Bluetooth module

IB725L-30B1

Dual-Mode BT5 Module

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1. Device Overview

1.1 Features

- V5.0+BR+EDR+BLE specification
- Provides +8dbm transmitting power
- Profiles supported: GAP\SMP\ATT\GATT\SPP\HID-over-GATT profile
- Receiver with -92dBm sensitivity
- UART or OTA firmware upgrade
- Serial port command for applications
- One IIC interface supports host and device mode
- 2M internal-flash

1.2 Applications

- Bluetooth SPP or BLE to RS232 (RS485) serial data conversion
- Bluetooth wireless data transmission
- Medical and industrial telemetry
- Portable printers
- Barcode scanning devices
- Mobile POS devices
- Smart appliances
- Industrial automation
- Custom Bluetooth audio devices

1.3 Descriptions

The Module IB725L has a notable merit that its firmware supports concurrent Bluetooth SPP and GATT connections. It establishes a Bluetooth bidirectional communication channel which is between the application MCU and the mobile phone through the UART interface. The application MCU can send a corresponding command to enable the Bluetooth module and to set it into different modes, then to send and receive communication data at the SPP or GATT level.The MCU can also read the mode status of the module through serial commands.

This module is designed with ITON@IN725L dual mode Bluetooth 5.0 SoC. IB725L features 96 MHz 32-Bit ARM-core, excellent receiving sensitivity down to -92 dBm (BLE GFSK), integrated PA to support Class 1 Tx power up to 8 dBm. These two RF parameters contribute to its best in class link budget to enable long Bluetooth communication distance around 100 meters or even farther.

As a dual mode Bluetooth module, it can realize both GATT and SPP connections concurrently, which provide the best interoperability for various iOS and Android mobile devices. It supports both BR (2 Mbps) and EDR (3 Mbps) when running SPP. These high Classic Bluetooth data rate provides high throughput, enabling applications which require higher through than what BLE can provide. Its raw data through running SPP can reach up to 1 Mbps.

This module also supports Bluetooth audio profiles including but not limited to A2DP, HFP, and AVRCP. An external audio codec can be flexibly connected via PCM interface to drive a speaker and a microphone. This module can also support iAP2 and HomeKit for MFi licensed developers.

The module comes with a set of AT commands via UART interface for setting up a bidirectional Bluetooth data link easily between an application MCU and mobile phones.

