# Specification Approval Sheet

## Model: DNK-LP502470

## Customer P/N:

| APPROVED BY | CHECKED BY | PREPARED BY |
|---|---|---|
| | | |

Remark: DNK Power may, at any time, at its sole discretion, make changes to the technical and functional specifications, the design, process, materials or other features of any of the batteries.

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# Content

## 1 Scope

This document describes the Product Specification of the Lithium-Polymer (LIP) Rechargeable Battery Pack supplied by DNK Power CO., LTD.

Reference standard: GB/T 18287-2013、IEC/EN61960、UL1642

## 2 Specifications of Battery Pack

| NO. | Items | Specifications | | Test tools | Comments |
|---|---|---|---|---|---|
| 4.1 | Charge voltage | 4.2V | | Electronic voltage meter | Exactitude±0.1V |
| 4.2 | Nominal voltage | 3.7V | | | |
| 4.3 | Nominal capacity | 1000mAh (with standard 0.5C Discharge ) | | Secondary batteries test equipment | (min100mAh @0.5C Discharge) |
| 4.4 | Charge current | Standard Charging:：0.2C<br>Rapid charge： 0.5C | | Secondary batteries test equipment | |
| 4.5 | Standard Charging method | 0.2C CC（constant current）charge to 4.2V,then CV(constant voltage 4.2V) charge till charge current decline to ≤0.01C | | Electronic voltage meter<br>Secondary batteries test equipment | |
| 4.6 | Charging time | Standard Charging：6.5 hours (Ref.)<br>Rapid charge：2.5 hours(Ref.) | | Secondary batteries test equipment | |
| 4.7 | Max. discharge current | 1C | | | |
| 4.8 | Discharge cut-off voltage | 2.5V | | Electronic voltage meter<br>Secondary batteries test equipment | |
| 4.9 | Operating Temperature | 0℃~+15℃ | Max Charging 0.2C | | |
| | | 15℃~+45℃ | Max Charging 0.5 C | | |
| | | -20℃~+15℃ | Max Discharging 1 C | | |
| | | 15℃~+45℃ | Max Discharging 1 C | | |
| | | 45℃~+60℃ | **Note**! If you working condition +45 to +60, please contact us for checking | | |
| 4.10 | Storage Temperature | -10℃ / +45℃ | Less than 1 months | | |
| | | -10℃ / +35℃ | Less than 6 months | | |
| 4.11 | Battery Pack Dimension | Length：75mm (Tolerance:±0.2mm)<br>Width：24mm (Tolerance:±0.2mm)<br>Thickness：5.0mm (Tolerance:±0.2mm) | | Calipers | Exactitude ±0.01mm |

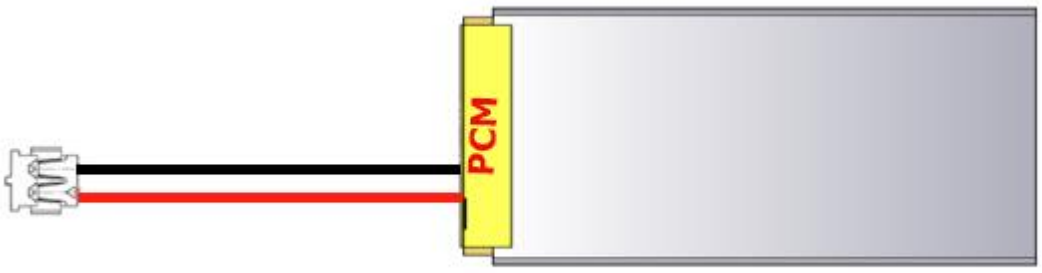
## 3 Battery Constitution

| NO. | Name | Model | Remark |
|---|---|---|---|
| 1 | Lipo battery cell | DNK-LP502470<br>3.7V 1000mAh | DNK Power Polymer Lithium Ion Cell |
| 2 | Protection board | IC：G3R<br>MOSFET：CJ8810 | |
| 3 | Lead wire | Wire UL1007-28AWG | |
| 4 | Cable Length | 50mm （default） | |
| 5 | Connector | JST ACHR-02V-S | |

## 4 Battery Pack Outline Drawing

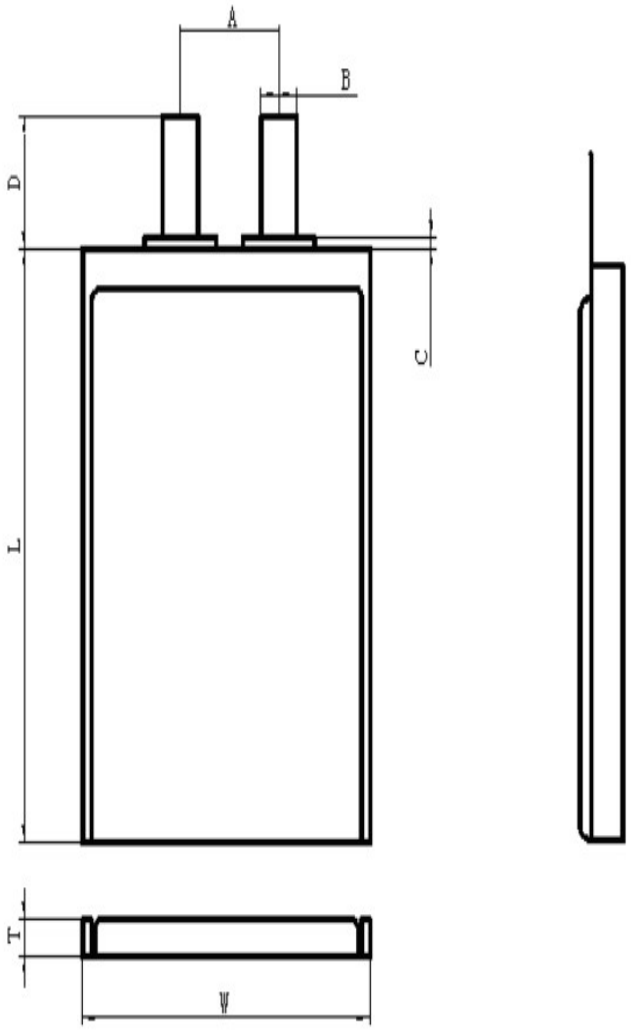
Battery Pack Dimension

Max 5(T)* Max 24(W) * Max75(L) (mm)  (Tolerance: ±0.2mm)



**Battery Cell Specifications**

| No | Item | | Specification | Remarks |
|---|---|---|---|---|
| 1 | Cell minimum capacity | | 1000mAh | 0.2C discharge |
| 2 | Initial impedance | | ≤60 mΩ | 1kHz AC Impedance |
| 3 | Nominal voltage | | 3.7 V | / |
| 4 | Dimensions | T | 5mm Max | Thickness |
| | | W | 24mm Max | Width |
| | | L | 70mm Max | Cell length (not include Tab sealant) |
| | | A | 18±1 mm | Distance of tab center |
| | | B | 4.0±0.2 mm | Tab width |



**PCM Parameters**

| Item | Syol | Content | Criterion |
|---|---|---|---|
| Over charge Protection | V (DET1) | Over charge detection voltage | 4.28±0.05V |
| | tV (DET1) | Over charge detection delay time | 80 ~200mS |
| | V (REL1) | Over charge release voltage | 4.08±0.05V |
| Over discharge protection | V (DET2) | Over discharge detection voltage | 2.400±0.100V |
| | tV (DET2) | Over discharge detection delay time | 40~120 mS |
| | V (REL2) | Over discharge release voltage | 3.0±0.1V |
| Over current protection | V (DET3) | Over current detection voltage | 0.2±0.03V |
| | I (DP) | Over current detection current | 3～5A |
| | tV (DET3) | Detection delay time | 5~10mS |
| | | Release condition | Cut load |
| Short protection | | Detection condition | Exterior short circuit |
| | T (SHORT) | Detection delay time | 200~600uS |
| | | Release condition | Cut short circuit |
| Interior resistance | R( DS) | Main loop electrify resistance | V C =4.2V； R DS ≤45m Ω |
| Current consumption | I (DD) | Current consume in normal operation | 2.0 μ A Type 6.0 μ A Max |

## 5 Battery Pack Performance Criteria

### 5.1 Electrical characteristics

| NO. | Items | Test Method and Condition | Test tools | Criteria |
|---|---|---|---|---|
| 5.1.1 | Standard Charge | Charging the cell initially with constant current at 0.2C and then with constant voltage at 4.2V till charge current declines to 0.01C | Electronic voltage meter<br>Secondary batteries test equipment | |
| 5.1.2 | Rated Capacity | The capacity means the discharge capacity of the cell, which is measured with discharge current of 0.2C with 2.5V cut-off voltage after standard charge.<br>The capacity of 0.2C charge and 0.5C discharge | Electronic voltage meter<br>Secondary batteries test equipment | ≥1000mAh<br>≥94% |

| | | | | |
|---|---|---|---|---|
| 5.1.3 | Cycle Life | A battery unit shall be repeated 100 charge/discharge cycles, charged at CC-CV 0.2C to 4.20V , laying the battery 5min, discharged at 0.2C to 2.5V end voltage, After 100 cycles, recording the discharging capacity | | 100 time of discharging capacities keep 92%<br>500 time of discharging capacities keep 80% |
| 5.1.4 | Self-discharge | After the standard charging, storied the cells under the condition as No.5.4 for 28 days, then measured the capacity with 0.2C till 2.5V | | Residual capacity：>85%<br>余容量：<br>>85% |
| 5.1.5 | Initial impedance of battery pack | Internal resistance measured at AC 1KHz after 50% charge | IR test equipment | ≤120mΩ |
| 5.1.6 | Cell Voltage | As of shipment. | Electronic voltage meter | ≥3.7V |
| 5.1.7 | Temperature Characteristics | 1. According to item 4.5, at 20±5℃.<br>2. Capacity comparison at each temperature, measured with constant discharge current 1C with 2.5V cut-off. Percentage as an index of the capacity compared with 100% at20℃ | Electronic voltage meter<br>Secondary batteries test equipment | -10℃: ≥60%<br>20℃: 100%<br>50℃: ≥85% |

**5.2 Mechanical characteristics**

| NO. | Items | Test Method and Condition | Test tools | Criteria |
|---|---|---|---|---|
| 5.2.1 | Vibration Test | After Standard Charging，fixed the cell to vibration table, then subjected to vibration test for 3hours<br>per axis of XYZ axes.<br>Frequency change time：15 min<br>Vibration frequency：7Hz~200Hz~7Hz<br>Excursion (single amplitude)：0.8mm | Secondary batteries test equipment、Vibration platform | Allowed Leakage.<br>No fire<br>No smoke<br>No explosion |
| 5.2.2 | Drop Test | The battery to be fully charged with standard charging<br>condition ,then fall from height of 1.0m and hit onto concrete ground. Drop every surface, a total of 6times. | Electronic voltage meter 、Secondary batteries test equipment | Allowed Leakage.<br>No fire<br>No smoke<br>No explosion |
| 5.2.3 | Over charge | Battery charged at 3C$_5$A current with a voltage limit of 4.4V.charging is continued for 7 hours. | | |
| 5.2.4 | Over discharge | Battery discharged continuously at the constant current of 0.2C5A to 2.5V,then connect cells terminals with 30Ω,Discharging is continued for 24 hours | | |

