Data Sheet

AB6031X-44PF-03

SDIO Wi-Fi Module

WRITTEN	CHECKED	APPROVED

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AltoBeam Inc.

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REVISION HISTORY

Revision Number	Revision Date	Changes	
		Item	Description
V1.0	2024-08-09		Official release version

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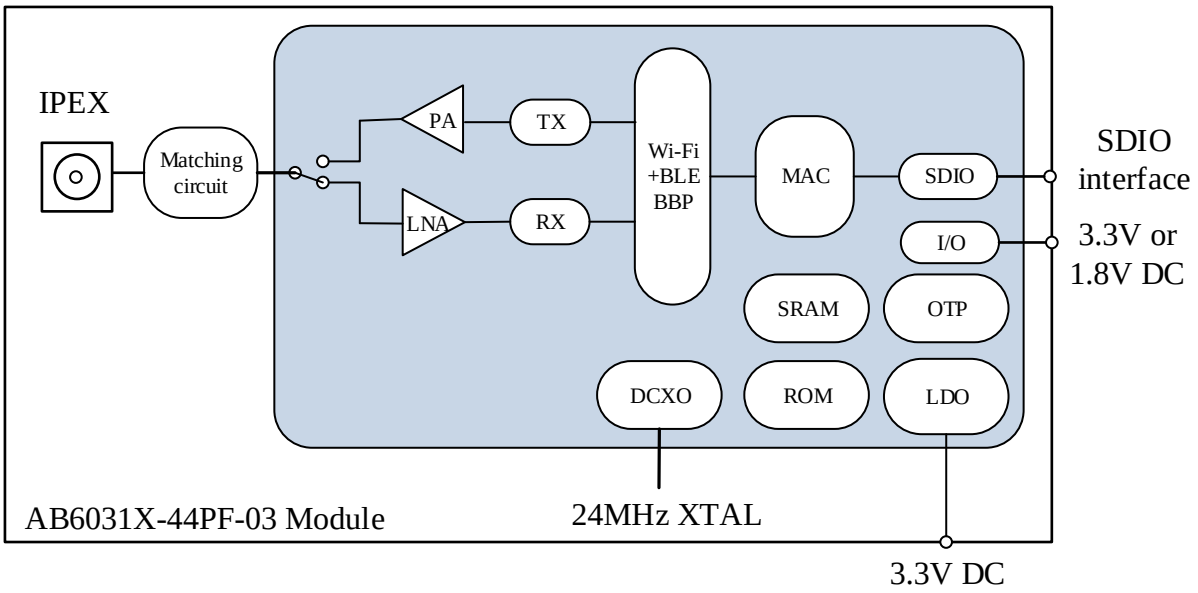
1 Overview

1.1 General description

AB6031X-44PF-03 module is a highly integrated 1T1R 802.11 b/g/n 20MHz and 40MHz bandwidth Wireless LAN (WLAN) device with SDIO 2.0 interface, based on AltoBeam's ATBM6031-X chip. AB6031X-44PF-03 also supports Bluetooth LE v5.0, Long range (Coded PHY), and Wi-Fi paring with BLE.

