

LA02305 Module User Manual

1. Introduction

1.1 Overview

The LA02305 is a Leedarson-developed universal Wi-Fi and Bluetooth SMART (BLE) combo module. It uses the Espressif Inc. ESP32-U4WDH System in Package that integrates an embedded 4MB flash.

The LA02305 contain 2 vision with different antenna type:

Type A: built in PCB Antenna

Type B: Add a Antenna connector, connect to external Antenna.

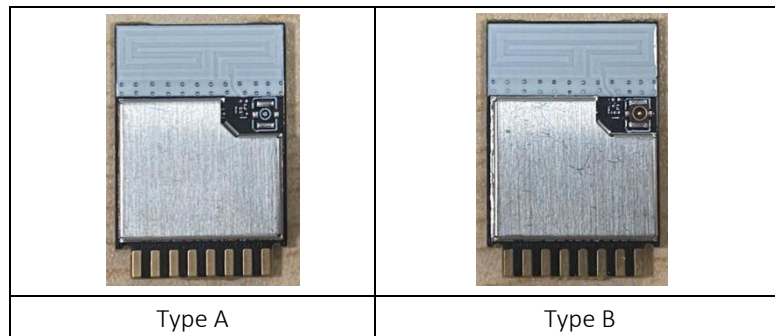


Figure 1.1. LA02305 Module

The LA02305 module is designed for a variety of IOT products such as Power Drivers, Sensors, Plugs, Lighting, Switches, etc.



Figure 1.2. Product Application

1.2 Key features

- Embedded Xtensa® 32-bit LX6 microprocessor, with clock up to 160MHz
- Data Memory: 520KB internal SRAM and 448KB internal ROM, 4MB Flash
- Power supply voltage: 3.3V
- Operating temperature: -40~105 Deg-C
- Frequency of crystal oscillator: 40MHz\32.768kHz
- Operating frequency: 2400~2483.5MHz
- Support WIFI 802.11b/g/n up to 150Mbps
- Compliant with Bluetooth LE specifications
- Wi-Fi 802.11 b/g/n and BLE can't transmission simultaneous
- Interface:
 - Vertical Mount (Plug-In)
 - ◆ 6 PWMs (GPIOs)
 - ◆ 1 Available UART
 - ◆ 1 ADC
 - ◆ 1 Dedicated Triac Dimmer Detection Pin
 - Horizontal (SMD)
 - ◆ 6 PWMs (GPIOs)
 - ◆ 3 GPIOs
 - ◆ 1 Available UART
 - ◆ 2 ADC
 - ◆ 1 Dedicated Triac Dimmer Detection Pin

1.3 Block Diagram

The LA02305 module is a highly-integrated, high-performance system with all the hardware components needed to enable 2.4GHz wireless connectivity and support Wi-Fi and BLE protocols.

Built around the ESP32-U4WDH Wireless SoC, the LA02305 includes, supply decoupling and filtering components, a 40MHz reference crystal, a 32.768kHz crystal, and an RF shield.

The different type of Antenna block diagram of the module is shown as below.

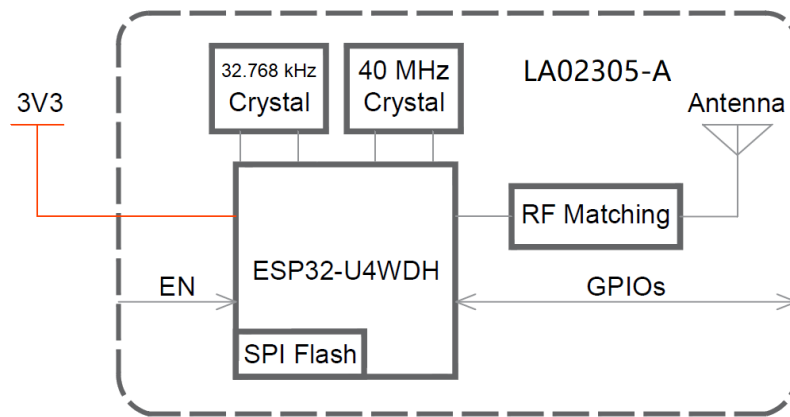


Figure 1.3. LA02305-A Block Diagram(PCB Antenna)

