TEST REPORT

Report No.:	BCTC2308084349B
Applicant:	Filtertechnik Ltd
Product Name:	Li-ion 6S1P Battery Pack
Product Type:	LP6S1P2A2AL001
Tested Date:	2023-08-03~2023-08-15
Issued Date:	2023-08-21

Shenzhen BCTC Testing Co., Ltd

IEC 62133-2

Secondary cells and batteries containing alkaline or other non-acid electrolytes – Safety requirements for portable sealed secondary cells, and for batteries made from them, for use in portable applications – Part 2: Lithium systems

Report Number. .....:	BCTC2308084349B
Date of issue .....:	2023-08-21
Total number of pages.....:	31 pages
Applicant's name.....:	Filtertechnik Ltd
Address .....:	1 Central Park, Lenton Lane, Nottingham, NG7 2NR, UK
Test specification:	
Standard.....:	IEC 62133-2:2017, IEC 62133-2:2017/AMD1:2021
Test procedure .....:	Commission Test
Non-standard test method .....:	N/A
Test Report Form No.....:	IEC62133_2C
Test Report Form(s) Originator ....:	DEKRA Certification B.V.
Master TRF.....:	Dated 2022-07-01

This report is not valid as a CB Test Report unless signed by an approved CB Testing Laboratory and appended to a CB Test Certificate issued by an NCB in accordance with IECEE 02.

General disclaimer:

The test results presented in this report relate only to the object tested.
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Test item description ..... :	Li-ion 6S1P Battery Pack
Trade Mark ..... :	N/A
Manufacturer ..... :	LiTech Power Co., Ltd 3F, Block 1, HaoYun TongYuan Science Park, Qiaojiao Middle Road #1, TangXia Town, DongGuan, China 523726
Model/Type reference ..... :	LP6S1P2A2AL001
Ratings ..... :	22.2V, 4000mAh, 88.8Wh

Responsible Testing Laboratory (as applicable), testing procedure and testing location(s):

Testing Laboratory:	Shenzhen BCTC Testing Co., Ltd.	
Testing location/ address.....:	1-2/F., Building B, Pengzhou Industrial Park, No.158, Fuyuan 1st Road, Zhancheng, Fuhai Subdistrict, Bao'an District, Shenzhen, Guangdong, China	
Tested by (name, function, signature).....:	George Hou (Project handler)	George How
Approved by (name, function, signature)...:	Andre Yu (Supervisor)	Andre Yu

List of Attachments (including a total number of pages in each attachment):
National Differences (0 page)
Enclosures (7 pages)

Summary of testing:

Tests performed (name of test and test clause):	**Testing location:**
7.1 Charging procedure for test purposes; 7.2.1 Continuous charging at constant voltage (cells); 7.3.1 External short circuit (cell); 7.3.2 External short circuit (battery); 7.3.3 Free fall (cell and battery); 7.3.4 Thermal abuse (cells); 7.3.5 Crush (cells); 7.3.6 Over-charging of battery; 7.3.7 Forced discharge (cells); 7.3.8 Mechanical test (batteries);	Shenzhen BCTC Testing Co., Ltd. 1-2/F., Building B, Pengzhou Industrial Park, No.158, Fuyuan 1st Road, Zhancheng, Fuhai Subdistrict, Bao'an District, Shenzhen, Guangdong, China

Summary of compliance with National Differences (List of countries addressed):
N/A
☒ **The product fulfils the requirements of EN 62133-2: 2017, EN 62133-2: 2017/A1:2021.**

Copy of marking plate:

The artwork below may be only a draft. The use of certification marks on a product must be authorized by the respective NCBs that own these marks.

Li-ion 6S1P Battery Pack
LP6S1P2A2AL001
22.2V, 4000mAh, 88.8Wh
6INR22/71 YYYYMMDD
LiTech Power Co., Ltd
Caution: Not short circuit.
Red(+) Black(-)

Remark:

“YYYY” represents the year of manufacture;

“MM” represents the month of manufacture;

“DD” represents the date of manufacture.

Test item particulars..... :	
Classification of installation and use..... :	To be defined in final product
Supply Connection ..... :	DC lead wire
Recommend charging method declared by the manufacturer ..... :	Charge at constant current 800mA until the voltage reaches 25.2V, then charge at 25.2V until charge current declines to 200mA.
Discharge current (0,2 It A) ..... :	800mA
Specified final voltage..... :	2.5V for cell, 16.8V for battery
Upper limit charging voltage per cell..... :	4.2V
Maximum charging current ..... :	6000mA for cell, 2000mA for battery
Charging temperature upper limit ..... :	45°C
Charging temperature lower limit..... :	0°C
Polymer cell electrolyte type..... :	☐ gel polymer ☐ solid polymer ☒ N/A
Possible test case verdicts:	
- test case does not apply to the test object.....:	N/A
- test object does meet the requirement.....:	P (Pass)
- test object does not meet the requirement.....:	F (Fail)
Testing.....:	
Date of receipt of test item .....:	2023-08-02
Date (s) of performance of tests .....:	2023-08-03 to 2023-08-15
General remarks:	
"(See Enclosure #)" refers to additional information appended to the report. "(See appended table)" refers to a table appended to the report. **Throughout this report a ☐ comma / ☒ point is used as the decimal separator.**	
Name and address of factory (ies) ..... :	LiTech Power Co., Ltd 3F, Block 1, HaoYun TongYuan Science Park, Qiaojiao Middle Road #1, TangXia Town, DongGuan, China 523726

General product information and other remarks:

Only test are performed in this report. The technology documentations, which should be provided by the manufacturer for the review requirement of IEC 62133, are not included in this report.

This battery is constructed with six lithium-ion cells(6S1P), and has overcharge, over-discharge, over current and short-circuits proof circuit.

The cell consists of the positive electrode plate, negative electrode plate, separator, electrolyte and steel case.

Additionally, detailed information of the cell and battery, as following:

Product	Cell	Battery
Model	INR21700-40T	LP6S1P2A2AL001
Rated capacity	4000mAh	4000mAh
Nominal voltage	3.7V	22.2V
Standard charge current	2000mA	800mA
Standard discharge current	10000mA	2000mA
Maximum charge current	6000mA	2000mA
Maximum discharge current	35000mA	2000mA
Normal charging voltage	4.2V	25.2V
Charge cut-off current	200mA	200mA
Final discharge voltage	2.5V	16.8V
Upper limit charging voltage	4.2V	25.2V
Charging temperature range	0~45℃	0~45°C