1.2 Block diagram



1.3 General specifications

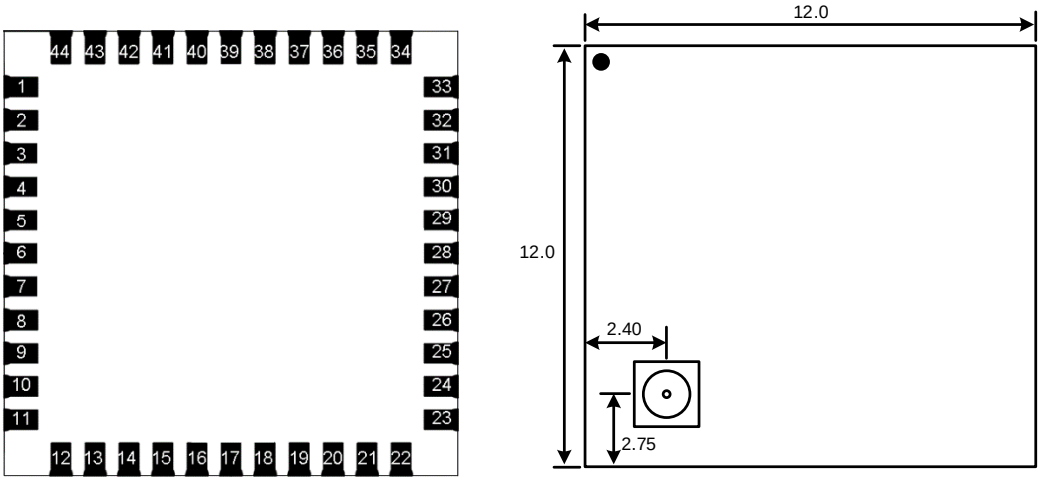
Main chipset		AltoBeam ATBM6031-X
Operating frequency		2.412 ~ 2.484 GHz
Wi-Fi	Standard	IEEE 802.11b/g/n 1T1R
	Modulation	802.11b: CCK (11, 5.5Mbps), QPSK (2Mbps), BPSK (1Mbps) 802.11 g/n: OFDM
	Bandwidth	802.11b/g/n 20MHz: ≤20MHz 802.11n 40MHz: ≤40MHz
	PHY data rates	802.11b: 1, 2, 5, 11Mbps 802.11g: 6, 9, 12, 18, 24, 36, 48, 54Mbps 802.11n: MCS0~7, ~ 150Mbps
	Receiver sensitivity	802.11b 1Mbps: -97.5dBm; 802.11b 11Mbps: -90.0dBm; 802.11g 6Mbps: -93.5dBm; 802.11g 54Mbps: -76.5dBm; 802.11n MCS7 HT20: -74.0dBm; 802.11n MCS7 HT40: -70.5dBm
Bluetooth	Standard	BLE v5.0
	Data rates	1Mbps, 2Mbps

	Output power	Max. 14dBm (class 1)
Host interface		SDIO 2.0
Operation range		More than 150 meters in open space
RF output power		802.11b: 17dBm; 802.11g: 15dBm; 802.11n HT20: 14dBm; 802.11n HT40: 13dBm
RF antenna		External antenna (2.4GHz 50Ohm Resistance)
Security		WPA, WPA2, WPA3 personal
Power consumption		3.3VDC 300mA @802.11b Max
Operating temperature		-40 ~ +85℃ ambient temperature
Storage temperature		-50~ +125℃ ambient temperature
Humidity		5% to 90% maximum (non-condensing)
Dimension		Typical L12.00*W12.00mm* H2.10mm (±0.2mm)

