LS Ultracapacitor
New-generation Energy Storage Devices with Low Resistance and Great Reliability
Leading Solution

LS Mtron, LS Cable & System, LSIS, LS-Nikko Copper, Gaon Cable, E1 and Yesco
Vision Statement

In order to become a leader in the competitive global market, LG has been divided into three business groups based upon their core competencies, Industrial Electric-Electronic Energy & Materials (LS), Electronic & Chemical (LG), and Energy & Retail (GS).

INNOVATIVE TECHNOLOGY PARTNER - LS Mtron

LS Mtron’s mission is to grow into a company that provides market-leading solutions while developing a workplace where its employee can achieve their dreams. All employees of LS Mtron stand behind the vision of becoming an Innovative Technology Partner and work tirelessly to make LS Mtron a world-class company.

LS Mtron will secure world-class core technologies to find and implement the most efficient solutions based on market knowledge that can meet the challenges of today’s markets. We will work hand-in-hand with our customers in order to grow into a global leader.

Business of LS Mtron

**Component**

Ultracapacitor

Electronic Parts
  Connectors / Antenna’s

Circuit Material
  Copper Foils / FCCL

Vehicle Parts
  Automotive Rubber Hose

Machinery

Tractor

Injection Molding Machine

Track Shoes
LS Ultracapacitor
New-generation Energy Storage Devices with Low Resistance and Great Reliability

Overview
LS Ultracapacitor energy storage devices are positioned between conventional electrolytic capacitors and rechargeable batteries. LS Ultra capacitors feature high power, high energy, reliability and long life which enables use in a variety of applications such as back-up power, auxiliary power, instantaneous power compensation and peak power compensation.

- Rated voltage: up to 3.0V
- High power performance (vs. Battery)
- High energy performance (vs. Conventional electrolytic capacitor)
- Environmentally friendly
- Maintenance-free
- Wide operating temperature range (-40°C ~ +65°C)
New-generation Energy Storage Devices with Low Resistance and Great Reliability
**Operating Principle**

Ultracapacitors store energy based on electrostatic charges on opposite electrode surface of the electric double layer which is formed between the electrodes and the electrolyte. Randomly distributed ions in the electrolyte move toward the electrode surface of opposite polarity under electric field when charged. It is a purely physical phenomenon rather than a chemical reaction and is a highly reversible process. This results in a high power, high cycle life, long shelf life and maintenance-free product.

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**Structure**

An Ultracapacitor consists of two electrodes immersed in an electrolyte and a separator which prevents the charge from moving between two electrodes of opposite polarity.

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LS Mtron provides optimal package design to provide the best in performance and reliability.
High Energy & High Power

Ultracapacitors are unique energy storage devices offering high power and high energy simultaneously, compared with conventional electrolytic capacitors and batteries. The high energy stored by Ultracapacitors in comparison to conventional electrolytic capacitors is derived from activated carbon electrode material having the extremely high surface area and the short distance of charge separation created by the opposite charges in the interface between electrode and electrolyte.

High power, long shelf and cycle life performance of Ultracapacitors originate in the energy storage mechanism differing from batteries. With batteries, energy is stored and released via chemical reaction inside electrode material that causes degradation of the entire system. On the other hand, Ultracapacitors use physical charge separation phenomena between the charge on an electrode and ions in electrolyte at the interface. Since the charge and discharge processes are purely physical and highly reversible, Ultracapacitors can release energy much faster and with more power compared to batteries which rely on slow chemical reactions and can be cycled hundreds of thousands of times without significant effect on performance.

Charge & Discharge

Ultracapacitors possess different charge and discharge characteristics compared with rechargeable batteries. Batteries have a voltage plateau region but Ultracapacitors have a linear relationship with voltage during charge and discharge. This linear relationship with voltage can change to constant voltage by simply utilizing a DC-DC converter. The amount of energy stored in an Ultracapacitor can be easily calculated by measuring voltage.

