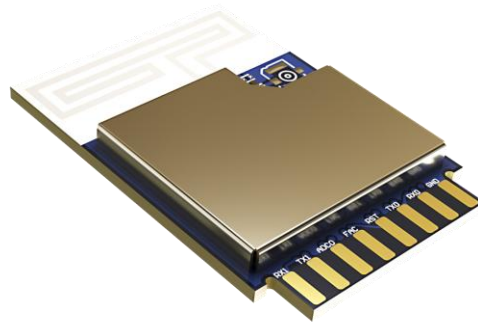


LA02303B

Bluetooth SMART (BLE) Module



Key features

- ◆ Support Bluetooth v5.1 core specification, support 2Mbps LE and LE long Range
- ◆ Embedded a 32-bit ARM Cortex-M4F with float-point unit, with clock up to 90MHz
- ◆ Data Memory: 256KB internal ROM, 192KB internal RAM, 1MB internal Flash
- ◆ Frequency of system crystal oscillator: 40MHz\32.768KHz
- ◆ Power supply voltage: 2.0V~3.6V
- ◆ Operating temperature: -40°C ~100°C
- ◆ Operating frequency: 2400~2483.5MHz
- ◆ TX output power:8dBm (Typical)
- ◆ BLE Receiving sensitivity:
 - 95dBm @1Mbps; -92dBm @2Mbps; -98dBm @500Kbps; -103dBm @125Kbps
- ◆ Dimension: 16mm*23.7mm*2.5mm
- ◆ Interface:
 - Vertical Mount (Plug-In)
 - 6 PWMs (GPIOs), 1 Available UART, 1 ADC (GPIO), 1 debug UART
 - Horizontal (SMD)
 - 6 PWMs (GPIOs), 1 Available UART, 3 ADCs (GPIOs), 1 debug UART, 1 GPIO
- ◆ Built-in PCB trace antenna
- ◆ Integrates the Afero Secure Connectivity Stack
- ◆ Supports Afero Easy Onboarding
- ◆ Supports Afero Secure Over the Air updates

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1 Introduction

1.1 Overview

The LA02303B is a Leedarson-developed universal Bluetooth SMART (BLE) module. It uses the Realtek Inc. RTL8762DKF System in Package that integrates an embedded 1MB flash.

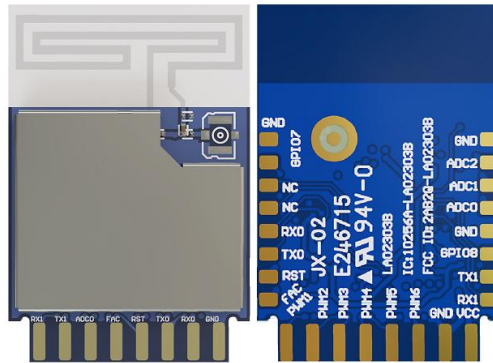


Figure 1.1 Module

It also integrates antenna on PCB which is designed for a variety of IOT products such as Door locker, Power Drivers, Sensors, Plugs, Lighting, Switches, etc.



Figure 1.2 Product Application

1.2 Block Diagram

A general block diagram of the module is shown as below.

