SBF508M-21/21T/21U
PCBA module

Datasheet

Rev 1.1

2021/08/31

Revision History

Version	Date	Owner	Change Log
1.0	2021/01/13	Syntronix	First release
1.1	2021/08/31	Syntronix	1. Added precautions for using external capacitor for VBAT PIN

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Federal Communications Commission (FCC) Statement

You are cautioned that changes or modifications not expressly approved by the part responsible for compliance could void the user's authority to operate the equipment.

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 of the device.

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 RF Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

This device complies with Part 15 of the FCC Rules.

This module has been granted modular approval for mobile applications. OEM integrators for host products may use the module in their final products without additional FCC certification if they meet the following conditions. Otherwise, additional FCC approvals must be obtained.

The host product with the module installed must be evaluated for simultaneous transmission requirements.

The users manual for the host product must clearly indicate the operating requirements and conditions that must be observed to ensure compliance with current FCC RF exposure guidelines.

To comply with FCC regulations limiting both maximum RF output power and human exposure to RF radiation, the maximum antenna gain including cable loss in a mobile-only exposure condition must not exceed 0dBi.

OEM Guidance

1. Applicable FCC rules

This module is granted by Single Modular Approval. It complies to the requirements of FCC part 15.247.

2. The specific operational use conditions

This module can be used in lot devices. The input voltage to the module is nominally DC3.3V. The operational ambient temperature of the module is -40 °C - 85°C. The PCB antenna has been fixed, any other external antenna is prohibited.

3. Limited module procedures

N/A

4. Trace antenna design

N/A

5. RF exposure considerations

The equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator and your body. If the equipment built into a host as a portable usage, the additional RF exposure evaluation may be required as specified by 2.1093.

6. Antenna

Antenna type: PCB antenna Peak gain: 0dBi

7. Label and compliance information

An exterior label on OEM's end product can use wording such as the following: "Contains Transmitter Module FCC ID: 2AUBRB5JPA.

8. Information on test modes and additional testing requirements

a) The modular transmitter has been fully tested by the module grantee on the required number of channels, modulation types, and modes, it should not be necessary for the host installer to re-test all the available transmitter modes or settings. It is recommended that the host product manufacturer, installing the modular transmitter, perform some investigative measurements to confirm that the resulting composite system does not exceed the spurious emissions limits or band edge limits (e.g., where a different antenna may be causing additional emissions).

b) The testing should check for emissions that may occur due to the intermixing of emissions with the other transmitters, digital circuitry, or due to physical properties of the host product (enclosure). This investigation is especially important when integrating multiple modular transmitters where the certification is based on testing each of them in a stand-alone configuration. It is important to note that host product manufacturers should not assume that because the modular transmitter is certified that they do not have any responsibility for final product compliance.

c) If the investigation indicates a compliance concern the host product manufacturer is obligated to mitigate the issue. Host products using a modular transmitter are subject to all the applicable individual technical rules as well as to the general conditions of operation in Sections 15.5, 15.15, and 15.29 to not cause interference. The operator of the host product will be obligated to stop operating the device until the interference have been corrected.

Table of Content

List of Figure

List of Table

1. Overview

SBF508M-21 series is a System-On-Chip integrated 2.4GHz radio transceiver and baseband processor for Bluetooth Low Energy 5(BLE5). It contains high-performance ARM ® Cortex TM -M0 32-bit RISC core, 256KB embedded Flash/OTP/ROM, 51KB embedded SRAM, the hardware of Link Layer for BLE5, 2.4GHz radio transceiver and peripheral for application.

The chip has flexible power management and low power consumption, which is suitable for Internet of Things or wearable device application.

The BLE (Bluetooth low energy) core is a qualified Bluetooth baseband controller that compatible with the Bluetooth low energy 5.0 specifications and it is in charge of packet encoding/decoding and frame scheduling.

2. Features

- 2.4 GHz GFSK RF transceiver
- 1 Mbps, 2Mbps and long range (125kbps and 500kbps mode) Bluetooth® low energy modes
- Supports Frequency-Hopping Spread Spectrum.
- Compliant to BLE 5.0 core specifications.
- All device states-advertising, scanning, initiating and connection.
- All packet types (Advertising / Data / Control).
- Support 8 connects.
- Support 4 extended advertising sets.
- White List & Duplicate filtering.
- Support long range.
- Support advertising length extensions.
- Support data length extensions.
- Manages connection setup procedures – both as the master and the slave.
- Framing and De-framing of the packet.
- Hardware AES encryption.

