



# Li-ion Polymer 70mAh Battery Datasheet

## Distributed by TinyCircuits:

**TinyCircuits Part Number:** ASR00011

**Website:** <https://tinycircuits.com/>

**Company Address:** 540 S. Main St Ste 457 Akron, OH 44311 USA

**Battery Connector Part:** JST SHR-02V-S-B

**Battery Mating Connector Part:** JST SM02B-SRSS-TB(LF)(SN)

## Manufacturing Information:

**Company:** Shenzhen Hondark Electronics Co., Ltd.

**Product Type:** Lithium-ion Polymer Battery

**Model Name:** 501515-70mAh

**USHTS:** 8507600020

**ECCN:** EAR99

**Country of Origin:** China

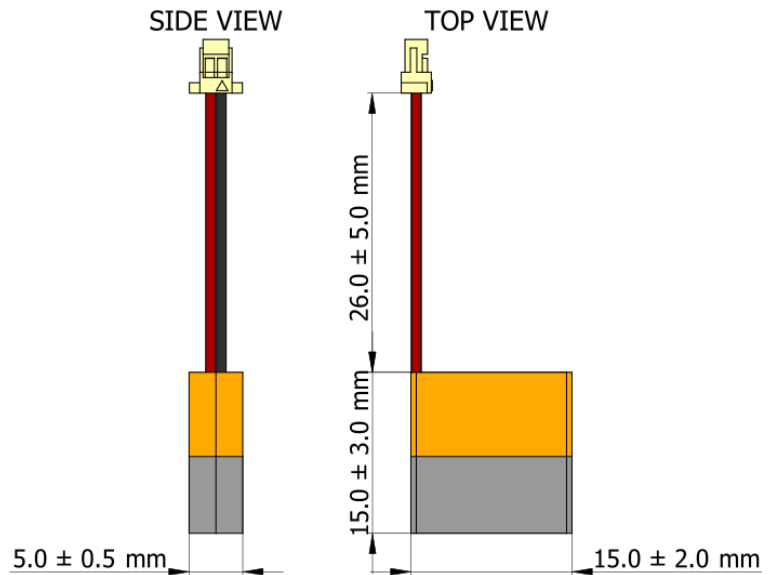


Figure 1: 70mAh Battery Drawing & Dimensions

## 1. Dimensions and Appearance

**1.1 Outline Dimensions:** See attached drawing, Figure 1, for dimensions.

Note: The thickness of the battery will swell when stored or used at high temperatures.

**1.2 Appearance:** The outer surface of the battery is clean, no electrolyte leakage, no obvious scratches and mechanical damage, no deformation, no other appearance defects that affect the value of the battery.

## 2. Battery Specifications

**Table 1: Ratings**

No.	Item	Specification	Unit	Notes
2.1	Normal Capacity	70	mAh	1.0C Discharge
	Minimum Capacity	65	mAh	
	Energy Capacity	0.26	Wh	
2.2	Nominal voltage	3.70	V	
2.3	AC Impedance Resistance	$\leq 560$	m $\Omega$	(with PCB)
2.4	Discharge Cut-off Voltage	3.0	V	
2.5	Charge Voltage	4.20	V	
2.6	Maximum Charging Voltage	4.20	V	
2.7	Standard Charge Current	35	mA	0.5C
2.8	Maximum Charge Current	70	mA	1.0C
2.9	Maximum Discharge Current	70	mA	1.0C
2.10	Weight	$\approx 1.9$	g	
2.11	Operating Temperature Charge	10 - +45	$^{\circ}\text{C}$	
	Operating Temperature Discharge	-10 - +45	$^{\circ}\text{C}$	
2.12	Storage Temperature ( $\leq 1$ month)	-10 - +45	$^{\circ}\text{C}$	storage temperature: 20 - 25 $^{\circ}\text{C}$
	Storage Temperature ( $\leq 6$ months)	-10 - +35	$^{\circ}\text{C}$	
2.13	Standard Testing Condition			Temperature: 25 $\pm$ 2 $^{\circ}\text{C}$ , Humidity: 45%-75%RH

