BW436S-44B1(2)

IEEE 802.11 b/g/n 1T1R Wi-Fi +BT5.2 Combo Module

Table of Contents

1. Device Overview

1.1 Features

- IEEE 802.11 b/g/n single-band radio with an internal power amplifier. LNA, and T/R switch
- Bluetooth V5.2 with integrated class 1 PA
- Concurrent Bluetooth and WLAN operation
- ON-chip WLAN driver execution capable of supporting IEEE 802.11functionality
- Simultaneous BT/WLAN reception with a single antenna
- WLAN host interface options:
- SDIO V2.0, interface default and high-speed timing
- gSPI--up to a 50 MHz clock rate
- BT UART (up to 4Mbps) host digital interface that can be used concurrently with the above WLAN host interfaces
- ECI-enhanced coexistence support, which coordinates BT SCO transmissions around WLAN receptions
- PCM for BT audio
- HCI high-speed UART(H4 and H5) transport support
- Wideband speed support(16bits, 16khz sampling PCM, through PCM interfaces)
- Bluetooth Smart Audio technology improves voice and music quality to headsets
- Bluetooth low power inquiry and page scan
- Bluetooth Low Energy(BLE) support
- Bluetooth Packet Loss Concealment (PLC)
- Multiple simultaneous A2DP audio streams

1.2 Applications

- IP camera
- Tablet
- Smart appliances
- Other multimedia devices
- Mobile devices
- Network devices
- Smartphone

1.3 Descriptions

This module is designed around Synaptics® SYN43436S. The Synaptics SYN43436S is a highly integrated single-chip solution and offers the lowest RBOM in the industry for smartphones, tablets, and a wide range of other portable devices. The chip includes a 2.4 GHz WLAN IEEE 802.11 b/g/n MAC / baseband / radio, and Bluetooth 5.2. In addition, it integrates a power amplifier (PA) that meets the output power requirements of most handheld systems, a low-noise amplifier (LNA) for

best-in-class receiver sensitivity, and an internal transmit/receive (iTR) RF switch, further reducing the overall solution cost and printed circuit board area.

The WLAN host interface supports gSPI and SDIO V2.0 modes, providing a raw data transfer rate up to 200 Mbps when operating in 4-bit mode at a 50 MHz bus frequency. An independent, high-speed UART is provided for the Bluetooth host interface.

Using advanced design techniques and process technology to reduce active and idle power, the SYN43436S is designed to address the needs of highly mobile devices that require minimal power consumption and compact size. It includes a power management unit that simplifies the system power topology and allows for operation directly from a rechargeable mobile platform battery while maximizing battery life.

The SYN43436S implements the world's most advanced Enhanced Collaborative Coexistence algorithms and hardware mechanisms, allowing for an extremely collaborative WLAN and Bluetooth coexistence.

1.4 Functional Block Diagram

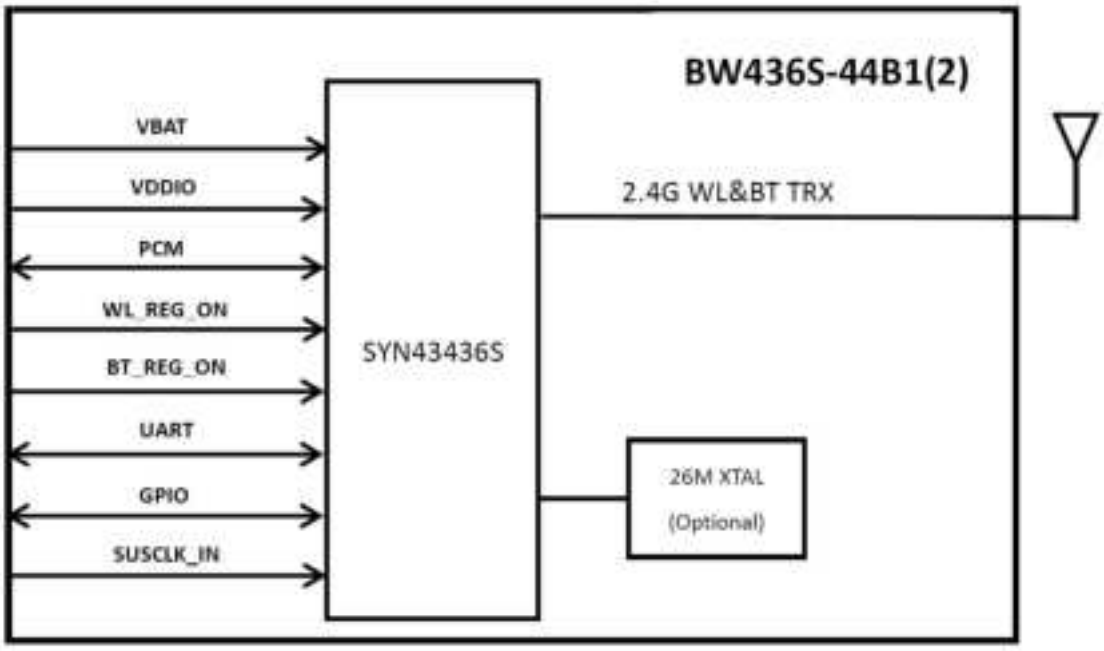


Figure 1. Block Diagram of BW436S-44B1(2)