1.4 Functional Block Diagram

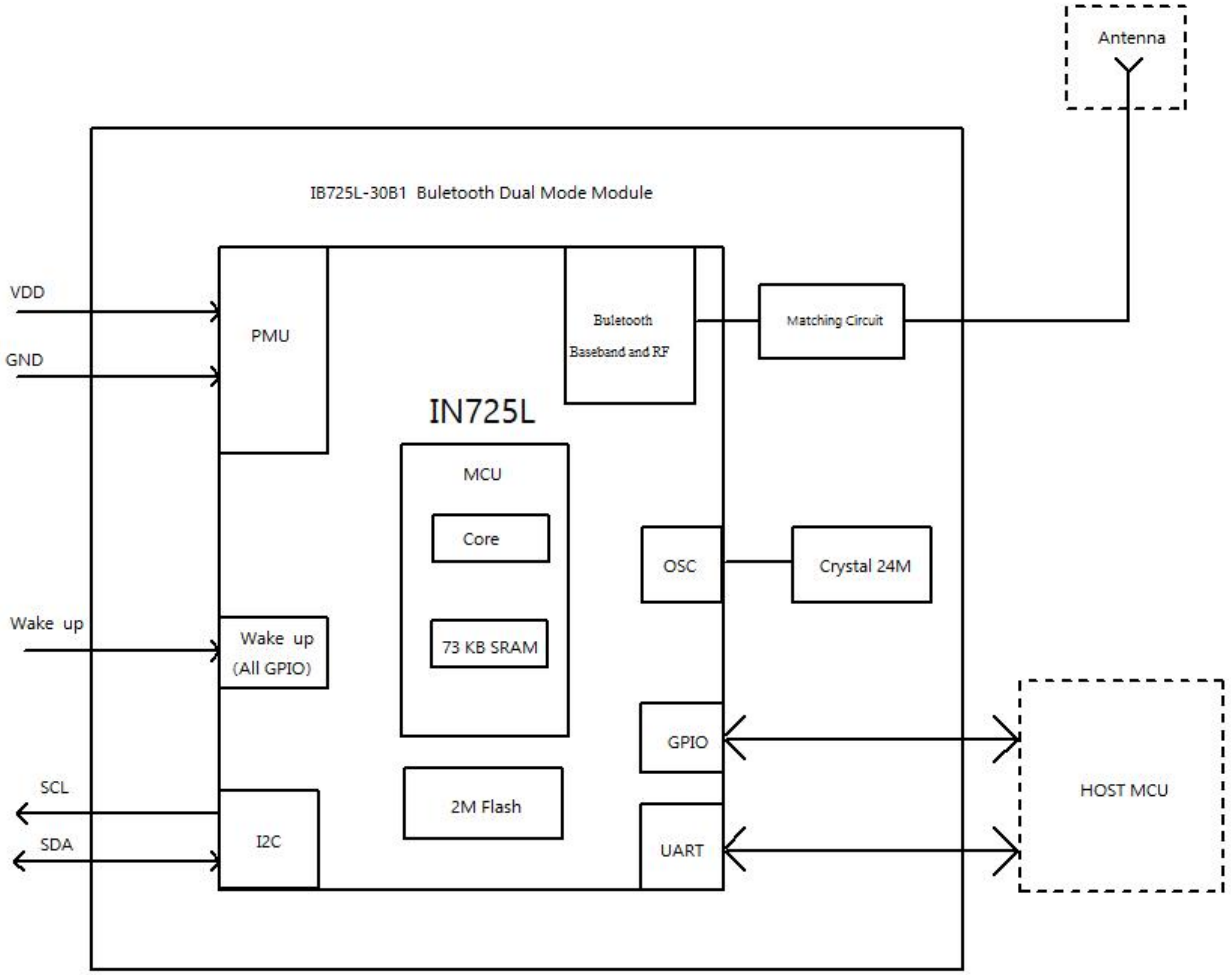

Figure 1.IB725L-30B1 Functional Block Diagram

2. Pin Configuration and Functions

2.1 Module Pin Diagram

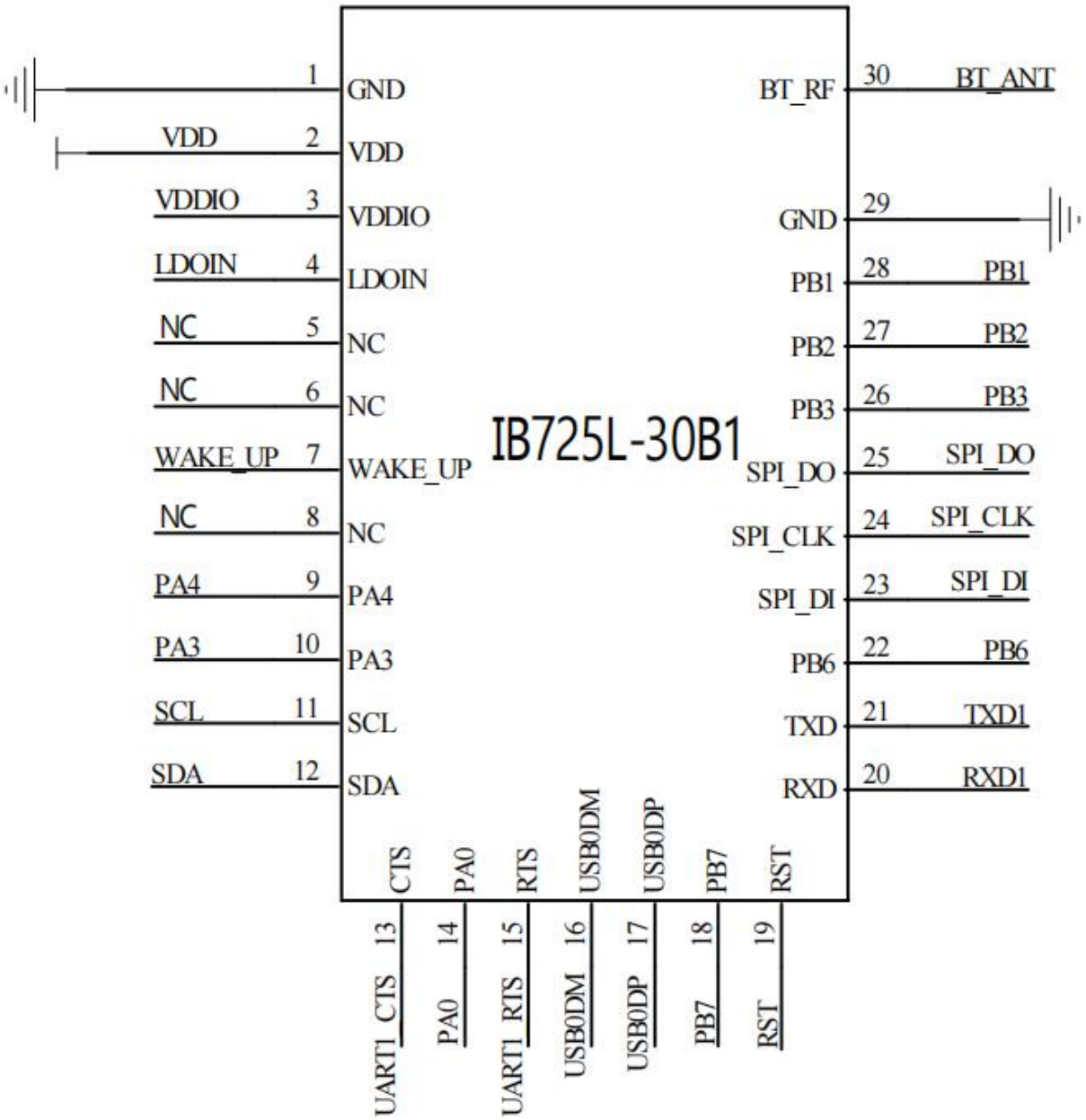

Figure 2.IB725L-30B1 Pin Diagram

2.2 Pin Functions

Pin	Name	Description	Typical
1	GND	Ground	Ground
2	VDD	Power	Power Supply: DC 2.4 V~4.5 V
3	VDDIO	Power	Input：DC1.8V-3.6V，VDD=2.4V-3.6V，Short it with VDD
4	LDOIN	Power	Input：DC5V，used to charge，recommend NC
5	NC	NC	/
6	NC	NC	/

7	Wake up	I/O	GPIO Wake up from sleep mode
8	NC	NC	/
9	PA4	I/O	GPIO PWM1: Timer1 PWM Output
10	PA3	I/O	GPIO PWMCH0L ADC1: ADC Channel 1
11	SCL	I/O	GPIO I2C_SCL
12	SDA	I/O	GPIO I2C_SDA
13	UART1_CTS	I/O	GPIO UART1_CTS
14	PA0	I/O	GPIO PWMCH0H
15	UART1_RTS	I/O	GPIO UART1_RTS
16	USB0DM	I/O	GPIO USB0DM for Download
17	USB0DP	I/O	GPIO USB0DP for Download
18	PB7	I/O	GPIO
19	RST	I	External reset signal input, active low
20	UART1_RXD	I	GPIO UART1_RX
21	UART1_TXD	O	GPIO UART1_TX
22	PB6	I/O	GPIO ADC12: ADC Channel 12 TMR3CK
23	SPI_DI	I/O	GPIO SPI_DI

24	SPI_CLK	I/O	GPIO SPI_CLK
25	SPI_DO	I/O	GPIO SPI_DO
26	PB3	I/O	GPIO PWMCH2L
27	PB2	I/O	GPIO PWMCH2H
28	PB1	I/O	GPIO PWM2: Timer2 PWM Output ADC7: ADC Channel 7
29	GND	Ground	Ground
30	BT_RF	O	RF pin connecting to an antenna

3. Specifications

3.1 Absolute Maximum Ratings

Caution! The absolute maximum ratings in the following table indicates voltages levels where permanent physical damage to the device can occur, even if these limits were exceeded for only a brief duration.

