BT638 BLE Module Specification

V1.0

Version Record

Version	Date	Author	Content
V1.0			Initial Release

FCC Statement
FCC standards: FCC CFR Title 47 Part 15 Subpart C Section 15.247
PCB antenna with antenna gain -6.13dBi
A:
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.
B:
Any Changes or modifications not expressly approved by the party responsible for compliance could
void the user's authority to operate the equipment.
C:
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: 2BAMT-
BT638-2 Or Contains FCC ID: 2BAMT-BT638-2″

The devices must be installed and used in strict accordancewith the manufacturer's instructions as described in the
user documentation that comes with the product.
Any company of the host device which install this modular with modular approval should perform the test of
radiated & conducted emission and spurious emission,etc. according to FCC part15B Class B requirement, Only if
the test result comply with FCC part 15B Class B requirement   then the host can be sold legally. When the
module is installed inside another device, the user manual of the host must contain above Paragraphs A, B, and C
warning statements.

1. Introduction

1.1 Overview

The BT638 Bluetooth module is designed based on the TLSR8232 chip. It's a Bluetooth BLE4.2 module that supports UART transparent transmission and AT commands. When in Bluetooth connection mode, it enters data transparent transmission mode. When not connected, it can be configured via AT commands to adjust parameters such as broadcast interval and device name.

1.2 Key Features

➢ Bluetooth V4.2 standard specification
➢ Class II RF power, with microampere-level ultra-low power consumption
➢ Ultra-low voltage operation, compatible with 3V button batteries
➢ Multiple interfaces: PIO/UART/AIO/I²C/SPI/PWM
➢ RoHS lead-free manufacturing process
➢ Dimensions: 16.5mm (L) × 13.3mm (W)
➢ Two variants: BT638-1 (without shielding cover) and BT638-2 (with shielding cover)

1.3 Application Fields

The BT638 module is designed for IoT and HID (Human Interface Devices) applications, including but not limited to:

➢ Smart home devices (access control, LED lighting control)
➢ Fitness equipment (treadmills, exercise machines)
➢ Medical devices (pulse meters, blood pressure monitors)
➢ Home entertainment devices (remote controls, toys)
➢ Office equipment (printers, scanners)
➢ Commercial devices (cash registers, QR code scanners)
➢ Mobile device accessories (for phones, tablets, and computers)
➢ Automotive equipment (car repair tools)
➢ RF and infrared remote controllers

1.4 Hardware Highlights

➢ Supports up to 16 GPIOs in addition to UART communication pins
➢ Equipped with hardware flow control UART interface and Swire debug interface
➢ Up to 6 PWM channels
➢ 6-channel 14-bit ADC
➢ TX output power: up to +8 dBm
➢ Hardware Connection Diagram

