



User Manual

LSUM 051R3C 0166F EA



User Manual

CONTENT

| | |
|--------------------------------------|----|
| 1. Overview | 04 |
| 2. Unpacking | 05 |
| 3. Safety | 05 |
| 4. Identification of features | 06 |
| 5. Module to module connection | 07 |
| 6. Output terminal connection | 08 |
| 7. Output connector | 09 |
| 8. Mounting | 12 |
| 9. Maintenance | 13 |
| 10. Contact Information | 14 |
| Appendix I | 15 |
| Appendix II | 16 |

User Manual

LSUM 051R3C 0166F EA

1. Overview

The LS 51.3V / 166F Ultracapacitor Module has high energy and low ESR to meet energy storage and power delivery requirements.

The cells used in the module have 2.85V maximum voltage rating and are connected in series to get higher operating voltage of modules. To meet the long cycle life requirements, the cells operate under 2.85V. In addition, all the cells are balanced by balancing circuit connected parallel to each cell.

User Manual

LSUM 051R3C 0166F EA

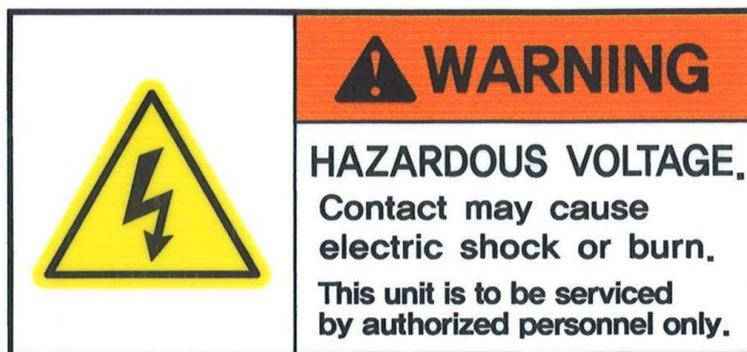
2. Unpacking

Inspect the shipping carton for signs of damage prior to unpacking the module. Damage to the shipping carton or module should be reported to the carrier immediately.

Remove the module from the shipping carton and retain the shipping materials until the unit has been inspected and is determined to be operational.

NOTE: The original shipping materials are approved for both air and ground shipment. The module should be removed from the shipping carton by lifting the body of the module.

3. Safety



Do not operate above specified voltage.

Do not operate above specified temperature rating.

Do not touch terminals with conductors while charged. Serious burns, shock, or material fusing may occur.

Protect surrounding electrical components from incidental contact.

Provide sufficient electrical isolation when working above 51.3V DC.

Prior to installation and removal from the equipment, it is mandatory to fully discharge the module.