2. Pin Configuration and Functions

2.1 Module Pin Diagram

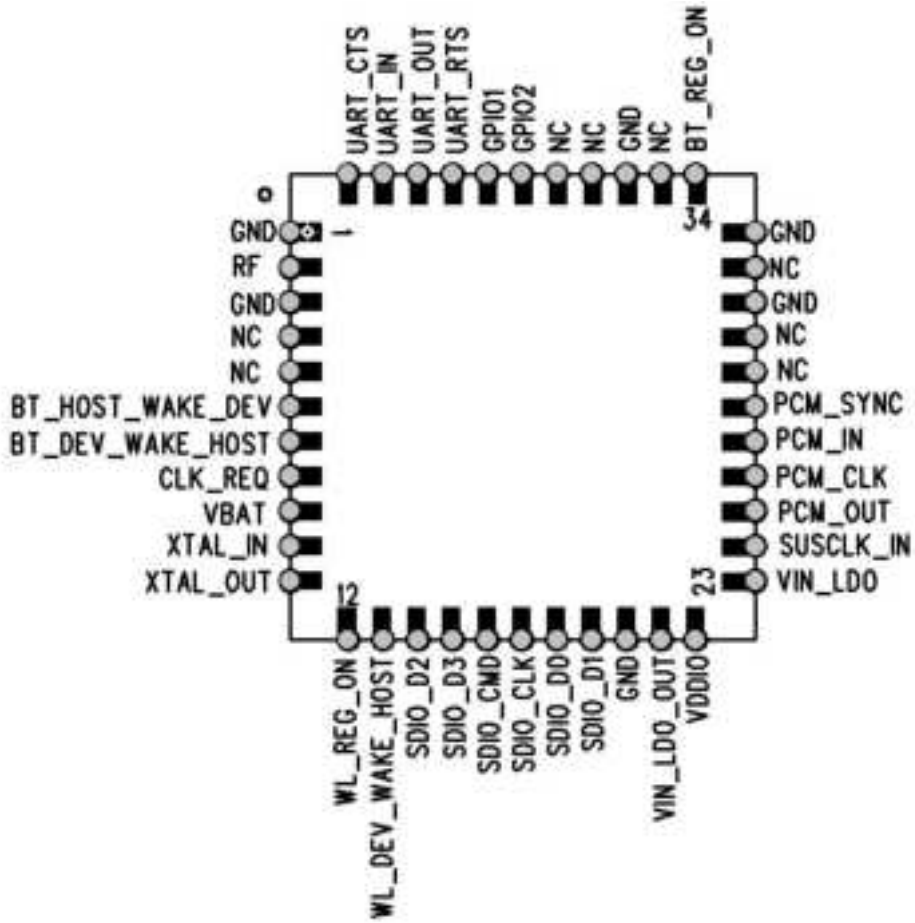


Figure 2. Pin Diagram of BW436S-44B1(2)

2.2 Pin Functions

Pin	Name	I/O	Description
1	GND	GND	Ground
2	WL_BT_ANT	RF	WLAN/BT RF TX/RX path
3	GND	GND	Ground
4	NC	Floating	Floating Pin, No connect to anything
5	NC	Floating	Floating Pin, No connect to anything
6	BT_HOST_WAKE_DEV	I	BT Device Wake
7	BT_DEV_WAKE_HOST	O	BT Host Wake

8	CLK_REQ	O	The module asserts CLK_REQ when Bluetooth or WLAN directs the host to turn on the reference clock. The CLK_REQ polarity is active-high
9	VBAT	VCC	3.3V power pin
10	XTAL_IN	I	Crystal input(BW436S-44B1) Floating Pin, No Connected (BW436S-44B2)
11	XTAL_OUT	O	Crystal output(BW436S-44B1) Floating Pin, No Connected (BW436S-44B2)
12	WL_REG_ON	I	Used by PMU to power up or power down the internal regulators used by the WLAN section. Also, when deasserted, this pin holds the WLAN section in reset. This pin has an internal 200k ohm pull down resistor that is enabled by default. It can be disabled through programming
13	WL_DEV_WAKE_HOST	O	WL Host Wake
14	SDIO_D2	I/O	SDIO Data Line 2
15	SDIO_D3	I/O	SDIO Data Line 3
16	SDIO_CMD	I/O	SDIO Command Input
17	SDIO_CLK	I	SDIO Clock Input
18	SDIO_D0	I/O	SDIO Data Line 0
19	SDIO_D1	I/O	SDIO Data Line 1
20	GND	GND	Ground.
21	VIN_LDO_OUT	P	Internal Buck voltage generation pin
22	VDDIO	VCC	1.8V-3.3V VDDIO supply for WLAN and BT
23	VIN_LDO	P	Internal Buck voltage generation pin
24	SUSCLK_IN	I	External 32K or RTC clock
25	PCM_OUT	O	PCM data Out
26	PCM_CLK	I/O	PCM Clock
27	PCM_IN	I	PCM data Input
28	PCM_SYNC	O	PCM Synchronization control
29	NC	Floating	Floating Pin, No connect to anything
30	NC	Floating	Floating Pin, No connect to anything
31	GND	GND	Ground
32	NC	Floating	Floating Pin, No connect to anything

