DATASHEET

B861/B862-AB1122

Bluetooth 4.2 Dual Mode Module

Specification

VERSION 0.2 14-Apr-2016

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Airoha Technology Corp.

Revision History

Version	Change Summary	Date	Author
0.0	Created	Jan, 25th, 16	YenChih Shen
0.1	modify Pin Definition (Figure 2-1) modify application schematic (Dry Battery 1.5V) add VREGOUT_MV Rated Output Current (Table 4-6)	Feb, 19th, 16	YenChih Shen
0.2	modify Pin Definition (Figure 2-1) modify application schematic delete Low-Voltage Switching Regulator (4.4.1) add VREGOUT_MV Rated Output Current (Table 4-5)	Apr, 19th, 16	ZhanLing

1 System Overview

1.1 General Description

B861 and B862 are the optimized bluetooth modules which integrates baseband, radio and flash memory for game controller, mobile payment, and wearable device applications. The difference between B861 and B862 are that the B861 module integrates the PCB antenna and the B862 module use external antenna. B861/B862 modules comply with Bluetooth version 4.2 with EDR and low energy functions. The embedded 8Mbit flash has high flexibility for customer software development. The support of 10 AIOs is used for the joystick for game controller application.

1.2 Features

- Bluetooth 4.2 dual mode (BT+BLE)
- Support EDR function
- HID profile version 1.1 compliant
- SPP profile version 1.2 compliant
- HOGP profile version 1.1 compliant
- Support LE data packet length extension
- Support LE secure connection
- Embedded 80251 MCU with 12/24MHz clock rate
- Embedded 4Mbit Flash
- Multiple AIO and I/O pins for control and status
- Integrated 1.25V switching regulator and 1.8V/3V LDO regulator
- Integrated Li-ion battery charger supports 700mA fast charging
- Ultra low power consumption for battery enabled applications

1.3 Applications

- Mobile Point of Sales (mPOS)
- Sports and Fitness
- Health Care
- Smart Home
- Game Controller

