Scope

This specification is applies to describe the related Battery product in this Specification and the Battery/cell supplied by Great Power Battery Co., Ltd only.

Cell Specification

NO	Items	Specifications		Remark
1	Nominal Capacity	240mAh		0.2C Standard discharge
2	Minimum Capacity	220mAh		
3	Nominal Voltage	3.7V		Mean Operation Voltage
4	Delivery voltage	Sea&Land	3.8~4.0V	Within 10 days from Factory
		Air	3.7~3.8V	In accordance with the requirements for the airline air battery charge 30% or less.
5	Limited Charging Voltage	4.2V		By standard charging method
6	Upper Limited Charging Voltage	4.2V		By standard charging method
7	Standard charging method	0.2C constant current,4.2V constant voltage charge to 4.2V,continuecharging till current decline to ≤0.01C (25±3℃)		
8	Charge current	0.2C		Standard charge, charge time:6.5h(Ref)
		0.5C		Rapid Charge, charge time:2.5h(Ref)
9	Standard discharging method	0.2C constant current discharge to 3.0V,(25±3℃)		
10	Discharge cut-off voltage	3.0V		By standard discharge method
11	Cell Internal Impedance	≤80mΩ		Internal resistance measured at AC 1KHZ after 50% charge
12	Maximum charge current	0.5C		For continuous charging mod
13	Maximum discharge current	1C		For continuous discharge mod

14	Operation Temperature and relative humidity Range	Charge	10~15℃	0.1C	High/low temperature environment reduce battery charge efficiency and influence battery life. Long time working under 60 ℃ environment will lead to battery abnormal.
			16~25℃	0.2C	
			26~45℃	0.5C	
		Discharge	-10~60℃ 60±25%R.H.		
15	Storage temperature for a long time	-20~25℃≤Six months -20~45℃≤one months			Do not storage exceed half year. Must charge once when storage for half year. Must charge the battery which with protect circuit when storage for three mouthed. (under normal storage conditions for long periods required storage capacity can lead to decay and fall of the life cycle, such as environmental requirements exceeded the storage capacity will be further exacerbated decline and decay cycle life)
16	Allow swelling Thickness	≤10% of Initial Thickness			

Temperature Dependence of discharge capacity

Cells shall be charged per 3.3.1 and discharged @0.2 C5A to 3.0 volts. Except to be discharged at temperatures per Table 3. Cells shall be stored for 3 hours at the test temperature prior to discharging and then shall be discharged at the test temperature. The capacity of a cell at each temperature shall be compared to the capacity achieved at 23 ºC and the percentage shall be calculated. Each cell shall meet or exceed the requirements of Table 3.

Table 3

Discharge Temperature	0±3℃	25±3℃	60±3℃
Discharge Capacity （0.2）	80%	100%	95%

Battery/Cell performance test Criteria

Appearance inspection by visual

There shall be no such defect as flaw, crack, rust, leakage, which may adversely affect commercial value of battery.

Environmental test condition

Unless otherwise specified, all test stated in this product specification are conduct at below test condition

◆Temperature: 20℃~25℃

◆Relative Humidity:60%±25% R.H.

Cell Electrical characteristics

NO	Items	Test Method and Condition	Criteria	
1	Rated Capacity at 0.2C(Min.)	After standard charge,the capacity shall be measured on 0.2C discharge till the voltage discharge to 3.0V,	≥220mAh	≥100%
2	Cycle Life	Charging and discharging battery as blew conditions 0.2C standard charge to 4.2V end-off 0.2C standard discharge to 3.0V cut-off Continuous charge and discharge for 500 cycles,the capacity will be measure after the 500th cycle	≥70% of initial capacity	
3	Capacity retention	The battery to be charge in accordance with standard charge condition at 20~25 ℃,then storage the battery at an ambient temperature 20~25 ℃ for 28 days. Measure the capacity after 30 days with 0.2C at 20~25℃ as retention capacity	Retention capacity ≥85%	

