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Date:2020/01/01

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Certificate of UN test for Lithium ion Battery Pack

Product numbers: B307258 Watt-hour Rating: 72Wh

Rated voltage: 18V Rated capacity: 4.0Ah

Manufacturer of cell: SAMSUNG SDI

Cell Model: INR18650-20R

The maximum charge current: 3A

The maximum charge voltage: 21V

Test results of the UN Recommendations on Transport of Dangerous Goods

NO.	Test Item	Result	Remark
T-1	Altitude simulation	Pass	
T-2	Thermal Test	Pass	
T-3	Vibration	Pass	
T-4	Shock	Pass	
T-5	External short circuit	Pass	
T-6	Impact	—	For cell only
T-7	Overcharge	Pass	
T-8	Forced discharge	—	For cell only

We, TECHWAY Industrial co., Ltd. hereby certify that above results are confirmed in accordance with the Manual of Tests and Criteria of the UN Recommendations on the Transport of Dangerous Goods, Part III ,sub-section 38.3 REV 6AMDT 1.

Approver: Jim Chen Electronic R&D Team Leader

Checker: Jim Chen Electronic R&D Team Leader

Appraiser: Hung Lin Electronic R&D Dept Engineer

Battery Pack Test Program

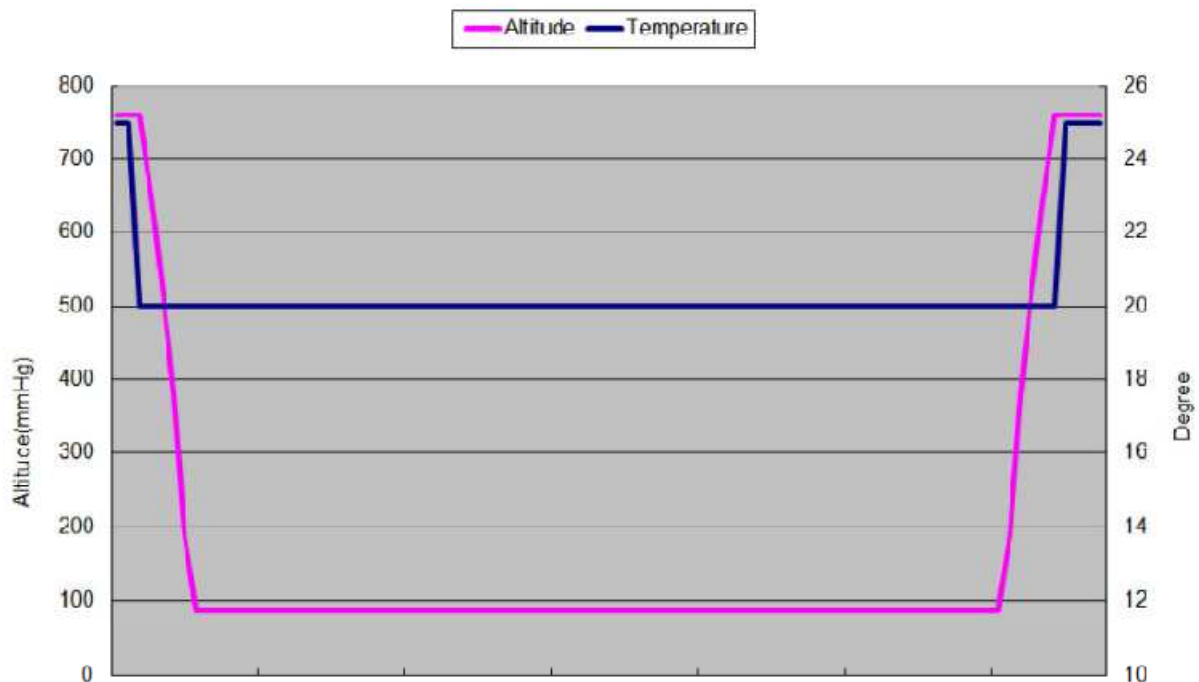
Test Item	Test Method	Criteria	First cycle Fully charged	25 cycles Fully charged
