



BL-M8733BU2-Q

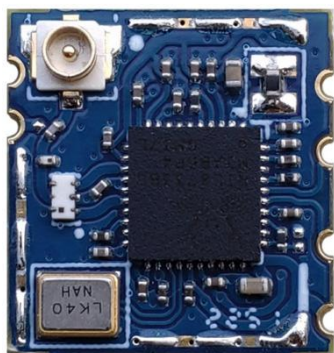
802.11n 72.2Mbps WLAN + BLE v4.2

USB2.0 Combo Module Specification

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(Top View)



(Bottom View)

Module Name: BL-M8733BU2-Q

Module Type: 802.11a/b/g/n 72.2Mbps WLAN + BLE v4.2 USB2.0 Combo Module

Revision: V1.0

Customer Approval:

Company:

Title:

Signature:

Date:

LB-link Approval:

Title:

Signature:

Date:

Revision History

Revision	Summary	Release Date	Revised By
0.1	Initial release	2023-07-29	Bo li
1.0	Official release	2023-08-29	Bo li

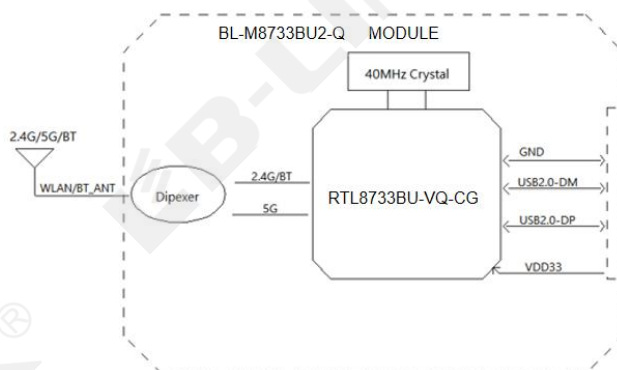
1. Introduction

BL-M8733BU2-Q is a highly integrated Dual-band WLAN + Bluetooth v4.2 Combo module. It combines a 1T1R Dual-band WLAN subsystem and a BT v4.2 subsystem. This module compatible IEEE 802.11 a/b/g/n standard and provides the maximum PHY rate up to 72.2Mbps, it only supports BLE v4.2 mode, offering feature-rich wireless connectivity at high standards, and delivering reliable, cost-effective throughput from an extended distance.

1.1 Features

- Operating Frequency: 2.4~2.4835GHz or 5.15~5.85GHz
- Host Interface is USB2.0
- IEEE Standards: IEEE 802.11a/b/g/n
- Wireless PHY rate can reach up to 72.2Mbps
- Bluetooth Standards: BLE v4.2
- IPEX / MHF-1 connector for external WLAN antenna
- Power Supply: DC 3.3V±0.2V main power supply

1.2 Block Diagram

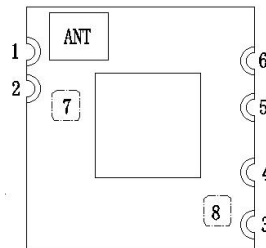


1.3 General Specifications

Module Name	BL-M8733BU2-Q
Chipset	RTL8733BU-VQ-CG
WLAN Standard	IEEE 802.11a/b/g/n
BT Specification	Bluetooth Core Specification v4.2
Host Interface	USB2.0 for WLAN&BT
Antenna	IPEX / MHF-1 connector for external WLAN antenna
Dimension	13.0*12.3*2.1mm (L*W*H)±0.15mm

Power Supply	DC 3.3V±0.2V @850 mA (Max)
Operation Temperature	-20°C to +70°C
Operation Humidity	10% to 95% RH (Non-Condensing)

2. Pin Assignments



(Top View)