1.4 Block Diagram

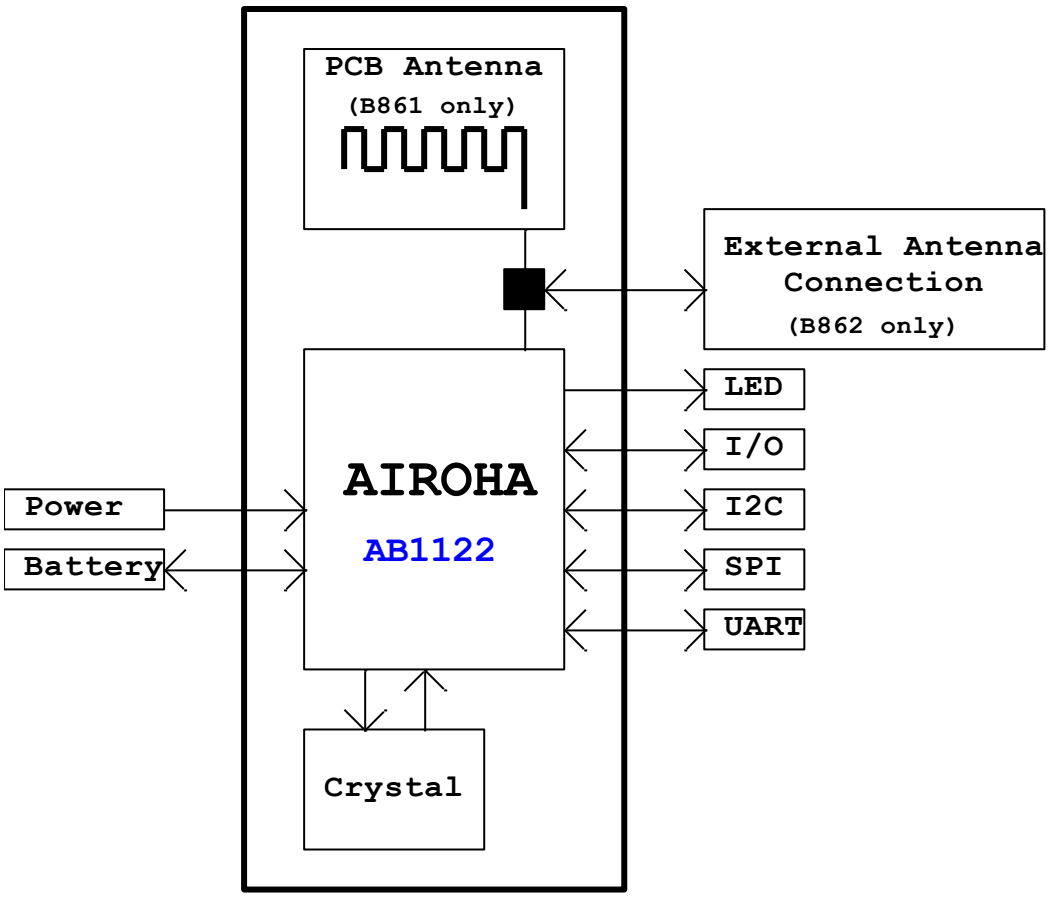


Figure 1-1 Block Diagram

2 Module Package Information

2.1 Module Pin Definition

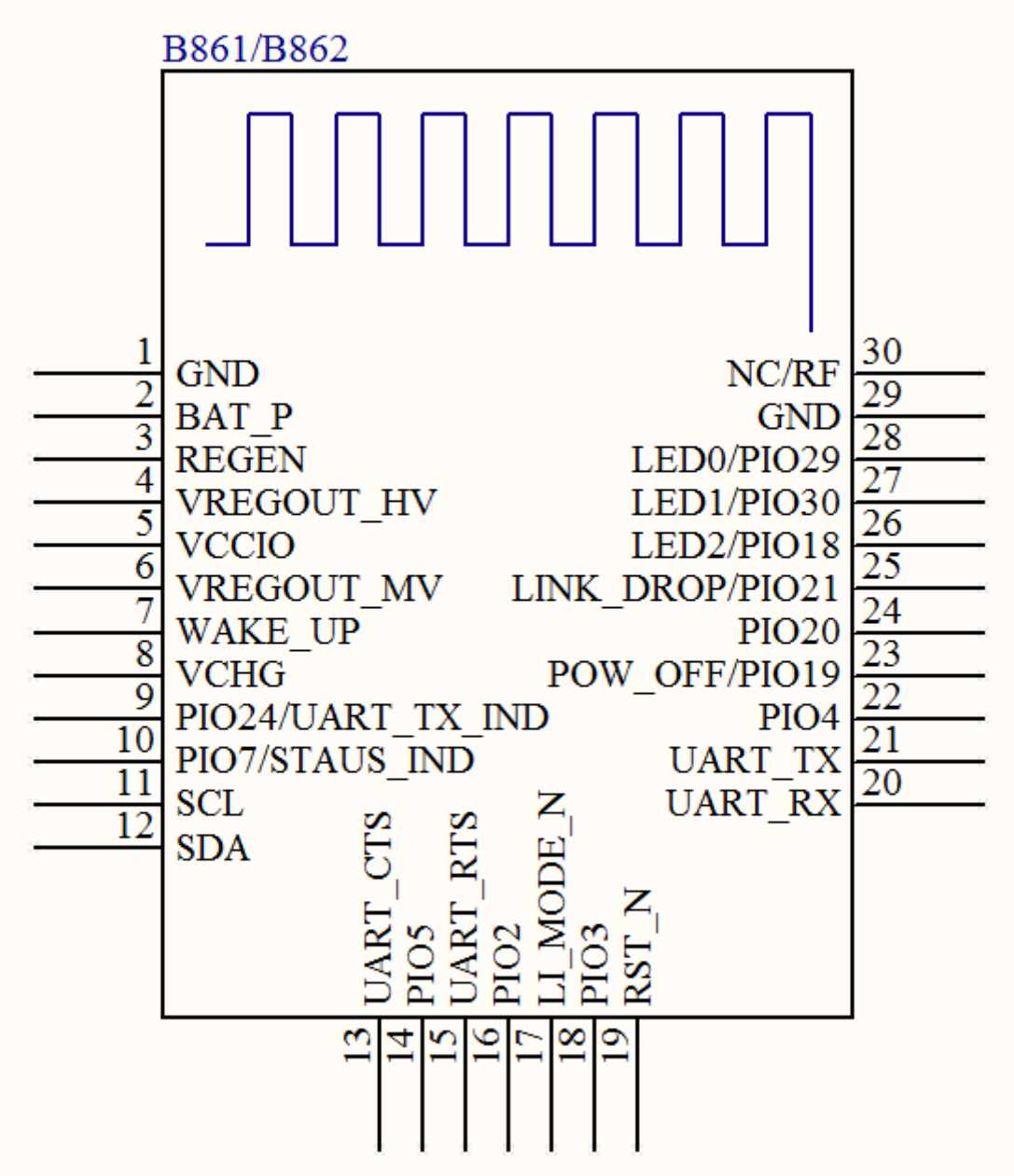


Figure 2-1 Pin Definition

2.2 Pin Description

PIN	SIGNAL	TYPE	DESCRIPTION	ALTERNATIVE
1	GND	Ground	Ground reference	
2	BAT_P	Supply	Battery input P, as Switching/Linear regulator input	
3	REGEN	Input only, Digital	Regulator enable： H：Enable internal LDO L：Disenable internal LDO	
4	VREGOUT_HV	Analog	3.0V LDO output	
5	VCCIO	Supply, 1.8V~3.3V	VCC for IO	
6	VREGOUT_MV	Analog	1.8V LDO output	
7	WAKE_UP	Input only, Digital	Wakeup B861 from Shutdown State (Low Active)	
8	VCHG	Supply, 5V	VCC for Charger	
9	PIO6/UART_TX_IND	Output only, Digital	UART_TX_IND: B861 indicate UART data will be transmitted out after a certain timing.	
10	PIO7/STATUS_IND	Output only, Digital	Bluetooth link status indication. H: Bluetooth is not connected L:Bluetooth is connected	
11	SCL	Input/Output, Digital	I2C clock line	
12	SDA	Input/Output, Digital	I2C data line	
13	UART_CTS	Output only, Digital	UART_CTS	
14	PIO5	Input/Output, Digital	Programmable IO	
15	UART_RTS	Input only, Digital	UART_RTS	
16	PIO2	Input only, Digital	System confiuration H:APP mode L: Command mode	
17	LI_MODE_N	Input only, Digital	Default Low	
18	PIO3	Input/Output, Digital	Programmable IO	
19	RST_N	Input only, Digital	Global reset, active low	
20	UART_RX	Input only, Digital	UART Rx data input	

21	UART_TX	Output only, Digital	UART Tx data output	
22	PIO4	Input/Output, Digital	Programmable IO	
23	PIO19/POWER_OFF	Input only, Digital	B861 will power off when this PIN detected more then 50ms low pulse (Default high level)	
24	PIO20	Input/Output, Digital	Programmable IO	
25	PIO21/LINK_DROP	Input only, Digital	B861 disconnect current link when this PIN detected more then 50ms low pulse and enter advertising (Default high level)	
26	LED2/PIO18	Input/Output, Digita	Programmable IO	
27	LED1/PIO30	Input/Output, Digita	Programmable IO	
28	LED0	Open Drain	LED 0 for Red Light	
29	GND	Ground	Ground reference	
30	NC/RF	NC/AIO	B861: No connection B862: External antenna connection (50 ohm)	

Table 2-1 Pin Description

2.3 Module package and PCB footprint dimensions

- **B861 module**

  Dimesion:22mm(L) x 12mm(W) x 0.8mm(H)

