


Prüfbericht-Nr.: <i>Test Report No.:</i>	CN230C6X 001	Auftrags-Nr.: <i>Order No.:</i>	168413175	Seite 1 von 20 <i>Page 1 of 20</i>
Kunden-Referenz-Nr.: <i>Client Reference No.:</i>	N/A	Auftragsdatum: <i>Order date:</i>	2023.02.03	
Auftraggeber: <i>Client:</i>	GlobTek, Inc. 186 Veterans Dr. Northvale NJ 07647, USA			
Prüfgegenstand: <i>Test item:</i>	Li-ion Rechargeable Cell			
Bezeichnung / Typ-Nr.: <i>Identification / Type No.:</i>	GP503048			
Auftrags-Inhalt: <i>Order content:</i>	TÜVus mark approval			
Prüfgrundlage: <i>Test specification:</i>	UL 1642:2020			
Wareneingangsdatum: <i>Date of sample receipt:</i>	2022.12.29			
Prüfmuster-Nr.: <i>Test sample No.:</i>	230128005-001~115			
Prüfzeitraum: <i>Testing period:</i>	2023.02.03 to 2023.03.08			
Ort der Prüfung: <i>Place of testing:</i>	Shenzhen ECT Testing Technology Co.,Ltd			
Prüflaboratorium: <i>Testing laboratory:</i>	TÜV Rheinland (Shenzhen) Co., Ltd.			
Prüfergebnis*: <i>Test result*:</i>	Pass			
erstellt von: <i>created by:</i>		genehmigt von: <i>authorized by:</i>		
Datum: 2023.03.31 <i>Date:</i>	Revan Dai	Datum: 2023.03.31 <i>Date:</i>	Jeffrey Qin	
Stellung / Position	Project Engineer	Stellung / Position	Reviewer	
Sonstiges / Other:	1. The complete test report includes the following attachments: - Attachment 1: Equipment list (4 pages); - Attachment 2: Photo documents (1 page).			
Zustand des Prüfgegenstandes bei Anlieferung: <i>Condition of the test item at delivery:</i>	Prüfmuster vollständig und unbeschädigt <i>Test item complete and undamaged</i>			
* Legende: P(ass) = entspricht o.g. Prüfgrundlage(n) F(ail) = entspricht nicht o.g. Prüfgrundlage(n) N/A = nicht anwendbar N/T = nicht getestet * Legend: P(ass) = passed a.m. test specification(s) F(ail) = failed a.m. test specification(s) N/A = not applicable N/T = not tested				
Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens. <i>This test report only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.</i>				

Test item particulars:

Information about the product needed to establish a correct test program, such as product mobility, type of power connections and similar.	(Test item particulars are selected by the TRF Originator base on the requirements in the standard)
Designation.....	GP503048
Trademark	
Nominal voltage.....	3.7V
Rated capacity.....	700mAh
Maximum charge voltage	4.2V
Maximum charge current.....	700mA
Final voltage	3.0V
Ambient temperature range.....	0~45°C (charge), -20~60°C (discharge)
Recommend charging method declared by the manufacturer	Charge the cell at 140mA CC to 4.2V, then 4.2V CV until charging current reaches 14mA at ambient 23±2°C.
Utilization Type	Technician replaceable cell

Testing:
Test clauses and results:

cl.10 Short-Circuit Test.....	P
cl.11 Abnormal Charging Test.....	P
cl.12 Forced-Discharge Test	N/A
cl.13 Crush Test	P
cl.14 Impact Test	P
cl.15 Shock Test.....	P
cl.16 Vibration Test.....	P
cl.17 Heating Test	P
cl.18 Temperature Cycling Test	P
cl.19 Low Pressure (Altitude Simulation) Test	P
cl.20 Projectile Test.....	P

Testing location:

Shenzhen ECT Testing Technology Co.,Ltd
B125, B126, B202 Block A.B, 107 Chuangzhi Park, Huijuxinqiao, No.18, Shangnan Shangliao Industrial Road, Shangliao Community, Xinqiao Street, Baoan District, Shenzhen, Guangdong, China

General remarks:

This report shall not be reproduced, except in full, without the written approval of the testing laboratory.
The test results presented in this report relate only to the object tested.
"(see remark #)" refers to a remark appended to the report.
"(see appended table)" refers to a table appended to the report.
Throughout this report a point is used as the decimal separator.

Copy of marking plate:

Remark: 1. YYMM represents the date of manufacture. "YY" represents the year, "MM" represents the month.

General product information:

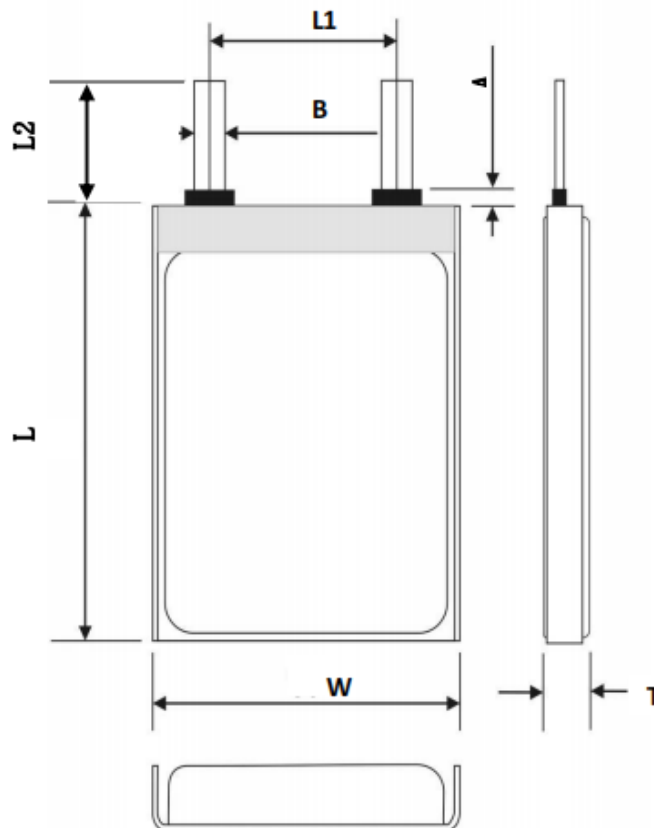
This cell consists of the positive electrode plate, negative electrode plate, separator and electrolyte. The positive and negative electrode plates are housed in the case in the state being separated by the separator.