2.1 Pin Definition

No	Pin Name	Type	I/O Level	Description
1	GND	RF		RF Ground for ANT
2	NC	/		NC(Reserve 2.4G/5G WLAN ANT/BT ANT)
3	VDD33	P		VDD 3.3V Power Supply
4	USB_DM	AI/O		USB Transmitter/Receiver Differential Pair
5	USB_DP	AI/O		USB Transmitter/Receiver Differential Pair
6	GND	P		Ground connections for power and USB Differential Pair
7	GND	RF		Auxiliary RF Ground connection PAD for ANT (It can be left floating, but grounding is strongly recommended to enhance ground connectivity and avoid RF interference)
8	GND	P		Auxiliary Ground connection PAD for power and USB (It can be left floating, but grounding is strongly recommended to reduce the power loop area and avoid interference with RF)
	ANT	RF		IPEX connector for 2.4G/5G WLAN ANT/BT ANT

P: Power or Ground; I/O: In/Output; I: Input; O: Output; O/D: Open Drain Output; A I/O: Analog In/Output; AI: Analog Input; AO: Analog Output; RF: Analog RF Port or RF Ground;

3. Electrical and Thermal Specifications

3.1 Recommended Operating Conditions

Parameters		Min	Typ	Max	Units
Ambient Operating Temperature		-20	25	70	°C
External Antenna VSWR		--	1.7	2.0	/
Supply Voltage	VDD33	3.1	3.3	3.5	V

3.2 Current Consumption

Conditions : VDD33=3.3V ; Ta:25°C			
Use Case	VDD33 Current (average)		
	Typ	Max	Units
WLAN unssociate (Linux Driver)	140	150	mA
2.4G WLAN TCP throughput TX 50Mbps (Linux Driver, BT disable)	409	430	mA
2.4G WLAN TCP throughput RX 50Mbps (Linux Driver, BT disable)	197	210	mA
5G WLAN TCP throughput TX 50Mbps (Linux Driver, BT disable)	419	448	mA
5G WLAN TCP throughput RX 58Mbps (Linux Driver, BT disable)	206	228	mA
2.4G 11b@1Mbps TX 20dBm (RF-Test)	640	690	mA
2.4G 11b@11Mbps TX 20dBm (RF-Test)	514	540	mA
2.4G 11b@6Mbps TX 20dBm (RF-Test)	650	690	mA
2.4G 11g@54MbpsTX 19dBm (RF-Test)	240	250	mA
2.4G 11n@MCS0(HT20) TX 20dBm (RF-Test)	650	680	mA
2.4G 11n@MCS7(HT20) TX 18dBm (RF-Test)	225	238	mA
2.4G 11b@1Mbps RX (RF-Test)	151	160	mA
2.4G 11n@MCS0(HT20) RX (RF-Test)	152	155	mA
2.4G 11n@MCS7(HT20) RX (RF-Test)	151	160	mA
5G 11a@6Mbps TX 19dBm (RF-Test)	540	560	mA
5G 11a@54Mbps TX 17dBm (RF-Test)	220	230	mA
5G 11n@MCS0(HT20) TX 18dBm (RF-Test)	523	545	mA
5G 11n@MCS7(HT20) TX 16dBm (RF-Test)	210	230	mA

5G 11g@6Mbps(HT20) RX (RF-Test)	145	150	mA
5G 11n@MCS0(HT20) RX (RF-Test)	143	150	mA
5G 11n@MCS7(HT20) RX (RF-Test)	145	155	mA
BLE@5dBm TX (RF-Test)	185	200	mA
BLE 1M RX (RF-Test)	178	190	mA