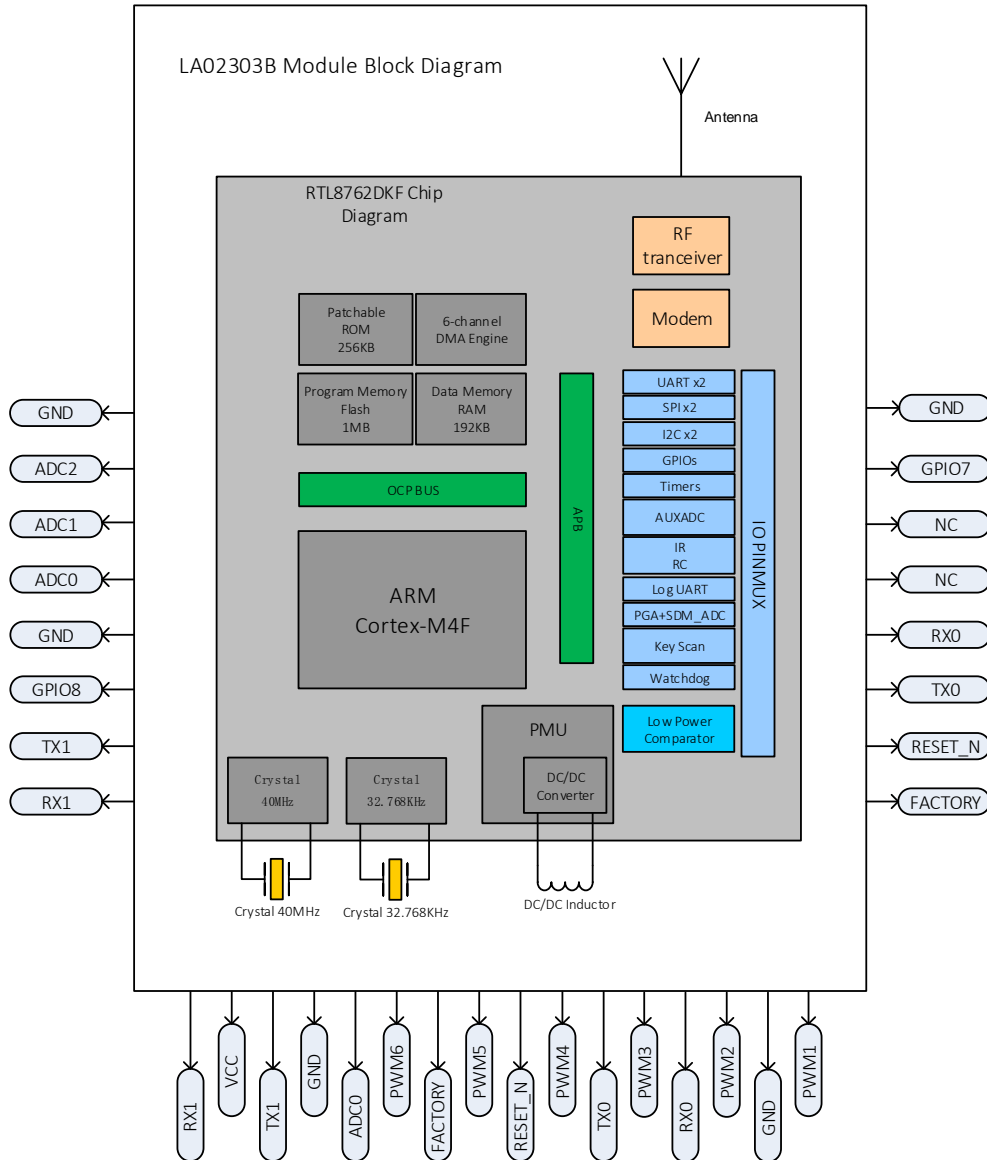


Figure 1.3 LA02303B Block Diagram

1.3 Ordering Information

Table 1.1 Ordering Information

Product	Protocol	IC Solution.	Operating Temperature	Dimension	Antenna
LA02303B	BLE	RTL8762DKF	-40 ~100°C	16mm*23.7mm*2.5mm	PCB antenna

2 Electrical Characteristics

2.1 Absolute Maximum Ratings

Stresses above those listed below may cause permanent damage to the device. This is a stress rating only and functional operation of the devices at those or any conditions above those indicated in the operation listing of this specification is not implied. Exposure to maximum rating conditions for extended periods may affect device reliability.

Table 2.1 Absolute Maximum Ratings

Symbol	Parameter	Min.	Max.	Units
VCC	Power supply	-0.3	+3.6	V
GND	Ground of module		0	V
VIO	Voltage of module IO	-0.3	+3.6	V
ST	Storage temperature	-40	+125	°C
MSL	Moisture sensitivity level	3		-
ESD HBM	Human body mode		±3.5	KV

2.2 General Operating Conditions

This table specifies the general operating temperature range and supply voltage range for all supplies, the minimum and maximum values of all other tables are specified over this operating range, unless otherwise noted.

Table 2.2 General Operating Conditions

Symbol	Parameter	Min.	Typ.	Max.	Units
VCC	Supply voltage, normal	2.0	3.3	3.6	V
TA	Operation temperature ¹	-40	25	85	°C
ICC Peak	Supply current peak ²	-	22	-	mA
ICC Average	Supply current average ²	-	7.24	-	mA
Note: ¹ . It refers in particular to the surface temperature on components of LA02303B when the module is working. If the surface temperature of components is above 100°C, the RF parameters will be worse; ² . It is measured when the module runs the RF test Firmware @25°C ambient temperature, it is provided here for reference only.					

2.3 DC Specifications

Unless otherwise indicated, typical conditions are: VCC=3.3V. TA=25 °C.

Table 2.3 DC Specifications

Symbol	Parameter(condition)	Min.	Typ.	Max.	Units
VIH	Input high voltage	0.65xVCC	-	VCC	V
VIL	Input low voltage	GND	-	0.28xVCC	V
VOH	Output high voltage	0.9xVCC	-	-	V
VOL	Output low voltage	-	-	0.1xVCC	V
IOH	Output high current	-	8	-	mA
IOL	Output low current	-	8	-	mA
RPU	Pull-up resistance	-	20	100	kΩ
RPD	Pull-down resistance	-	20	100	kΩ
ITX Peak	Pout=7dBm	-	17.7	-	mA
IRX	Rx average current	-	5.8	-	mA
Note: The current is measured with the module running the RF test Firmware, it is provided here for reference only.					

2.4 RF Specifications

Unless otherwise indicated, typical conditions are: VCC=3.3V TA=25 °C.

Table 2.4 BLE Specifications

Description	Min.	Typ.	Max.	Units
Operating Frequency	2400	-	2483.5	MHz
Modulation	GFSK			-
Channel Number	40			-
Channel Bandwidth	2			MHz
Basic Transmitting Rate	1Mbps/2Mbps/500Kbps/125Kbps			-
Frequency Offset	-100	-	100	KHz
TX Power	8			dBm
Receiving Sensitivity@1Mbps	-	-95	-	dBm
Receiving Sensitivity@2Mbps	-	-92	-	dBm
Receiving Sensitivity@500Kbps	-	-98	-	dBm
Receiving Sensitivity@125Kbps	-	-103	-	dBm
Maximum Receiving Level	-1			dBm

2.5 Antenna Specifications

Table 2.5 Antenna Specifications

Parameter	Value
Frequency Range	2.4 ~ 2.4835GHz
Impedance	50 Ohm
VSWR	≤ 2.5
Antenna Gain	≤ 4dBi
Efficiency	≥ 50%

Remark: Different products have different configurations, which will result in different antenna performances. The above parameters are based on the module being mounted on the evaluation board, horizontally or vertically, shown as followed:

3 Pin Definition

3.1 Default and Multiplexing Pin Definition

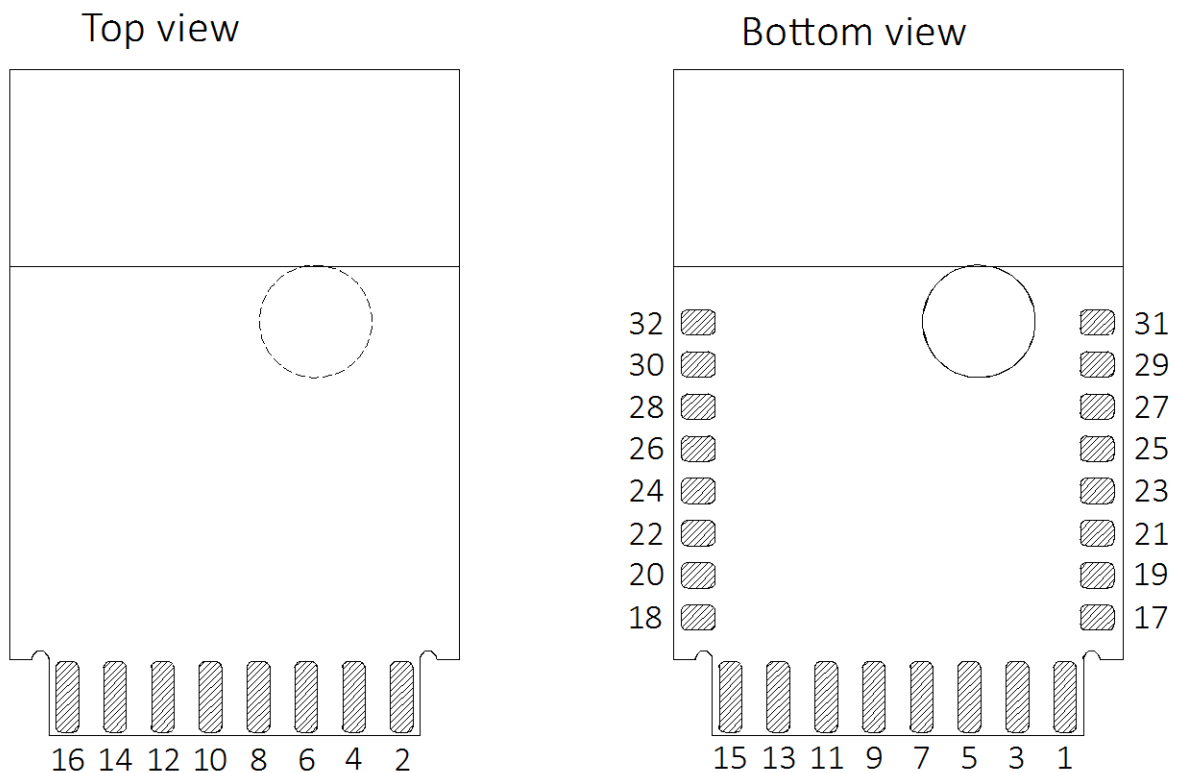


Figure 3.1 Module Pin Out

Table 3.1 Pin Definition

The Pin (1-18) is used for Plug-in application. The Pin on Bottom layer used for SMD application. Pin 1 is adjacent to Pin 2.

No.	Pin of IC	Definition	Pin Function Description	Default Pull State	Direction
1	29_P0_0	PWM1/IO0	PWM Channel 1 output / GPIO 0	Pull Down	I/O
2	49	GND	Ground of Module	-	-
3	28_P0_1	PWM2/IO1	PWM Channel 2 output / GPIO 1	Pull Down	I/O
4	43_P3_1	RX0	FACTORY_UART_RX data in	Pull Up	I
5	27_P0_2	PWM3/IO2	PWM Channel 3 output / GPIO 2	Pull Down	I/O
6	44_P3_0	TX0	FACTORY_UART_TX data out	Pull Up	O
7	25_P0_4	PWM4/IO3	PWM Channel 4 output / GPIO 3	Pull Down	I/O
8	16_RST_N	RESET_N	Reset, Low Active	Pull Up	I
9	20_P4_0	PWM5/IO4	PWM Channel 5 output / GPIO 4	Pull Down	I/O
10	23_P0_5	FACTORY	FACTORY MODE enable, low active	Pull Down	I
11	19_P4_1	PWM6/IO5	PWM Channel 6 output / GPIO 5	Pull Down	I/O
12	2_P2_2	ADC0/IO6	Analog-to-Digital Converter 0/GPIO 6	Pull Down	I/O
13	49	GND	Ground of Module	-	-
14	17_P4_3	TX1/SDA/ IR_RX	HOST_UART_RX (data out from RTL8762D)/I2C data	Pull Up	O
15	-	VCC	Power Supply	-	I
16	18_P4_2	RX1/SCL/ IR_TX	HOST_UART_TX (data in to RTL8762D)/I2C clock	Pull Down	I
17	23_P0_5	FACTORY	FACTORY MODE enable, low active	Pull Down	I
18	18_P4_2	RX1/SCL/ IR_TX	HOST_UART_TX (data in to RTL8762D)/I2C clock	Pull Down	I
19	16_RST_N	RESET_N	Reset, Low Active	Pull Up	I
20	17_P4_3	TX1/SDA/ IR_RX	HOST_UART_RX (data out from RTL8762D)/I2C data	Pull Up	O
21	44_P3_0	TX0	FACTORY_UART_TX data out	Pull Up	O
22	22_P0_6	IO8	GPIO 8	Pull Down	I/O
23	43_P3_1	RX0	FACTORY_UART_RX data in	Pull Up	I
24	49	GND	Ground of Module	-	-
25	-	NC	-	-	-
26	2_P2_2	ADC0/IO6	Analog-to-Digital Converter 0/GPIO 6	Pull Down	I/O
27	-	NC	-	-	-

28	4_P2_4	ADC1/IO9	Analog-to-Digital Converter 1/GPIO 9	Pull Down	I/O
29	26_P0_3	IO7	GPIO 7	Pull Up	I/O
30	5_P2_5	ADC2/IO10	Analog-to-Digital Converter 2/GPIO 10	Pull Down	I/O
31	49	GND	Ground of Module	-	-
32	49	GND	Ground of Module	-	-

