Product Specification

Product Name: Lithium Iron Phosphate Battery

Model: HTCFR18650 (1500mAh 3.2V)

Contents

1. Application Scope

This product specification describes product performance indicators of Lithium-ion battery distributed by Master Instruments Pty Ltd.

2. Model

HTCFR18650 - 1500mAh 3.2V

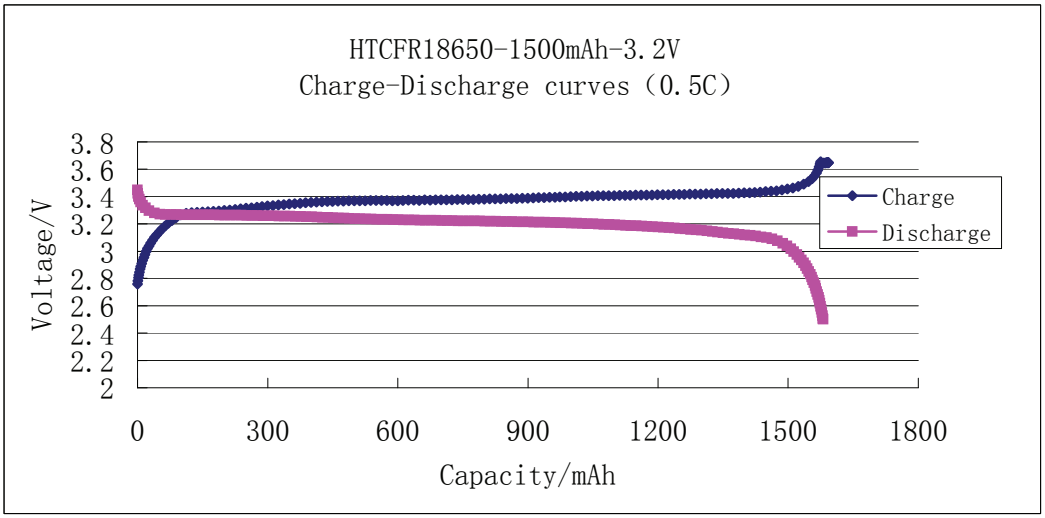
3. Appearance and Dimension

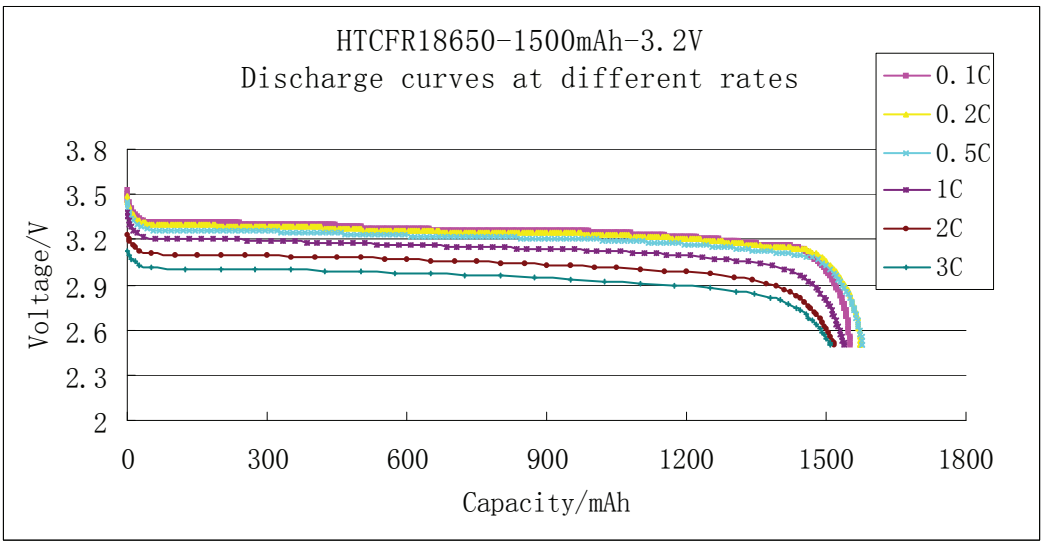
Item	H	Φ 1	Φ 2	Φ 3
Dimension(mm)	65.2± 0.3	8.85± 0.15	10± 0.2	18.15± 0.1