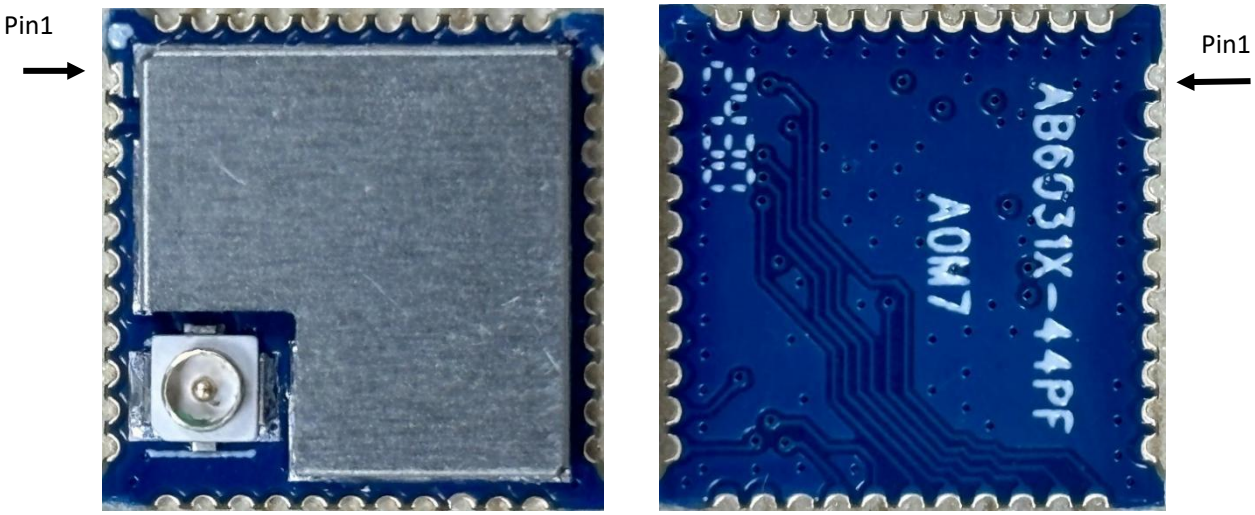
2 Mechanical Specification

2.1 Outline drawing

Typical module size is L12.00*W12.00mm* H2.10mm (±0.2mm).



<Top View>



AB6031X-44PF-03-03 module pictures

2.2 Pin definition

Pin Number	Pin Name	Pin Description
1	GND	Ground
2	ANT	External Antenna (2.4GHz 50ohm)
3	GND	Ground
4	NC	
5	NC	
6	NC	
7	NC	
8	NC	
9	VCC33	3.3V DC power supply
10	NC	
11	NC	Left it floating as default
12	RST	Hardware reset pin, low level is reset chip
13	WL_HOST_WAKE	WLAN wakes up host
14	SDIO_DAT2	SDIO data line 2
15	SDIO_DAT3	SDIO data line 3
16	SDIO_CMD	SDIO command line
17	SDIO_CLK	SDIO clock line
18	SDIO_DAT0	SDIO data line 0
19	SDIO_DAT1	SDIO data line 1
20	GND	Ground
21	NC	
22	VDDIO	1.8V or 3.3V I/O power supply Note1: Writing eFuse is only enable with 3.3V I/O power supply, so it is recommended to use 3.3V I/O power supply. Note 2: If using 1.8V I/O power supply, the high level of all I/Os is required to be 1.8V, including SDIO, RESET and other I/Os.
23	NC	UART_TX/I2C SDA/GPIO0 for debug and test
24	NC	UART_RX/I2C SCL/GPIO1 for debug and test
25	NC	
26	NC	
27	NC	
28	NC	
29	NC	
30	NC	
31	GND	Ground
32	NC	
33	GND	Ground
34	NC	
35	NC	
36	GND	Ground

Pin Number	Pin Name	Pin Description
37	NC	
38	NC	
39	NC	
40	NC	
41	NC	
42	NC	
43	NC	
44	NC	

3 Wi-Fi RF Performance

3.1 Typical RF output power

Mode	Data Rate	Unit	Spec	Channel 1	Channel 6	Channel 13
802.11b	1Mbps	dBm	<20	17	17	17
	11Mbps			17	17	17
802.11g	6Mbps			15	15	15
	54Mbps			15	15	15
802.11n	MCS7_HT20			14	14	14
	MCS7_HT40			13	13	13

Note: The above data is factory default value, user can increase or reduce output power by setting.

3.2 Typical EVM

Mode	Data Rate	Unit	Spec	Channel 1	Channel 6	Channel 13
802.11b	1Mbps	dB	<-10.5	-27	-27	-27
	11Mbps		<-10.5	-26	-26	-26
802.11g	6Mbps		<-5	-32	-32	-32
	54Mbps		<-25	-32	-32	-32
802.11n	MCS7_HT20		<-27	-32	-32	-32
	MCS7_HT40		<-27	-32	-32	-32

3.3 Center frequency tolerance

Mode	Data Rate	Unit	Spec	Channel 1	Channel 6	Channel 13
802.11b	11Mbps	ppm	<±20	±10.0	±10.0	±10.0
802.11g	54Mbps			±10.0	±10.0	±10.0
802.11n	MCS7			±10.0	±10.0	±10.0

