BroadLink World's leading smart home solution provider

BL5027-P/EL5027-P Combo Module

Product

Version：1.3 Release date： 27/9/2023

Features

- Cortex-M33+Cortex-M23 dual core
- 512KBSRAM/4MBpSRAM
- External 4MB FLASH
- Support XIP
- Support AES, MD5 and SHA1
- Working voltage: DC 5.0V
- Support BLE5.0
- Wi-Fi related features
  - Support 802.11 b/g/n standard
  - Support station and soft AP
  - Support SmartConfig and AP configuration
  - Support WEP/WPA2
  - Support multiple cloud services.
  - Integrated balun/PA/LNA
  - TCP/IP stack optimized for IoT application.
  - PCB antenna
- Peripherals:
  - 1x UART
- Working temperature: 0~ 85 ℃

Applications

- Smart transportation
- Smart home / appliances
- Instruments
- Health care
- Industrial automation
- Intelligent security
- Smart energy

Model

Model	Antenna	Note
BL5027-P	PCB antenna	Default
EL5027-P	PCB antenna	Default

Content

1. Overview

BL5027-P/EL5027-P is an embedded Wi-Fi module designed by BroadLink, highly integrated with Cortex-M33+Cortex-M23 dual core MCU with 512KB SRAM + 4MB pSRAM and 4MB external flash, with 5V power supply.

The module integrates radio transceiver, MAC, baseband, all Wi-Fi protocols, configurations, and network stack. It can be widely used in applications like smart home devices, remote monitoring devices and medical care instruments.

2. Basic Specifications

2.1. Power Consumption

Please refer to Table 1 for power consumption data.

Table 1 Power Consumption Data

Specifications	Min.	Typ.	Max.	Units
VDD	4.5	5	5.5	V
VIL (input low voltage)	0		0.4	V
VIH (input high voltage)	4		VDD	V
VOL (output low voltage)	0		0.4	V
VOH (output high voltage)	VDD-0.4		VDD	V
Standby (RX)		45		mA
pulse current @TX 11b @17dBm 11Mbps		260		mA
pulse current @TX 11g @15dBm 54Mbps		250		mA
pulse current @TX		245		mA

11n @14.5dBm 65Mbps				
pulse current @BLE @5.5dBm		125		

2.2. Working Environment

Please refer to Table 2 for working environment data.

Table 2 Working Environment Data

Symbol	Description	Min.	Max.	Units
Ts	Storage temperature	-40	125	℃
TA	Ambient operating temperature	0	85	℃
Vdd	Supply voltage	4.5	5.5	V
Vio	Voltage on IO pin	0	5.5	V

3. Radio Specifications

3.1. Basic Radio Specification

Please refer to Table 3 for radio specification.

Table 3 Radio Specification

Radio range	2.402 GHz - 2.480 GHz
Wireless standards	IEEE 802.11 b/g/n
Radio output (conductive)	802.11b:15.5±1.5dBm@11Mbps
	802.11g:14.5±1.5dBm@54Mbps
	802.11n:14.5±1.5dBm@MCS7/HT20
	BLE: 2.5±2.5dBm
Antenna type	Internal: PCB antenna
	External: Not supported
Receiving sensitivity	802.11b≦-90dBm@11Mbps

	802.11g≦-76dBm@54Mbps
	802.11n/HT20≦-73dBm@MCS7
	BLE ≦- 97dBm
Stack	IPv4, TCP/UDP/FTP/HTTP/HTTPS/TLS/mDNS
Data rate (max)	11M@802.11b, 54M@802.11g, MCS7@802.11n
Security	Encryption standard: Open/WEP-Open/WPA/WPA2
	Encryption algorithm: WEP64/WEP128/TKIP/AES
Network types	STA/AP

3.2. Radio Performance

3.2.1 IEEE802.11b

Table 4 Basic specifications under IEEE802.11b

ITEM	**Specification**
Modulation Type	DSSS / CCK
Frequency range	2412MHz~2462MHz
Channel	CH1 to CH11
Data rate	1, 2, 5.5, 11Mbps

Table 5 Transmitting performance under IEEE802.11b

TX Characteristics	Min.	Typical	Max.	Unit
Power@11Mbps		**17**		dBm
Frequency Error	**-15**		**+15**	ppm
EVM@11Mbps			**-14**	dB
Transmit spectrum mask				
Pass				

Table 6 Receiving performance under IEEE802.11b

RX Characteristics	Min.	Typical	Max.	Unit
11Mbps Input Level Sensitivity				
Minimum Input Level (FER≦ 8%)			**-90**	dBm