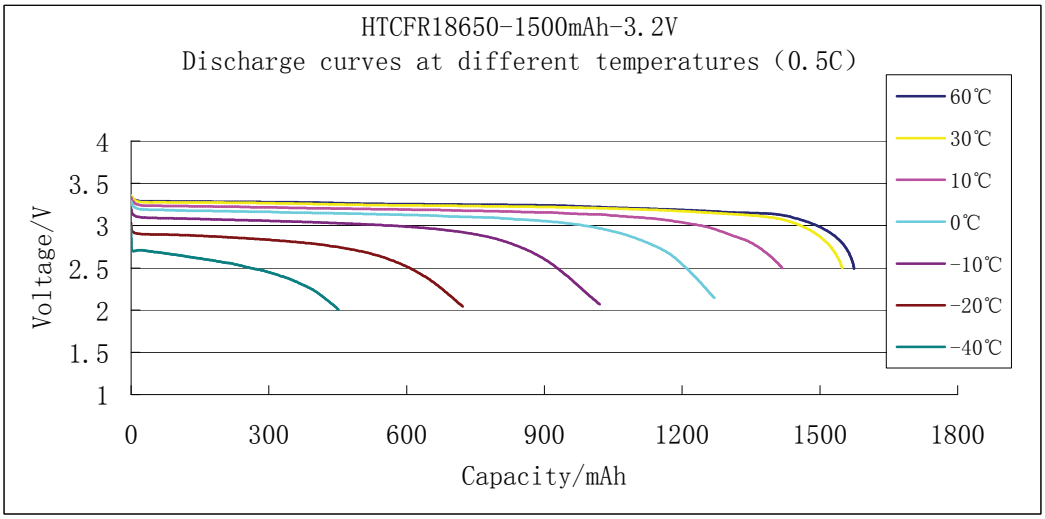
4. Major Technical Parameters

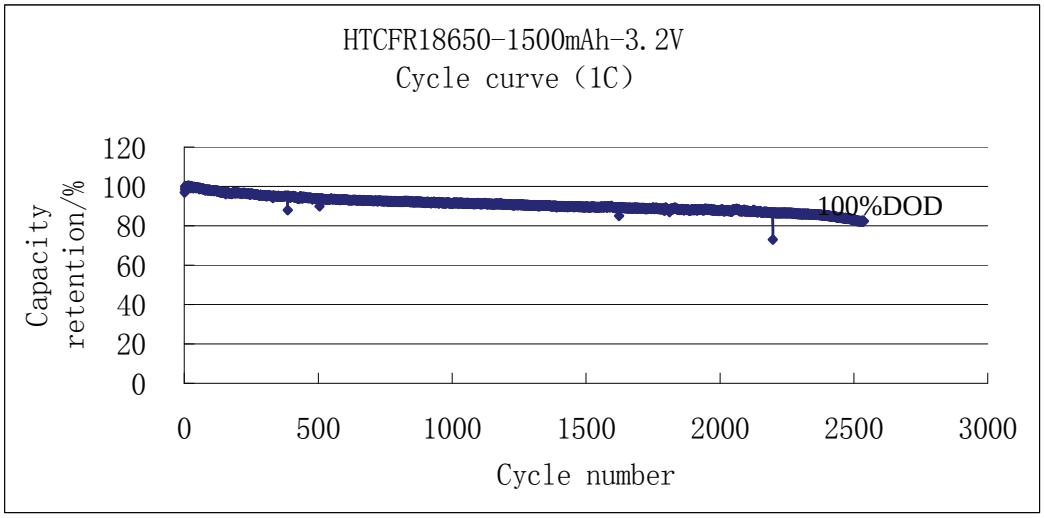
No.	Item		Standard	Note
1	Standard Capacity		1500mAh	0.5C,(current value of 1500mA at 1C)
2	Capacity Range		1450～1550mAh	0.5C
3	Standard Voltage		3.2 V	
4	Alternating Internal Resistance		≤45mΩ	
5	Charge Conditions	Cut-off Voltage	3.65±0.05V	Constant-current charge to 3.65V at 0.5C, constant voltage charge to stop until 0.01C mA
		Cut-off Current	0.01C	
6	Discharge Cut-off Voltage		2.5V	
7	Cycle Characteristic		2000 times（100%DOD）	The residual capacity is no less than 80% of rated capacity at 1C rate.
			4000 times（80%DOD）	
			7000 times（50%DOD）	
8	Max. charging current		1.5A	
9	Max. Continuous Discharge Current		4.5A	
10	Pulse Discharge Current		10A, 10s	
11	Working Temperature		Charge:0°C~55°C Discharge:-20°C~60°C	
12	Storage Temperature		-20°C ~ 45°C	Short-term storage (< 3 months)
13	Battery Weight		42 g (Approx.)	