3.2 Trap Pins

Table 3.2 Trap Pins Definition

No.	Pin of IC	Trap Pin Description	Note
29	26_P0_3	Power On Trap Pin Description 1:Normal operation mode(default) 0:Enter download mode	Don't pull down when Power on, and otherwise the module will enter download mode.
26	2_P2_2	There must not be any voltage drop placed on ADC pin before module is powered, because current input that over 1mA will damage ADC channel connect to this pin. (Digital function will not be affected).	If used as ADC, There are two modes for module: Bypass mode (range: 0~0.9V): ADC maximum input voltage cannot exceed 0.9V in this mode, and AUXADC full-scale voltage is about 0.9V. If the input voltage exceeds the ADC range, IC will be damaged. Divide mode (range: 0~3.3V): In this mode, AUXADC full-scale is 3.3V in this mode. When the input voltage is 3.3~3.6V, the ADC value may be out of range, causing measurement error.
28	4_P2_4		
30	5_P2_5		
19	16_RST_N	The module has RC circuit connect to the Reset pin, there is no need to add RC externally, and otherwise it will cause abnormal operation.	-
20	17_P4_3	If used as I2C SDA, an external pull up resistor is suggested to be reserved.	-
18	18_P4_2	If used as I2C SCL, an external pull up resistor is suggested to be reserved.	-

4 Design Guidelines

4.1 Power Supply

The LA02303B requires a single nominal supply level of 3.3V. All the necessary decoupling and filtering components are included in the module. To secure the best RF performance, the power supply for the module is recommended to have the output current higher than 30mA and have the ripple voltage less than 100mV

4.2 Module Placement

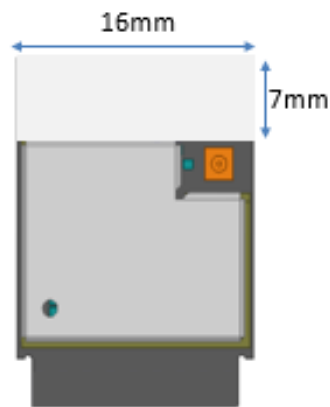


Figure 4.1 Antenna Area

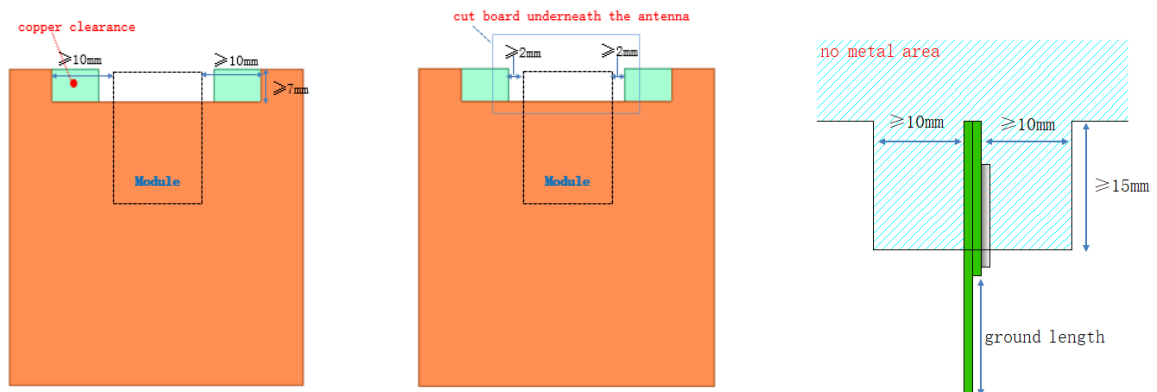


Figure 4.2 Horizontal Mounting

- The copper clearance area under the antenna must be void of traces or components;
- It should be clear of any metal, no metal structures, no metal compositions like metallic paint etc.;
- The ground length should be 30mm at least.

Reference examples are shown as below:

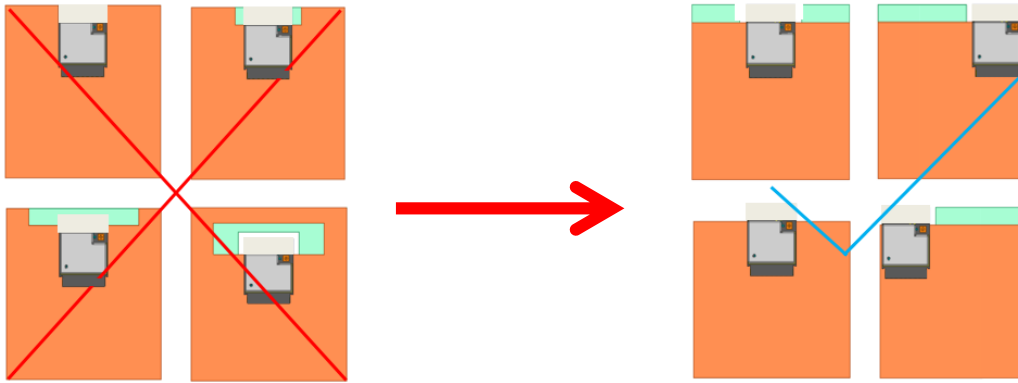


Figure 4.3 Reference Examples for Horizontal Mounting

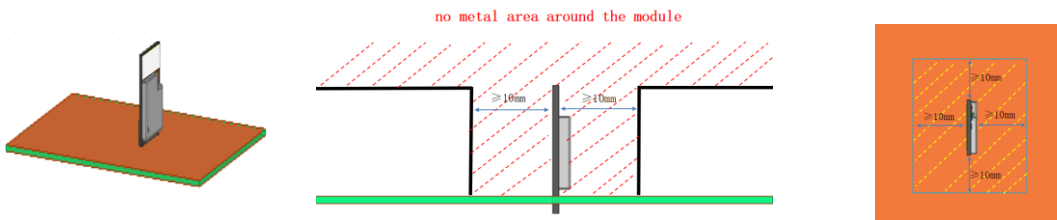


Figure 4.4 Vertical Mounting

- Space around the module should be clear of metal, there should be no metal and no metal compositions. (no copper clearance on the application board);
- For better performance, keep metal away from the module as far as possible, especially heavy metal components;
- The best position we suggest is at the edge of the application board, which provides more distance from the metal.