4. WLAN & Bluetooth RF Specifications

4.1 2.4G WLAN RF Specification

Conditions: VDD33=3.3V; Ta:25℃			
Features	Description		
WLAN Standard	IEEE 802.11b/g/n		
Frequency Range	2.4~2.4835GHz (2.4GHz ISM Band)		
Channels	Ch1~Ch13 (For 20MHz Channels)		
Modulation	802.11b (DSSS): DBPSK, DQPSK, CCK; 802.11g (OFDM): BPSK, QPSK, QAM16, QAM64; 802.11n (OFDM): BPSK, QPSK, QAM16, QAM64;		
Data Rate	802.11b: 1, 2, 5.5, 11Mbps; 802.11g: 6, 9, 12, 18, 24, 36, 48, 54Mbps; 802.11n (HT20): MCS0~MCS7 6.5~72.2Mbps;		
Frequency Tolerance	≤ ±20ppm		
2.4G Transmitter Specifications (TX power tolerance calibrated, customers can define the target TX power by modifying configuration file of the driver software. Customers must define the TX power same or lower than recommended Target TX Power as below)			
TX Rate	Recommended Target TX Power (dBm)	TX Power Tolerance (dBm)	EVM(dB)
802.11b@1~11Mbps	20dBm	±2dBm	≤-10
802.11g@6Mbps	20dBm	±2dBm	≤-10
802.11g@54Mbps	19dBm	±2dBm	≤-25
802.11n@HT20_MCS0	20dBm	±2dBm	≤-10
802.11n@HT20_MCS7	18dBm	±2dBm	≤-28
2.4G Receiver Specifications			
RX Rate	Min Input Level (Typ)	Max Input Level (Typ)	PER
802.11b@1Mbps	-95dBm	-5dBm	< 8%
802.11b@11Mbps	-87dBm	-5dBm	< 8%

802.11g@6Mbps	-92dBm	-5dBm	< 10%
802.11g@54Mbps	-74dBm	-5dBm	< 10%
802.11n@HT20_MCS0	-92dBm	-5dBm	< 10%
802.11n@HT20_MCS7	-72dBm	-5dBm	< 10%

4.2 5G WLAN RF Specification

Conditions: VDD33=3.3V; Ta:25°C

Features	Description
WLAN Standard	IEEE 802.11a/n
Frequency Range	5.15~5.25GHz; 5.25~5.35GHz; 5.47~5.73GHz; 5.735~5.835GHz (5GHz ISM Band)
Channels	Ch36, Ch40, Ch44, Ch48; Ch52~Ch64; Ch100~Ch140; Ch149~Ch165(For 20MHz Channels)
Modulation	802.11a (OFDM): BPSK, QPSK, QAM16, QAM64; 802.11n (OFDM): BPSK, QPSK, QAM16, QAM64;
Data Rate	802.11a: 6, 9, 12, 18, 24, 36, 48, 54Mbps; 802.11n (HT20): MCS0~MCS7 6.5~72.2Mbps;
Frequency Tolerance	≤ ±20ppm

5G Transmitter Specifications （TX power tolerance calibrated, customers can define the target TX power by modifying configuration file of the driver software. Customers must define the TX power same or lower than recommended Target TX Power as below）

TX Rate	Recommended Target TX Power (dBm)	TX Power Tolerance (dBm)	EVM(dB)
802.11a@6Mbps	19dBm	±2dBm	≤-10
802.11a@54Mbps	17dBm	±2dBm	≤-25
802.11n@HT20_MCS0	18dBm	±2dBm	≤-10
802.11n@HT20_MCS7	16dBm	±2dBm	≤-28

5G Receiver Specifications

RX Rate	Min Input Level (Typ)	Max Input Level (Typ)	PER
802.11a@6Mbps	-91dBm	-5dBm	< 10%
802.11a@54Mbps	-74dBm	-5dBm	< 10%