Hardware connection diagram
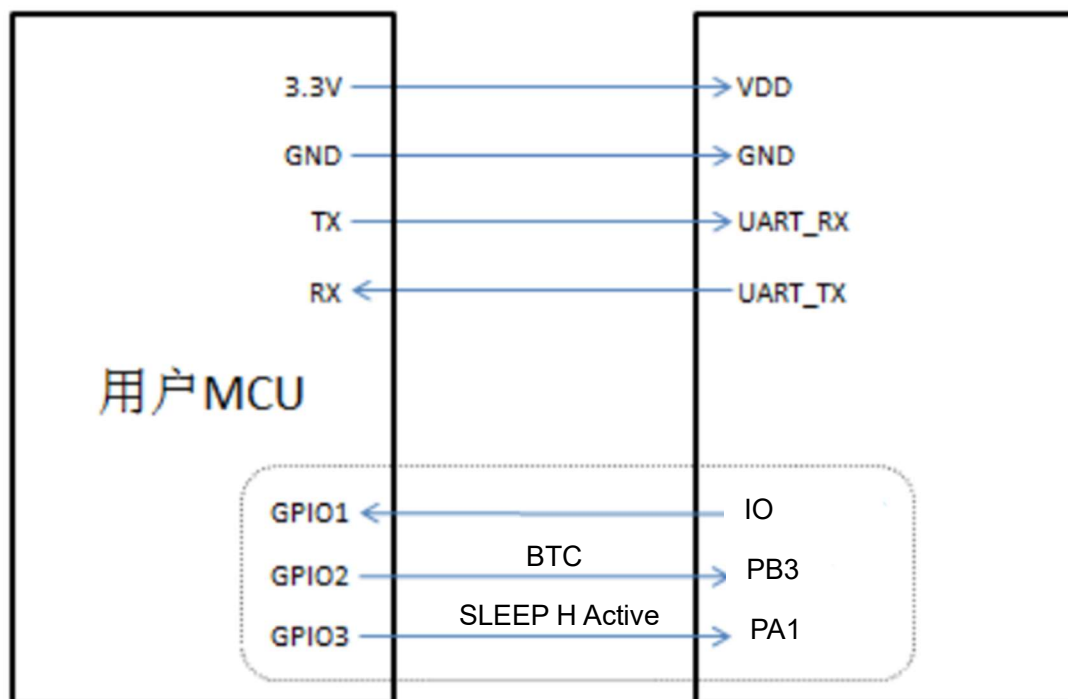
The functional pins of the module can be reconfigured according to specific applications.

For example, PB3 can be set as a Bluetooth control pin (BTC) to switch other devices on/off, and PA1 can be configured as a low-power control wake-up pin (P_SLEEP) to wake up the Bluetooth module or perform other functions.

2. Electrical Parameters

2.1 Absolute Maximum Ratings

Item	Sym.	Min.	Max	Unit	Conditions
Supply Voltage	V_{DD}	-0.3	3.9	V	All AVDD and DVDD pin must have the same voltage
Voltage on input pin	V_{IN}	-0.3	$V_{DD}+0.3$	V	-
Output voltage	V_{OUT}	0	V_{DD}	V	-
Storage temperature range	T_{Str}	-65	150	℃	-
Soldering temperature	T_{Sld}	-	260	℃	-

2.2 Recommended Operating Conditions

Item	Sym.	Min	Typ.	Max	Unit	Conditions
Power-supply voltage	V_{DD}	1.9	3.3	3.6	V	-
Supply rise time (from 1.6 V to 1.8 V)	T_r	-	-	1	ms	-
Operating temperature range	T_{Opr}	-40	-	85	℃	-

2.3 Current Consumption (V_{DD} = 3.3 V, T= 25℃)

Mode	Sym.	Min	Typ.	Max	Unit	Conditions
TX	I_{Tx}	-	14.5	-	mA	0dBm Continuous Tx transmission
		-	25	-	mA	8dBm Continuous Tx transmission
RX	I_{Rx}	-	16.	--	mA	Continuous Rx reception
Suspend	I_{susp}	-	8	-	µA	IO wake up
		-	10	-	µA	Timer wake up
Deep sleep	I_{Deep1}	-	1	-	µA	Flash not included, without 32kHz external XOSC, and internal 32kHz RC OSC off
	I_{Deep2}	-	1.7	--	µA	Flash not included, with 32kHz external XOSC, and internal 32kHz RC OSC off
	I_{Deep3}	-	2.2	-	µA	Flash not included, without 32kHz external XOSC, and internal 32kHz RC OSC on

NOTE:
   Without 32K RC: The wakeup source is external signal from GPIO input，   the internal 32K RC is disabled
   With 32K RC: The wakeup source is 32K RC，   it is enabled.

