






Test Report issued under the responsibility of:




TEST REPORT 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 :	BA-4788768266-A-1
Date of issue :	2018-12-12
Total number of pages	23
Name of Testing Laboratory preparing the Report	Underwriters Laboratories Taiwan Co., Ltd.
Applicant's name	LG CHEM, LTD
Address :	128 YEOUNI-DAERO, YEONGDEUNGPO-GU SEOUL 150-721 REPUBLIC OF KOREA
Test specification:	
Standard	IEC 62133-2:2017
Test procedure	CB Scheme
Non-standard test method	N/A
Test Report Form No.	IEC62133_2A
Test Report Form(s) Originator :	DEKRA
Master TRF	Dated 2017-08-10
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Test item description :	Rechargeable Li-Ion Cell	
Trade Mark :		
Manufacturer	LG CHEM, LTD/ RESEARCH PARK 188 MUNJIRO, YUSEONG-GU, DAEJEON, 34122, REPUBLIC OF KOREA	
Model/Type reference	INR18650M29 or M29 / INR19/66	
Ratings :	3.67Vdc, 2750mAh	
Responsible Testing Laboratory (as applicable), testing procedure and testing location(s):		
<input checked="" type="checkbox"/>	CB Testing Laboratory:	Underwriters Laboratories Taiwan Co., Ltd.
	Testing location/ address :	260 Da-Yeh Road 112 Peitou Taipei City, CHINESE TAIPEI
	Tested by (name, function, signature) :	Joon Huh / Project Handler 
	Approved by (name, function, signature) ... :	SooJin Kim / Project Reviewer 
<input type="checkbox"/>	Testing procedure: CTF Stage 1:	
	Testing location/ address :	
	Tested by (name, function, signature) :	
	Approved by (name, function, signature) ... :	
<input type="checkbox"/>	Testing procedure: CTF Stage 2:	
	Testing location/ address :	
	Tested by (name + signature)	
	Witnessed by (name, function, signature) . :	
	Approved by (name, function, signature) ... :	
<input type="checkbox"/>	Testing procedure: CTF Stage 3:	
<input type="checkbox"/>	Testing procedure: CTF Stage 4:	
	Testing location/ address :	
	Tested by (name, function, signature) :	
	Witnessed by (name, function, signature) . :	
	Approved by (name, function, signature) ... :	
	Supervised by (name, function, signature) :	

<p>List of Attachments (including a total number of pages in each attachment):</p> <p>National Differences (0 pages)</p> <p>Enclosures (8 pages)</p>	
<p>Summary of testing:</p>	
<p>Tests performed (name of test and test clause):</p> <p>7.2.1 Continuous charge (cells)</p> <p>7.3.1 External short-circuit (cells)</p> <p>7.3.3 Free fall</p> <p>7.3.4 Thermal abuse (cells)</p> <p>7.3.5 Crush (cells)</p> <p>7.3.7 Forced discharge (cells)</p> <p>7.3.9 Forced internal short-circuit (cells)</p>	<p>Testing location:</p> <p>Underwriters Laboratories Taiwan Co., Ltd.</p> <p>260 Da-Yeh Road 112 Peitou Taipei City, CHINESE, TAIPEI</p>
<p>Summary of compliance with National Differences (List of countries addressed):</p> <p>No National Differences.</p> <p>7.3.9 Forced internal short circuit was considered for France, Japan, Korea and Switzerland.</p> <p><input checked="" type="checkbox"/> The product fulfils the requirements of EN 62133-2:2017.</p>	

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.

Product Label			
Rechargeable Li-ion Cell			
Model Code	INR18650M29 or M29 / INR19/66	Rating	3.67Vdc, 2750mAh

Test item particulars.....:	
Classification of installation and use.....:	N/A
Supply Connection	N/A
Recommend charging method declared by the manufacturer	CC/CV
Discharge current (0,2 It A)	0.550 A
Specified final voltage.....:	2.5 Vdc
Upper limit charging voltage per cell.....:	4.2 Vdc
Maximum charging current	2750 mA
Charging temperature upper limit	50 °C
Charging temperature lower limit.....:	0 °C
Polymer cell electrolyte type.....:	<input type="checkbox"/> gel polymer <input type="checkbox"/> solid polymer <input type="checkbox"/> 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	2018-11-26
Date (s) of performance of tests	2018-11-30 to 2018-12-10
General remarks:	
<p>"(See Enclosure #)" refers to additional information appended to the report. "(See appended table)" refers to a table appended to the report.</p> <p>Throughout this report a <input type="checkbox"/> comma / <input checked="" type="checkbox"/> point is used as the decimal separator.</p>	
Manufacturer's Declaration per sub-clause 4.2.5 of IEC62133:	
The application for obtaining a CB Test Certificate includes more than one factory location and a declaration from the Manufacturer stating that the sample(s) submitted for evaluation is (are) representative of the products from each factory has been provided	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> Not applicable
When differences exist; they shall be identified in the General product information section.	
Name and address of factory (ies)	1. LG CHEM LTD. 29, GWAHAKSANEOP 3-RO, OKSAN-MYEON, HEUNGDEOK-GU, CHEONGJU-SI, CHUNGHEONGBUK-DO, KOREA 2. LG CHEM. (NANJING) I&E MATERIALS CO LTD NO. 17 HENGYI RD, NANJING ECONOMICAL & TECHNICAL DEVELOPMENT ZONE, NANJING, JIANGSU, CHINA