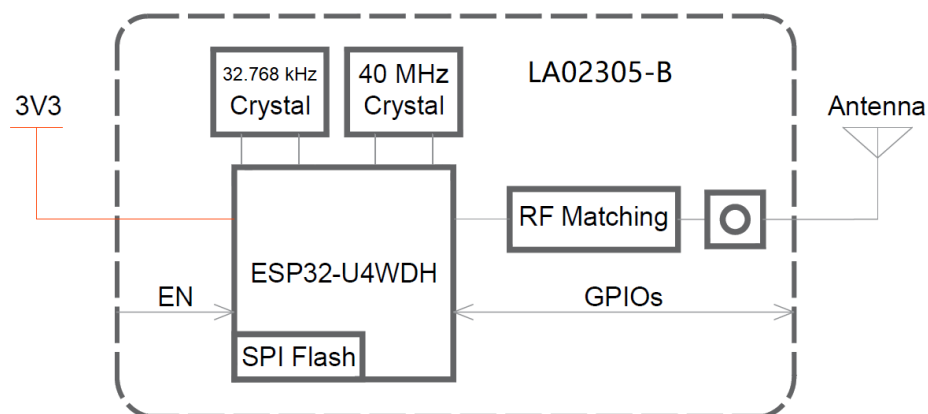


Figure 1.3. LA02305-B Block Diagram(External Antenna)

1.4 Power Supply

The LA02305 requires a single nominal supply level of 3.3V. All the necessary decoupling and filtering components are included in the module. The supply voltage noise tolerance of the module should be less than 100mVpp and the supply current should be more than 500mA.

1.5 Module Certification Information

Table 1.1. Module Certification Information

Module	Certification Information
LA02305	FCC ID: 2AB2Q-LA02305
	IC: 10256A-LA02305

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
Storage temperature		-40	+125	Deg-C
MSL	Moisture Sensitivity Level	3		
ESD HBM	Human Body Mode		± 1.5	KV
ESD CDM	Charge Device Mode		± 500	V

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	3.0	3.3	3.6	V
TA	Operation temperature ¹	-40	25	105	Deg-C
ICC peak	Supply Current Peak ²	-	400	450	mA
ICC average	Supply Current average ²	-	150		mA

Note:

1. It refers in particular to the surface temperature on 40MHz reference crystal of the LA02305 when it is working, if the surface temperature of 40MHz reference crystal is above 105 Deg-C, the RF parameters will be worse.
2. It is measured when the module runs the RF test Firmware @ 10% duty cycle and 25 Deg-C ambient temperature.

2.3 DC Specifications

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

Table 2.3. DC Specifications

Symbol	Parameter(condition)	Min.	Typ.	Max.	Units
VIH	Input high voltage	0.75xVCC	-	VCC	V
VIL	Input low voltage	GND	-	0.25xVCC	V
VOH	Output high voltage	0.8xVCC	-	-	V
VOL	Output low voltage	-	-	0.1xVCC	V

IOH	Output high current	-	40	-	mA
IOL	Output low current	-	28	-	mA
RPU	Pull-up resistance	-	45	-	k Ω
RPD	Pull-down resistance	-	45	-	k Ω
ITX 802.11b peak	Transmit 11b DSSS 1Mbps Pout=+19dBm	-	382		mA
ITX 802.11b average	Transmit 11b DSSS 1Mbps Pout=+19dBm	-	148	-	mA
ITX 802.11b peak	Transmit 11b DSSS 11Mbps Pout=+19dBm	-	378	-	mA
ITX 802.11b average	Transmit 11b DSSS 11Mbps Pout=+19dBm	-	146	-	mA
ITX 802.11g peak	Transmit 11g OFDM 6Mbps Pout=+17dBm	-	332	-	mA
ITX 802.11g average	Transmit 11g OFDM 6Mbps Pout=+17dBm	-	139	-	mA
ITX 802.11g peak	Transmit 11g OFDM 54Mbps Pout=+13 dBm	-	272	-	mA
ITX 802.11g average	Transmit 11g OFDM 54Mbps Pout=+13 dBm	-	130	-	mA
ITX 802.11n peak	Transmit 11n OFDM MCS0 Pout=+17.5 dBm	-	328	-	mA
ITX 802.11n average	Transmit 11n OFDM MCS0 Pout=+17.5 dBm	-	140	-	mA
ITX 802.11n peak	Transmit 11n OFDM MCS7 Pout=+12 dBm	-	256	-	mA
ITX 802.11n average	Transmit 11n OFDM MCS7 Pout=+12 dBm	-	128	-	mA
IRX 802.11b/g/n	Rx average current	-	108	-	mA
ITX BLE	Pout=8 dBm	-	236	-	mA
ITX BLE average	Pout=8 dBm	-	184	-	mA
IRX BLE	Rx average current	-	115	-	mA
Note: The current is measured with the module running the RF test Firmware @ 10% duty cycle					

