Buffalo-DS531-B User Guide

Project:Buffalo-DS531 Bluetooth 5.1 BLE module

Module name: Buffalo-DS531-B

Designed:Suzhou Pairlink Network Technology Ltd.

Version	Note	Date
V1.0	Create	2021/12/17
V1.1	1:Update Module Appearance 2:Add FCC&IC Statement	2022/06/24
V1.2	Modify FCC&IC Statement	2022/06/30

Contents

1.Electrical Specifications

1.1.Absolute Ratings

Parameter	*Specification*		*Unit*
	Min.	*Max.*	
Power Supply(V)	-0.3V	+3.6V	Burn the module permanently if it exceeds +3.6V
Storage temperature(℃)	-40	+125	
Working temperature(℃)	-40	+85	
ESD HBM	-4KV	+4KV	Human Body Model
ESD CDM	-500V	+500V	Charged Device Model

1.2.Recommended Operating Conditions

Parameter		*Specification*			**Note**
		Min.	*Typical*	*Max.*	
Power Supply(V)		1.8	3.3	3.6	
Communication level(V)			3.3		Can't communicate with 5V TTL level directly
Working temperature(℃)		-40	20	+85	Industry Standard
Consume	TX Current (mA)			3.5	TX Power=+2.5dBm
	RX Current (mA)			2.2	1Mbps
	Sleep Current (uA)		2		Software off period
TX Power(dBm)		-19.5		+2.5	
Receive Sensitivity(dBm)				-94	1Mbps

1.3.Physical Parameters

Parameter	*Performance*	*Note*
Distance	Buffalo-DS531-B 30m	Data Transfer (BLE) Environment: Sunny and open Airspeed: 1Mbps Buffalo-DS531-B with PCB antenna
Crystal	32MHz	Industry Standard
Protocol	Bluetooth 5.1	Supported data rates: 1 Mbps
Package	Patch	Refer to section 4.3
IC	DA14531-00000FX2	Package： FCGQFN24
Core	ARM Cortex-M0	
OTP	32KB	One-Time-Programmable
RAM	48KB	
ROM	144KB	
EEPROM	Buffalo-DS531-B:2Kbit	Type:P24C02A
Dimensions(mm)	16.3*12.0*2.4	L*W*H
Antenna Type	Buffalo-DS531-B	On-board PCB antenna
Antenna Gain	+0dbi	On-board PCB antenna

2.Peripheral Interface

- 2 x UARTs (one with flow control)
- 1 x SPI interface with master configurable
- 1 x I2Cs interface
- 12 x GPIOs
- 4 x 10-bit ADC input
- 8 x PWMs interface
- 2 x general purpose timer

3.Hardware Design and PCB layout

3.1.Pin assignment and Pin description

Buffalo-DS531-B Pin definition can refer to Figure 1.

Table 1: Module Pin Description

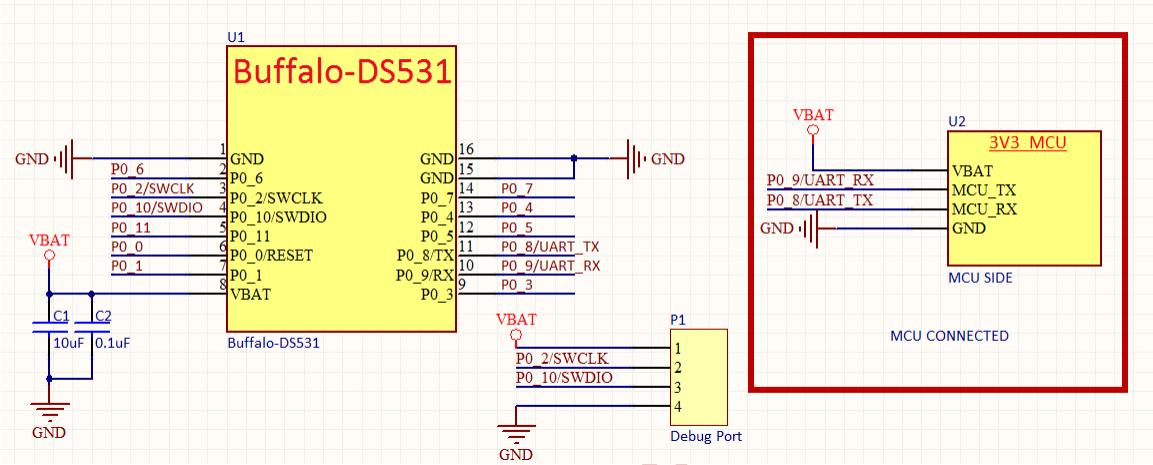
Pin Number	*Pin Name*	*I/O*	*RESET STATE*	*Alternate Function Description*
8	VBAT	P		Power Supply
1,15,16	GND	P		Connect to Ground
6	P0_0	DIO	I-PD	GPIO:P0_0
	Reset	DI	I-PD	Reset signal (active high).
2	P0_6	DIO	I-PD	INPUT/OUTPUT with selectable pull up/down resistor. General purpose I/O port bit or alternate function nodes. Contain state retention mechanism during power down.
	ADC2	AI		
3	P0_2	DIO	I-PD	
	SWCLK	DIO		
	ADC1	AI		
4	P0_10	DIO	I-PD	
	SWDIO	DIO		
5	P0_11	DIO	I-PD	
7	P0_1	DIO	I-PD	
	ADC0	AI		
9	P0_3	DIO	I-PD	
10	P0_9	DIO	I-PD	
	BLE_RX	DIO		
11	P0_8	DIO	I-PD	
	BLE_TX	DIO		
12	P0_5	DIO	I-PD	
13	P0_4	AI	I-PD	
14	P0_7	DIO	I-PD	
	ADC3	AI		