# 3. Module Pins and Descriptions
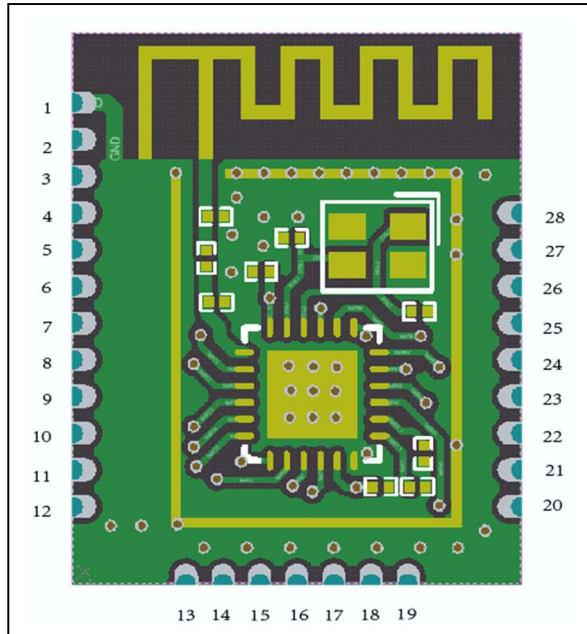
NO.	Name	Description
1	GND	Groud
2	VCC	3.3V Power supply
3	NC	NC
4	PC2	SPI Slave chip select (active low) / SPI Master chip select(active low) / PWM0 inverting output/ UART_CTS / GPIO PC[2]
5	PC7/SWS	Single wire slave / PWM3 output / GPIO PC[7] in Program mode as SWS
6	PA1	PWM3 inverting output/UART_CTS / GPIO PA[1] (Set to Sleep-Wake UP Function H for Sleep L for Active)
7	NC	NC
8	PC3	SPI Slave data output / SPI Master data output / PWM5 inverting output / UART_RTS/ GPIO PC[3]
9	PC4	SPI Slave data input / I2C Master serial data / SPI Master data input / UART_TX / GPIO PC[4]
10	PC5	SPI Slave clock / I2C Master clock / SPI Master clock / UART_RX / GPIO PC[5]
11	PC1	PWM2 inverting output / GPIO PC[1]
12	PA5	PWM5 output / I2C Slave clock / I2C Master clock / GPIO PA[5]
13-19	NC	NC
20	PA4	PWM2 output / UART_RX / I2C Master serial data / SPI Slave clock / GPIO PA[4] (Set to UART RX)
21	PA3	PWM4 output / UART_TX / I2C Master clock / SPI Slave data input / GPIO PA[3] (Set to UART TX)
22	PA6	PWM4 inverting output / I2C Slave serial data / I2C Master serial data / Control external LNA / GPIO PA[6]

23	PB1	PWM1 output / SPI Master data output / Control external PA / GPIO PB[1] /PGA input
24	PB2	PWM2 output / SPI Master data input / UART_CTS / I2C Master clock / GPIO PB[2] / PGA input
25	PB3	PWM0 output / SPI Master clock / UART_RTS / I2C Master serial data / GPIO PB[3] (SET to Blue Tooth Control Pin)
26	PB4	PWM1 inverting output / UART_TX / GPIO PB[4] / PGA input
27	PB5	PWM4 output / UART_RX / GPIO PB[5] / PGA input
28	NC	NC

4. Module Mechanical Dimensions

BT638-1

BT638-2
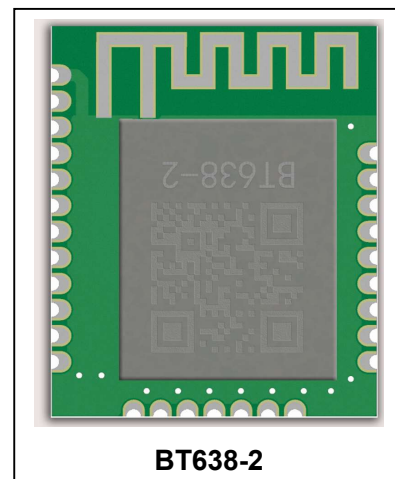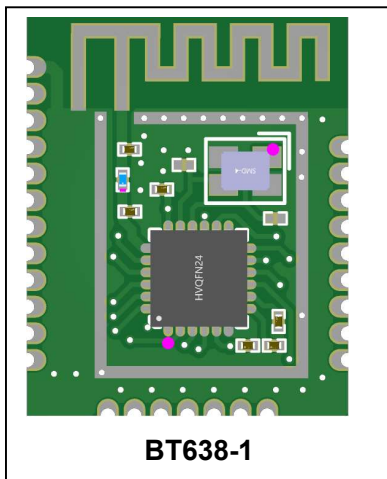