Reference examples are shown as below:

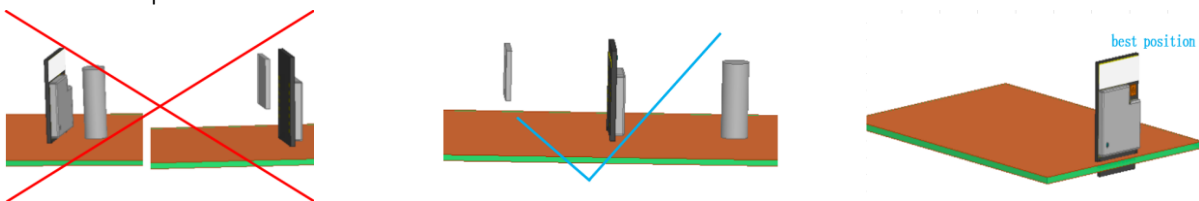


Figure 4.5 Reference Examples for Vertical Mounting

Regardless of which mounting method you choose, keep at least 1.5mm distance between module and plastic part, especially between the antenna and plastic housing.

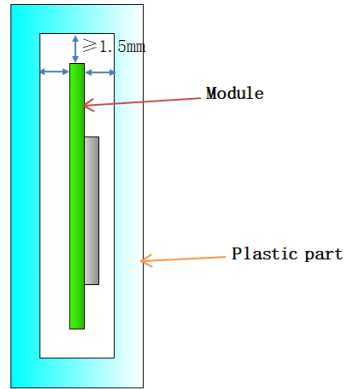


Figure 4.6 Distance between Module and Plastic

Remark: due to the size and the shape of the application board could have impact on antenna patterns and efficiency, and different components make different coupling, different end products would have different antenna performance.