The cell is evaluated according to UL 1642:2020 in this test report, and passed all the tests.

- 1) These tested cells have not been evaluated in combination with charger(s) or host product(s). Additional evaluation to determine compliance may be required on the combination(s) in the end product evaluation.
- 2) The tested cells were evaluated for a maximum charge current and maximum voltage limit outlined in the Table below. The end product evaluation shall ensure that current and voltage limits noted are maintained.
- 3) The tested cells shall be fixed in a case with sufficient protective strength as mechanical enclosure and fire enclosure. The end product shall be kept away from fire and high temperature area.
- 4) The charging temperature is 0~45°C and the discharging temperature is -20~60°C.

Electrical parameter of model:

Model	Rated capacity	Nominal voltage	Nominal Charge current	Nominal discharge current	Max. charge current	Max. discharge current	Max. charge voltage	End discharge voltage
GP503048	700mAh	3.7V	140mA	140mA	700mA	700mA	4.2V	3.0V

Construction:


T: Max 5.0mm, W: Max 30.3mm, L: Max 48.0mm
Cell

UL 1642:2020			
Clause	Requirement + Test	Result - Remark	Verdict
INTRODUCTION			
1	Scope		P
2	General		P
3	Glossary		P
CONSTRUCTION			
4	General		N/A
4.1	Casing		N/A
4.1.1	The casing of a lithium battery shall have the strength and rigidity necessary to resist the abuses to which it may be subjected, without resulting in a risk of fire. The casing of a user-replaceable lithium battery shall have the strength and rigidity necessary to resist the abuses to which it may be subjected without resulting in a risk of injury to persons.	Technician replaceable cell without enclosure.	N/A
4.1.2	A cell of a user-replaceable battery shall be in a rigid casing of sufficient strength to prevent flexing. A tool providing the mechanical advantage of a pliers, screwdriver, or hacksaw shall be the minimum capable of opening the user-replaceable cell casing, if opening of the casing will expose metallic lithium.	See above	N/A
4.2	Electrolyte		N/A
4.2.1	A user-replaceable battery shall not contain pressurized vapor or liquid that could spray materials into the eyes or leak more than 5 mL of liquid when the battery casing is punctured under normal laboratory conditions, 23 ±2°C (73 ±3.6°F).	Technician-replaceable Battery.	N/A
4.3	Use		N/A
4.3.1	A lithium battery shall be protected from abnormal charging currents during use. A battery tested and found acceptable for the charging current, IC (see Section 11), under fault conditions specified by the manufacturer, shall be protected from larger charging currents in the end product application by: a) Two blocking components, such as diodes, or b) One blocking component and one current limiting component, such as a resistor or a fuse. The current limiting component shall limit the charging current to one-third the value used in the Abnormal Charging Test, Section 11.	Single cell only	N/A
PERFORMANCE			
5	General		P
5.1	Technician-replaceable Batteries		P

UL 1642:2020			
Clause	Requirement + Test	Result - Remark	Verdict
5.1.1	Technician-replaceable lithium cells or batteries are to be tested as described in Sections 10 – 20. Section 12, Forced-Discharge Test, is applicable only to cells intended to be used in series-connected multicell applications such as battery packs. For multicell installations, also see 5.3.1.		P
5.1.2	When a fire or explosion occurs as a result of the Crush Test, Section 13, or the Impact Test, Section 14, or the cell or battery ruptures to the extent that the aluminum test cage is penetrated during the Projectile Test, Section 20; the use of the technician replaceable cell or battery shall be restricted to applications in which it is not exposed to, or is protected from, any conditions shown to cause a fire or explosion.	No fire or explosion occurs	P
5.1.3	Cells and batteries subjected to the Shock Test, Section 15, Vibration Test, Section 16, Temperature Cycling Test, Section 18, and Low Pressure (Altitude Simulation) Test, Section 19, shall also not leak or vent. For these tests, unacceptable leakage is determined to have occurred when the resulting mass loss exceeds the values shown in Table 5.1, Venting and leakage mass loss criteria.	No leak or vent	P
5.2	User-replaceable Batteries		N/A
5.2.1	User-replaceable lithium cells or batteries are to be tested as described in Sections 10 – 20. Section 12, Forced Discharge Test, is applicable only to cells intended to be used in multicell applications such as battery packs. In addition to complying with the requirements for a technician replaceable cell or battery as specified in 5.1.1, a user-replaceable cell or battery shall not explode or ignite when subjected to the Crush Test, Section 13, or the Impact Test, Section 14. A user-replaceable battery shall comply with the requirements for Sections 10 – 20 and with the applicable construction requirements outlined in Section 4. Secondary lithium cells shall not be considered user-replaceable.	Technician-replaceable cell	N/A
5.2.2	Sets of five specimens each are to be used for the Projectile Test, Section 20.3; see Table 6.1. When only one specimen from a set of five does not comply with the requirements, another set of five specimens is to be tested. All specimens from this second set shall comply with the requirements.	Technician-replaceable cell	N/A
5.3	Multicell Installations		N/A
5.3.1	A technician-replaceable or user-replaceable cell intended for use in multicell installations or battery packs shall also be tested as described in 10.3 and Section 12. No fire or explosion shall occur as a result of these tests. In addition, batteries subjected to the test described in 10.3 shall meet the requirements as described in 5.1.1 and 5.2.1 for a cell or battery subjected to the Short-Circuit Test, Section 10.	Single cell.	N/A
6	Samples		P