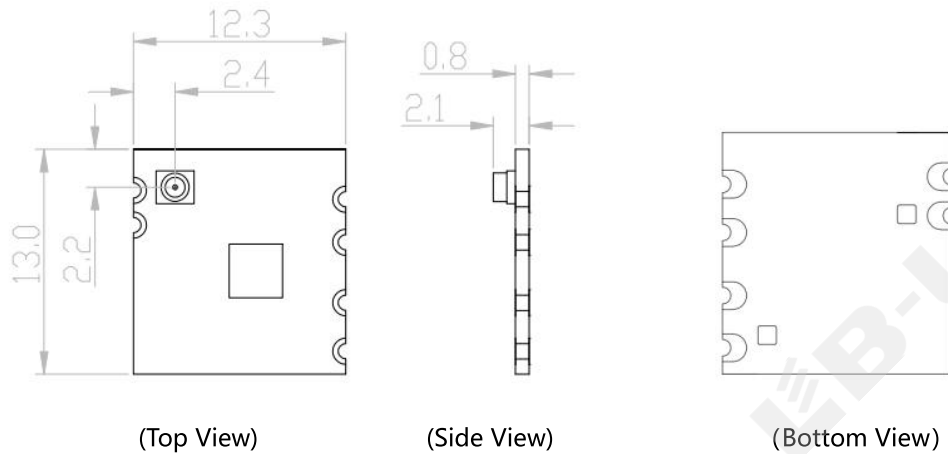
802.11n@HT20_MCS0	-90dBm	-5dBm	< 10%
802.11n@HT20_MCS7	-72dBm	-5dBm	< 10%

4.3 Bluetooth RF Specification

Conditions: VDD33=3.3V; Ta:25°C					
Features		Description			
Bluetooth Specification		Bluetooth Core Specification v4.2			
Frequency Range		2.4~2.4835GHz (2.4GHz ISM Band)			
Channels		Bluetooth Low Energy: Ch0~Ch39 (For 2MHz Channels);			
Power Classes		Bluetooth Low Energy: Class1.5;			
Data Rate & Modulation		LE_1Mbps: GFSK (Uncoded);			
Bluetooth Transmitter Specifications					
Items		Min	Typ	Max	
TX Power					
LE_1M		2dBm	5dBm	8dBm	
Items		Min	Typ	Max	
LE_1M Modulation Characteristics					
Δf1avg		225KHz	252.22KHz	275KHz	
Δf2avg		185KHz	229.49KHz	/	
Δf2max		185KHz	221.84KHz	/	
Δf2avg/Δf1avg		0.8	0.9	/	
Bluetooth Receiver Specifications					
Items		Sensitivity		Maximum Input Level	
		Input Level (Typ)	PER	Input Level (Typ)	PER
LE_1M		-88dBm	≤5%	-10dBm	≤5%

5. Mechanical Specifications

5.1 Module Outline Drawing



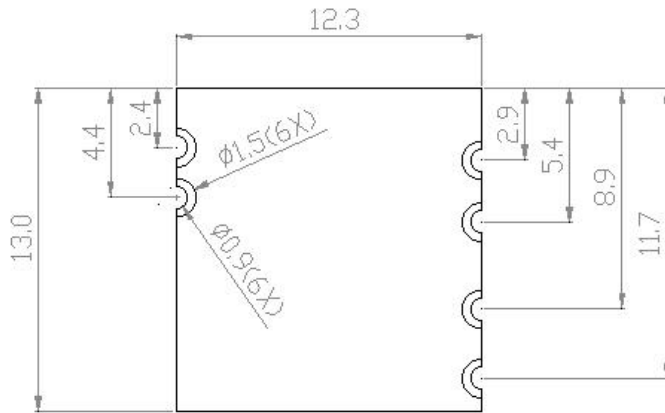
Module dimension: 13.0*12.3*2.1mm(L*W*H; Tolerance: $\pm 0.15\text{mm}$)

IPEX / MHF-1 connector dimension: 2.6*3.0*1.25mm (L*W*H; $\varnothing 2.0\text{mm}$)

