i410e-s_Datasheet

July 24, 2019

Version 3.0

VERSION HISTORY

REVISION	AMENDMENT	DATE	AUTHOR
1.0	Initial version	2014-02-19	Wan Zhifu Li Li
1.1	Update Table 6 PIN 25&26 descriptions	2014-05-08	Li Li
1.2	Add Tolerance	2015-04-03	Gong Yong
1.3	Add Package information	2015-07-03	Daming Tang
1.4	Update pin description	2016-03-08	Xiangyang Sun
1.5	Update Bluetooth 4.1 spec	2016-03-23	Rechael
1.6	Change contact info	2016-08-11	Li Li
1.7	Add BQB,Telec certificate	2016-11-24	Yin Tian
1.8	Add Appendix	2016-12-27	Tracy
1.9	Add MOQ	2017-02-28	Tracy
2.0	Modify the certificate	2017-03-21	Tracy
2.1	Add net weight	2017-08-24	mojie
2.2	Update Bluetooth 4.0 spec	2017-12-16	wuting
2.3	Update Bluetooth 4.1 spec Add support for encryption mode.	2018-04-24	Joe
2.4	Update pin 6, 8, 9,10,11,17,21 descriptions	2018-06-29	Joe
2.5	Review	2018-09-20	Joe
2.6	Update block diagram	2019-01-21	Wu Kaiyue
2.7	Update format	2019-03-27	Wu kaiyue
2.8	For SRRC	2019-05-15	Wu Kaiyue
2.9	For FCC Add FCC statements	2019-06-13	Wu Kaiyue
3.0	Update module picture Update Bluetooth specification	2019-07-24	Wu Kaiyue

Contents

i410e-s Datasheet

DESCRIPTION

i410e-s is a Bluetooth 4.1 single-mode module. It provides a Bluetooth Low Energy fully compliant system for data communication with BRT BlueLet stack. It allows your target devices to send and receive data via Bluetooth 4.1 without connecting a serial cable to your computer.

By default, i410e-s module is equipped with powerful and easy-to-use BlueLet firmware. It's easy-to-use and completely encapsulated. BlueLet enables users to access Bluetooth functionality with simple ASCII commands delivered to the module over serial interface - it's just like a Bluetooth modem.

Therefore, BRT i410e-s provides an ideal solution for developers who want to integrate Bluetooth wireless technology into their design.

FEATURES

- Fully Qualified Bluetooth system v4.1
- Low energy
- Support Master or Slave roles
- Integrated layout antenna
- Support AES-CCS and AES Encryption
- Industrial temperature range from -40℃ to +85℃
- RoHS Compliant

APPLICATIONS

- Cable replacement
- Sports and fitness
- Healthcare
- Home entertainment
- Office and mobile accessories
- Automotive
- Commercial
- Watches
- Human interface devices

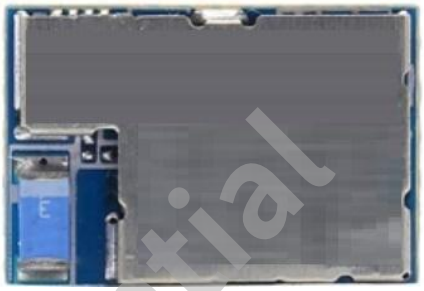


Figure 1: i410e-s

1. Block Diagram

i410e-s's block diagram is illustrated in Figure2 below.

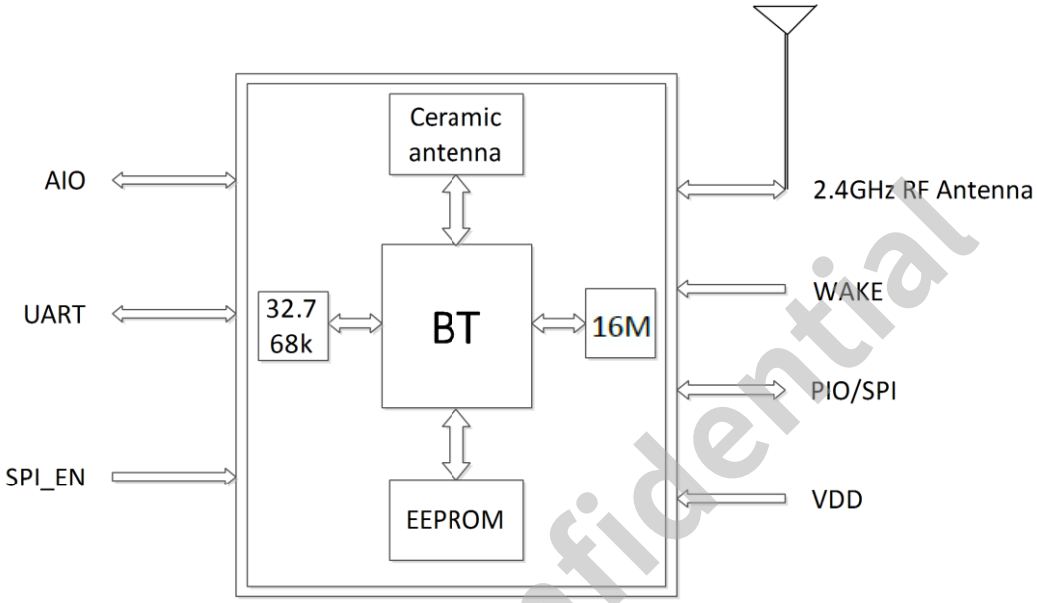


Figure 2: i410e-s Block Diagram

1.1. Crystal

The crystal oscillates include 16MHz and 32.768 KHz. 16MHz is external reference clock source. 32.768 KHz is used during deep sleep and in other low-power modes.

1.2. EEPROM

EEPROM is used for storing the Bluetooth protocol stack, profile and applications.

1.3. Low Pass Filter

The filter is a band pass filter (ISM band).

1.4. Antenna

Default ceramic antenna. If an external antenna is used, the ceramic antenna must be removed

1.5. Synchronous Serial Interface

This is a synchronous serial port interface (SPI) for interfacing with other digital devices. The SPI port can be used for system debugging. It can also be used for programming the Flash memory.

1.6. UART

This is a standard Universal Asynchronous Receiver Transmitter (UART) interface for communicating with other serial devices.