UL 1642:2020			
Clause	Requirement + Test	Result - Remark	Verdict
6.1	Fully charged primary cells or batteries and primary cells or batteries that have been conditioned by partial or complete discharge, or both, are to be used for the tests described in Sections 10 – 20. The number of samples to be used in each test for a primary cell or battery is shown in Table 6.1. When a group of cells or batteries of different sizes, but similar chemistries is involved, selected sizes representative of the range are to be tested.	The samples are secondary cells.	N/A
6.2	Fully charged secondary cells or batteries and secondary cells or batteries that have been conditioned by charge-discharge cycling are to be used for the tests described in Sections 10 – 20. The number of samples to be used in each test for a secondary cell or battery is shown in Table 6.2. When a group of cells or batteries of different sizes, and similar chemistries is involved, selected sizes representative of the range are to be tested.	The samples are secondary technician-replaceable cells. Prepared as required.	P
6.3	Prior to conducting the testing in Section 17, the lithium ion cell samples shall be pre-conditioned as outlined in 6.4 and 6.5.	Prepared as required.	P
6.4	For the heating test of Section 17, two sets of five lithium ion cell samples are to be fully discharged (i.e. to the manufacturer's specified end point voltage). The samples are then placed in a test chamber and conditioned for 1 to 4 h (5 samples at the upper temperature limit and 5 samples at the lower temperature limit of the operating region) as outlined in Table 6.3.	Prepared as required.	P
6.5	While still in the test chamber set at the temperature limits, the samples are charged (5 samples at the upper temperature limit and 5 samples at lower temperature limit) at the specified maximum charging current and upper limit charging voltage per Table 6.3, using a constant voltage charging method. Charging is continued until the charge current is reduced to the specified end of charge conditions (i.e. 0.05 times the charge current).	Prepared as required.	P
7	Conditioning of Samples		P
7.1	Discharge		N/A
7.1.1	Primary batteries are to be completely discharged by connecting their terminals through resistors that provide the desired level of discharge within 60 days. Batteries are to be discharged at room temperature. Cells with a liquid cathode such as thionyl chloride or sulfur dioxide, shall also be conditioned by one-half discharge	The samples are secondary cells.	N/A

UL 1642:2020			
Clause	Requirement + Test	Result - Remark	Verdict
7.1.2	For solid electrolyte and other types of primary lithium batteries that cannot be discharged within 60 days because of the small currents they inherently produce, longer discharge times plus discharge at higher temperatures may be used to obtain the desired level of discharge. The manufacturer's recommended discharge procedures are to be followed so as to obtain the required discharge level in the minimum time.	The samples are secondary cells.	N/A
7.2	Charge-discharge cycling		P
7.2.1	Secondary cells are to be conditioned at 25°C (77°F). Cells are continuously cycled as per the manufacturer's specifications. The specification shall be such that the full rated capacity of the cell is utilized and the number of cycles accumulated shall be at least equal to 25% of the advertised cycle life of the cell or cycled continuously for 90 days, whichever is shorter. Cycling is to be done either individually or in groups. Cells are to be recharged prior to testing as indicated in Table 6.2.	The samples are cycled at manufacturer's factory before they were sent for test.	P
8	Important test considerations		P
8.1	Some lithium batteries are capable of exploding when the tests described in Sections 10 – 20 are conducted. It is important that personnel be protected from the flying fragments, explosive force, sudden release of heat, and noise that results from such explosions. The test area is to be well ventilated to protect personnel from possible harmful fumes or gases.	Prepared the tests as required.	P
8.2	As an additional precaution, the temperatures on the surface of the battery casings shall be monitored during the tests described in Sections 10, 11, 12, 13, and 14. All personnel involved in the testing of lithium batteries are to be instructed never to approach a lithium battery while the surface temperature exceeds 90°C (194°F) and not to touch the lithium battery while the surface temperature exceeds 45°C (113°F).	Prepared the tests as required.	P
8.3	For protection, the Projectile Test, Section 20 is to be conducted in a room separate from the observer.	Prepared the tests as required.	P
9	Temperature Measurements		P
9.1	Temperatures are to be measured by thermocouples consisting of wires not larger than 24 AWG (0.21 mm ²) and not smaller than 30 AWG (0.05 mm ²) and a potentiometer-type instrument.	Prepared the tests as required.	P
9.2	The temperature measurements on the batteries are to be made with the measuring junction of the thermocouple held tightly against the metal casing of the battery.	Prepared the tests as required. Casing temperature was recorded on the center of the cell surface;	P
TESTS FOR TECHNICIAN-REPLACEABLE AND USER-REPLACEABLE BATTERIES			
ELECTRICAL TESTS			

UL 1642:2020			
Clause	Requirement + Test	Result - Remark	Verdict
10	Short-Circuit Test		P
10.1	Each test sample battery, in turn, is to be short-circuited by connecting the positive and negative terminals of the battery with a circuit load having a resistance load of $80 \pm 20 \text{ m}\Omega$. The temperature of the battery case is to be recorded during the test. The battery is to discharge until a fire or explosion is obtained, or until it has reached a completely discharged state of less than 0.2 V and the battery case temperature has returned to $\pm 10^\circ\text{C}$ ($\pm 18^\circ\text{F}$) of ambient temperature. The voltage at the end of the test may not reach 0.2 V due to operation of protective devices in the circuit. The return to near ambient of the battery (cell) casing in an indication of ultimate results.	Tested as required. See table 10	P
10.2	Tests are to be conducted at $20 \pm 5^\circ\text{C}$ ($68 \pm 9^\circ\text{F}$) and at $55 \pm 5^\circ\text{C}$ ($131 \pm 9^\circ\text{F}$). The batteries are to reach equilibrium at $20 \pm 5^\circ\text{C}$ or $55 \pm 5^\circ\text{C}$, as applicable, before the terminals are connected.	Tested as required.	P
10.3	A battery is to be tested individually unless the manufacturer indicates that it is intended for use in series or parallel. For series or parallel use, additional tests on five sets of batteries are to be conducted using the maximum number of batteries to be covered for each configuration.	Tested as required.	P
10.4	When an overcurrent protective device activates during the test, the test shall be repeated with the battery supply connected to the maximum load that does not cause the protective device to open. Protective devices that are relied upon to meet the compliance criteria for the short circuit test shall comply with 2.3.1.	Only one single Li-ion Rechargeable Cell, no over-current or thermal protective device was integrated into the cell.	N/A
10.5	The samples shall not explode or catch fire.	The test results meet the requirements.	P
11	Abnormal Charging Test		P
11.1	Primary cells or batteries shall comply with 11.2 – 11.7.	Secondary cell	N/A
11.2	Cells or batteries conditioned in accordance with Tables 6.1, as applicable, are to be used for this test. The batteries are to be tested in an ambient temperature of $20 \pm 5^\circ\text{C}$ ($68 \pm 9^\circ\text{F}$).		N/A