33	GND	GND	Ground
34	BT_REG_ON	I	Used by PMU to power up or power down the internal regulators used by the Bluetooth section. Also, when deasserted, this pin holds the Bluetooth section in reset. This pin has an internal 200k ohm pull down resistor that is enabled by default. It can be disabled through programming
35	NC	Floating	Floating Pin, No connect to anything
36	GND	GND	Ground
37	NC	Floating	Floating Pin, No connect to anything
38	NC	Floating	Floating Pin, No connect to anything
39	GPIO2	I/O	Wi-Fi Co-existence pin with LTE
40	GPIO1	I/O	Wi-Fi Co-existence pin with LTE.
41	UART_RTS	O	High-Speed UART RTS
42	UART_OUT	O	High-Speed UART Data Out
43	UART_IN	I	High-Speed UART Data In
44	UART_CTS	I	High-Speed UART CTS

3. Specifications

3.1 Absolute Maximum Rating

Caution! The absolute maximum ratings in the following table indicates voltages levels where permanent physical damage to the device can occur, even if these limits were exceeded for only a brief duration.

Parameter	Specification			Unit
	Min.	Typ.	Max.	
VBAT	-0.5	3.3	6	V
VDDIO	-0.5	3.3	3.9	V

3.2 Recommended Operating Conditions

Power Supply Voltage (VBAT)	3.0V~4.8V
DC supply voltage for digital I/O（VDDIO）	1.7V~3.6V
Operating Temperature	-30 ℃ ~ +70 ℃

Storage Temperature	-40 ℃ ~ +125℃

3.3 RF Characteristics

3.3.1 WiFi RF Specifications

Category	Description
Chip-set	SYN43436S
Standard	IEEE802.11b/g/n, Bluetooth 5.2
Modulation Type	CCK,OFDM(16-QAM/64-QAM)
Frequency Band	2.400~2.500GHz
Interface	Support SDIO/UART
Spread Spectrum	DSSS
Transmission Distance	Indoor up to 100m, outdoor up to 300m (limited in an environment)
Data Security	64/128 bit WEP, WPA/WPA2, WPA-PSK/WPA2-PSK(TKIP/AES)
Transmit Power(Conducted)	11b 1M:17±2dBm 11b 11M:17±2dBm
	11g 6M:17±2dBm 11g 54M:15±2dBm,
	11n HT20 MCS0: 17±2dBm 11n HT20 MCS7: 15±2dBm
Rx Sensitivity	11b:11Mbps: -87dBm@8% PER
	11g:54Mbps: -76dBm@10% PER
	11n HT20:MCS7:-73dBm@10% PER
Data Rate	802.11b: 1, 2, 5.5, 11Mbps
	802.11g: 6, 9, 12, 18, 24, 36, 48, 54Mbps
	802.11n(20MHz):up to 72 Mbps
Relative Humidity	10%~95%
Antenna	External Antenna

3.3.2 BT RF Specifications

Parameter	Conditions	Minimum	Typical	Maximum	Unit
Frequency range		2402		2480	MHz
RX sensitivity	1 Mbps		-88		dBm
	2 Mbps		-88		dBm
	3 Mbps		-85		dBm
	LE 1M		-88		dBm
Initial carrier frequency offset			25		KHz
Output power(Conducted)	Class 1		8		dBm

3.4 Power Consumption Summary

3.4.1 WiFi Consumption

Mode	Rate	VBAT = 3.6V, VDDIO = 1.8V, TA 25°C	
		VBAT(mA)	VDDIO(uA)
Sleep Modes			
Leakage (OFF)	N/A	0.0035	0.08
Sleep (idle, unassociated)	N/A	0.0058	80
Sleep (idle, associated, inter-beacons)	Rate1	0.0058	80
Active Modes			
Rx Active (at –50dBm RSSI)	Rate 11	40	12
	Rate 54	40	12
	Rate MCS7	41	12
TX	Rate 11 @ 18dBm	290	15
	Rate 54 @ 15dBm	260	15
	Rate MCS7 @ 15dBm	260	15

3.4.2 BT Consumption

Operation Mode	Conditions	Min.	Typ.	Max.	Unit
DM5/DH5 Master	VBAT (VBAT = 3.6V) Typical VDDIO (VDDIO = 1.8V)	-	29.1	-	mA

BLE Scan	VBAT (VBAT = 3.6V) Typical VDDIO (VDDIO = 1.8V)	-	187	-	uA
Sleeping	VBAT (VBAT = 3.6V) Typical VDDIO (VDDIO = 1.8V)	-	6	-	μA

