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Date:2016/01/10

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## *Certificate of UN test for Lithium ion Battery Pack*

Product numbers: B308258/TJEP no. 115986

Watt-hour Rating: 36Wh

Rated voltage: 18V

Rated capacity: 2.0Ah

Manufacturer of cell: SAMSUNG SDI

Cell Model: INR18650-20R

The maximum charge current: 2A

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.

Approver: Alen Chang

Checker: Alen Chang

Appraiser: Jim Chen

## Battery Pack Test Program

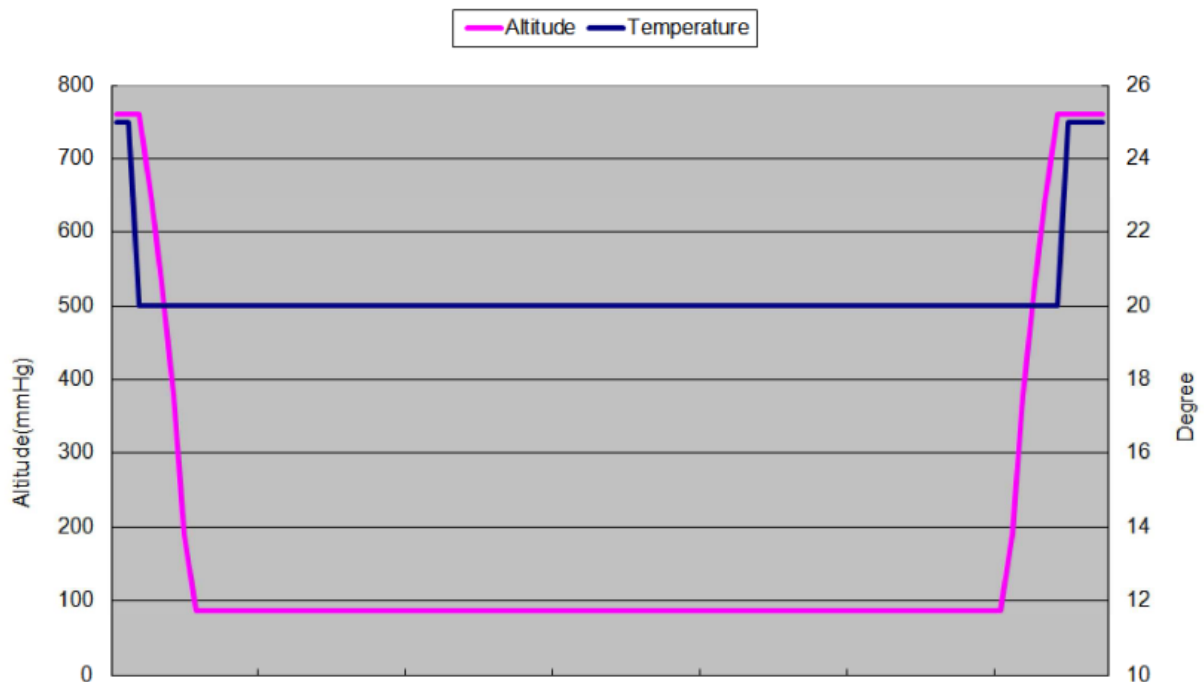
Test Item	Test Method	Criteria	First cycle Fully charged	50 cycles Fully charged
T-1 Altitude simulation	Storing at(low pressure)11.6kPa for 6hr at 20±5°C	No leakage No venting No disassembly	4PCS	4PCS
T-2 Thermal Test	75±2°C for 6 hours↔-40±2°C for 6 hours, (Transfer time:30min), 10cycle Storing at 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	422.69	20.809	422.67	20.801	0.04%	0
2	First cycle	422.95	20.815	422.92	20.808	0.03%	0
3	First cycle	423.71	20.829	423.68	20.821	0.04%	0
4	First cycle	421.65	20.830	421.62	20.822	0.04%	0
5	50 cycles	423.60	20.809	423.58	20.799	0.05%	0
6	50 cycles	423.04	20.845	423.01	20.837	0.04%	0
7	50 cycles	421.49	20.805	421.46	20.798	0.03%	0
8	50 cycles	421.05	20.831	421.02	20.823	0.04%	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