3. Antenna List

Antenna gain (dBi)	廠牌 Brand：Syntronix 型號 model：IFMA 類型 Type：printed ANT BT : 0 dBi

Figure 3-1 Antenna List

4. DC Power Connection

MODE	MIN	TYP	MAX	Unit
CPU running at 26MHz and no RF active		1.81		mA
CPU running at 26MHz and advertising interval 20ms (0dBm)		2.3		mA
CPU running at 26MHz and advertising interval 1s (0dBm)		0.101		mA
CPU running at 26MHz and connection interval 50ms (0dBm)		0.514		mA
CPU at 32.768KHz Deep-Sleep Mode(ECO mode)		0.209		mA
CPU at Power standby Mode		0.208		mA
CPU at SPU Sleep Mode		39.7		uA
CPU at SPU Deep-sleep Mode		29.8		uA
CPU at SPU Power Down Mode		5		uA
CPU at SPU Deep Power Down Mode		2		uA

Table 4-1 DC Power Connection

5. General Specification

Model Name	SBF508M -21/21T/21U
Bluetooth standard	BLE5
Main Chipset	SBF508BF-48/SBF508BP-33
PCBA Dimension	22.0 x 15.0 x 2.6（mm）
Frequency Range	2402 ~ 2480 MHz ISM Band
Date Rates	1 Mbps, 2Mbps and long range (125kbps and 500kbps mode)
Modulation	GFSK
Operating conditions	
Voltage	3.0V ~ 3.6V (Note 1)
Operating Temperature	-40 ~ 85°C ambient temperature
Storage Temperature	-40 ~ 85°C ambient temperature
Operating Humidity	5 to 90% maximum（non-condensing）

Radio Specifications					
Maximum input /output power level	Mode	Data Rate		Power	Unit
	input			10	dBm
	output			MAX= 0	dBm
RX sensitivity(IC)	Mode	Conditions		Sensitivity	Unit
	1M	PER < 30.8%		-95	dBm
	2M	PER < 30.8%		-93	dBm
	500Kb	PER < 30.8%		-97	dBm
	125Kb	PER < 30.8%		-102	dBm
C/I	Mode	Parameter	Conditions	Sensitivity	Unit
	1Mbps	Co-Channel interference	BER < 0.1%	3	dB
	1Mbps	Adjacent -1MHz interference	BER < 0.1%	-10	dB
	1Mbps	Adjacent +1MHz interference	BER < 0.1%	-10	dB
	1Mbps	Adjacent -2 MHz interference	BER < 0.1%	-24	dB

	Mode	Parameter	Conditions	Sensitivity	Unit
C/I	1Mbps	Adjacent +2 MHz interference	BER < 0.1%	-45	dB
	1Mbps	Adjacent -3 MHz interference	BER < 0.1%	-45	dB
	1Mbps	Adjacent +3 MHz interference	BER < 0.1%	-49	dB
	2Mbps	Co-Channel interference	BER < 0.1%	4	dB
	2Mbps	Adjacent -2 MHz interference	BER < 0.1%	-19	dB
	2Mbps	Adjacent +2 MHz interference	BER < 0.1%	-24	dB
	2Mbps	Adjacent -4 MHz interference	BER < 0.1%	-25	dB
	2Mbps	Adjacent +4 MHz interference	BER < 0.1%	-54	dB
	2Mbps	Adjacent -6 MHz interference	BER < 0.1%	-53	dB
	2Mbps	Adjacent +6 MHz interference	BER < 0.1%	-56	dB
PBL	I	Block performance 30 –2000MHz	Min= -10	0	dBm
	II	Block performance 2000 –2399MHz	Min= -27	-6	dBm
	III	Block performance 2484 –3000MHz	Min= -27	-3	dBm
	IV	Block performance 3 –12.75GHz	Min= -10	0	dBm
IMD	1M	Intermodulation performance	Min= -50	-48	dBm
	2M	Intermodulation performance	Min= -50	-43	dBm

Table 5-1 General specification

Note 1:

1) The absolute maximum rating of VBAT is 3.6V, make sure the applied power supply does not exceed it.
2) The external capacitor of VBAT PIN should be < 100uF because the module already has build-in capacitors.