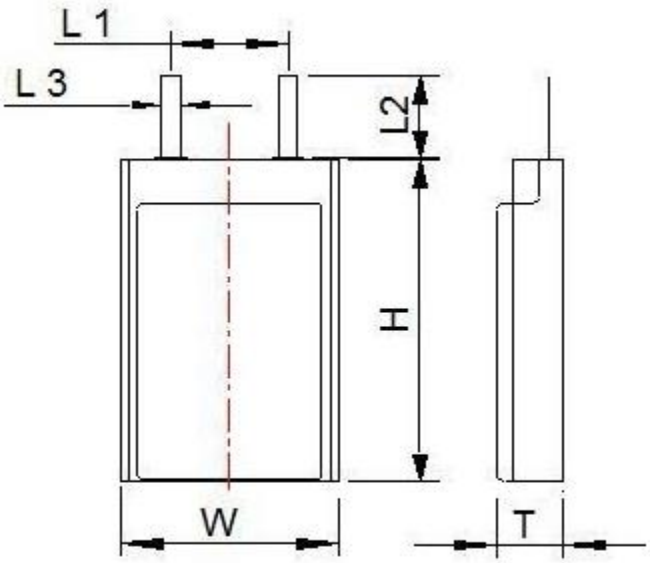
Mechanical characteristics

No	Items	Test Method and Condition	Criteria
1	Free fall test	The battery to be fully charged in accordance with standard charge condition, then drop the battery three times from a height of 1,0 m onto a concrete floor. The batteries are dropped so as to obtain impacts in random orientations.	No Fire,
2	Vibration test	After standard charging, fixed the cell to vibration table and subjected to vibration cycling that the frequency is to be varied at the rate of 1Hz per minute between 10Hz and 55Hz, the excursion of the vibration is 1.6mm. The cell shall be vibrated for 30 minutes per axis of XYZ axes.	No explosion,No leakage, No fire
3	Crush test	Fully charged the battery in accordance with standard charge condition, the battery is to be crushed between two flat plates. Continuous to applied force on battery of 13kN(17.2Mpa),stopped until a pressure reading of 17.2Mpa is reached on the hydraulic ram	No explosion, No fire

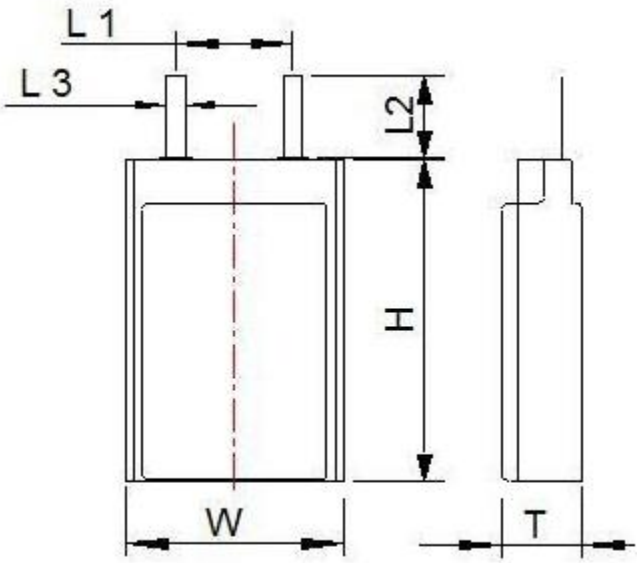
Safety performance

No	Items	Test Method and Condition	Criteria
1	Thermal exposure test	Each fully charged cell, stabilized at room temperature, is placed in a circulating air-convection oven. The oven temperature is raised at a rate of 5 °C/min ± 2 °C/min to a temperature of 130 °C ± 2 °C. The cell remains at this temperature for 10 min before the test is discontinued.	No explosion,No fire
2	Low pressure	Each fully charged cell is placed in a vacuum chamber, in an ambient temperature of 20~25℃. Once the chamber has been sealed, its internal pressure is gradually reduced to a pressure equal to or less than 11,6 k Pa (this simulates an altitude of 15240 m) held at that value for 6 h.	No explosion,No leakage, No fire
3.	Short test	The fully charged battery is to be short-circuited by connecting the positive and negative terminals of the battery with resistance load not exceed 100m Ω.Tests are to be conducted at room temperature 20~25℃.	No explosion,No fire The Temperature of the Battery Surface not exceeded than 150℃
4	Forced discharge test	A discharged cell is subjected to a reverse charge at 1C for 90 min.	No explosion,No fire
5	Over charge test	After standard charge, continue to charge with a constant voltage 4.6V per a cell, holding 8h.	No explosion, No fire, No leakage
6	Soak Test	Put the batteries into clean water, be soaked for 24 hours.	No break, No fire