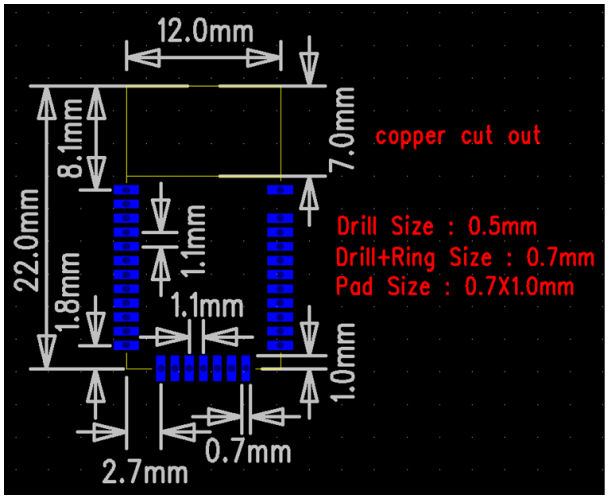


Figure 2-2 Module package dimensions

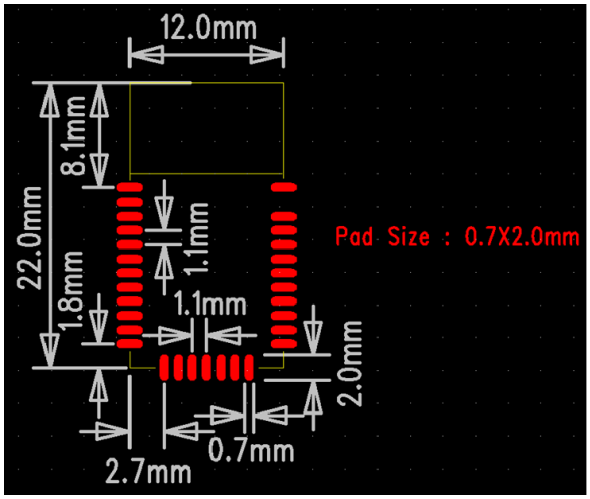


Figure 2-3 Module PCB footprint dimensions

➢ **B862 module (without antenna)**

Dimesion:15mm(L) x 12mm(W) x 0.8mm(H)