1.7. Programmable I/O

i410e-s has five digital programmable I/O terminals controlled by firmware running on the device.

1.8. AIO

i410e-s has three general-purpose analogue interface pins, AIO[2:0].

1.9. WAKE

Wake up input. It wakes i410e-s from sleep mode.

2. Module Characteristics

2.1. General Characteristics

Table 1：General Characteristics

Product	**BlueLet-series Bluetooth Module**

model	i410e-s
Bluetooth Specification	**Bluetooth V4.1 , Class II**
Frequency Band	2.4~2.48GHz
Modulation Method	GFSK
RF Input Impedance	50 ohms
Crystal OSC	16MHz
Interface	UART/SPI/PIO/AIO
Operation Range	10 m
Sensitivity	-89dBm@0.1%BER
Transmit power	0.5dBm Typ.
Connectivity	Single point link
Antenna type	Ceramic Antenna
Dimension	
Dimension	9mm×13.3mm×1.75mm(Tolerance:±0.25mm)
Power	
Operating voltage	1.8 -3.6V DC
Operation Environment	
Temperature	-40℃ to +85℃
MSL	3

3. Pin Description

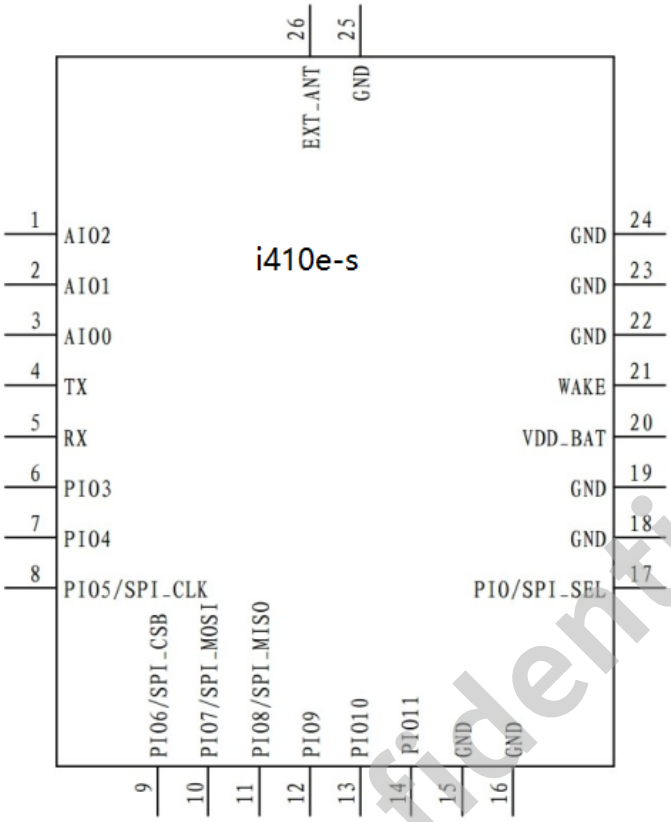


Figure 3: i410e-s PIN diagram

Table 2：PIN Description

PIN NO.	Name	Type	Function
1	AIO2	Bidirectional analogue	Analogue programmable I/O line. General-purpose analogue interface pins.
2	AIO1	Bidirectional analogue	Analogue programmable I/O line. General-purpose analogue interface pins.
3	AIO0	Bidirectional analogue	Analogue programmable I/O line. General-purpose analogue interface pins.
4	TX	CMOS Output	CMOS output with weak internal pull-up. TXD is used to implement UART data transfer from i410e-s to another device.
5	RX	CMOS Input	CMOS input with weak internal pull-down. RXD is used to implement UART data transfer from another device to i410e-s.
6	PIO3	Bidirectional with programmable strength internal	Reset if low,Pull low for minimum 50ms to cause a reset

		pull-up/down	
7	PIO4	Bidirectional with programmable strength internal pull-up/down	Programmable I/O line
8	PIO5 / SPI_CLK	Bidirectional with programmable strength internal pull-up/down	Programmable I/O line or debug SPI CLK selected by SPI_ SEL #. CMOS input for the SPI clock signal with weak internal pull-down. PIO5 and PIO6 are outputs, used to inform the mode group status. Note：The corresponding states of PIO [5:6] are: [00] idle state, [01] broadcast state, [10] successful connection, data cache area is not full, [11] connection state, and data cache area is full.
9	PIO6 / SPI_CSB	Bidirectional with programmable strength internal pull-up/down	Programmable I/O line or debug SPI CSB selected by SPI_ SEL #. CMOS input with weak internal pull-up. Active low chip select for SPI PIO5 and PIO6 are outputs, used to inform the mode group status. Note： The same as the pio5
10	PIO7 / SPI_MOSI	Bidirectional with programmable strength internal pull-up/down	Host wake up:Signal from the module to the host,output high level for 50ms ; Debug SPI MOSI selected by SPI_ SEL #.
11	PIO8 / SPI_MISO	Bidirectional with programmable strength internal pull-up/down	Bluetooth disconnect（Active low）: Pull down more than 1s and less than 5s： 1. When the module is connected, it could disconnect; 2. When the module is idle, it starts advertising. Pulling down more than 5s： 1. When the module is connected, it could disconnect and clear the pairing information; 2. When the module is idle, it could clear the pairing information and starts advertising. Debug SPI MISO selected by SPI_ SEL #.

			The above version applies to I41Xe.STD.0.20171117.1 and previous versions.The following version refers to the following： Pull down more than 20ms and less than 2s： 1. When the module is connected, it could disconnect; 2. When the module is idle, it starts advertising. Pulling down more than 2s： 1. When the module is connected, it could disconnect and clear the pairing information; 2. When the module is idle, it could clear the pairing information and starts advertising. Debug SPI MISO selected by SPI_SEL#.
12	PIO9	Bidirectional with programmable strength internal pull-up/down	Programmable I/O line
13	PIO10	Bidirectional with programmable strength internal pull-up/down	Programmable I/O line
14	PIO11	Bidirectional with programmable strength internal pull-up/down	Programmable I/O line
15	GND	GND	Ground
16	GND	GND	Ground
17	PIO0/SPI_SEL	Input with strong internal pull-down	This pin foot pulls high to SPI mode, pulled low for programmable I/O port mode. i410e-s internal pull-down
18	GND	GND	Ground
19	GND	GND	Ground
20	VDD_BAT	POWER	+3.3V supply voltage connection. Battery input and regulator enables (active high).
21	WAKE	WAKE	Bluetooth device wake-up: Signal from the host to the module, pull high to sleep mode, pull low for wake up mode. NC if not used.
22	GND	GND	Ground

23	GND	GND	Ground
24	GND	GND	Ground
25	GND	GND	Ground
26	EXT_ANT	External antenna	If use the external antenna interface, the on-board antenna needs to be removed.

