Product Specifications: Li-ion Polymer 11.1V / 4000mAh - BP-LP-11-CT148

Battery Type:		Lithium Ion Polymer Rechargeable			
Part Number:		BP-LP-11-CT148			
Battery Specification:		11.1V / 4000mAh typical			
Ver:		3/TBTTL			
Issue Date:		21/09/07			
Prepared By	Date	Checked By	Date	Approved By	Date
Customer confirmation:					Date
Note: 1. Please sign above and return on approval. 2. Kindly contact us as soon as possible if the sample is not approved.					

History of revisions		
Prepared by	Approved by	Date

- CONTENTS -

1. SCOPE

This specification describes the related technical standard and requirements of the BP-LP-11-CT148 rechargeable Li-ion Polymer battery pack.

2. SPECIFICATIONS:

Table 1

	ITEM	SPECIFICATION		REMARK
	Model	BP-LP-11-CT148		
1	Capacity	Typical	4000mAh	Standard discharge（0.2C C_5A） after Standard charge
		Minimum	3900mAh	
2	Nominal Voltage	11.1V		Mean Operation Voltage
3	Voltage at end of Discharge	9.0V		Discharge Cut-off Voltage
4	Charging Voltage	12.6±0.03V		
5	Internal Impedance	≤300mΩ		Internal resistance measured at AC 1KHZ after 50% charge.
6	Standard charge	Constant Current 0.5C_5A Constant Voltage 12.6V 0.01 C_5A cut-off		Charge time : Approx 4.0h
7	Standard discharge	Constant current 0.2 C_5A end voltage 9.0V		
8	Fast charge	Constant Current 1C_5A Constant Voltage 12.6V 0.01 C_5A cut-off		Charge time : Approx 2.5h
9	Fast discharge	Constant current 1 C_5A end voltage 9.0V		
10	Maximum Continuous Charge Current	1 C_5A		
11	Maximum Continuous Discharge Current	1.5C_5A		
12	Operating Temperature Range	Charge: 0~45℃		60±25%R.H Bare Cell.
		Discharge: -20~60℃		
13	Storage Temperature Range	Less than 1 year: -20~25℃		60±25%R.H at shipment state.
		less than 3 months: -20~40℃		
14	Dimensions (max mm)	103 H x 69 W x 20 T mm		Initial Dimension
15	Weight	Approx 240g		Battery Pack

3. PERFORMANCE AND TESTING CONDITIONS

3.1 Standard Test Conditions:

Test should be conducted with new batteries within one week after shipment from our factory and the cells shall not be cycled more than five times before the test. Unless otherwise specified, test and measurement shall be done under temperature of 20±5℃ and relative humidity of 45~85%. If it is judged that the test results are not affected by such conditions, the tests may be conducted at temperature 15~30℃ and humidity 25~85%RH.

3.2 Measuring Instrument or Apparatus:

3.2.1 Dimension Measuring Instrument

Instruments with equal or more precision scale of 0.01mm shall implement the dimension measurement.

3.2.2 Voltmeter

Standard class specified in the national standard or more sensitive class having internal impedance more than 10kΩ/V

3.2.3 Ammeter

Standard class specified in the national standard or more sensitive class. Total external resistance including ammeter and wire is less than 0.01Ω.

3.2.4 Impedance Meter

Impedance shall be measured by a sinusoidal alternating current method (1kHz LCR meter).

3.3 Standard Charge\Discharge:

3.3.1 Standard Charge：

Test procedure and its criteria are referred as follows::

$0.5C_5A$ = 2000mA

Charging shall consist of charging at a $0.5C_5A$ constant current rate until the cell reaches 12.6V. The cell shall then be charged at constant voltage of 12.6 volts while tapering the charge current. Charging shall be terminated when the charging current has tapered to 0.01 C_5A . Charge time : Approx 4.0h, The cell shall demonstrate no permanent degradation when charged between 0 ºC and 45 ºC.