General product information and other remarks:

This cell consists of Positive Electrode, Negative Electrode, Separator, Electrolyte canned by Ni plated steel. This cell is also investigated to UL 1642.

The product was complying with the latest version of IEC 62133-2:2017(1st edition) issued date February 01, 2017.

The product was investigated to the following additional standards: EN 62133-2:2017.

Model Differences:

Model INR19/66 is the marking of IEC 62133-2 requirement for the model, INR18650M29.

Model M29 is identical to Model INR18650M29 except for model designation.

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	Considered in Battery Pack.	N/A
	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		N/A
	Insulation resistance (MΩ) :		—
	Internal wiring and insulation are sufficient to withstand maximum anticipated current, voltage and temperature requirements		N/A
	Orientation of wiring maintains adequate clearance and creepage distances between conductors		N/A
	Mechanical integrity of internal connections accommodates reasonably foreseeable misuse		N/A
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	Vent design in cell.	P
	Encapsulation used to support cells within an outer casing does not cause the battery to overheat during normal operation nor inhibit pressure relief	Considered in Battery Pack.	N/A
5.4	Temperature, voltage and current management	Considered in Battery Pack.	N/A
	Batteries are designed such that abnormal temperature rise conditions are prevented		N/A
	Batteries are designed to be within temperature, voltage and current limits specified by the cell manufacturer		N/A
	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		N/A
5.5	Terminal contacts	Considered in Battery Pack.	N/A
	The size and shape of the terminal contacts ensure that they can carry the maximum anticipated current		N/A

IEC 62133-2			
Clause	Requirement + Test	Result - Remark	Verdict
	External terminal contact surfaces are formed from conductive materials with good mechanical strength and corrosion resistance		N/A
	Terminal contacts are arranged to minimize the risk of short-circuit		N/A
5.6	Assembly of cells into batteries	Considered in Battery Pack.	N/A
5.6.1	General		N/A
	Each battery have 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		N/A
	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 have 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		N/A
	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 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	Considered in Battery Pack.	N/A
	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

IEC 62133-2			
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		N/A
	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 not be counted as an overcharge protection		N/A
	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		N/A
	It is recommended that the cells and cell blocks not discharged beyond the cell manufacturer's specified final voltage		N/A
	For batteries consisting of series-connected cells or cell blocks, cell balancing circuitry incorporated into the battery management system		N/A
5.6.3	Mechanical protection for cells and components of batteries	Considered in Battery Pack.	N/A
	Mechanical protection for cells, cell connections and control circuits within the battery provided to prevent damage as a result of intended use and reasonably foreseeable misuse		N/A
	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 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 considered when conducting mechanical tests		N/A
5.7	Quality plan		P

IEC 62133-2			
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	The manufacturer has ISO 9001 certification.	P
5.8	Battery safety components		N/A
	According annex F		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
	Coin cells with resistance $\leq 3 \Omega$ (measured according annex D) are tested according table 1		N/A
	Unless otherwise specified, tests are carried out in an ambient temperature of $20 \text{ }^\circ\text{C} \pm 5 \text{ }^\circ\text{C}$		P
	The safety analysis of 5.6.1 identify those components of the protection circuit that are critical for short-circuit, overcharge and overdischarge protection		N/A
	When conducting the short-circuit test, consideration 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		N/A

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 $20 \text{ }^\circ\text{C} \pm 5 \text{ }^\circ\text{C}$, using the method declared by the manufacturer		P
	Prior to charging, the battery have been discharged at $20 \text{ }^\circ\text{C} \pm 5 \text{ }^\circ\text{C}$ 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
	After stabilization for 1 h and 4 h, respectively, at ambient temperature of highest test temperature and lowest test temperature, 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 voltage charging method		P

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Clause	Requirement + Test	Result - Remark	Verdict
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)	Only applicable for battery packs evaluation.	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)		N/A
	The batteries were tested until one of the following occurred:		N/A
	- 24 hours elapsed; or		N/A
	- The case temperature declined by 20 % of the maximum temperature rise		N/A
	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		N/A
	A single fault in the discharge protection circuit conducted on one to four (depending upon the protection circuit) of the five samples before conducting the short-circuit test		N/A
	A single fault applies to protective component parts such as MOSFET, fuse, thermostat or positive temperature coefficient (PTC) thermistor		N/A
	Results: No fire. No explosion..... :	(See appended table 7.3.2)	N/A
7.3.3	Free fall		P
	Results: No fire. No explosion		P
7.3.4	Thermal abuse (cells)		P
	Oven temperature (°C)..... :	130	—