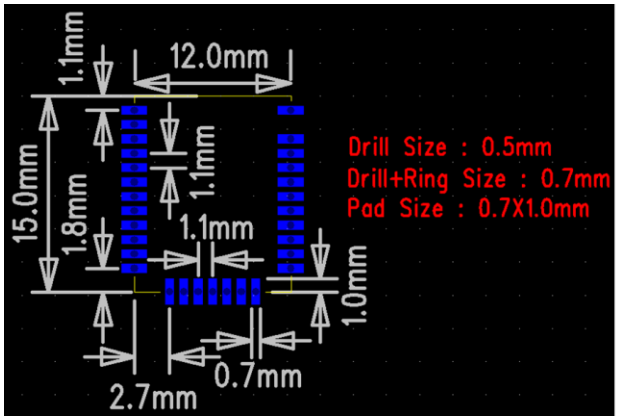


Figure 2-4 Module package dimensions

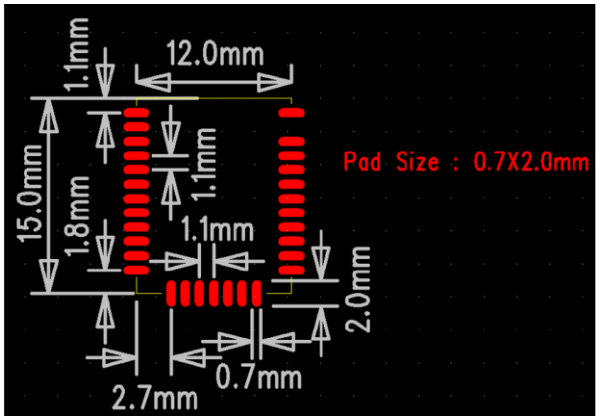


Figure 2-5 Module PCB footprint dimensions

2.4 Shielding Case

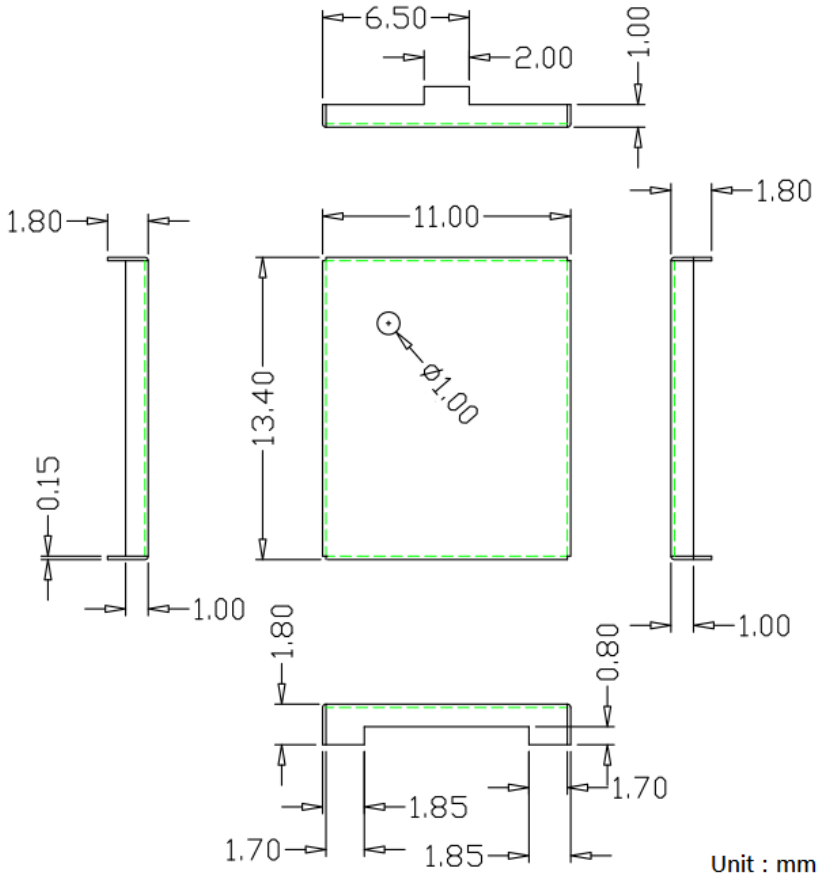