Note: GPIO has integrated pull-up and pull-down resistors

3.2.Reference Design

The latest schematic and design examples, bill of material, and layout file are available from original developer . Contact us for details.

Figure 1: Module Reference Design



Circuit Description

1:VBAT supply voltage value is 1.80V-3.60V.

2:PIN10 (P0_9 / UART_RX), PIN11(P0.8 / UART_TX) is configured as the module's UART interface by default.

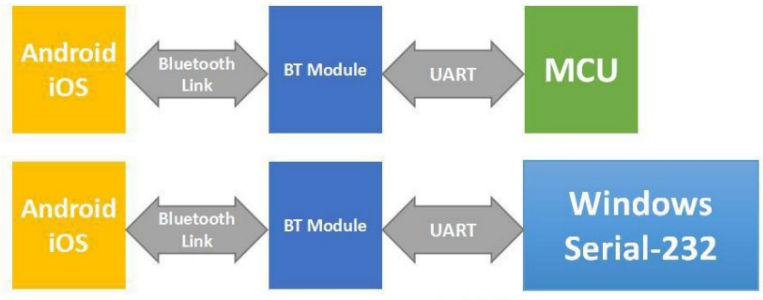
3:PIN6(P0_0/RESET) multiplexing module RESET, software can be configured as RESET function, internal pull-down by default.If need to configure the RESET function, must consult Pairlink for recommendations.

4:The Buffalo-DS531-B is TTL level, and the uart port can communicate directly with the 3.3V MCU.

5:Support GPIO super multiplexing function, WAKE_UP / UART / SPI / IIC / PWM / and other functions can be arbitrarily configured on GPIO.

6:Reserve P1 burning interface if the PCB board has enough space.

7:The application diagram is shown below.