3.2.2. IEEE 802.11g

Table 7 Basic specifications under IEEE802.11g

ITEM	**Specification**
Modulation Type	OFDM
Frequency range	2412MHz~2462MHz
Channel	CH1 to CH11
Data rate	6, 9, 12, 18, 24, 36, 48, 54Mbps

Table 8 Transmitting performance under IEEE802.11g

TX Characteristics	Min.	Typical	Max.	Unit
Power@54Mbps		**16**		dBm
Frequency Error	**-15**		**+15**	ppm
EVM@54Mbps			-30	dB
Transmit spectrum mask				
Pass				

Table 9 Receiving performance under IEEE802.11g

RX Characteristics	Min.	Typical	Max.	Unit
54Mbps Input Level Sensitivity				
Minimum Input Level (FER≦10%)			**-76**	dBm

3.2.3 IEEE802.11n

IEEE802.11n 20MHz bandwidth mode

Table 10 Basic specifications under IEEE802.11n with 20MHz

ITEM	**Specification**
Modulation Type	OFDM
Frequency range	2412MHz~2462MHz
Channel	CH1 to CH11
Data rate	MCS0/1/2/3/4/5/6/7

Table 11 Transmitting performance under IEEE802.11n with 20MHz

TX Characteristics	Min.	Typical	Max.	Unit
Power@HT20, MCS7		**16**		dBm
Frequency Error	**-15**		**+15**	ppm
EVM@HT20, MCS7			**-30**	dB
Transmit spectrum mask				
Pass				

Table 12 Receiving performance under IEEE802.11n with 20MHz

RX Characteristics	Min .	Typical	Max.	Unit
MCS7 Input Level Sensitivity				
Minimum Input Level (FER≦10%)			**-73**	dBm

4. Hardware Information

4.1. PIN Sequence

Please refer to Fig 1 for the pin sequence.

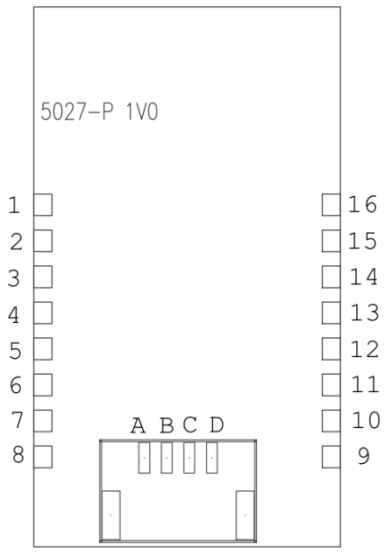


Fig 1 Pin Sequence (TOP VIEW)

4.2. PIN Definitions

Please refer to Table 13 for pin definitions.

Pin	Definitions	Note
A	UART_TX_5V	Module UART TX; 5V level
B	UART_RX_5V	Module UART RX; 5V level
C	VDD5	5V VCC
D	GND	
1	PA13	LP_UART_RX

2	PA19	HS_UART_RX
3	PA18	HS_UART_TX
4	NC	
5	VDD33	3.3V VCC
6	GND	
7	RST	HW reset, LV effective
8	NC	
9	PB31	GPIO
10	PA0	GPIO
11	PA4	GPIO
12	PA2	GPIO
13	NC	
14	PA8	UART_RX_LOG
15	PA7	UART_TX_LOG
16	PA12	LP_UART_TX

Table 13 BL5027-P pin definitions

Note:

1. Pin1~Pin16 can be used if the module is modified on hardware for 3.3V input.
2. LP_UART; HS_UART and UART_LOG only support 3.3V level.
3. UART_TX_5V, UART_TX_5V is used for communication with external MCU

powered by 5V. Please refer to the description in 1.1. 3. DC Characteristics for UART output current level.

4. DO NOT add current-limiting resistor in the circuit of UART_TX_5V and UART_RX_5V to avoid abnormal communication due to abnormal level conversion on chipset.
5. Pulling down PA7 will switch the module to firmware programming mode.

4.3 Recommendations

The following precautions should be considered during PCB designing:

It is recommended to not place any electrical components within 10mm range of module antenna and not design any circuit or bond copper on main board under this area.

Do not use the module inside any metal case or containers with metal painting.

4.4. Mechanical Dimensions

Please refer to Fig 3 for the dimensions of module.