2.4 RF Specifications

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

Table 2.4. Wi-Fi Specifications

Symbol	Description	Min.	Typ.	Max.	Units
Fop	Operating frequencies	2412	-	2462	MHz
PRF11b	11b DSSS 1Mbps output power	-	17.46	-	dBm
	11b DSSS 11Mbps output power	-	17.46	-	dBm
PRF11g	11g OFDM 6Mbps output power	-	15.67	-	dBm
	11g OFDM 54Mbps output power	-	15.67	-	dBm
PRF11n	11n OFDM HT20 MCS0 output power	-	15.43	-	dBm
	11n OFDM HT20 MCS7 output power	-	15.43	-	dBm
	11n OFDM HT40 MCS0 output power	-	15.23	-	dBm
	11n OFDM HT40 MCS7 output power	-	15.23	-	dBm
PSENS11b	Receiver sensitivity @11b DSSS 1Mbps	-	-95	-	dBm
	Maximum receiving level @11b DSSS 1Mbps	-	5	-	dBm
	Receiver sensitivity @11b DSSS 11Mbps	-	-86	-	dBm

	Maximum receiving level @11b DSSS 11Mbps	-	5	-	dBm
PSENS11g	Receiver sensitivity @11g OFDM 6Mbps	-	-91	-	dBm
	Maximum receiving level @11g OFDM 6Mbps	-	0	-	dBm
	Receiver sensitivity @11g OFDM 54Mbps	-	-73	-	dBm
	Maximum receiving level @11g OFDM 54Mbps	-	-8	-	dBm
PSENS11n	Receiver sensitivity @11n OFDM HT20 MCS0	-	-90	-	dBm
	Maximum receiving level @11n OFDM HT20 MCS0	-	0	-	dBm
	Receiver sensitivity @11n OFDM HT20 MCS7	-	-71	-	dBm
	Maximum receiving level @11n OFDM HT20 MCS7	-	-8	-	dBm
	Receiver sensitivity @11n OFDM HT40 MCS0	-	-88	-	dBm
	Maximum receiving level @11n OFDM HT40 MCS0	-	0	-	dBm
	Receiver sensitivity @11n OFDM HT40 MCS7	-	-68	-	dBm
	Maximum receiving level @11n OFDM HT40 MCS7	-	-8	-	dBm

Table 2.5. BLE Specifications

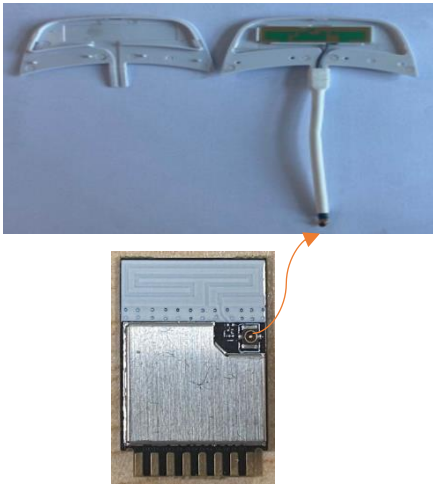
Symbol	Description	Min.	Typ.	Max.	Units
Fop	Operating frequencies	2402	-	2480	MHz
PRFLE	LE Output Power	-	8.78	-	dBm
	LE Out Power Control range	-	24	-	dB
	LE Out Power Control step	-	3	-	dB
PSENSLE	LE Receiver sensitivity	-	-90	-	dBm
	LE Maximum receiving level	-	0	-	dBm