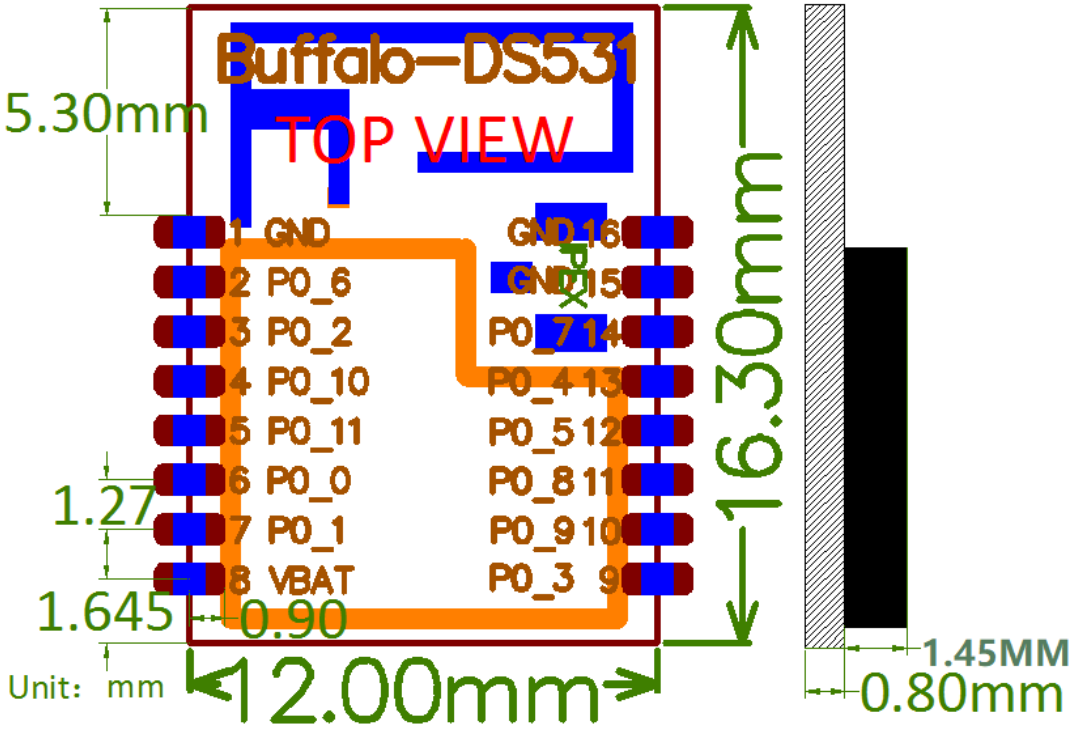


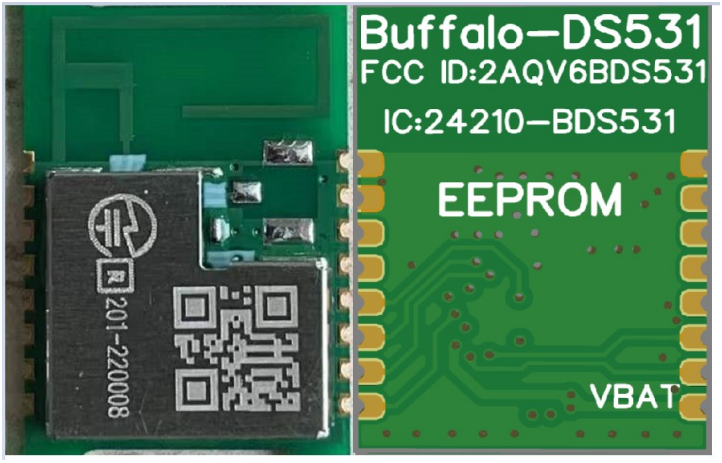
3.3.Appearance and Dimensions

Figure 2 shows the size of the module.The components and prominent structure are not allowed put in this size range(16.3mm*12.0mm*2.4mm).

The following land pattern size is recommended for user board design. However, user can modify it according PCB soldering conditions. Sufficient examination is necessary if use the modified land pattern.

Figure 2: Mechanical Information



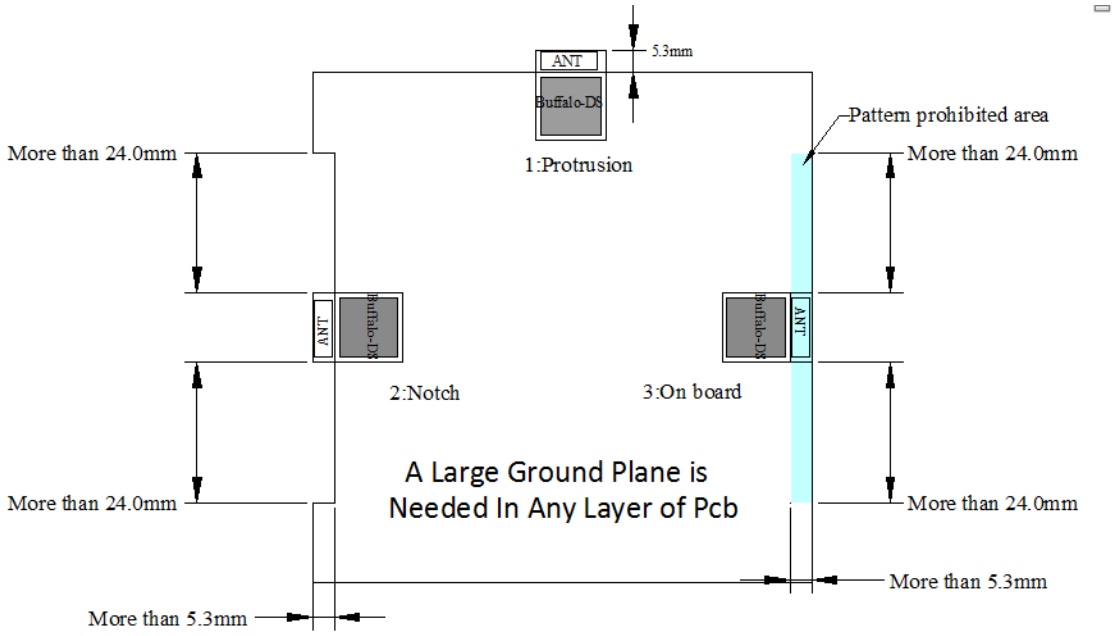


3.4.Module Layout Guideline

The layout on user PCB should be designed according to the following guideline.