4. Application, Implementation, and Layout

4.1 Application Diagram

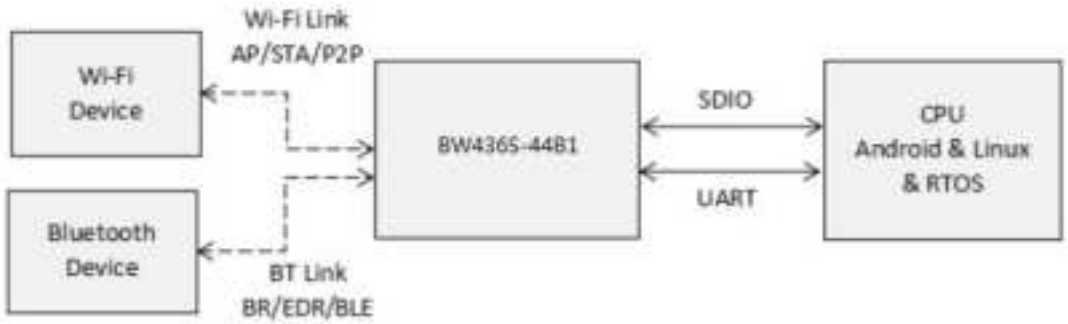


Figure 3. Remote Control Block Diagram of BW436S-44B1(2)

4.2 Typical Application Circuit

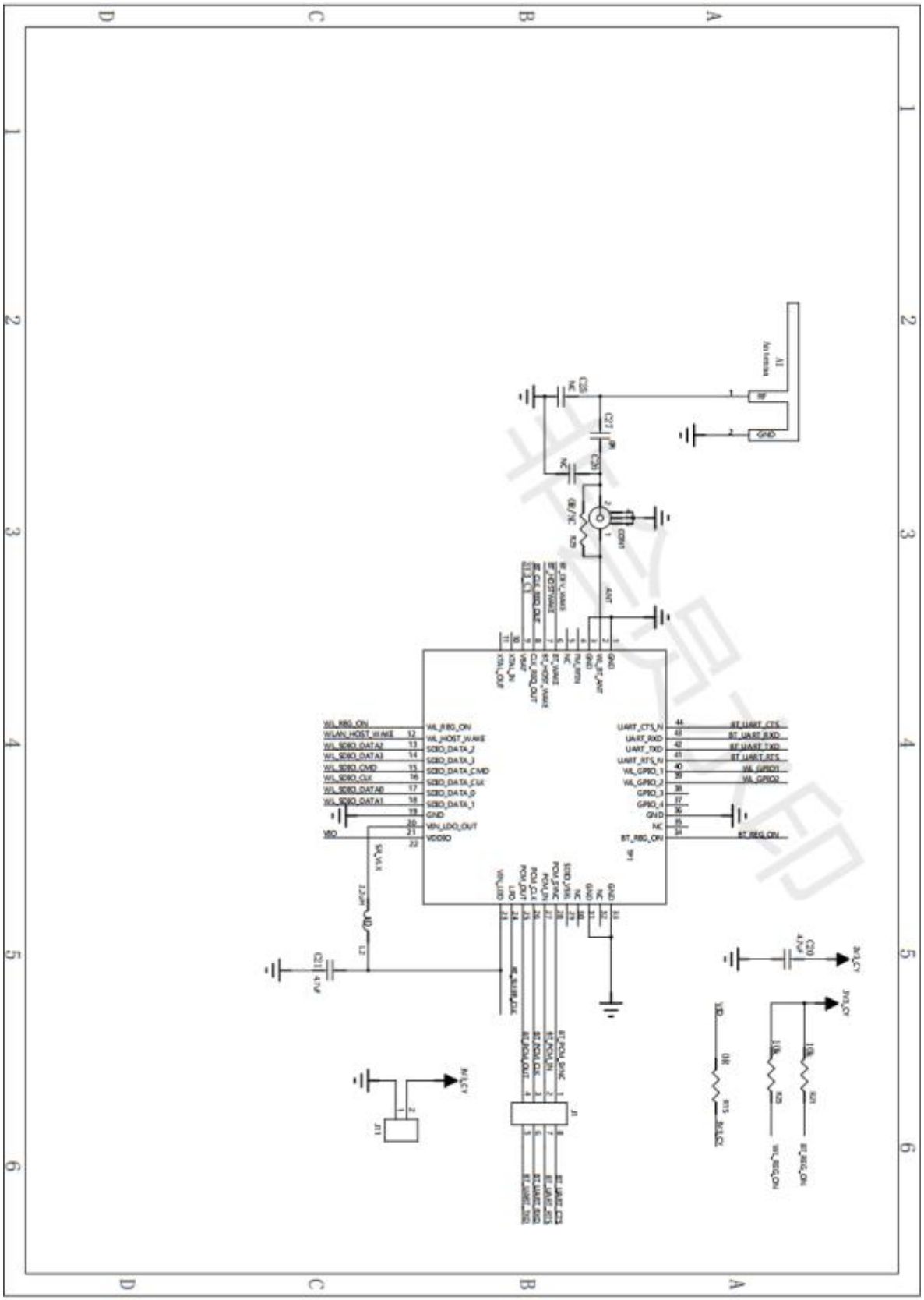


Figure 4. Application schematic of BW436S-44B1(2)