### 3. General Performance

#### 3.1 Initial Performance Test

Item	Measuring Procedure	Requirements
(1) Open-Circuit Voltage	The open-circuit voltage should be measured within 24 hours after standard charge.	$\geq 4.15V$
(2) Internal Resistance	The Impedance shall be measured in an alternating current method (1kHz LCR meter) after standard charge at $25\pm 2^{\circ}C$	$\leq 560m\Omega$
(3) Minimum Capacity	After standard charging, put it aside for 30 minutes, discharge 0.5C to 2.75V, and test the cell capacity (The capacity is defined as <b>C5</b> )	<b>C5</b> $\geq 70mAh$
(4) 0.5C Discharge Capacity	After standard charging, test 0.5C discharge capacity	Discharge Capacity $\geq 95\%C5$

#### 3.2 Electrical Performance

Item	Measuring Procedure	Requirements
Cycle Life (25°C)	First charge with a constant current of 0.5C to 4.2V and a constant voltage of 4.2V until the charge current is less than or equal to 0.01C. Leave it aside for 10 minutes. Then discharge to 2.75V with a current of 0.5C - leave it aside for another 10 minutes. Repeat the above steps 300 times. The capacity of the cells should be higher than 80% of the minimum capacity.	Cycle life $\geq 300$ cycles
Long Term Storage Performance	The battery for this experiment should be a battery less than 3 months from the date of production to the date of the experiment. Charge the battery with 50% of its capacity before storage, then leave it open for 365 days, and cycle at 0.2C at $25\pm 2^{\circ}C$ . Second, test the recovery capacity (the maximum discharge capacity in a 3-week cycle).	Capacity Recovery $\geq 85\% C5$
Self-discharge at room temperature	Charge the battery at a constant current and constant voltage of 0.2C for 360 minutes, with a cut-off voltage of 4.0V. Then place the battery in a normal temperature environment, leave it open for 24 hours.	Battery will lose up to 10 millivolts of voltage

### 3.3 Shelf Life (Charge Retention Capability)

Item	Measuring Procedure	Requirements
Storage Characteristics 1.1	After standard charging, the battery is stored in an environment of $25\pm 2^{\circ}\text{C}$ for 30 days, and the 0.5C discharge capacity (holding capacity) is tested.	Remaining Capacity $\geq 85\% C5$
Storage Characteristics 1.2	After the above remaining capacity test, test the discharge capacity after standard charging (the maximum discharge capacity in a 3-week cycle)	Recovery Capacity $\geq 90\% C5$
Storage Characteristics 2.1	After standard charging, the battery is stored in an environment of $60\pm 2^{\circ}\text{C}$ for 7 days, and the 0.5C discharge capacity (holding capacity) is tested.	Remaining Capacity $\geq 60\% C5$
Storage Characteristics 2.2	After the above remaining capacity test, test the discharge capacity after standard charging (the maximum discharge capacity in a 3-week cycle).	Recovery Capacity $\geq 80\% C5$