6. Pin Description and PCBA size: SBF508M-21/21T/21U

PCBA module size: W15 x L22 x H2.6 (mm)

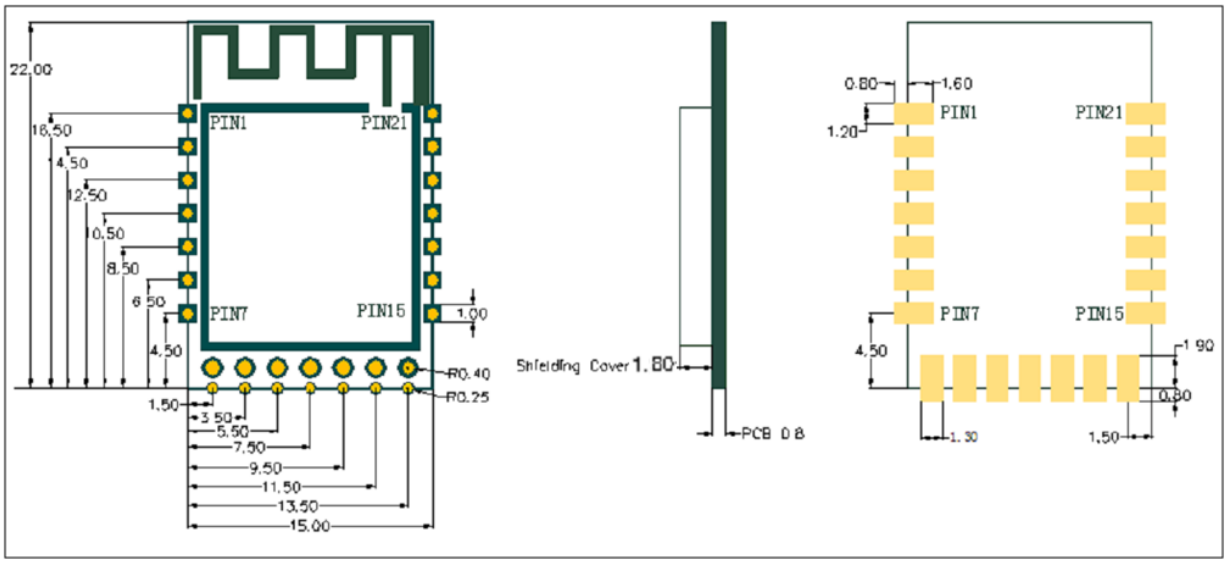

Figure 6-1 PCBA size

Pin function and description

NO	Name	Type	Description
1	GND	-	Ground Connection
2	PA28	I/O	SWCLK
3	PA29	I/O	SWDIO
4	TM_TCLK	I	Flash Program
5	RESETN	EN	Reset pin
6	PB01	I/O	UART0_TX
7	PA17	I/O	PWM1
8	VBAT	-	Power supply pin
9	GND	-	Ground Connection
10	PB06	I/O	I2C_SCL
11	PB07	I/O	I2C_SDA
12	PB08	I/O	UART1_RX

NO	Name	Type	Description
13	PB09	I/O	UART1_TX
14	PA02	I/O	PWM4
15	PA03	I/O	PWM5
16	PA08	I/O	PWM7/SPI_MISO
17	PA09	I/O	SPI_SCK
18	PA04	I/O	PWM6/SPI_SS
19	PA11	I/O	SPI_MOSI
20	VBAT	-	Power supply pin
21	GND	-	Ground Connection

Table 6-1 Pin function & description

7. Placement of module

7.1 Notes of module placement

1. It is recommended that the module antenna to be placed outside the motherboard and be placed as close to the edge of the motherboard to ensures the best RF performance.
2. Please refer the figure in section 7.3 for the placement example.
3. Please keep the motherboard power line for VBAT as short as possible to lower the impedance of power trace.
4. It is recommended to have a ground plane under the top metallic shielding zone of the module. The ground plane should be the complete plane in the internal pin connection area at the bottom of the module.
5. Be awarded that this is no component, cable, mounting screw, or metallic material near the antenna area.
6. The antenna should not cover by any metallic material on outer enclosure.