Note 1: External SUSCLK_IN signal characteristics

Parameter	Specification	Units
Nominal input frequency	32.768	kHz
Frequency accuracy	±200	ppm
Duty cycle	30 - 70	%
Input signal amplitude	200 to 3300	mV, p-p
Signal type	Square-wave or sine wave	-
Input impedance	>100k	Ω
	<5	pF

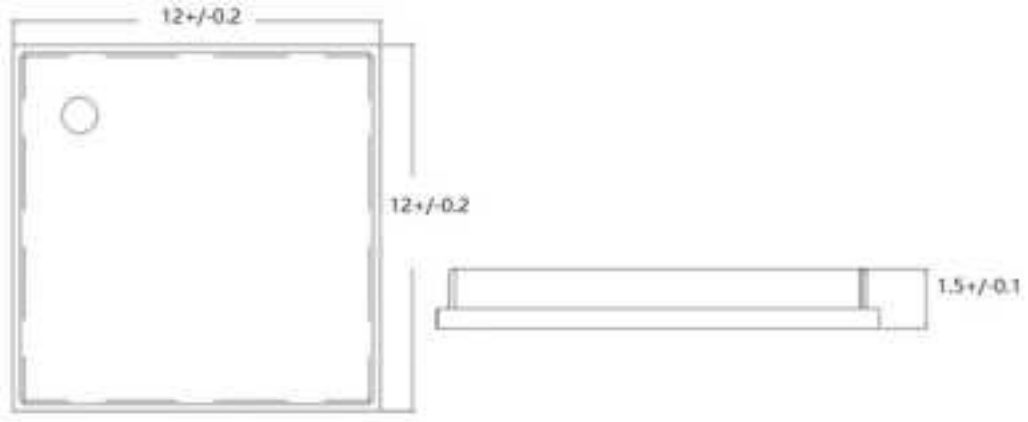
4.3 Layout Guideline

1. Keep RF traces with 50 Ohm impedance.
2. The antenna needs to have enough clearance area.
3. The filter capacitor should be as close as possible to the module.
4. Do not place strong interference lines under the module.
5. Crystal traces must be shorter and GND has to be around it.

5. Mechanical and Package

5.1 Module Size

Top View Side View



(Unit: mm)

Figure 5. Module Size of BW436S-44B1(2)