Parameter	Specifications			Unit
	Min.	Typ.	Max.	
VDD_3V3	-0.3	3.3	4.5	V
Ambient Temperature	-20	25	+65	℃
Storage Temperature	-65	-	+150	℃

3.2 RF Characteristics

3.2.1 Transmitter RF Parameters

Basic Data Rate

Parameter	Min.	Typ.	Max.	Unit	Test Conditions
RF Transmit Power		0	8	dBm	
RF Power Control Range		20		dB	

20dB Bandwidth			950		KHz	25℃
Adjacent Channel Transmit Power	+2MHz		-40		dBm	Power Supply VBAT=5V 2441MHz
	-2MHz		-38		dBm	
	+3MHz		-44	10	dBm	
	-3MHz		-35	20	dBm	

Enhanced Data Rate

Parameter		Min	Typ	Max	Unit	Test Conditions
Relative Power			-1		dB	25℃, Power Supply VBAT=5V 2441MHz
DEVM RMS π/4 DQPSK Modulation Accuracy	DEVM RMS		7		%	
	DEVM 99%		12		%	
	DEVM Peak		17		%	
Adjacent Channel Transmit Power	+2MHz		−40		dBm	
	-2MHz		-38		dBm	
	+3MHz		-44		dBm	
	-3MHz		-35		dBm	

Note:

All specifications are for industrial temperature.

All specifications are single-ended. Unused input are left open,

Maximum value is the value required for Bluetooth qualification.

Meets this spec using a front-end bandpass filter.

3.2.2 Receiver RF Parameters

Basic Data Rate

Parameter		Min	Typ	Max	Unit	Test Conditions
Sensitivity			-92		dBm	25℃, Power Supply VBAT=5V 2441MHz
Co-channel Interference Rejection			-9		dB	
Adjacent Channel Interference	+1MHz		+5		dB	
	−1MHz		+2		dB	

Rejection	+2MHz		+37		dB	
	−2MHz		+36		dB	
	+3MHz		+40		dB	
	−3MHz		+35		dB	

Enhanced Data Rate

Parameter		Min	Typ	Max	Unit	Test Conditions
Sensitivity			-92		dBm	
Co-channel Interference Rejection			-9		dB	
Adjacent Channel Interference Rejection	+1MHz		+5		dB	25℃, Power Supply VBAT=5V 2441MHz
	−1MHz		+2		dB	
	+2MHz		+37		dB	
	−2MHz		+36		dB	
	+3MHz		+40		dB	
	−3MHz		+35		dB	

Note:

All specifications are single ended. Unused inputs are left open.

All specifications, except typical, are for industrial temperature.

3.2.3 Antenna Requirements

The module requires to configure with external 2.4G Antenna.

3.3 Power Consumption

3.3.1 SPP (Under Dual-mode)

Operation Mode	AVG Current	Note
Starting current	15.5mA	
Operating current	5.2mA	
Broadcast power consumption	1.1mA	500 ms broadcast interval
Not-connect current	0.9mA	

3.3.2Low Energy (Under Dual-mode)

Operation Mode	AVG Current	Note
Standby current	150uA	Connect mode（sniff）
Minimum Standby current	60uA	Connect mode 2s broadcast interval（Different mobile phones have different power consumption，Range：50-105uA）
Soft-Shutdown	2.5uA	

3.3.3 Low Power Mode Current Consumption（Under UART）

Parameter	AVG Current	Note
Pairing current	780uA	Continuously sending broadcasts
Connecting current	720uA	Stay connected
RX current	3mA	10 ms broadcast interval
TX current	3.8mA	10 ms broadcast interval