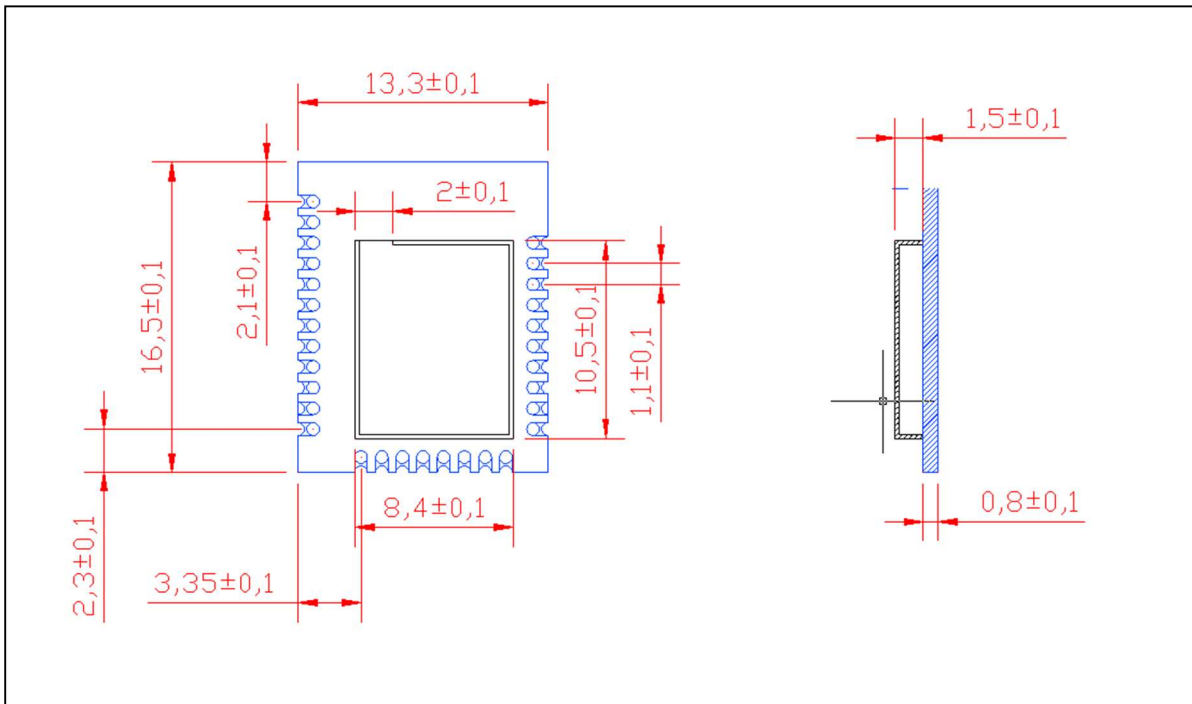
5. Module Circuit Diagram
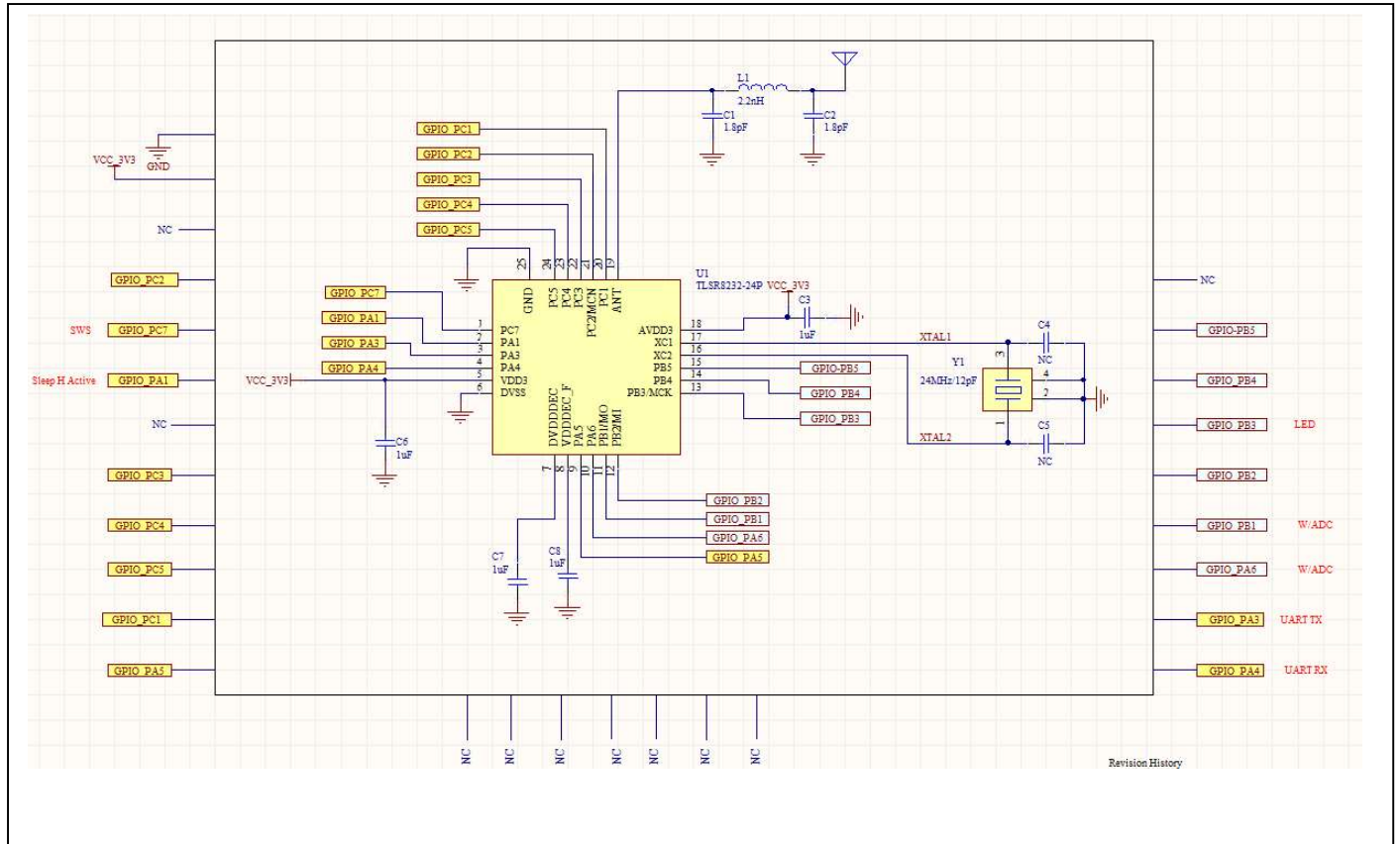
6.BOM