5.2 Recommended PCB Footprint

Top View

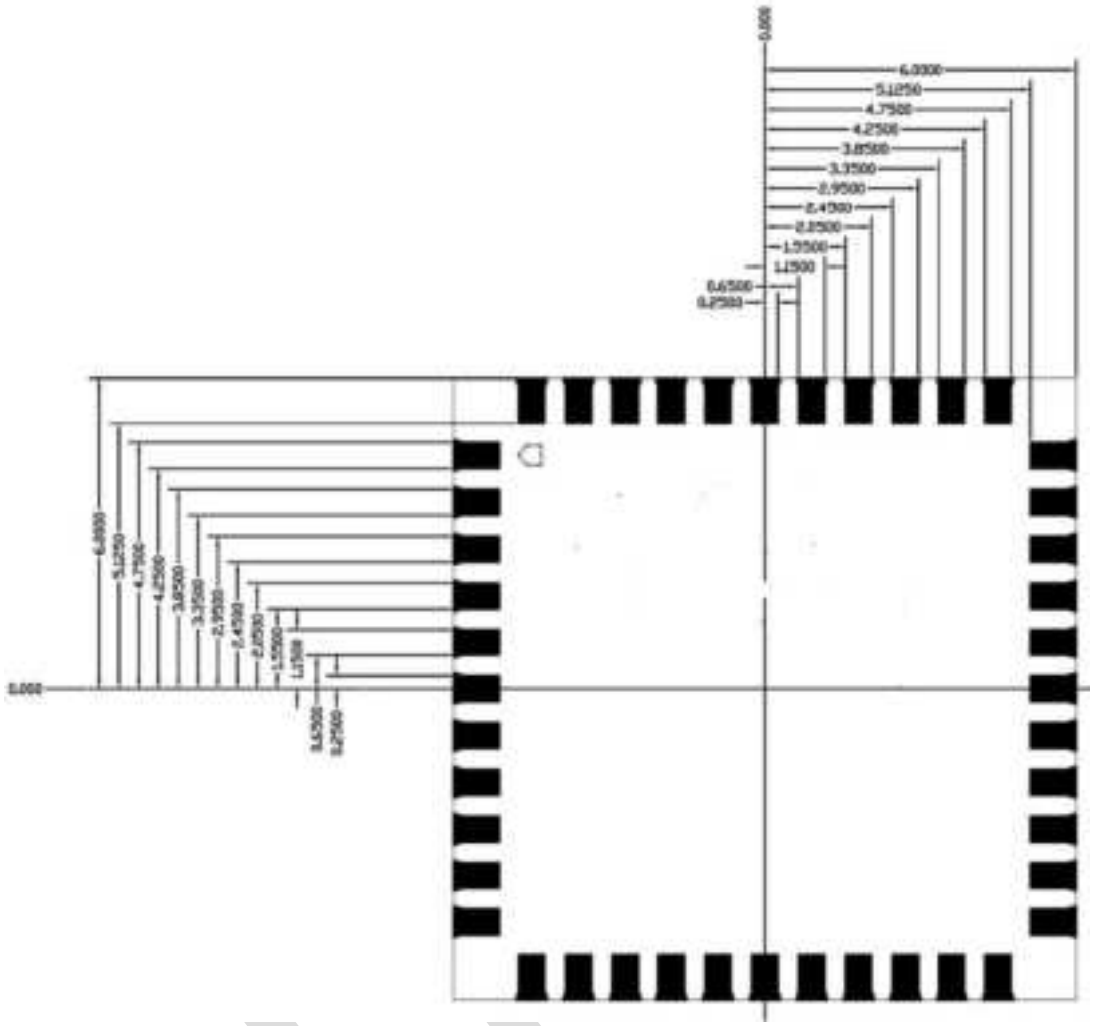


Figure 6. Recommended PCB Footprint of BW436S-44B1(2)

5.3 Package Information

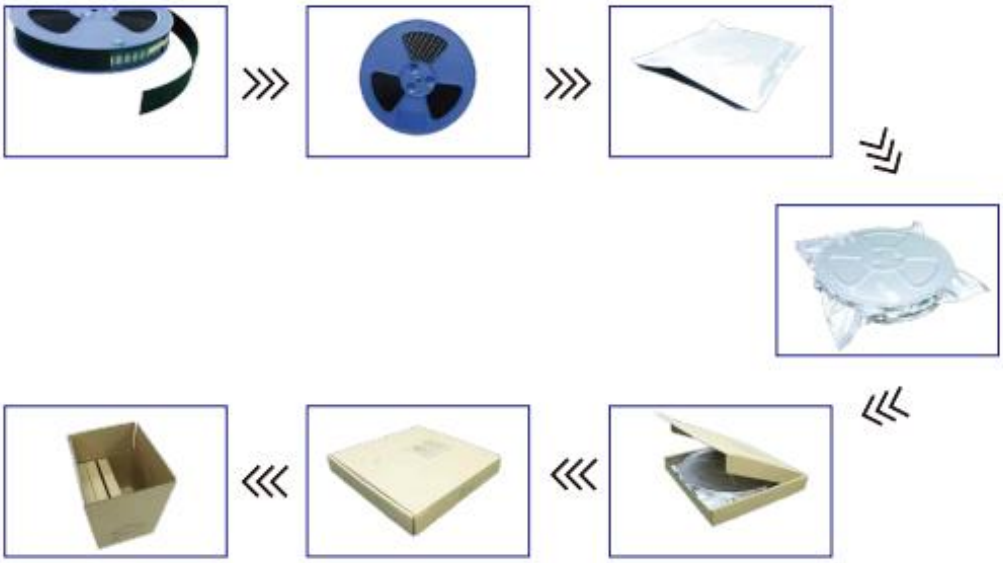


Figure 7. Brief Packaging Process of BW436S-44B1(2) Modules

6. Thermal Reflow

Referred to IPC/JEDEC standard.

Peak temperature: <250°C

Number of times: ≤2

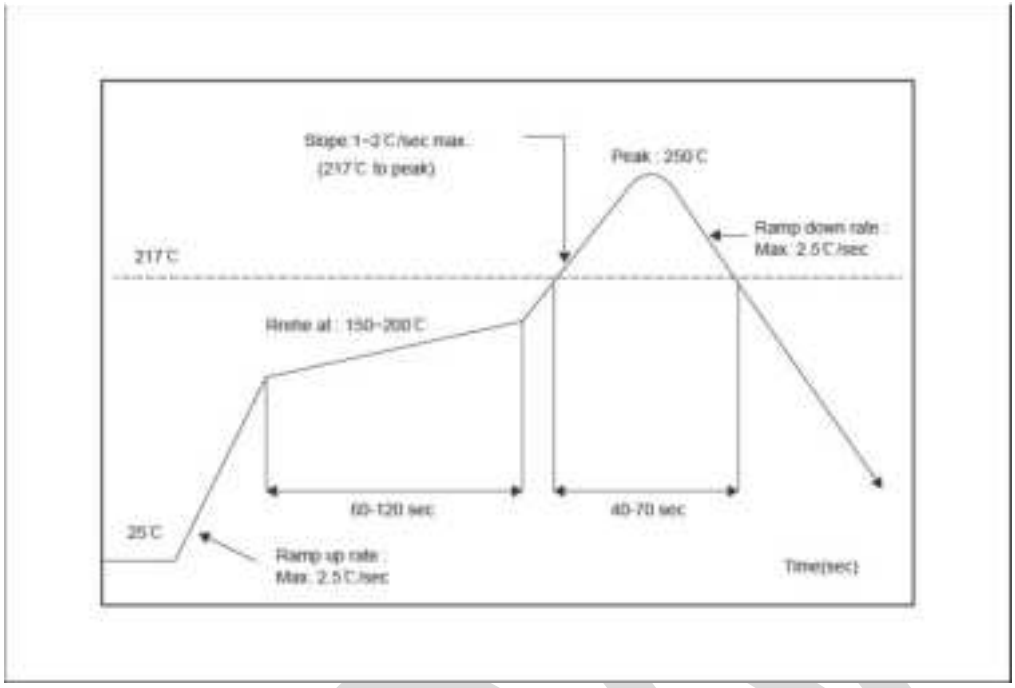


Figure 8. Recommended Reflow for Lead Free Solder

Note: The module is recommended not to go through reflow oven twice.