3.3.2 Standard Discharge:

$0.2C_5A$ = 800mA

Cells shall be discharged at a constant current of 0.2 C_5A to 9.0 volts @ 20º ± 5C

3.3.3 If not otherwise specified, the rest time between Charge and Discharge is 30min.

3.4 Appearance:

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

3.5 Initial Performance Test

Table 2

Item	Test Method and Condition	Requirements
(1) Open-Circuit Voltage	The open-circuit voltage shall be measured within 24 hours after standard charge.	≥12.24V
(2) Internal impedance	Internal resistance measured at AC 1KHz after 50% charge.	≤300mΩ
(3) Minimal Rated Capacity	The capacity on $0.2C_5A$ discharge until the voltage has tapered to 9.0V shall be 30min after standard charge.	Discharge Capacity ≥3900mAh

3.6 Temperature Dependence of discharge capacity:

Cells shall be charged per 3.3.1 and discharged @ 0.2 C_5A to 9.0 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	-10℃	0℃	23℃	60℃
Discharge Capacity （0.2 C_5A）	50%	80%	100%	95%

3.7 Cycle Life and Leakage-Proof:

Table 4

No.	Item	Criteria	Test Conditions
1	Cycle Life (0.5 C_5A)	Higher than 70% of the Initial Capacities of the Cells	Carry out 500 cycle Charging/Discharging in the below condition: ◆ Charge: Standard Charge, per 3.3.1 ◆ Discharge:0.5 C5A to 9.0 V ◆ Rest Time between charge/discharge:30min. ◆Temperature:20±5℃
2	Leakage-Proof	No leakage (visual inspection)	After full charge with standard charge, store at 60±3℃, 60±10%RH for 1 month.

4. MECHANICAL CHARACTERISTICS AND SAFETY TEST

Table 5 (Mechanical characteristics)

No.	Items	Test Method and Condition	Criteria
1	Vibration Test	After standard charging, fix the cell to vibration table and subject to vibration cycling. 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 on X, Y, and Z axis.	No leakage No fire
2	Drop Test	The cell is to be dropped from a height of 1 meter twice onto concrete ground.	No explosion, No fire, No leakage.

Table 6 (Safety Test)

Item	Battery Condition	Test Method	Requirements
Crush	Fresh, Fully charged	Crush between two flat plates. Applied force is about 13kN(1.72Mpa) for 30min.	No explosion, No fire
Short Circuit (0℃)	Fresh, Fully charged	Each test sample battery, in turn, is to be short-circuited by connecting the (+) and (-) terminals of the battery with a Cu wire having a maximum resistance load of 0.1Ω.Tests are to be conducted at room temperature (20±2℃).	No explosion, No fire The Temperature of the surface of the Cells are lower than 150℃

High Temp Short Circuit (60℃)	Fresh, Fully charged	Each test sample battery, in turn, is to be short-circuited by connecting the (+) and (-) terminals of the battery with a Cu wire having a maximum resistance load of 0.1Ω .Tests are to be conducted at temperature (60±2℃)	No explosion, No fire The Temperature of the surface of the Cells are lower than 150℃
Impact	Fresh, Fully charged	A 56mm diameter bar is inlayed into the bottom of a 10kg weight. And the weight is to be dropped from a height of 1m onto a sample battery and the bar will be across the centre of the sample.	No explosion, No fire
Forced Discharge	Fresh, Fully charged	Discharge at a current of 1 C_5A for 2.5h.	No explosion, No fire
Nail Pricking (3mm)	Fresh, Fully charged	Prick through the sample battery with a nail having a diameter of 3mm and remain 2h	No explosion, No fire

5. PROTECTION CIRCUIT

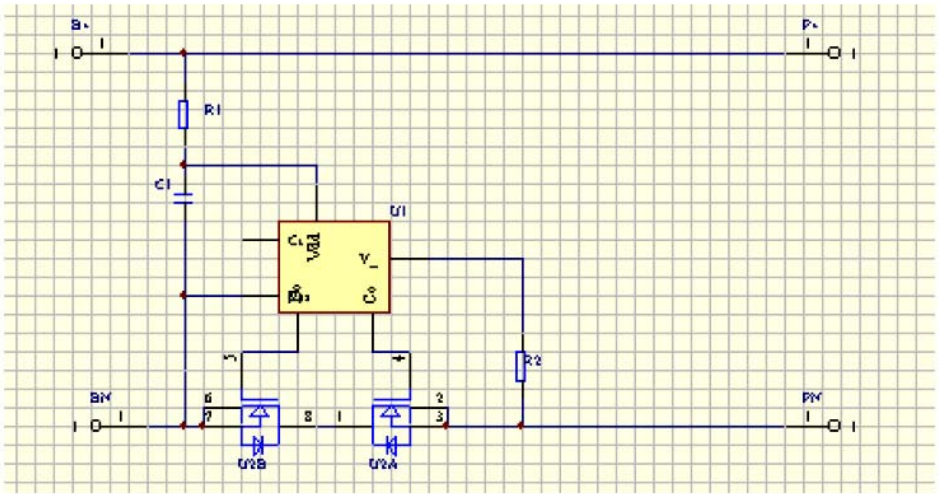
5.1 PCM Specification:

Item	Test Condition
Over charge protection	The battery should be charged under 4.28V/1C. The charging should be shut off when the internal cell voltage becomes more than the specified protection voltage.
Over discharge protection	The battery should be discharged with 1C, The discharging should be shut off when the internal cell voltage becomes less than the specified protection voltage.
Short protection	After rated charge, (+) and (-) terminals are connected with 10mΩ metal resistor or equivalent.

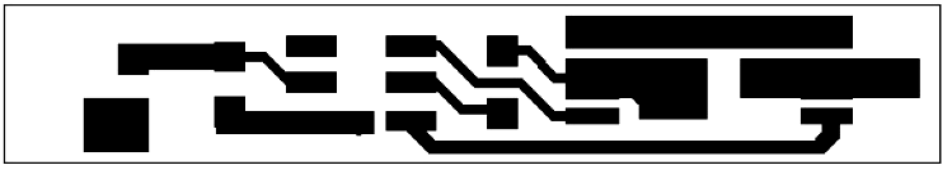
5.2 PCM Standard:

Symbol	Name	MIN.	TYP.	MAX.	Unit
VDET1	Over-Charge detect voltage	4.255	4.28	4.305	V
VHVS1	Over-Charge reset voltage	4..025	4.075	4.125	V
VDET2	Over-discharge detect voltage	2.975	3.0	3.025	V
I_{EC}	Excess Current threshold	1.5	--	5	A
IDD	Supply current	--	--	7	μA
ISTANDBY	Standby current	--	--	0.7	μA
R_D	Internal resistance in normal operation	--	--	70	mΩ

5.3 Schematic Diagram



5.4 PCB Top Overlay



5.5 PCB Bottom Overlay

6. HANDLING OF CELLS

6.1 Consideration of strength of film package

1) Soft Aluminium foil is easily damaged by sharp edged parts such as pins and needles, Ni-tabs, compared with metal- can-cased LIB.
2) Sealed edge may be damaged by heat above 100°C, bending or folding of sealed edge.

6.2 Short Circuit Prohibited:
Never short-circuit any cell. It generates very high current, which causes heating of the cells and may cause very dangerous electrolyte leakage, gassing or explosion. The LIP tabs may be easily short-circuited by putting them on conductive surface. Such short circuit may lead to heat generation and damage of the cell. An appropriate circuitry with PCM shall be used to protect accidental short circuit of the battery pack.

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

6.4 Handling of tabs
The battery tabs are not particularly robust - especially aluminium tabs. Don't bend tabs.

7. NOTICES FOR DESIGNING & ASSEMBLING BATTERY PACK

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

7.2 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.

7.3 Inside design
No sharp edge components should be inside 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 so that shear force is not applied to the LIP tabs.
If manual solder method is used to connect tab with PCM, the notice below is very important to ensure battery performance:
The solder iron should be temperature controlled and ESD safe:

- Soldering temperature should not exceed 350°C;
- Soldering time should not be longer than 3s;
- Soldering times should not exceed 5 times, - allow battery tab cool-down before next soldering;
- Directly heating cell body is strictly prohibited, Battery may be damaged by heat above approx. 100°C

7.4 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.

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

8. OTHERS

8.1.Cell connection

1) Direct soldering of wire leads or devices to the cell is strictly prohibited.
2) Lead tabs with pre-soldered wiring shall be spot welded to the cells.
3) Direct soldering may cause damage of components, such as separator and insulator, by heat generation.

8.2. 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 fire.

9.3. Disassembly - Prohibited

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.