PCB assembly parts				
Part Name	**Description**	**QTY.**	**Unit**	**Remark**
Capacitor	ROHS 1.8pF 0201, X7R, +/-10%	2		C1, C2
Capacitor	ROHS 1μF 0201, X7R, +/-10%	4		C3, C6, C7, C8
Inductor	ROHS 2.2nH 0402, +/-5%	1		L1
IC	Telink 2.4G Bluetooth IC TLSR8232F512ET24 QFN24	1		U1
Crystal	24 MHz 12 pF 20 ppm 2016 Package	1		Y1
PCB	ROHS double-sided FR4, thickness 0.8mm, dimensions 16.5mm×13.3mm	1		Main PCB
Shielding case	Nickel silver, thickness 0.2mm, laser-etched QR code	1		Same as BT628-2

7. Module Installation Requirements

The BT638 module operates at 2.4GHz, so its placement on the product is critical to antenna performance. Avoid the following:

Metal enclosures can shield RF signals and prevent the module from working properly.

Keep internal metal components away from the module's RF section.

Place the module around the edges of the mainboard, with the antenna part near the edge or corner.

Avoid copper pours or traces under the antenna.

It's recommended to extend the antenna area outward from the main PCB to position the module as close to the edge as possible.

Module Installation Position Diagram
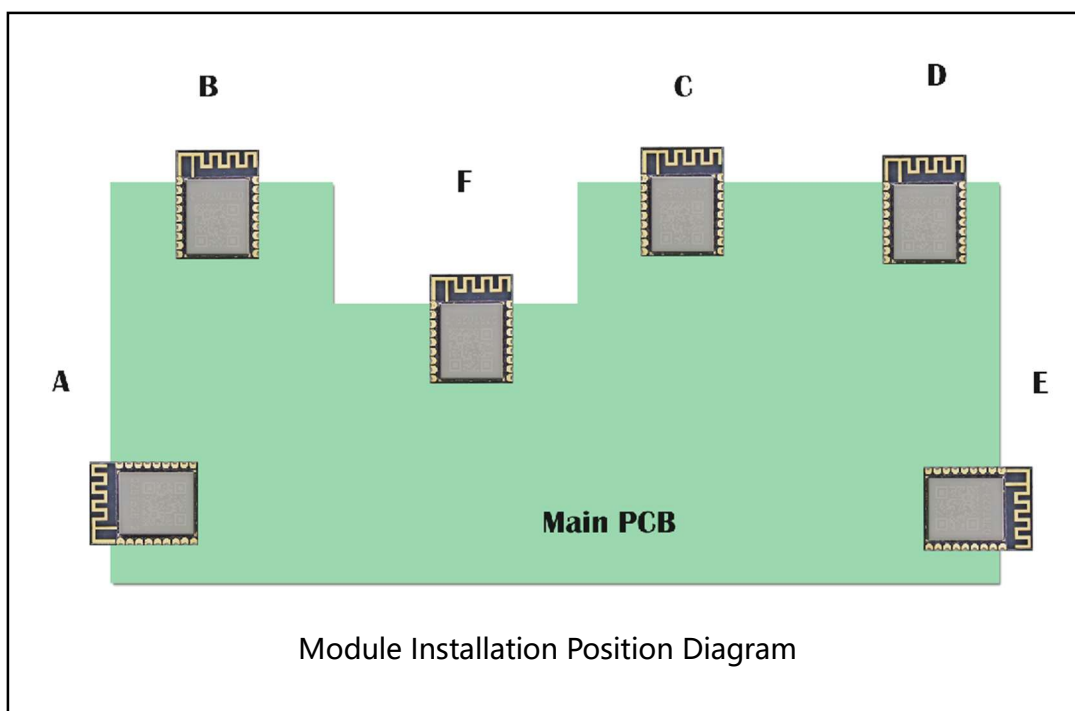
A、B：Strongly recommended。C, D, E：Acceptable but not recommended。

F：If the main PCB lacks space, maintain a 15mm gap between the module and the main PCB

8．Module Reflow Soldering Recommendations

Module Welding Guidance (Refer to IPC/JEDEC Industry Standard)

Preheating process	
Rump up rate： From T_S (25℃ Room temperature)to T_L （Preheating temperature）	2℃/s (Max)
Preheating temperature T_L	150℃ (Min.) 175℃ (Typ.) 200℃ (Max.)
Preheat time	60~120 s
Soldering	
Heating rate for soldering：from (Preheating temperature) T_L to T_P （Peak temperature）	1~2℃/s
Tolerance of T_P	245℃ +0/-5℃
Duration of T_P	10 s
Duration of soldering （Above 217℃）	40~60 s
Ramp down rate	2.5℃/s (Max.)

The reflow curve recommended：