7. Ordering Information

Part NO.	Working Voltage(VBAT)	Operating Temperature	Shielding Cover	26M Crystal
BW436S-44B1	3.3V	-30℃~+70℃	Included	No
BW436S-44B2	3.3V	-30℃~+70℃	Included	Yes

8. Revision History

Version	Change Content	Reviser	Date
V1.0	Initial Version	Phil	2023.05.28
V1.1	Add Module Picture Update Block Diagram Update Ordering Information	Phil	2023.07.31

FCC Interference Statement

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.

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment

***RF warning for Mobile device:**

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.

The OEM must certify the final end product to comply with unintentional radiators (FCC Sections 15.107 and 15.109) before declaring compliance of the final product to Part 15 of the FCC rules and regulations. Integration into devices that are directly or indirectly connected to AC lines must add with Class II Permissive Change.

The OEM must comply with the FCC labeling requirements. If the module's label is not visible when installed, then an additional permanent label must be applied on the outside of the finished product which states: "Contains transmitter module FCC ID: VYVBW436S-44B1 ".

Additionally, the following statement should be included on the label and in the final product's user manual:

"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 interferences, and

(2) this device must accept any interference received, including interference that may cause undesired operation." The module is limited to installation in applications. Separate approval is required for all other operating configurations, including portable configuration with respect to Part 2.1093 and different antenna configurations. A module or modules

can only be used without additional authorizations if they have been tested and granted under the same intended end - use operational conditions, including simultaneous transmission operations. When they have not been tested and granted in this manner, additional testing and/or FCC application filing may be required. The most straightforward approach to address additional testing conditions is to have the grantee responsible for the certification of at least one of the modules submit a permissive change application. When having a module grantee file a permissive change is not practical or feasible, the following guidance provides some additional options for host manufacturers. Integrations using modules where additional testing and/or FCC application filing(s) may be required are: (A) a module used in devices requiring additional RF exposure compliance information (e.g., MPE evaluation or SAR testing); (B) limited and/or split modules not meeting all of the module requirements; and (C) simultaneous transmissions for independent collocated transmitters not previously granted together.This Module is full modular approval, it is limited to OEM installation ONLY. Integration into devices that are directly or indirectly connected to AC lines must add with Class II Permissive Change. (OEM) Integrator has to assure compliance of the entire end product include the integrated Module.

Additional measurements (15B) and/or equipment authorizations (e.g. Verification) may need to be addressed depending on co-location or simultaneous transmission issues if applicable. (OEM) Integrator is reminded to assure that these installation instructions will not be made available to the end user.

Integration instructions for host product manufacturers according to KDB 996369 D03 OEMManual v01

2.2 List of applicable FCC rules

FCC Part 15 Subpart C 15.247 & 15.207 & 15.209 & 15.205

2.3 Specific operational use conditions

Operation Mode	:	☒ BT BDR ☒ BT EDR
Operation Frequency	:	2402~2480MHz
Number of Channel	:	79 Channels
Modulation Type	:	GFSK, π/4-DQPSK, 8-DPSK
Operation Mode	:	☒ BT BLE
Support Rate	:	☒ 1Mbps ☐ 2Mbps
Operation Frequency	:	2402~2480MHz
Number of Channel	:	40 Channels
Operation Mode	:	☒802.11b ☒802.11g ☒802.11n(HT20) ☐802.11n(HT40)
Operation Frequency	:	2412~2462MHz
Number of Channel	:	11 Channel for 20MHz bandwidth (2412~2462MHz)
Modulation Type	:	☒ 802.11b: DSSS (CCK, DQPSK, DBPSK) ☒ 802.11g: OFDM (BPSK, QPSK, 16QAM, 64QAM) ☒ 802.11n: OFDM (BPSK, QPSK, 16QAM, 64QAM)
Antenna Type	:	FPC Antenna
Antenna Gain	:	2.25dBi

The module can be used for mobile or portable applications with a maximum2.25 dBi antenna. The host manufacturer installing this module into their product must ensure that the final composit product complies with the FCC requirements by a technical assessment or evaluation to the FCC rules, including the transmitter operation. The host manufacturer has to be aware not to provide informationto the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module. The end user manual shall include all required regulatory information/warning as show in this manual.