### 3.4. Charging and Discharging Curve

- Temperature:  $25^{\circ}\text{C}$
- Charging: CC-CV: 37.5mA-4.2V

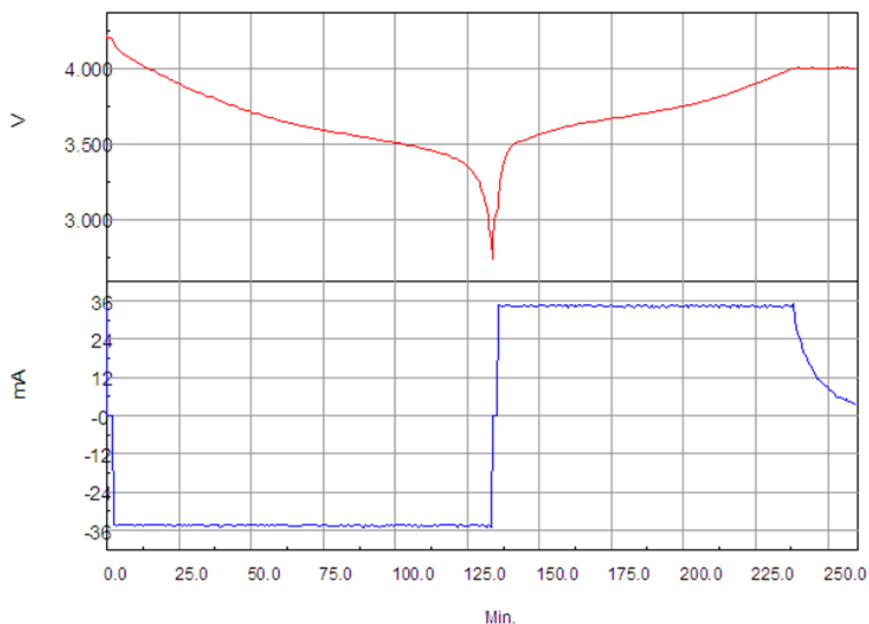


Figure 2: 70mAh Battery Charge and Discharge curve

## 4. Environmental Performance

### Mechanical Properties

Item	Measuring Procedure	Requirements
Vibration Test	After standard charging, the battery is to be tested under the following conditions: <b>Displacement Amplitude:</b> 0.19mm <b>Frequency:</b> 10-55Hz (sweep:1Hz/min) <b>Direction for vibration:</b> X/Y/Z axis for 30min. The battery is to be tested in three mutually perpendicular axes.	The battery has no leakage, smoke, or explosion. The battery voltage is $\geq 4.0V$
Drop Test	After standard charging, the drop test shall be carried out according to the following conditions: <b>Drop height:</b> 1.0m <b>Surface:</b> 18-20mm or more thick hardwood or concrete <b>Falling direction:</b> fall once along the front and back sides of the horizontal direction	The battery has no leakage, smoke or explosion.
Thermal-shock Test	A battery is to be heated in a gravity convection or circulating air oven. The temperature of the oven is to be raised at a rate of $5\pm 2^{\circ}C/min$ to a temperature of $130\pm 2^{\circ}C$ where the battery is to remain for 30 minutes.	No explosion, no fire
Constant Heat and Humidity Characteristics	Under the temperature of $20\pm 5^{\circ}C$ , after charging the battery with 0.2C, put it in a constant temperature and humidity box at $40\pm 2^{\circ}C$ and a humidity of 90-95% for 48h. The battery should have no obvious deformation, leakage, rust, smoking, or explosion. After testing, take the battery out and put it aside for 2 hours, and discharge it to 2.75V at 1.0C under the temperature of $20\pm 5^{\circ}C$	Discharge capacity $\geq 60\% C5$

## 5. Safety Performance

Item	Measuring Procedure	Requirements
5.1 Over-Charge Test	After standard charging, the battery and the sliding rheostat are connected in series with a constant current and constant voltage source, the voltage is adjusted to 4.6V, the current is adjusted to 3.0C through the sliding rheostat, and then the battery is charged at 3.0C. The test time is 2.5H.	No explosion, no fire
5.2 Over-Discharge Test	The fully discharged cell is continually discharged for 24h with the (30×n) load at 23±2°C	No explosion, no fire
5.3 Short-Circuit Test	After standard charge, short-circuit the battery by connecting the positive and negative terminals of the battery with copper wire having a maximum resistance load of 0.1Ω	No explosion, no fire. The external temperature of the battery shall not exceed 160°C