IEC 62133-2			
Clause	Requirement + Test	Result - Remark	Verdict
4	**PARAMETER MEASUREMENT TOLERANCES**		P
	Parameter measurement tolerances		P
5	**GENERAL SAFETY CONSIDERATIONS**		P
5.1	**General**		P
	Cells and batteries so designed and constructed that they are safe under conditions of both intended use and reasonably foreseeable misuse		P
5.2	**Insulation and wiring**		P
	The insulation resistance between the positive terminal and externally exposed metal surfaces of the battery (excluding electrical contact surfaces) is not less than 5 MΩ	No externally exposed metal surfaces.	N/A
	Insulation resistance (MΩ) ..... :		—
	Internal wiring and insulation are sufficient to withstand maximum anticipated current, voltage and temperature requirements		P
	Orientation of wiring maintains adequate clearances and creepage distances between conductors		P
	Mechanical integrity of internal connections accommodates reasonably foreseeable misuse		P
5.3	**Venting**		P
	Battery cases and cells incorporate a pressure relief mechanism or are constructed so that they relieve excessive internal pressure at a value and rate that will preclude rupture, explosion and self-ignition		P
	Encapsulation used to support cells within an outer casing does not cause the battery to overheat during normal operation nor inhibit pressure relief		N/A
5.4	**Temperature, voltage and current management**		P
	Batteries are designed such that abnormal temperature rise conditions are prevented		P
	Batteries are designed to be within temperature, voltage and current limits specified by the cell manufacturer		P
	Batteries are provided with specifications and charging instructions for equipment manufacturers so that specified chargers are designed to maintain charging within the temperature, voltage and current limits specified		P
5.5	**Terminal contacts**		P

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Clause	Requirement + Test	Result - Remark	Verdict
	The size and shape of the terminal contacts ensure that they can carry the maximum anticipated current		P
	External terminal contact surfaces are formed from conductive materials with good mechanical strength and corrosion resistance		P
	Terminal contacts are arranged to minimize the risk of short circuits		N/A
5.6	**Assembly of cells into batteries**		P
5.6.1	General		P
	Each battery has an independent control and protection for current, voltage, temperature and any other parameter required for safety and to maintain the cells within their operating region		P
	This protection may be provided external to the battery such as within the charger or the end devices		N/A
	If protection is external to the battery, the manufacturer of the battery provide this safety relevant information to the external device manufacturer for implementation		N/A
	If there is more than one battery housed in a single battery case, each battery has protective circuitry that can maintain the cells within their operating regions		N/A
	Manufacturers of cells specify current, voltage and temperature limits so that the battery manufacturer/designer may ensure proper design and assembly		P
	Batteries that are designed for the selective discharge of a portion of their series connected cells incorporate circuitry to prevent operation of cells outside the limits specified by the cell manufacturer		N/A
	Protective circuit components are added as appropriate and consideration given to the end-device application		N/A
	The manufacturer of the battery provide a safety analysis of the battery safety circuitry with a test report including a fault analysis of the protection circuit under both charging and discharging conditions confirming the compliance		N/A
5.6.2	Design recommendation		P
	For the battery consisting of a single cell or a single cellblock, it is recommended that the charging voltage of the cell does not exceed the upper limit of the charging voltage specified in Table 2		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	For the battery consisting of series-connected plural single cells or series-connected plural cellblocks, it is recommended that the voltages of any one of the single cells or single cellblocks does not exceed the upper limit of the charging voltage, specified in Table 2, by monitoring the voltage of every single cell or the single cellblocks		P
	For the battery consisting of series-connected plural single cells or series-connected plural cellblocks, it is recommended that charging is stopped when the upper limit of the charging voltage is exceeded for any one of the single cells or single cellblocks by measuring the voltage of every single cell or the single cellblocks		N/A
	For batteries consisting of series-connected cells or cell blocks, nominal charge voltage are not counted as an overcharge protection		P
	For batteries consisting of series-connected cells or cell blocks, cells have closely matched capacities, be of the same design, be of the same chemistry and be from the same manufacturer		P
	It is recommended that the cells and cell blocks are not discharged beyond the cell manufacturer's specified final voltage		P
	For batteries consisting of series-connected cells or cell blocks, cell balancing circuitry are incorporated into the battery management system		N/A
5.6.3	Mechanical protection for cells and components of batteries		P
	Mechanical protection for cells, cell connections and control circuits within the battery are provided to prevent damage as a result of intended use and reasonably foreseeable misuse		P
	The mechanical protection can be provided by the battery case or it can be provided by the end product enclosure for those batteries intended for building into an end product		N/A
	The battery case and compartments housing cells are designed to accommodate cell dimensional tolerances during charging and discharging as recommended by the cell manufacturer		N/A
	For batteries intended for building into a portable end product, testing with the battery installed within the end product is considered when conducting mechanical tests		N/A
5.7	**Quality plan**		P

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Clause	Requirement + Test	Result - Remark	Verdict
	The manufacturer prepares and implements a quality plan that defines procedures for the inspection of materials, components, cells and batteries and which covers the whole process of producing each type of cell or battery		P
5.8	**Battery safety components**		N/A
6	**TYPE TEST AND SAMPLE SIZE**		P
	Tests are made with the number of cells or batteries specified in Table 1 using cells or batteries that are not more than six months old		P
	The internal resistance of coin cells are measured in accordance with Annex D. Coin cells with internal resistance less than or equal to 3 Ω are tested in accordance with Table 1	Not coin cell.	N/A
	Unless otherwise specified, tests are carried out in an ambient temperature of 20 °C ± 5 °C		P
	The safety analysis of 5.6.1 identify those components of the protection circuit that are critical for short-circuit, overcharge and over discharge protection		N/A
	When conducting the short-circuit test, consideration is given to the simulation of any single fault condition that is likely to occur in the protecting circuit that would affect the short-circuit test		P
7	**SPECIFIC REQUIREMENTS AND TESTS**		P
7.1	**Charging procedure for test purposes**		P
7.1.1	First procedure		P
	This charging procedure applies to subclauses other than those specified in 7.1.2		P
	Unless otherwise stated in this document, the charging procedure for test purposes is carried out in an ambient temperature of 20 °C ± 5 °C, using the method declared by the manufacturer		P
	Prior to charging, the battery has been discharged at 20 °C ± 5 °C at a constant current of 0,2 It A down to a specified final voltage		P
7.1.2	Second procedure		P
	This charging procedure applies only to 7.3.1, 7.3.4, 7.3.5, and 7.3.9		P

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Clause	Requirement + Test	Result - Remark	Verdict
	After stabilization for 1 h to 4 h, at an ambient temperature of the highest test temperature and the lowest test temperature, respectively, as specified in Table 2, cells are charged by using the upper limit charging voltage and maximum charging current, until the charging current is reduced to 0,05 It A, using a constant current to constant voltage charging method	Charge temperature 0~45°C declared. 45°C and 0°C were used as highest test temperature and lowest test temperature during tests.	P
7.2	**Intended use**		P
7.2.1	Continuous charging at constant voltage (cells)		P
	Fully charged cells are subjected for 7 days to a charge using the charging method for current and standard voltage specified by the cell manufacturer		P
	Results: no fire, no explosion, no leakage.....:	(See appended table 7.2.1)	P
7.2.2	Case stress at high ambient temperature (battery)		N/A
	Oven temperature (°C).....:		—
	Results: no physical distortion of the battery case resulting in exposure of internal protective components and cells		N/A
7.3	**Reasonably foreseeable misuse**		P
7.3.1	External short-circuit (cell)		P
	The cells were tested until one of the following occurred:		P
	- 24 hours elapsed; or		N/A
	- The case temperature declined by 20 % of the maximum temperature rise		P
	Results: no fire, no explosion.....:	(See appended table 7.3.1)	P
7.3.2	External short-circuit (battery)		P
	The batteries were tested until one of the following occurred:		P
	- 24 hours elapsed; or		N/A
	- The case temperature declined by 20 % of the maximum temperature rise		P
	In case of rapid decline in short circuit current, the battery pack remained on test for an additional one hour after the current reached a low end steady state condition		P
	A single fault in the discharge protection circuit is conducted on one to four (depending upon the protection circuit) of the five samples before conducting the short-circuit test		P