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Clause	Requirement + Test	Result - Remark	Verdict
	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 \pm 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	Only applicable for battery packs evaluation.	N/A
	The supply voltage which is:		N/A
	- 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		N/A
	- Sufficient to maintain a current of 2,0 It A throughout the duration of the test or until the supply voltage is reached		N/A
	Test was continued until the temperature of the outer casing:		N/A
	- Reached steady state conditions (less than 10 °C change in 30-minute period); or		N/A
	- Returned to ambient		N/A
	Results: No fire. No explosion..... :	(See appended table 7.3.6)	N/A
7.3.7	Forced discharge (cells)		P
	If 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
	If 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)	Only applicable for battery packs evaluation.	N/A
7.3.8.1	Vibration		N/A
	Results: No fire, no explosion, no rupture, no leakage or venting. :	(See appended table 7.3.8.1)	N/A
7.3.8.2	Mechanical shock		N/A

IEC 62133-2			
Clause	Requirement + Test	Result - Remark	Verdict
	Results: No leakage, no venting, no rupture, no explosion and no fire	(See appended table 7.3.8.2)	N/A
7.3.9	Design evaluation – Forced internal short-circuit (cells)		P
	The cells complied with national requirement for	France, Japan, Korea, Switzerland	—
	The pressing was stopped upon:		P
	- 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	800N	P
	Results: No fire	(See appended table 7.3.9)	P
8	INFORMATION FOR SAFETY		P
8.1	General		P
	Manufacturers of secondary cells ensure that information is provided about current, voltage and temperature limits of their products		P
	Manufacturers of batteries ensure that equipment manufacturers and, in the case of direct sales, end-users are provided with information to minimize and mitigate hazards		N/A
	Systems analyses 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 provided to the end user		N/A
	Do not allow children to replace batteries without adult supervision		N/A
8.2	Small cell and battery safety information		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

IEC 62133-2			
Clause	Requirement + Test	Result - Remark	Verdict
	Cells marked as specified in IEC 61960, except coin cells	By agreement between the manufacturer and user, cells used in manufacturer of a battery need not be marked.	P
	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	Considered in Battery Pack.	N/A
	Batteries marked as specified in IEC 61960, except for coin batteries		N/A
	Coin batteries whose external surface area is too small to accommodate the markings on the batteries show the designation and polarity. Batteries also marked with an appropriate caution statement		N/A
	Terminals have clear polarity marking on the external surface of the battery		N/A
	Batteries with keyed external connectors designed for connection to specific end products need 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		N/A
	Coin cells and batteries identified as small batteries according to 8.2 include a caution statement regarding the hazards of ingestion in accordance with 8.2		N/A
	When small cells and batteries are intended for direct sale in consumer-replaceable applications, caution for ingestion given on the immediate package		N/A
9.4	Other information		P
	Storage and disposal instructions		P
	Recommended charging instructions		P
10	PACKAGING AND TRANSPORT		P
	Packaging for coin cells not small enough to fit within the limits of the ingestion gauge of Figure 3		N/A
	The materials and packaging design are chosen so as to prevent the development of unintentional electrical conduction, corrosion of the terminals and ingress of environmental contaminants	Refer to enclosure ID 04	P

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

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	4.2Vdc	P
A.3.2.2	Explanation of safety viewpoint		P
A.3.2.3	Safety requirements, when different upper limit charging voltage is applied		P
A.4	Consideration of temperature and charging current		P
A.4.1	General		P
A.4.2	Recommended temperature range		P
A.4.2.1	General		P
A.4.2.2	Safety consideration when a different recommended temperature range is applied	Upper/Lower limit charging Temperature : 50/0 °C	P
A.4.3	High temperature range		P
A.4.3.1	General		P
A.4.3.2	Explanation of safety viewpoint		P
A.4.3.3	Safety considerations when specifying charging conditions in the high temperature range		N/A
A.4.3.4	Safety considerations when specifying a new upper limit in the high temperature range	Upper limit charging Temperature : 50 °C	P
A.4.4	Low temperature range		P
A.4.4.1	General		P
A.4.4.2	Explanation of safety viewpoint		P
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	Lower limit charging Temperature : 0 °C	P
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