Cell initial Dimensions



单坑



双坑

NO	Items		Units:mm		Remark
1	Thickness		7.4		Max.
2	Width		12.5		Max.
3	Height		36.0		Max.
4	L1		11-15MM		
5	L2		8±2		
6	L3		3±0.1		
7	Trace code	□ Positive ☑ Reverse □ No request	□ 單坑	☑ 雙坑	Note: Test battery should be new produced battery that arri ved less than 1 month

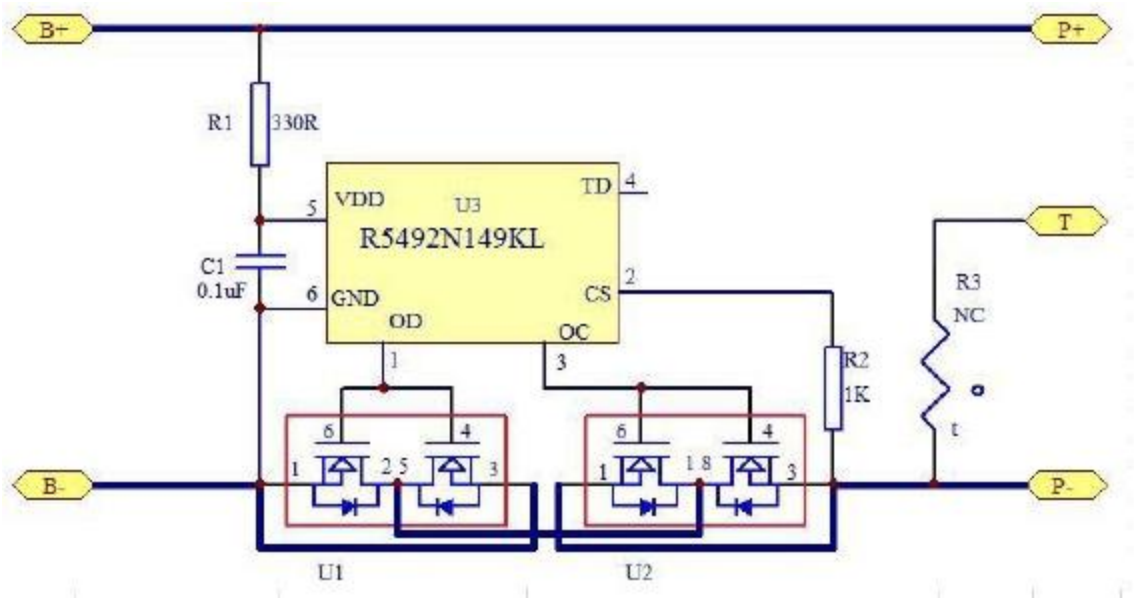
Pack Battery specifications

NO	Items	Specifications			Remark
1	Capacity for assembled cell discharging by 0.2C	≥220mAh			Standard discharging method
2	Battery Voltage	Sea & Land	3.8~4.0V		Within 10 days from Factory
		Air	3.7~3.8V		In accordance with the requirements for the airline air battery charge 30% or less.
3	Standard charge condition	0.2C constant current,4.2V constant voltage charge to 4.2V,continuecharging till current decline to ≤0.01C (25±3℃)			
4	Standard discharging method	0.2C constant current discharge to 3.0V, (25±3℃)			
5	Maximum charge current	0.5C			For continuous charging mod
6	Maximum discharge current	1C			For continuous discharge mod
7	Operation Temperature and relative humidity Range	Charge	10~15℃	0.1C	High/low temperature environment reduce battery charge efficiency and influence battery life. Long time working under 60 ℃ environment will lead to battery abnormal
			16~25℃	0.2C	
			26~45℃	0.5C	
		Discharge	-10~60℃ 60±25%R.H.		
8	Internal Impedance	Assemblage Impedance≤160mΩ			Measure two sides of the drawing line after assembling.