4. Electrical Characteristics

4.1. Absolute Maximum Ratings

Table 3： Absolute Maximum Ratings

Rating	Min	Max	Unit
Storage temperature	-40	85	℃
Battery (VDD_BAT)operation	1.8	3.6	V
I/O supply voltage	-0.4	3.6	V
Other terminal voltages	VSS-0.4	VDD+0.4	V

4.2. Recommended Operating Conditions

Table 4：Recommended Operating Conditions

-	Min	Typ	Max	Unit
Operating temperature	-40	20	85	℃
Battery(VDD_BAT) Operation	1.8	-	3.6	V
I/O supply voltage(VDD_PADS)	1.2	-	3.6	V

4.3. Input/output Terminal Characteristics

4.3.1. Switch-mode Regulator

Table 5：Switch-mode Regulator

-	Min	Typ.	Max	Unit
Switch-mode Regulator				
input voltage	1.8	-	3.6	V
Output voltage	0.65	1.35	1.35	V

Temperature coefficient	-200	-	200	ppm/℃
Normal Operation				
Output noise, Frequency range 100Hz to 100KHz	-	-	0.4	mV rms
Setting time, setting to within 10% of final value	-	-	30	μs
Output current(I_{max})	-	-	50	mA
Quiescent current(excluding load, I_{load}<1mA)	-	-	20	μA
Ultra Low-power Mode				
Output current(I_{max})	-	-	100	μA
Quiescend current	-	-	1	μA

4.3.2. Digital Terminals

Table 6：Digital Terminals

-	Min	Typ.	Max	Unit
Input Voltage Levels				
V_{IL} input Logic level low	-0.4	-	0.4	V
V_{IH} input logic level high	0.7*VDD	-	VDD+0.4	V
T_r/T_f	-	-	25	ns
Output Voltage Levels				
V_{OL} output logic level low, I_{OL} = 4.0mA	-	-	0.4	V
V_{OH} output logic level high, I_{OH}=-4.0mA	0.75*VDD	-	-	V
T_f/T_f	-	-	5	ns
Input and Tristate Currents				
With strong pull-up	-150	-40	-10	μA
I^2C with strong pull-up	-250	-	-	μA
With strong pull-down	10	40	150	μA
With weak pull-up	-5.0	-1.0	-0.33	μA
With weak pull-down	0.33	1.0	5.0	μA
C_I input capacitance	1.0	-	5.0	pF

4.3.3. AIO

Table 7：AIO

Input Voltage Levels	Min	Typ.	Max	Unit
Input voltage	0	-	1.3	V

4.3.4. ESD Protection

Table 8：ESD Handling Maximum Ratings

Condition	Max	Unit
Human body model contact discharge per JEDEC EIA/JESD22-A114	2	2000V(all pins)
Machine model contact Discharge per JEDEC EIA/JESD22-A115	200V	200V(all pings)
Charged Device Model Contact Discharge per JEDEC EIA/JESD22-C101	III	500V(all pins)

4.4. Current Consumption

Table 9：Current Consumption

Operation Mode	Description	Average
Dormant	All functions are shutdown. To wake up toggle the wake pin.	5~6uA
Deep Sleep	VDD_PADS=ON, REFCLK=OFF, SLEEPCLK=ON, VDD_BAT=ON, RAM=ON, digital circuits=ON, SMPs=ON(low-power mode), 1ms wake-up time	7~8μA
Connected Standby	-	~1.2mA
RX/TX active	-	~ 4mA

4.5. RF Characteristics

Table 10：RF Characteristics for Bluetooth

Items	contents			
Bluetooth specification	Version 4.1			
Channel frequency	2402 to 2480 MHz			
Current Consumption	Min.	Typ.	Max.	unit
(a) DH5 Packet 50% Rx/Tx slot duty cycle	-	1.35	4	mA
(b) 2DH5 Packet 50% Rx/Tx slot duty cycle	-	-	-	mA
(c) 3DH5 Packet 50% Rx/Tx slot duty cycle	-	-	-	mA
Transmitter	Min.	Typ.	Max.	unit

Output Power	-	0.5	2	dBm
Frequency range	2400	-	2483.5	MHz
Receiver	Min.	Typ.	Max.	unit
Sensitivity (BER<0.1%)	-	-89	-90	dBm

5. Physical Interfaces

5.1. UART Interface

i410e-s Universal Asynchronous Receiver Transmitter (UART) interface provides a simple mechanism for communicating with other serial devices using the RS232 standard. The UART interface of i410e-s uses voltage levels of 0 to VDD and thus external transceiver IC is required to meet the voltage level specifications of UART.

In order to communicate with the UART at its maximum data rate using a standard PC, an accelerated serial port adapter card is required for the PC.

Table 11：Possible UART Settings

Parameters		**Possible Values**
Baud rate	Minimum	1200 baud (≤2%Error)
		9600 baud (≤1%Error)
	Maximum	2Mbaud (≤1%Error)
Flow control		RTS/CTS, none
Parity		None, Odd, Even
Number of stop bits		1 or 2
Bits per channel		8

NOTE: The maximum baud rate is 9600bps during deep sleep.

5.2. SPI Interface

The synchronous serial port interface (SPI) is for interfacing with other digital devices. The SPI port can be used for system debugging. SPI interface is connected using the MOSI, MISO, CSB and CLK pins. It uses a 16-bit data and 16-bit address programming and debug interface. Transaction occurs when the internal processor is running or is stopped.

The module operates as a slave and receives commands on MOSI and outputs data on MISO. Table12 shows the instruction cycle for a SPI transaction.