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Clause	Requirement + Test	Result - Remark	Verdict
A.4.6.4	Scope of application of the discharging current		P
A.5	Sample preparation		P
A.5.1	General		P
A.5.2	Insertion procedure for nickel particle to generate internal short		P
A.5.3	Disassembly of charged cell		P
A.5.4	Shape of nickel particle		P
A.5.5	Insertion of nickel particle in cylindrical cell		P
A.5.5.1	Insertion of nickel particle in winding core		P
A.5.5.2	Marking the position of the nickel particle on both ends of the winding core of the separator		P
A.5.6	Insertion of nickel particle in prismatic cell		N/A
A.6	Experimental procedure of the forced internal short-circuit test		P
A.6.1	Material and tools for preparation of nickel particle		P
A.6.2	Example of a nickel particle preparation procedure		P
A.6.3	Positioning (or placement) of a nickel particle		P
A.6.4	Damaged separator precaution		P
A.6.5	Caution for rewinding separator and electrode		P
A.6.6	Insulation film for preventing short-circuit		P
A.6.7	Caution when disassembling a cell		P
A.6.8	Protective equipment for safety		P
A.6.9	Caution in the case of fire during disassembling		P
A.6.10	Caution for the disassembling process and pressing the electrode core		P
A.6.11	Recommended specifications for the pressing device		P
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..... :	(See appended table D.2)	N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	Coin cells with an internal resistance of less than or equal to 3 Ω are subjected to the testing according to Clause 6 and Table 1		N/A
	Coin cells with an internal resistance greater than 3 Ω require no further testing		N/A
ANNEX E	PACKAGING AND TRANSPORT		P
ANNEX F	COMPONENT STANDARDS REFERENCES		N/A

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⁾
Cells	--	--	--	--	--
- Electrolyte	--	--	LiPF ₆ salt + EC based solvent	--	--
- Separator	W-scope	WL20C	--	--	--
- Anode (Negative electrode)	--	--	Carbon coated on Cu film	--	--
- Cathode (Positive electrode)	--	--	Li(Mn,Ni,Co)O ₂ coated on AL film	--	--
- Case	--	--	Stainless steel	--	--
Supplementary information:					
1) Provided evidence ensures the agreed level of compliance. See OD-CB2039.					

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	
1918051-86	4.2	1.375	4.162	A	
1918051-87	4.2	1.375	4.176	A	
1918051-88	4.2	1.375	4.181	A	
1918051-89	4.2	1.375	4.175	A	
1918051-90	4.2	1.375	4.178	A	
Supplementary information:					
A : No fire or explosion, No leakage					
- 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 : 50°C (Tested at 50°C)						
1918051-1	55.4	4.188	79.2	63.6	A,B	
1918051-2	55.4	4.181	83.4	51.9	A,B	
1918051-3	55.4	4.188	83.9	51.0	A,B	
1918051-4	55.4	4.187	89.6	31.7	A,B	
1918051-5	55.4	4.185	84.9	42.8	A,B	
Samples charged at charging temperature lower limit : 0°C (Tested at 0°C)						
1918051-21	55.4	4.187	89.0	37.3	A,B	
1918051-22	55.4	4.182	83.3	44.1	A,B	
1918051-23	55.4	4.181	84.7	47.6	A,B	
1918051-24	55.4	4.180	83.8	51.1	A,B	
1918051-25	55.4	4.186	83.2	44.6	A,B	
Supplementary information:						
A : No fire or explosion						
B : The test was completed after the cell casing cooled to 20% of the maximum temperature rise.						
- Others (please explain)						

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

7.3.2	TABLE: External short-circuit (battery)					N/A
Sample no.	Ambient T (°C)	OCV before test (Vdc)	Resistance of circuit (mΩ)	Maximum case temperature rise ΔT (K)	Component single fault condition	Results

Supplementary information:
- No fire or explosion
- Others (please explain)

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 (lbs)	Results	
Samples charged at charging temperature upper limit : 50°C (Tested at 50°C)					
1918051-11	4.186	4.222	2923	A,B	
1918051-12	4.186	4.218	2923	A,B	
1918051-13	4.185	4.222	2923	A,B	
1918051-14	4.185	4.226	2923	A,B	
1918051-15	4.179	4.217	2923	A,B	
Samples charged at charging temperature lower limit : 0°C (Tested at 0°C)					
1918051-31	4.169	4.205	2923	A,B	
1918051-32	4.177	4.216	2923	A,B	
1918051-33	4.168	4.208	2923	A,B	
1918051-34	4.174	4.208	2923	A,B	
1918051-35	4.166	4.202	2923	A,B	

Supplementary information:
A : No fire or explosion
B : Force released after maximum level reached
- Others (please explain)
1N=0.224809 lbs
13KN=2922.52=2923 lbs

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

7.3.6	TABLE: Over-charging of battery			N/A
Constant charging current (A)				—
Supply voltage (Vdc)				—
Sample no.	OCV before charging (Vdc)	Total charging time (minute)	Maximum outer case temperature (°C)	Results
Supplementary information:				
- No fire or explosion - 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
1918051-41	2.724	2.7593	0	A,B
1918051-42	2.642	2.7550	0	A,B
1918051-43	2.661	2.7521	0	A,B
1918051-44	2.648	2.7521	0	A,B
1918051-45	2.638	2.7560	0	A,B
Supplementary information:				
A : No fire or explosion B : The voltage did not reach negative value of upper limit charging voltage - Others (please explain)				