## 6. Protection Circuit Characteristics

**Table 2: PCM Standard (Protection Board Standard)**

Item	Symbol	Details	Standard
Overcharge Protection	$V_{DET1}$	Overcharge detection voltage	4.28±0.025V
	$tV_{DET1}$	Overcharge detection delay time	0.15s - 4.6s
	$V_{REL1}$	Overcharge release voltage	4.15±0.025V
Overdischarge Protection	$V_{DET2}$	Overdischarge detection voltage	2.5±0.05V
	$V_{DET2}$	Overdischarge release voltage	2.9±0.1V
	$tV_{DET2}$	Overdischarge detection delay time	36ms - 210ms
Overcurrent Protection	$I_{DP}$	Charging overcurrent protection current	2.0A - 3.6A
	$I_{DP}$	Discharge overcurrent protection current	2.0A - 3.6A
	$tV_{DET3}$	Overcurrent detection delay time	4.5ms - 18ms
		Protection release condition	Disconnect load
Short Circuit Protection	$T_{SHORT}$	Protection condition	External short circuit
		Detection delay time	3200 $\mu$ s - 600 $\mu$ s
		Protection release conditions	Break the short circuit
Internal resistance	$R_{DS}$	Main circuit on-state internal resistance	$R_{DS} \leq 560m\Omega$
Current consumption	$I_{DD}$	Current consumption in normal operation	7.0 $\mu$ A Max
Current consumption	$I_{DD}$	Current consumption during sleep	0.1 $\mu$ A Max
Recommended working temperature		Operating temperature	-30 $^{\circ}$ C - 65 $^{\circ}$ C
0V Recharge		Is it possible to charge the 0V battery?	Yes
Short circuit recovery		Is there a short circuit automatic recovery function?	Yes

### 5. Schematic Diagram & Table

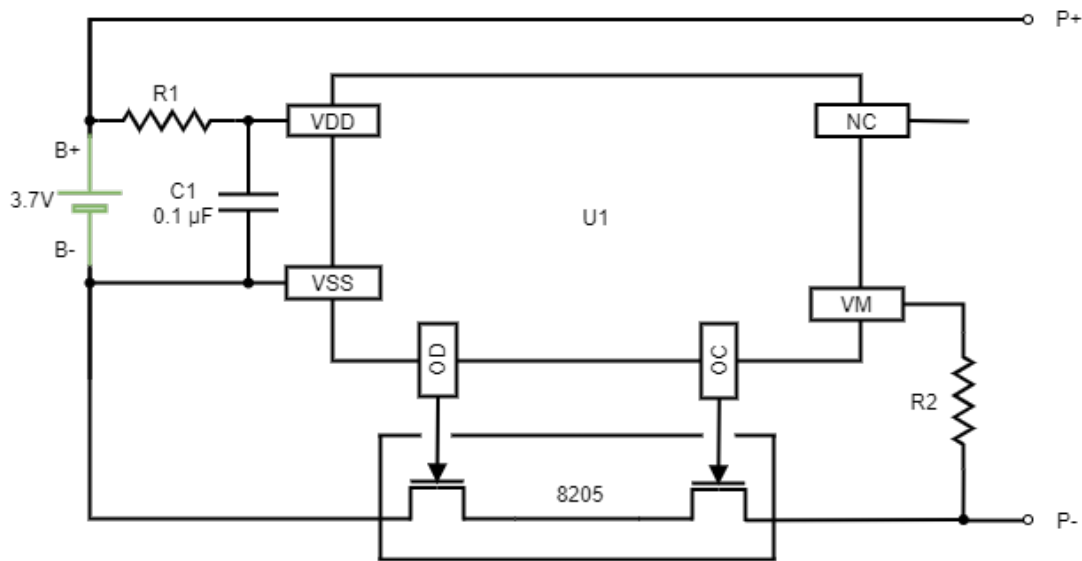


Figure 3: 70mAh Battery Schematic

Table 3: PCM BOM List

No.	Component	Label	Specification	Package	Unit	Qty.
1	Silicon MOSFET	U2	8205A	SOT-23-6	pcs	1
2	Battery Protection IC	U1	DW01	SOT-23-6	pcs	1
3	Resistance	R1	100Ω 5% 1/16W	0603	pcs	1
4	Resistance	R2	1KΩ 5% 1/16W	0603	pcs	1
5	Resistance	R3	5% 1/16W	0603	pcs	-
6	Capacitance	C1	0.1μF 5% 1/16W	0402	pcs	1
7	Printed Circuit Board	-	9.0*3.8*0.6M	FR4	pcs	1
8	Nickel Sheets	-	3*2.5*0.3MM		PCS	2



## Reference Battery Charging Schematic Diagram & Table

The following schematic and list of parts is implemented in a lithium ion polymer battery charging diagram that is a simplified version of the TinyCircuits Battery Charger, product ASL2112\*.