T-1 Altitude simulation	Storing at(low pressure)11.6kPa for 6hr at 20±5°C	No leakage No venting No disassembly	4PCS	4PCS
T-2 Thermal Test	72±2°C for 6 hours↔-40±2°C for 6 hours, (Transfer time:30min), 10cycle Storing at 20±5°C for 24 hours	No rupture No fire		
T-3 Vibration	7Hz→200Hz→7Hz,in 15min 12 cycle for 3 hours, 3direction 1)sinusoidal waveform with a logarithmic sweep 2)7Hz 18Hz(maintaining 1gn)app. 50Hz(until 8gn) 200Hz(maintaining 8gn), 1.6mm total excursion	Measuring voltage before/after each test (more than 90%) No mass loss Occurred by leakage or vent.		
T-4 Shock	Half sine shock of peak acceleration: 150gn, pulse duration: 6msec 3(pos.)shocks→3(neg.)shocks 3 direction, total 18 cycle			
T-5 External short circuit	Wire: Less 100mohm Short circuit at 57±4°C 1 hour continue after returning at 57±4°C	Not exceed 170°C No disassembly No rupture No fire within 6 hours		
T-6 Impact	For cell only	—	—	—
T-7 Overcharge	Test Current: 2* Max. charge current Test Voltage: If Max. charge voltage ≤ 18V→22V If Max. charge voltage > 18V→120%V The duration of the test shall be 24 hours	No disassembly No fire within 7 days	4PCS	4PCS
T-8 Forced discharge	For cell only	—	—	—

