



# **BL-M8731BS1-Q**

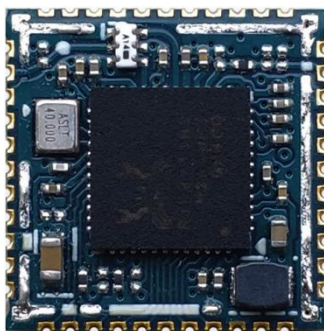
**802.11n 72.2Mbps WLAN**

**SDIO Module Specification**

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(Top View)



(Bottom View)

Note: BL-M8731BS1-Q and BL-M8733BS1 share PCB design

|                                                      |       |
|------------------------------------------------------|-------|
| Module Name: BL-M8731BS1-Q                           |       |
| Module Type: 802.11a/b/g/n 72.2Mbps WLAN SDIO Module |       |
| Revision: V1.0                                       |       |
| Customer Approval:                                   |       |
| Company:                                             |       |
| Title:                                               |       |
| Signature:                                           | Date: |
| LB-link Approval:                                    |       |
| Title:                                               |       |
| Signature:                                           | Date: |

## Revision History

| Revision | Summary          | Release Date |
|----------|------------------|--------------|
| 0.1      | Initial release  | 2023-01-10   |
| 1.0      | Official release | 2023-02-24   |
|          |                  |              |

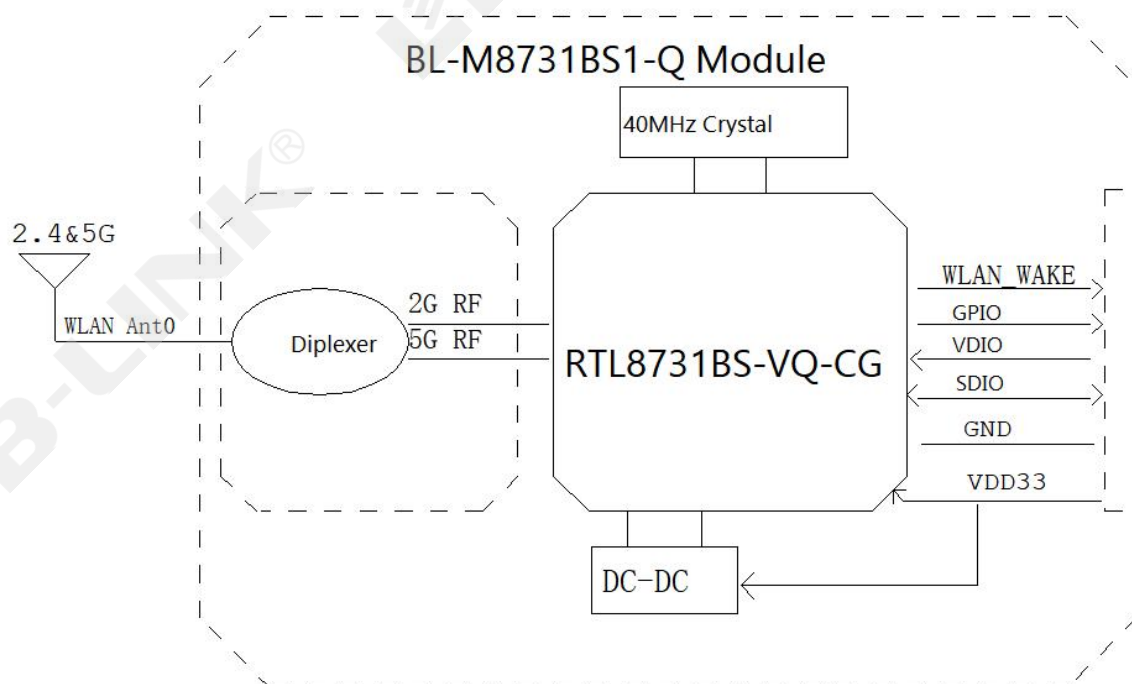
## 1. Introduction

BL-M8731BS1-Q is a highly integrated dual-band WLAN module base on RTL8731BS-VQ-CG, which combines WLAN MAC, 1T1R Baseband and Radio in single chip. It compatible IEEE 802.11a/b/g/n standard and supports Maximum PHY rate up to 72.2Mbps. The module provides excellent WLAN performance and lower cost ideal for wireless network applications such as set-top boxes, OTT boxes, projectors.