3.4 Receiver sensitivity

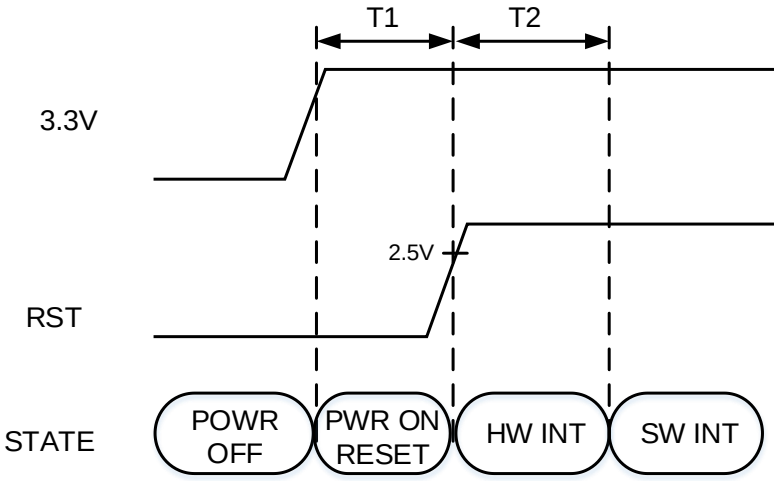
Mode	Data Rate	Unit	Spec	Channel 1	Channel 6	Channel 13
802.11b	1Mbps	dBm	<-90	-97.5	-97.5	-97.5
	11Mbps		<-76	-90.0	-90.0	-90.0
802.11g	6Mbps		<-82	-93.5	-93.5	-93.5
	54Mbps		<-65	-76.5	-76.5	-76.5
802.11n	MCS7_HT20		<-64	-74.0	-74.0	-74.0
	MCS7_HT40		<-61	-70.5	-70.5	-70.5

4 Bluetooth RF Performance

Item	Description	Min	Typ	Max	Unit
Frequency range		2402		2480	MHz
Output power			7	14	dBm
Receiving sensitivity	1Mbps		-97		dBm
	2Mbps		-94		dBm
	Coded-PHY, S=2		-99		dBm
	Coded-PHY, S=8		-103		dBm