4. Application, Implementation, and Layout

4.1 Application

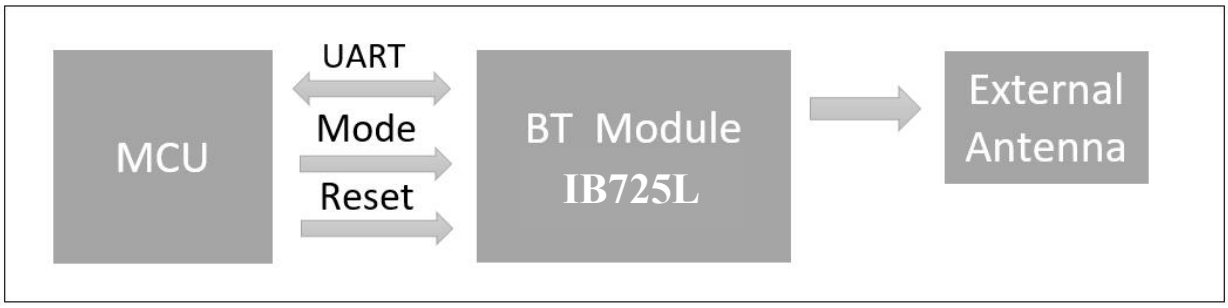

Figure 3 .Transparent Transmission Block Diagram

4.2 Typical Application Schematic Diagram

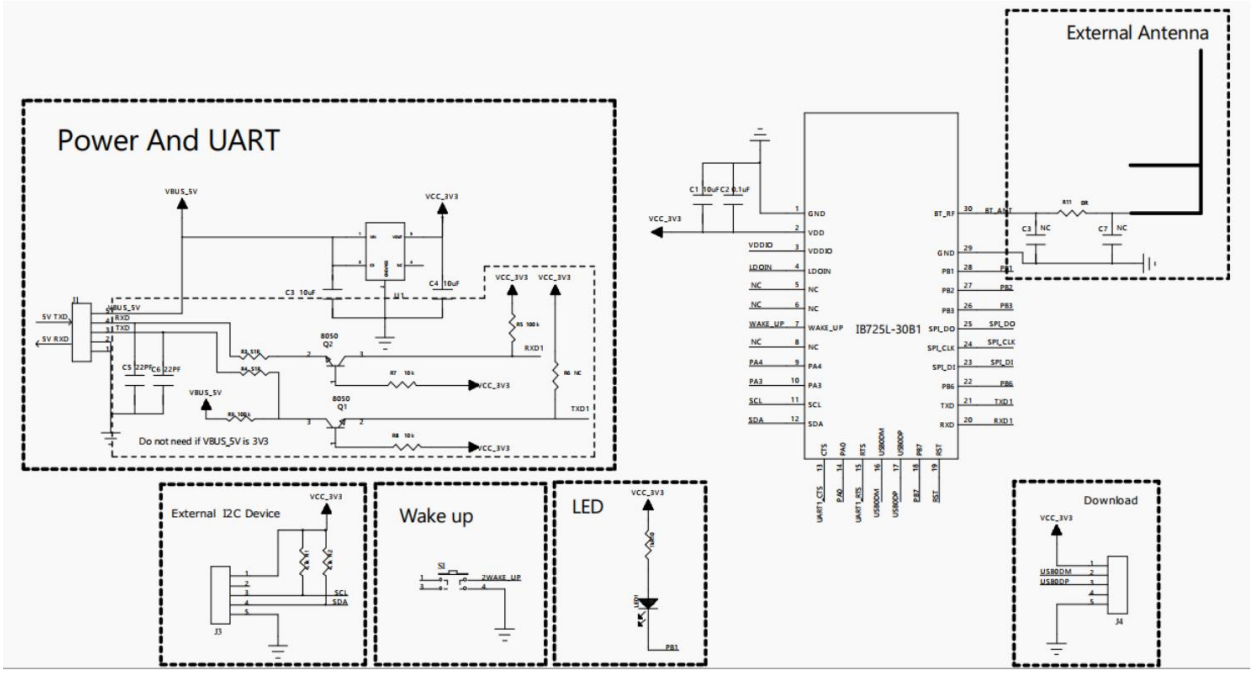

Figure 4.Typical Application Schematic Diagram of IB725L-30B1

4.3 Layout Guideline

1. Keep RF traces with 50 Ohm impedance.
2. The antenna requires enough clearance area.
3. The filter capacitor should be as close as possible to the module.
4. Do not place strong interference lines under the module.