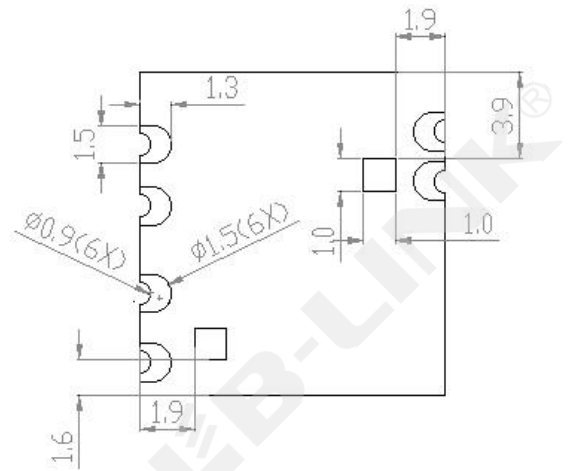


Module Bow and Twist: $\leq 0.1\text{mm}$

5.2 Mechanical Dimensions



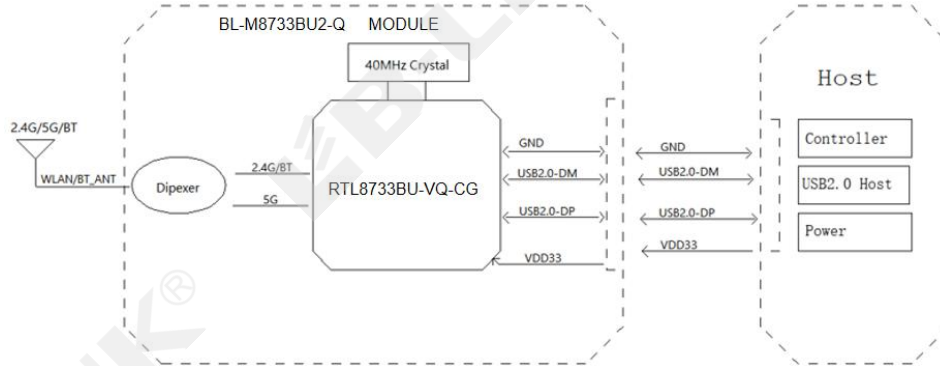
(Top View)



(Bottom View)

6. Application Information

6.1 Typical Application Circuit



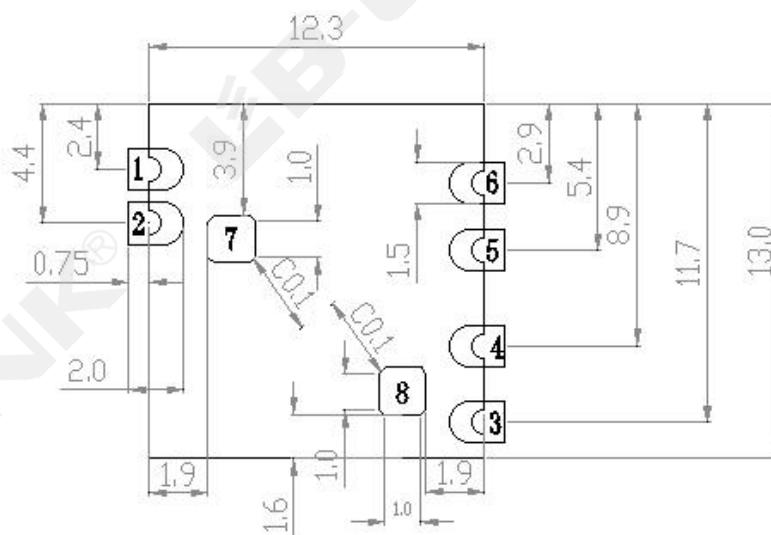
6.2 VDD33 Power requirement:

- DC 3.1~3.5V & Ripple Voltage <100mV power supply input, Maximum RMS current $\geq 0.85A$ and Maximum Peak current $\geq 1A$.
- For achieve fast transient response, a current mode buck converter recommended.
- Use 10uF and 100nF MLCC capacitors close to the module's VDD33 Pin for power input decoupling. Each GND Pin has three close vias to ensure connectivity and thermal conductivity.
- BL-M8733BU2-Q uses general packaging of USB_6Pin, which has the defect that GND Pins are too far away from Signal Pins, therefore, soldering two auxiliary grounding PADs at the bottom of BL-M8733BU2-Q to customer's motherboard are strongly recommended.