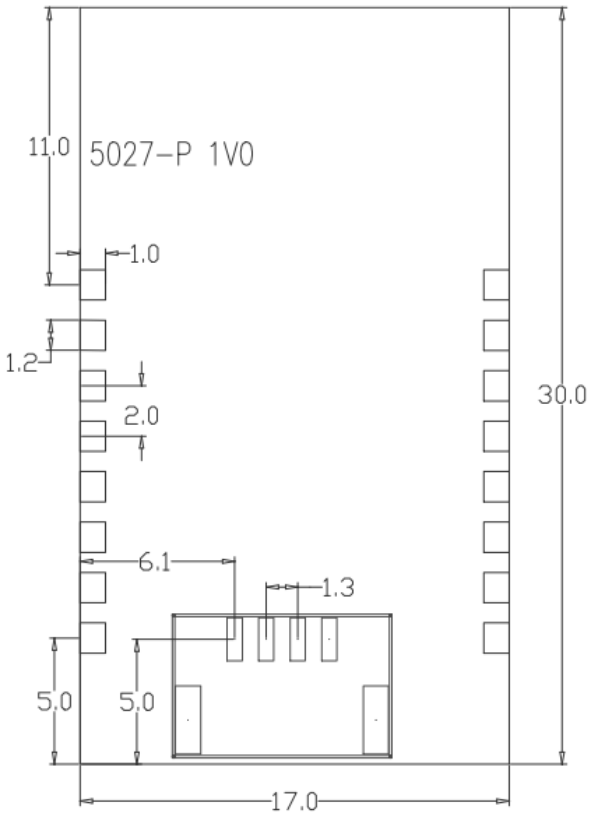
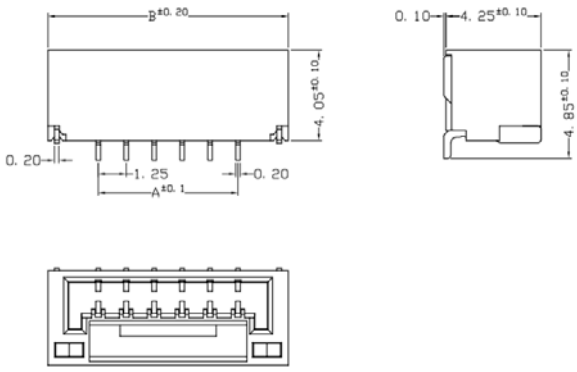


Fig 3 Module Dimensions

Note: Dimensions (17±0.2) mm * (30±0.2) mm * () mm (with shielding case)

4.5. Connector Dimensions

Please refer to Fig 4 for the dimensions of connector



4.6. Certifications

1. Certified for SRRC standard
2. Compliant with requirement of RoHS 2.0.
3. Compliant with requirement of REACH.

4.7. Label

To be updated

Fig 5 label content

Please refer to Fig 8 for the content description on label.

Model: *******: Module model

SN： : Serial Number, module unique MAC address

NOTE: Label for reference and may vary from actual spec.

4.7. Mechanical Dimensions

Please refer to Fig 6 for the dimensions of shielding case.