### 1.1 Features

- Operating Frequencies: 2.4~2.4835GHz or 5.15~5.85GHz
- Host Interface: SDIO 2.0 for WLAN
- IEEE Standard: IEEE 802.11a/b/g/n
- Wireless PHY rate can reach up to 72.2Mbps
- Power Supply: 3.3V main power and 1.8V/3.3V I/O power

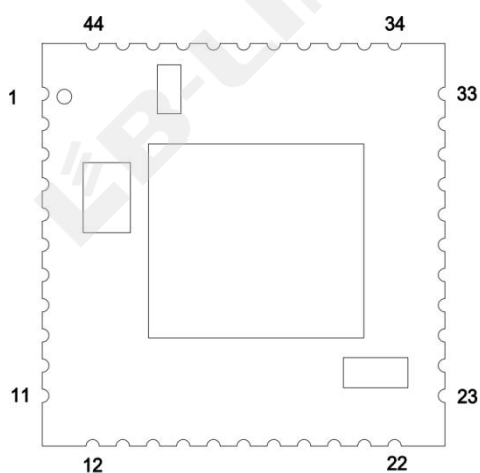
### 1.2 Block Diagram



## 1.3 General Specifications

|                       |                                                                           |
|-----------------------|---------------------------------------------------------------------------|
| Module Name           | BL-M8731BS1-Q                                                             |
| Chipset               | RTL8731BS-VQ-CG                                                           |
| WLAN Standards        | IEEE802.11 a/b/g/n                                                        |
| Host Interface        | SDIO 2.0 for WLAN                                                         |
| Antenna               | Connect to the external antenna through half hole                         |
| Dimension             | 12.0*12.0*1.90mm (L*W*H)                                                  |
| Power Supply          | DC 3.3V±0.2V @ 800 mA (Max)<br>DC 3.3V±0.2V or 1.8V±0.1V I/O power supply |
| 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 connections          |
| 2  | WLAN ANT | RF   |           | 2.4G / 5G RF PAD for WLAN_ANT0 |
| 3  | GND      | RF   |           | RF Ground connections          |

|    |                    |     |      |                                                                                                                                                                                                                                                                                                                                                                              |
|----|--------------------|-----|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 4  | NC                 | /   |      | NC                                                                                                                                                                                                                                                                                                                                                                           |
| 5  | NC                 | /   |      | NC                                                                                                                                                                                                                                                                                                                                                                           |
| 6  | GPIO11             | I   | VDIO | General Purpose Input / Output Pin GPIO11                                                                                                                                                                                                                                                                                                                                    |
| 7  | GPIO12             | O   | VDIO | General Purpose Input / Output Pin GPIO12                                                                                                                                                                                                                                                                                                                                    |
| 8  | NC                 | /   |      | NC                                                                                                                                                                                                                                                                                                                                                                           |
| 9  | VDD33              | P   |      | 3.3V Main power supply                                                                                                                                                                                                                                                                                                                                                       |
| 10 | NC                 | /   |      | NC                                                                                                                                                                                                                                                                                                                                                                           |
| 11 | NC                 | /   |      | NC                                                                                                                                                                                                                                                                                                                                                                           |
| 12 | WL_DSI#            | I   | VDIO | General Purpose Input / Output Pin GPIO13<br>This pin can externally shut down WLAN function when WL DIS# is pulled low, and SDIO interface will be also disabled. It can also be configured as the WLAN Radio-off function with host interface remaining connected. There is no pull-up resistor inside the module and high level input is required to enable WLAN function |
| 13 | WLAN_WAKE_H<br>OST | O   | VDIO | General Purpose Input / Output Pin GPIO14<br>This pin is used by WLAN to wake up the host when the remote wake function is enabled. The polarity can be defined by the customer                                                                                                                                                                                              |
| 14 | SD_D2              | I/O | VDIO | SDIO data line 2                                                                                                                                                                                                                                                                                                                                                             |
| 15 | SD_D3              | I/O | VDIO | SDIO data line 3                                                                                                                                                                                                                                                                                                                                                             |
| 16 | SD_CMD             | I/O | VDIO | SDIO command line                                                                                                                                                                                                                                                                                                                                                            |
| 17 | SD_CLK             | I   | VDIO | SDIO clock line                                                                                                                                                                                                                                                                                                                                                              |
| 18 | SD_D0              | I/O | VDIO | SDIO data line 0                                                                                                                                                                                                                                                                                                                                                             |
| 19 | SD_D1              | I/O | VDIO | SDIO data line 1                                                                                                                                                                                                                                                                                                                                                             |
| 20 | GND                | P   |      | Ground connections                                                                                                                                                                                                                                                                                                                                                           |
| 21 | NC                 | /   |      | NC                                                                                                                                                                                                                                                                                                                                                                           |
| 22 | VDIO               | P   |      | 1.8V or 3.3V power supply for digital I/O                                                                                                                                                                                                                                                                                                                                    |
| 23 | NC                 | /   |      | NC                                                                                                                                                                                                                                                                                                                                                                           |
| 24 | SUSCLK_IN          | I   | VDIO | Shared with GPIO14. External 32K or RTC clock input                                                                                                                                                                                                                                                                                                                          |
| 25 | GPIO1              | O   | VDIO | General Purpose Input / Output Pin GPIO1<br>Strap Pin, internal pull low by 100K resistor to set internal 1.2V supply "SPS_Mode", the Module enter into "LDO_Mode" (More power consumption) when it pulled high, do not pull High during power on!                                                                                                                           |
| 26 | GPIO3              | I/O | VDIO | General Purpose Input / Output Pin GPIO3                                                                                                                                                                                                                                                                                                                                     |
| 27 | GPIO0              | I   | VDIO | 1. General Purpose Input / Output Pin GPIO0<br>2. Strap Pin, internal pull low to set "Normal operation mode", the Module enter into "Test/Debug mode" (Can't work properly) when it pulled high, do not pull High during                                                                                                                                                    |