T-1 Altitude Simulation Test Report

Sample No	Sample Status	Before		After		Residual OVC(%)	Other Event
		Weight(g)	OCV(V)	Weight(g)	OCV(V)		
1	First cycle	769.87	20.914	769.78	20.907	99.97%	0
2	First cycle	767.32	20.881	767.23	20.874	99.97%	0
3	First cycle	767.53	20.880	767.45	20.873	99.97%	0
4	First cycle	767.30	20.864	767.21	20.857	99.97%	0
5	25 cycles	768.47	20.893	768.35	20.886	99.97%	0
6	25 cycles	767.67	20.881	767.59	20.874	99.97%	0
7	25 cycles	766.67	20.890	766.55	20.883	99.97%	0
8	25 cycles	767.79	20.890	767.67	20.883	99.97%	0

Note: L-Leakage, V-Venting, D-Disassembly, R-Rupture, F-Fire,
0- No leakage, No venting, No disassembly, No rupture, No fire.

Test Curve

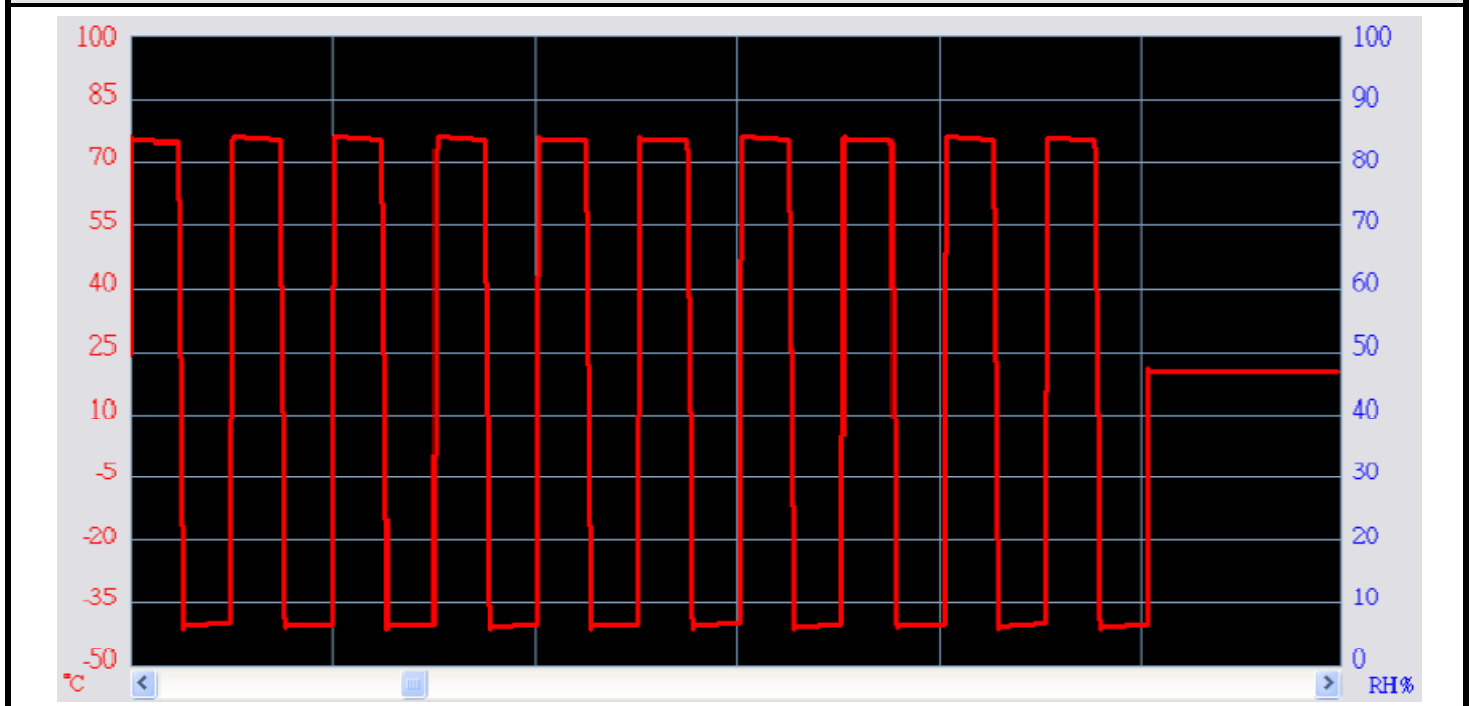


T-2 Thermal Test Report

Sample No	Sample Status	Before		After		Residual OVC(%)	Other Event
		Weight(g)	OCV(V)	Weight(g)	OCV(V)		
1	First cycle	769.78	20.907	768.01	20.544	98.26%	0
2	First cycle	767.23	20.874	765.40	20.522	98.31%	0
3	First cycle	767.45	20.873	765.58	20.520	98.31%	0
4	First cycle	767.21	20.857	765.39	20.509	98.33%	0
5	25 cycles	768.35	20.886	766.56	20.527	98.28%	0
6	25 cycles	767.59	20.874	765.82	20.520	98.30%	0
7	25 cycles	766.55	20.883	764.82	20.527	98.30%	0
8	25 cycles	767.67	20.883	765.81	20.526	98.29%	0

Note: L-Leakage, V-Venting, D-Disassembly, R-Rupture, F-Fire,
0- No leakage, No venting, No disassembly, No rupture, No fire.