7.3.8.1	TABLE: Vibration				N/A
Sample no.	OCV before test (Vdc)	OCV after test (Vdc)	Mass before test (g)	Mass after test (g)	Results
Supplementary information:					
- No fire or explosion - No rupture - No leakage - No venting - Others (please explain)					

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

7.3.8.2	TABLE: Mechanical shock					N/A
Sample no.	OCV before test (Vdc)	OCV after test (Vdc)	Mass before test (g)	Mass after test (g)	Results	

Supplementary information:

- No fire or explosion
- No rupture
- No leakage
- No venting
- Others (please explain)

7.3.9	TABLE: Forced internal short circuit (cells)					P
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 : 50°C (Tested at 50°C)						
1918051-16	50	4.185	1	800	A,B	
1918051-17	50	4.189	1	800	A,B	
1918051-18	50	4.189	1	800	A,B	
1918051-19	50	4.189	1	800	A,B	
1918051-20	50	4.172	1	800	A,B	
Samples charged at charging temperature lower limit : 0°C (Tested at 0)						
1918051-36	0	4.174	1	800	A,B	
1918051-37	0	4.173	1	800	A,B	
1918051-38	0	4.168	1	800	A,B	
1918051-39	0	4.171	1	800	A,B	
1918051-40	0	4.165	1	800	A,B	

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 : Test concluded when 800/400 N pressure was reached and 50 mV voltage drop was not achieved

- Others (please explain)

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

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

Enclosure

Supplement ID	Description
01	Overview of Rechargeable Lithium ion Cell , Model : INR18650M29
02	Safety instruction
03	UN38.3
04	Package information
05	Specification

ID 02

**<Caution and Prohibition>**

-Warning for using the lithium ion rechargeable battery. Mishandling of the battery may cause heat, fire and deterioration in performance. Be sure to observe the following.

<Caution>

- When using the application equipped with the battery, refer to the user's manual before usage.
- Please read the specific charger manual before charging.
- Charge time should not be longer than specified in the manual.
- When the cell is not charged after long exposure to the charger, discontinue charging.
- Battery must be charged at operating temperature range 0 ~ 50 °C
- Battery must be discharged at operating temperature range -30 ~ 60 °C
- Please check the positive(+) and negative(-) direction before packing.
- When a lead plate or wire is connected to the cell for packing, check out insulation not to short-circuit.
- Battery must be stored separately.
- Battery must be stored in a dry area with low temperature for long-term storage.
- Do not place the battery in direct sunlight or heat.
- Do not use the battery in high static energy environment where the protection device can be damaged.
- When rust or smell is detected on first use, please return the product to the seller immediately.
- Please insulate the battery by sealing the tape in the terminal before you return it to the seller.
- The battery must be away from children or pets
- When cell life span shortens after long usage, please exchange to new cells.
- When the battery reaches the end of its useful life, the spent battery should be disposed by a qualified recycles or hazardous materials handler.
- Do not mix this battery with the solid waste stream.
- Contact your Local Technologies Service Center for recycling or disposal information.
- Do insulate between the metal plate and cell or other components not to make a electrical short.

<Prohibitions>

- Do not use different charger. Do not use cigarette jags (in cars) for charging.
- Do not charge with constant current more than maximum charge current.
- Do not disassemble or reconstruct the battery.
- Do not throw or cause impact.
- Do not pierce a hole in the battery with sharp things. (such as nail, knife, pencil, drill)
- Do not use with other batteries or cells.
- Do not solder on battery directly.
- Do not press the battery with overload in manufacturing process, especially ultrasonic welding.
- Do not use old and new cells together for packing.
- Do not expose the battery to high heat. (such as fire)
- Do not put the battery into a microwave or high pressure container.
- Do not use the battery reversed.
- Do not connect positive(+) and negative(-) with conductive materials (such as metal, wire)
- Do not allow the battery to be immersed in or wetted with water or sea-water.
- Do not give immoderate heat and force to battery cell during a welding process of metal plates on it.
- Do not let any kinds of negative poles on Battery PCM or on application system to give mechanical damage or electrical connection to the battery cell's pouch.