5. Mechanical and Package

5.1 Recommended PCB Footprint

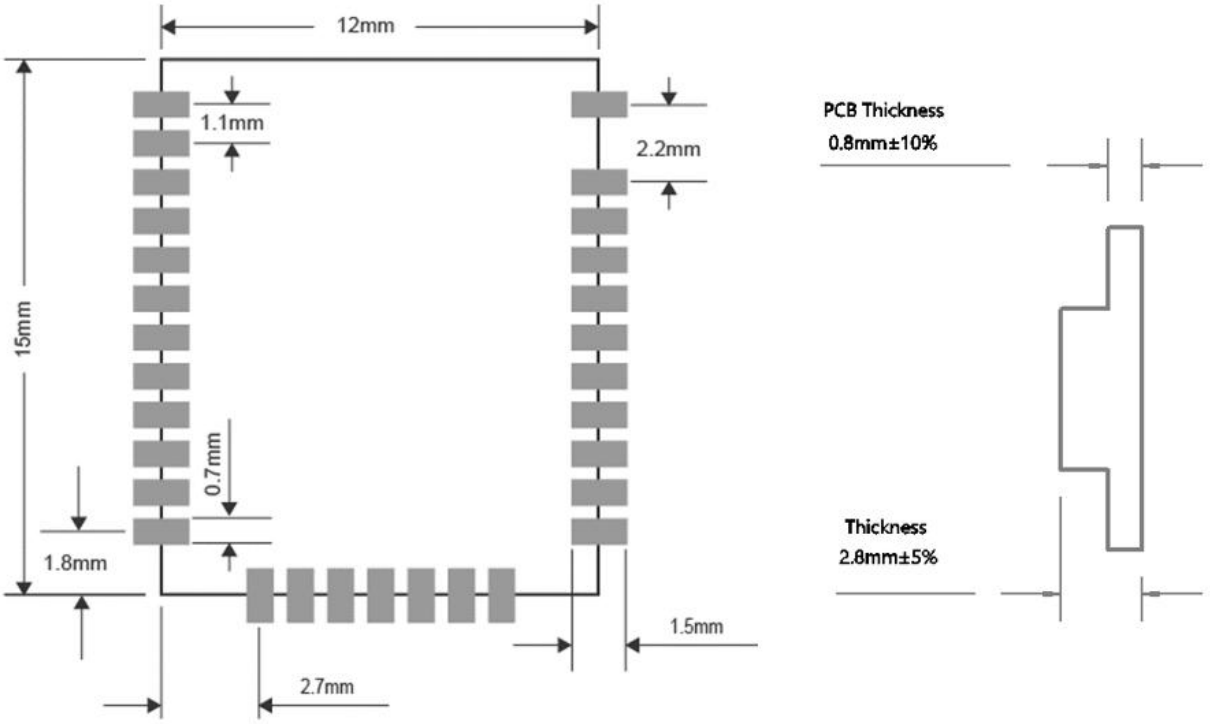

Figure 5.Recommended PCB Footprint of IB725L-30B1

Note:

1. The RF trace on the product board connecting to the RF pin needs to be controlled at 50 Ohm impedance. Normally an L/C matching network is needed in between.
2. The decoupling capacitor for VDD_3V3 input should be as close to the module as possible.
3. Strong interference line at the bottom of the module should be forbidden.
4. The whole Thickness is 2.8mm，2.17mm refers to the thickness of components height and pcb thickness.