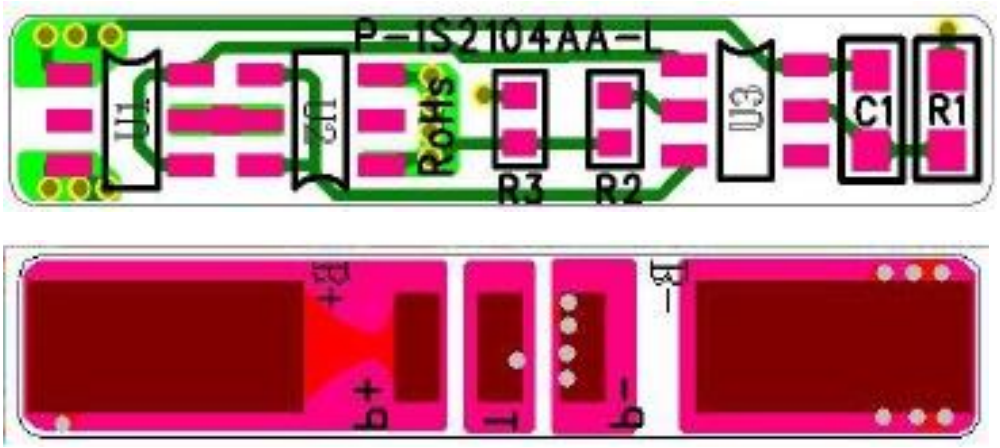
PCM specification

IC	R5492N149KL	parameter value			
Item name		min	type	max	unit
Overcharge Testing Voltage		4.260	4.280	4.300	V
Overcharge renew voltage		4.255	4.080	4.305	V
Overdischarge testing Voltage		2.827	2.900	2.973	V
Overdischarge renew voltage		3.022	3.100	3.178	V
Overcurrent testing Voltage		0.110	0.125	0.140	V
over current|		5.0	/	9.0	A
Overdischarge protect Voltage		700	1000	1300	ms
Charge overcurrent detection current		1.5	/	3.0	A
Overdischarge protect prolong time		14	20	26	ms
Over current prolong time		8.0	12.0	16.0	ms
Short testing Voltage		230	300	500	μs
Supply Current		-	4.0	8.0	μA
Discharge static state current		-	-	0.5	μA
Resistance			45	60	mΩ
Inputvoltage between VCCandGND		VSS-0.3	-	VSS+12	V
Operating temperature range		-40	-	85	°C
Storage temperature range		-55	-	125	°C
The 0V battery charging function			允许		