2.5 Antenna Specifications

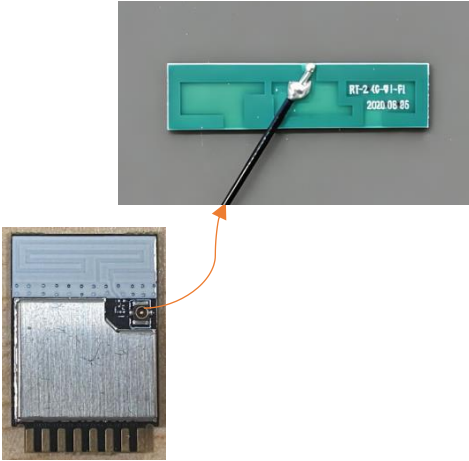
2.5.1 Internal PCB Antenna Specifications

Antenna Picture	
Antenna Type	PCB Antenna
Antenna Peak Gain	4dBi
Operating Band	2400 MHz ~ 2483.5 MHz

2.5.2 External Antenna Type-1 Specifications

Antenna Picture	
Antenna	PCB Antenna
Antenna Peak Gain	3.7dBi
Operating Band	2400 MHz ~ 2483.5 MHz

2.5.3 External Antenna Type-2 Specifications

Antenna Picture	
Antenna	PCB Antenna
Antenna Peak Gain	2.89dBi
Operating Band	2400 MHz ~ 2483.5 MHz

3. Pin Definition

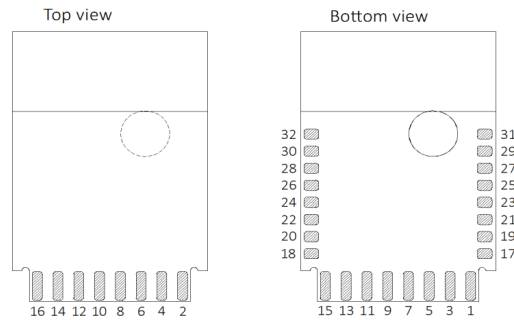


Figure 3.1. Vertical Mount (Plug-In)

Table 3.1. Plug-In pin definition

Module No	Pin of IC	Pin Definition	Pin Function Description	Direction
1	17_MTMS	PWM1/IO0	PWM channel 1 output / GPIO 0	I/O
2	GND	GND	Ground of Module	--
3	15_GPIO26	PWM2/IO1	PWM channel 2 output / GPIO 1	I/O
4	40_U0RXD	RX0	FACTORY_UART_RX data in (RX)	I
5	17_MTMS	PWM3/IO2	PWM channel 3 output / GPIO 2	I/O
6	41_U0TXD	TX0	FACTORY_UART_TX data out (TX)	O
7	21_MTDO	PWM4/IO3	PWM channel 4 output / GPIO 3	I/O
8	9_CHIP_PU	RESET	Reset, Low Active	I
9	24_GPIO4	PWM5/IO4	PWM channel 5 output / GPIO 4	I/O
10	10_VDET_1	FAC	FACTORY MODE enable, low active	I
11	35_GPIO18	PWM6/IO5	PWM channel 6 output / GPIO 5	I/O
12	5_SENSOR_VP	ADC0	Analog-to-Digital Converter	I
13	GND	GND	Ground of Module	--
14	16_GPIO27	TX1	HOST_UART_RX (data out from ESP32) , need an external pull up	O
15	1,3,4,19,26,37,43,46	VCC	Power Supply	--
16	14_GPIO25	RX1	HOST_UART_TX (data in to ESP32) , need an external pull up	I

Note:

1. AC_TRIAC_DETECT is used to detect if a device is powered through a triac dimmer and to determine the dimmer settings. The circuit that feeds this signal should give a scaled DC voltage representation of the average AC voltage integrated over approximately 200ms. If the triac is set to chop the AC waveform 50%, the AC_TRIAC_DETECT signal should be at 50% of VCC. If the triac dimmer is turned up completely, the AC waveform will be minimally chopped and the AC_TRIAC_DETECT signal should be at 100% of VCC.