User Manual

LSUM 051R3C 0166F EA

4. Identification of features

- Product Image



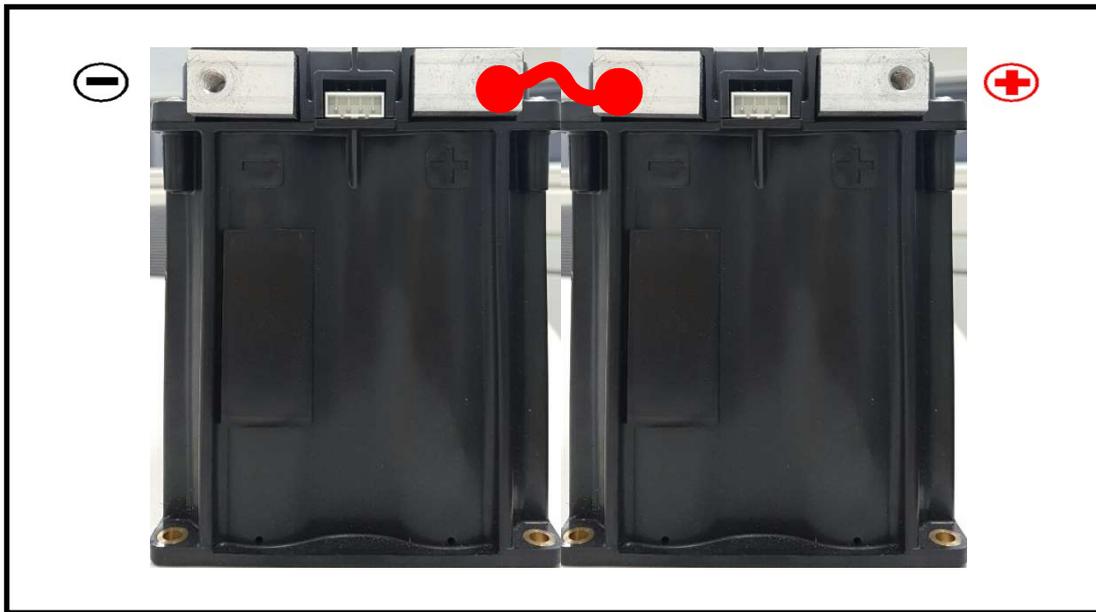
<Fig. 1> Product Image

User Manual

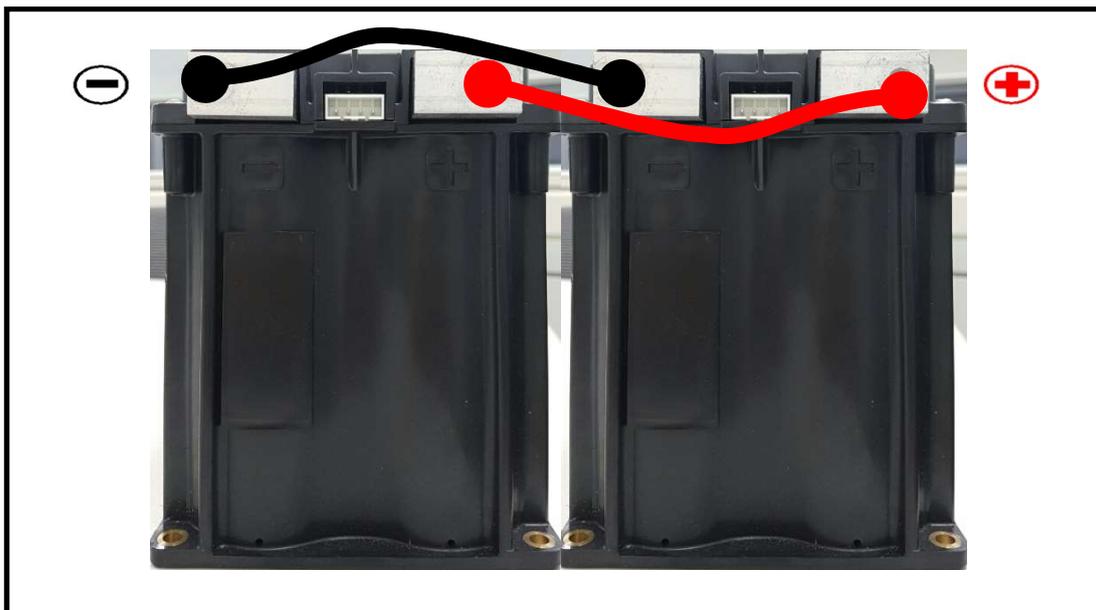
LSUM 051R3C 0166F EA

5. Module to module connection

- There are series and parallel connection for High power



<Fig. 2> Series Connection of Modules



<Fig. 3> Parallel Connection of Modules.

User Manual

LSUM 051R3C 0166F EA

6. Output terminal connection

The LS 51.3V / 166F Ultracapacitor Modules are designed to connect directly to a ring or a bus bar. The positive and negative terminals have each hole for the screw. The positive terminal threaded size is M8 and negative terminal is M10. Wave washers are required to ensure long term, reliable connections.

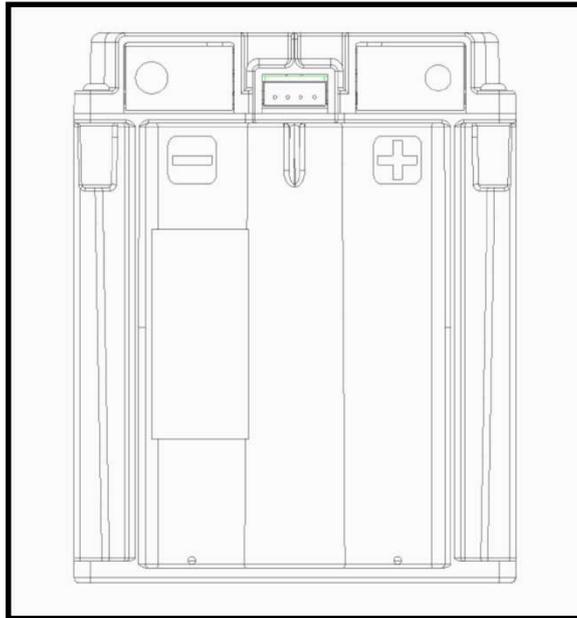
When tightening the terminal bolt, a torque of 20 N-m for the M8 bolt should be used.(30N-m for the M10 bolt) Because the modules have a very low ESR, total ESR will be affected by a ring lug, bus bar or torque. Therefore, it needs more attention to assemble the modules. And appropriate protection and sealing should be used on both module terminals to avoid shock hazards and corrosion.

User Manual

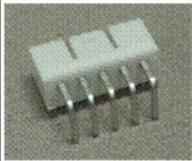
LSUM 051R3C 0166F EA

7. Output connector

- The part's No. of 4pin-connector is tabulated below.



<Fig. 4> Front view of the Module

| LS UC Module side | | Customer System side | | | |
|---------------------|---|------------------------|--|------------------------|---|
| Lock Wafer | | Crimp Terminal Housing | | Crimp Terminal | |
| Image* |  | Image |  | Image |  |
| Vendor (Part's No.) | Han-lim (LAB 1143-04**) | Vendor #1 (Part's No.) | Han-lim (CHB 1143-04***) | Vendor #1 (Part's No.) | Han-lim (CTB 1140****) |
| | | Vendor #2 (Part's No.) | Molex (35156-040) | Vendor #2 (Part's No.) | Molex (50217) |

* Image is used just reference only 4-pin type is actually used.

** http://en.han-lim.com/bbs/board.php?bo_table=products&swr_id=114

*** http://en.han-lim.com/bbs/board.php?bo_table=products&swr_id=113

**** http://en.han-lim.com/bbs/board.php?bo_table=products&swr_id=112

User Manual

LSUM 051R3C 0166F EA

- The output of 4pin-connector is tabulated below.

| Pin # | Pin out | Signal |
|-------|--------------------|-------------------------|
| 1 | Temp. pin#1 | 470Ω ± 50% @25 °C* |
| 2 | Temp. pin#2 | |
| 3 | Over Voltage Alarm | H - normal L - Alarm |
| 4 | GND | |

* Resistance to temperature chart for the appendix I

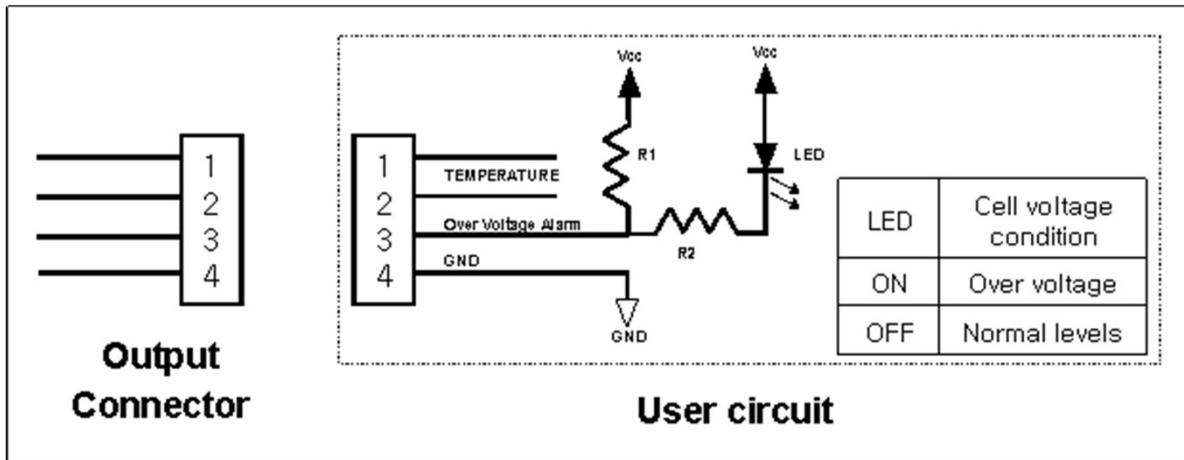
Pin 4 is connected with monitoring connector output signals receiver circuit's ground. The output signals are isolated from the capacitor voltage and from chassis ground. The recommended voltage is 5V DC.

When a cell in the module goes into over voltage condition, pin 3 has alarm signal. When every cell voltage is not over voltage state, the output of Pin 3 is high. If any cell in the module is exceeding normal voltage, the voltage balancing circuit becomes active and starts to discharge the cell to become normal voltage range. Then the output of Pin 3 goes low. At this time, user should stop charging. However, in order to use the signal, the user needs to attach a pull-up resistor(typically 1kΩ) to pin 3 and a 5V supply.

When the cell voltage is below the threshold, the output of Pin 3 goes high. And if the cell voltage is drop more, the balancing circuit becomes inactive and the cell stop discharging. It is possible that the output of Pin 3 is indicated by LED. The output signal receiver circuit is as following.

User Manual

LSUM 051R3C 0166F EA



<Fig. 5> Typical output signal receiver circuit to the Output connector

Pin 1-2 are connected with a PTC thermistor for temperature monitoring. According to temperature variation in the module, the resistance of the thermistor is determined. The resistance is approximately $470\Omega \pm 50\%$, when the internal temperature in the module is $25\text{ }^{\circ}\text{C}$.

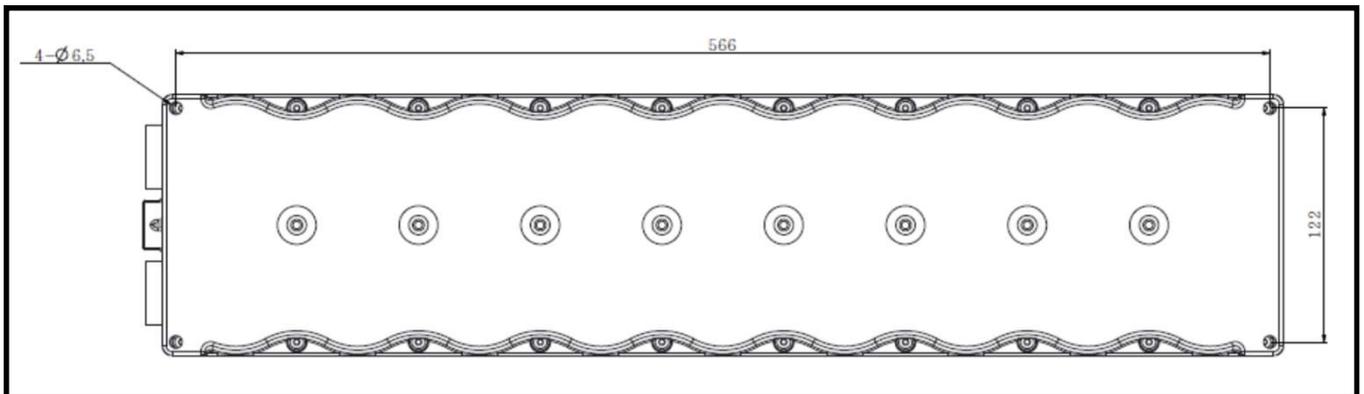
User Manual

LSUM 051R3C 0166F EA

8. Mounting

The modules should not be mounted in locations where they are directly exposed to the environment.

- <Fig. 6> shows the mounting positions of the module.