7.2 Recommended footprint layout of solder pad

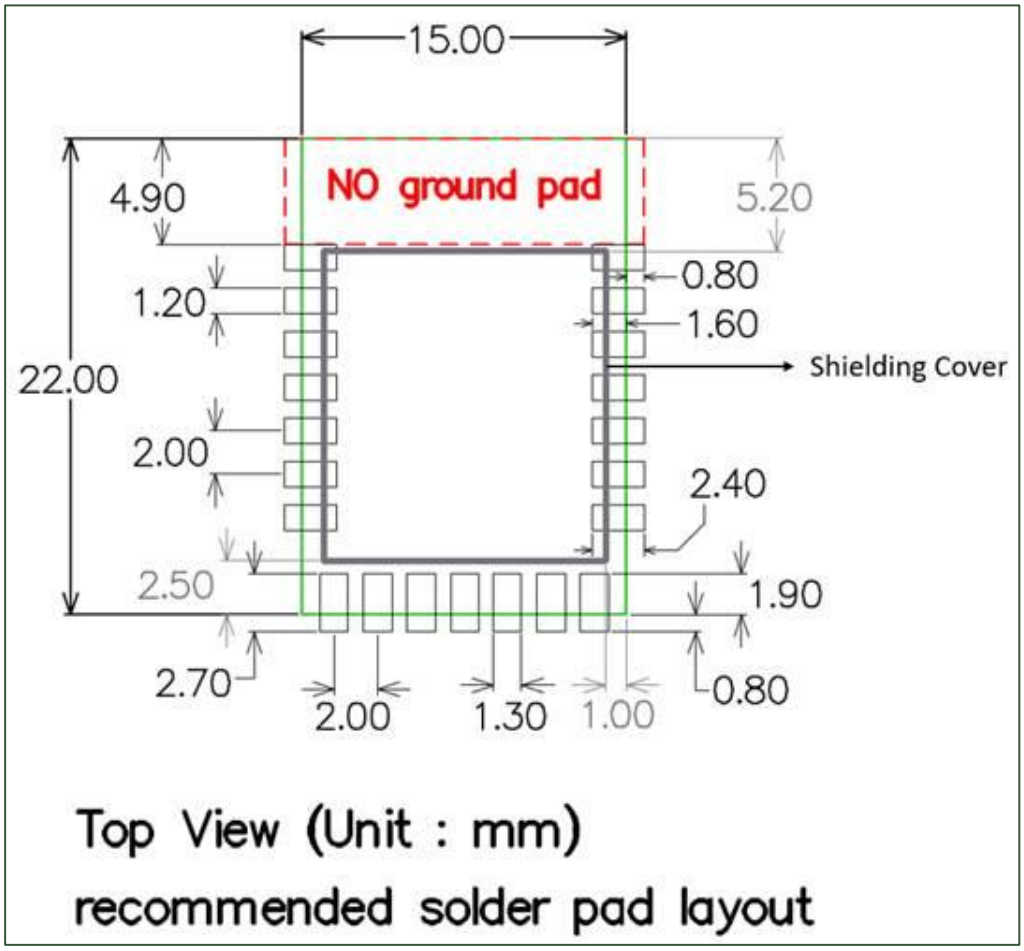

Figure 7-1 Solder pad layout reference

7.3 Recommended module placement on motherboard

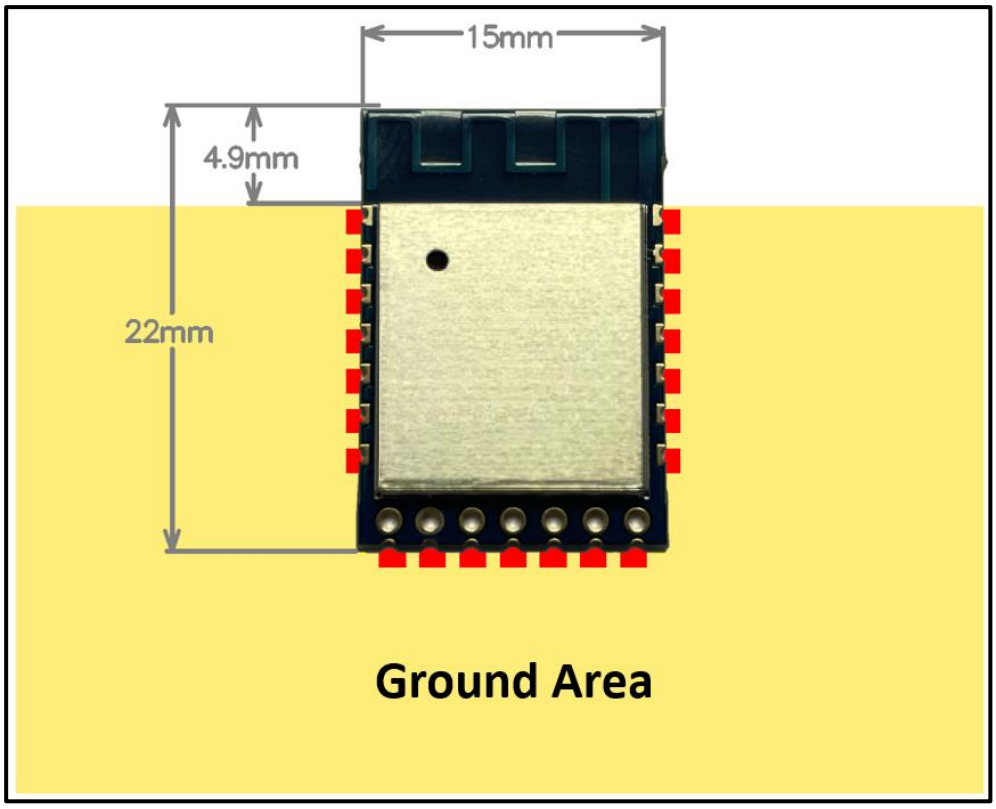

Figure 7-2 Placement of module

8. Recommended Reflow profile

Referred IPC/JEDEC standard.
Peak temperature: < 250°C
Number of times: 2 times

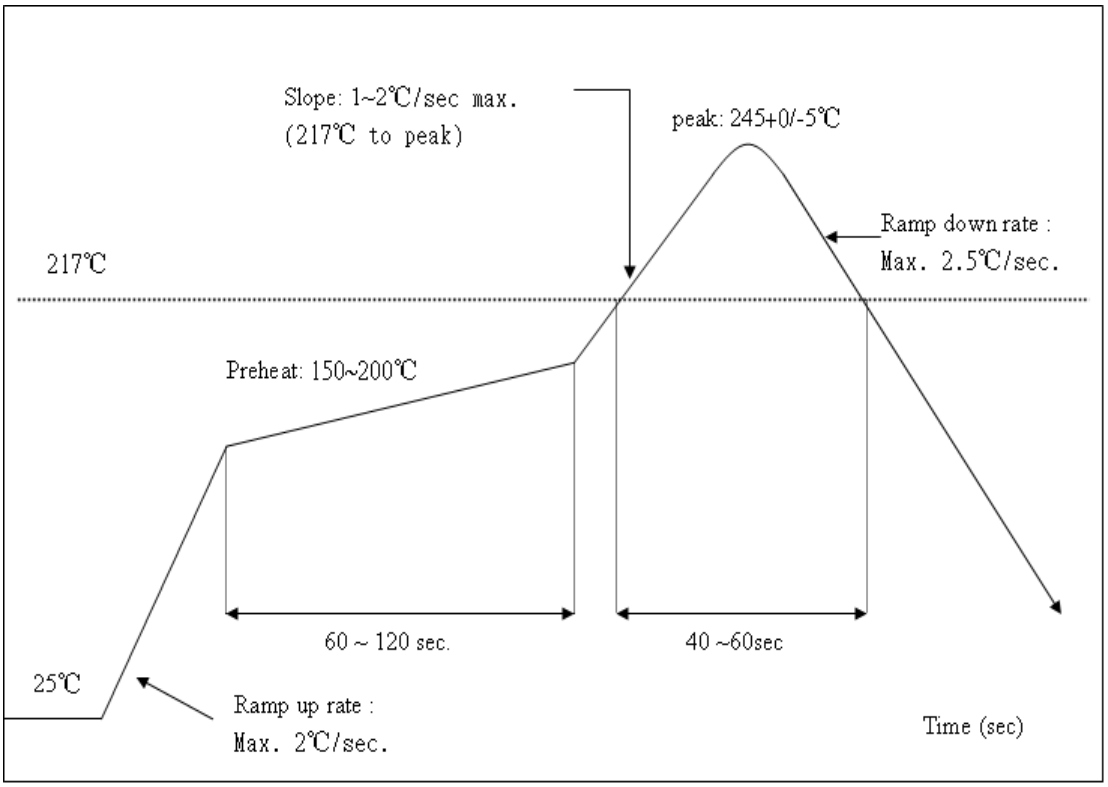

Figure 8-1 Recommended reflow profile

9. Packing

Box dimension: 335 x 347 x 70 (mm)

Figure 9-1 Packing Box

Tape reel dimension:

1. Reel size=330mm
2. Tape: width=44mm, cavity size=15.8*22.5*3.1mm, total length=20.6m

Figure 9-2 Plastic disc & tape reel

Quantity: 1000PCS/Reel

ESD CAUTION

The SBF508M-21/21T/21U is ESD (electrostatic discharge) sensitive device and may be damaged with ESD or spike voltage. Although SBF508M-21/21T/21U is with built-in ESD protection circuitry, please handle with care to avoid the permanent malfunction or the performance degradation.