Table 12：Instruction Cycle for a SPI Transaction

Step	Operation	Description
1	Reset the SPI interface	Hold CSB high for 2 CLK cycles
2	Write the command word	Take CSB low and clock in the 8-bit command
3	Write the address	Clock in the 16-bit address word
4	Write or read data words	Clock in or out 16-bit data words
5	Termination	Take CSB high

With the exception of reset, CSB must be held low during the transaction. Data on MOSI is clocked on the rising edge of the clock line CLK. When reading, i410e-s replies to the master on MISO with the data changing on the falling edge of the CLK. The master provides the clock on CLK. The transaction is terminated by taking CSB high.

The auto increment operation on the i410e-s cuts down on the overhead of sending a command word and the address of a register for each read or write, especially when large amounts of data are to be transferred. The auto increment offers increased data transfer efficiency on the i410e-s. To invoke auto increment, CSB is kept low, which auto increments the address, while providing an extra 16 clock cycles for each extra word written or read.

6. i410e-s physical Dimensions

6.1. Dimension

Dimension is 9mm (L) *13.3mm (W)* 1.75mm (H). (Tolerance:±0.25mm)

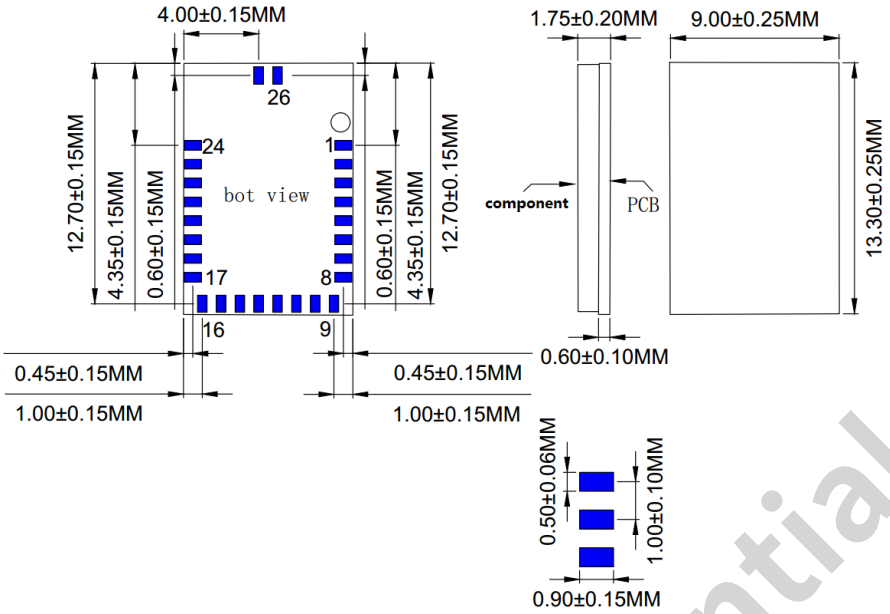


Figure 4: i410e-s Footprint

6.2. Recommended PCB layout Footprint

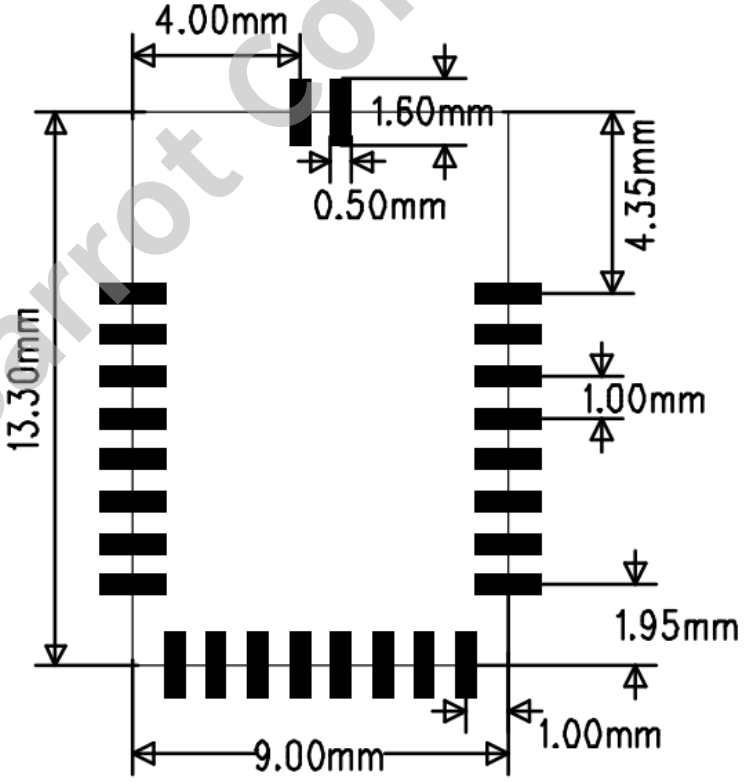


Figure 5: PCB layout Footprint

7. Package

7.1. Net weight

The module net weight: 0.42±0.05g

7.2. Package

Tray package: 150pcs (10*15) per tray.

Tray package size: 25.3cm (L) x20.5cm (W)

Each cell size: 13.5cm (L) x10mm (W)