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Clause	Requirement + Test	Result - Remark	Verdict
	A single fault applies to protective component parts such as MOSFET (metal oxide semiconductor field-effect transistor), fuse, thermostat or positive temperature coefficient (PTC) thermistor	Single fault on Q4, F1.	P
	Results: no fire, no explosion ..... :	(See appended table 7.3.2)	P
7.3.3	Free fall		P
	Results: no fire, no explosion		P
7.3.4	Thermal abuse (cells)		P
	Oven temperature (°C) ..... :	130	—
	Results: no fire, no explosion		P
7.3.5	Crush (cells)		P
	The crushing force was released upon:		P
	- The maximum force of 13 kN ± 0,78 kN has been applied; or		P
	- An abrupt voltage drop of one-third of the original voltage has been obtained		N/A
	Results: no fire, no explosion ..... :	(See appended table 7.3.5)	P
7.3.6	Over-charging of battery		P
	The supply voltage which is:		P
	- 1,4 times the upper limit charging voltage presented in Table A.1 (but not to exceed 6,0 V) for single cell/cell block batteries or		N/A
	- 1,2 times the upper limit charging voltage resented in Table A.1 per cell for series connected multi-cell batteries, and	30.24V used for test.	P
	- Sufficient to maintain a current of 2,0 It A throughout the duration of the test or until the supply voltage is reached		P
	Test was continued until the temperature of the outer casing:		P
	- Reached steady state conditions (less than 10 °C change in 30-minute period); or		P
	- Returned to ambient		N/A
	Results: no fire, no explosion ..... :	(See appended table 7.3.6)	P
7.3.7	Forced discharge (cells)		P
	Discharge a single cell to the lower limit discharge voltage specified by the cell manufacturer		P
	The discharged cell is then subjected to a forced discharge at 1 It A to the negative value of the upper limit charging voltage		P

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Clause	Requirement + Test	Result - Remark	Verdict
	- The discharge voltage reaches the negative value of upper limit charging voltage within the testing duration. The voltage is maintained at the negative value of the upper limit charging voltage by reducing the current for the remainder of the testing duration		N/A
	- The discharge voltage does not reach the negative value of upper limit charging voltage within the testing duration. The test is terminated at the end of the testing duration		P
	Results: no fire, no explosion ..... :	(See appended table 7.3.7)	P
7.3.8	Mechanical tests (batteries)		P
7.3.8.1	Vibration		P
	Results: no fire, no explosion, no rupture, no leakage or venting. ..... :	(See appended table 7.3.8.1)	P
7.3.8.2	Mechanical shock		P
	Results: no leakage, no venting, no rupture, no explosion and no fire ..... :	(See appended table 7.3.8.2)	P
7.3.9	Design evaluation – Forced internal short-circuit (cells)		N/A
	The cells complied with national requirement for ..... :	France, Japan, Korea, Switzerland	—
	The pressing was stopped upon:		N/A
	- A voltage drop of 50 mV has been detected; or		N/A
	- The pressing force of 800 N (cylindrical cells) or 400 N (prismatic cells) has been reached		N/A
	Results: no fire ..... :	(See appended table 7.3.9)	N/A
8	**INFORMATION FOR SAFETY**		P
8.1	**General**		P
	Manufacturers of secondary cells provides information about current, voltage and temperature limits of their products		P
	Manufacturers of batteries provides information regarding how to minimize and mitigate hazards to equipment manufacturers or end-users		P
	Systems analyses are performed by device manufacturers to ensure that a particular battery design prevents hazards from occurring during use of a product		N/A
	As appropriate, any information relating to hazard avoidance resulting from a system analysis is provided to the end user		P

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Clause	Requirement + Test	Result - Remark	Verdict
	Do not allow children to replace batteries without adult supervision		P
8.2	**Small cell and battery safety information**	Not small battery	N/A
	The following warning language is to be provided with the information packaged with the small cells and batteries or equipment using them:		N/A
	- Keep small cells and batteries which are considered swallowable out of the reach of children		N/A
	- Swallowing may lead to burns, perforation of soft tissue, and death. Severe burns can occur within 2 h of ingestion		N/A
	- In case of ingestion of a cell or battery, seek medical assistance promptly		N/A
9	**MARKING**		P
9.1	**Cell marking**		P
	Cells are marked as specified in IEC 61960, except coin cells		N/A
	Coin cells whose external surface area is too small to accommodate the markings on the cells show the designation and polarity		N/A
	By agreement between the cell manufacturer and the battery and/or end product manufacturer, component cells used in the manufacture of a battery need not be marked		P
9.2	**Battery marking**		P
	Batteries are marked as specified in IEC 61960, except for coin batteries	The battery is marked in according with IEC 61960.	P
	Coin batteries whose external surface area is too small to accommodate the markings on the batteries show the designation and polarity		N/A
	Batteries are marked with an appropriate caution statement		P
	- Terminals have clear polarity marking on the external surface of the battery, or		P
	- Not be marked with polarity markings if the design of the external connector prevents reverse polarity connections		N/A
9.3	**Caution for ingestion of small cells and batteries**	Not small battery	N/A
	Coin cells and batteries identified as small batteries include a caution statement regarding the hazards of ingestion in accordance with 8.2		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	Small cells and batteries are intended for direct sale in consumer-replaceable applications, caution for ingestion is given on the immediate package		N/A
9.4	**Other information**		P
	The following information are marked on or supplied with the battery:		P
	- Storage and disposal instructions		P
	- Recommended charging instructions		P
10	**PACKAGING AND TRANSPORT**		P
	Packaging for coin cells are not be small enough to fit within the limits of the ingestion gauge of Figure 3	Not coin cell.	N/A
ANNEX A	**CHARGING AND DISCHARGING RANGE OF SECONDARY LITHIUM ION CELLS FOR SAFE USE**		P
A.1	**General**		P
A.2	**Safety of lithium ion secondary battery**		P
A.3	**Consideration on charging voltage**		P
A.3.1	General		P
A.3.2	Upper limit charging voltage		P
A.3.2.1	General		P
A.3.2.2	Explanation of safety viewpoint		N/A
A.3.2.3	Safety requirements, when different upper limit charging voltage is applied		N/A
A.4	**Consideration of temperature and charging current**		P
A.4.1	General		P
A.4.2	Recommended temperature range	Charging temperature range declared by client is 0~45°C	P
A.4.2.1	General		P
A.4.2.2	Safety consideration when a different recommended temperature range is applied		P
A.4.3	High temperature range	45°C used for test.	N/A
A.4.3.1	General		N/A
A.4.3.2	Explanation of safety viewpoint		N/A
A.4.3.3	Safety considerations when specifying charging conditions in the high temperature range		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
A.4.3.4	Safety considerations when specifying a new upper limit in the high temperature range		N/A
A.4.4	Low temperature range	0°C used for test.	N/A
A.4.4.1	General		N/A
A.4.4.2	Explanation of safety viewpoint		N/A
A.4.4.3	Safety considerations, when specifying charging conditions in the low temperature range		N/A
A.4.4.4	Safety considerations when specifying a new lower limit in the low temperature range		N/A
A.4.5	Scope of the application of charging current		P
A.4.6	Consideration of discharge		P
A.4.6.1	General		P
A.4.6.2	Final discharge voltage and explanation of safety viewpoint		P
A.4.6.3	Discharge current and temperature range		P
A.4.6.4	Scope of application of the discharging current		P
A.5	**Sample preparation**		N/A
A.5.1	General		N/A
A.5.2	Insertion procedure for nickel particle to generate internal short		N/A
A.5.3	Disassembly of charged cell		N/A
A.5.4	Shape of nickel particle		N/A
A.5.5	Insertion of nickel particle in cylindrical cell		N/A
A.5.5.1	Insertion of nickel particle in winding core		N/A
A.5.5.2	Marking the position of the nickel particle on both ends of the winding core of the separator		N/A
A.5.6	Insertion of nickel particle in prismatic cell		N/A
A.6	**Experimental procedure of the forced internal short-circuit test**		N/A
A.6.1	Material and tools for preparation of nickel particle		N/A
A.6.2	Example of a nickel particle preparation procedure		N/A
A.6.3	Positioning (or placement) of a nickel particle		N/A
A.6.4	Damaged separator precaution		N/A
A.6.5	Caution for rewinding separator and electrode		N/A
A.6.6	Insulation film for preventing short-circuit		N/A
A.6.7	Caution when disassembling a cell		N/A
A.6.8	Protective equipment for safety		N/A