|    |        |     |      |                                                                                                                                                                                                                                            |
|----|--------|-----|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|    |        |     |      | power on!                                                                                                                                                                                                                                  |
| 28 | GPIO2  | I/O | VDIO | 1. General Purpose Input / Output Pin GPIO2<br>2. Strap Pin, internal pull low to set "Internal NV memory mode ", the Module enter into "External EPROM mode" (Can't work properly) when it pulled high, do not pull High during power on! |
| 29 | NC     | /   |      | NC                                                                                                                                                                                                                                         |
| 30 | NC     | /   |      | NC                                                                                                                                                                                                                                         |
| 31 | GND    | P   |      | RF Ground connections                                                                                                                                                                                                                      |
| 32 | NC     | /   |      | NC                                                                                                                                                                                                                                         |
| 33 | GND    | P   |      | RF Ground connections                                                                                                                                                                                                                      |
| 34 | GPIO6  | I   | VDIO | General Purpose Input / Output Pin GPIO6                                                                                                                                                                                                   |
| 35 | NC     | /   |      | NC                                                                                                                                                                                                                                         |
| 36 | GND    | P   |      | Ground connections                                                                                                                                                                                                                         |
| 37 | NC     | /   |      | NC                                                                                                                                                                                                                                         |
| 38 | NC     | /   |      | NC                                                                                                                                                                                                                                         |
| 39 | NC     | /   |      | NC                                                                                                                                                                                                                                         |
| 40 | NC     | /   |      | NC                                                                                                                                                                                                                                         |
| 41 | GND    | P   |      | Ground connections                                                                                                                                                                                                                         |
| 42 | GPIO8  | I   | VDIO | General Purpose Input / Output Pin GPIO8                                                                                                                                                                                                   |
| 43 | GPIO9  | I   | VDIO | General Purpose Input / Output Pin GPIO9                                                                                                                                                                                                   |
| 44 | GPIO10 | I   | VDIO | General Purpose Input / Output Pin GPIO10                                                                                                                                                                                                  |

P: Power, I: Input, O: Output, I/O: In/Output, RF: Analog RF Port

### 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 | 2.1  | /     |
| Supply Voltage                | VDD33 | 3.1  | 3.3 | 3.5  | V     |
|                               | VDIO  | 1.62 | 1.8 | 1.98 | V     |
|                               |       | 3.1  | 3.3 | 3.5  | V     |

### 3.2 Digital 3.3V I/O DC Specifications

| Symbol | Parameter           | Min  | Typ | Max  | Units |
|--------|---------------------|------|-----|------|-------|
| VIH    | Input High Voltage  | 2.0  | 3.3 | 3.6  | V     |
| VIL    | Input Low Voltage   | --   | 0   | 0.5  | V     |
| VOH    | Output High Voltage | 2.97 | 3.3 | 3.6  | V     |
| VOL    | Output Low Voltage  | 0    | --  | 0.33 | V     |

### 3.3 Digital 1.8V I/O DC Specifications

| Symbol | Parameter           | Min  | Typ | Max  | Units |
|--------|---------------------|------|-----|------|-------|
| VIH    | Input High Voltage  | 1.3  | 1.8 | 2.0  | V     |
| VIL    | Input Low Voltage   | --   | 0   | 0.3  | V     |
| VOH    | Output High Voltage | 1.62 | --  | 1.98 | V     |
| VOL    | Output Low Voltage  | 0    | --  | 0.18 | V     |

### 3.4 Current Consumption

| Conditions : VDD33=3.3V ; Ta:25°C                |                         |                          |       |
|--------------------------------------------------|-------------------------|--------------------------|-------|
| Use Case                                         | VDD33 Current           |                          |       |
|                                                  | Typ (I <sub>RMS</sub> ) | Max (I <sub>Peak</sub> ) | Units |
| 2.4G WLAN 72.2Mbps Web browsing (Linux Driver)   | 110                     | 400                      | mA    |
| 5G WLAN 72.2Mbps Web browsing (Linux Driver)     | 110                     | 400                      | mA    |
| 2.4G WLAN TCP throughput TX 50Mbps (Linux Drive) | 230                     | 440                      | mA    |
| 2.4G WLAN TCP throughput RX 50Mbps (Linux Drive) | 110                     | 500                      | mA    |
| 5G WLAN TCP throughput TX 50Mbps (Linux Drive)   | 310                     | 520                      | mA    |
| 5G WLAN TCP throughput RX 50Mbps (Linux Drive)   | 154                     | 400                      | mA    |
| 2.4G 11b 1Mbps TX @20dBm(RF-Test)                | 520                     | 624                      | mA    |
| 2.4G 11b 11Mbps TX @20dBm(RF-Test)               | 510                     | 656                      | mA    |
| 2.4G 11g 6Mbps TX @20dBm(RF-Test)                | 437                     | 712                      | mA    |
| 2.4G 11g 54Mbps TX@19dBm (RF-Test)               | 237                     | 616                      | mA    |
| 2.4G 11n HT20_MCS7 TX@18dBm (RF-Test)            | 389                     | 736                      | mA    |
| 5G 11a 6Mbps TX@19dBm (RF-Test)                  | 466                     | 760                      | mA    |
| 5G 11a 54Mbps TX@17dBm (RF-Test)                 | 260                     | 680                      | mA    |

|                                     |     |     |    |
|-------------------------------------|-----|-----|----|
| 5G 11n HT20_MCS0 TX @18dBm(RF-Test) | 457 | 744 | mA |
| 5G 11n HT20_MCS7 TX @16dBm(RF-Test) | 237 | 584 | mA |
| 2.4G 11n@HT20_MCS7 RX (RF-Test)     | 78  | 80  | mA |
| 5G 11n@HT20_MCS7 RX (RF-Test)       | 78  | 80  | mA |

## 4. WLAN RF Specifications

### 4.1 2.4G WLAN RF Specification

| Conditions : VDD33=3.3V ; Ta:25°C                                                                                                                                                           |                                                                                                                              |                          |          |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|--------------------------|----------|
| 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): CCK, DQPSK, DBPSK;<br>802.11g (OFDM): BPSK, QPSK, QAM16, QAM64;<br>802.11n (OFDM): BPSK, QPSK, QAM16, QAM64; |                          |          |
| Date Rate                                                                                                                                                                                   | 802.11b: 1, 2, 5.5, 11Mbps;<br>802.11g: 6, 9, 12, 18, 24, 36, 48, 54Mbps;<br>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 within recommended range by modifying configuration file of the driver software ) |                                                                                                                              |                          |          |
| TX Rate                                                                                                                                                                                     | Recommended Target TX Power ≡ (dBm)                                                                                          | TX Power Tolerance (dBm) | EVM (dB) |
| 802.11b@1~11Mbps                                                                                                                                                                            | 20                                                                                                                           | ±2                       | ≤-10     |
| 802.11g@6Mbps                                                                                                                                                                               | 20                                                                                                                           | ±2                       | ≤-15     |
| 802.11g@54Mbps                                                                                                                                                                              | 19                                                                                                                           | ±2                       | ≤-25     |
| 802.11n@HT20_MCS0                                                                                                                                                                           | 20                                                                                                                           | ±2                       | ≤-15     |
| 802.11n@HT20_MCS7                                                                                                                                                                           | 18                                                                                                                           | ±2                       | ≤-28     |
| 2.4G Receiver Specifications                                                                                                                                                                |                                                                                                                              |                          |          |
| RX Rate                                                                                                                                                                                     | Min Input Level (Typ)                                                                                                        | Max Input Level (Typ)    | PER      |
| 802.11b@1Mbps                                                                                                                                                                               | -95dBm                                                                                                                       | -10dBm                   | < 8%     |
| 802.11b@11Mbps                                                                                                                                                                              | -86dBm                                                                                                                       | -10dBm                   | < 8%     |
| 802.11g@6Mbps                                                                                                                                                                               | -89dBm                                                                                                                       | -10dBm                   | < 10%    |
| 802.11g@54Mbps                                                                                                                                                                              | -73dBm                                                                                                                       | -10dBm                   | < 10%    |
| 802.11n@HT20_MCS0                                                                                                                                                                           | -88dBm                                                                                                                       | -10dBm                   | < 10%    |

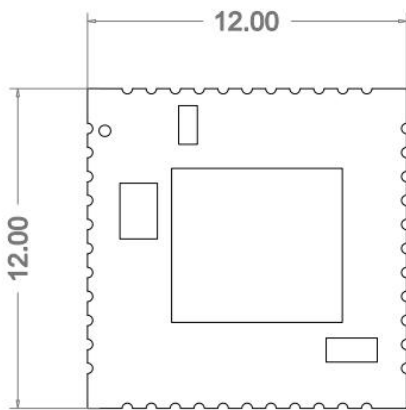
|                   |        |        |       |
|-------------------|--------|--------|-------|
| 802.11n@HT20_MCS7 | -70dBm | -10dBm | < 10% |
|-------------------|--------|--------|-------|

## 4.2 5G WLAN RF Specification

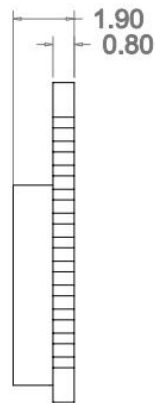
| Conditions : VDD33=3.3V ; Ta:25°C                                                                                                                                                         |                                                                                        |                          |          |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|--------------------------|----------|
| Features                                                                                                                                                                                  | Description                                                                            |                          |          |
| WLAN Standard                                                                                                                                                                             | IEEE 802.11a/n                                                                         |                          |          |
| Frequency Range                                                                                                                                                                           | 5.15~5.25GHz; 5.25~5.35GHz; 5.47~5.73GHz;<br>5.735~5.835GHz(5GHz ISM Band)             |                          |          |
| Channels                                                                                                                                                                                  | Ch36, Ch40, Ch44, Ch48; Ch52~Ch64;<br>Ch100~Ch140; Ch149~Ch165 (For 20MHz Channels)    |                          |          |
| Modulation                                                                                                                                                                                | 802.11a (OFDM): BPSK, QPSK, QAM16, QAM64;<br>802.11n (OFDM): BPSK, QPSK, QAM16, QAM64; |                          |          |
| Date Rate                                                                                                                                                                                 | 802.11a: 6, 9, 12, 18, 24, 36, 48, 54Mbps;<br>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 within recommended range by modifying configuration file of the driver software ) |                                                                                        |                          |          |
| TX Rate                                                                                                                                                                                   | Recommended Target TX Power ≡ (dBm)                                                    | TX Power Tolerance (dBm) | EVM (dB) |
| 802.11a@6Mbps                                                                                                                                                                             | 19                                                                                     | ±2                       | ≤-15     |
| 802.11a@54Mbps                                                                                                                                                                            | 17                                                                                     | ±2                       | ≤-25     |
| 802.11n@HT20_MCS0                                                                                                                                                                         | 18                                                                                     | ±2                       | ≤-15     |
| 802.11n@HT20_MCS7                                                                                                                                                                         | 16                                                                                     | ±2                       | ≤-28     |
| 5G Receiver Specifications                                                                                                                                                                |                                                                                        |                          |          |
| RX Rate                                                                                                                                                                                   | Min Input Level (Typ)                                                                  | Max Input Level (Typ)    | PER      |
| 802.11a@6Mbps                                                                                                                                                                             | -92dBm                                                                                 | -10dBm                   | < 10%    |
| 802.11a@54Mbps                                                                                                                                                                            | -73dBm                                                                                 | -10dBm                   | < 10%    |
| 802.11n@HT20_MCS0                                                                                                                                                                         | -90dBm                                                                                 | -10dBm                   | < 10%    |
| 802.11n@HT20_MCS7                                                                                                                                                                         | -70dBm                                                                                 | -10dBm                   | < 10%    |

## 5. Mechanical Specifications

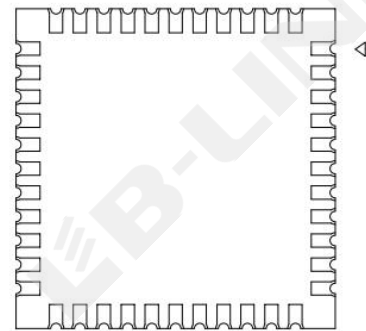
### 5.1 Module Outline Drawing



(Top View)

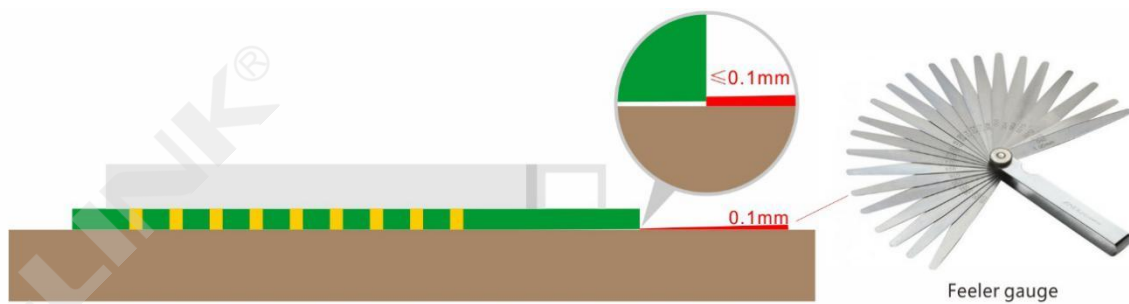


(Side View)



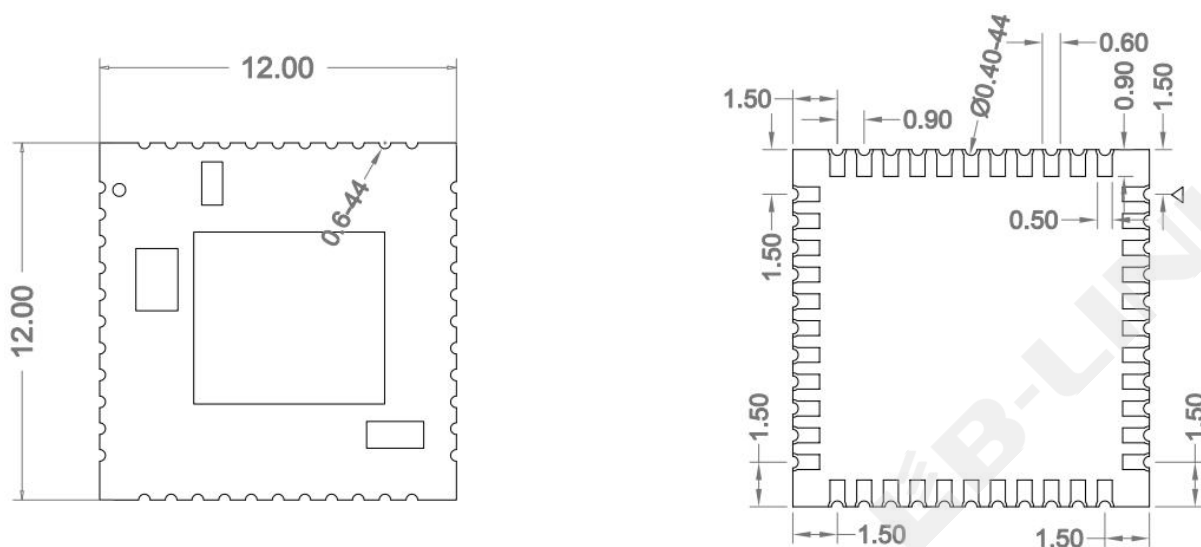
(Bottom View)

Module dimension: 12.0\*12.0\*1.90mm (L\*W\*H; Tolerance:  $\pm 0.15$ mm)