Formulas for calculating energy in a capacitor

The different units used between Ultracapacitors (Farad) and batteries (Ampere hour) can be confusing to users when adopting Ultracapacitors in their system. The amount of energy stored in an Ultracapacitor can be easily calculated by using following equation.

\[
\text{Energy (Joule)} = \frac{1}{2} \times \text{Capacitance (Farad)} \times \text{Voltage}^2 \ (\text{Volt})
\]

This can be converted from Farad for Ultracapacitors to Watt hour unit which is normally used for conventional rechargeable batteries.

\[
\text{Energy (Watt hour)} = \frac{\text{Energy (Joule)}}{3600} \ (\text{sec})
\]

LS Mtron recommends discharging Ultracapacitors from 100% of their rated voltage to 50% of their rated voltage in order to deliver 75% of their total energy.
**Specifications**

<table>
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<tr>
<td>Snap-in &amp; Lug Type</td>
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<td>74A</td>
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<td>Φ22 X L46mm</td>
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<td>268A</td>
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<td>0.49Wh</td>
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<td>Lug</td>
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<td>Snap-in &amp; Lug Type</td>
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<td>-40~65°C</td>
<td>Lug</td>
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<td>LSUC 002R8P 3000F EA</td>
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<td>3.0V</td>
<td>0.36mΩ</td>
<td>509A</td>
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<td>3.27Wh</td>
<td>0.650kg</td>
<td>-40~65°C</td>
<td>Prismatic</td>
<td>W55 X D55 X L155mm</td>
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- Endurance time (65°C, Vr): 1500 hours for 2.8V / 1000 hours for 3.0V (ΔC<20% decrease, ΔESR<100% increase of initial specified value)
- Life time (25°C, Vr): 10 years (ΔC<20% decrease, ΔESR<100% increase of initial specified value)
- Cycle life time (25°C, Vr): 500,000 cycles (ΔC<20% decrease, ΔESR<100% increase of initial specified value)

**Products**

*Terminal Type*

- Snap-in (100F / 120F)
- Lug (300F – 600F)
- Snap-in (4pin, 150F – 600F)

- 2.8/3.0V Lug & Snap-in Type Cell
- Prismatic Type Cell
Specifications

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<td>2.7V</td>
<td>0.7mΩ</td>
<td>640A</td>
<td>&lt;1.5mA</td>
<td>0.200kWh</td>
<td>0.66Wh</td>
<td>-40~65°C</td>
<td>Cylindrical</td>
<td>Ø60 X L51.5mm</td>
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<td>0.3mΩ</td>
<td>1160A</td>
<td>&lt;2.7mA</td>
<td>0.280kWh</td>
<td>1.22Wh</td>
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<td>Cylindrical</td>
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<td>2.7V</td>
<td>0.2mΩ</td>
<td>1425A</td>
<td>&lt;3.0mA</td>
<td>0.220kWh</td>
<td>1.52Wh</td>
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<td>Cylindrical</td>
<td>Ø60 X L85mm</td>
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<td>2.7V</td>
<td>0.17mΩ</td>
<td>1753A</td>
<td>&lt;4.0mA</td>
<td>0.180kWh</td>
<td>2.01Wh</td>
<td>-40~65°C</td>
<td>Cylindrical</td>
<td>Ø60 X L102mm</td>
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<td>2.7V</td>
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<td>2396A</td>
<td>&lt;5.0mA</td>
<td>0.519kWh</td>
<td>3.04Wh</td>
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<td>-40~65°C</td>
<td>Cylindrical</td>
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- Endurance time (65°C, 60000 hours): ΔC<20% decrease, ΔESR<100% increase of initial specified value
- Life time (25°C, 6000 hours): ΔC<20% decrease, ΔESR<100% increase of initial specified value
- Cycle life time (25°C, 6000 hours): 1,000,000 cycles ΔC<20% decrease, ΔESR<100% increase of initial specified value

Products

Terminal Type

- Short Screw
- Weldable
- Long Screw (LT01) φM16 Terminal
- Long Screw (LT02) φM16 Terminal

Cell/Module Part No. Rule

LS [Voltage] [Series] [Product(Cell)] [Product(Module)] [Capacitance] [Cell Type] [Electrolyte] (Internally Control Code)
LS Ultracapacitor Modules provide the optimal solution for high voltage and current requirements by connecting Ultracapacitor unit cells in series. Higher voltage and capacitance modules can be built simply by connecting the modules.

Low internal resistance and high working voltage features of LS Mtron modules maximize the available energy while keeping maintenance free, high reliability and wide operating temperature features of LS Ultracapacitor unit cell.

**Features**

- Low Internal Resistance
- Balancing and Overvoltage Protection
- Easy Build-up Design for High Voltage Module
- Efficient Heat Transfer to Outside
- Pressure / Moisture Control

LS Ultracapacitor modules are suitable energy storage systems for a wide variety of applications.