UL 1642:2020			
Clause	Requirement + Test	Result - Remark	Verdict
11.3	<p>Each test sample battery is to be subjected to a charging current of three times the current I_c, specified by the manufacturer by connecting it in opposition to a dc-power supply. The specified charging current is to be obtained by connecting a resistor of the specified size and rating in series with the battery. The test charging time is to be calculated using the formula:</p> $t_c = \frac{2.5C}{3(I_c)}$ <p>, in which</p> <p>t_c is the charging time in hour</p> <p>C is the capacity of the cell/battery in ampere-hours, and</p> <p>I_c is the maximum charging current, in amperes, specified by the manufacturer.</p> <p>The minimum charging time is to be 7 hours.</p>		N/A
11.4	<p>When a non-resettable overcurrent or protective device operates during the test, the test is to be repeated at a charge current below the level that the protective device operates. When a resettable protective device operates during the test, the protector is allowed to reset to a total of 10 cycles; or until the appropriate charging time has been completed, but not less than 7 hours. Protective devices that are relied upon to meet the compliance criteria for the abnormal charging test shall comply with 2.3.1.</p>		N/A
11.5	The samples shall not explode or catch fire.		N/A
11.6	Secondary cells or batteries shall comply with 11.7 – 11.10.	See table 11, tested as required	P
11.7	Cells or batteries conditioned in accordance with Tables 6.2, as applicable, are to be used for this test. The batteries are to be tested in an ambient temperature of $20 \pm 5^\circ\text{C}$ ($68 \pm 9^\circ\text{F}$).	Tested as required.	P
11.8	Each test sample battery is to be discharged at a constant current of $0.2 C/1 \text{ h}$, to a manufacturer specified discharge endpoint voltage. The cell or battery is then to be charged with a constant maximum specified output voltage and a current limit of three times the maximum charging current I_c , specified by the manufacturer. Charging duration is to be 7 hours or the time required to reach the manufacturer's specified end-of-charge condition, whichever is greater.	Tested as required.	P

UL 1642:2020			
Clause	Requirement + Test	Result - Remark	Verdict
11.9	When a non-resettable overcurrent or protective device operates during the test, the test shall be repeated at an overcharging current below the level that the protection device operates. When a resettable protective device operates during the test, the protector is to be allowed to reset to a total of 10 cycles; or until the appropriate charging time has been completed, but not less than 7 hours. Protective devices that are relied upon to meet the compliance criteria for the abnormal charging test shall comply with 2.3.1.	The samples are to be tested without any assistance of over-current or thermal protective devices.	N/A
11.10	The samples shall not explode or catch fire.	No explosion or catch fire during and after the test	P
12	Forced-Discharged Test		N/A
12.1	This test is intended for cells that are to be used in series-connected, multicell applications, such as battery packs.	One single cell	N/A
12.2	A fully discharged cell is to be force-discharged by connecting it in series with fully charged cells of the same kind. The number of fully charged cells to be connected in series with the discharged cell is to equal the maximum number less one of the cells to be covered for series use. Five cells are to be completely discharged, at room temperature.		N/A
12.3	Once the fully discharged cell is connected in series with the specified number of fully charged cells the resultant battery pack is to be short circuited.		N/A
12.4	The positive and negative terminals of the sample are to be connected with a copper wire with a resistance load of $80 \pm 20 \text{m}\Omega$. The sample is to discharge until a fire or explosion is obtained, or until it has reached a completely discharged state of less than 0.2V and the battery case temperature has returned to $\pm 10^\circ\text{C}$ (18°F) of ambient temperature. The voltage at the end of the test may not reach 0.2V due to operation of protective devices in the circuit. The return to near ambient of the cell casing is an indication of ultimate results.		N/A
12.5	When an overcurrent or protective operates during the test, the test shall be repeated with the battery supply connected to the maximum load that does not cause the protective device to open. Protective devices that are relied upon to meet the compliance criteria for the forced discharge test shall comply with 2.3.1.		N/A
12.6	The samples shall not explode or catch fire.		N/A
MECHANICAL TESTS			
13	Crush Test		P

UL 1642:2020			
Clause	Requirement + Test	Result - Remark	Verdict
13.1	A battery is to be crushed between two flat surfaces. The force for the crushing is to be applied by a hydraulic ram or similar force mechanism. The flat surfaces are to be brought in contact with the cells and the crushing is to be continued until an applied force of 13 ±1 kN (3000 ±224 lbs) is reached. Once the maximum force has been obtained it is to be released.	Tested as required. See table 13	P
13.2	A cylindrical, pouch or prismatic cell is to be crushed with its longitudinal axis parallel to the flat surfaces of the crushing apparatus. A prismatic cell is also to be rotated 90° around its longitudinal axis so that both the wide and narrow sides will be subjected to the crushing force. Each sample is to be subjected to a crushing force in only one direction. Separate samples are to be used for each test.	Tested as required. The sample are pouch Li-ion Rechargeable Cells.	P
	Exception: For Lithium ion systems, a cylindrical, pouch or prismatic cell is to be crushed with its longitudinal axis parallel to the flat surface of the crushing apparatus. Each sample is to be subjected to a crushing force in only one direction. Test only the wide side of pouch and prismatic cells.	Li-ion cell.	P
13.3	A coin or button battery is to be crushed with the flat surface of the battery parallel with the flat surfaces of the crushing apparatus.	Not a coin or button battery	N/A
13.4	The samples shall not explode or catch fire.	No explosion or catch fire during and after the test	P
14	Impact Test		P
14.1	A test sample battery is to be placed on a flat surface. A 15.8 ±0.1-mm (5/8 ±0.004-in) diameter bar is to be placed across the center of the sample. A 9.1 ±0.46-kg (20 ±1-lb) weight is to be dropped from a height of 610 ±25 mm (24 ±1 in) onto the sample. See Figure 14.1.	Prepared the test as required. See table 14	P
14.2	A cylindrical, pouch or prismatic cell is to be impacted with its longitudinal axis parallel to the flat surface and perpendicular to the longitudinal axis of the 15.8-mm (5/8-in) diameter curved surface lying across the center of the test sample. A prismatic cell is also to be rotated 90° around its longitudinal axis so that both the wide and narrow sides are subjected to the impact. Each sample is to be subjected to only a single impact. Separate samples are to be used for each test.	Tested as required.	P
	Exception: For Lithium ion systems, a cylindrical, pouch or prismatic cell is to be impacted with its longitudinal axis parallel to the flat surface and perpendicular to the longitudinal axis of the 15.8-mm (5/8-in) diameter curved surface lying across the center of the test sample. Each sample is to be subjected to only a single impact. Test only the wide side of pouch and prismatic cells.	The samples are prismatic Li-ion Rechargeable Cells.	P