IEC 62133-2			
Clause	Requirement + Test	Result - Remark	Verdict
A.6.9	Caution in the case of fire during disassembling		N/A
A.6.10	Caution for the disassembling process and pressing the electrode core		N/A
A.6.11	Recommended specifications for the pressing device		N/A
ANNEX B	**RECOMMENDATIONS TO EQUIPMENT MANUFACTURERS AND BATTERY ASSEMBLERS**		P
ANNEX C	**RECOMMENDATIONS TO THE END-USERS**		N/A
ANNEX D	**MEASUREMENT OF THE INTERNAL AC RESISTANCE FOR COIN CELLS**		N/A
D.1	**General**		N/A
D.2	**Method**		N/A
	A sample size of three coin cells is required for this measurement		N/A
	Coin cells with an internal resistance greater than 3 Ω require no further testing .....:	(See appended table D.2)	N/A
	Coin cells with an internal resistance less than or equal to 3 Ω are subjected to the testing according to Clause 6 and Table 1		N/A
ANNEX E	**PACKAGING AND TRANSPORT**		**N/A**
ANNEX F	**COMPONENT STANDARDS REFERENCES**		**N/A**

IEC 62133-2			
Clause	Requirement + Test	Result - Remark	Verdict

7.2.1	TABLE: Continuous charging at constant voltage (cells)			P
Sample no.	**Recommended charging voltage Vc (Vdc)**	**Recommended charging current I_{rec} (A)**	**OCV before test (Vdc)**	**Results**
C01	4.2	2.0	4.195	A, B
C02	4.2	2.0	4.194	A, B
C03	4.2	2.0	4.194	A, B
C04	4.2	2.0	4.193	A, B
C05	4.2	2.0	4.195	A, B

Supplementary information:

A - No fire or explosion;
B - No leakage;
C - Others (please explain).

7.3.1	TABLE: External short-circuit (cell)				P
Sample no.	**Ambient T (°C)**	**OCV before test (Vdc)**	**Resistance of circuit (mΩ)**	**Maximum case temperature rise ΔT (K)**	**Results**
Samples charged at charging temperature upper limit 45°C					
C06	55.7	4.163	85	68.6	A, C
C07	55.7	4.165	82	68.9	A, C
C08	55.7	4.165	88	72.4	A, C
C09	55.7	4.168	83	71.5	A, C
C10	55.7	4.162	90	67.1	A, C
Samples charged at charging temperature lower limit 0°C					
C11	56.1	4.135	81	67.1	A, C
C12	56.1	4.137	85	74.3	A, C
C13	56.1	4.132	87	69.9	A, C
C14	56.1	4.134	80	76.9	A, C
C15	56.1	4.135	89	76.2	A, C

Supplementary information:

A - No fire or explosion;
B - The test was completed after 24 hours elapsed;
C - The test was completed after the cell casing cooled to 20% of the maximum temperature rise;
D - Others (please explain).

IEC 62133-2			
Clause	Requirement + Test	Result - Remark	Verdict

7.3.2	TABLE: External short-circuit (battery)					P
Sample no.	**Ambient T (°C)**	**OCV before test (Vdc)**	**Resistance of circuit (mΩ)**	**Maximum case temperature rise ΔT (K)**	**Component single fault condition**	**Results**
B01	23.4	24.96	82	0.9	SC Q4	A, D
B02	23.4	24.98	87	0.7	SC Q4	A, D
B03	23.4	24.95	79	0.8	SC F1	A, D
B04	23.4	25.01	88	0.7	SC F1	A, D
B05	23.4	24.97	84	0.4	--	A, D

Supplementary information:

A - No fire or explosion;

B - The test was completed after 24 hours elapsed;

C - The test was completed after the case temperature declined by 20 % of the maximum temperature rise;

D - Rapid decline in short circuit current, the battery pack remained on test for an additional one hour after the current reaches a low end steady state condition;

E - Others (please explain);

SC= Short circuit.

7.3.5	TABLE: Crush (cells)			P
Sample no.	**OCV before test (Vdc)**	**OCV at removal of crushing force (Vdc)**	**Maximum force applied to the cell during crush (kN)**	**Results**
Samples charged at charging temperature upper limit 45°C				
C29	4.162	4.160	12.97	A, B
C30	4.166	4.166	12.98	A, B
C31	4.165	4.164	12.97	A, B
C32	4.163	4.162	12.99	A, B
C33	4.165	4.163	12.97	A, B
Samples charged at charging temperature lower limit 0°C				
C34	4.132	4.131	12.98	A, B
C35	4.137	4.136	12.97	A, B
C36	4.135	4.133	12.97	A, B
C37	4.140	4.140	12.98	A, B
C38	4.133	4.132	12.97	A, B

IEC 62133-2			
Clause	Requirement + Test	Result - Remark	Verdict

Supplementary information:

A - No fire or explosion;

B - Force released after maximum level reached;

C - An abrupt voltage drop of one-third of the original voltage has been obtained;

D - Others (please explain).