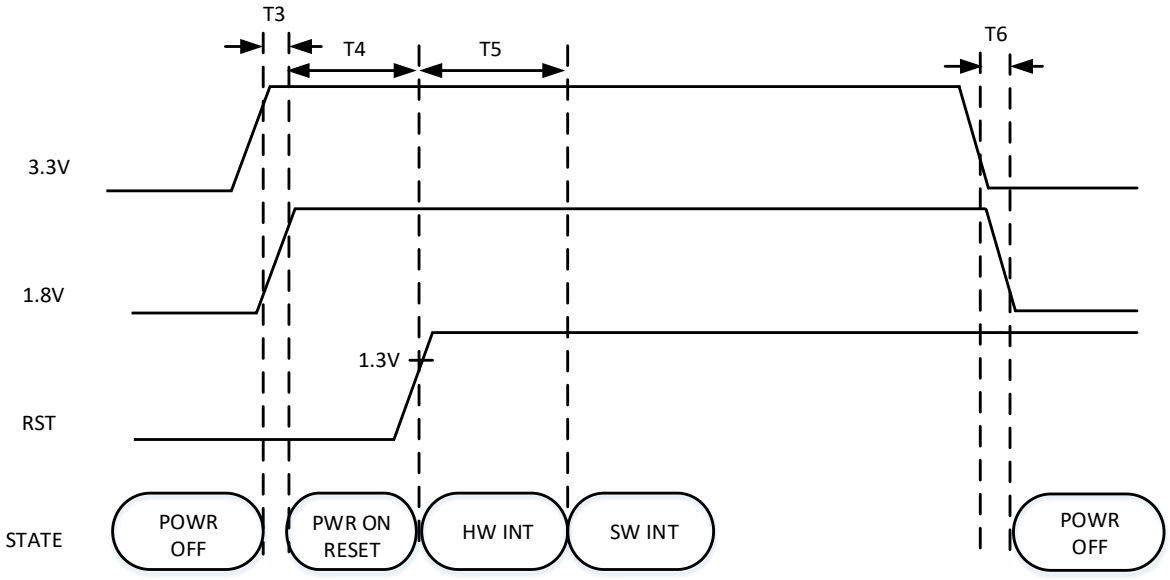
5 Timing Sequence Requirements

The recommended power on sequence is shown as below.



Parameters	Description	Min	Typ	Max	Unit
T1	The stable period of chip power on	30			ms
T2	Waiting for hardware wake up		10		ms

The recommended power on sequence of 3.3V and 1.8V dual power is shown below.



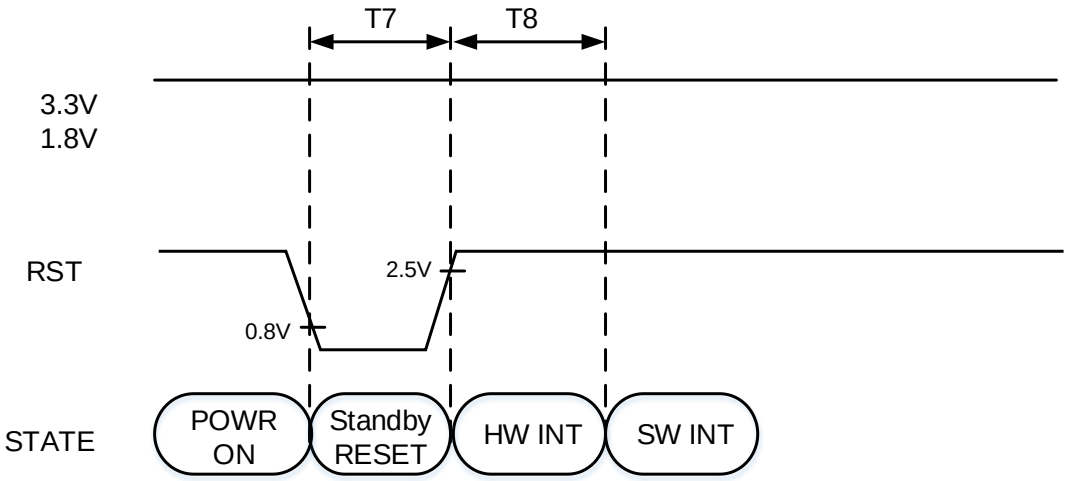
Parameter	Description	Min	Typ	Max	Unit
T3	The interval between 3.3V and 1.8V power on Note: 3.3V is recommended to be powered on before 1.8V or at the same time	0		100	ms

T4	Wait for internal POR taking effect	30			ms
T5	Wait for hardware initialization		10		ms
T6	The interval between 3.3V and 1.8V power off Note: 3.3V is recommended to be powered off before 1.8V or at the same time	0			ms

Note 1: Between 3.3V and 1.8V is powered on, high level input is forbidden on SDIO interface and other I/Os. High level input is permitted only after 1.8V is powered on.