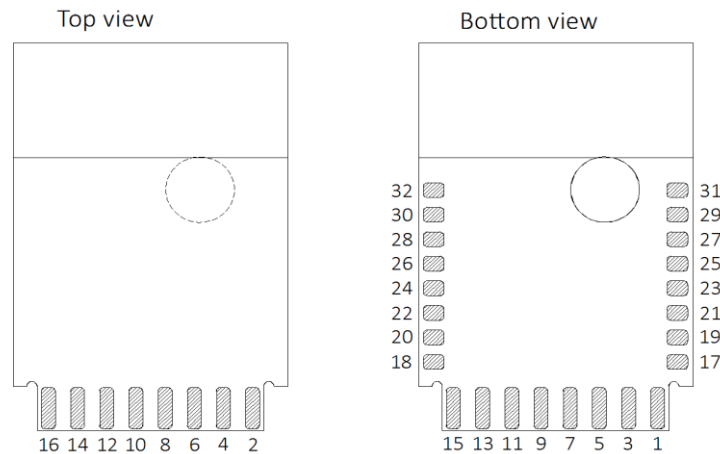


Figure 3.2. Horizontal (SMD)
Table 3.2. SMD pin definition

Module No	Pin of IC	Pin Definition	Pin Function Description	Direction
1	17_MTMS	PWM1/IO0	PWM channel 1 output / GPIO 0	I/O
2	GND	GND	Ground of Module	--
3	15_GPIO26	PWM2/IO1	PWM channel 2 output / GPIO 1	I/O
4	40_U0RXD	RX0	FACTORY_UART_RX data in (RX)	I
5	17_MTMS	PWM3/IO2	PWM channel 3 output / GPIO 2	I/O
6	41_U0TXD	TX0	FACTORY_UART_TX data out (TX)	O
7	21_MTD0	PWM4/IO3	PWM channel 4 output / GPIO 3	I/O
8	9_CHIP_PU	RESET	Reset, Low Active	I
9	24_GPIO4	PWM5/IO4	PWM channel 5 output / GPIO 4	I/O
10	10_VDET_1	FAC	FACTORY MODE enable, low active	I
11	35_GPIO18	PWM6/IO5	PWM channel 6 output / GPIO 5	I/O
12	5_SENSOR_VP	ADC0	Analog-to-Digital Converter	I
13	GND	GND	Ground of Module	--
14	16_GPIO27	TX1	HOST_UART_RX (data out from ESP32) , need an external pull up	O
15	1,3,4,19,26,37,43, 46	VCC	Power Supply	--
16	14_GPIO25	RX1	HOST_UART_TX (data in to ESP32) , need an external pull up	I
17	10_VDET_1	FAC	FACTORY MODE enable, low active	I
18	14_GPIO25	RX1	HOST_UART_TX (data in to ESP32) , need an external pull up	I
19	9_CHIP_PU	RESET	Reset, Low Active	I
20	16_GPIO27	TX1	HOST_UART_RX (data out from ESP32) , need an external pull up	O

21	41_U0TXD	TX0	FACTORY_UART_TX data out (TX)	O
22	42_GPIO21	IO8	GPIO8	I/O
23	40_U0RXD	RX0	FACTORY_UART_RX data in (RX)	I
24	GND	GND	Ground of Module	--
25	--	NC	--	--
26	5_SENSOR_VP	ADC0	Analog-to-Digital Converter	I
27	--	NC	--	--
28	39_GPIO22	IO9	GPIO9	I/O
29	23_GPIO0	IO7	GPIO7	I/O
30	11_VDET_2	ADC2	Analog-to-Digital Converter	I
31	GND	GND	Ground of Module	--
32	GND	GND	Ground of Module	--

Note:

1. AC_TRIAC_DETECT is used to detect if a device is powered through a triac dimmer and to determine the dimmer settings. The circuit that feeds this signal should give a scaled DC voltage representation of the average AC voltage integrated over approximately 200ms. If the triac is set to chop the AC waveform 50%, the AC_TRIAC_DETECT signal should be at 50% of VCC. If the triac dimmer is turned up completely, the AC waveform will be minimally chopped and the AC_TRIAC_DETECT signal should be at 100% of VCC.

4. Package Specifications

4.1 Dimension

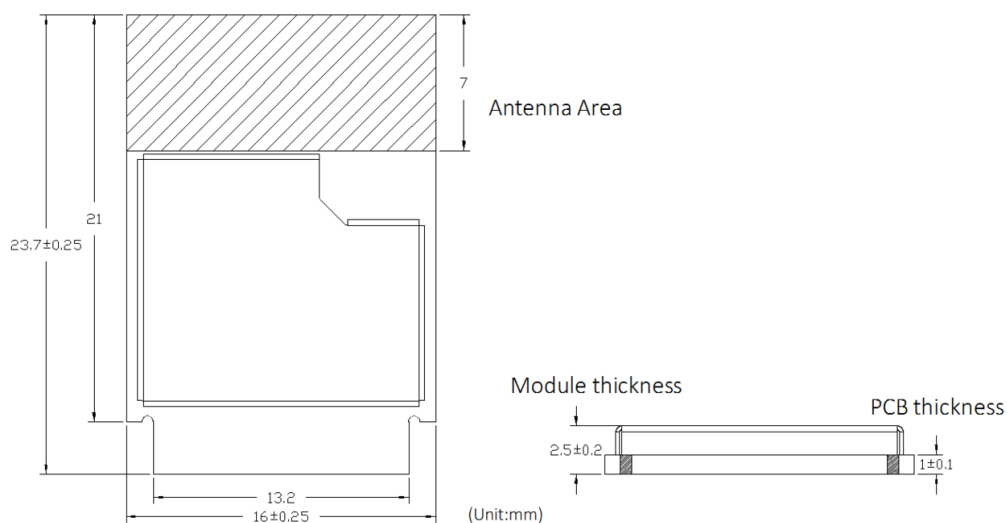


Figure 4.1. Module Dimensions (Unit: mm)

Note: The type B's PCB Antenna Area is no connected.

4.2 PCB Pads Information

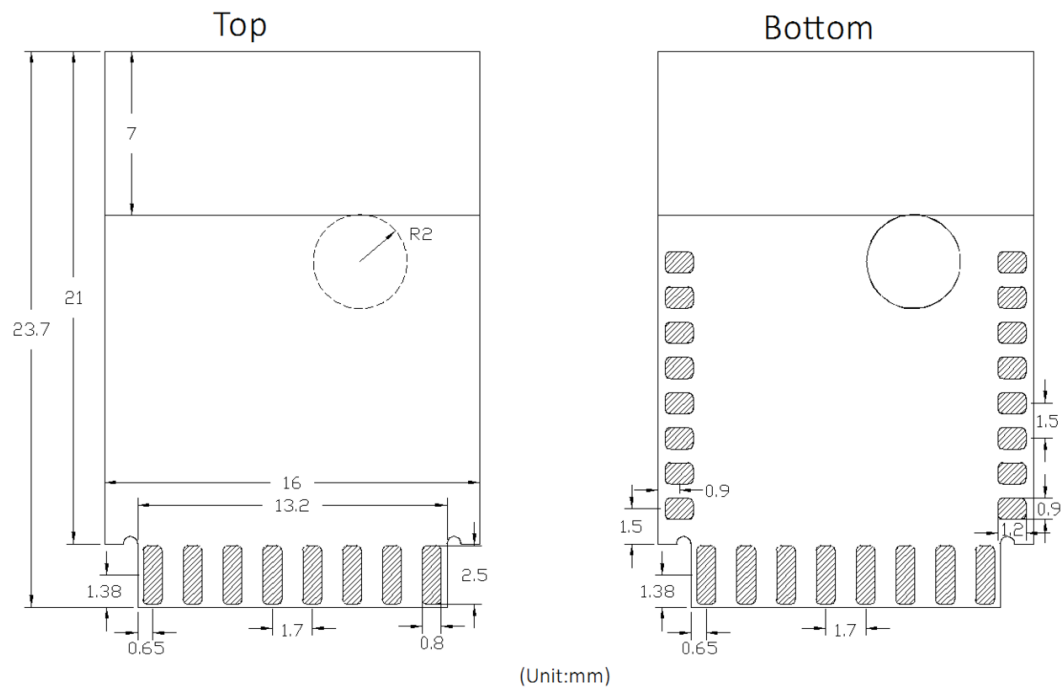


Figure 4.2. Pad Size (Unit: mm)

4.3 Plug-in Land pattern example

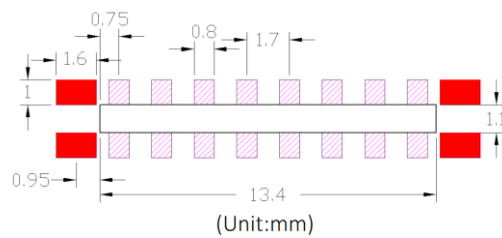


Figure 4.3. Plug-in PCB Land Pattern (Unit: mm)

Please see below lay-out:

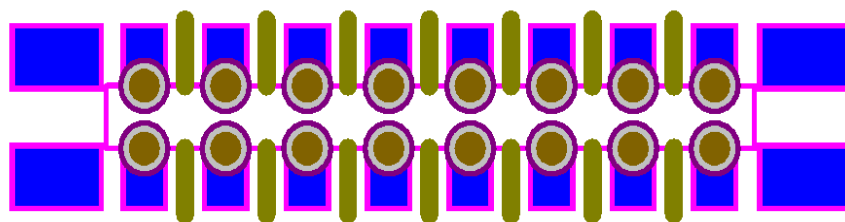


Figure 4.4. Plug-in PCB Land Pattern (Unit: mm)

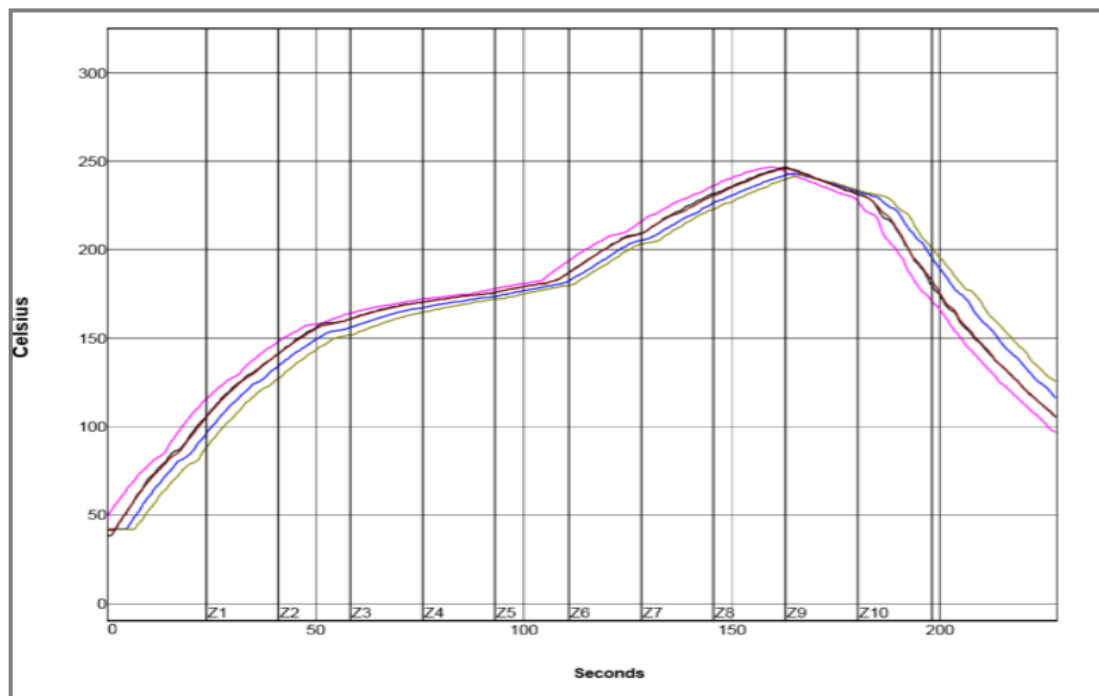


Figure 5.1. SMT temperature setting curve

6. Declaration

FCC Statement

1. 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.
 - (2) This device must accept any interference received, including interference that may cause undesired operation.

15.21

Note: The grantee is not responsible for any changes or modifications not expressly approved by the party responsible for compliance. Such modifications could void the user's authority to operate the equipment.

15.105(b)

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

This equipment complies with FCC/ISED 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.

L'appareil est conforme aux limites d'exposition aux rayonnements spécifiées par la FCC/ISED pour les environnements non contrôlés. La distance entre le radiateur et le corps doit être d'au moins 20 cm lors de l'installation et du fonctionnement de l'appareil.

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two

conditions:

1. This device may not cause interference.
2. This device must accept any interference, including interference that may cause undesired operation of the device.

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique 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'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Integration instructions for host product manufacturers according to KDB 996369 D03 OEM

2.2 List of applicable FCC rules

CFR 47 FCC PART 15 SUBPART C has been investigated. It is applicable to the modular.

2.3 Specific operational use conditions

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.