7.3.6	TABLE: Over-charging of battery	P
Constant charging current (A) .....:	8.0	—
Supply voltage (Vdc) .....:	30.24	—

Sample no.	OCV before charging (Vdc)	Total charging time (minute)	Maximum outer case temperature (°C)	Results
B09	17.96	62	23.2	A, B
B10	18.11	62	23.0	A, B
B11	17.93	62	23.0	A, B
B12	18.05	62	22.8	A, B
B13	18.02	62	22.7	A, B

Supplementary information:

A - No fire or explosion;

B - The temperature of the outer casing reached steady state conditions (less than 10 °C change in 30-minute period);

C - The temperature of the outer casing returned to ambient;

D - Others (please explain).

7.3.7	TABLE: Forced discharge (cells)	P

Sample no.	OCV before application of reverse charge (Vdc)	Measured reverse charge I_t (A)	Lower limit discharge voltage (Vdc)	Results
C39	2.927	4.0	2.5	A, C
C40	2.923	4.0	2.5	A, C
C41	2.932	4.0	2.5	A, C
C42	2.937	4.0	2.5	A, C
C43	2.929	4.0	2.5	A, C

Supplementary information:

A - No fire or explosion;

B - The voltage reach negative value of upper limit charging voltage;

C - The voltage did not reach negative value of upper limit charging voltage;

D - Others (please explain).

IEC 62133-2			
Clause	Requirement + Test	Result - Remark	Verdict

7.3.8.1	TABLE: Vibration				P
Sample no.	**OCV before test (Vdc)**	**OCV after test (Vdc)**	**Mass before test (g)**	**Mass after test (g)**	**Results**
B14	24.95	24.93	465.997	465.994	A
B15	24.98	24.97	466.887	466.886	A
B16	24.93	24.92	466.118	466.116	A

Supplementary information:

A - No fire. No explosion. No leakage. No venting. No rupture;
B - Others (please explain).

7.3.8.2	TABLE: Mechanical shock				P
Sample no.	**OCV before test (Vdc)**	**OCV after test (Vdc)**	**Mass before test (g)**	**Mass after test (g)**	**Results**
B17	24.97	24.97	466.127	466.126	A
B18	24.94	24.93	466.410	466.408	A
B19	24.95	24.94	466.480	466.479	A

Supplementary information:

A - No fire. No explosion. No leakage. No venting. No rupture;
B - Others (please explain).

7.3.9	TABLE: Forced internal short circuit (cells)				N/A
Sample no.	**Chamber ambient T (°C)**	**OCV before test (Vdc)**	**Particle location [1)]**	**Maximum applied pressure (N)**	**Results**
Samples charged at charging temperature upper limit °C					
Samples charged at charging temperature lower limit °C					

IEC 62133-2			
Clause	Requirement + Test	Result - Remark	Verdict

Supplementary information:

[1)] Identify one of the following:

1: Nickel particle inserted between positive and negative (active material) coated area.

2: Nickel particle inserted between positive aluminium foil and negative active material coated area.

A - No fire or explosion;

B - Others (please explain).

D.2	TABLE: Internal AC resistance for coin cells			N/A
Sample no.	**Ambient T (°C)**	**Store time (h)**	**Resistance Rac (Ω)**	**Results [1)]**

Supplementary information:

[1)] Coin cells with internal resistance less than or equal to 3 Ω, see test result on corresponding tables

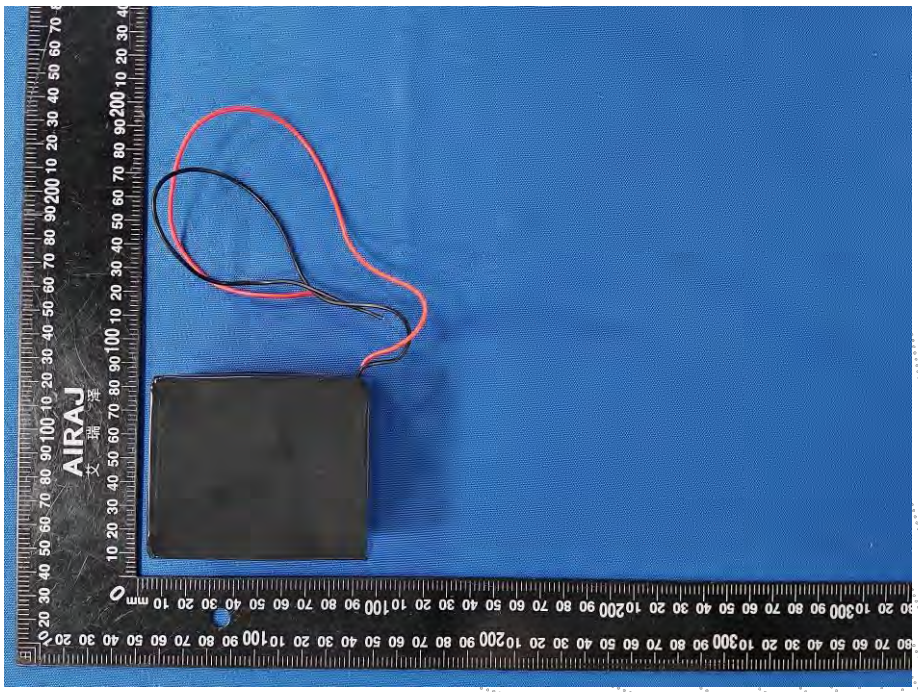
IEC 62133-2			
Clause	Requirement + Test	Result - Remark	Verdict

	TABLE: Critical components information				P
Object / part No.	**Manufacturer / trademark**	**Type / model**	**Technical data**	**Standard**	**Mark(s) of conformity[1)]**
PCB	ShenZhen RisingSun Circuit Technology Co. Ltd.	FR4/HCX-PCB-D1079	V-0, 130°C	UL 796	E513042
Wire	DONGGUAN HAODE WIRE & CABLE TECHNOLOGY CO LTD	3239	22AWG, 200°C, 3KV	UL 758	E364036
Protective IC (U1)	Saiwei Microelectronics Co., Ltd.	CW1274ALBS	V_{CU}: 4.25V±0.25V, V_{DL}: 2.8V±0.03V	--	Tested with appliance
MOSFET (Q1, Q2, Q3, Q4, Q5, Q6)	Huayi Microelectronics Co., Ltd.	HYG025N04NA1C2	V_{DS}= 401V, V_{GS}= ±20V, I_D= 135A	--	Tested with appliance
FUSE (F1)	DONGGUAN TLC ELECTRONIC TECHNOLOGY CO., LTD.	2410	72VDC 20A	--	Tested with appliance
NTC (R11)	GUANGDONG XINSHIHENG TECHNOLOGY CO., LTD.	MF52D103F3435	10K±5%	--	Tested with appliance
Cell	Samsung SDI Co., Ltd.	INR21700-40T	3.7V, 4000mAh	IEC 62133-2:2017/AMD 1:2021	Tested with appliance
-Electrolyte	--	SWKD2-C005	LiPF6+DMC+EC+EMC	--	--
-Separator	--	RW61mm*20um	PE, shutdown temperature: 125±5°C	--	--
-Positive electrode	--	L5550	$Li(Ni_{0.5}Co_{0.2}Mn_{0.3})O_2$, Dimensions of pole: 948mm*62.5mm*0.141mm	--	--
-Negative electrode	--	AML400	Graphite, Dimensions of pole: 1032mm*64mm*0.151mm	--	--
Supplementary information: N/A					