6.3 USB interface Design Guidelines:

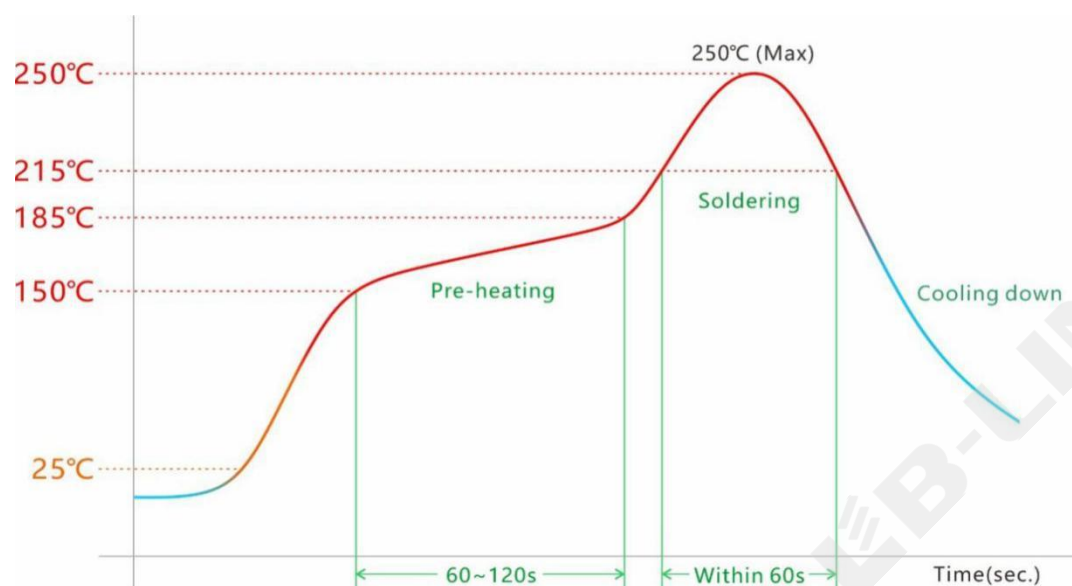
- A、BL-M8733BU2-Q provides a USB device interface which is compatible with USB2.0 specification, High-Speed mode supports data transmission rate up to 480Mbps.
- B、PCB traces of the USB high-speed signal pair should be maintain 90Ω differential impedance, structure of “Differential Coated Coplanar Waveguide With Ground” with the advantages of impedance control and GND surrounding isolation interference may be an ideal choice. To avoid interference, USB signal pair must be far away from power, RF and other signals, GND copper can be used to surround and isolate them.
- C、PCB traces of the USB high-speed signal pair as short as possible, as far away from other signal as possible, minimize the length mismatch of signal pair, avoid layer change and maintain a complete reference layer to reduces signal reflections and impedance changes.
- D、If It is necessary to change layers for USB signal pair routing, use GND vias close to signal pair's vias as the shortest return path.
- E、On customer's motherboard, keep complete GND copper area under and around the module, do not route Power, USB and other signals there to avoid interfering with the module causing RF performance derating problem.

6.4 Recommend PCB Layout Footprint



(Design Unit: mm))