Test Curve

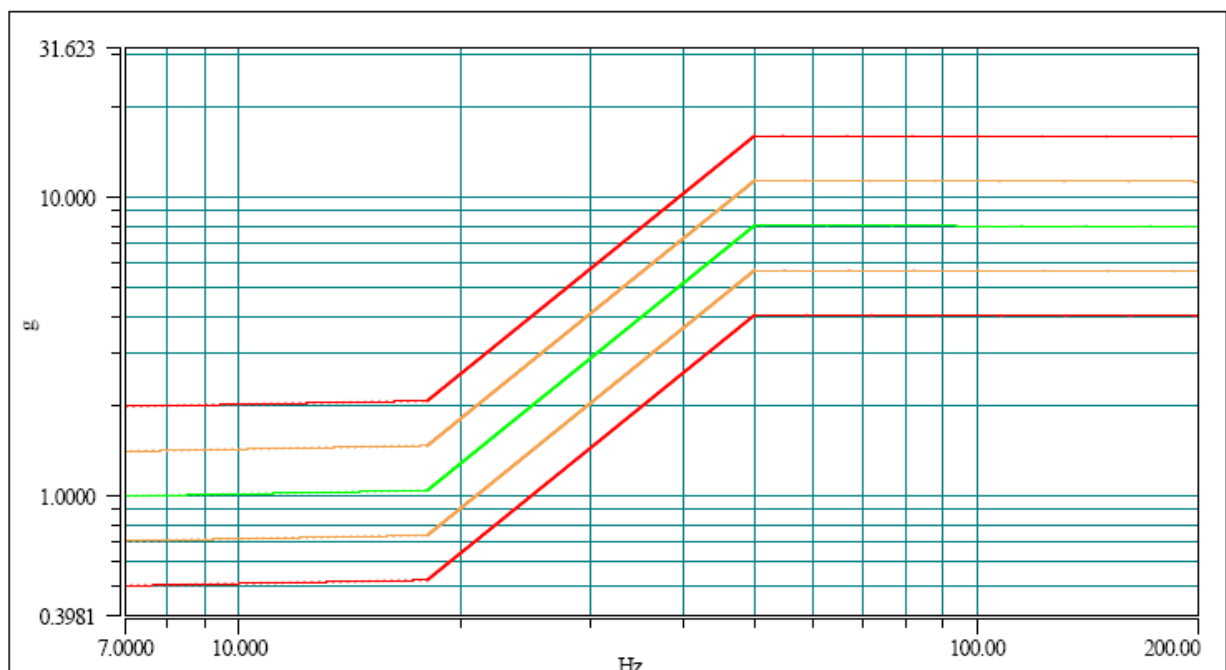


T-3 Vibration Test Report

Sample No	Sample Status	Before		After		Residual OVC(%)	Other Event
		Weight(g)	OCV(V)	Weight(g)	OCV(V)		
1	First cycle	768.01	20.544	768.16	20.541	99.99%	0
2	First cycle	765.40	20.522	765.56	20.519	99.99%	0
3	First cycle	765.58	20.520	765.79	20.517	99.99%	0
4	First cycle	765.39	20.509	765.58	20.507	99.99%	0
5	25 cycles	766.56	20.527	766.77	20.524	99.99%	0
6	25 cycles	765.82	20.520	766.02	20.517	99.99%	0
7	25 cycles	764.82	20.527	765.01	20.525	99.99%	0
8	25 cycles	765.81	20.526	766.04	20.523	99.99%	0

Note: L-Leakage, V-Venting, D-Disassembly, R-Rupture, F-Fire,
0- No leakage, No venting, No disassembly, No rupture, No fire.