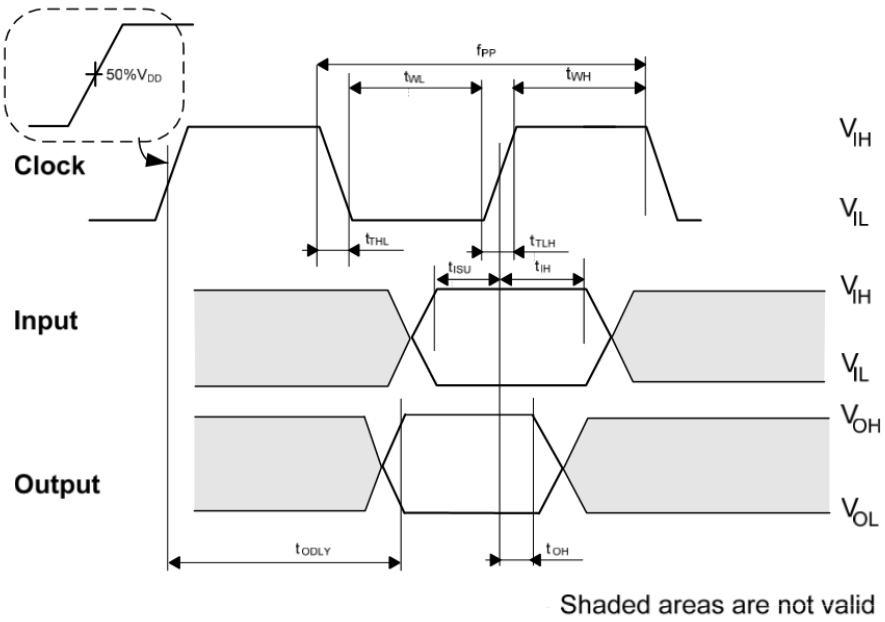
Note 2: When chip powers off, 3.3V should be powered off before 1.8V or at the same time. If either 3.3V or 1.8V is powered off, and then power on again, the chip cannot work normally.

The recommended standby/wake up sequence is shown as below.



Parameters	Description	Min	Typ	Max	Unit
T7	The effective period of hardware reset	1			ms
T8	Waiting for hardware wake up		10		ms

The SDIO interface timing requirement is shown as below.



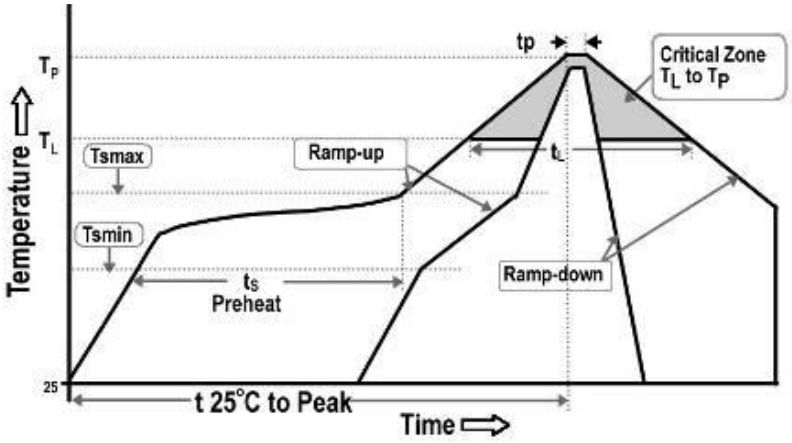
Symbol	Parameter	Min	Typical	Max	Unit
f_{pp}	SDIO clock frequency	0	-	50	MHz
t_{THL}	SDIO clock fall time			3	ns
t_{TLH}	SDIO clock rise time			3	ns
t_{WL}	SDIO clock low time	7			ns
t_{WH}	SDIO clock high time	7			ns
t_{ISU}	Input setup time	6			ns
t_{IH}	Input hold time	2			ns
t_{ODLY}	Output delay time			14	ns
t_{OH}	Output Hold time	2.5			ns

6 Solder Reflow Profile

Referred to IPC/JEDEC standard.