5. Characteristics Curves









6. Safety Characteristics

NO.	Item	Test Method	Standard
1	Overcharge	After normal charge, test the batteries' initial state and capacity. Charge to 10.0V at 3C, then charge at CV mode to 0.01C. Observe battery's variation of appearance.	No explosion, No fire.
2	Over Discharge	After normal charge, test the batteries' initial state. When the batteries are normal, Discharge to 0V at 0.5C. Observe battery's variation of appearance.	No explosion, No fire.
3	External Short-circuit	After normal charge, test the batteries initial state, Keep the battery into explosion protection cover, short-circuit the positive and negative terminals directly (general resistance shall be less than or equal to 50mΩ). Stop the test when the temperature falls to 10℃ lower than the peak value. Observe the variation of the batteries' appearance and temperature.	No explosion, No fire.
4	Thermal Abuse	Test the batteries' initial state and capacity. Standard charge. Put battery into oven, increase the temperature to 130±2℃ at rate of （5±2℃）/min, and keep it for 30min. Observe the variation of batteries' appearance.	No explosion, No fire.
5	Drop	After normal charge, test the batteries' initial state and capacity. Then let it fall from a height of 1m (the lowest height) to a smooth cement floor, twice.	No explosion, No fire.
6	Heavy Impact	A diameter of 15.8 mm steel rod is placed in the middle of the fully charged battery, then the weight of 10Kg hammer from 1.0m height free falls to the battery upper.	No explosion, No fire.
7	Extrusion Test	Place the battery in between the pressing surface of extrusion apparatus, parallel the axes of cylindrical battery to the pressing surface, and gradually increase pressure up to 13KN, keeping the pressure for 1min.	No explosion, No fire.

8	Prick test	Use Φ3 mm to 5 mm high temperature resistant steel needle, to 10 mm/s ~ 40 mm/s of speed, from the perpendicular to the direction of the battery plate(Steel needle stops in the battery).	No explosion, No fire.

7. Environmental Adaptability

NO.	Item	Test Method	Standard
1	Temperature Cycle	Store the battery for 48 hours at 75±2℃after standard charge, then store the battery at -20℃ for 6 hours, and at room temperature for 24 hours. Observe the batteries' appearance.	No leakage, No smoke, No fire, No explosion.
2	Static Humidity	Put the battery at 40℃±5℃ and 95%RH chamber for 48h, then get it out and store it for 2h at room temperature. Observe the appearance and discharge at 0.5C to 2.5V, then test the final capacity.	Discharge capacity after storage is more than 90% of rated capacity. No obvious outside damage, No corrosion, No smoke, No explosion
3	Vibration	Standard charge. Equip it to the vibration platform, prepare the test equipment according to following vibration frequency and relevant swing, doing frequency sweeping from X, Y, Z three directions, each from 10Hz to 55Hz for 30 minutes of recycling, rating of which is 1oct/min: A)vibration frequency:10Hz～30Hz Displacement breadth (single swing): 0.38mm B)vibration frequency:30Hz～55Hz Displacement breadth (single swing): 0.19mm. Observe the final state after scanning.	Residual Capacity≥90% Rated Capacity Voltage Decrease Rate ≤0.5% No obvious outside damage, No leakage, No smoke, No explosion.
4	Normal Storage	Test the batteries' initial state and capacity; store the battery for 30 days after standard charge, test the final state. Discharge at 0.5C to 2.5V, then test batteries' residual capacity. Then after normal charge, discharge at 0.5C to 2.5V, then test the batteries' recovery capacity，Three cycles are permitted for this test, If one of the three cycles can reach the standard, it represents the battery has reached the standard.	Residual Capacity ≥90% Initial Capacity Recuperative Capacity ≥95% Initial Internal

8. Standard Test Environment

Unless especially specified, all tests stated in this Product Specification are conducted at below condition:
Temperature: 25±2℃

Humidity: (65±20) % RH

9. Storage and Others

9.1 Long Time Storage

If the battery is stored for a long time (more than three months),the battery should be stored in dry and cool place. The battery should be charged and discharged every three months. The batteries' storage voltage should be 3.3~3.4V and the battery should be stored in a condition as NO.8.