2.4 Limited module procedures

Not applicable

2.5 Trace antenna designs

Not applicable

2.6 RF exposure considerations

To maintain compliance with FCC's RF Exposure guidelines, This equipment should be installed and operated with minimum distance of 20cm from your body.

2.7 Antennas

This radio transmitter FCC ID: 2AB2Q-LA02305 has been approved by Federal Communications Commission to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.

ANT No.	Antenna Type	Antenna Gain	Impedance	Frequency Range
1	PCB	4 dBi	50Ω	2.4~2.5GHz
2	PCB	3.7dBi	50Ω	2.4~2.5GHz
3	PCB	2.89dBi	50Ω	2.4~2.5GHz

ANT 1 is an internal antenna arrangement.

ANT 2 and ANT 3 are external antenna arrangements with unique (non-standard) connector.

2.8 Label and compliance information

The final end product must be labeled in a visible area with the following " Contains

FCC ID: 2AB2Q-LA02305"

2.9 Information on test modes and additional testing requirements

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

2.10 Additional testing, Part 15 Subpart B disclaimer

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

This device is intended only for OEM integrators under the following condition: The transmitter module may not be co-located with any other transmitter or antenna. As long as the condition above is met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed.

Cet appareil est conçu uniquement pour les intégrateurs OEM dans les conditions suivantes: Le module émetteur peut ne pas être coïmplanté avec un autre émetteur ou antenne. Tant que les 1 condition ci-dessus sont remplies, des essais supplémentaires sur l'émetteur ne seront pas nécessaires. Toutefois, l'intégrateur OEM est toujours responsable des essais sur son produit final pour toutes exigences de conformité supplémentaires requis pour ce module installé.

Important Note:

In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the Canada authorization is no longer considered valid and the ISED cannot be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate Canada authorization.

Any company of the host device which install this modular with limit modular approval should perform the test of radiated emission and spurious emission according to RSS-247 and RSS-Gen requirement, only if the test result comply with RSS-247 and RSS-Gen requirement, then the host can be sold legally.

Note Importante:

Dans le cas où ces conditions ne peuvent être satisfaites (par exemple pour certaines configurations d'ordinateur portable ou de certaines co-localisation avec un autre émetteur), l'autorisation du Canada n'est plus considéré comme valide et l'ISED ne peut pas être utilisé sur le produit final. Dans ces circonstances, l'intégrateur OEM sera chargé de réévaluer le produit final (y compris l'émetteur) et l'obtention d'une autorisation distincte au Canada. toute entreprise de l'hôte qui installent ce dispositif modulaire avec limite approbation devrait effectuer l'essai des modules et des rayonnements non essentiels des émissions rayonnées selon RSS-247 et le cnr - gen, seulement si le résultat d'essai conforme RSS-247 et le cnr - gen, puis l'hôte peut être vendu légalement.

End Product Labeling

The final end product must be labeled in a visible area with the following:

Contains IC: 10256A-LA02305.

Plaque signalétique du produit final

Le produit final doit être étiqueté dans un endroit visible avec l'inscription suivante: Contient des IC: 10256A-LA02305.

Manual Information to the End User

The OEM integrator has to be aware not to provide information to 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.

Manuel d'information à l'utilisateur final

L'intégrateur OEM doit être conscient de ne pas fournir des informations à l'utilisateur final quant à la façon d'installer ou de supprimer ce module RF dans le manuel de l'utilisateur du produit final qui intègre ce module.

Le manuel de l'utilisateur final doit inclure toutes les informations réglementaires requises et avertissements comme indiqué dans ce manuel.

This radio transmitter [IC: 10256A-LA02305] has been approved by Innovation, Science and Economic Development Canada to operate with the antenna types listed below:

Cet émetteur radio [IC: 10256A-LA02305] a été approuvé par Innovation, Sciences et Développement économique Canada pour fonctionner avec les types d'antenne énumérés ci-dessous:

ANT No.	Antenna Type	Antenna Gain	Impedance	Frequency Range
1	PCB	4 dBi	50Ω	2.4~2.5GHz
2	PCB	3.7dBi	50Ω	2.4~2.5GHz
3	PCB	2.89dBi	50Ω	2.4~2.5GHz

Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.

Les types d'antennes non inclus dans cette liste qui ont un gain supérieur au gain maximum indiqué pour tout type répertorié sont strictement interdits pour l'utilisation avec cet appareil.