ID 03

Document Number	QDI-170818-C-INR18650M29		CONFIDENTIAL
Prepared	MyeongHoon Choi	<i>Choi</i>	
Reviewed	MinJe Woo	<i>MinJe Woo</i>	
Approved	DaeHo Nam	<i>DaeHo Nam</i>	

UN38.3 Test Report

- INR18650M29 (Min. 2750mAh, 3.67V)-

Index

1. UN38.3 Test Condition
2. General Information
3. Test Result
4. Sample Image

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Rev.6

1. UN38.3 Test Condition

Test item	Test Condition	Requirements	Etc.
Test 1. Altitude Simulation	Storing at (low pressure) 11.6kPa for 6hr at 20+/-5°C	- After OCV (%) ≥ 90% - No leakage, no venting, no disassembly, no rupture, no fire - Mass loss limit (leakage) 1) If M<1g, less than 0.5%, 2) If 1g≤M≤75g, less than 0.2%, 3) If M>75g, less than 0.1%	T1-T5 : Sequence Tests
Test 2. Thermal Test	[72±2°C, 6hr ↔ -40±2°C, 6hr, interval max. 30min] x 10cycle Storing at 20±5°C for 24h		
Test 3. Vibration	[7Hz→200Hz→7Hz, in 15min] x 12 times x 3 direction 1) sinusoidal waveform with a logarithmic sweep 2) 7Hz 18Hz (maintaining 1gn) app. 50Hz (until 8gn) 200Hz (maintaining 8gn), 1.6mm total excursion		
Test 4. Shock	Half sine shock 1) Peak acceleration - For cells & single cell batteries : 150gn - For batteries (whichever is smaller) : 150gn or $\sqrt{\frac{100850}{Mass(kg)}} gn$ 2) Pulse duration : 6msec 3) 6 direction (±x, y, z) x 3 cycle		
Test 5. External Short Circuit	1) Samples to be heated to 57±4°C in chamber (Measured on external case) 2) Less than 0.1Ω, ext. short-circuit at 57±4°C 3) 1hr continue after returning to 57±4°C		
Test 6. Impact	Φ=15.8±0.1mm bar, 9.1±0.1kg mass, 61±2.5cm height	- No disassembly, no fire within 6 hours after the test - Max. Temp ≤ 170°C	for cylindrical cells (not less than 18mm diameter)
Test 6. Crush	Crushing rate : 1.5cm/s, until 13kN±0.78kN or 100mV drop or 50% deformation	- No disassembly, no fire within 6 hours after the test - Max. Temp ≤ 170°C	for cylindrical cells (less than 18mm diameter) for prismatic, pouch, coin/button cells
Test 7. Overcharge	Current = Manufacturer's recommended max. continuous charge current X 2 Voltage 1. If charge voltage ≤ 18V, V (min.) = 2 x (max. charge voltage) or 22V. 2. If charge voltage > 18V, V (min.) = 1.2 x (max. charge voltage)	- No disassembly, no fire within 7 days after the test	Only for Single Cell Battery / Battery
Test 8. Forced Discharge	Discharge at max. discharge current (connecting in series with 12V DC power supply), Duration time = rated capacity/initial test current	- No disassembly, no fire within 7 days after the test	Resistance of Electric Loader 1/Ω = (max. discharge current) / (12 + Initial OCV)

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2. General Information

1. Standard charge / discharge Condition

	Mode	Condition	End Condition
Charge	CC / CV	Current = 1375 mA Voltage = 4.2 V	Current = 50 mA
Discharge	CC	Current = 550 mA	Voltage = 2.5 V

2. Cycle Condition

	Mode	Condition	End Condition
Charge	CC / CV	Current = 1500 mA Voltage = 4.2 V	Current = 100 mA
Discharge	CC	Current = 4000 mA	Voltage = 2.75 V

3. Test Condition

	Mode	Condition
Test 8. Forced Discharge	CC	Max. Discharge Current = 10000 mA Duration Time = 16.5 min



3-1. T1-T4 Test Result

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Before			Altitude (T1)					Thermal (T2)					Vibration (T3)					Shock (T4)				
NO.	OCV	Mass (g)	After OCV (V)	Mass (g)	After OCV(%)	Mass Loss(%)	Result	After OCV (V)	Mass (g)	After OCV(%)	Mass Loss(%)	Result	After OCV (V)	Mass (g)	After OCV(%)	Mass Loss(%)	Result	After OCV (V)	Mass (g)	After OCV(%)	Mass Loss(%)	Result