Application Circuit



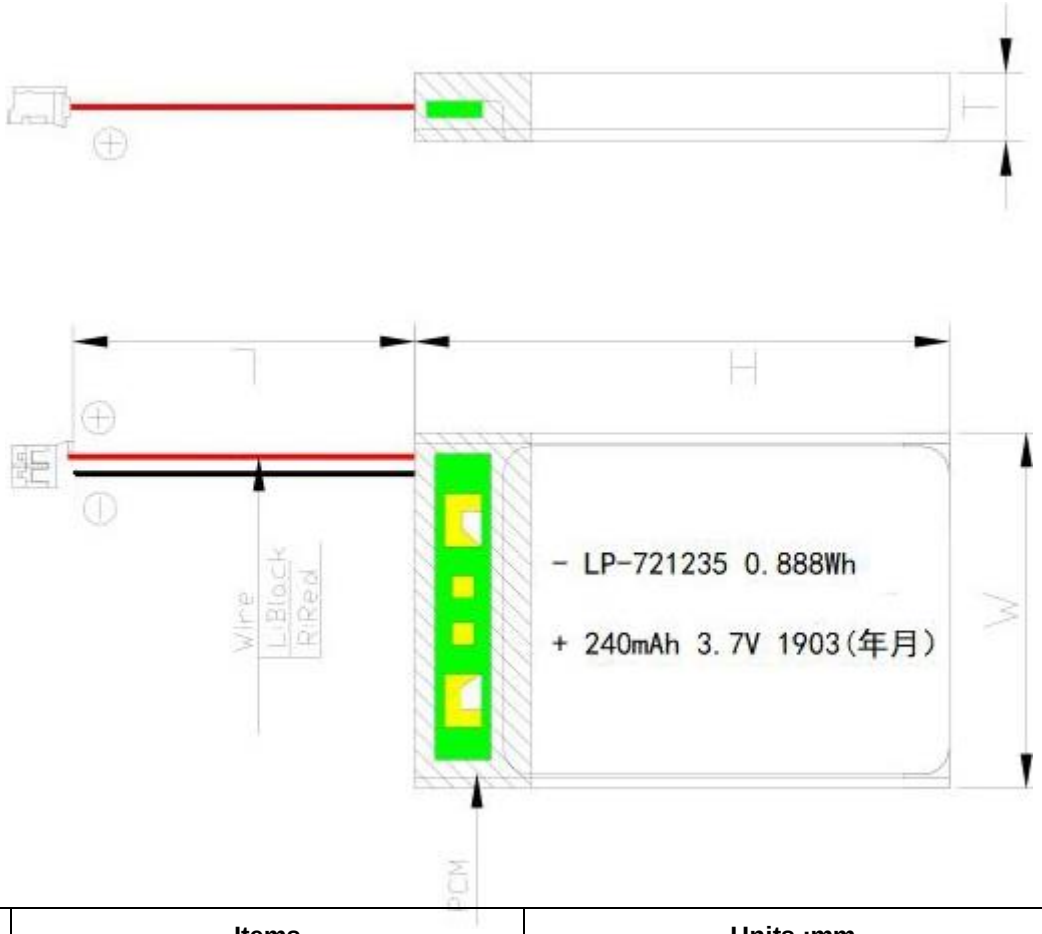
PCB layout



PCM BOM LIST

No.	description	vendor	symbol	Spec./model	unit	Q'ry
1	PCB 板	富士威	PCB	P-1S2104A	pcs	1
2	電阻	國巨	R1	330R/0603 ±5%	pcs	1
3	電阻	國巨	R2	1K/0402 ±5%	pcs	1
4	電容	國巨	C1	0.1UF/0603+80% -20% 50V	pcs	1
5	IC	理光	U3	R5492N149KL SOT-23-6	pcs	1
6	MOS	鑫飛鴻	U1/U2	FH8205A SOT-23-6	pcs	2

Pack Battery Pack Dimensions



NO	Items	Units :mm		Remark
1	Thickness	T	7.4	Max.
2	Width	W	13.0	Max.
3	Height	H	37.5	Max.
4	Cable Length	L	40±3	
6	Cable Length	L1	/	

BOM of Battery Pack

NO	Part name	Quantity	Remark	符合 HSF 屬性
1	Cell	1	Great Power	
2	Tape	~120~		符合 ROHS,REACH 要求
3	Solder	0.2	Lead Free	符合 ROHS,REACH 要求
4	插頭	1	Molex51021-2P 反向 1571#28	符合 ROHS,REACH 要求
5	保護板	1	(R5492N149KL+FH8205*2)	符合 ROHS,REACH 要求

Handling of Cells

Consideration of strength of film package

1) Soft Aluminum foil

   Easily damaged by sharp edge parts such as pins and needles, Ni-tabs, so don't strike by those sharp parts.

2) Sealed edge may be damaged by heat above 100°C, bend or fold sealed edge.

Prohibition short circuit

Never make short circuit cell. It generates very high current which causes heating of the cells and may cause electrolyte leakage, gassing or explosion that are very dangerous.

The LIP tabs may be easily short-circuited by putting them on conductive surface.

Such outer short circuit may lead to heat generation and damage of the cell.

An appropriate circuitry with PCM shall be employed to protect accidental short circuit of the battery pack.

Mechanical shock

LIP cells have less mechanical endurance than metal-can-cased LIB. alling, hitting, bending, etc. may cause degradation of LIP characteristics.

Handling of tabs

The battery tabs are not so stubborn especially for aluminum tab. Don't bend tab. Do not bend tabs unnecessarily.