UL 1642:2020			
Clause	Requirement + Test	Result - Remark	Verdict
14.3	A coin or button battery is to be impacted with the flat surface of the test sample parallel to the flat surface and the 15.8-mm (5/8-in) diameter curved surface lying across its center.	Not a coin or button battery	N/A
14.4	The samples shall not explode or catch fire.	No explosion or catch fire.	P
ENVIRONMENTAL TESTS			
17	Heating Test		P
17.1	A battery is to be heated in a gravity convection or circulating air oven with an initial temperature of 20 ±5°C (68±9°F). The temperature of the oven is to be raised at a rate of 5 ±2°C (9±3.6°F) per minute to a temperature of 130 ±2°C (266±3.6°F) and remain for 10 min. The sample shall return to room temperature (20±5°C) and then be examined. For batteries specified for temperatures above 100°C (212°F), the conditioning temperature shall be increased from 130 ±2°C (266±3.6°F), to 30±2°C (86±3.6°F) above the manufacturers maximum specified temperature. For a battery of lithium metal chemistry, the conditioning temperature shall be increased to a maximum of 170 ±2°C (338±3.6°F).	Tested as required. Oven temperature: 130°C.	P
17.2	The samples shall not explode or catch fire.	The test results meet the requirements.	P
18	Temperature Cycling Test		P
18.1	The batteries are to be placed in a test chamber and subjected to the following cycles: a) Raising the chamber-temperature to 70 ±3°C (158 ±5°F) within 30 minutes and maintaining this temperature for 4 hours. b) Reducing the chamber temperature to 20 ±3°C (68 ±5°F) within 30 minutes and maintaining this temperature for 2 hours. c) Reducing the chamber temperature to minus 40 ±3°C (minus 40 ±5°F) within 30 minutes and maintaining this temperature for 4 hours. d) Raising the chamber temperature to 20 ±3°C (68 ±5°F) within 30 minutes. e) Repeating the sequence for a further 9 cycles. f) After the 10th cycle, storing the batteries for a minimum of 24 hours, at a temperature of 20 ±5°C (68 ±9°F) prior to examination.	Tested as required. See table 18	P
18.2	The samples shall not explode or catch fire. In addition, the samples shall not vent or leak as described in 5.1.1.	The test results meet the requirements.	P
19	Low Pressure (Altitude Simulation) Test		P
19.1	Sample batteries are to be stored for 6 hours at an absolute pressure of 11.6 kPa (1.68 psi) and a temperature of 20 ± 3°C (68 ± 5°F).	Tested as required. See table 19	P

UL 1642:2020			
Clause	Requirement + Test	Result - Remark	Verdict
19.2	The samples shall not explode or catch fire as a result of the Low Pressure (Altitude Simulation) Test. In addition, the samples shall not vent or leak as described in 5.1.1.	The test results meet the requirements.	P
FIRE EXPOSURE TEST			
20	Projectile Test		P
20.1	When subjected to the test described in 20.2 - 20.5 no part of an exploding cell or battery shall penetrate the wire screen such that some or all of the cell or battery protrudes through the screen.	The test results meet the requirements.	P
20.2	Each test sample cell or battery is to be placed on a screen that covers a 102-mm (4-inch) diameter hole in the center of a platform table. The screen is to be constructed of steel wire mesh having 20 openings per 25.4 mm (1 in) and a wire diameter of 0.43 mm (0.017 in).	Prepared the test as required.	P
20.3	The screen is to be mounted 38 mm (1-1/2 in) above a Meker type burner. The fuel and air flow rates are to be set to provide a bright blue flame that causes the supporting screen to glow a bright red.	Prepared the test as required.	P
20.4	An eight-sided covered wire cage, 610-mm (2-ft) across and 305-mm (1-ft) high, made from metal screening is to be placed over the test sample. See Figure 20.1. The metal screening is to be constructed from 0.25-mm (0.010-in) diameter aluminum wire with 16 -18 wires per 25.4 mm (1 inch) in each direction.	Tested as required.	P
20.5	The sample is to be heated and shall remain on the screen until it explodes or the cell or battery has ignited and burned out. It is not required to secure the sample in place unless it is at risk of falling off the screen before the test is completed. When required, the sample shall be secured to the screen with a single wire tied around the sample.	Tested as required.	P
MARKING			
21	General		P
21.1	A battery shall be legibly and permanently marked with: The manufacturer's name, trade name, or trademark or other descriptive marking by which the organization responsible for the product may be identified; A distinctive ("catalog" or "model") number or the equivalent; The date or other dating period of manufacture not exceeding any three consecutive months.	See marking plate on page 3	P
21.2	If a manufacturer produces a battery at more than one factory, each battery package shall have a distinctive marking to identify it as the product of a particular factory.	One factory only.	N/A
22	Primary Batteries		N/A

UL 1642:2020			
Clause	Requirement + Test	Result - Remark	Verdict
22.1	A primary battery shall be marked with the word "WARNING" and the following or an equivalent statement: "Risk of fire and burns. Do not recharge, open, crush, heat above (the manufacturer's specified temperature rating), or incinerate." If space does not permit marking on the battery, the marking may be on the smallest unit package.	Secondary cell	N/A
22.2	The packaging for a user-replaceable battery shall be marked with the word "CAUTION" and the following or equivalent statements: "Risk of fire and burns. Do not recharge, disassemble, heat above (the manufacturer's specified temperature rating), or incinerate. Keep battery out of reach of children and in original package until ready to use. Dispose of used batteries promptly."		N/A
22.3	For user replaceable lithium primary coin cells (3.0 V) the packaging shall also include the following or equivalent: "WARNING – Never put batteries in mouth. Swallowing may lead to serious injury or death. If ingested, immediately seek medical attention and have the doctor phone the National Capital Poison Control Center." This marking may be combined with the marking of 22.2, if the signal word "WARNING" is used instead of "CAUTION."		N/A

10	TABLE: Short-Circuit Test					P
Fully Charged Samples						
Sample No.	230128005-001	230128005-002	230128005-003	230128005-004	230128005-005	
Ambient temperature: (at 20±5°C, °C)	23.3	23.3	23.3	23.3	23.3	
Max. casing temp Tmax (°C)	124.9	120.8	129.9	125.3	117.3	
Sample No.	230128005-006	230128005-007	230128005-008	230128005-009	230128005-010	
Ambient temperature: (at 55 ±5°C, °C)	58.4	58.4	58.4	58.4	58.4	
Max. casing temp Tmax (°C)	115.3	111.9	120.8	125.4	116.1	
Cycled Samples						
Sample No.	230128005-011	230128005-012	230128005-013	230128005-014	230128005-015	
Ambient temperature: (at 20±5°C, °C)	22.1	22.1	22.1	22.1	22.1	
Max. casing temp Tmax (°C)	125.9	101.5	125.8	120.2	125.6	
Sample No.	230128005-016	230128005-017	230128005-018	230128005-019	230128005-020	
Ambient temperature: (at 55 ±5°C, °C)	57.0	57.0	57.0	57.0	57.0	
Max. casing temp Tmax (°C)	116.6	112.7	121.6	127.0	117.1	
Supplementary information: Tmax was recorded on the centre of the cell surface. No explode or catch fire.						