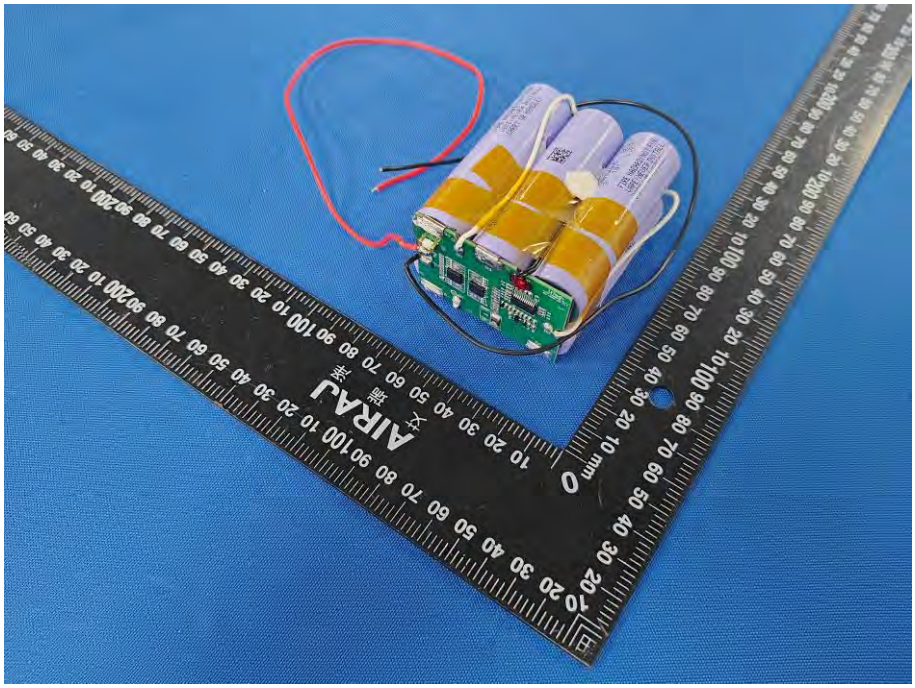
Enclosure

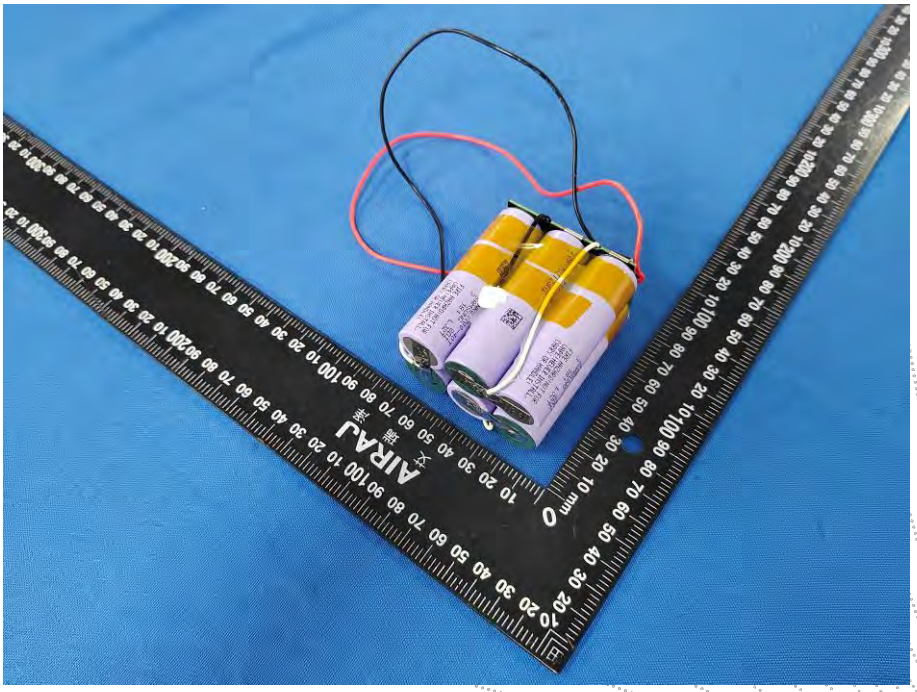
Supplement ID	Description
01	Over view photograph
02	Internal structure of battery
03	Internal cell photograph
04	PWB photograph
05	Dimension drawing
06	Circuit diagram and layout