| | | | | |
|---|---|---|---|---|
| 5.2.5 | Heating Test | Put cell into an hot box, test condition:<br>Temperature Rate ： 5±2℃ /min<br>Ending temperature :130℃±2℃<br>Keep temperature for 10 minutes , Then stop testing. | Electronic voltage meter, Secondary batteries test equipment Hot box | |
| 5.2.6 | Short-circuit Test | After Standard Charging， Short circuit the positive and negative， and the resistance of copper wire is 80±20mΩ ,When the temperature falls 20%lower than the peak ,Stop testing or Short circuit time reached 24hours. | Electronic voltage meter, Secondary batteries test equipment | Allowed leakage.<br>No fire<br>No smoke<br>No explosion<br>After instantaneous charge voltage≥3.6V |
| 5.2.7 | High temperature and high humidity test | After Standard Charging, test condition：<br>Temperature：40±5℃<br>Relative Humidity：90~95%RH<br>Storage Time：48 hours<br>Then return to room temperature for 2 hours， Then 0.2C discharged to ending voltage. | Thermometer Hygrometer | Discharge time≥3hours<br>No distortion<br>No smoke<br>No explosion |

5.3 Visual inspection

There shall be no such defect as scratch, flaw, crack, and leakage, which may adversely affect commercial value of the cell.

5.4 Standard environmental test condition

Unless otherwise specified, all tests stated in this Product Specification are conducted at below condition:

Temperature：20±5℃

Humidity: 60±15%RH

Barometric:86kpa-106kpa

**6 Bulk Order Standard Package**

The sketch, size, color of marking should match GB/T 18287-2013,IEC/EN61960 and UL1642 requests.

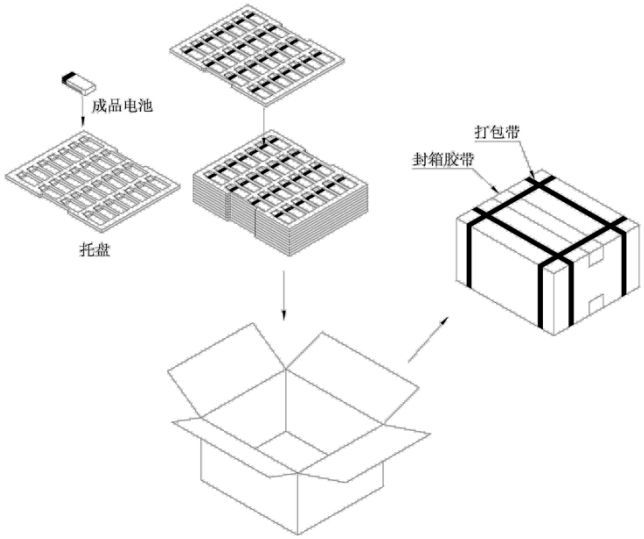
6.1 Model and specification of product;

6.2 Quantity;

6.3 Measure up marking;

6.4 Make date;

6.5 Other markings, like color.




## 7 Storage

Long Time Storage

If the battery pack is stored for a long time, the cell's storage should be 3.6-4.2V and the battery pack is to be stored in a condition as No.5.4。

Strongly recommend that every six months the stock battery make charging at least one time.

## 8 Dangers

8.1 Don't disassemble or modify the battery.

DNK battery pack is packaged by Aluminum laminated plastic film which is easy to be damaged by sharp edge such as pin, needle, edge of devices like nickel tabs, etc. If they have serious damage, electrolyte leakage, short-circuit between positive and negative tabs, etc. It would cause the generation, smoke, rupture, or flaming with mishandling.

8.2 Don't incinerate or heat the battery pack

Don't use or leave battery nearby fire, stove or heated place (more than 130℃). These occur the melting of insulator, damage of safety function, or ignition on electrolyte. In case that separator made of polymer is melted by high temperature, the internal short-circuit occurs in individual cells and then it would cause the generating, smoke, rupture or flaming.

8.3 Don't use any damage battery pack

Don't use the battery that are dented or bent on their edge part. DNK batteries are possible to be damaged by strong mechanical shock and it would cause wire break, short-circuit inside the cell, leakage of electrolyte, etc.