8. Certification

8.1. BQB


QDL Bluetooth® Qualified Design Listing

The Bluetooth SIG Hereby Recognizes

IVT International Validation & Testing Corporation
Member Company

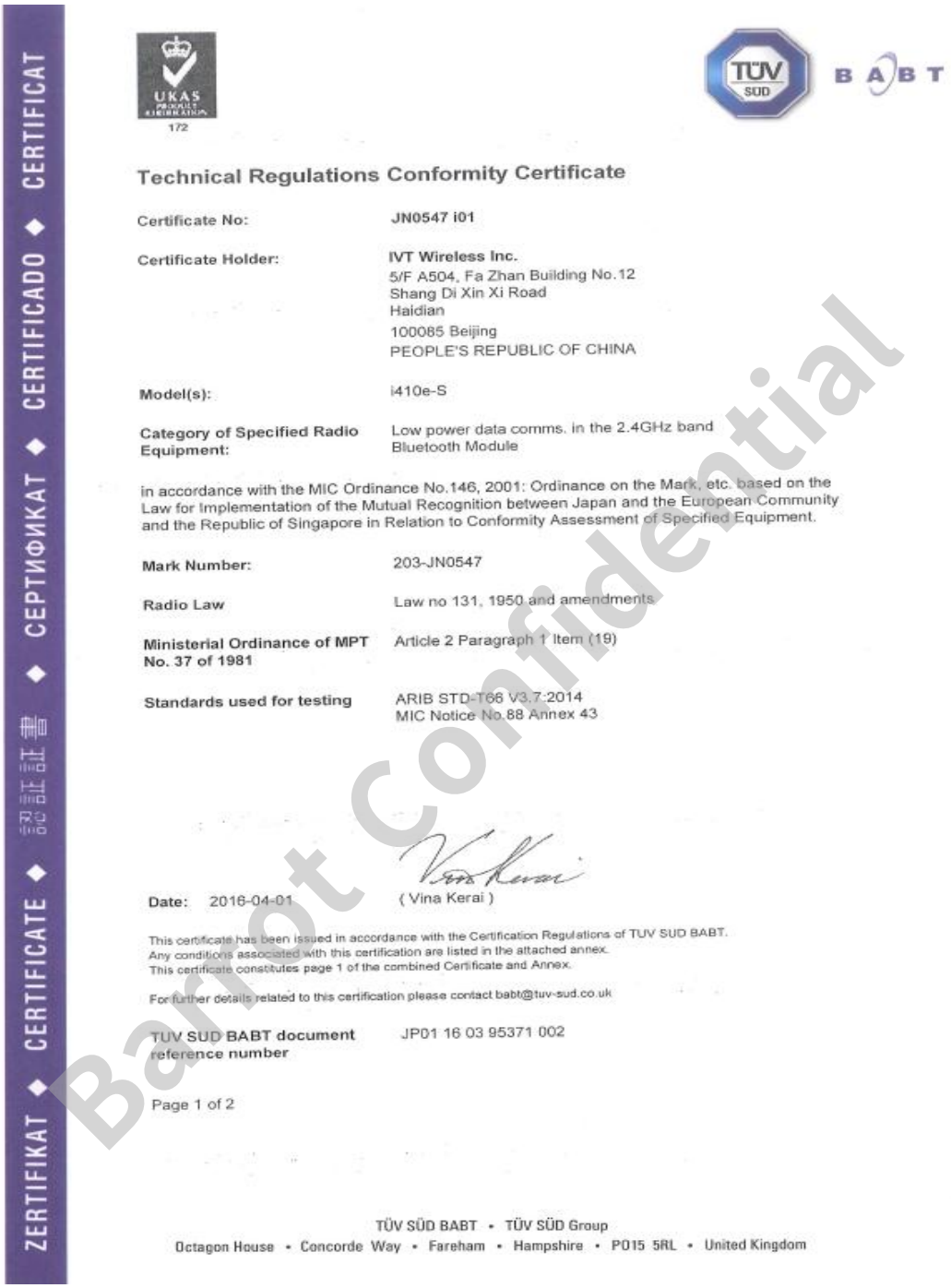
Bluetooth 4.0 single-mode Module
Qualified Design Name

Declaration ID: B020729
Qualified Design ID: 45763
Specification Name: 4.0
Product Type: End Product
Model Number: i410e,i410e-S
Listing Date: 15 April 2013
Assessment Date: 15 April 2013
Hardware Version Number: 1.0
Software Version Number: 4.0

This certificate acknowledges the *Bluetooth*® Specifications declared by the member were achieved in accordance with the *Bluetooth* Qualification Process as specified within the *Bluetooth* Specifications and as required within the current PRD

Bluetooth® SPECIAL INTEREST GROUP

8.2. TELEC



ZERTIFIKAT ◆ CERTIFICATE ◆ 認証書 ◆ СЕРТИФИКАТ ◆ CERTIFICADO ◆ CERTIFICAT

UKAS PRODUCT CERTIFICATION 172

TÜV SÜD BABT

Technical Regulations Conformity Certificate

Certificate No:	**JN0547 i01**
Certificate Holder:	**IVT Wireless Inc.** 5/F A504, Fa Zhan Building No.12 Shang Di Xin Xi Road Haidian 100085 Beijing PEOPLE'S REPUBLIC OF CHINA
Model(s):	i410e-S
Category of Specified Radio Equipment:	Low power data comms. in the 2.4GHz band Bluetooth Module

in accordance with the MIC Ordinance No.146, 2001: Ordinance on the Mark, etc. based on the Law for Implementation of the Mutual Recognition between Japan and the European Community and the Republic of Singapore in Relation to Conformity Assessment of Specified Equipment.

Mark Number:	203-JN0547
Radio Law	Law no 131, 1950 and amendments
Ministerial Ordinance of MPT No. 37 of 1981	Article 2 Paragraph 1 Item (19)
Standards used for testing	ARIB STD-T66 V3.7.2014 MIC Notice No.88 Annex 43

Date: 2016-04-01 (Vina Kerai)

This certificate has been issued in accordance with the Certification Regulations of TUV SUD BABT.
Any conditions associated with this certification are listed in the attached annex.
This certificate constitutes page 1 of the combined Certificate and Annex.

For further details related to this certification please contact babt@tuv-sud.co.uk

TUV SUD BABT document reference number JP01 16 03 95371 002

Page 1 of 2

TÜV SÜD BABT • TÜV SÜD Group
Octagon House • Concorde Way • Fareham • Hampshire • PO15 5RL • United Kingdom

8.3. For FCC

FCC ID: 2AOXV-I410E-S

While maintain a distance>20cm:

Federal Communication Commission (FCC) Radiation Exposure Statement

When using the product, maintain a distance of 20cm from the body to ensure compliance with RF exposure requirements.

FCC statements:

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.

NOTE: The manufacturer is not responsible for any radio or TV interference caused by unauthorized modifications or changes to this equipment. Such modifications or changes could void the user's authority to operate the equipment.

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.

8.4. Certificate of Broadcasting and Communication Equipments

9851-D074-394A-342F

방송통신기자재등의 적합인증서

Certificate of Broadcasting and Communication Equipments

상호 또는 성명 *Trade Name or Applicant*	(주) 두성기술
기자재 명칭 *Equipment Name*	특정소출력 무선기기(무선데이터통신시스템용 무선기기)
기본모델명 *Basic Model Number*	i410e-s
파생모델명 *Series Model Number*	
인증번호 *Certification No.*	MSIP-CRM-DSD-i410e-s
제조자/제조국가 *Manufacturer/ Country of Origin*	(주) 두성기술 / 한국
인증연월일 *Date of Certification*	2015-06-18
기타 *Others*	

위 기자재는 「전파법」 제58조의2 제2항에 따라 인증되었음을 증명합니다.