6.5 Reflow Soldering Standard Condition



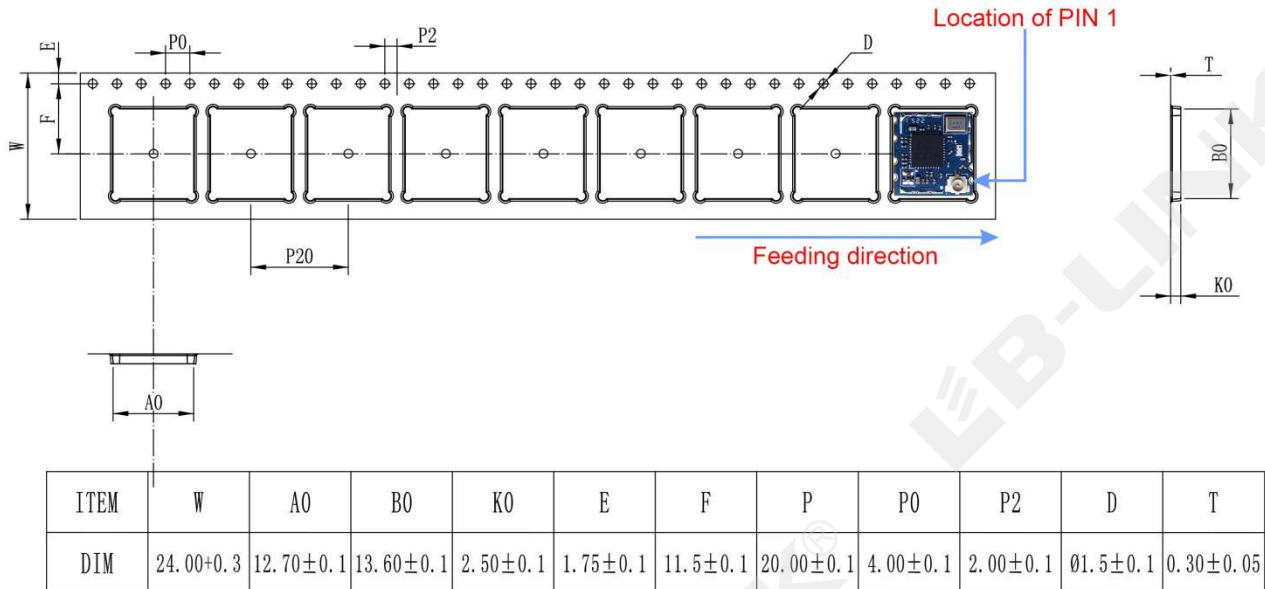
Please use the reflow within 2 times.
Set up the highest temperature within 250°C.

7. Key Components Of Module

No.	Parts	Specification	Manufacturer	Note
1	Chipset	RTL8733BU-VQ-CG	Realtek Semiconductor Corp.	
2	PCB	BL-M8733BU2	SHEN ZHEN QILI ELECTRON CO.,LTD	
			ShenZhen Tie Fa Technology Limited	
			Huizhou Dayawan Kexiang Technology Circuit Board Co., Ltd	
			Quzhou Sunlord Electronics Co.,Ltd	
3	Crystal	40MHz-3225	Chengde oscillator Electronic Technology CO.,LTD	
			LUCKI CM ELECTRONICS CO.,LTD	
			JinHua East Crystal Electronic CO.,LTD	
4	Diplexer	DIP1608	Dongguan Hekang Electronics Co.,LTD	
			Walsin Technology Corporation	

8. Package and Storage Information

8.1 Package Dimensions



Package specification:

- 1,000 modules per roll and 5,000 modules per box.
- Outer box size: 37.5*36*29cm.
- The diameter of the blue environment-friendly rubber plate is 13 inches, with a total thickness of 28mm (with a width of 24mm carrying belt).
- Put 1 package of dry agent (20g) and humidity card in each anti-static vacuum bag.
- Each carton is packed with 5 boxes.

8.2 Storage Conditions

Absolute Maximum Ratings:

Storage temperature: -40°C to +85°C,

Storage humidity: 10% to 95 (Non-Condensing)

Recommended Storage Conditions:

Storage temperature: 5°C to +40°C,

Storage humidity: 20% to 90% RH

Please use this Module within 12month after vacuum-packaged.

The Module shall be stored without opening the packing.

After the packing opened, the Module shall be used within 72hours.

When the color of the humidity indicator in the packing changed,
the Module shall be baked before soldering.

Baking condition: 60°C, 24hours, 1time.

ESD Sensitivity:

ESD Protection: 2KV(HBM, Maximum rating)

The Module is a static-sensitive electronic device.

Do not operate or store near strong electrostatic fields.

Take proper ESD precautions!



ESD CAUTION