5.2 Packaging Information

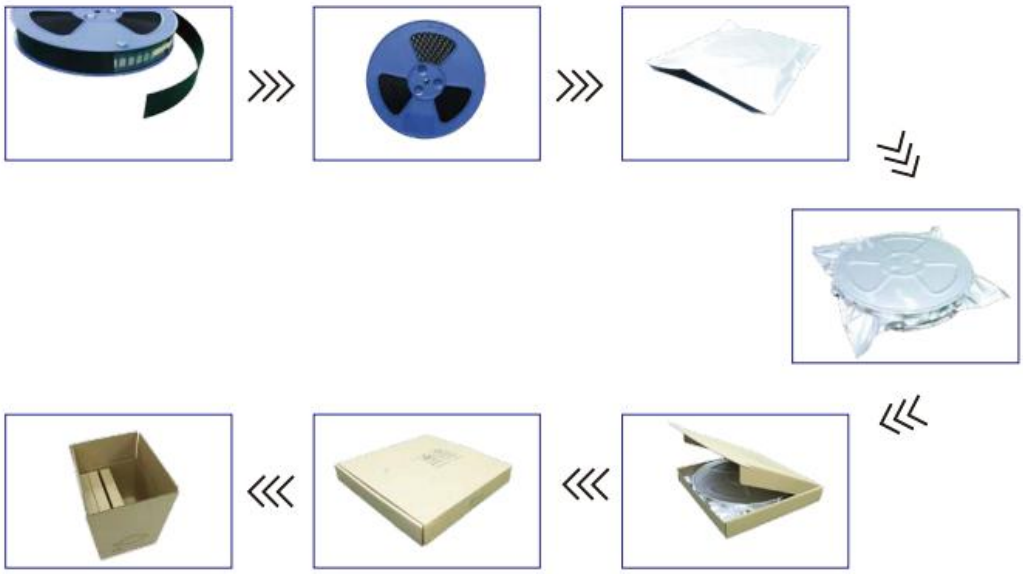

Figure 6.Brief Packaging Process of IB725L-30B1 Modules

6. Thermal Reflow

Referred to IPC/JEDEC standard.

Peak temperature: <250°C

Number of times: ≤2

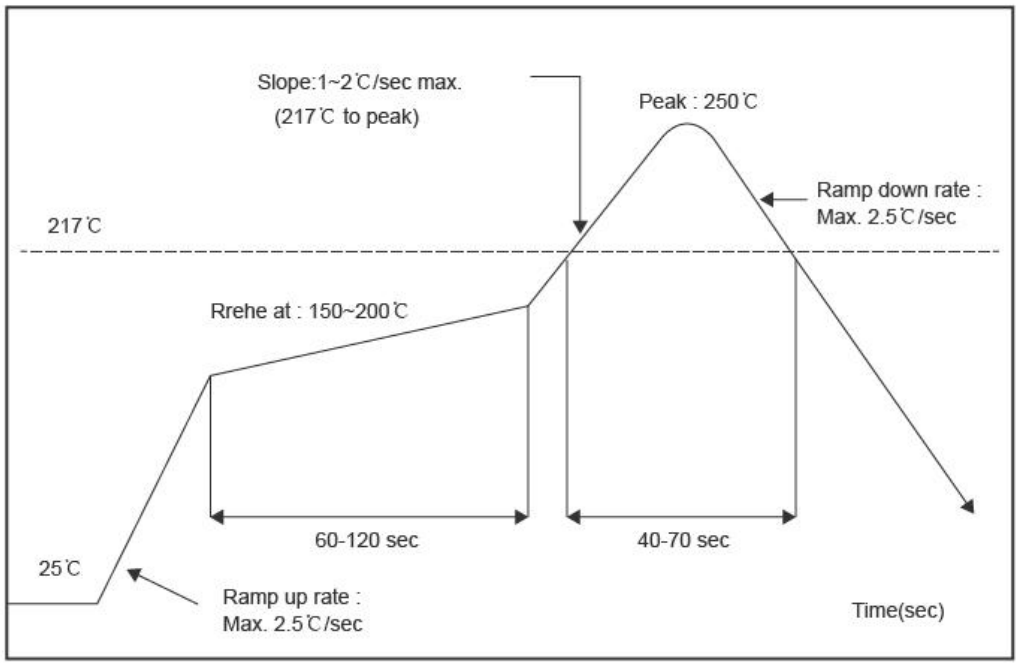

Figure 7.Recommended Reflow for Lead Free Solder

Note: The module is recommended not to go through reflow oven twice;

7. Ordering Information

Part NO.	Working Voltage	ANT	Shielding Cover	Remark
IB725L-30B1	2.4V~4.5V	Not included	Not included	

8. Revision History

Version	Change Content	Reviser	Date
V1.0	Initial Version	Chris	2022.11.14
V1.1	Update power consumption parameters	Chris	2023.04.07
V1.2	Add module appearance diagram	Leron	2023.09.13
V1.3	Add Low Power Mode Current	Leron	2023.12.06