It is verified that foregoing equipment has been certificated under the Clause 2, Article 58-2 of Radio Waves Act.

2015년(Year) 06월(Month) 18일(Date)

국립전파연구원장 국립전파연구원장인

Director General of National Radio Research Agency

※ 인증 받은 방송통신기자재는 반드시 "적합성평가표시" 을 부착하여 유통하여야 합니다.
위반시 시정요구 처분 및 인증이 취소될 수 있습니다.

9. SRRC

This Datasheet is for SRRC certification.

Equipment label (this part of the label will be reflected on the outer packaging of the product when shipped)

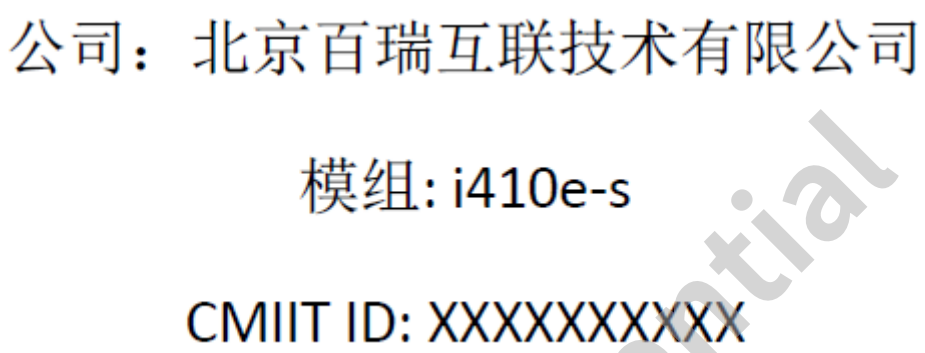


Figure 6: label

10. Company Profile

Barrot Technology – Barrot is a world leading one-stop chipset level solution provider who offers wireless connectivity and audio intelligent hardware solutions featuring with own IPs. The company is an associated member of The Bluetooth SIG, and it is the only one who contributes to Bluetooth specification definition in Greater China. Barrot owns three high-tech IPs: Bluetooth RF, Bluetooth stack and Acoustic algorithms, so Barrot offers most integrated, robust, reliable, and easy-to-use wireless turn-key solutions for IOT, Automotive and Wireless audio applications.

Barrot devotes itself to being the most reliable short distance wireless technologies' solution provider in the world.

11. Contact Information

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Support: support@barrot.com.cn
Web site: www.barrot.com.cn

12. Copyright

Appendix

1. Storage Requirements

1.1 Temperature: 22~28℃;

1.2 Humidity: <70%（RH）;

Vacuum packed and sealed in good condition to ensure 12 months of welding.

2. Humidity Sensitive Characteristic

2.1 MSL: 3 level

2.2 Once opened, SMT within 168 hours in the condition of temperature: 22~28℃ and humidity<60%（RH）. Once production line stops, modules should either be stored in the drying box or be vacuum packed. If it fails to meet above storage conditions, *Bluetooth* modules need drying. Drying parameters refer to Table 2-1.

2.3 Handling, storage, and processing should follow IPC/JEDECJ-STD-033

Table 2-1： Mounted or un-mounted SMD package drying reference condition

（User drying：Shop life starts after drying，Time=0）

Drying under 125℃		Drying under 90℃，≤5%RH		Drying under 40℃，≤5%RH	
Over floor life >72 hours	Over floor life≤72 hours	Over floor life >72 hours	Over floor life≤72 hours	Over floor life >72 hours	Over floor life≤72 hours
9 hours	7 hours	33 hours	23 hours	13 days	9 days

3. PCB Design Instruction

3.1 PCB Pad Surface Treatment

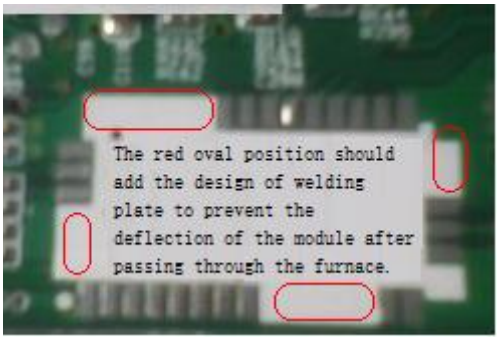
ENIG（Chemistry Ni/Au）、OSP are recommended for PCB surface treatment. ENIG（Chemistry Ni/Au）is preferred.

3.2 PCB Pad Design

3.2.1 In order to ensure high production efficiency and high reliability of solder joints, PCB pad design refers to recommended PCB pad size in the corresponding product specification.

3.2.2 Even only part of PINs are used, it is recommended to do full pad design, symmetric pad design, or asymmetric pad design(refer to Figure 3-1). During reflow, if the pad paste melts, the module is vulnerable to non-balanced force pull. It may lead to PIN short circuit if the module deflects under the action of torque.

Figure 3-1:Asymmetric Pad Design



3.3.3 Layout Requirements

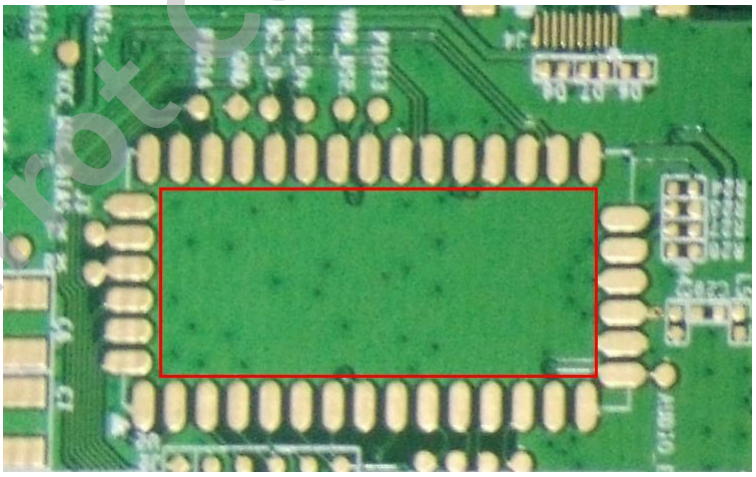
a. For PCB double sided layout, it is recommended to process on 2nd side.

b. The layout of other elements should be avoided on the outermost end 1mm area of module pad. In order to increase repair space, other elements layouts should be as far away from the module as possible. The minimum distance between the module pad and PCB board edge is 1.5mm.