When the module is placed on the PCB, it must be ensured that the RF antenna area (2 times the width of the module) is hollow or suspended, and there must be no traces, vias or copper.

Figure 3: Module Placement



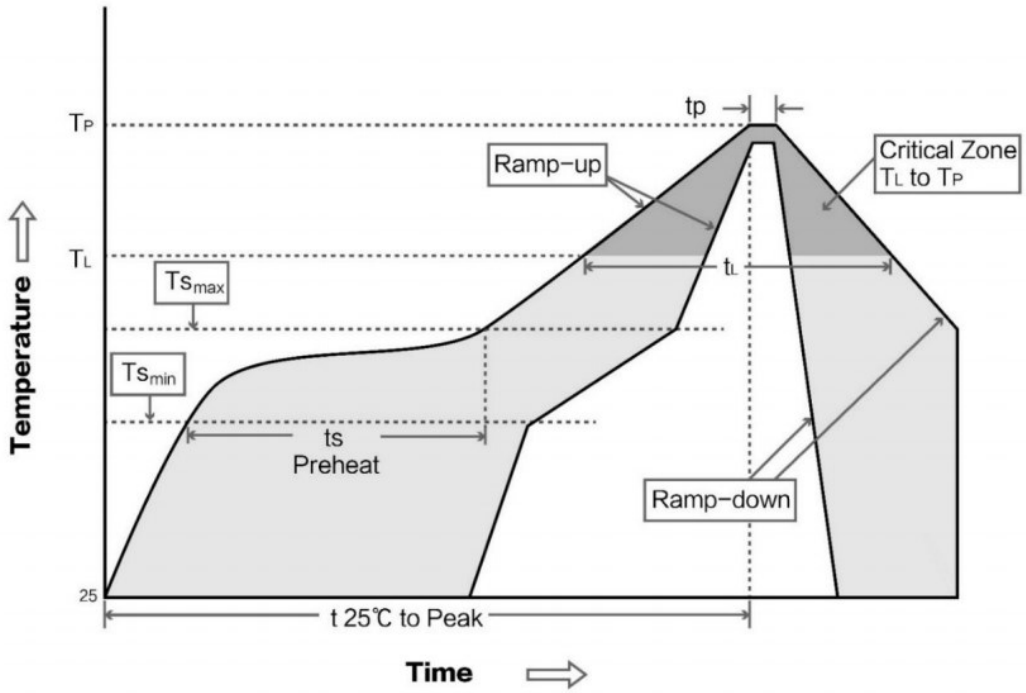
4.Welding Declaration

The Buffalo-DS531-B module only supports one reflow soldering. Our company is not responsible for the module failure caused by multiple reflow soldering.

Figure 4:Reflow Soldering Temperature

Profile Feature	Sn-Pb Assembly	Pb-Free Assembly
Solder Paste	Sn63/Pb37	Sn96.5/Ag3/Cu0.5
Preheat Temperature min （Tsmin）	100℃	150℃
Preheat temperature max (Tsmax)	150℃	200℃
Preheat Time (Tsmin to Tsmax)(ts)	60-120 sec	60-120 sec
Average ramp-up rate(Tsmax to Tp)	3℃/second max	3℃/second max
Liquidous Temperature (TL)	183℃	217℃
Time（tL）Maintained Above（TL）	60-90 sec	30-90 sec
Peak temperature（Tp）	220-235℃	230-250℃
Aveage ramp-down rate（Tp to Tsmax）	6℃/second max	6℃/second max
Time 25℃ to peak temperature	6 minutes max	8 minutes max

Figure 5:Reflow Soldering Curve



5.Federal Communications Commission (FCC) Interference Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part15 of the FCC Rules.

These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generate, 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 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:
(1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.
FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

The module is limited to OEM installation only.

This product is mounted inside of the end product only by professional installers OEM. They use this module with changing the power and control signal setting by software of end product within the scope of this application. End user cannot change this setting.