11	TABLE: Abnormal Charging Test					P
Id	<u>0.14 A</u>		Ue		<u>3.0 V</u>	
Ic	<u>0.7 A</u>		Uc		<u>4.2 V</u>	
Fully Charged Samples						
Sample No.	230128005-021	230128005-022	230128005-023	230128005-024	230128005-025	
Ambient temperature: (°C)	20.1	20.1	20.1	20.1	20.1	
Max. casing temp Tmax (°C)	25.6	25.7	26.5	26.4	26.8	
Cycled Samples						
Sample No.	230128005-026	230128005-027	230128005-028	230128005-029	230128005-030	
Ambient temperature: (°C)	20.1	20.1	20.1	20.1	20.1	
Max. casing temp Tmax (°C)	27.8	27.9	24.9	25.7	26.5	
Supplementary information: Test current is 2.1A. No explode or catch fire.						

13	TABLE: Crush Test					P
Ambient temperature: 22.8°C						
Fully Charged Samples						
Sample No.	230128005-031	230128005-032	230128005-033	230128005-034	230128005-035	
Fire or explosion?	No	No	No	No	No	
Crush direction	Wide side	Wide side	Wide side	Wide side	Wide side	
Cycled Samples						
Sample No.	230128005-036	230128005-037	230128005-038	230128005-039	230128005-040	
Fire or explosion?	No	No	No	No	No	
Crush direction	Wide side	Wide side	Wide side	Wide side	Wide side	
Supplementary information: no explosion or catch fire.						

14	TABLE: Impact Test					P
Ambient temperature: 22.1°C						
Fully Charged Samples						
Sample No.	230128005-041	230128005-042	230128005-043	230128005-044	230128005-045	
Fire or explosion?	No	No	No	No	No	
Impact direction	Wide side	Wide side	Wide side	Wide side	Wide side	
Cycled Samples						
Sample No.	230128005-046	230128005-047	230128005-048	230128005-049	230128005-050	
Fire or explosion?	No	No	No	No	No	
Impact direction	Wide side	Wide side	Wide side	Wide side	Wide side	
Supplementary information: no explosion or catch fire.						

15	TABLE: Shock Test					P
Ambient temperature: 22.3°C						
Fully Charged Samples						
Sample No.	230128005-051	230128005-052	230128005-053	230128005-054	230128005-055	
Mass before test (g)	13.533	13.762	13.589	13.545	13.443	
Mass after test (g)	13.531	13.760	13.588	13.543	13.442	
Mass loss ratio (%)	0.015	0.015	0.007	0.015	0.007	
Cycled Samples						
Sample No.	230128005-056	230128005-057	230128005-058	230128005-059	230128005-060	
Mass before test (g)	13.233	13.589	13.411	13.537	13.504	
Mass after test (g)	13.231	13.587	13.408	13.535	13.502	
Mass loss ratio (%)	0.015	0.015	0.022	0.015	0.015	
Supplementary information: no explosion or catch fire, in addition the sample did not vent or leak. Max loss less than 0.1%						

16	TABLE: Vibration Test					P
Ambient temperature: 22.4°C						
Fully Charged Samples						
Sample No.	230128005-061	230128005-062	230128005-063	230128005-064	230128005-065	
Mass before test (g)	13.279	13.446	13.481	13.628	13.564	
Mass after test (g)	13.276	13.443	13.478	13.626	13.561	
Mass loss ratio (%)	0.023	0.022	0.022	0.015	0.022	
Cycled Samples						
Sample No.	230128005-066	230128005-067	230128005-068	230128005-069	230128005-070	
Mass before test (g)	13.623	13.574	13.577	13.788	13.554	
Mass after test (g)	13.620	13.572	13.574	13.786	13.551	
Mass loss ratio (%)	0.022	0.015	0.022	0.015	0.022	
Supplementary information: no explosion or catch fire, in addition the sample did not vent or leak. Max loss less than 0.1%						

18	TABLE: Temperature Cycling Test					P
Ambient temperature: 22.3°C						
Fully Charged Samples						
Sample No.	230128005-091	230128005-092	230128005-093	230128005-094	230128005-095	
Mass before test (g)	13.762	13.538	13.594	13.547	13.545	
Mass after test (g)	13.758	13.532	13.590	13.543	13.541	
Mass loss ratio (%)	0.029	0.044	0.029	0.030	0.030	
Cycled Samples						
Sample No.	230128005-096	230128005-097	230128005-098	230128005-099	230128005-100	
Mass before test (g)	13.517	13.475	13.587	13.453	13.536	
Mass after test (g)	13.513	13.471	13.582	13.450	13.531	
Mass loss ratio (%)	0.030	0.030	0.037	0.022	0.037	
Supplementary information: no explosion or catch fire, in addition the sample did not vent or leak. Max loss less than 0.1%						

19	TABLE: Low Pressure (Altitude Simulation) Test					P
Ambient temperature: 22.3°C						
Fully Charged Samples						
Sample No.	230128005-101	230128005-102	230128005-103	230128005-104	230128005-105	
Mass before test (g)	13.763	13.542	13.586	13.439	13.547	
Mass after test (g)	13.762	13.540	13.584	13.437	13.547	
Mass loss ratio (%)	0.007	0.015	0.015	0.015	0.000	
Cycled Samples						
Sample No.	230128005-106	230128005-107	230128005-108	230128005-109	230128005-110	
Mass before test (g)	13.514	13.468	13.597	13.459	13.534	
Mass after test (g)	13.513	13.467	13.596	13.458	13.534	
Mass loss ratio (%)	0.007	0.007	0.007	0.007	0.000	
Supplementary information: no explosion or catch fire, in addition the sample did not vent or leak. Max loss less than 0.1%						