Peak Temperature: ≤260℃

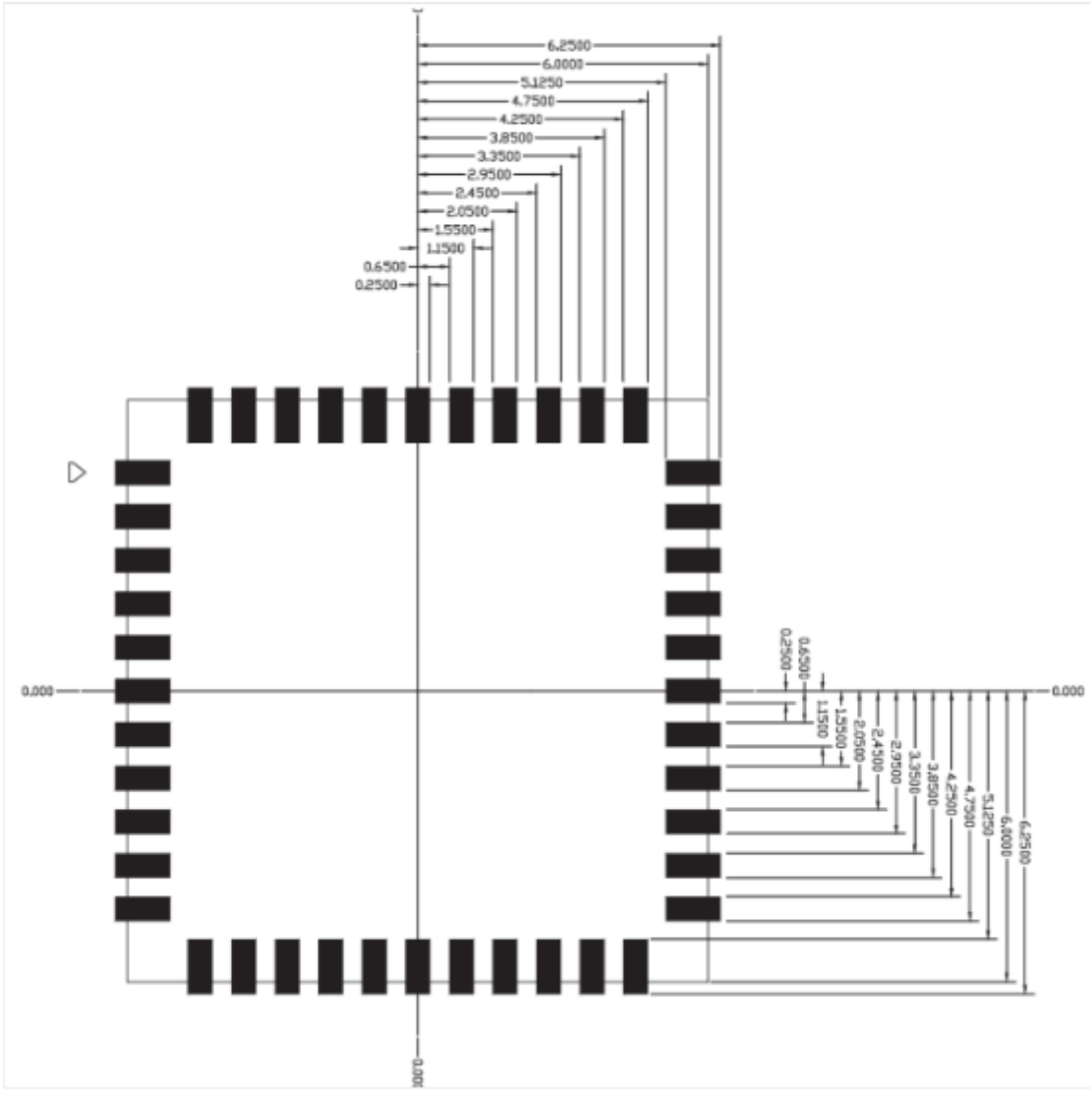
Number of Times: ≤2 times



Profile Feature		Specification*
Average ramp-up rate (t_{smax} to t_P)		2℃/second max.
Pre-heat	Minimal temperature (T_{smin})	150℃
	Maximal temperature (T_{smax})	200℃
	Time (t_s)	60~120 seconds
Time maintained above	Temperature (T_L)	217℃
	Time (t_L)	40~60 seconds
Peak/Classification temperature (T_P)		260℃
Time within 5℃ of actual peak temperature (t_P)		10~20 seconds
Ramp-down rate		2.5℃/second max.
Time 25℃ to peak temperature		8 minutes max.