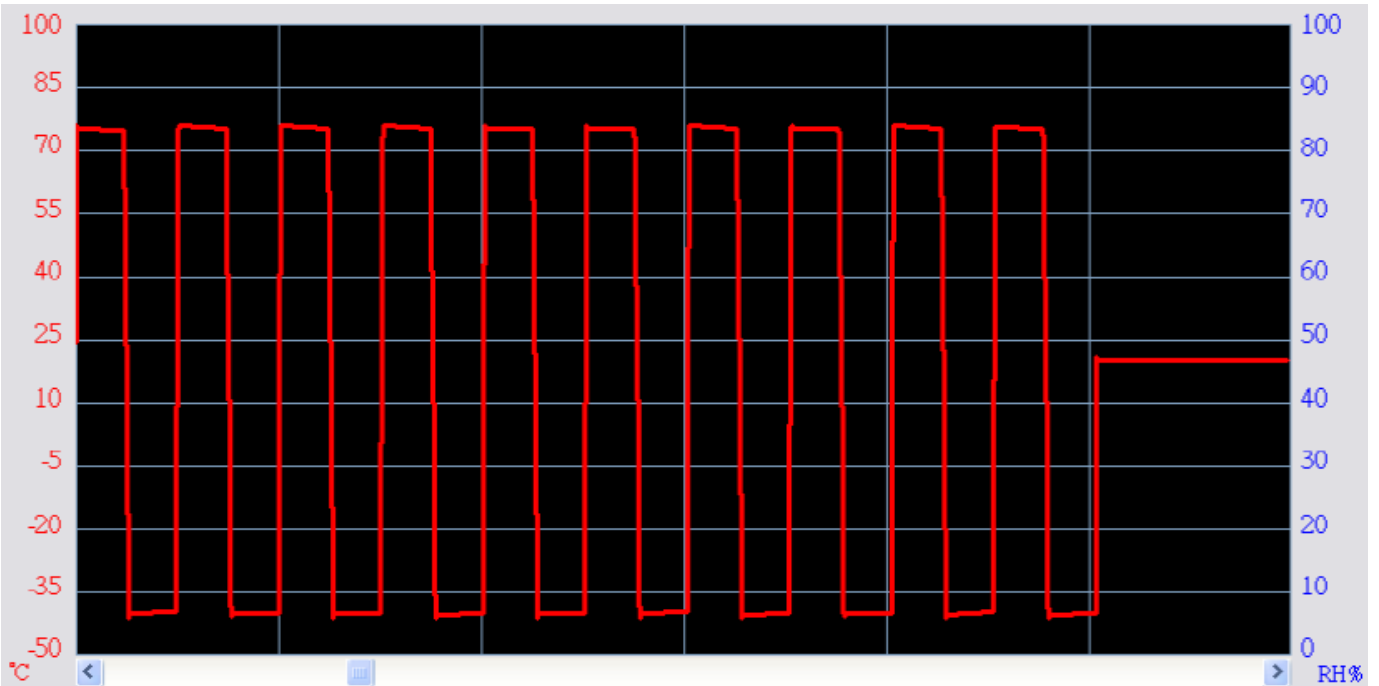


## T-2 Thermal Test Report

Sample No	Sample Status	Before		After		Residual OVC(%)	Other Event
		Weight(g)	OCV(V)	Weight(g)	OCV(V)		
1	First cycle	422.67	20.801	421.93	20.448	1.70%	0
2	First cycle	422.92	20.808	422.17	20.456	1.69%	0
3	First cycle	423.68	20.821	422.90	20.467	1.70%	0
4	First cycle	421.62	20.822	420.85	20.470	1.69%	0
5	50 cycles	423.58	20.799	422.80	20.390	1.97%	0
6	50 cycles	423.01	20.837	422.26	20.478	1.72%	0
7	50 cycles	421.46	20.798	420.68	20.445	1.70%	0
8	50 cycles	421.02	20.823	420.24	20.465	1.72%	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