Critical components information					
Material: e.g. external enclosure, PCB, closed-end connector, sleeves, cord anchorage etc.					
Components with winding: e.g. motor, transformer, magnetic coil etc.					
Other components: e.g. switch, thermostat, heater, plug, internal wire, capacitor, relay, varistor etc.					
Object/ Part No.	Manufacturer/ trademark	Type/ Model	Technical data	Standard	Mark(s) of conformity
Cell	JUHEYUAN SCIENCE & TECHNOLOGY CO., LTD.	GP503048	3.7V, 700mAh	UL 1642:2020	Tested with appliance
-Positive electrode	HuNan ShanShan New Energy Co., Ltd	LC-412	LiCoO ₂ , PVDF, NMP, Conductive Additive	--	--
-Negative electrode	Jiangxi Zichen Technology Co., Ltd.	FT-1	Graphite, CMC, SBR, Distilled Water, Conductive Additive	--	--
-Separator	Shanghai Energy New Materials Technology Co., Ltd.	0.02*43.5mm	0.02mm, PE, Shutdown Temperature: 130°C	--	--
-Electrolyte	Shenzhen Capchem Technology Co., Ltd.	LBC-3008A	LiPF ₆ +DMC+EC+PC+EMC	--	--

--End of main report--

List of test equipment used

Testing location:

Shenzhen ECT Testing Technology Co.,Ltd

B125, B126, B202, Block A.B, Huijuxinqiao 107 Chuangzhi Park, No.18, Shangnan Shangliao Industrial Road, Shangliao Community, Xinqiao Street, Baoan District, Shenzhen, Guangdong, China

Clause	Measurement/ testing	Testing/measuring equipment/material used, (equipment ID)	Range used	Last calibration date	Calibration due date
7	Conditioning of Samples	--	--	--	--
10	Short-Circuit Test	SZZY-YQ-027/Temperature measuring device/Guangke instrument	23°C~125°C	2022/06/14	2023/06/13
		SZZY-YQ-028/Temperature measuring device/Guangke instrument	23°C~125°C	2022/06/14	2023/06/13
		SZZY-YQ-108/Temperature control battery short circuit testing machine/Dongguan Gaoxin Testing Equipment Co., LTD	20~150°C, 80mΩ±20mΩ	2022/04/25	2023/04/24
		SZZY-YQ-109/High performance battery detection system/Neware	5V/6A	2022/09/30	2023/09/29
		SZZY-YQ-124/High performance battery detection system/Neware	5V/1A	2022/09/30	2023/09/29
		SZZY-YQ-125/High performance battery detection system/Neware	5V/6A	2022/09/30	2023/09/29
11	Abnormal Charging Test	SZZY-YQ-027/Temperature measuring device/Guangke instrument	23°C~125°C	2022/06/14	2023/06/13
		SZZY-YQ-028/Temperature measuring device/Guangke instrument	23°C~125°C	2022/06/14	2023/06/13
		SZZY-YQ-109/High performance battery detection system/Neware	5V/6A	2022/09/30	2023/09/29

		SZZY-YQ-124/High performance battery detection system/Neware	5V/1A	2022/09/30	2023/09/29
		SZZY-YQ-125/High performance battery detection system/Neware	5V/6A	2022/09/30	2023/09/29
13	Crush Test	SZZY-YQ-027/Temperature measuring device/Guangke instrument	23°C~125°C	2022/06/14	2023/06/13
		SZZY-YQ-028/Temperature measuring device/Guangke instrument	23°C~125°C	2022/06/14	2023/06/13
		SZZY-YQ-099/Temperature controlled battery extrusion testing machine/Dongguan Gaoxin Testing Equipment Co., LTD	2~20kN, -5°C~+65°C, 2~100mm, 0.1~5mm/s, 30~300s	2022/04/25	2023/04/24
		SZZY-YQ-109/High performance battery detection system/Neware	5V/6A	2022/09/30	2023/09/29
		SZZY-YQ-124/High performance battery detection system/Neware	5V/1A	2022/09/30	2023/09/29
		SZZY-YQ-125/High performance battery detection system/Neware	5V/6A	2022/09/30	2023/09/29
14	Impact Test	SZZY-YQ-027/Temperature measuring device/Guangke instrument	23°C~125°C	2022/06/14	2023/06/13
		SZZY-YQ-028/Temperature measuring device/Guangke instrument	23°C~125°C	2022/06/14	2023/06/13
		SZZY-YQ-100/Battery heavy impact tester/ZZCKONG	H: 200~800mm, 9.1kg, 10kg, D: 15.8mm	2022/09/30	2023/09/29
		SZZY-YQ-109/High performance battery detection system/Neware	5V/6A	2022/09/30	2023/09/29
		SZZY-YQ-124/High performance battery detection system/Neware	5V/1A	2022/09/30	2023/09/29

		SZZY-YQ-125/High performance battery detection system/Neware	5V/6A	2022/09/30	2023/09/29
15	Shock Test	SZZY-YQ-098/High acceleration impact table/Guangdong Jianqiao Test Equipment Co., LTD	100~6500m/s ² , 0.6~20ms, 0~1500mm	2022/11/03	2023/11/02
		SZZY-YQ-114/Electronic scales/YINGHENG	0~500g	2022/09/30	2023/09/29
		SZZY-YQ-109/High performance battery detection system/Neware	5V/6A	2022/09/30	2023/09/29
		SZZY-YQ-124/High performance battery detection system/Neware	5V/1A	2022/09/30	2023/09/29
		SZZY-YQ-125/High performance battery detection system/Neware	5V/6A	2022/09/30	2023/09/29
16	Vibration Test	SZZY-YQ-097/Vibration table/Guangdong Jianqiao Test Equipment Co., LTD	5~3500Hz, 1~50g _n , 0.5~20mm	2022/11/03	2023/11/02
		SZZY-YQ-114/Electronic scales/YINGHENG	0~500g	2022/09/30	2023/09/29
		SZZY-YQ-109/High performance battery detection system/Neware	5V/6A	2022/09/30	2023/09/29
		SZZY-YQ-124/High performance battery detection system/Neware	5V/1A	2022/09/30	2023/09/29
		SZZY-YQ-125/High performance battery detection system/Neware	5V/6A	2022/09/30	2023/09/29
17	Heating Test	SZZY-YQ-080/Programmable constant temperature and humidity box/Guangzhou Gerui Testing Equipment Co., LTD	25~85°C, 85~98%RH	2022/06/14	2023/06/13
		SZZY-YQ-103/Thermal shock test chamber/Dongguan Gaoxin Testing Equipment Co., LTD	20~200°C	2022/09/30	2023/09/29
		SZZY-YQ-109/High performance battery detection system/Neware	5V/6A	2022/09/30	2023/09/29
		SZZY-YQ-124/High performance battery detection system/Neware	5V/1A	2022/09/30	2023/09/29