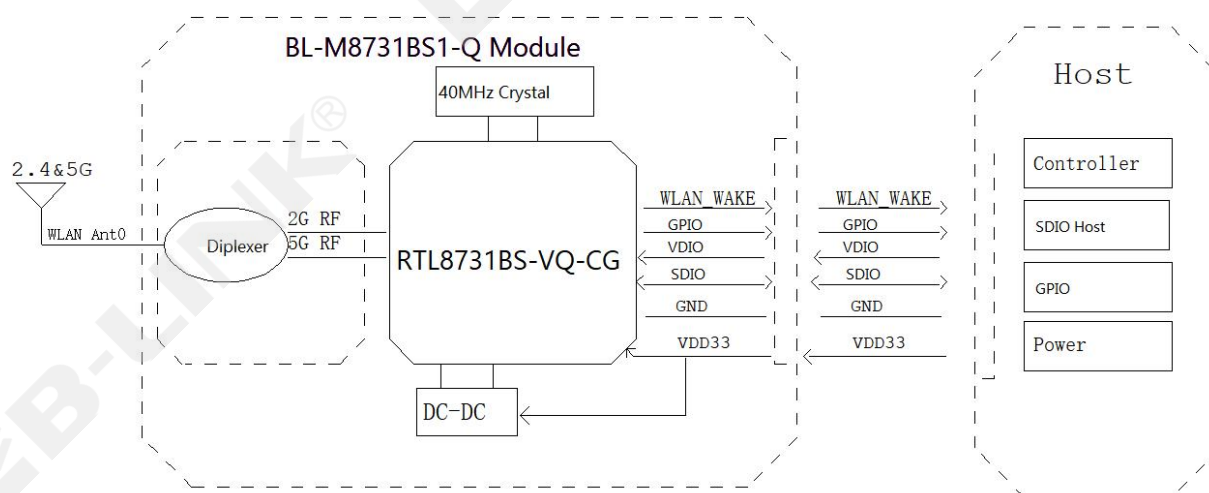
Module Bow and Twist:  $\leq 0.1$ mm

## 5.2 Mechanical Dimensions

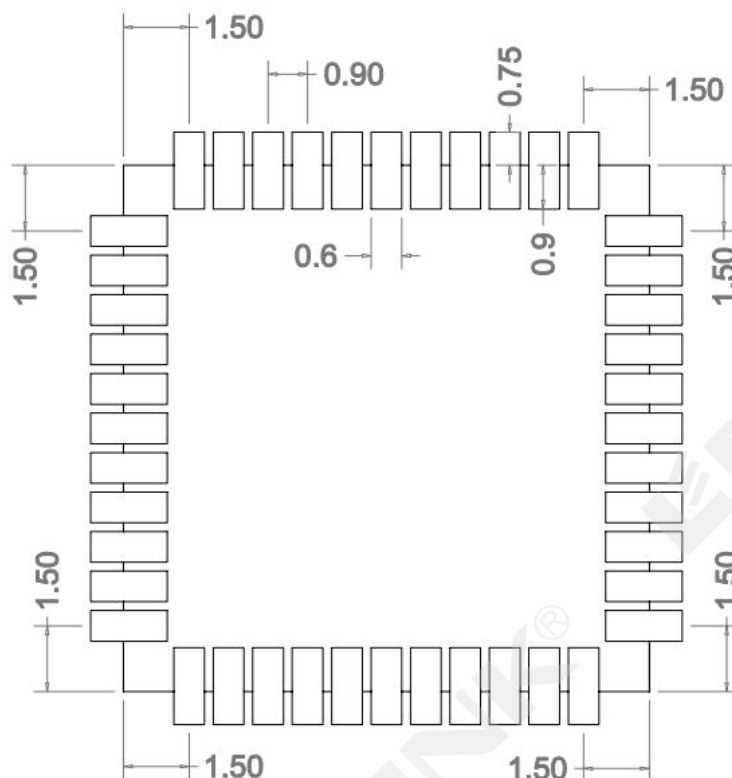


## 6. Application Information

### 6.1 Typical Application Circuit

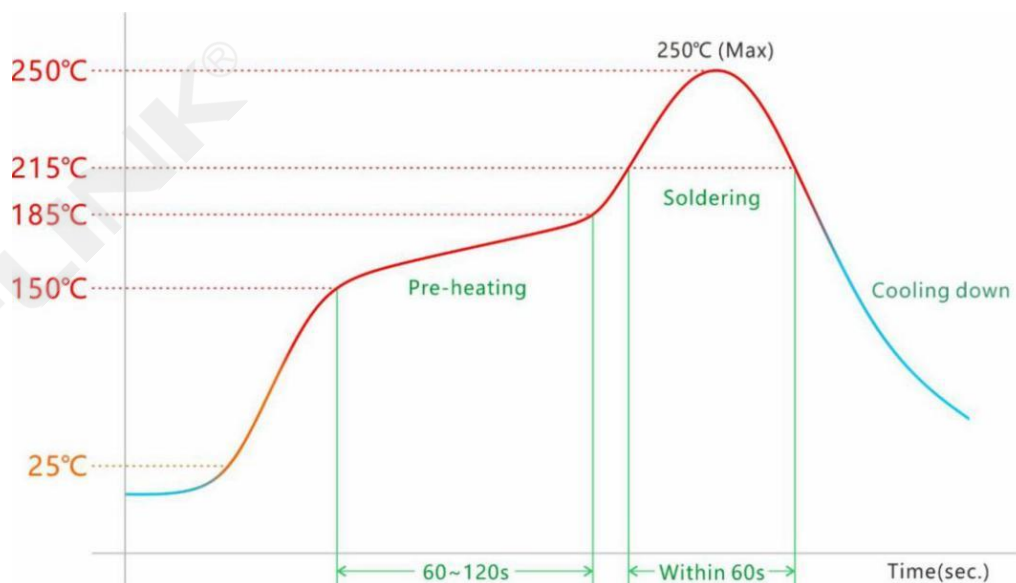


## 6.2 Recommend PCB Layout Footprint



Design size: mm

## 6.3 Reflow Soldering Standard Conditions



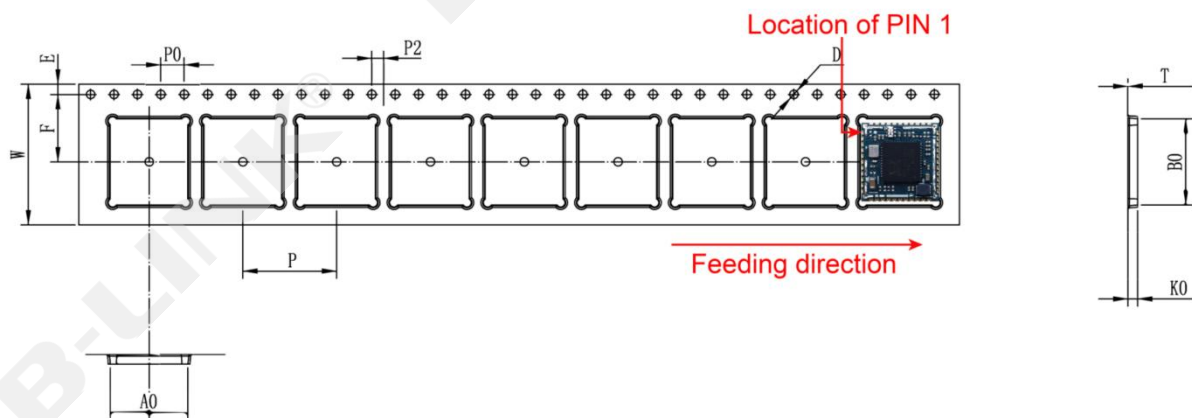
Please use the reflow within 2 times.  
Set up the highest temperature within 250°C.

## 7. Key Components Of Module

| No. | Parts    | Specification   | Manufacturer                                      | Note |
|-----|----------|-----------------|---------------------------------------------------|------|
| 1   | Chipset  | RTL8731BS-VQ-CG | Realtek CO., Ltd                                  |      |
| 2   | PCB      | BL-M8733BS1     | Shenzhen Tie Fa Technology Limited                |      |
|     |          |                 | Guangdong KING SHINE Technology CO., Ltd          |      |
|     |          |                 | Quzhou Sunlord Electronics Co., Ltd               |      |
|     |          |                 | Shenzhen Qi Li Electron CO., Ltd                  |      |
| 3   | Crystal  | 40MHz           | Shenzhen Kaiyuexiang Electronics Co., Ltd         |      |
|     |          |                 | Lucki Electronics Co., Ltd                        |      |
|     |          |                 | Chengde Oscillator Electronic Technology Co., Ltd |      |
| 4   | Diplexer | DP1608          | Walsin Technology Corporation                     |      |
|     |          |                 | TDK China Co., Ltd                                |      |
|     |          |                 | FTR Technology Corporation                        |      |

## 8. Package and Storage Information

### 8.1 Package Dimensions



| ITEM | W         | A0        | B0        | K0       | E        | F        | P         | P0       | P2       | D        | T         |
|------|-----------|-----------|-----------|----------|----------|----------|-----------|----------|----------|----------|-----------|
| DIM  | 24.00±0.3 | 12.50±0.1 | 12.50±0.1 | 2.40±0.1 | 1.75±0.1 | 11.5±0.1 | 20.00±0.1 | 4.00±0.1 | 2.00±0.1 | Ø1.5±0.1 | 0.30±0.05 |



## 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% RH (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**