Figure 2-6 Shielding Case dimensions

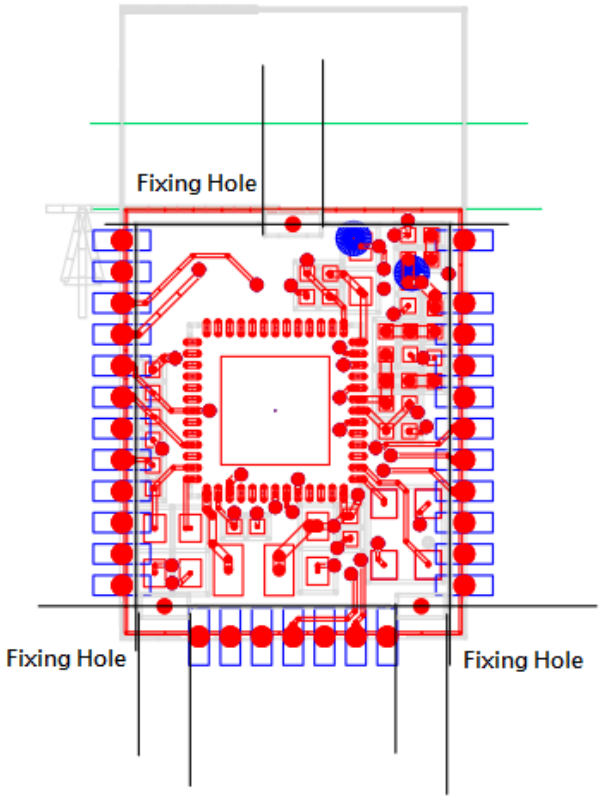
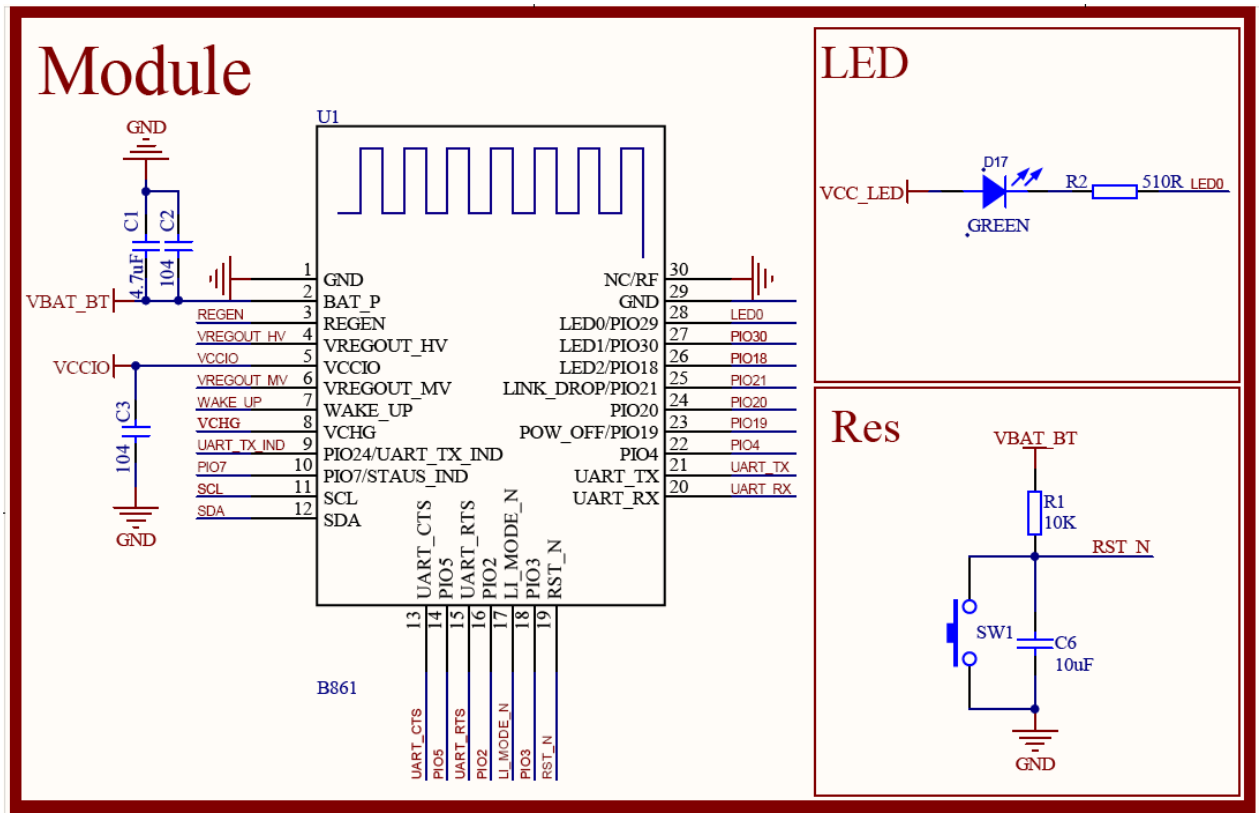
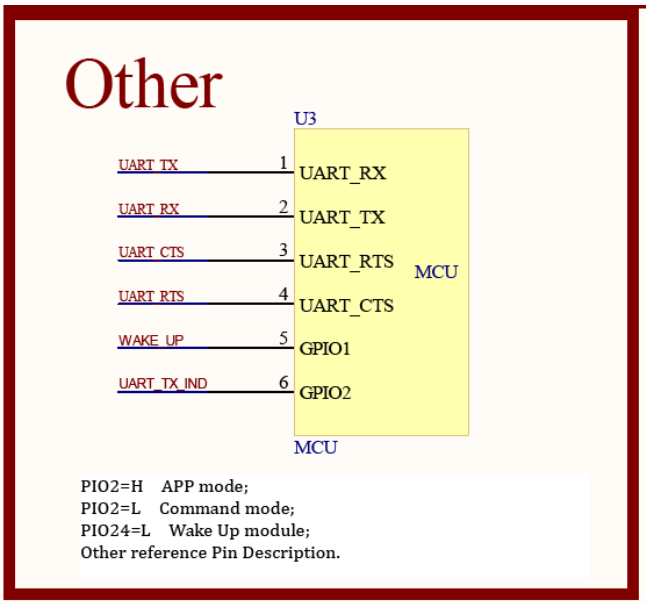
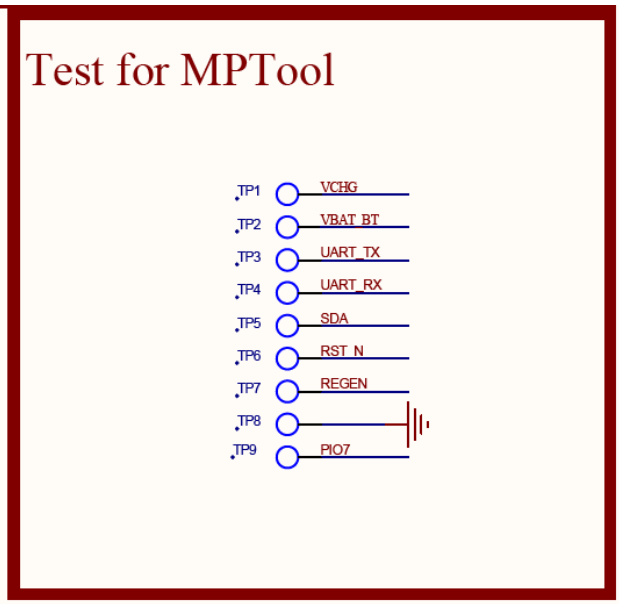


