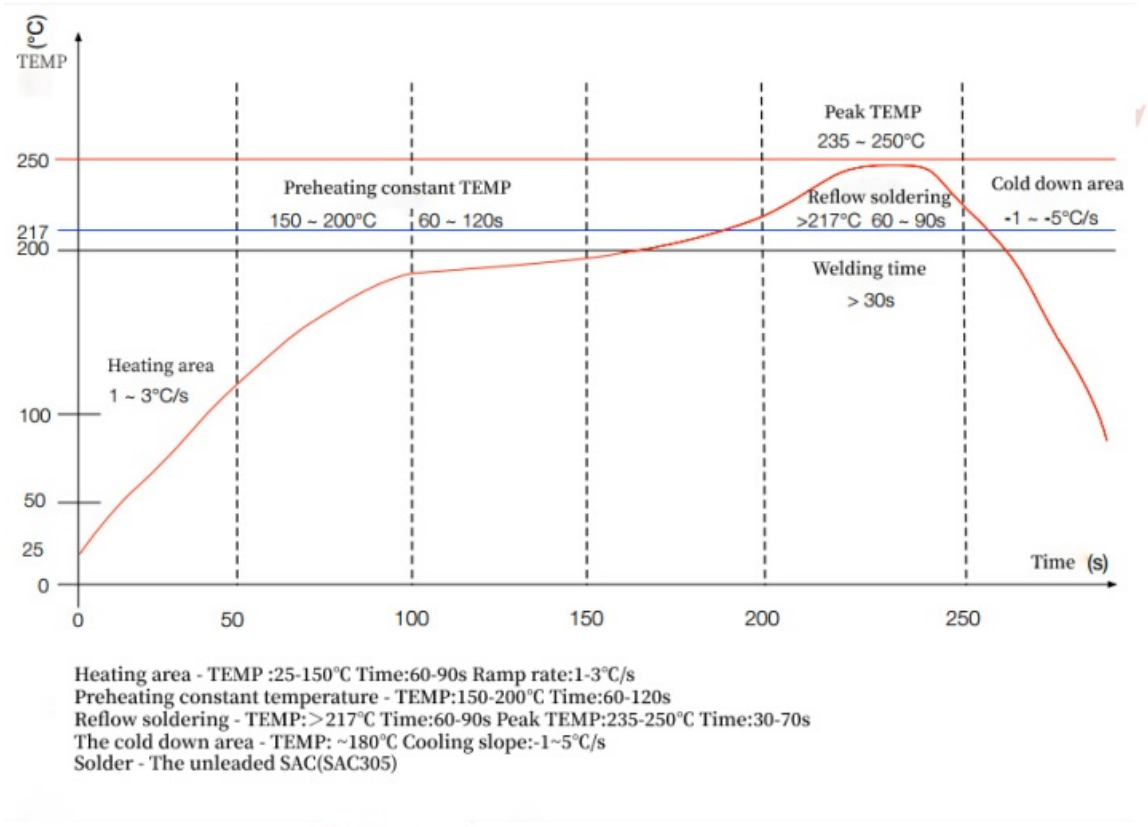

Figure 6.1 Temperature reflow profile

- The recommended SMT temperature reflow profile of BB840F is shown in Figure 6.1.

Part number & Selections

Part No.	SoC	Frequency band	Transmission power	Bluetooth protocol	Dimensions	Shield	Antenna type
BB840F	nRF52840	2.4GHz	+8dBm	BLE5.4	13.9 ×23×1.75mm	No	On board / PCB
BB840FS	nRF52840	2.4GHz	+8dBm	BLE5.4	13.9 ×23×2.1mm	Yes	On board / PCB

- The selection list related to BB840F is shown in Table 7.1.

Sales channel & Service

Shenzhen Best of Best Holdings Co., Ltd.

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- **Web** www.bobholdings.com

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- **Tel** 86-21-54071701
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Chengdu office

- **Add** Room 1402, Bldg#2, Shudu Center, No.138, Tianfu No.2 Street, Mid Section, Tianfu Avenue, HighTech District, Chengdu City, Sichuan Province, China
- **Tel** 86-28-85355677
- **Fax** 86-28-85350890

Guangzhou office

- **Add** Room 620 6 floor, Ao Yuan City Plaza,hanxi avenueGuangzhou,China.
- **Tel** 86-20-34776690

Revision history

Version	Date	Description	Reviser
V1.0	2024/01/05	Initial version	Wesley/Damon

FCC Statement

FCC standards: FCC CFR Title 47 Part 15 Subpart C Section 15.247 Device is equipped with PCB antenna , Antenna gain -0.03dBi 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, and (2) this device must accept any interference received, including interference that may cause undesired operation. Any Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.
Note: This equipment 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 equipment 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 equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment 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 equipment and receiver.
- Connect the equipment 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.

FCC Radiation Exposure Statement

- This modular complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter. If the FCC identification number is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. This exterior label can use wording such as the following: “Contains Transmitter Module FCC ID: 2A6CI-BB840FS Or Contains FCC ID: 2A6CI-BB840FS” When the module is installed inside another device, the user manual of the host must contain below warning statements;

1. **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
        - **Note**: This equipment 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 equipment 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 equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment 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 equipment and receiver.
        - Connect the equipment 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.
2. Changes or modifications not expressly approved by the party responsible for compliance could void the user’s authority to operate the equipment. The devices must be installed and used in strict accordance with the manufacturer’s instructions as described in the user documentation that comes with the product.

- Any company of the host device which install the modular with modular approval should perform the test of radiated & conducted emission and spurious emission, etc. according to FCC part 15C : 15.247 and 15.209 & 15.207 ,15B Class B requirement, Only if the test result comply with **FCC part 15C** : 15.247 and 15.209 & 15.207 ,15B Class B requirement then the host can be sold legally.

Documents / Resources

	Dadoutek BB840F S Ultra Low Power Bluetooth 5.4 Module [pdf] User Manual BB840F S Ultra Low Power Bluetooth 5.4 Module, BB840F S, Ultra Low Power Bluetooth 5.4 Module, Power Bluetooth 5.4 Module, Bluetooth 5.4 Module, 5.4 Module

References

- User Manual