<Fig. 6> Mounting Positions

User Manual

LSUM 051R3C 0166F EA

9. Maintenance

Power Rating

The rated voltage of the module is max 51.3V. If the applied voltage is over 51.3V, charging the module should be stopped. And the allowable low voltage level of the module depends on the user's requirements, but full discharging to 0V does not affect the module performance.

Temperature

The module has its optimal operating temperature range of -40 to 65. Over 70°C, charging and discharging should be stopped to expect its performance and life cycle.

Do not expose to direct sunlight

For installation do not make the module expose to direct sunlight due to temperature increase inside the module.

Maintenance

The module has its expected life cycle over 10years at rated voltage and +25°C. However the life cycle of the module may be decreased in high temperature condition or over voltage charging.

If following abnormal module performances are detected, operation should be stopped and checking the electrical & mechanical connections is recommended.

- Monitoring high temperature in normal operating conditions
- Internal resistance increase or initial voltage drop increase
- Deformation of the module case

User Manual

LSUM 051R3C 0166F EA

10. Contact Information

LS Ultracapacitor

LS Mtron

6F, LS Mtron Hi-Tech Center, 39, LS-Ro, 116beon-gil, Dongan-gu, Anyang-si,
Gyeonggi-do 431-831, Korea

Tel. +82-31-8045-9579

Fax. +82-31-8045-9544

E-mail. ultracapacitor@lsmtron.com

User Manual

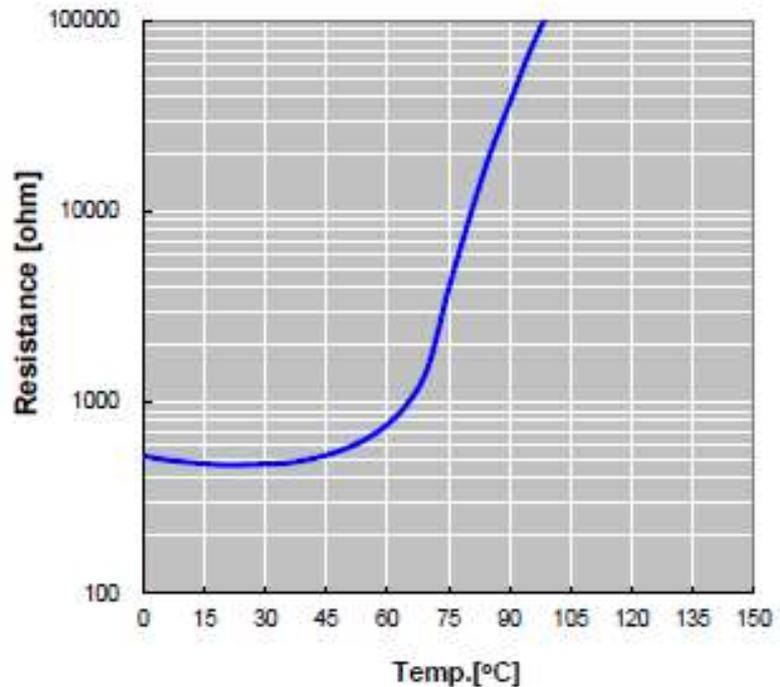
LSUM 051R3C 0166F EA

Appendix I

● DATA [Reference Only]

| 온도 [°C] | Resistance [ohm] |
|------------|------------------|
| 0 | 622 |
| 5 | 500 |
| 10 | 487 |
| 15 | 478 |
| 20 | 469 |
| 25 | 470 |
| 30 | 476 |
| 35 | 480 |
| 40 | 498 |
| 45 | 528 |
| 50 | 574 |
| 55 | 647 |
| 60 | 768 |
| 65 | 987 |
| 70 | 1632 |
| 75 | 3880 |
| 80 | 8934 |
| 85 | 19347 |
| 90 | 36595 |
| 95 | 68392 |
| 100 | 116318 |
| 105 | 189903 |
| 110 | 315151 |
| 115 | 524433 |
| 120 | 813036 |
| 125 | 1268220 |
| 130 | |
| 135 | |
| 140 | |
| 145 | |
| 150 | |

R-T curve



User Manual

LSUM 051R3C 0166F EA

Appendix II

Drawing