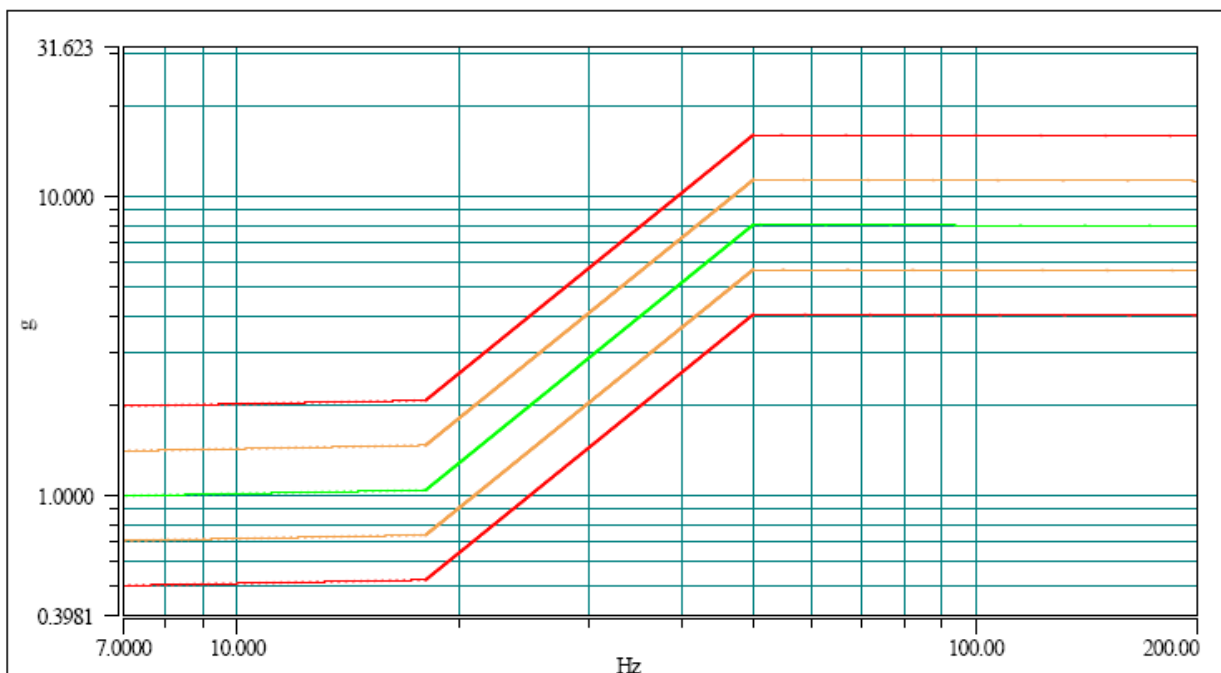


## T-3 Vibration Test Report

Sample No	Sample Status	Before		After		Residual OVC(%)	Other Event
		Weight(g)	OCV(V)	Weight(g)	OCV(V)		
1	First cycle	421.93	20.448	421.90	20.447	0.00%	0
2	First cycle	422.17	20.456	422.16	20.456	0.00%	0
3	First cycle	422.90	20.467	422.89	20.467	0.00%	0
4	First cycle	420.85	20.470	420.84	20.469	0.00%	0
5	50 cycles	422.80	20.390	422.79	20.389	0.00%	0
6	50 cycles	422.26	20.478	422.25	20.477	0.00%	0
7	50 cycles	420.68	20.445	420.66	20.444	0.00%	0
8	50 cycles	420.24	20.465	420.22	20.464	0.00%	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