\*The ASL2112 is a standalone Lithium battery charger that can be used with a Micro USB B cable. Use the JST SH connector on the ASL2112 board to easily plug-in a battery (compatible batteries sold at <https://tinycircuits.com/>). Alternatively, a battery can be connected without the JST SH connector by using the two through holes, J3 and J4, to connect to a battery pack. To charge a battery with ASL2112, plug the USB B side of the charger into a power source using a compatible cable, and plug a lithium polymer or lithium ion rechargeable (3.7V / 4.2V) battery into the other side. A status LED on the board will indicate when a battery is charging, and the LED will turn off when the battery is fully charged.

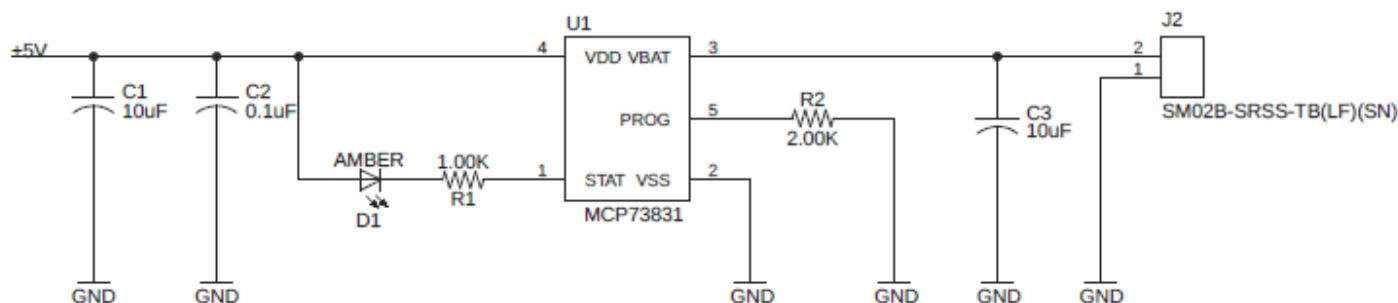


Figure 4: Sample Battery Charger Schematic

Table 4: PCM BOM List

Component	Label	Specification	Notes
IC	U1	MCP73831	
R	R1	1KΩ	
R	R2	2KΩ 2	
C	C1,C3	10μF	
C	C2	0.1μF	
LED Diode	D1	AMBER	Charging Status LED
Connector	J2	JST SM02B-SRSS-TB(LF)(SN)	Compatible Battery Connector: JST SHR-02V-S-B

## Handling Instruction and Warnings

Read and observe the following precautions carefully to ensure the correct use of lithium-ion batteries. Our company is not responsible for any problems arising from violation of the following precautions.

Failure to observe the following precautions may result in battery leakage, overheating, explosion and/ or fire.

### Battery Environment

- Do not immerse the pack in water, seawater, or other liquids.
- Do not use, or leave the battery near heat sources such as a fire or heater.
- Do not use or store the battery where it is exposed to an extremely hot environment, such as in a car under direct sunlight or on a hot day. Otherwise, the battery will overheat and may catch fire (ignite). This can also reduce battery performance and/or shorten service life.
- Do not place the battery in a microwave oven or pressurized container.
- Do not use the battery in a location where static electricity or magnetic fields are great, otherwise, the safety devices in the pack may be damaged, which may cause unsafe risks.
- Keep the batteries out of the reach of young children. If a child somehow swallows a battery, seek medical attention immediately. In cases where children use the battery, instruct them on the contents of this document and supervise them to ensure that the battery is being used correctly.
- Use the battery only under the environmental conditions mentioned in this document. Failure to do so can result in reduced performance or a shorten service life. Using the battery outside this temperature range can cause the battery to overheat, explode or catch fire.

### Aluminum Foil Flexible Packaging

- The aluminum foil flexible packaging encasing the battery cells is vulnerable to sharp objects that could puncture or damage the integrity of the aluminum.
- Do not transport or store the battery together with metal objects such as keys, necklaces etc.
- Do not strike at pack with any sharp objects. The soft aluminum packing foil may be easily damaged by sharp edge parts such as Ni-tabs, pins and needles.
- Do not strike the battery with any sharp-edged parts.
- Trim nails or wear gloves before handling batteries.
- Clean worktable where battery is used to avoid any sharp objects.
- Polymer batteries have lower mechanical durability than metal shell prismatic batteries. Drops, collisions, bending, etc. may reduce the performance of polymer batteries.