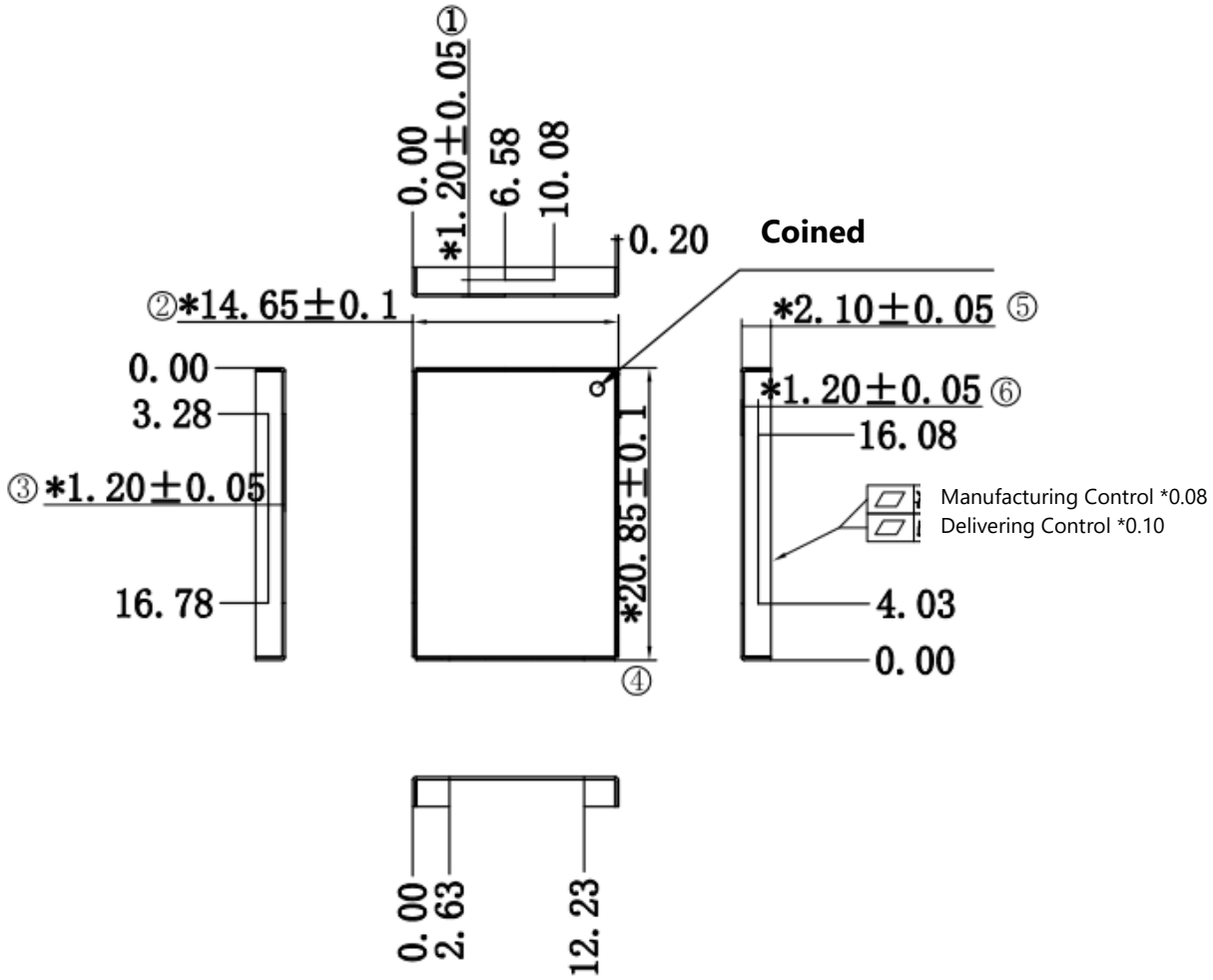


Fig 6 BL5027-P Dimensions of shielding case

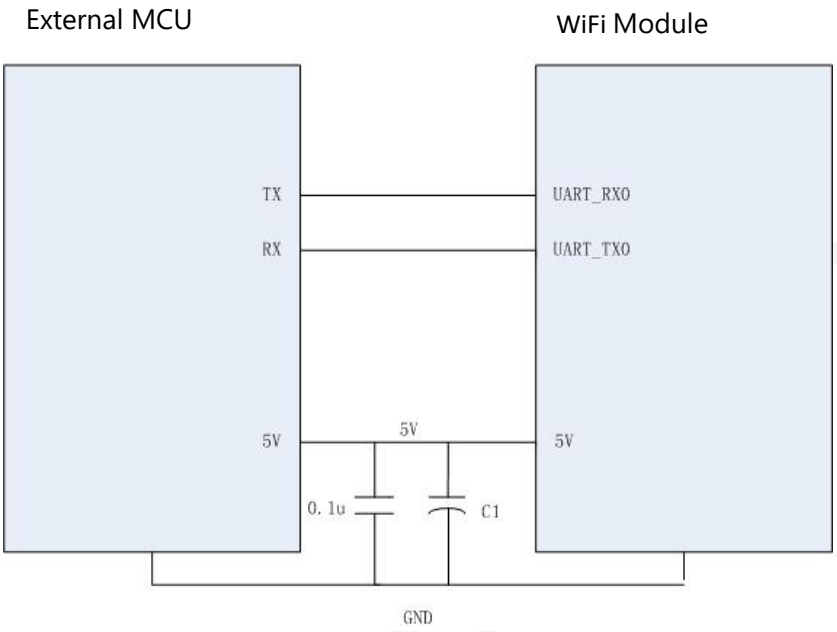
(Unit: mm)

4.8. Packaging

Electrostatic bag + honeycomb pallet box

5. Reference Design

5.1. UART Interface Design



For devices with 5V power supply, you can directly connect the device UART port with module UART port according to the illustration.

DO NOT add current-limiting resistor in the circuit of UART_TX_5V and UART_RX_5V to avoid abnormal communication due to abnormal level conversion on chipset.

5.2. Power Supply Requirement

Please ensure that the power supply can provide a sufficiently large current. During the DPD phase, the module will experience consecutive pulses with a duration of approximately 50us. It is recommended that the power supply be capable of providing a

pulse current of at least 600mA. During the normal operation of the module in the data transmission phase, the power supply should be able to sustain a current of at least 400mA.