8.4 Disposal by fire - Prohibited

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

8.5 Cells immersion - Prohibited

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

8.6 Battery cells replacement

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

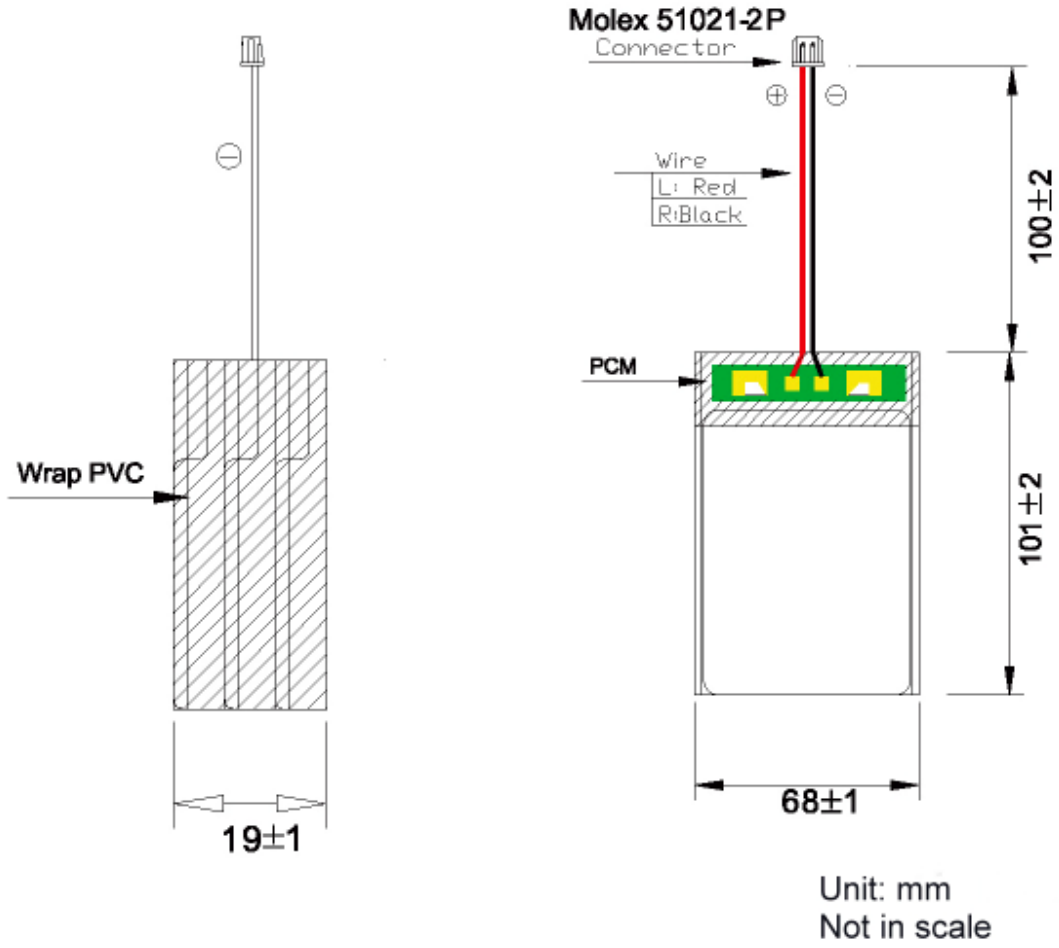
8.7 Use of damaged cells is Prohibited

The cells might be damaged during shipping by shock. If any abnormal features of the cells are found such as damage in a plastic envelop of the cell, deformation of the cell package, smell of electrolyte, an electrolyte leakage and others, the cells shall NOT be used. The Cells with a smell of the electrolyte or a leakage shall be kept away from fire to avoid explosion.

9. PERIOD OF WARRANTY

The period of warranty is Twelve Months from the date of shipment. The Manufacturer guarantees to give a replacement in case of cells with defects proven due to manufacturing process - not customer abuse and misuse.

10. BATTERY PACK INITIAL DIMENSIONS:



Unit: mm
Not in scale

11. CAUTIONS

To ensure proper use of the battery please read the manual carefully before using it.

Handling

- Do not expose to, or dispose of the battery in fire.
- Do not put the battery in a charger or equipment with wrong terminals connected.
- Avoid shorting the battery
- Avoid excessive physical shock or vibration.
- Do not disassemble or deform the battery.
- Do not immerse in water.
- Do not use the battery mixed with other different make, type, or model batteries.
- Keep out of the reach of children.

Charge and discharge

- Battery must be charged in appropriate charger only.
- Never use a modified or damaged charger.
- Do not leave battery in charger over 24 hours.

Storage

- Store the battery in a cool, dry and well-ventilated area.
- The batteries should be stored 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 over discharge.

Disposal

- Regulations vary for different countries. Dispose of in accordance with local regulations.
- Consider the environment.

"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.

- Users must ensure that they satisfy themselves as to the suitability for purpose of this product.
- Any other items which are not covered in this specification shall be agreed by both parties.
- SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE