



TEST REPORT UN38.3 TRANSPORT OF DANGEROUS GOODS - Lithium metal and lithium ion batteries		
Report Number.....	4790596323-A-1	
Date of issue.....	2022-12-09	
Total number of pages	21	
Manufacturer's identification:		
Name	Orient Technology (S) Pte Ltd	
Address.....	178 Paya Lebar Road. #07-06 409030 Singapore	
Phone number	+65 63553388	
Email	sales@orient-technology.com.sg	
Website	https://www.orient-technology.com.sg/	
Test specification:		
Standard	ST/SG/AC.10/11/Rev.7/Amend. 1	
Test procedure	Type Test	
Non-standard test method	N/A	
Test item description:		
	Rechargeable Lithium Ion Battery Pack	
Trade Mark.....	N/A	
Manufacturer	Orient Technology (S) Pte Ltd	
Model/Type reference	Y5087828	
Ratings	10.8Vdc, Minimum Capacity: 2450mAh, Rated Capacity: 2500mAh, 27Wh	
Testing procedure and testing location:		
Testing Laboratory:	Underwriters Laboratories Taiwan Co., Ltd.	
Address.....	260 Da-Yeh Road 112 Peitou Taipei City, Chinese Taipei	
Phone number.....	+886-2-7737-3168	
Email	customerservice.tw@ul.com	
Website	https://taiwan.ul.com/	
Tested by (name + title + signature)	Joy Shen	
Approved by (name + title + signature) ...:	Eric Hsu	

Summary of testing:**Tests conducted and results:**

☒ T.1 Altitude simulation	☒ Pass;	☐ Fail;
☒ T.2 Thermal test	☒ Pass;	☐ Fail;
☒ T.3 Vibration	☒ Pass;	☐ Fail;
☒ T.4 Shock	☒ Pass;	☐ Fail;
☒ T.5 External short circuit	☒ Pass;	☐ Fail;
☐ T.6 Impact	☐ Pass;	☐ Fail;
☒ T.7 Overcharge	☒ Pass;	☐ Fail;
☐ T.8 Forced discharge	☐ Pass;	☐ Fail;

T.6 Impact and T.8 Forced discharge were considered in component Cell's report.

Test item particulars:	
Chemistry	☐ lithium metal / ☒ lithium ion
Mass	146g
Lithium content (for lithium metal)	--
Wh capacity (for lithium ion)	27Wh
Battery connection configuration (X-S/Y-P)	3-S/1-P
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	2022-10-27
Date (s) of performance of tests	2022-10-31 to 2022-11-24
General remarks:	
The test results presented in this report relate only to the object tested. This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory. "(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) : Orient Technology (S) Pte Ltd 178 Paya Lebar Road #07-06 Singapore 409030	
General product information:	
Product Description Rechargeable Lithium Battery Pack, electronic components mounted on PWB with 3-series, 1-parallel cells, secured together by PVC shrink sleeve.	

UN 38.3			
Clause	Requirement + Test	Result - Remark	Verdict
38.3.3	Assembled battery testing requirements		Pass
38.3.3 (f)	The battery assembly has aggregate lithium content of not more than 500 g (lithium metal type) or with a Watt-hour rating of not more than 6 200 Wh (lithium ion type), and is assembled from batteries that have passed all applicable tests. One assembled battery in a fully charged state is tested under tests T.3, T.4 and T.5, and, in addition, test T.7 in the case of rechargeable battery.		Pass
38.3.3 (g)	Batteries that have passed all applicable tests are electrically connected to form a battery in which the aggregate lithium content is more than 500 g (lithium metal type) or with a Watt-hour rating of more than 6 200 Wh (lithium ion type). The assembled battery is not tested if the assembled battery is of a type that has been verified as preventing: (i) Overcharge; (ii) Short circuits; and (iii) Over discharge between the batteries.	Battery is not more than 500 g	N/A
38.3.4	Transport tests		Pass
38.3.4.1	Test T-1: Altitude simulation		Pass
	Cells or batteries are stored at a pressure of 11.6 kPa or less for at least 6 h at ambient temperature.		Pass
	Results: no leakage, no venting, no short-circuit, no rupture, no explosion and no fire during this test.	See appended Table 38.3.4.1	Pass
38.3.4.2	Test T-2: Thermal test		Pass
	Cells or batteries previously subjected to altitude simulation test.		Pass
	Cells or batteries are stored for at least 6 h at a test temperature of 72 ± 2 °C, followed by storage for at least 6 h at a test temperature of -40 ± 2 °C. Maximum time for transfer is 30 minutes. This procedure is repeated until 10 total cycles are complete, after which all test cells and batteries are to be stored for 24 hours at ambient temperature.		Pass
	For large cells or batteries the duration of exposure to the test temperatures is at least 12 h instead of 6 h.	Not large batteries	N/A
	Storage for at least 24 h at ambient temperature.		Pass
	Results: no leakage, no venting, no short-circuit, no rupture, no explosion and no fire during this test.	See appended Table 38.3.4.2	Pass
38.3.4.3	Test T-3: Vibration		Pass
	Cells or batteries previously subjected to thermal test		Pass

UN 38.3			
Clause	Requirement + Test	Result - Remark	Verdict
	Cells or batteries are subjected to the following sinusoidal vibration with a logarithmic sweep: from 7 Hz a peak acceleration of 1 g _n is maintained until 18 Hz is reached. The amplitude is then maintained at 0.8 mm and the frequency increased until a peak acceleration of 8 g _n occurs (approximately 50 Hz). A peak acceleration of 8 g _n is then maintained until the frequency is increased to 200 Hz.		Pass
	Large batteries are subjected to the following sinusoidal vibration with a logarithmic sweep: from 7 Hz a peak acceleration of 1 g _n is maintained until 18 Hz is reached. The amplitude is then maintained at 0.8 mm and the frequency increased until a peak acceleration of 2 g _n occurs (approximately 25 Hz). A peak acceleration of 2 g _n is then maintained until the frequency is increased to 200 Hz.		N/A
	Cycle is repeated 12 times for a total of 3 h for each of three mutually perpendicular mounting positions. One of the directions is perpendicular to the terminal face.		Pass
	Results: no leakage, no venting, no short-circuit, no rupture, no explosion and no fire during this test.	See appended Table 38.3.4.3	Pass
38.3.4.4	Test T-4: Shock		Pass
	Cells or batteries previously subjected to vibration test.		Pass
	Cells or batteries are subjected to three shocks in each direction of three mutually perpendicular mounting positions of the cell or battery for a total of 18 shocks.		Pass
	Cells are subjected to half-sine shock of peak acceleration of 150 g _n and pulse duration of 6 ms.		N/A
	As an alternative, large cells are subjected to a half-sine shock of peak acceleration of 50 g _n and pulse duration of 11 ms.		N/A
	Small batteries are subjected to half-sine shock of peak acceleration of the smaller of the following and pulse duration of 6 ms: - 150 g_n; or - $\sqrt{(100850 / \text{mass in kg})}$ g_n	Peak acceleration: 150 g _n	Pass
	Large batteries are subjected to half-sine shock of peak acceleration of the smaller of the following and pulse duration of 11 ms: - 50 g_n; or - $\sqrt{(30000 / \text{mass in kg})}$ g_n		N/A
	Results: no leakage, no venting, no short-circuit, no rupture, no explosion and no fire during this test.	See appended Table 38.3.4.4	Pass
38.3.4.5	Test T-5: External short-circuit		Pass
	Cells or batteries previously subjected to shock test.		Pass

UN 38.3			
Clause	Requirement + Test	Result - Remark	Verdict
	Cells or batteries are heated for a period of time necessary to reach a homogeneous stabilized temperature of 57 ± 4 °C, measured on the external case.		Pass
	Cells or batteries are subjected to a short-circuit condition with a total external resistance of less than 0.1 ohm at 57 ± 4 °C. Short-circuit condition is continued for at least 1 h after the cell or battery external case temperature has returned to 57 ± 4 °C, or in the case of the large batteries, has decreased by half of the maximum temperature increase observed during the test and remains below that value.		Pass
	The test sample is observed for a further 6 h.		Pass
	Results: no excessive temperature rise, no rupture, no explosion and no fire during this test and within the 6 h of observation.	See appended Table 38.3.4.5	Pass
38.3.4.6	Test T-6: Impact / crush	Considered in Cell UN38.3 report	N/A
	The test is conducted using test cells or component cells that have not been previously subjected to other transport tests.		N/A
	Each test cell or component cell shall be subjected to one impact / crush only.		N/A
	Cylindrical cells not less than 18.0 mm in diameter are tested with impact test procedure.		N/A
	The cell is placed on a flat smooth surface. A stainless steel bar with a diameter of 15.8 ± 0.1 mm and a length of at least 60 mm or of the longest dimension of the cell, whichever is greater, is placed across the centre of the test sample. A mass of 9.1 ± 0.1 kg is dropped from a height of 61 ± 2.5 cm at the intersection of the bar and the test sample using a vertical sliding track or channel. The vertical track is oriented 90 degrees from the horizontal supporting surface.		N/A
	The test sample is impacted with its longitudinal axis parallel to the flat surface and perpendicular to the longitudinal axis of the steel bar lying across the centre of the test sample.		N/A
	Prismatic, pouch, coin/button cells and cylindrical cells less than 18.0 mm in diameter are tested with crush test procedure.		N/A
	The cell is crushed between two flat surfaces. The crushing is to be gradual with a speed of approximately 1.5 cm/s at the first point of contact.		N/A
	A prismatic or pouch cell shall be crushed by applying the force to the widest side. A button/coin cell shall be crushed by applying the force on its flat surfaces. For cylindrical cells, the crush force shall be applied perpendicular to the longitudinal axis.		N/A

UN 38.3			
Clause	Requirement + Test	Result - Remark	Verdict
	The crushing is to be continued until one of the three conditions below is reached: - The applied force reaches 13 ± 0.78 kN; - The voltage of the cell drops by at least 100 mV; or - The cell is deformed by 50 % or more of its original thickness. As soon as one of the above conditions has been obtained, the pressure shall be released.		N/A
	The test sample is observed for a further 6 h.		N/A
	Results: no excessive temperature rise, no explosion and no fire during this test and within the 6 h of observation.		N/A
38.3.4.7	Test T-7: Overcharge		Pass
	The charge current of the battery is twice the manufacturer's recommended maximum continuous charge current.	Charge current: $2 \times 1.1A = 2.2A$	Pass
	The manufacturer's recommended charge voltage is not more than 18 V. The minimum voltage of the test is the lesser of two times the maximum charge voltage of the battery or 22 V.	Minimum voltage: 22Vdc	Pass
	The manufacturer's recommended charge voltage is more than 18 V. The voltage of the test is not less than 1.2 times the maximum charge voltage.		N/A
	The test is conducted at ambient temperature. The charging condition is maintained for at least 24 h.		Pass
	The test sample is observed for a further 7 days.		Pass
	Results: no explosion and no fire during this test and within the 7 days of observation.		Pass
38.3.4.8	Test T-8: Forced discharge	Considered in Cell UN38.3 report	N/A
	Each cell is forced discharged at ambient temperature by connecting it in series with a 12 V direct current power supply at an initial current equal to the maximum continuous discharge current specified by the manufacturer. Time interval for discharging equals to rated capacity divided by the initial test current.		N/A
	The test sample is observed for a further 7 days.		N/A
	Results: no explosion and no fire during this test, nor within the 7 days of observation.		N/A

UN 38.3			
Clause	Requirement + Test	Result - Remark	Verdict

38.3.4.1	TABLE: Altitude							Pass
Sample No.	Pre-condition	Open circuit voltage before test (V)	Mass before test (g)	Open circuit voltage after test (V)	Mass after test (g)	Mass loss (%)	Voltage remain (%)	Results
5477314-S1	C	12.58	145.36	12.46	145.36	0.000	99.05	A
5477314-S2	C	12.58	145.94	12.47	145.94	0.000	99.13	A
5477314-S3	C	12.58	145.35	12.48	145.35	0.000	99.21	A
5477314-S4	C	12.58	145.57	12.46	145.57	0.000	99.05	A
5477314-S5	D	12.58	145.53	12.47	145.53	0.000	99.13	A
5477314-S6	D	12.58	145.40	12.46	145.40	0.000	99.05	A
5477314-S7	D	12.58	145.75	12.47	145.75	0.000	99.13	A
5477314-S8	D	12.58	145.40	12.48	145.40	0.000	99.21	A

Precondition:

Results:

Results:

A: No leakage, no venting, no short-circuit (voltage not remain 90%), no rupture, no disassembly (explosion), and no fire.

B: Other (please explain)

UN 38.3			
Clause	Requirement + Test	Result - Remark	Verdict

38.3.4.2	TABLE: Thermal Test							Pass
Sample No.	Pre-condition	Open circuit voltage before test (V)	Mass before test (g)	Open circuit voltage after test (V)	Mass after test (g)	Mass loss (%)	Voltage remain (%)	Results
5477314-S1	C	12.46	145.36	12.28	145.36	0.000	98.56	A
5477314-S2	C	12.47	145.94	12.28	145.94	0.000	98.48	A
5477314-S3	C	12.48	145.35	12.28	145.35	0.000	98.40	A
5477314-S4	C	12.46	145.57	12.28	145.57	0.000	98.56	A
5477314-S5	D	12.47	145.53	12.28	145.53	0.000	98.48	A
5477314-S6	D	12.46	145.40	12.28	145.40	0.000	98.56	A
5477314-S7	D	12.47	145.75	12.28	145.75	0.000	98.48	A
5477314-S8	D	12.48	145.40	12.28	145.40	0.000	98.40	A

Precondition:

A: Fully discharged state.
B: Undischarged state.
C: First cycle in fully charged state.
D: After 25 cycles ending in fully charged state.

Results:

A: No leakage, no venting, no short-circuit (voltage not remain 90%), no rupture, no disassembly (explosion), and no fire.
B: Other (please explain)

UN 38.3			
Clause	Requirement + Test	Result - Remark	Verdict

38.3.4.3	TABLE: Vibration							Pass
Sample No.	Pre-condition	Open circuit voltage before test (V)	Mass before test (g)	Open circuit voltage after test (V)	Mass after test (g)	Mass loss (%)	Voltage remain (%)	Results
5477314-S1	C	12.28	145.36	12.28	145.36	0.000	100.00	A
5477314-S2	C	12.28	145.94	12.28	145.94	0.000	100.00	A
5477314-S3	C	12.28	145.35	12.28	145.35	0.000	100.00	A
5477314-S4	C	12.28	145.57	12.28	145.57	0.000	100.00	A
5477314-S5	D	12.28	145.53	12.28	145.53	0.000	100.00	A
5477314-S6	D	12.28	145.40	12.28	145.40	0.000	100.00	A
5477314-S7	D	12.28	145.75	12.28	145.75	0.000	100.00	A
5477314-S8	D	12.28	145.40	12.28	145.40	0.000	100.00	A

Precondition:

Results:

Results:

A: No leakage, no venting, no short-circuit (voltage not remain 90%), no rupture, no disassembly (explosion), and no fire.

B: Other (please explain)

UN 38.3			
Clause	Requirement + Test	Result - Remark	Verdict

38.3.4.5	TABLE: External short-circuit				Pass
Sample No.	Pre-condition	Open circuit voltage before test (V)	Maximum case temperature (°C)	Total external resistance (Ω)	Results
5477314-S1	C	12.28	56.4	88.4m	A
5477314-S2	C	12.28	56.4	75.4m	A
5477314-S3	C	12.28	56.5	85.4m	A
5477314-S4	C	12.28	56.3	76.2m	A
5477314-S5	D	12.28	56.4	86.2m	A
5477314-S6	D	12.28	56.7	78.2m	A
5477314-S7	D	12.28	56.8	83.3m	A
5477314-S8	D	12.28	56.9	86.3m	A

Supplementary information:

Precondition:

- A: Fully discharged state.
- B: Undischarged state.
- C: First cycle in fully charged state.
- D: After 25 cycles ending in fully charged state.

Results:

- A: No excessive temperature rise (above 170°C), no rupture, no disassembly (explosion), and no fire.
- B: Other (please explain)

UN 38.3			
Clause	Requirement + Test	Result - Remark	Verdict

38.3.4.6a	TABLE: Impact			N/A
Sample No.	Precondition	Open circuit voltage before test (V)	Maximum case temperature (°C)	Results

Supplementary information:

Precondition:

- A: Undischarged.
- B: Fully discharged.
- C: First cycle in one-half discharged state.
- D: After 25 cycles in one-half discharged state.

Results:

- A: No excessive temperature rise (above 170°C), no disassembly (explosion), and no fire.
- B: Other (please explain)

38.3.4.6b	TABLE: Crush						N/A
Sample No.	Open circuit voltage before test (V)	Voltage drop of the cell (mV)	Applied force (kN)	Thickness before test (mm)	Thickness after test (mm)	Maximum case temperature (°C)	Results

Supplementary information:

Precondition:

- A: Undischarged.
- B: Fully discharged.
- C: First cycle in one-half discharged state.
- D: After 25 cycles in one-half discharged state.

Results:

- A: No excessive temperature rise (above 170°C), no disassembly (explosion), and no fire.
- B: Other (please explain)

UN 38.3			
Clause	Requirement + Test	Result - Remark	Verdict

38.3.4.7	TABLE: Overcharge					Pass
Sample No.	Precondition	Open circuit voltage before test (V)	Maximum charging current (mA)	Maximum charging voltage (V)	Total charging time (h)	Results
5477314-S9	A	12.54	2.2072	22	24	A, B
5477314-S10	A	12.55	2.2003	22	24	A, B
5477314-S11	A	12.54	2.1996	22	24	A, B
5477314-S12	A	12.55	2.2096	22	24	A, B
5477314-S13	B	12.55	2.2005	22	24	A, B
5477314-S14	B	12.55	2.1996	22	24	A, B
5477314-S15	B	12.55	2.2019	22	24	A, B
5477314-S16	B	12.55	2.2091	22	24	A, B

Supplementary information:

Precondition:

A: First cycle in fully charged state.
B: After 25 cycles ending in fully charged state.

Results:

A: No disassembly (explosion), and no fire.
B: Other (please explain) The battery's protective circuitry is activated and the current was reduced to about 0 A.

Note:

Charging current: $1.1A \times 2 = 2.2A$
Charging voltage: 22Vdc ($12.6V \times 2 = 25.2V$ dc which is more than 22V)

UN 38.3			
Clause	Requirement + Test	Result - Remark	Verdict

38.3.4.8	TABLE: Forced discharge				N/A
Sample No.	Precondition	Open circuit voltage before test (V)	Measured reverse charging current (mA)	Total time for reversed charging application (min)	Results

Supplementary information:

Precondition:

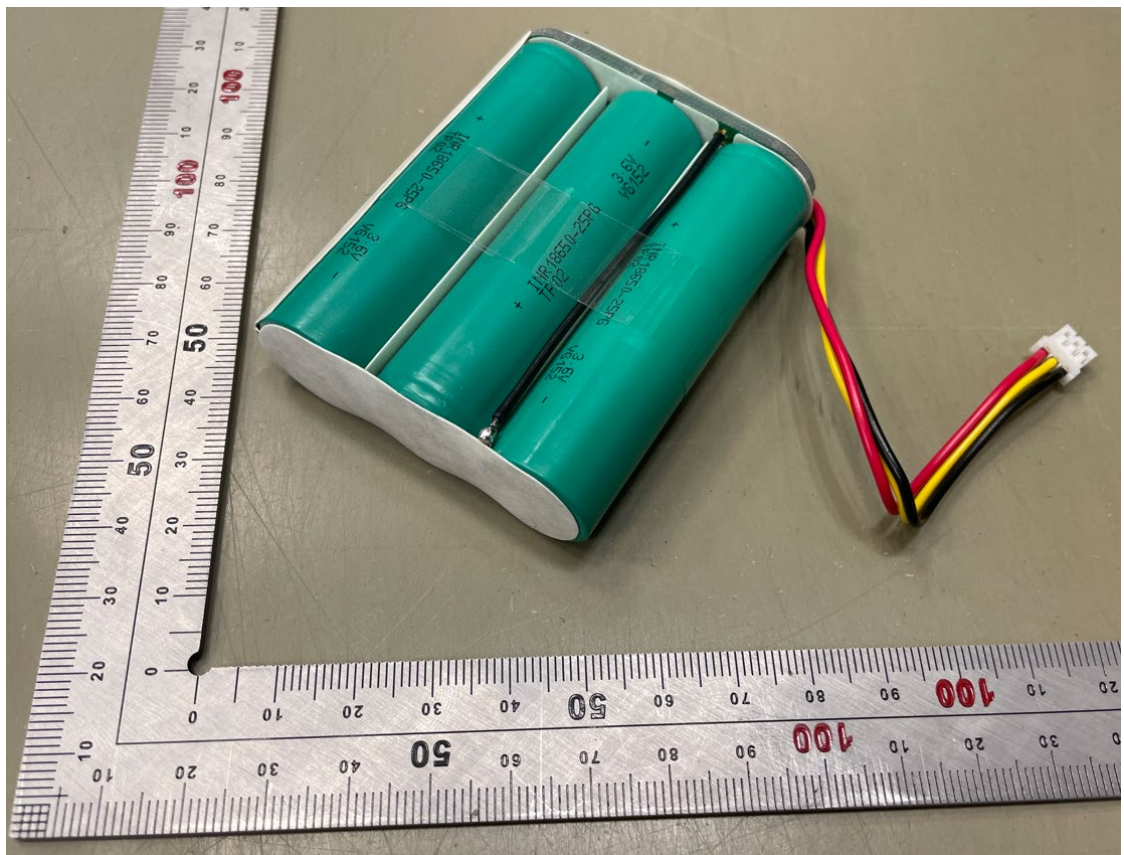
- A: Fully discharged state.
- B: First cycle in fully discharged state.
- C: After 25 cycles ending in fully discharged state.

Results:

- A: No disassembly (explosion), and no fire.
- B: Other (please explain)

ENCLOSURE

Supplement Id	Description
01	Overall view
02	Specification
03-1~2	Critical component list
04	Packaging Method



4. GENERAL SPECIFICATIONS

Unless otherwise specified, the cell is fresh cell and tested by standard charge and discharge.

Item		Specification	
4.1.	Capacity	Minimum	2450mAh by standard charge and discharge
		Nominal	2500mAh by standard charge and discharge
4.2.	Nominal Voltage		10.80V
4.3.	Device Discharge Cut-off Voltage		9.0V (Recommended)
4.4.	Maximum Charging Current		1.1A
4.5.	Charging Voltage		12.6V
4.6.	Continuous Discharge Current (Max) ^{※1}		2.0A
4.7.	Peak Discharge Current (Max)		10A pulse 2.5ms
4.8.	Internal Resistance		TBC
4.9.	Weight		TBC
4.10.	Operating Temperature	Charge	0°C ~ 45°C
		Discharge	-20°C ~ 60°C
4.11.	Storage Condition	1 year	-20°C ~ 25°C, 60% RH Max
		3 months	-20°C ~ 45°C, 60% RH Max
		1 months	-20°C ~ 60°C, 60% RH Max

※1 After the battery pack assembly, maximum discharge current will be limited by protection circuit, connector wire or device.

TABLE: Critical components information						Pass
Object / part No.	Manufacturer / trademark	Type / model	Technical data	Standard	Mark(s) of conformity ¹⁾	
01. Lithium-Ion Rechargeable Battery Cell (3S1P)	Jiangsu Tenpower Lithium Co., Ltd.	INR18650-25++ (++: could be optional alphanumeric suffix or blank, all models are identical except for model designation difference)	3.6 Vdc,2500mAh	IEC 62133-2: 2017	IEC CBTC No: DK-81811-UL, issued 2019-03-22, CBTR No: BATT-4788624221-003, issued 2019-03-21 by UL.	
02. Connectors and Receptacles (secondary SELV circuits)	Interchangeable	Interchangeable	--	UL 1977	UL.	
02a. Connectors and Receptacles (secondary SELV circuits) (alternate)	Interchangeable	Metal/Plastic	Copper alloy pins housed in bodies of plastic rated V-2 min.	UL 94 UL 746C	UL.	
03. Wiring	Interchangeable	Interchangeable	Rated minimum 105 degree C, FEP, PTFE, PVC, TFE, neoprene or polyimide; or surface marked VW-1 or FT-1 or better.	UL 758	UL.	
04. PVC Shrink Sleeve	Interchangeable	Interchangeable	Min. V-2, except area less or equal to 1.75 cubic centimeters or less than 4g	UL 94, UL 746C	UL.	
05. Internal Plastic Part Materials (for parts greater than 1.75cm ³)	Interchangeable	Interchangeable	Min V-2	UL 746C	UL.	
06. Label	Interchangeable	Interchangeable	60 degree C if maximum surface temperature not specified.	UL 969	UL.	
07. PWB	SK Printed Circuit Enterprise Co Ltd.	2L	V-0, 130 degree C.	UL 796	UL(E208126)	

07a. PWB (alternate)	Interchangeable	Interchangeable	Min. V-0, 130 degree C.	UL 796	UL.
08. IC (U11)	Nisshinbo Micro Devices Inc.	R5436T502BA	--	--	--
09. IC (U10)	ABLIC	S-8264AAA-I8T1U	--	--	--
10. MOSFET (Q15, Q16)	FETek Technology Corp.	FKBB3052	--	--	--
11. MOSFET (Q10)	Alpha and Omega Semiconductor	AO3400A	--	--	--
11a. MOSFET (Q10)	Interchangeable	Interchangeable	--	--	--
12. MOSFET (Q14)	On Semiconductor	2N7002KW	--	--	--
12a. MOSFET (Q14)	Interchangeable	Interchangeable	--	--	--
13. Thermistor (RT11)	GID Gloria International Development Co., Ltd	TH05-4H104FR	100k ohm at 25 degree C.	UL1434	UL.
13a. Thermistor (RT11) (alternate)	Interchangeable	Interchangeable	100k ohm at 25 degree C.	UL1434	UL.
14. Thermistor (RT10)	Thinking Electronic Industrial Co., Ltd	NTSE0103FZ70 3H	10k ohm at 25 degree C.	UL1434	UL.
14a. Thermistor (RT10) (alternate)	Interchangeable	Interchangeable	10k ohm at 25 degree C.	UL1434	UL.
15. Fuse (F11)	Polytronics Technology Corp.	CLM1612P1212	36Vdc, 12A	UL 248-1	UL.
16. Fuse (F10)	Bel Fuse Inc.	C1H10	32Vdc, 10A	UL 248-1	UL.
17. Current Sensing Resistor (R30)	Prosperity Dielectrics Co., Ltd.	FMF25FPHR01 0-L	10m ohm 1W	--	--
17a. Current Sensing Resistor (R30) (alternate)	Interchangeable	Interchangeable	10m ohm 1W	--	--

Supplementary information:

¹⁾ Provided evidence ensures the agreed level of compliance. See OD-CB2039.

²⁾ License available upon request.