A. 1st cycle fully charged state

1	4.173	43.377	4.172	43.375	99.98	0.005	Pass	4.128	43.373	98.95	0.005	Pass	4.127	43.371	99.98	0.005	Pass	4.127	43.369	100.00	0.005	Pass
2	4.174	43.482	4.173	43.481	99.98	0.002	Pass	4.129	43.477	98.95	0.009	Pass	4.128	43.474	99.98	0.007	Pass	4.128	43.472	100.00	0.005	Pass
3	4.173	43.403	4.173	43.401	100.00	0.005	Pass	4.128	43.398	98.92	0.007	Pass	4.127	43.397	99.98	0.002	Pass	4.127	43.396	100.00	0.002	Pass
4	4.174	43.405	4.173	43.402	99.98	0.007	Pass	4.128	43.400	98.92	0.005	Pass	4.128	43.397	100.00	0.007	Pass	4.127	43.395	99.98	0.005	Pass
5	4.173	43.416	4.172	43.414	99.98	0.005	Pass	4.128	43.400	98.95	0.032	Pass	4.127	43.396	99.98	0.009	Pass	4.127	43.393	100.00	0.007	Pass
6	4.173	43.398	4.173	43.396	100.00	0.005	Pass	4.128	43.393	98.92	0.007	Pass	4.128	43.390	100.00	0.007	Pass	4.127	43.389	99.98	0.002	Pass
7	4.174	43.602	4.173	43.600	99.98	0.005	Pass	4.127	43.596	98.90	0.009	Pass	4.127	43.594	100.00	0.005	Pass	4.126	43.592	99.98	0.005	Pass
8	4.174	43.429	4.173	43.427	99.98	0.005	Pass	4.129	43.423	98.95	0.009	Pass	4.128	43.421	99.98	0.005	Pass	4.128	43.419	100.00	0.005	Pass
9	4.173	43.367	4.172	43.366	99.98	0.002	Pass	4.128	43.363	98.95	0.007	Pass	4.127	43.360	99.98	0.007	Pass	4.127	43.359	100.00	0.002	Pass
10	4.173	43.389	4.173	43.387	100.00	0.005	Pass	4.128	43.383	98.92	0.009	Pass	4.128	43.380	100.00	0.007	Pass	4.127	43.378	99.98	0.005	Pass



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3-2. T5/T6/T8 Test Result

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EXT. Short Circuit (T5)				Impact (T6)				Forced Discharge (T8)							
NO.	Initial OCV(V)	Max. Temp (°C)	Result	NO.	Initial OCV(V)	Max. Temp (°C)	Result	NO.	Initial OCV(V)	Max. Temp (°C)	Result	NO.	Initial OCV(V)	Max. Temp (°C)	Result
A. 1st cycle fully charged state				A. 1st cycle 50% charged state				A. 1st cycle fully discharged state				B. 50th cycle fully discharged state			
1	4.127	125.39	Pass	11	3.696	25.26	Pass	16	3.319	43.55	Pass	26	3.052	44.81	Pass
2	4.128	120.21	Pass	12	3.700	27.00	Pass	17	3.323	42.40	Pass	27	3.045	44.76	Pass
3	4.127	125.09	Pass	13	3.701	28.10	Pass	18	3.323	44.14	Pass	28	3.056	43.59	Pass
4	4.127	122.44	Pass	14	3.698	25.84	Pass	19	3.347	42.90	Pass	29	3.050	43.08	Pass
5	4.127	119.28	Pass	15	3.700	24.39	Pass	20	3.315	44.04	Pass	30	3.051	44.90	Pass
6	4.127	124.88	Pass					21	3.338	43.80	Pass	31	3.050	43.72	Pass
7	4.126	108.51	Pass					22	3.325	44.75	Pass	32	3.081	42.12	Pass
8	4.128	126.56	Pass					23	3.325	43.95	Pass	33	3.063	43.94	Pass
9	4.127	120.82	Pass					24	3.330	44.80	Pass	34	3.048	44.39	Pass
10	4.127	121.66	Pass					25	3.342	42.14	Pass	35	3.051	43.72	Pass

LG Chem

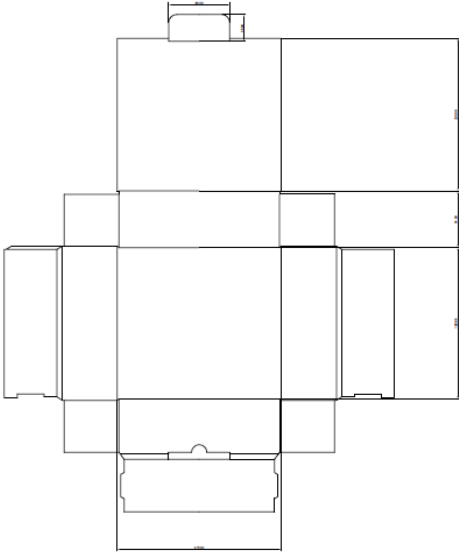
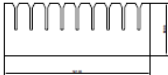
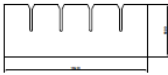