5 Package Specifications

5.1 Dimension

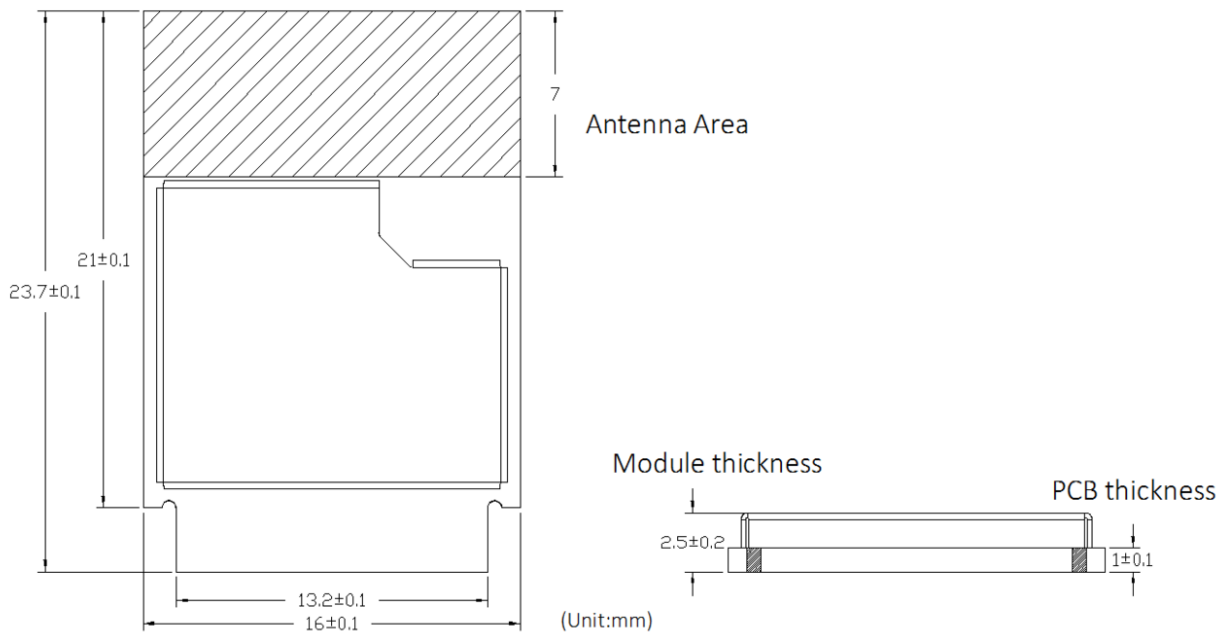


Figure 5.1 Module Dimensions

5.2 PCB Pads Information

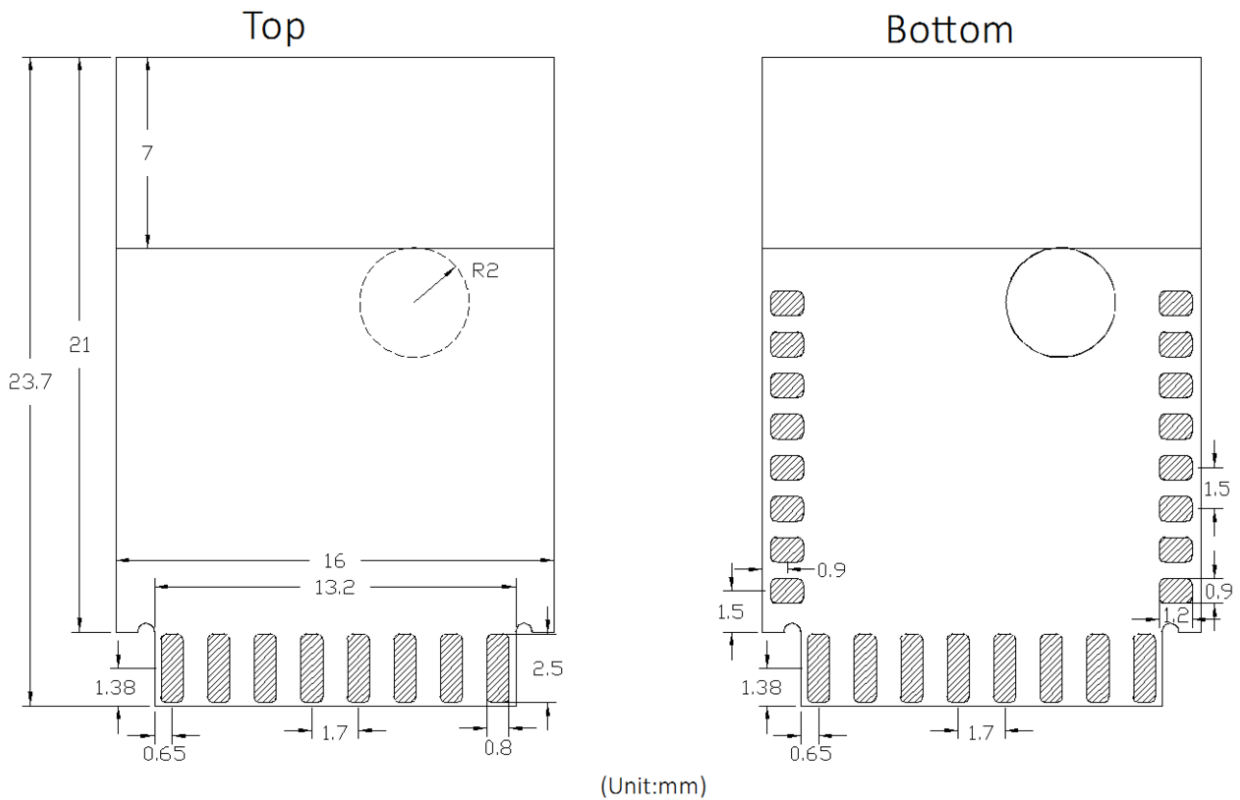


Figure 5.2 Pad Size

5.3 Plug-in Land Pattern Example

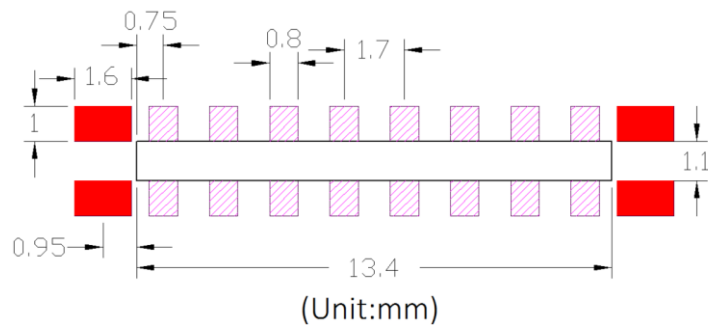


Figure 5.3 Plug-in PCB Land Pattern

Note:

- Black printing is PCB slot, the size tolerance should be $+0.1/-0$ mm, the thickness of the PCB should be 1.2mm or 1.6mm;
- The red solder pad is to drag solder water across, it is not the solder pad for the module. During wave soldering it is used to drag the solder paste water across, so that it will not be soldered together with the module's solder pads;
- It is suggested to add silk printing between the pads to avoid them welded together;

- It is suggested to put metallized through holes between the module pad and PCB slots to improve connectivity. See the recommended lay-out in Figure 5.4.

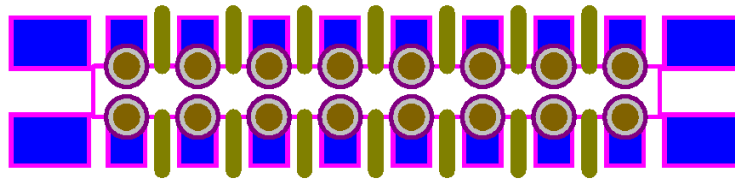


Figure 5.4 Plug-in PCB View

5.4 SMD Land Pattern Example

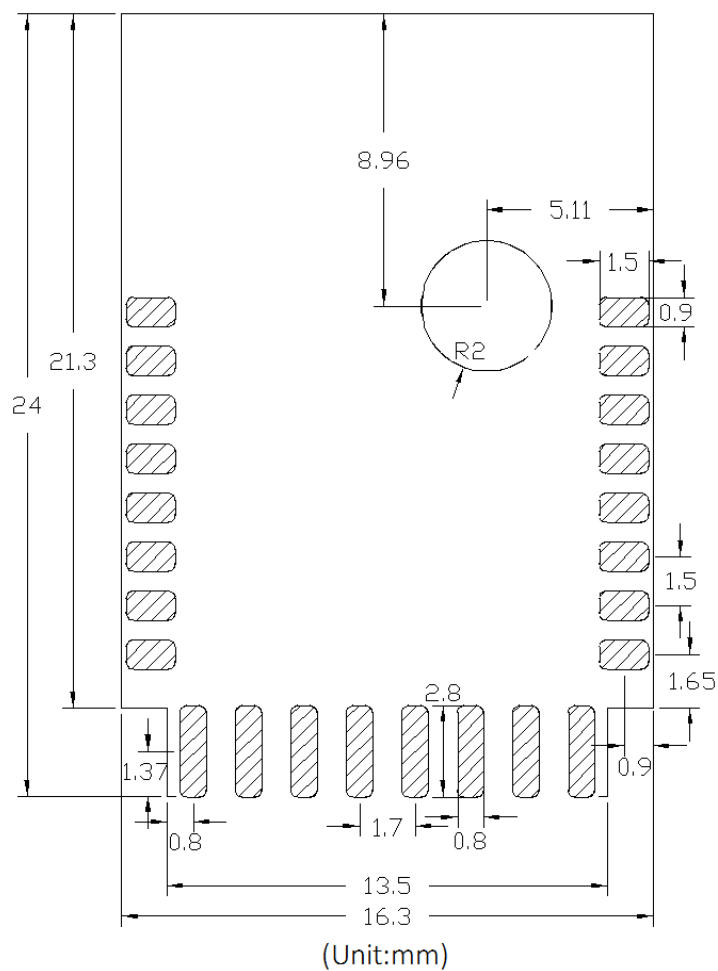


Figure 5.5 SMD Land Pattern

Note:

- Antenna area refer to [4.2 Module Placement](#) for antenna integration guidelines for optimal performance;
- The area marked by the R2 circle should be copper keep-out.