You can change the spec of capacitor at C1 according to actual hardware design to fit the needs for ripple control (recommended to apply capacitance higher than 22uF)

List of applicable FCC rules

FCC Part 15.247

Label and compliance information

FCC ID label on the final system must be labeled with “Contains FCC ID: 2ATEV-BL5027-P” or “Contains transmitter module FCC ID: 2ATEV-BL5027-P”.

Information on test modes and additional testing requirements

Contact Hangzhou BroadLink Technology Co., Ltd will provide stand-alone modular transmitter test mode. Additional testing and certification may be necessary when multiple modules are used in a host.

Additional testing, Part 15 Subpart B disclaimer

To ensure compliance with all non-transmitter functions the host manufacturer is responsible for ensuring compliance with the module(s) installed and fully operational. For example, if a host was previously authorized as an unintentional radiator under the Supplier’s Declaration of Conformity procedure without a transmitter certified module and a module is added, the host manufacturer is responsible for ensuring that the after the module is installed and operational the host continues to be compliant with the Part 15B unintentional radiator requirements. Since this may depend on the details of how the module is integrated with the host, Hangzhou BroadLink Technology Co., Ltd. shall provide guidance to the host manufacturer for compliance with the Part 15B requirements.

FCC Warning

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

FCC Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. End users must follow the specific operating instructions for satisfying RF exposure compliance.

Note 1: This module certified that complies with RF exposure requirement under mobile or fixed condition, this module is to be installed only in mobile or fixed

applications.

A mobile device is defined as a transmitting device designed to be used in other than fixed locations and to generally be used in such a way that a separation distance of at least 20 centimeters is normally maintained between the transmitter's radiating structure(s) and the body of the user or nearby persons. Transmitting devices designed to be used by consumers or workers that can be easily re-located, such as wireless devices associated with a personal computer, are considered to be mobile devices if they meet the 20 centimeter separation requirement.

A fixed device is defined as a device is physically secured at one location and is not able to be easily moved to another location.

Note 2: Any modifications made to the module will void the Grant of Certification, this module is limited to OEM installation only and must not be sold to end-users, end-user has no manual instructions to remove or install the device, only software or operating procedure shall be placed in the end-user operating manual of final products.

Note 3: The module may be operated only with the antenna with which it is authorized. Any antenna that is of the same type and of equal or less directional gain as an antenna that is authorized with the intentional radiator may be marketed with, and used with, that intentional radiator.

Note 4: For all products market in US, OEM has to limit the operation channels in CH1 to CH11 for 2.4G band by supplied firmware programming tool. OEM shall not supply any tool or info to the end-user regarding to Regulatory Domain change.

IC WARNING

This device contains licence-exempt transmitter(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:
(1) This device may not cause interference.
(2) This device must accept any interference, including interference that may cause undesired operation of the device.

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:
1. L'appareil ne doit pas produire de brouillage;

2. L’appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d’en compromettre le fonctionnement.

IC Radiation Exposure Statement:

This device and its antenna(s) must not be co-located with any other transmitters except in accordance with IC multi-transmitter product procedures. Referring to the multi-transmitter policy, multiple-transmitter(s) and module(s) can be operated simultaneously without reassessment permissive change.

Cet appareil et son antenne (s) ne doit pas être co-localisés ou fonctionnement en association avec une autre antenne ou transmetteur.

This equipment complies with IC RSS-102 radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

Cet équipement est conforme aux limites d'exposition aux rayonnements IC établies pour un environnement non contrôlé. Cet équipement doit être installé et utilisé avec un minimum de 20cm de distance entre la source de rayonnement et votre corps.

This module is limited to OEM installation only and must not be sold to end-users, end-user has no manual instructions to remove or install the device, only software or operating procedure shall be placed in the end-user operating manual of final products. Additional testing and certification may be necessary when multiple modules are used.

Any changes or modifications not expressly approved by the manufacturer could void the user's authority to operate this equipment.

The final end product must be labeled in a visible area with the following " Contains IC: 25062-BL5027P ".

Revision History

Date	Version	Updated Content
6/26/2023	1.0	Preliminary version
6/30/2023	1.1	Updated the value of VIH and added important notice for using 5V UART
7/4/2023	1.2	Updated the value of VIH, changed the power supply requirement, added the current consumption when sending BLE packets, added size of shielding case and added support of XIP
27/9/2023	1.3	Add instructions for entering download mode

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