ID 01-Over view photograph

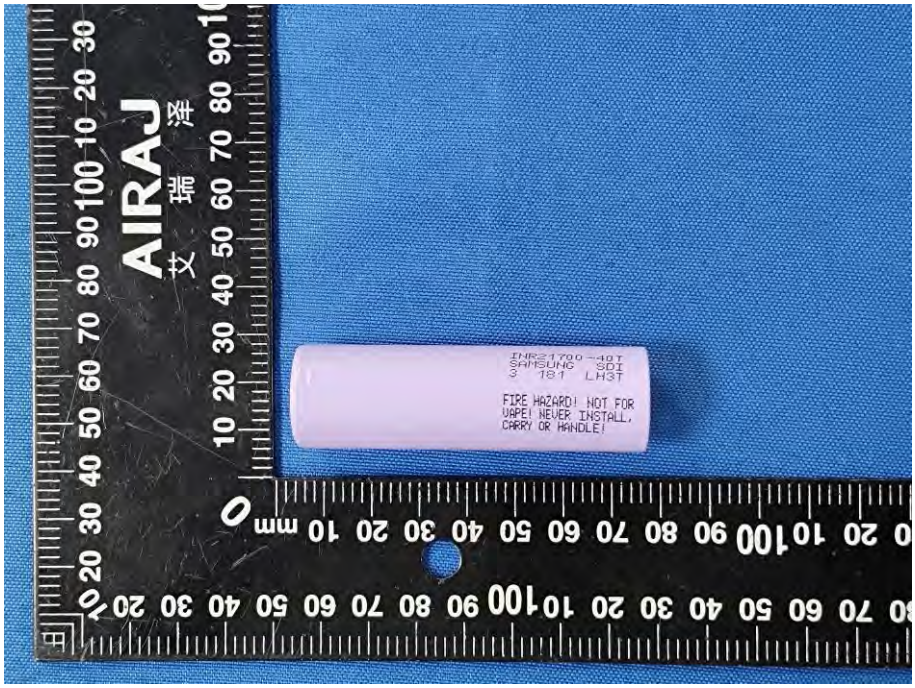


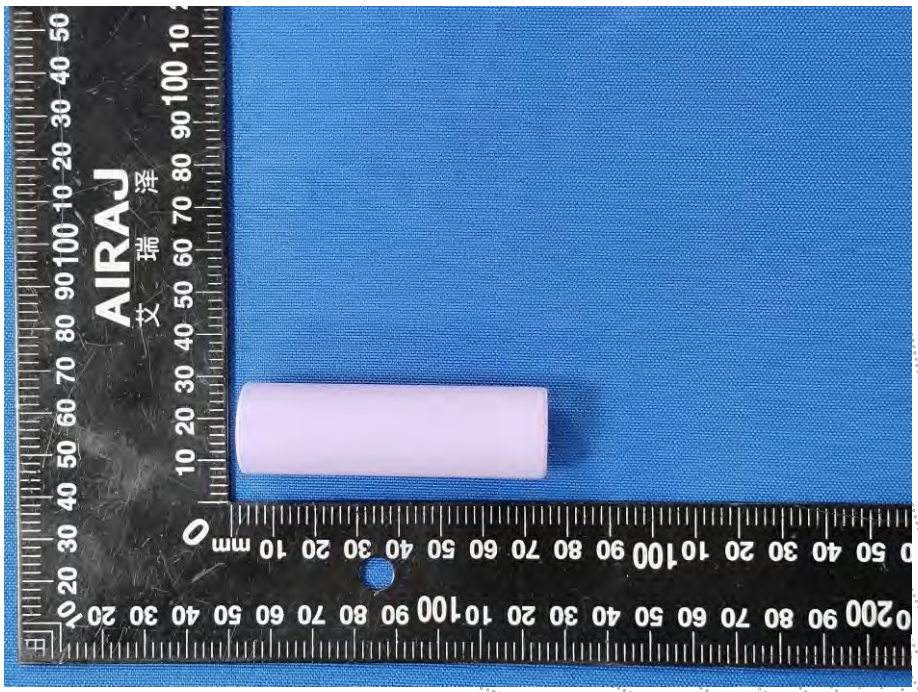
ID 02- Internal structure of battery



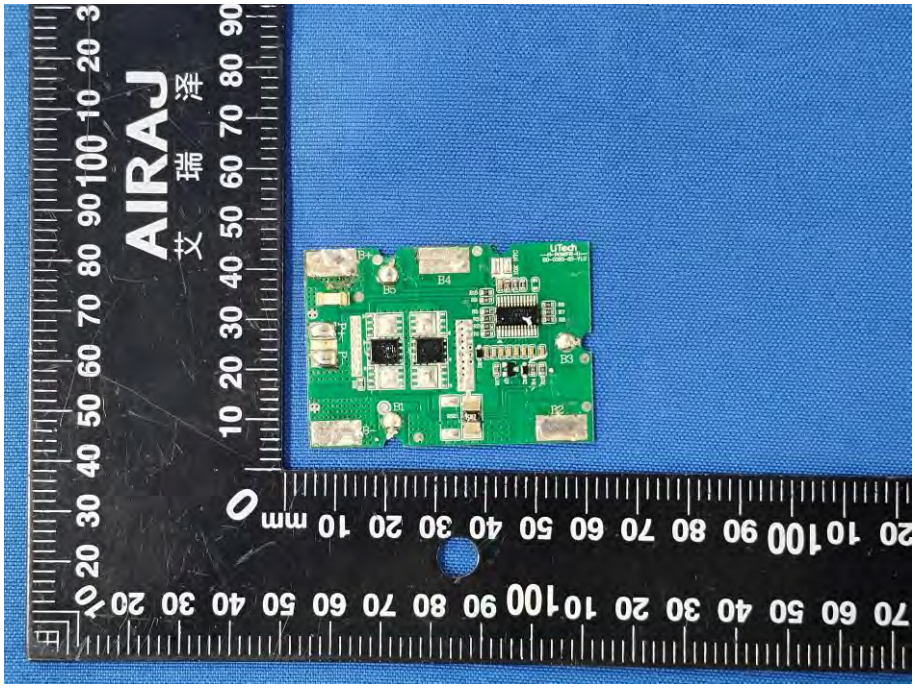


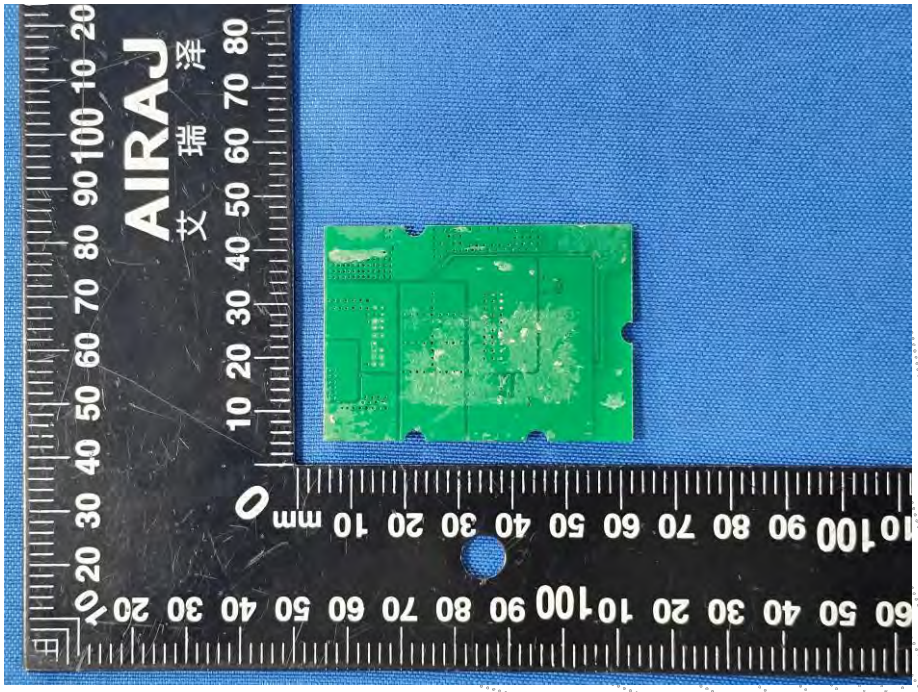
ID 03- Internal cell photograph



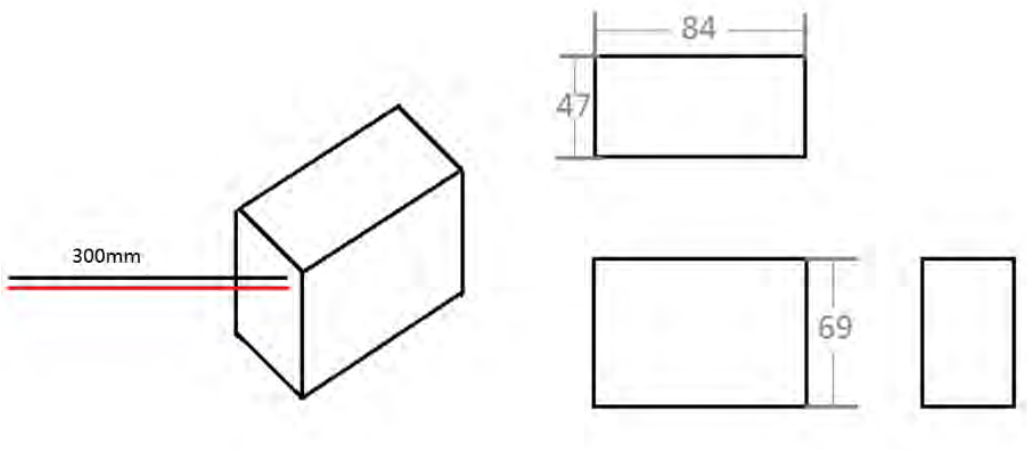


ID 04- PWB photograph

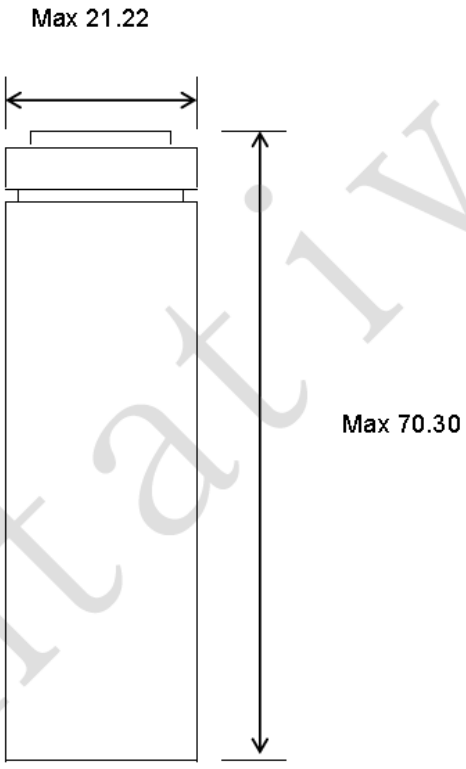




ID 05- Dimension drawing

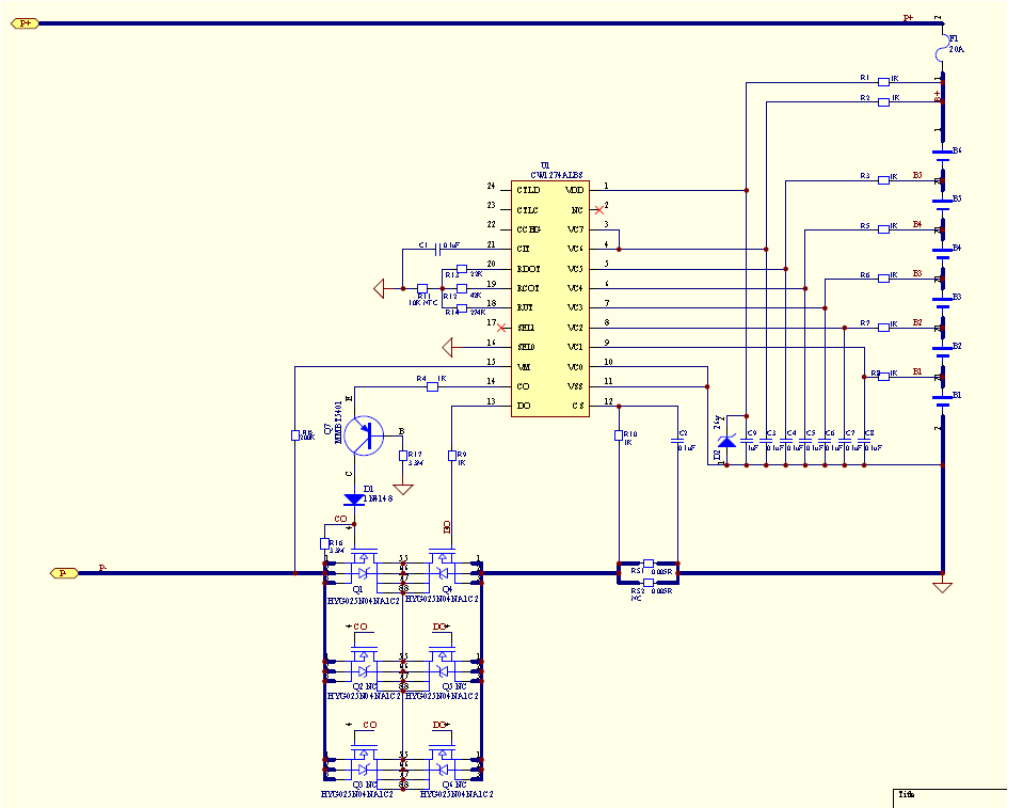


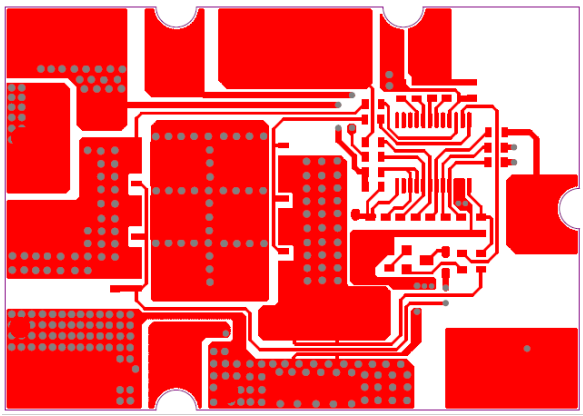
Battery (Unit: mm)

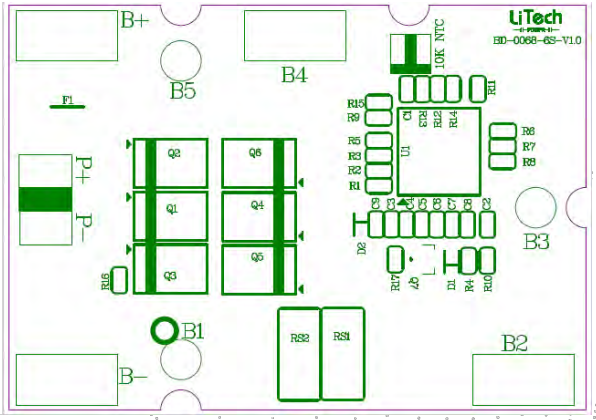


Cell (Unit: mm)

ID 06- Circuit diagram and layout







STATEMENT

1. The equipment lists are traceable to the national reference standards.

2. The test report can not be partially copied unless prior written approval is issued from our lab.

3. The test report is invalid without the "special seal for inspection and testing".

4. The test report is invalid without the signature of the approver.

5. The test process and test result is only related to the Unit Under Test.

6. Sample information is provided by the client and the laboratory is not responsible for its authenticity.

7. The quality system of our laboratory is in accordance with ISO/IEC17025.

8. If there is any objection to this test report, the client should inform issuing laboratory within 15 days from the date of receiving test report.

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※※※※※ **END** ※※※※※