The OEM integrator has to be aware no to provide information to the end user regarding how to install or remove this RF module in the user manual of the end product with integrates this module. The end user manual shall include all required regulatory information/warning as show in this manual.

That separate approval is required for all other operating configurations, including portable configurations with respect to Part 2.1093 and different antenna configurations.

RF exposure warning

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment.

This product may not be collocated or operated in conjunction with any other antenna or transmitter.

This equipment must be installed and operated in accordance with provided instructions and the antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be collocated or operating in conjunction with any other antenna or transmitter.

Industry Canada (IC)

CAN ICES-3 (B)/NMB-3(B)

This device complies with Industry Canada's licence-exempt RSSs. 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.

Cetappareilestconforme à la norme RSS d'Industrie Canada. Son fonctionnementestsujet aux deux conditions suivantes:

(1) ledispositif ne doit pas produire de brouillagepréjudiciable, et

(2) cedispositifdoit accepter tout brouillagereçu, y compris un brouillage susceptible de provoquer un fonctionnementindésirable.

IMPORTANT NOTE:

Radiation Exposure Statement:

This equipment complies with IC 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.

Déclarationd'exposition aux radiations:

Cetéquipementestconforme aux limitesd'exposition aux rayonnements IC établies pour unenvironnement non contrôlé. Cetéquipementdoitêtreinstalléetutilisé avec un minimum de 20cm de distance entre la source de rayonnement et votre corps.

OEM Integration Instructions：

This device is intended only for OEM integrators under the following conditions：

The module can be used to installation in other host, and the transmitter module may not be co-located with any other transmit or antenna. The module shall be only used with the integral antenna(s) that has been originally tested and certified with this module. As long as 3 conditions above are met, further transmitter test will not be required. However, the

OEM integrator is still responsible for testing their end-product for any additional compliance requirement with this module installed (for example,digital device emission, PC peripheral requirements, etc.)

IMPORTANT NOTE：

In the event that these conditions cannot be met (for example certain laptop configuration or co-location with another transmitter), then the FCC authorization for this module in combination with the host equipment is no longer considered valid and the FCC ID of the module cannot be used on the final product. In these and circumstance, the OEM integrator will be responsible for re-evaluating. The end product (including the transmitter) and obtaining a separate FCC authorization. The final end product must be labeled in a visible area with the following:

“**Contains Transmitter Module FCC ID:2AQV6BDS531**”.

Antenna Specification:

Antenna Type	**Manufacturer**	**Frequency Range (MHz)**	**Maximum Peak Antenna Gain(dBi)**
PCB Antenna	N/A	2402 - 2480	-0.41dBi

IMPORTANT NOTE：

This Wireless Module (IC:24210-BDS531) has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Ce Module sans fil (IC:24210-BDS531) a été approuvé par industrie Canada pour fonctionner avec les types d'antennes énumérés ci-dessous avec le gain maximal autorisé indiqué. Les types d'antenne non inclus dans cette liste, ayant un gain supérieur au gain maximum indiqué pour ce type, sont strictement interdits pour l'utilisation avec ce dispositif.

The Host Marketing Name (HMN) must be displayed (according to e-labelling requirements) or indicated at any location on the exterior of the host product or product packaging or product literature, which shall be available with the host product or online.

Le nom de commercialisation de l'hôte (HMN) doit être affiché (conformément aux exigences d'étiquetage électronique) ou indiqué à tout endroit à l'extérieur du produit hôte ou de l'emballage du produit ou de la documentation de produit, qui doit être disponible avec le produit hôte ou en ligne.

The host product shall be properly labelled to identify the modules within the host product. The Innovation, Science and Economic Development Canada certification label of a module shall be clearly visible at all times when installed in the host product; otherwise, the host product must be labelled to display the Innovation, Science and Economic Development Canada certification number for the module, preceded by the word "Contains" or similar wording expressing the same meaning, as follows: Contains IC:24210-BDS531

Le produit hôte doit être correctement étiqueté pour identifier les modules du produit hôte. Le label de certification Innovation, Science et développement économique Canada d'un

module doit être clairement visible à tout moment lorsqu'il est installé dans le produit hôte; Dans le cas contraire, le produit hôte doit porter le numéro de certification Innovation, Science et développement économique Canada pour le module, précédé du mot "contient" ou d'une formulation similaire exprimant la même signification, Contient IC:24210-BDS531 .

Antenna Specification:

Antenna Type	**Manufacturer**	**Frequency Range (MHz)**	**Maximum Peak Antenna Gain(dBi)**
PCB Antenna	N/A	2402 - 2480	-0.41dBi