### Battery Electrolyte

- If the pack leaks and the electrolyte get into the eyes, do not rub eyes. Instead, rinse the eyes with clean running water, and immediately seek medical attention. Otherwise, eye injury may result.
- If the battery leaks and electrolyte gets on your skin or clothing, immediately rinse the affected area with clean running water. If left as is, skin inflammation can occur.

- Pay attention to the use of insulation structures between the battery core (the exposed aluminum layer on the side and the top edge of the package sealing film) and the PCB, as well as between the battery core and electrical appliances. Pay special attention to the insulation between the aluminum layer and positive and negative terminals of the battery. Contact of the poles and aluminum layer or electrical equipment may cause battery leakage or swelling.
- If the battery leaks or emits an odor, immediately remove it from the proximity of any exposed flame. The leaking electrolyte can ignite and cause a fire or explosion.

## Prohibit Short Circuit

- A short circuit will generate high current and may cause the battery to generate heat, leak electrolyte, smoke, and/or explode.
- Do not short-circuit the pack by connecting the positive and negative terminals directly, or by using conductive materials such as metal wire.
- Short circuiting is very dangerous. The battery tabs may be short-circuited by putting them on a conductive surface. An external short circuit such as this may lead to heat generation and damage to the battery.

## Electrical Application

- Do not use the battery in combination with batteries of different capacity, type, or brand.
- Do not attempt to disassemble or modify the battery in any way.
- Do not use any chargers other than those recommended for Lithium-ion Polymer batteries. Consider using TinyCircuits' Battery Charger product ASL2112.
- Do not reverse the positive (+) and negative (-) terminals.
- Do not connect the pack to an electrical outlet, such as wall outlets or car cigarette-lighter sockets.
- Do not directly solder the pack or battery terminals.
- If the pack emits an odor, generates heat, becomes discolored or deformed, or any abnormal phenomenon occurs during charging, recharging or storage, immediately remove the battery from the charger or device, and stop use.
- If the case pack terminals are dirty, clean the terminals with a dry cloth before use. Otherwise power failure or charge failure may occur due to the poor connection with the instrument.
- Be aware that discharged battery may cause fire or smoke; tape the terminals with insulating paper to insulate them.
- For directions on battery installation and removal, read the instruction manual that accompanies the equipment in which the battery will be used.
- The load circuit may generate voltage and current, which will be reversed to the battery pack (including PCM). The voltage and current cannot exceed the reverse withstand voltage (RWV) and current (RWI) value of the protection board itself. High voltage or current can damage the protection board in the battery pack.

## Storage

If a device is not used for an extended period, the battery should be removed and stored in a cool, dry place. Otherwise, resting, or reduced performance may occur.

The pack should be stored at room temperature, charged to about 40% to 60% of capacity. In case of over-discharge, a pack should be charged once every 3 months while storing and batteries should be discharged and charged after being stored more than a year in order to activate and restore energy.

## Vendor Notes

The customer is requested to contact TinyCircuits in advance, if and when the customer needs other applications or operating conditions than those described in this document. Additional experimentation may be required to verify performance and safety under such conditions.

TinyCircuits will take no responsibility for any accident when the battery is used under other conditions than those described in this Document.

TinyCircuits will inform, in a written form, the customer of improvement(s) regarding proper use and handling of the battery, if it is deemed necessary.

Any matters that this specification does not cover should be conferred between the customer and TinyCircuits.

## Period of Warranty

The period of warranty is 90 days from the date of shipment. If you find that the product does not perform to specifications at any time within ninety (90) calendar days of purchase, TinyCircuits will gladly replace the defective product. If the problem is caused by the user's misuse, it will not be replaced.

## Amendment of this Specification

The company, TinyCircuits, has the right to revise this product specification. After revising the product specification, our company will notify the customer.