Figure 2-7 Fixing Hole location

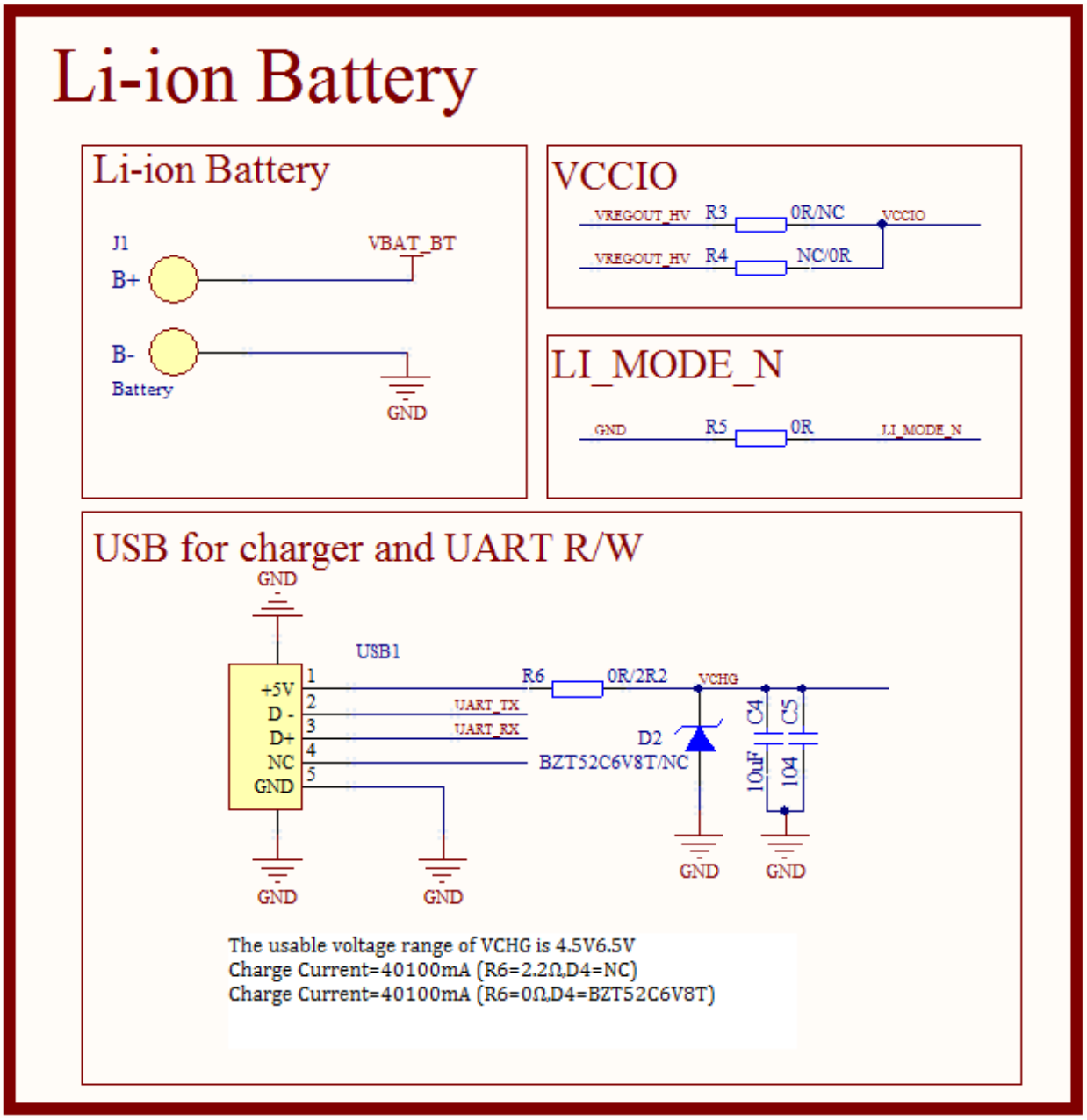
3 General Application Schematic



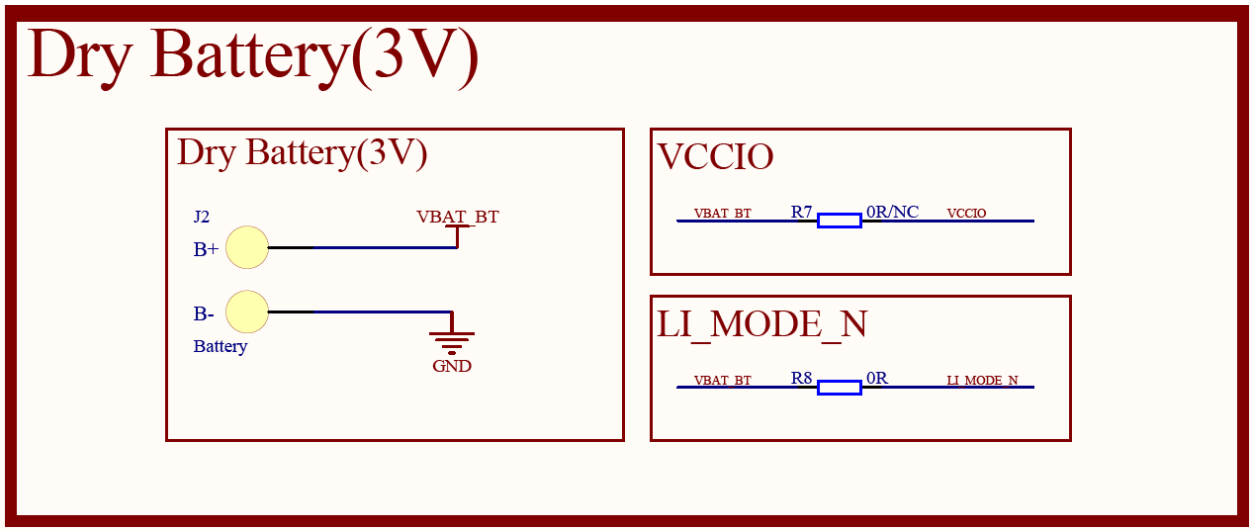




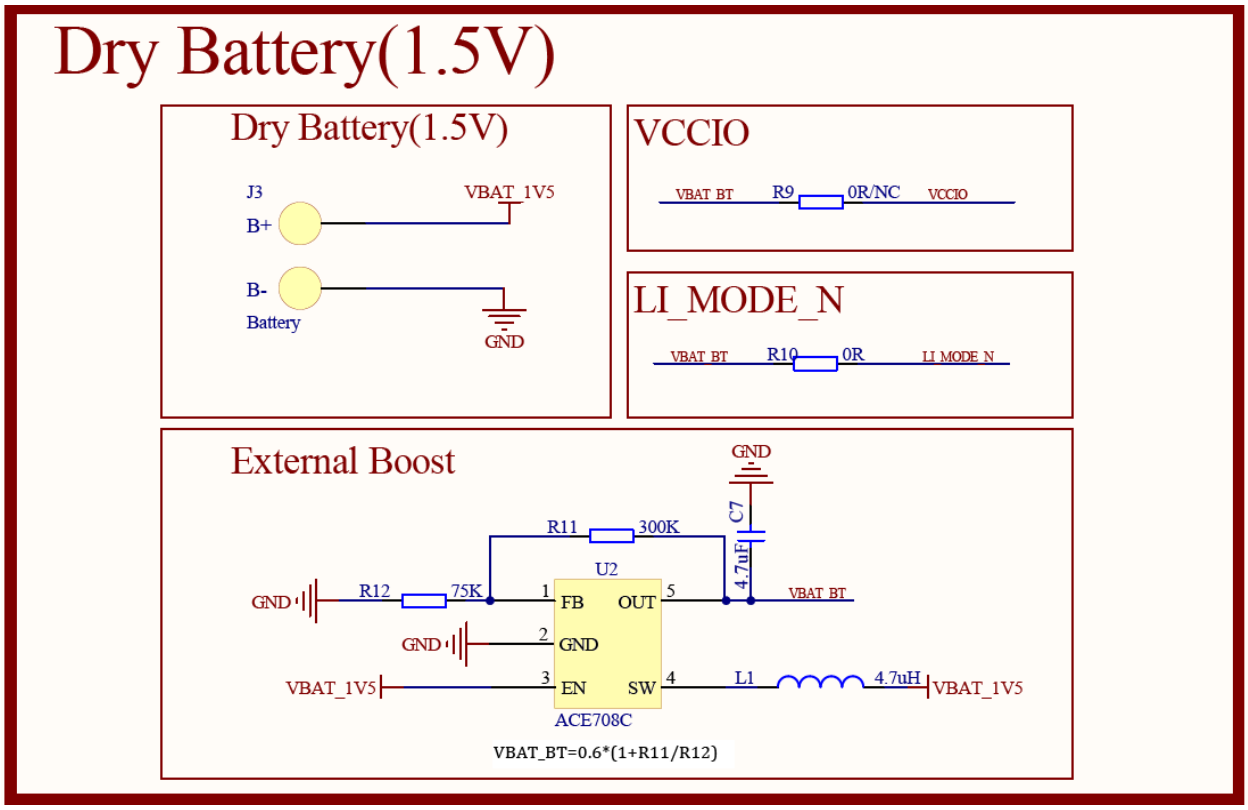
➢ **Li-ion Battery**



➢ **Dry Battery (3V)**



➢ **Dry Battery (1.5V)**



4 Electrical Characteristics

4.1 Recommended Operating Conditions

Item	Condition	Min.	Typ.	Max.	Unit
I/O supply voltage (VCCIO)		1.7		3.6	V
Battery Input (BAT_P)	LI_MODE_N=0	2.7		4.2	V
	LI_MODE_N=1	2		3.6	V
Charger supply voltage (VCHG)		4.5	5	6.5	V

