# Specification

1. Customer : _____

2. Product : **Li-Ion 3S3P Battery Pack (4,800mAh)**

3. Model : **Li201SX-48**

4. Reviewed By : _____


**Emerging Power, Inc.**
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## 1. Scope

This Product Specification ('Specification' hereinafter) covers the requirements for the Rechargeable Lithium Ion battery Hard Pack ('Pack' hereinafter) manufactured and supplied by Emerging Power, Inc.

The pack contains Lithium Ion cells, safety devices, and a Fuel Gauge module compatible with Smart Battery Specification R1.1.

## 2. Descriptions and Model name

| | | |
|---|---|---|
| 2.1. | Description | Li-Ion rechargeable smart battery pack |
| 2.2. | Battery Cell Configuration | 3S3P |
| 2.3. | Model name | Li201SX-48 |

## 3. Ratings

| | | |
|---|---|---|
| 3.1. | Normal Capacity | 4,800mAh |
| 3.2. | Minimum Capacity | 4,500mAh |
| 3.3. | Nominal Voltage | 11.1V |
| 3.4. | Charging Method | CC-CV(Constant-Current/Constant-Voltage) |
| | Charging Voltage | 12.6±0.1V |
| | Standard Charging Current | 2,400mA |
| | Rapid Charging Current | 4,800mA |
| | Cut-Off Current | ≤ 240mA |
| 3.5. | Standard Discharge Current | 960mA |
| | Max Discharge Current(Continuous) | 3,000mAh |
| | Max Discharge Current(Pulse) | 4,800mAh |
| 3.6. | Discharge Cut-off Voltage | 9.0V |
| 3.7. | Internal Resistance (impedance) | ≤ 350mΩ |
| 3.8. | Weight | ≤ 390g |
| 3.9. | Operating Temperature | |
| | Standard Charge | 0 ~ 50 °C |
| | Standard Discharge | -20 ~ 60 °C |
| 3.10. | Storage Temperature | |
| | -10 ~ 30 °C | ≤ 1 Year |
| | -20 ~ 45 °C | ≤ 3 Months |
| | -20 ~ 60 °C | ≤ 1 Month |
| 3.11. | Storage Humidity | 20 ~ 85 %RH (not condensed) |

## 4. Smart Battery System Support

4.1. General

The pack has a Smart Function Module with SMBus R1.0/R1.1 Interface and supports the Smart Battery Data(SB Data revision 1.0/1.1 fully compatible) commands, SB Data charge control function, battery state of charge, remaining capacity, remaining time, chemistry, and manufacturer's info over the serial link.

4.2. Major Features:

Provides accurate measurement of the electrical properties in the packs such as voltage, current, temperature, full capacity, remaing capacity and time.

Five segment LEDs display for remaining capacity. Battery charge state can be directly indicated using a five segment LED display to graphically depict battery full-to-emptry in 20% increments.

Fully compatible with SMBus(System Management Bus) v1.0/V1.1

Fully compatible with SBS(Smart Battery System) v1.0/v1.1 including charger control, multi-master.

## 5. Outline Dimension

W x L x H = 214.5±0.5 x 52.5±0.5 x 18.5±0.5 (mm) (Refer to attached drawings.)

## 6. Appearance

Any cosmetic damage should not be found on the product.

## 7. Standard test condition

7.1. Test sample condition

The battery used for the test shall be manufactured and delivered no later than one month before the test is conducted.

7.2. Environmental condition

Unless otherwise specified, all tests stated in the specification are conducted at temperature 25± 5°C and humidity 65± 20%RH in charged state.

7.3. Test equipment condition

The grade of Voltmeter and Ammeter used in the test shall be higher than class 0.5, a high impedance type.

## 8. Characteristics

### 8.1. Standard Charge

"Standard Charge" means charging the pack with the constant current at 2,400mA until a "full charge condition" is detected.

The "full charge condition" can be detected under conditions given below:

- Pack temerature is higher than 55°C while charging (Maximum T Control).
- Pack temperature is increased by 1°C/min or higher (dT/dt Control).
- Tapper current is detected at less than 240mA (Tapper current).
- Full charge is detected by the smart module in the battery pack.

### 8.2. Initial Capacity

"Initial Capacity" is defined as the initial discharge capacity of the pack. which is measured with discahrge current of 960mA with 9.0V cut-off at 25°C within 1~2 hour after a standard charge.

**The initial discharge time shall be longer than 280min.**

### 8.3. Cycle Life

Cycle life is defined by the discharge time one day after 299 cycles measured under same condition in 8.2.

**The discharge time shall be longer than 240min**.

### 8.4. Initial internal impedance

Internal impedance shall be checked at 1000Hz with a standard charge state.

**The initial internal impedance of the pack is lower than 350mΩ**.

### 8.5. Discharge capacity with temperature

This means relative value of discharge time at various temperatures compared with the discharge time

Measured under same conditons given in 8.2. except for temperature condition.

| Temperature | -10°C | 25°C | 45°C | 60°C |
|---|---|---|---|---|
| Relative Capacity | **70%** | **100%** | **95%** | **90%** |

### 8.6. Storage characteristics

The pack is fully charged to the standard charge and stored at 25°C for 30 days. Capacity is measured as specified under 8.2 for "Initial Capacity".

Remaining capacity (after storage) should be more than 3,840mAh.

## 9. Safety test

9.1 Overcharge Test

Method : Apply continuous charge until the thermal protection function gets activated.

Criteria : No leakage, flame, or fire is allowed.

9.2 Over Current Test

Method : Short-circuit the fully charged pack by connecting positive and negative terminals with 1Ω wire for one hour.

Criteria : Internal Over-current Protector shall operate and decrease the discharge current. No damage such as leakage, flame, or fire is allowed.

9.3 Over Discharge Test

Method: Discharge the pack to voltage less than 6.0V.

Criteria: No damage such as leakage, flame, or fire is allowed.

## 10. Mechanical Characteristics

10.1 Drop Test

Method : Drop a fully charged pack onto a concrete floor from 0.76m height in any directions, for3 times.

Criteria : No leakage, OCV should be higher than 11.1V, and internal impedance lower than 350mΩ

10.2 Vibration Test

Method : This procedure tests the endurance of the pack against vibration.

Frequency and amplitude : 10Hz → 55Hz → 10Hz/0.8mm.

Sweep speed : 1±0.055Hz/min.

Criteria: No leakage, OCV should be higher than 11.1V, and internal impedance lower than 350mΩ

## 11. Shipment

The battery shall be shipped in about 30%~80% charged state.

## 12. Caution and prohibition

Before using and handling the pack, see carefully attached “Handling Instruction Guide for Li-Ion Battery Pack”.

**For safety reasons, rechargeable batteries are shipped out with a capacity that is deemed safe. The battery pack is initialized before shipping.**

**If the battery pack is used for a long period without fully charging and completely discharging over one cycle, a loss in capacity can be expected.**

**Battery performance can be recovered by repeating several cycles of full charge and discharge.**

## 13. Others

### 13.1 Long term storage

If the pack is to be kept stored for a long period (3 months or more), it is strongly recommended that the pack be preserved in a dry and low temperature atomsphere. The battery pack should be recharged before use.

### 13.2 Warranty

Emergingpower,Inc. will be responsible for replacing the pack against defects or poor workmanship within a period of 12 months from the date of shipping. Any other problems caused by malfunction of the equipment or misuse of the battery are not covered under this warranty.

## Appendix A : Handling Instruction Guide for Li-ion Battery Pack

1. General

Battery packs supplied by Emerging Power, Inc. have to be handled and used carefully according to the given specifications.

2. Storage of pack

The packs should be normally stored under the following conditions:

a. Indoor storage in a cool place without direct sun light on the packs or cartons.

b. Store batteries in a dry location with low humidity, and a temperature range of –20°C to +30°C.

For long term storage, the following should be observed:

a. Long-term storage can accelerate battery self-discharge and lead to the deactivation of the batteries. To minimize the deactivation effect, store battery packs in a temperature range of +10°C to +30°C.

b. When charging for the first time after long-term storage, deactivation of the packs may have led to decreased capacity. Recover such packs to original performance through repeating several cycles of full charging and discharging.

c. When storing packs for more than 6 months, at least one charging is require every 6 months to prevent leakage and deterioration in performance due to self-discharging.

3. Charging the pack

a. Use suitable Charger with the specified voltage and current. We strongly recommend the Smart Battery Charger. Recommendations on usage or Charger specifications or available on request.

b. Never attempt “reverse charging” of the Battery Pack. Charging with polarity reversed can cause a reversal in battery polarity, causing gas pressure inside of the battery to rise, which can be lead to leakage of the batteries in the pack.

c. Avoid overcharing. Repeated overcharging can lead to deterioration in pack. performance and over-heating of the pack.

d. Charging efficiency drops at temperatures above 40°C.

4. Protection from unexpected damaged to pack

a. (+) and/or (-) terminals must not be in touch or connected to metal wires, necklaces or chains.

b. Do not drop packs from a height in order to prevent them from possible malfunction or damage.

c. Do not twist or bend packs in order to prevent possible damage.

5. For safety

a. Do not disassemble packs.

b. Do not use the pack when abnormal conditions are observed such as smells, deformation, discoloration, and so on.

c. Do not re-use Li-ion Polymer cells or other parts after removing from the packs.

d. When the electrolyte leakage occurs, do not touch the liquid.

e. Any contact with water, may cause packs to have potential malfunctions. Do not use those packs.

f. Do not keep packs under high-temperature conditions (60°C or more).

g. Do not dispose packs in fire.

h. Do not crush/nail packs.

i. Do not apply solder directly to packs.

## Appendix A : Drawing of Battery Pack External View