Notice for Designing Battery Pack

Pack toughness

Battery pack should have sufficient strength and the LIP cell inside should be protected from mechanical shocks.

Cell fixing

The LIP cell should be fixed to the battery pack by its large surface area. No cell movement in the battery pack should be allowed.

Inside design

No sharp edge components should be insides the pack containing the LIP cell.

Tab connection

Ultrasonic welding or spot welding is recommended for LIP tab connection method.

Battery pack should be designed that shear force are not applied to the LIP tabs.

If apply manual solder method to connect tab with PCM, below notice is very important to ensure battery performance:

1) The solder iron should be temperature controlled and ESD safe;

2) Soldering temperature should not exceed 350°C;

3) Soldering time should not be longer than 3s;

4) Soldering times should not exceed 5 times, Keep battery tab cold down before next time soldering;

5) Directly heat cell body is strictly prohibited, Battery may be damaged by heat above approx. 100°C

For mishaps

Battery pack should be designed not to generate heat even when leakage occurs due to mishaps.

1) Isolate PCM (Protection Circuit Module) from leaked electrolyte as perfectly as possible.

2) Avoid narrow spacing between bare circuit patterns with different voltage. (Including around connector)

3) LIP battery should not have liquid from electrolyte, but in case If leaked electrolyte touch bare circuit patterns, higher

potential terminal material may dissolve and precipitate at the lower potential terminal, and may cause short circuit. The design of the PCM must have this covered.

Notice for Assembling Battery Pack

Shocks, high temperature, or contacts of sharp edge components should not be allowed in battery pack assembling process.

Others

Cell connection

1) Direct soldering of wire leads or devices to the cell is strictly prohibited.

2) Lead tabs with per-soldered wiring shall be spot welded to the cells.

Direct soldering may cause damage of components, such as separator and insulator, by heat generation.

Prevention of short circuit within a battery pack

Enough insulation layers between wiring and the cells shall be used to maintain extra safety protection.The battery pack shall be structured with no short circuit within the battery pack, which may cause generation of smoke or firing.

Prohibition of dis assembly

1) Never disassemble the cells

The disassembling may generate internal short circuit in the cell, which may cause gassing, firing, explosion, or other problems.

2) Electrolyte is harmful

LIP battery should not have liquid from electrolyte flowing, but in case the electrolyte come into contact with the skin, or eyes, physicians shall flush the electrolyte immediately with fresh water and medical advice is to be sought.

Prohibition of dumping of cells into fire

Never incinerate nor dispose the cells in fire. These may cause explosion of the cells, which is very dangerous and is prohibited.

Prohibition of cells immersion into liquid such as water

The cells shall never be soaked with liquids such as water, seawater, drinks such as soft drinks, juices, coffee or others.

Battery cells replacement

The battery replacement shall be done only by either cells supplier or device supplier and never be done by the user.

Prohibition of use of damaged cells

The cells might be damaged during shipping by shock. If any abnormal features of the cells are found such as damages in a plastic envelop of the cell, deformation of the cell package, smelling of an electrolyte, an electrolyte leakage and others, the cells shall never be used any more.

The Cells with a smell of the electrolyte or a leakage shall be placed away from fire to avoid firing or explosion.

Period of Warranty

The period of warranty is one year from the date of shipment. Great Power guarantees to give a replacement in case of cells with defects proven due to manufacturing process instead of the customer abuse and misuse.

Storage of the Batteries

The batteries should bestored at room temperature, charged to about 30% to 50% of capacity. We recommend that batteries be charged about once per half a year to prevent overdischarge.

Other The Chemical Reaction

Because batteries utilize a chemical reaction, battery performance will deteriorate over time even if stored for a long period of time without being used. In addition, if the various usage conditions such as charge, discharge, ambient temperature, etc. are not maintained within the specified ranges the life expectancy of the battery may be shortened or the device in which the battery is used may be damaged by electrolyte leakage. If the batteries cannot maintain a charge for long periods of time, even when they are charged correctly, this may indicate it is time to change the battery.

Note

Any other items which are not covered in this specification shall be agreed by both parties.