8.4 Don't drive a nail into a battery pack, strike it by hammer, or tread it.

As the battery might be broken or deformed and then it will be short-circuited, it would cause the generating, smoke, rupture or flaming.

8.5 Don't give battery pack impact or fling it

If the battery is broken, the battery will be charged at abnormal voltage or current and abnormal chemical reaction will occur. It may cause the generating, smoke, rupture or flaming.

8.6 Don't make the direct ultrasonic wave power to the battery or soldering near the battery

It may cause serious damage to the batteries. Soldering near the battery may cause damage of the components, such as separator and insulator, are melted by heat, it would cause the gas generating, smoke, rupture or flaming.

8.7 Don't use battery nearby the high temperature place or under the blazing sun.
DNK batteries have possibility to be degraded its performance such as capacity, thickness increase, impedance, etc. The battery will be charged at the abnormal chemical reaction occurs in the high temperature place. The thickness change may lead to stressing on battery case/ device, wiring or cell which may have possibility to lead to damage performance.

8.8 Don't use the unspecified charger.
If the battery is charged with unspecified condition, there are causes that it will be overcharged or the abnormal chemical reaction will occur in cells. It causes the gas generating, smoke, rupture or flaming.

8.9 Don't reverse polarity (and terminals)
On charging, the battery is reversed-charged and
abnormal chemical reaction occurs. There may be case that unexpected large current flows on discharging. There causes the generating, smoke, rupture or flaming.

8.10 Don't reverse-charge or reverse-connect
The battery has polarity. In case the battery is not connected with charger or equipment smoothly do not force them to connect and do check polarity of battery. If the battery is connected to opposite polarity with charger. It will be reverse-charged and abnormal chemical reaction will occur. It would cause the generating, swelling, smoke, rupture or flaming.

8.11 Don't connect battery to the plug socket or car-cigarette-plug
Added high voltage to the battery, the excessive current will flow in it and then it may cause the generating, swelling, smoke, rupture or flaming.

8.12 Don't use battery for another equipment
If the battery is used for unspecified equipment, it will deteriorate its performance and cycle-life.

8.13 Don't touch a leaked battery directly
In case the leaked electrolyte gets into eyes, wash them with fresh water as soon as possible without rubbing eyes. And then, see a doctor immediately. If leave damaged eyes undone, it will cause eye-trouble.

## 9 Warnings

9.1 Keep the battery away from babies
Keep the little battery out of the reach of babies in order to avoid troubles by swallowing. In case of swallowing the battery, see a doctor immediately.

9.2 Don't get into a microwave or a high pressure container
Because of sudden heat or damage of sealing condition of battery, it may cause the generating, smoke, rupture or flaming.

9.3 Don't use a leaked battery nearby fire
If the liquid leaks from the battery (or the battery gives out bad smell), let the battery leave from flammable objects immediately. Unless do that, the electrolyte leaked from battery may catch fire and it would cause the smoke, flaming or rupture of it.

9.4 Don't use an abnormal battery, such as leakage, swelling, deformation, etc.
In case the battery has bad smell, it generates, its color change or it is warped in using (includes charging and storage), let it take out from equipment or charger and do not use it. If an abnormal battery is used, it may generate bad performance or damage the device or pack.

## 10 Cautions:

10.1 Don't use or leave the battery under the blazing sun (or in heated car by sunshine)
The battery may smoke, heat or flame. And also, it might cause the deterioration of battery's characteristics or cycle life.

10.2 Manual

Please read the manual before using the battery and let it keep after reading. And also, please read it necessary.

10.3 Charging Method

Please read the manual of specific charger about charging method.

10.4 First time use

When the battery has rust, bad smell or something abnormal at first-time-using, do not use the equipment and go to the shop which it was bought.

## 11 Warranty Period

One year (12 months)

## 12 Others

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