3.3.4 Compatible Design Considerations

To prevent any hidden risks, module placement area（See the red rectangle in Figure 3-2 below） shouldn't include any pad design which intends to be compatible with other elements.

Figure 3-2 :Module Placement Area Example



4. SMT Notes

4.1 All *Bluetooth* modules of our company are lead free. It is suggested to use lead free process technique when SMT processing to prevent the reduction of the reliability of module welding technique which may be caused by the usage of lead production process technique.

Note：the lead BGA solder ball has low melting point（183℃），the lead-free BGA solder ball has high melting point（217℃-221℃）。When the temperature rises to 183

℃, the solder paste is melting; When the temperature rises to 220℃, lead free BGA solder ball starts to melt, and it is in the state of coexistence of solid and liquid. If lead technology is used and the furnace starts cooling, the original welding surface structure of BGA elements is damaged, and a new alloyed layer of the welding surface cannot be formed. This may lead to lead free BGA solder joint failure during reflow, which results in pseudo solder joints and other reliability issues in further.

4.2 SMT stencil Design

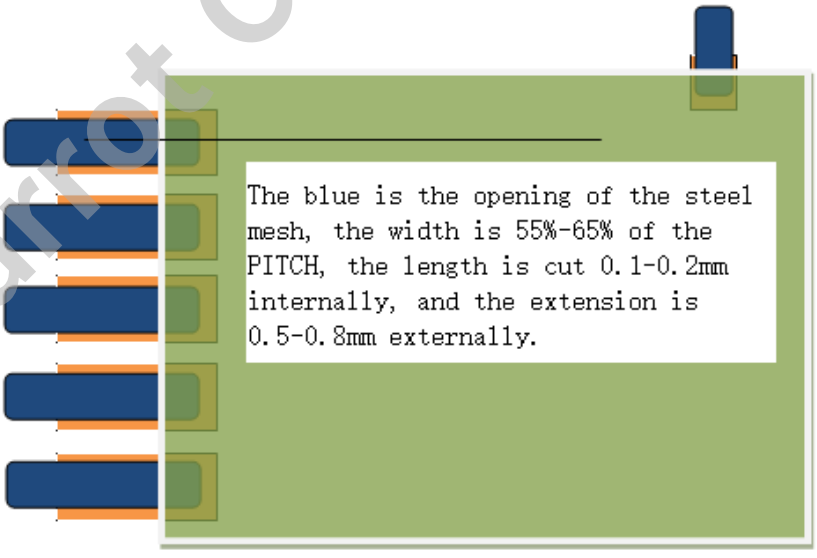
Ladder stencil is recommended. Stencil opening design requirements are as follows:

4.2.1 The module PIN foot area is suggested to be thickened to 0.18-0.25mm; this thickened area should be kept at least 1mm spacing with other elements;

4.2.2 Opening width: 55%-65% of PCB PIN foot pad Pitch (centre-to-centre spacing)

(Since the actual width of the motherboard pad is not ensured, the opening width is determined by pitch.)

4.2.3 Opening length: based on PCB PIN foot, cutting 0.1-0.2mm towards inside, and extending 0.5-0.8mm towards outside. Outer extension pads maintain at least 0.25mm safety spacing with other elements. Cutting module pad opening if not enough space is left. Opening should be round corners.



4.3 Reflow Profile

4.3.1When making the furnace temperature curve，it should add temperature measuring circuit under *Bluetooth* module's BGA to measure its real time temperature.