9.2 Others

Any matters that this specification does not cover should be consulted between the customer and Master Instruments.

10. Notice in Using Battery

Please pay attention to the following in case of battery will have leakage, heat etc.

- Do not immerse the battery in water or seawater, and keep the battery in a cool dry surrounding if it stands by.
- Do not use or leave the battery at high temperature as fire or heater. Otherwise, it can overheat or fire or its performance will degenerate and its service life will be decreased.
- Do not reverse the position and negative terminals.
- Do not connect the battery electrodes to an electrical outlet.
- Do not short circuit. Otherwise it will cause serious damage of the battery.
- Do not transport or store the battery together with metal objects such as hairpins, necklaces, etc.
- Do not strike, trample, throw, fall and shock the battery.
- Do not directly solder the battery and pierce the battery with a nail or other sharp objects.
- Do not use the battery in a location where static electricity and magnetic field is great, otherwise, the safety devices may be damaged, causing hidden trouble of safety.
- Use the battery charger specifically when recharging.
- If the battery leaks and the electrolyte gets into the eyes, do not rub the eyes, instead, rinse the eyes with clean water, and immediately seek medical attention. Otherwise, it may injure eyes.
- If the battery gives off strange odor, generates heat, becomes discolored or deformed, or in any way appears abnormal during use, recharging or storage, immediately stop charging, using, and remove it from the device.
- In case the battery terminals are dirty, clean the terminals with a dry cloth before use. Otherwise poor performance may occur due to the poor connection with the instrument.
- Tape the discarded battery terminals to insulate them.

Note

The following is the interpretation of some terms in the above test project:

(1) Standard charge: Under the environment of 25℃±2℃, for constant current battery charging 0.5 C to cut-off voltage, to a constant voltage charging to the cut-off current, stop charging.
(2) Initial state: Initial state of voltage and internal resistance of the battery.
(3) Final state: State of battery internal resistance and voltage.
(4) Residual Capacity: The first discharge capacity batteries after a specific test.
(5) Recovery Capacity: The discharge capacity by specifically charge-discharge cycle repeatedly after being tested by the specific procedure.

Appendix A

Suggestions for Battery Packs

1、Selecting principle of nickel strip is often applied to the design of battery packs.

Based on the working current of battery packs to make the shunt selection of nickel strip. The common nickel strip could under the current as below:

Nickel Strip Type	3*0.1	4*0.1	7*0.15	8*0.15
Normal Working Current	2A	3A	7A	8A
Maximum Continues Current	4A	5A	13A	15A

2、Relation between the battery packs design current and lead wires current breakdown, and principle of wires selection.

Based on the working current of battery packs to make the shunt selection of wires. Different wires could under the current as below:

AWG	外径 公制mm	外径 英制inch	截面积 (mm2)	电阻值 (Ω/km)	正常电流 (A)	最大电流 (A)	AWG	外径 公制mm	外径 英制inch	截面积 (mm2)	电阻值 (Ω/km)	正常电流 (A)	最大电流 (A)
0000	11.68	0.46	107.22	0.17	423.2	482.6	22	0.643	0.0253	0.3247	54.3	1.280	1.460
000	10.4	0.4096	85.01	0.21	335.5	382.6	23	0.574	0.0226	0.2588	48.5	1.022	1.165
00	9.27	0.3648	67.43	0.26	266.2	303.5	24	0.511	0.0201	0.2047	89.4	0.808	0.921
0	8.25	0.3249	53.49	0.33	211.1	240.7	25	0.44	0.0179	0.1624	79.6	0.641	0.731
1	7.35	0.2893	42.41	0.42	167.4	190.9	26	0.404	0.0159	0.1281	143	0.506	0.577
2	6.54	0.2576	33.62	0.53	132.7	151.3	27	0.361	0.0142	0.1021	128	0.403	0.460
3	5.83	0.2294	26.67	0.66	105.2	120.0	28	0.32	0.0126	0.0804	227	0.318	0.362
4	5.19	0.2043	21.15	0.84	83.5	95.2	29	0.287	0.0113	0.0647	289	0.255	0.291
5	4.62	0.1819	16.77	1.06	66.2	75.5	30	0.254	0.01	0.0507	361	0.200	0.228
6	4.11	0.162	13.3	1.33	52.5	59.9	31	0.226	0.0089	0.0401	321	0.158	0.181
7	3.67	0.1443	10.55	1.68	41.6	47.5	32	0.203	0.008	0.0316	583	0.128	0.146
8	3.26	0.1285	8.37	2.11	33.0	37.7	33	0.18	0.0071	0.0255	944	0.101	0.115
9	2.91	0.1144	6.63	2.67	26.2	29.8	34	0.16	0.0063	0.0201	956	0.079	0.091
10	2.59	0.1019	5.26	3.36	20.8	23.7	35	0.142	0.0056	0.0169	1200	0.063	0.072
11	2.3	0.0907	4.17	4.24	16.5	18.8	36	0.127	0.005	0.0127	1530	0.050	0.057
12	2.05	0.0808	3.332	5.31	13.1	14.9	37	0.114	0.0045	0.0098	1377	0.041	0.046
13	1.82	0.072	2.627	6.69	10.4	11.8	38	0.102	0.004	0.0081	2400	0.032	0.036
14	1.63	0.0641	2.075	8.45	8.2	9.4	39	0.089	0.0035	0.0062	2100	0.025	0.028
15	1.45	0.0571	1.646	10.6	6.5	7.4	40	0.079	0.0031	0.0049	4080	0.019	0.022
16	1.29	0.0508	1.318	13.5	5.2	5.9	41	0.071	0.0028	0.004	3685	0.016	0.018
17	1.15	0.0453	1.026	16.3	4.1	4.7	42	0.064	0.0025	0.0032	6300	0.013	0.014
18	1.02	0.0403	0.8107	21.4	3.2	3.7	43	0.056	0.0022	0.0025	5544	0.010	0.011
19	0.912	0.0359	0.5667	26.9	2.6	2.9	44	0.051	0.002	0.002	10200	0.008	0.009
20	0.813	0.032	0.5189	33.9	2.0	2.3	45	0.046	0.0018	0.0016	9180	0.006	0.007
21	0.724	0.0285	0.4116	42.7	1.6	1.9	46	0.041	0.0016	0.0013	16300	0.005	0.006

3、Voltage protection point value (for single cell) of protection board or BMS, and selecting principle of protection board.

	Over-charged Protection Voltage	Over-discharged Protection Voltage	The protection voltage point for monomer should be selected also based on the safety voltage point of cell and protection voltage point of IC.
Lithium Iron Phosphate	3.6-3.9	2.0-2.5	
Ni-Co- Mn	4.05-4.25	2.5-3.0	
Selecting principles of protection board: based on the safety needs of the cell and customers' requirements. To select the suitable protection board according to the size of battery packs.			

4、Selecting principles of chargers

Selecting principles of chargers

(1) Voltage should be regulated by the safest voltage of chargeable cell * n (make the Lithium iron phosphate as 3.6 V and Ni- Co- Mn as 4.2 V);

(2) Current should be limited by the safe current of chargeable cell, and the customers' specific requirements also should be considered.

(3) If above 120W, chargers with aluminium alloy cooling fin or cooling fan will be suggested.

(4) If under 60W, chargers with plastic shell will be suggested.

5、In the process of packs structure design and production, some measures and skills could be handled to avoid battery short circuit.

(1) To strengthen the positive insulation treatment of the monomer batteries, with barley paper or other high temperature resistant material;

(2) Battery in the case of size allowed, should try to use batteries of the isolation.

(3) Battery when working current is larger and can't use bracket, should strengthen the insulation of the batteries shell, for example, using paper sleeve, PVC casing.

(4) The power line shall not directly contact with the surface of the batteries, avoid cross; Must cross the line and the line between the bracket with high temperature tape or barley paper.

(5) Power line is not connected to the nickel spot welding surface as far as possible, cannot be avoided, the power line between nickel and high temperature insulation tape to stick a highland barley paper.

(6) The reasonable design of nickel welding way, minimize nickel piece of calorific value.