FCC 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.
Changes or modifications not expressly approved by the party responsible for compliance 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, pursua nt to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful inte rference in a residential installation. This equipment generates uses and can radiate radio frequency energy a nd, if not installed and used in accordance with the instructions, may cause harmful interference to radio com munications. 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 turn ing 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 important announcement Important Note:

Radiation Exposure Statement
This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator and your body.
This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter. Country Code selection feature to be disabled for products marketed to the US/Canada.
This device is intended only for OEM integrators under the following conditions:
1.The antenna must be installed such that 20 cm is maintained between the antenna and users, and
2.The transmitter module may not be co-located with any other transmitter or antenna,

Important Note:
In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization is no longer considered valid and the FCC ID 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 FCC authorization.

End Product Labeling
The final end product must be labeled in a visible area with the following"
Contains FCC ID: 2ANIV-IB725L-30B1 "

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.

Integration instructions for host product manufacturers according to KDB 996369 D03 OEM Manual v01r01
2.2List of applicable FCC rules

CFR 47 FCC PART 15 SUBPART C has been investigated. It is applicable to the modular transmitter
2.3Specific 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.

2.4Limited module procedures
Not applicable
2.5Trace antenna designs
Not applicable
2.6RF exposure considerations

This equipment complies with FCC 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.

2.7Antennas
This radio transmitter FCC ID:2ANIV-IB725L-30B1 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.

Antenna No.	Model No. of antenna:	Type of antenna and Gain of the antenna (Max.)	Frequency range:
Bluetooth Antenna	/	FPC Antenna , -0.19dBi(Max.)	2400-2500MHz

2.8Label and compliance information
The final end product must be labeled in a visible area with the following" Contains FCC ID:2ANIV-IB725L-30B1".
2.9Information 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.
2.10Additional 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.
2.11Note EMI Considerations
Host manufacture is recommended to use D04 Module Integration Guide recommending as "best practice" RF
design engineering testing and evaluation in case non-linear interactions generate additional non-compliant limits due to module placement to host components or properties.
2.12How to make changes
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.
According to the KDB 996369 D02 Q&A Q12, that a host manufacture only needs to do an evaluation (i.e., no C2PC required when no emission exceeds the limit of any individual device (including unintentional radiators) as a composite. The host manufacturer must fix any failure.

ISED Statement

English: This device complies with Industry Canada license‐exempt RSS standard(s). Operation is subject to the following two conditions: (1) This device may not cause interference, a nd (2) This device must accept any interference, including interference that may cause undesired operation of the device.

The digital apparatus complies with Canadian CAN ICES‐3 (B)/NMB‐3(B).

‐French: Le présentappareilestconforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitationestautorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareildoit accepter tout brouillageradi oélectriquesubi, mêmesi le brouillageest susceptible d'encompromettre le fonctionnement. l'appareil numérique du ciem conforme canadien peut ‐3 (b) / nmb ‐ 3 (b).

This 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.

cet appareil est conforme à l'exemption des limites d'évaluation courante dans la section 2.5 du cnr - 102 et conformité avec rss 102 de l'exposition aux rf, les utilisateurs peuvent obtenir des données canadiennes sur l'exposition aux champs rf et la conformité.

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

Cet équipement est conforme Canada limites d'exposition aux radiations dans un environnement non contrôlé.

This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

Cet équipementdoit être installé et utilisé à une distance minimale de 20 cm entre le radiateur et votre corps.

ISED Modular Usage Statement

NOTE 1: When 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 the wording ”Contains transmitter module IC: 22889-IB725L30B1” or “Contains IC: 22889-IB725L30B1”.

NOTE 1: Lorsque le numéro de certification ISED n'est pas visible lorsque le module est installé dans un autre appareil, l'extérieur de l'appareil dans lequel le module est installé doit également afficher une étiquette faisant référence au module inclus. Cette étiquetteextérieure peut être libellée Contient le module émetteur IC: 22889-IB725L30B1 ou Contient IC: 22889-IB725L30B1.