4. Sample Image

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ID 04

	1	2	3	4	5	6	7																																																																								
A					REVISION			A																																																																							
B					REV.	POSITION	CONTENTS	ENGINEER	APPROVER	DATE	B																																																																				
C					A	-	INITIAL RELEASE	JH OH	CJ LEE	15.02.06	C																																																																				
D					B	3E	Partition Height Change	JH OH	CJ LEE	15.09.01	D																																																																				
E					<p>NOTES:</p> <ol style="list-style-type: none"> MATERIAL REQUIREMENTS <ul style="list-style-type: none"> A. RAW MATERIAL: CORRUGATED CARDBOARD B. THICKNESS: 3.0T C. COLOR: BROWN MUST COMPLY WITH HALOGEN-FREE&ROHS COMPLIANCE DESIGN & SAMPLE REQUIREMENTS <ul style="list-style-type: none"> A. ALL DIMENSIONS IN mm UNLESS OTHERWISE SPECIFIED. B. THE NOTED DIMENSIONS ARE OUTER DIMENSIONS OF THE BOX. QUALITY CONTROL REQUIREMENTS <ul style="list-style-type: none"> A. CRITICAL TO QUALITY point: ◆ B. AFTER PROCESSING THE BOX, THERE ARE NO DAMAGE ON THE SURFACE. C. THE PRINTING MUST BE COMPLIED WITH FILM DESIGN STANDARD. D. THE PRINTING MUST BE PRINTED ON RUBBER RESIN BOARD. SUPPLIER REQUIREMENTS <ul style="list-style-type: none"> A. AFTER APPROVAL, TO BE MANUFACTURED. B. FOR ALL INITIAL DRAWING DETAILS AND SUBSEQUENT REVISIONS TO DRAWING, THE SUPPLIER MUST CHECK THE LATEST REVISION WITH LGCE PACKAGE TEAM. C. NO CHANGE SHALL BE ALLOWED ON PRODUCTION MATERIAL, PROCESS, MANUFACTURING LOCATIONS REGARDLESS OF WHETHER SUCH CHANGES AFFECTS CHARACTERISTICS SPECIFIED, WITHOUT PRIOR EXPLICIT WRITTEN APPROVAL BY LGCE'S PACKAGE TEAM. D. THE DANGER GOODS PACKAGING MUST APPLY THE REGULATIONS. 			E																																																																							
					 <p><Partition A 1.5t x 4></p>	 <p><Partition B 1.5T x 9></p>		<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th>UNIT</th> <th>SCALE</th> <th>NO.</th> <th>DESCRIPTION</th> <th>Q'TY</th> <th>DRAWING NO.</th> <th>REMARK</th> </tr> <tr> <td>mm</td> <td>1:1</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td colspan="7" style="text-align: center;">PARTS INDEX</td> </tr> <tr> <td>TOLERANCE</td> <td></td> <td>DATE</td> <td>NAME</td> <td>자질</td> <td>MATERIAL</td> <td>CORRUGATED CARDBOARD/3.0T</td> </tr> <tr> <td>XX ±0.0 ±1.0</td> <td>APP.</td> <td>15.02.06</td> <td>CJ LEE</td> <td>모델</td> <td></td> <td></td> </tr> <tr> <td>FINISH</td> <td>CHEC.</td> <td>15.02.06</td> <td>SK YOON</td> <td>도면</td> <td>MOD. NAME</td> <td>18650 CY CELL</td> </tr> <tr> <td></td> <td>DESG.</td> <td>15.02.06</td> <td>JH OH</td> <td>도형</td> <td>DWG. NAME</td> <td>BOX_215*200*74</td> </tr> <tr> <td>REF. DRAWING</td> <td></td> <td></td> <td></td> <td>도번</td> <td></td> <td></td> </tr> <tr> <td>PART NO.</td> <td></td> <td></td> <td></td> <td>DWG. NO.</td> <td></td> <td></td> </tr> <tr> <td colspan="4" style="text-align: center;">  </td> <td style="text-align: center;">A1</td> <td></td> <td style="text-align: right;">PAGE 1/1</td> </tr> </table>		UNIT	SCALE	NO.	DESCRIPTION	Q'TY	DRAWING NO.	REMARK	mm	1:1						PARTS INDEX							TOLERANCE		DATE	NAME	자질	MATERIAL	CORRUGATED CARDBOARD/3.0T	XX ±0.0 ±1.0	APP.	15.02.06	CJ LEE	모델			FINISH	CHEC.	15.02.06	SK YOON	도면	MOD. NAME	18650 CY CELL		DESG.	15.02.06	JH OH	도형	DWG. NAME	BOX_215*200*74	REF. DRAWING				도번			PART NO.				DWG. NO.							A1		PAGE 1/1
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ID 05

Cell Specification			
Capacity	Nominal	2850	mAh
	Minimum	2750	mAh
Nominal Voltage	Average	3.67	V
Standard Charge (at RT.)	Current	1375.0	mA
	Voltage	4.200	V
Standard Discharge (at RT.)	Cut-off	50.0	mA
	Current	550.0	mA
Cycle Charge (at RT.)	Cut-off	2.50	V
	Current	1500.0	mA
Cycle Discharge (at RT.)	Voltage	4.200	V
	Cut-off	100.0	mA
Cycle Discharge (at RT.)	Current	4000.0	mA
	Cut-off	2.75	V
Cell Safety condition			
Charge Operating Temp.	High	50	°C
	Low	-10	°C
Charge Operating Temp. (Max. Current & Voltage. Area)	High	50	°C
	Low	0	°C
Max charge	Current	2750	mA
	Voltage	4.2	V
Discharge Operating Temp.	High	60	°C
	Low	-30	°C
Max discharge	Current	10000	mA