Test Curve

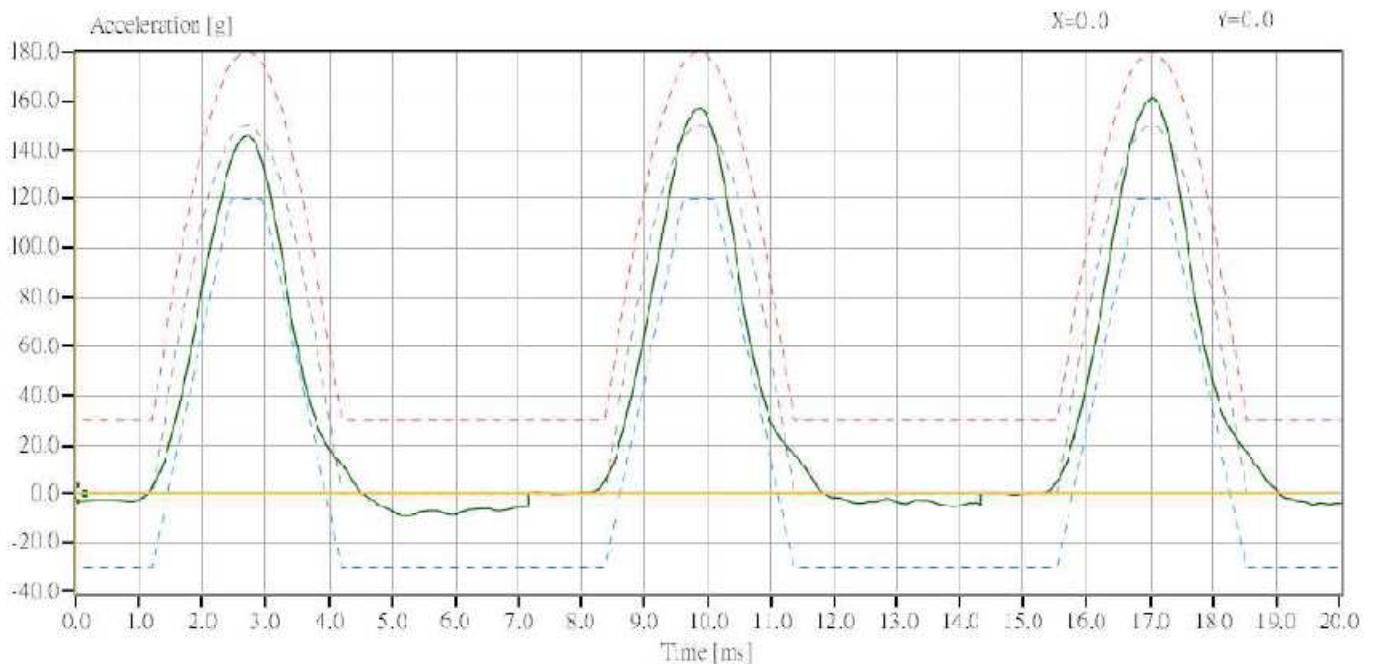


T-4 Shock Test Report

Sample No	Sample Status	Before		After		Residual OVC(%)	Other Event
		Weight(g)	OCV(V)	Weight(g)	OCV(V)		
1	First cycle	768.16	20.541	768.18	20.541	100.00%	0
2	First cycle	765.56	20.519	765.56	20.519	100.00%	0
3	First cycle	765.79	20.517	765.76	20.517	100.00%	0
4	First cycle	765.58	20.507	765.56	20.507	100.00%	0
5	25 cycles	766.77	20.524	766.78	20.524	100.00%	0
6	25 cycles	766.02	20.517	766.02	20.517	100.00%	0
7	25 cycles	765.01	20.525	765.01	20.525	100.00%	0
8	25 cycles	766.04	20.523	766.02	20.523	100.00%	0

Note: L-Leakage, V-Venting, D-Disassembly, R-Rupture, F-Fire,
0- No leakage, No venting, No disassembly, No rupture, No fire.

Test Curve



T-5 External short circuit Test Report

Sample No	Sample Status	Measure external Resistance(m Ω)	Initial OCV(V)	Max. External Case Temperature($^{\circ}$ C)	Other Event
1	First cycle	9	20.541	58.1	0
2	First cycle	9	20.519	58.7	0
3	First cycle	9	20.517	58.8	0
4	First cycle	9	20.507	59.3	0
5	25 cycles	9	20.524	59.3	0
6	25 cycles	9	20.517	58.4	0
7	25 cycles	9	20.525	58.1	0
8	25 cycles	9	20.523	58.7	0

Note: L-Leakage, V-Venting, D-Disassembly, R-Rupture, F-Fire,
0- No disassembly, No rupture, No fire.

Set up photos



T-7 Overcharge Test Report

Sample No	Sample Status	OCV before test (V)	OCV after test (V)	Other Event
1	First cycle	20.884	0.000	0
2	First cycle	20.921	0.000	0
3	First cycle	20.878	0.000	0
4	First cycle	20.864	0.000	0
5	25 cycles	20.888	0.000	0
6	25 cycles	20.913	0.000	0
7	25 cycles	20.892	0.000	0
8	25 cycles	20.889	0.000	0

Note: L-Leakage, V-Venting, D-Disassembly, R-Rupture, F-Fire,
0- No disassembly, No fire.

The charge current: $3 \times 2 = 6A$

The maximum charge voltage: 25.2V

Set up photos



Appendix A
Photos

External view of battery pack



External view of battery pack