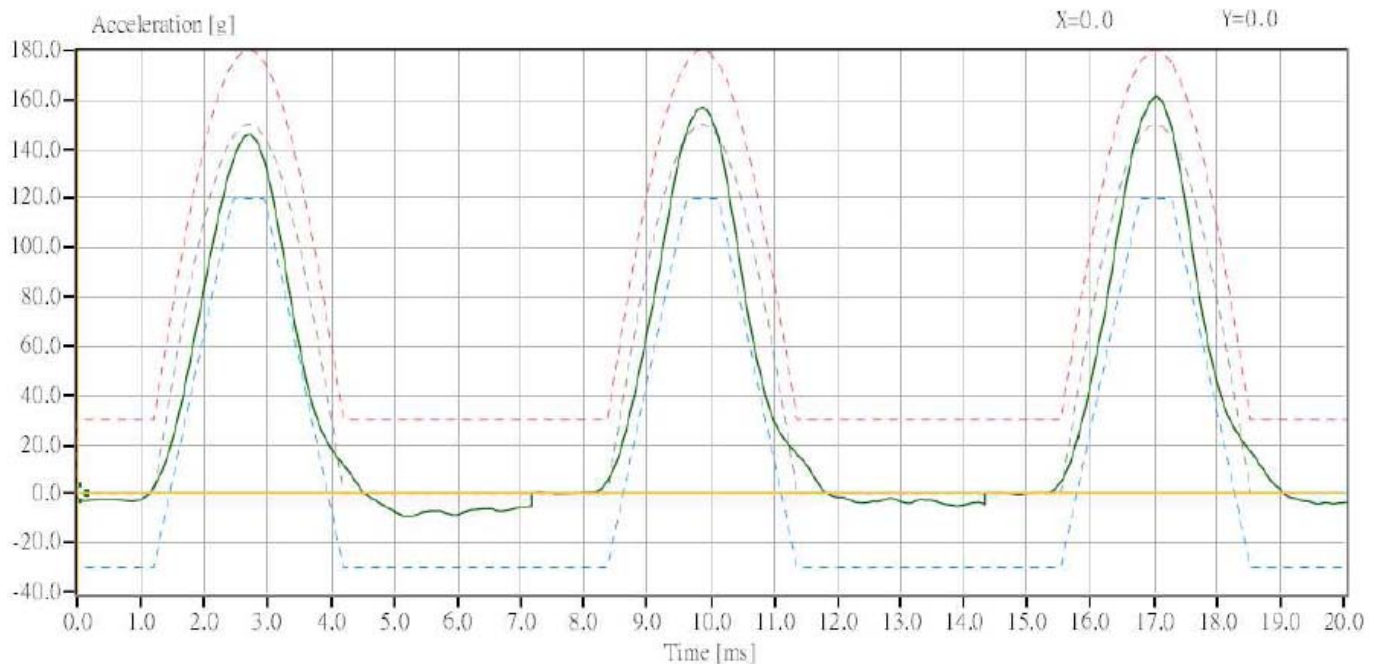


## T-4 Shock Test Report

Sample No	Sample Status	Before		After		Residual OVC(%)	Other Event
		Weight(g)	OCV(V)	Weight(g)	OCV(V)		
1	First cycle	421.90	20.447	421.92	20.447	0.00%	0
2	First cycle	422.16	20.456	422.18	20.455	0.00%	0
3	First cycle	422.89	20.467	422.90	20.467	0.00%	0
4	First cycle	420.84	20.469	420.85	20.469	0.00%	0
5	50 cycles	422.79	20.389	422.80	20.388	0.00%	0
6	50 cycles	422.25	20.477	422.26	20.477	0.00%	0
7	50 cycles	420.66	20.444	420.68	20.444	0.00%	0
8	50 cycles	420.22	20.464	420.25	20.464	0.00%	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(mΩ)	Initial OCV(V)	Max. External Case Temperature(°C)	Other Event
1	First cycle	9	20.447	58.9	0
2	First cycle	9	20.455	59.4	0
3	First cycle	9	20.467	59.0	0
4	First cycle	9	20.469	59.7	0
5	50 cycles	9	20.388	58.7	0
6	50 cycles	9	20.477	59.2	0
7	50 cycles	9	20.444	58.7	0
8	50 cycles	9	20.464	59.2	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	20.812	0.000	0
2	First cycle	20.822	0.000	0
3	First cycle	20.804	0.000	0
4	First cycle	20.841	0.000	0
5	50 cycles	20.829	0.000	0
6	50 cycles	20.823	0.000	0
7	50 cycles	20.818	0.000	0
8	50 cycles	20.841	0.000	0

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

The charge current:  $2 \times 2 = 4A$

The maximum charge voltage: 25.2V

### Set up photos





Appendix A  
Photos

External view of battery pack



External view of battery pack