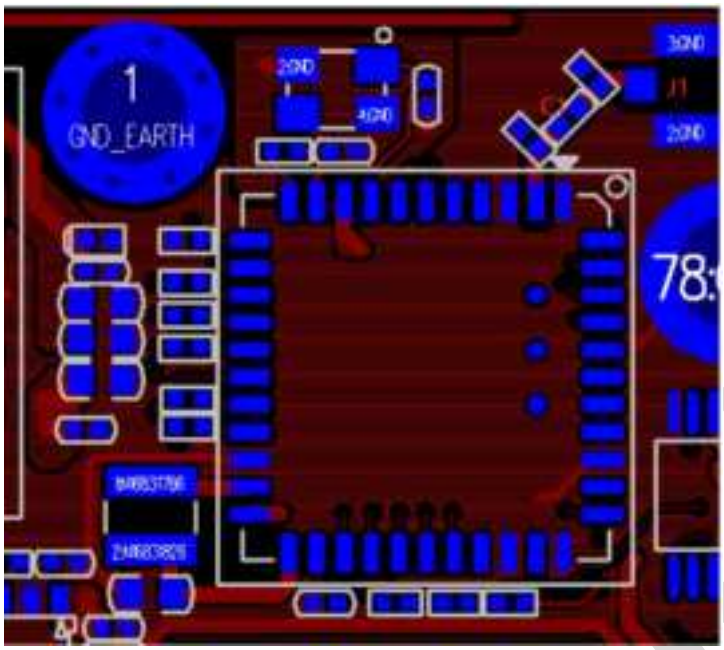
2.4 Limited module procedures

Not applicable. The module is a Single module and complies with the requirement of FCC Part 15.212.

2.5 Trace antenna designs

You can see antenna size is 36.2mm*14.6mm* From below Specification.

Please refer to the chart below for PCB size of RF line terminal.



Scrape a GND off the side of the J1,connect the FPC antenna to the PCB at the position of the J1 connector.

[The line between the FPC antenna and the WiFi module] must be 50 ohm.

C1 is 10pF Capacitors.

2.6 RF exposure considerations

The device can be used in portable exposure condition without restriction and if RF exposure statement or module layout is changed, then the host product manufacturer required to take responsibility of the module through a change in FCC ID or new application. The FCC ID of the module cannot be used on the final product. In these circumstances, the host manufacturer will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

2.7 Antennas

This module has been approved to operate with the antenna types listed below, with the maximum permissible gain indicated.The module requires professional installation, and the antenna type cannot be changed. The gain cannot exceed 2.25dBi.

Frequency band	Antenna Type	Model Number	Max Gain
2400-2500MHz	FPC antenna	N1911	2.25(dBi)

This device is intended only for host manufacturers under the following conditions: The transmitter module may not be co-located with any other transmitter or antenna;

The module shall be only used with the External antenna(s) that has been originally tested and certified with this module. The antenna must be either permanently attached or employ a 'unique'antenna coupler.

As long as the conditions above are met, further transmitter test will not be required. However, the host manufacturer is still responsible for testing their end-product for any additional compliance requirements required with this module installed (for example, digital device emissions, PC peripheralrequirements, etc.).

2.8 Label and compliance information

Host product manufacturers need to provide a physical or e-label stating

"Contains FCC ID: VYVBW436S-44B1 With their finished product.

2.9 Information on test modes and additional testing requirements

Operation Mode	:	☒ BT BDR ☒ BT EDR
Operation Frequency	:	2402~2480MHz
Number of Channel	:	79 Channels
Modulation Type	:	GFSK, π/4-DQPSK, 8-DPSK
Operation Mode	:	☒ BT BLE
Support Rate	:	☒ 1Mbps
Operation Frequency	:	2402~2480MHz
Number of Channel	:	40 Channels
Operation Mode	:	☒802.11b ☒802.11g ☒802.11n(HT20) ☐802.11n(HT40)
Operation Frequency	:	2412~2462MHz
Number of Channel	:	11 Channel for 20MHz bandwidth (2412~2462MHz)
Modulation Type	:	☒ 802.11b: DSSS (CCK, DQPSK, DBPSK) ☒ 802.11g: OFDM (BPSK, QPSK, 16QAM, 64QAM) ☒ 802.11n: OFDM (BPSK, QPSK, 16QAM, 64QAM)

Antenna Type	:	FPC Antenna
Antenna Gain	:	2.25dBi

Host manufacturer must perfom test of radiated & conducted emission and spurious emission, etcaccording to the actual test modes for a stand-alone modular transmitter in a host, as well as for multiple simultaneously transmitting modules or other transmitters in a host product.

Only when all the test results of test modes comply with FCC requirements, then the end product canbe sold legally.

2.10 Additional testing, Part 15 Subpart B disclaimer

The modular transmitter is only FCC authorized for FCC Part 15 Subpart C 15.247 & 15.207 & 15.209 & 15.205and that the host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification. If the grantee markets their product as being Part 15 Subpart B compliant (when it also contains unintentional-radiator digital circuity), then the grantee shall provide a notice stating that the final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed.

2.11 The user manual of the end product should include:

a) Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

b) The antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons.

c) 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.

d) This device is restricted to indoor use.

e) The antenna(s) used for this transmitter must not transmit simultaneously with any other antenna or transmitter.