Table 4-1 Recommended Operating Conditions

4.2 Digital Terminals

Item	Min.	Typ.	Max.	Unit
INPUT VOLTAGE LEVELS				
Input logic level low (V_{IL})	0		0.3*VCCIO	V
Input logic level high (V_{IH})	0.7*VCCIO		VCCIO+0.4	V
OUTPUT VOLTAGE LEVELS (1.7V≦VCCIO≦1.9V)				
Output logic level low (V_{OL}), I_O=4.0mA			0.2	V
Output logic level high (V_{OH}), I_O=-4.0mA	VCCIO-0.2			V
OUTPUT VOLTAGE LEVELS (2.7V≦VCCIO≦3.0V)				
Output logic level low (V_{OL}), I_O=4.0mA			0.4	V
Output logic level high (V_{OH}), I_O=-4.0mA	VCCIO-0.4			V

Table 4-2 Digital Terminals

4.3 Reference Clock

Item	Min.	Typ.	Max.	Unit
CRYSTAL REQUIREMENT				
Nominal Frequency		16		MHz
Operating Temperature Range	-40	25	85	℃
Frequency Stability over Operating Temperature Range				ppm

CRYSTAL OSCILLATOR CHARACTERISTICS				
Negative resistance (@ C0 = 0.89pF, CL = 9pF)		-150		Ω

Table 4-3 Reference Clock

4.4 Power

4.4.1 High-Voltage LDO (VREGOUT_HV)

Item	Condition	Min.	Typ.	Max.	Unit
Input Voltage	LI_MODE_N=0	2.7		4.4	V
	LI_MODE_N=1			3.6	V
Output Voltage	Input voltage > 3.3V	2.9	3	3.1	V
Rated Output Current (Iout)	Input voltage = 4.2V			300	mA

Table 4-4 High-Voltage LDO

4.4.2 Medium Voltage LDO (VREGOUT_MV)

Item	Condition	Min.	Typ.	Max.	Unit
Input Voltage	LI_MODE_N=0	2.7		4.4	V
	LI_MODE_N=1			3.6	V
Output Voltage		1.7	1.8	1.9	V
Rated Output Current (Iout)	Input voltage = 4.2V			200	mA

Table 4-5 Medium-Voltage LDO

4.5 Battery Charger

Item	Min.	Typ.	Max.	Unit
Input Voltage	4.5	5	6.5	V
Charge Current (CC Mode)	25		700	mA
Trickle Charge Current		8		mA
Trickle Charge Threshold Voltage		2.92		V
Regulated Output (Float) Voltage		4.2		V

Table 4-7 Battery Charger

4.6 Typical Current Consumption

4.6.1 Current consumption-Classic

Parameter	Current (avg.)	Units	Notes
Standby mode (Discoverable and Connectable mode)	1.21	mA	LE fast advertising interval = 160 ms, standby from 0s to 30s
	0.863		LE Reduced Power advertising interval = 961 ms, standby from 30s to120s
Deep Power-Down mode	0.1	uA	—
Connected (No data)	3.86	mA	No data was transmitted, BT 3.0 connection interval = 20 ms
Connected (Transfer data)	6.32	mA	AB1122 Receive Data Send every (1s) BT 3.0 interval=20ms 240Bytes/S
Connected (Transfer data)	7.93	mA	AB1122 Transmit Data Send every (1s) BT 3.0 interval=20ms 240Bytes/S
Connected (Transfer data)	8.05	mA	Transmitting Data from bothside Send every (1s) BT 3.0 interval=20ms 240Bytes/S

Table 4-8 Typical Current Consumption-Classic

Note: BT3.0 and BLE coexist in standby mode.

4.6.2 Current consumption-Low Energy

Parameter	Current (avg.)	Units	Notes
Standby mode (Discoverable and Connectable mode)	1.21	mA	LE fast advertising interval = 160 ms, standby from 0s to 30s
	0.863		LE Reduced Power advertising interval = 961 ms, standby from 30s to120s
Deep Power-Down mode	0.1	uA	—

Connected (No data)	0.276	mA	No data was transmitted, BT 4.0 connection interval = 1.5s , Latency=2
Connected (Transfer data)	0.373	mA	AB1122 Receive Data Send every (1s) BT 4.0 interval=500ms 20Bytes/S
Connected (Transfer data)	7.44	mA	AB1122 Transmit Data Send every (1s) BT 4.0 interval=500ms 20Bytes/S
Connected (Transfer data)	7.55	mA	Transmitting Data from bothside Send every (1s) BT 4.0 interval=500ms 20Bytes/S

Table 4-9 Typical Current Consumption-Low Energy

Note: Current consumption values were taken under following conditions:

1. BAT_P pin=3.3V
2. Core Supply Voltage = 1.25V @ 25℃
3. LEDs disconnected.

4.7 Radio Characteristics

4.7.1 Transmitter

Basic Data Rate

Core Supply Voltage = 1.25V @ 25℃

Item		Min.	Typ.	Max.	Unit
Maximum RF transmit Power			8		dBm
RF power control range			20		dB
20dB bandwidth for modulated carrier			900		KHz
Adjacent channel transmit power	+2MHz			-20	dBm
	-2MHz			-20	dBm
	+3MHz			-40	dBm
	-3MHz			-40	dBm
Frequency deviation	Δf1avg Maximum Modulation		165		KHz
	Δf2max Minimum Modulation		140		KHz
	Δf1avg/Δf2avg		0.9		
Initial carrier frequency tolerance		-75		75	KHz