		SZZY-YQ-125/High performance battery detection system/Neware	5V/6A	2022/09/30	2023/09/29
18	Temperature Cycling Test	SZZY-YQ-107/Programmable constant temperature and humidity box/ZZCKONG	-40~+150°C, 20~98% RH	2022/09/30	2023/09/29
		SZZY-YQ-114/Electronic scales/YINGHENG	0~500g	2022/09/30	2023/09/29
		SZZY-YQ-109/High performance battery detection system/Neware	5V/6A	2022/09/30	2023/09/29
		SZZY-YQ-124/High performance battery detection system/Neware	5V/1A	2022/09/30	2023/09/29
		SZZY-YQ-125/High performance battery detection system/Neware	5V/6A	2022/09/30	2023/09/29
19	Low Pressure (Altitude Simulation) Test	SZZY-YQ-102/Low pressure and high altitude simulation test chamber/Dongguan Gaoxin Testing Equipment Co., LTD	0.5~100kPa, 1~8h	2022/09/30	2023/09/29
		SZZY-YQ-109/High performance battery detection system/Neware	5V/6A	2022/09/30	2023/09/29
		SZZY-YQ-124/High performance battery detection system/Neware	5V/1A	2022/09/30	2023/09/29
		SZZY-YQ-125/High performance battery detection system/Neware	5V/6A	2022/09/30	2023/09/29
20	Projectile Test	SZZY-YQ-104/Battery combustion testing machine/Dongguan Gaoxin Testing Equipment Co., LTD	0~9999H/M/S	2022/09/30	2023/09/29
		SZZY-YQ-109/High performance battery detection system/Neware	5V/6A	2022/09/30	2023/09/29
		SZZY-YQ-124/High performance battery detection system/Neware	5V/1A	2022/09/30	2023/09/29
		SZZY-YQ-125/High performance battery detection system/Neware	5V/6A	2022/09/30	2023/09/29

Product: Li-ion Rechargeable Cell

Type Designation: GP503048

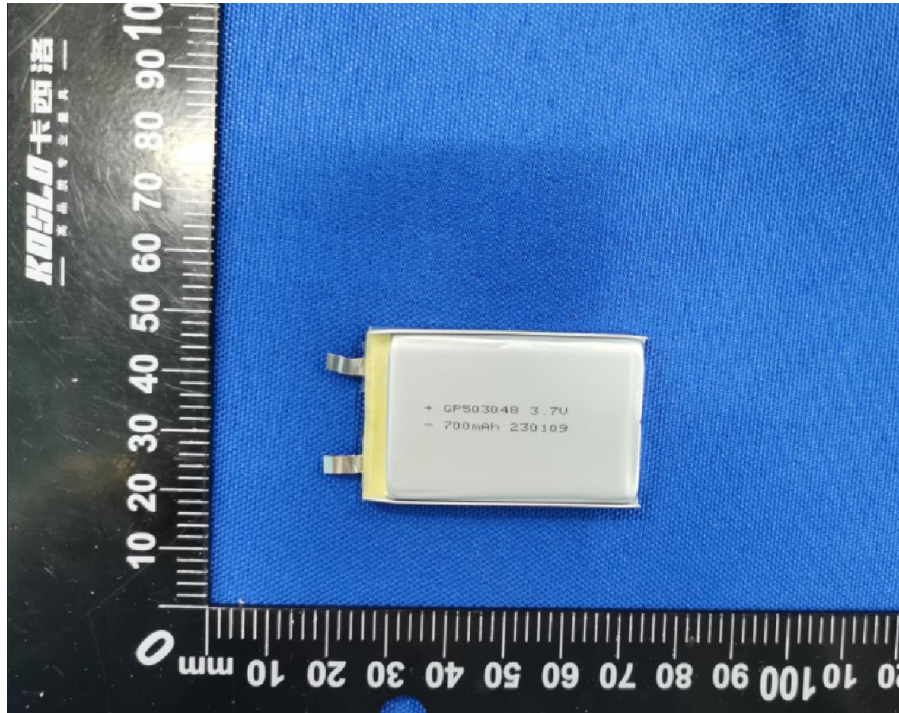


Figure 1. Front view of cell (The final version of the label, see main report)

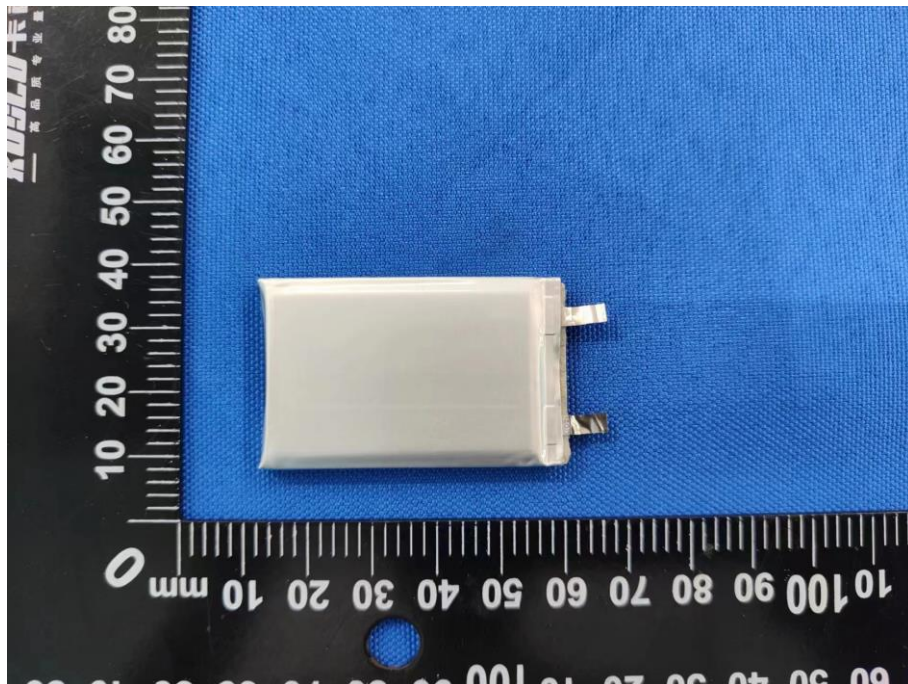


Figure 2. Back view of cell