6 Production Guide

6.1 Handling Precaution

- The modules packed with the anti-moisture bag shall be stored in the environment with ambient temperature under 40°C and ambient humidity less than 90%RH;
- The module is suggested to be applied to end product in 12 months after the production date;
- With respect to the storage condition for the module after it's unpacked, the ambient temperature shall be controlled at $25 \pm 5^\circ\text{C}$ and humidity shall be less than 10%RH;
- All the surface mounting processes (reflow process including rework process) must be completed in 168 hours after the bag is opened (including any other processes);
- All the operators shall use ESD protective floor mats, wrist straps, ESD protective footwear, air ionizers etc.,
- While operating, water and dirt should not make any contact with the modules.

6.2 Soldering Recommendation

Refer to below information for SMT temperature settings, which has been used at the module production site. It is provided here for reference only. Note that the reflow times should not be more than 2 times.

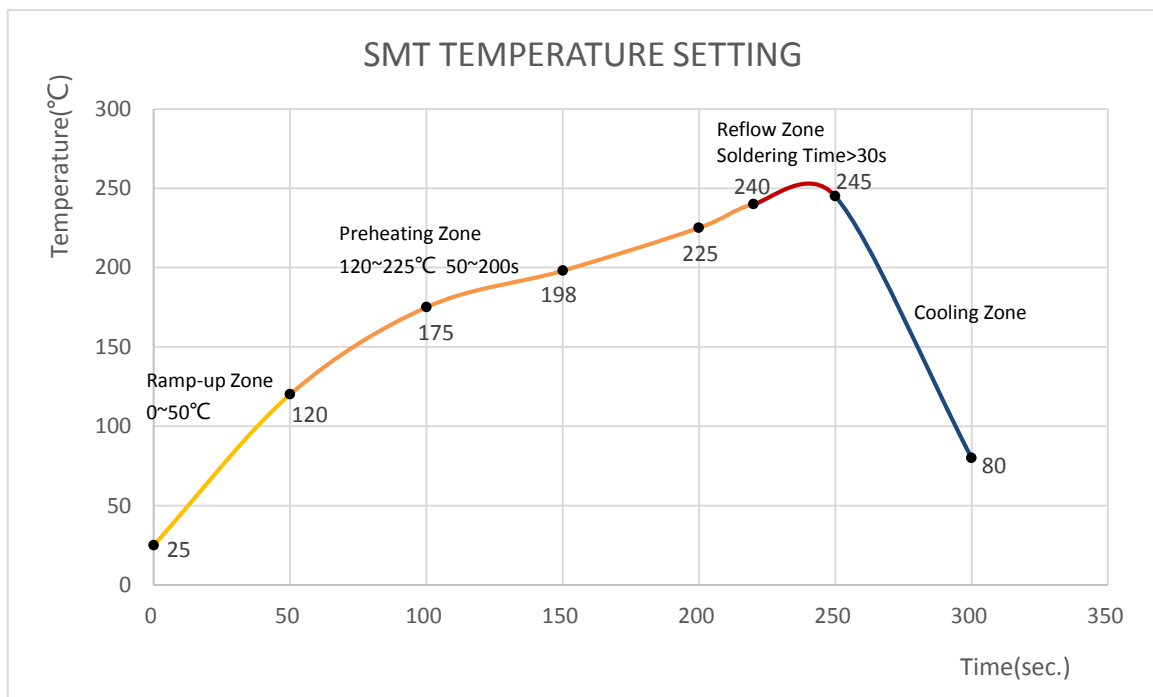


Figure 6.1 SMT Temperature Setting Curve

7 Package Information

7.1 Tape and Reel

All dimensions are given in mm unless otherwise indicated.