Recommended temperature parameters：

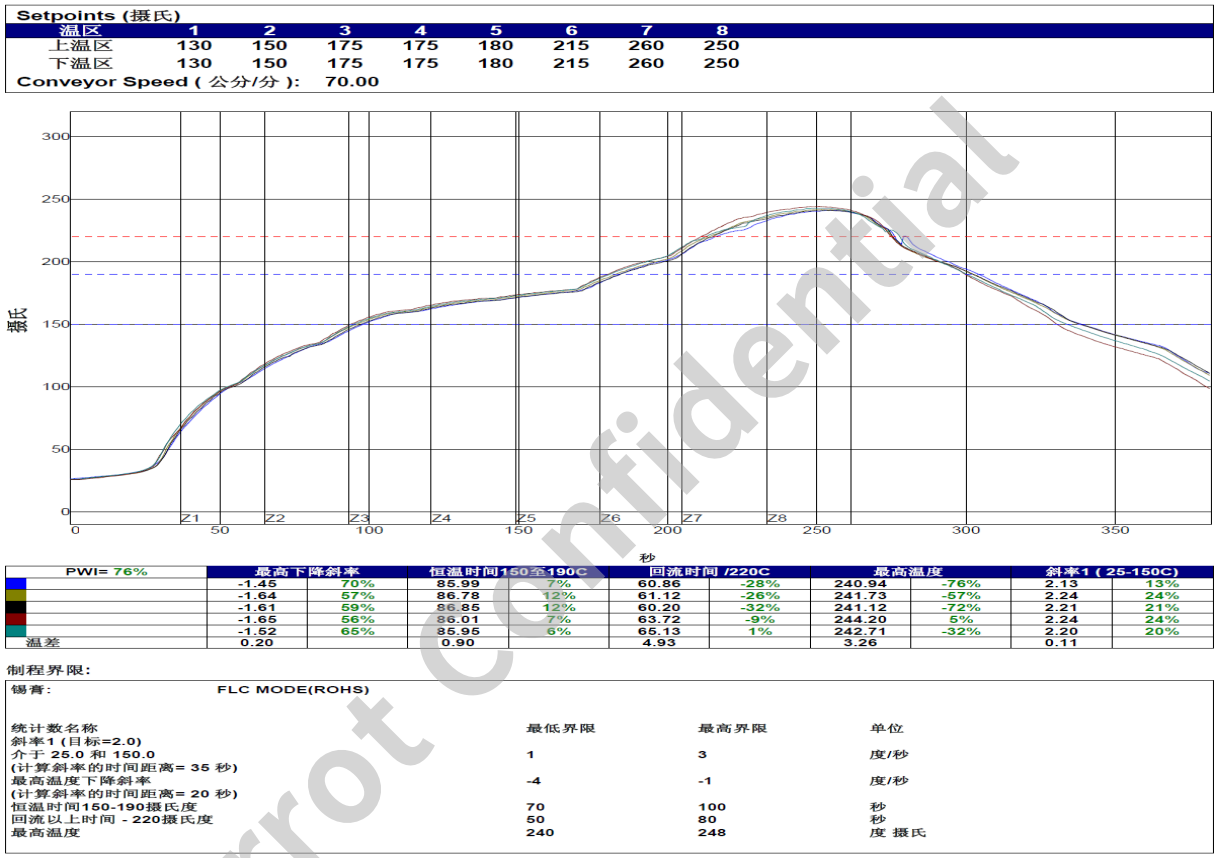
Increasing slope（℃/SEC）：1~2

Descending slope（℃/SEC）：-4~-1

Reflow time（S）：40~70

Peak teamperature（℃）：240-248

The actual furnace temperature curve for *Bluetooth* modules production:



Setpoints (摄氏)

温区	1	2	3	4	5	6	7	8
上温区	130	150	175	175	180	215	260	250
下温区	130	150	175	175	180	215	260	250

Conveyor Speed (公分/分): 70.00

PWI= 76%	最高下降斜率		恒温时间150至190C		回流时间 /220C		最高温度		斜率1 (25-150C)	
	-1.45	70%	85.99	7%	60.86	-28%	240.94	-76%	2.13	13%
	-1.64	57%	86.78	12%	61.12	-26%	241.73	-57%	2.24	24%
	-1.61	59%	86.85	12%	60.20	-32%	241.12	-72%	2.21	21%
	-1.65	56%	86.01	7%	63.72	-9%	244.20	5%	2.24	24%
	-1.52	65%	85.95	6%	65.13	1%	242.71	-32%	2.20	20%
温差	0.20		0.90		4.93		3.26		0.11	

制程界限:

锡膏: FLC MODE(ROHS)

统计数名称	最低界限	最高界限	单位
斜率1 (目标=2.0)			
介于 25.0 和 150.0	1	3	度/秒
(计算斜率的时间距离= 35 秒)			
最高温度下降斜率	-4	-1	度/秒
(计算斜率的时间距离= 20 秒)			
恒温时间150-190摄氏度	70	100	秒
回流以上时间 - 220摄氏度	50	80	秒
最高温度	240	248	度 摄氏

4.4 Reflow Soldering

4.4.1 When PCBA which is mounted with *Bluetooth* module and it enters reflow, please strictly ensure PCBA boards to pass through furnace via track path. Passing through furnace via the net cover of reflow oven is prohibited.

Since *Bluetooth* contains BGA elements, the net cover vibration may lead to high rates of BGA solder welding defects.

4.4.2 During reflow, if it is not double-side board, it shouldn't place the side which is mounted *Bluetooth* as the first side to proceed. Mounting *Bluetooth* on the second sid is suggested. Note: During reflow, since BGA type components are downwards, BGA solder joints are stretched. This may lead to the vulnerability of solder joints. It may eventually result in the brokenness of solder joints and other hidden dangers under the influence of external forces.

4.4.3 Interference Design which may lead to offset of module's elements should be avoided during reflow soldering technique design (i.e. designing furnace jig).

4.4.4 No need to add red glue or other adhesive on the lower part of module. Module recommended pad design can ensure the good solder ability of module PIN foot. Even for any special reason, modules are designed on the first side and need to be reflowed.

4.5 Wave soldering of PCBA after module is mounted

4.5.1 If process requirements require PCBA which is mounted with modules do wave soldering, please ensure special protection to the module in order to prevent its elements from soldering shortcut or other unpredictable hidden risks which may be caused by splash or other abnormity during wave soldering.

4.5.2 Wave soldering on PCBA which is mounted with module is not recommended. Pls wave soldering PCBA at the first and then manually soldering module on it.

4.6 Manual welding of other elements after module is mounted on PCBA

4.6.1 If some elements needs to be manually soldered onto PCBA after PCBA is mounted with module, such as welding wires, please protect the module with the cover during manual welding process, especially when the manual welding area is close to the module.

4.6.2 PCBA should be placed in the upper part of the manual welding bench, or quickly flows to the next bench. It is not suggested to place it in the lower part of welding bench, such as under welding bench.

5. Repair Instructions

5.1 The process of rework depends on the condition of repair.

The recommended repair method in this document is not the only method. The selection of repair operations depends on the actual hardware, and it should follow the basic technique requirements during repair.

5.2 Repair Technique Instruction

5.2.1 No matter it is disassembly or welding, repairing requires for the condition of the temperature ascension requirement ≤3℃/sec，highest temperature≤260℃

5.2.2 If repair elements exceed the storage period, it needs drying (refers to Table 2-1) before repairing

5.3 Module Disassembly

5.3.1 When disassembly, melting and reflowing soldering flux by proving fast,

controllable and even heating. It ensures all solder joints melt at the same time. When disassembly, it should avoid any thermal or mechanical damage to modules, PCB, adjacent elements, and their solder joints.

5.3.2 It is recommended to adopt infrared heating or hot air heating method; It is recommended to design & use special jig for module disassembly or pickup

5.4 Module Welding/Replacement

5.4.1 Preparation Before Welding：

5.4.1.1 Using irons and woven materials which are able to moisten soldering flux to remove the old soldering flux on soldering pad.

5.4.1.2 Cleaning pad & remove flux residues

5.4.1.3 Soldering flux pre-fill：Before module is installed into the board, using the appropriate way to add soldering tin on solder pads, it ensures the closeness of the height of solder paste after it melts and re-solidifies.

5.4.1.4 It is suggested to make jig or small printed tin steel mesh to repair solder paste printing

5.4.2 Installing modules into solder pads and ensure the correction of its direction. In order to ensure the temperature of each assembly element stays same during reflow, it is suggested to preheat modules. After heating soldering flux, it reflows to ensure reliable connection. When the solder joint maintains the appropriate reflow time at a predetermined temperature, it forms better IMC.

5.4.3 When the module is installed into the pad after printing, it is suggested to use special jig to pick it up.

5.4.4 Special repair equipment is recommended to be either selected or designed for repairing.