7 Module Pad Dimensions (Unit: mm)

<Top View>



8 Packing Information

Packing: Tape and Reel

MPQ (Minimum Packing Quantity): 1,500pcs

9 Warning

1. Do not use this product under humid or hot conditions.

2. Do not use overloaded.

3.FCC regulatory compliance statement

§15.19 Statement

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.

§15.21 Information to user

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

#List of applicable FCC Rules:

47 CFR Part 15, Subpart C 15.203
47 CFR Part 15, Subpart C 15.205
47 CFR Part 15, Subpart C 15.207
47 CFR Part 15, Subpart C 15.209
47 CFR Part 15, Subpart C 15.247
47 CFR Part 2.1091

#Summarize the specific operational use conditions

This module can be used in IOT devices, the input voltage to the module is nominally 3.3V.

#Limited module procedures

This module is not a limited module.

#Trace antenna designs

The antenna is not a trace antenna.

#RF Exposure compliance statement

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

Antenna Change Notice to Host manufacturer

If you desire to increase antenna gain and either change antenna type or use same antenna type certified, a Class II permissive change application is required to be filed by us, or you (host manufacturer) can take responsibility through the change in FCC ID (new application) procedure followed by a Class II permissive change application.

#Labelling Instruction for Host Product Integrator

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: 2BAVS-AB6031X44PF03" any similar wording that expresses the same meaning may be used.

§ 15.19 Labelling requirements shall be complied on end user device.
Labelling rules for special device, please refer to *§2.925, § 15.19 (a)(5)* and relevant KDB publications. For E-label, please refer to *§2.935*.

#Information on test modes and additional testing requirements

The OEM integrator is responsible for ensuring that the end-user has no manual instruction to remove or install module.
The module is limited to installation in mobile application, a separate approval is required for all other operating configurations, including portable configurations with respect to §2.1093 and difference antenna configurations.

Test software access to different test modes: Bluetooth test 3 (V2.6)
Testing item, Frequencies, Transmit Power, Modulation Type can be selected on the test script instructions.

#FCC other Parts, Part 15B Compliance Requirements for Host product manufacturer

This modular transmitter is only FCC authorized for the specific rule parts listed on our grant, 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 in any case shall ensure host product which is installed and operating with the module is in compliant with Part 15B requirements.
Please note that For a Class B or Class A digital device or peripheral, the instructions furnished the user manual of the end-user product shall include statement set out in *§15.105 Information to the user* or such similar statement and place it in a prominent location in the text of host product manual.
Original texts as following:
For Class 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.

For Class A

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

ISED compliance statement

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.

ISED Radiation Exposure statement

This equipment complies with IC RSS-102 radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20 cm between the radiator and your body.
Cet équipement est conforme aux limites d'exposition aux radiations IC CNR-102 établies pour un environnement non contrôlé. Cet équipement doit être installé et utilisé avec une distance minimale de 20 cm entre le radiateur et votre corps. Cet émetteur ne doit pas être colocalisé ou fonctionner en conjonction avec une autre antenne ou un autre émetteur.

Please notice that if the IC 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 IC: 31395-AB6031X44PF" any similar wording that expresses the same meaning may be used.

L'étiquette d'homologation d'un module d'Innovation, Sciences et Développement économique Canada devra être posée sur le produit hôte à un endroit bien en vue, en tout temps. En l'absence d'étiquette, le produit hôte doit porter une étiquette sur laquelle figure le numéro d'homologation du module d'Innovation, Sciences et Développement économique Canada, précédé du mot « contient », ou d'une formulation similaire allant dans le même sens et qui va comme suit :
Contient IC :31395-AB6031X44PF est le numéro d'homologation du module

This radio transmitter [IC:31395-AB6031X44PF] has been approved by Innovation, Science and Economic Development Canada 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.
a list of all antenna types

Dipole Antenna	2.82 dBi
Dipole Antenna	2.82 dBi, 50Ω