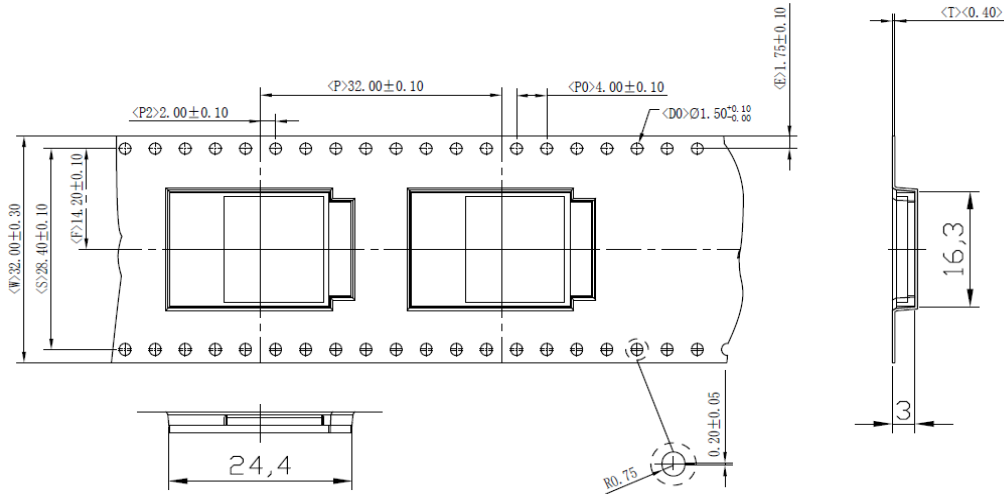


Figure 7.1 Carrier Tape Dimensions

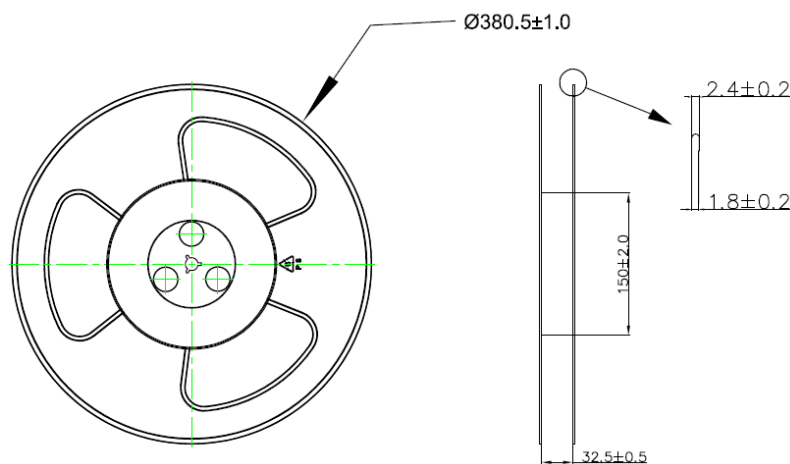


Figure 7.2 Reel Dimensions

7.2 Package and Weight

- Each reel contains 700 pcs, weight of single module is $1.47\text{g} \pm 15\%$ (1.25g-1.69g).

8 Declaration

FCC 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 equipment 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.

Please notice that 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 FCC ID: 2AB2Q-LA02303B" any similar wording that expresses the same meaning may be used.

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

The device must be professionally installed.

The intended use is generally not for the general public. It is generally for industry/commercial use.

The connector is within the transmitter enclosure and can only be accessed by disassembly of the transmitter that is not normally required. The user has no access to the connector.

Installation must be controlled. Installation requires special training

This module has been assessed against the following FCC rule parts: CFR 47 FCC Part 15 C (15.247, DTS) and CFR 47 FCC Part 15 E (NII). It is applicable to the modular transmitter.

Canada Statement

This device complies with Industry Canada's licence-exempt RSSs. Operation is subject to the following two conditions:

- (1) This device may not cause interference; and
- (2) This device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:

- (1) l'appareil ne doit pas produire de brouillage;
- (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Please notice that if the ISED certification 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 IC: 10256A-LA02303B” any similar wording that expresses the same meaning may be used. l'appareil hôte doit porter une étiquette donnant le numéro de certification du module d'Industrie Canada, précédé des mots « Contient un module d'émission », du mot « IC: 10256A-LA02303B» ou d'une formulation similaire exprimant le même sens, comme suit.

The device meets the exemption from the routine evaluation limits in section 2.5 of RSS 102 and compliance with RSS-102 RF exposure, users can obtain Canadian information on RF exposure and compliance.

Le dispositif rencontre l'exemption des limites courantes d'évaluation dans la section 2.5 de RSS 102 et la conformité à l'exposition de RSS-102 RF, utilisateurs peut obtenir l'information canadienne sur l'exposition et la conformité de rf.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter. This equipment should be installed and operated with a minimum distance of 20 centimeters between the radiator and your body.

Cet émetteur ne doit pas être Co-placé ou ne fonctionnant en même temps qu'aucune autre antenne ou émetteur. Cet équipement devrait être installé et actionné avec une distance minimum de 20 centimètres

entre le radiateur et votre corps.

Notice to OEM integrator

Must use the device only in host devices that meet the FCC/ISED RF exposure category of mobile, which means the device is installed and used at distances of at least 20cm from persons.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

The end user manual shall include FCC Part 15 /ISED RSS GEN compliance statements related to the transmitter as show in this manual(FCC/IC Canada statement).

Host manufacturer is responsible for compliance of the host system with module installed with all other applicable requirements for the system such as Part 15 B, ICES 003.

Host manufacturer is strongly recommended to confirm compliance with FCC/ISED requirements for the transmitter when the module is installed in the host.

The use condition limitations extend to professional users, then instructions must state that this information also extends to the host manufacturer's instruction manual.

This module is stand-alone modular. If the end product will involve the multiple simultaneously transmitting condition or different operational conditions for a stand-alone modular transmitter in a host, host manufacturer have to consult with module manufacturer for the installation method in end system.

Any company of the host device which install this modular 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.

This modular transmitter is only FCC authorized for the specific rule parts (47CFR Part 15.247 and 15.407) listed on the grant, and 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.

Host manufacturer is strongly recommended to confirm compliance with FCC/ISED requirements for the transmitter when the module is installed in the host.

Must have on the host device a label showing Contains FCC ID: 2AB2Q-LA02303B or IC: 10256A-LA02303B

Both FCC ID and IC ID are not to be placed on the host at the same time and only hosts going into the US can use the FCC ID and only hosts going into Canada can use the IC ID.

Antenna: PCB Antenna & 4 dBi

l'hôte doit utiliser l'instrument uniquement dans des dispositifs qui répondent à la fcc / (catégorie d'exposition rf mobile, ce qui signifie le dispositif est installé et utilisé à une distance d'au moins 20

cm de personnes.

le manuel de l'utilisateur final doit inclure la partie 15 / (fac rss gen déclarations de conformité relatives à l'émetteur que de montrer dans ce manuel.

le fabricant est responsable de la conformité de l'hôte, le système d'accueil avec le module installé avec toutes les autres exigences applicables du système comme la partie 15 b, ices - 003.

accueillir le fabricant est fortement recommandé de confirmer la conformité avec les exigences de la fcc / (émetteur lorsque le module est installé dans l'hôte.

le dispositif d'accueil doivent avoir une étiquette indiquant contient FCC ID: 2AB2Q-LA02303B, IC: 10256A-LA02303B

Doit avoir sur l'appareil hôte une étiquette indiquant Contient l'ID FCC ID: 2AB2Q-LA02303B ou IC : 10256A-LA02303B L'ID FCC et l'ID IC ne doivent pas être placés sur l'hôte en même temps et seuls les hôtes se rendant aux États-Unis peuvent utiliser l'ID FCC et seuls les hôtes se rendant au Canada peuvent utiliser l'ID IC.

Antennes: antennes PCB et 4 DBI