Freq. Drift	DH1 packet	-25		25	KHz
	DH3 packet	-40		40	KHz
	DH5 packet	-40		40	KHz
Freq. Drift Rate		-20		20	KHz/50us
Harmonic Content			-45		dBm

Table 4-10 Transmitter Basic Data Rate

Enhanced Data Rate

Core Supply Voltage = 1.25V @ 25℃

Item		Min.	Typ.	Max.	Unit
Relative transmit power			-1.5		dB
π/4 DQPSK max carrier frequency stability $\|\omega_o\|$		-10		10	KHz
π/4 DQPSK max carrier frequency stability $\|\omega_i\|$		-75		75	KHz
π/4 DQPSK max carrier frequency stability $\|\omega_o+\omega_i\|$		-75		75	KHz
8DPSK max carrier frequency stability $\|\omega_o\|$		-10		10	KHz
8DPSK max carrier frequency stability $\|\omega_i\|$		-75		75	KHz
8DPSK max carrier frequency stability $\|\omega_o+\omega_i\|$		-75		75	KHz
π/4 DQPSK Modulation Accuracy	RMS DEVM			20	%
	99% DEVM	99			%
	Peak DEVM			35	%
8DPSK Modulation Accuracy	RMS DEVM			13	%
	99% DEVM	99			%
	Peak DEVM			25	%
In-band spurious emissions	F > F0 + 3MHz			-40	dBm
	F < F0 - 3MHz			-40	dBm
	F = F0 + 3MHz			-40	dBm
	F = F0 - 3MHz			-40	dBm
	F = F0 + 2MHz			-20	dBm
	F = F0 - 2MHz			-20	dBm
	F = F0 + 1MHz			-26	dB
	F = F0 - 1MHz			-26	dB
EDR Differential Phase Encoding		99			%

Table 4-11 Transmitter Enhanced Data Rate

low Energy

Core Supply Voltage = 1.25V @ 25℃

Item		Min.	Typ.	Max.	Unit
Maximum RF transmit power			8		dBm
Peak power – Average power				3	dB
In-band emissions	≥ +3MHz			-30	dBm
	+2MHz			-20	dBm
	-2MHz			-20	dBm
	≤ -3MHz			-30	dBm
Modulation characteristics	∆f1avg	225		275	KHz
	99.9% Δf2max	185			KHz
	∆f1avg/Δf2avg	0.8			
Center freq. deviation, F n (n = 0,1,2,….k)		-150		150	KHz
Freq. drift, |F 0 - F n | (n = 2,3,4,…k)		-50		50	KHz
Initial freq. drift, |F 1 - F 0 |		-20		20	KHz
Max. freq. drift rate, |F n - F n-5 | (n = 6,7,8,…k)		-20		20	KHz/50us
Harmonic content			-45		dBm

Table 4-12 Transmitter Low Energy

4.7.2 Receiver

Basic Data Rate

Core Supply Voltage = 1.25V @ 25℃

Item		Min.	Typ.	Max.	Unit
Sensitivity	2.402GHz		-94		dBm
	2.441GHz		-94		dBm
	2.480GHz		-94		dBm
Maximum input level		-20			dBm
Co-Channel interference, C/I				11	dB
Adjacent channel interference, C/I	F = F_0+1MHz			0	dB
	F = F_0-1MHz			0	dB

	$F = F_0+2MHz$			-30	dB
	$F = F_0-2MHz$			-20	dB
	$F = F_0+3MHz$			-40	dB
	$F = F_{image}$			-9	dB
Intermodulation		-39			dBm
Blocking	30-2000 MHz	-10			dBm
	2000-2400 MHz	-27			dBm
	2500-3000 MHz	-27			dBm
	3000-12750 MHZ	-10			dBm

Table 4-13 Receiver Basic Data Rate

Enhanced Data Rate

Core Supply Voltage = 1.25V @ 25℃

Item			Min.	Typ.	Max.	Unit
Sensitivity	π/4 DQPSK			-94		dBm
	8DPSK			-85		dBm
Maximum input level	π/4 DQPSK		-20			dBm
	8DPSK		-20			dBm
Co-Channel interference, C/I	π/4 DQPSK				13	dB
	8DPSK				21	dB
Adjacent channel interference, C/I	$F = F_0+1MHz$	π/4 DQPSK			0	dB
		8DPSK			5	dB
	$F = F_0-1MHz$	π/4 DQPSK			0	dB
		8DPSK			5	dB
	$F = F_0+2MHz$	π/4 DQPSK			-30	dB
		8DPSK			-25	dB
	$F = F_0-2MHz$	π/4 DQPSK			-20	dB
		8DPSK			-13	dB
	$F = F_0+3MHz$	π/4 DQPSK			-40	dB
		8DPSK			-33	dB
	$F = F_{image}$	π/4 DQPSK			-7	dB
		8DPSK			0	dB

Table 4-14 Receiver Enhanced Data Rate

Low Energy

Core Supply Voltage = 1.25V @ 25℃

Item		Min.	Typ.	Max.	Unit
Sensitivity	2.402GHz		-98		dBm
	2.440GHz		-98		dBm
	2.480GHz		-98		dBm
Maximum input level		-10			dBm
Co-Channel interference, C/I				21	dB
Adjacent channel interference, C/I	F = F_0+1MHz			15	dB
	F = F_0-1MHz			15	dB
	F = F_0+2MHz			-17	dB
	F = F_0-2MHz			-15	dB
	F = F_0+3MHz			-27	dB
	F = F_{image}			-9	dB
Intermodulation		-50			dBm
Blocking	30-2000 MHz	-30			dBm
	2003-2399 MHz	-35			dBm
	2484-2997 MHz	-35			dBm
	3000-12750 MHZ	-30			dBm
PER report integrity		50		65.4	%

Table 4-15 Receiver Low Energy