**Specifications**

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<td>58F</td>
<td>16.8V</td>
<td>22mΩ</td>
<td>20A</td>
<td>&lt;18mA</td>
<td>3.12Wh/kg</td>
<td>0.7kg</td>
<td>Active or Passive</td>
<td>-</td>
<td>-40 ~ 65°C</td>
<td>L245 x W47 x H175.9mm</td>
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<td>58F</td>
<td>16.8V</td>
<td>240mΩ</td>
<td>12A</td>
<td>&lt;28mA</td>
<td>3.53Wh/kg</td>
<td>6.5kg</td>
<td>Passive</td>
<td>Temperature (NTC) / Half Voltage Terminal</td>
<td>-40 ~ 65°C</td>
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<td>LSUM 038R8L0002F EA</td>
<td>2.5F</td>
<td>380.8V</td>
<td>650mΩ</td>
<td>12A</td>
<td>&lt;12mA</td>
<td>2.75Wh/kg</td>
<td>17.4kg</td>
<td>Passive</td>
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<td>16.2V</td>
<td>2mΩ</td>
<td>150A</td>
<td>&lt;3mA</td>
<td>2.31Wh/kg</td>
<td>3.9kg</td>
<td>Active or Passive</td>
<td>Temperature (NTC)</td>
<td>-40 ~ 65°C</td>
<td>L311 x W166 x H175.9mm</td>
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<td>16.2V</td>
<td>1.7mΩ</td>
<td>200A</td>
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<td>3.31Wh/kg</td>
<td>5.6kg</td>
<td>Active or Passive</td>
<td>Temperature (NTC)</td>
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<td>&lt;5mA</td>
<td>3.11Wh/kg</td>
<td>5.8kg</td>
<td>Active or Passive</td>
<td>Temperature (NTC)</td>
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<td>L670 x W166 x H170mm</td>
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<td>&lt;18mA</td>
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<td>Active or Passive</td>
<td>Temperature (NTC)</td>
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<td>L720 x W405 x H226mm</td>
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- Leakage Current(1) can be changed by Balancing method
- NTC Thermistor & Group voltage monitoring via CAN2.0B
- Customized module can be supplied under the customer’s requirement

**New-generation Energy Storage Devices with Low Resistance and Great Reliability**

**LS Ultracapacitor Modules**
Size Scalable (Up or Down)
Markets for LS Ultracapacitors

**HEV (Hybrid Electric Vehicle)**
- Auxiliary power
  Recapture braking energy and compensate peak power load. Increase energy efficiency of vehicle
- Emergency backup power for brake
  Increase reliability of safety system

**FCEV (Fuel Cell Electric Vehicle)**
- Output load compensation for fuel cell
  Provide peak power compensation. (Fuel cell has constant power performance)

**Locomotives**
- Auxiliary power
  Regenerate energy while braking. Provide peak power compensation. Installed in vehicle or station. Increase energy efficiency

**Hybrid Harbor Crane**
- Auxiliary power
  Regenerate the energy while lowering the container. Provide output load compensation during lifting container. Reduce size of ICE. Increase energy efficiency of crane

**Photovoltaic & Solar light**
- Energy storage
  - Photovoltaic
    Provide energy for motor used in heliostats
  - Solar light
    Store energy generated from the sun light during daytime. Provide energy for light during night time. Increase service life of solar light product

**Wind Turbine**
- Emergency backup power
  Provide emergency power for pitch system. Increase reliability of pitch system

**Power Quality Solution (UPS)**
- Instantaneous power compensation
  Suitable for short time backup (~30 sec).
  Fast reacting time could prevent voltage sag. Increase power quality for delicate process

**Hybrid Construction & Distribution Equipment**
- Auxiliary power
  Recapture the energy from equipment operation. Excavator: Boom movement, Upper part rotation etc. Forklift: Lowering goods, braking forklift etc. Provide peak power compensation
LS Miron Ltd. Anyang Hi-Tech Center

OHSAS 18001:2007

Design & Development, Manufacturer of Connectors and Antennas for Electronic Equipment, Ultra Capacitors

TRA Certification International (TRAC) hereby declares that this facility has been audited to the requirements of OHSAS 18001:2007 and meets the audit criteria defined in the certification scheme of TRAC Certification International (TRAC). The certificate is valid for two years.

Certificate No.: OHSAS 18001:2007

Authorized By:

Hwanseog Yu - Chairman

REGISTRERED OCCUPATIONAL HEALTH AND SAFETY MANAGEMENT SYSTEM

LS Miron Ltd. Anyang Hi-Tech Center

OHSAS 18001:2007

Design & Development, Manufacturer of Connectors and Antennas for Electronic Equipment, Ultra Capacitors

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Certificate No.: OHSAS 18001:2007

Authorized By:

Hwanseog Yu - Chairman

ISO 14001:2004

Design & Development, Manufacturer of Connectors and Antennas for Electronic Equipment, Ultra Capacitors

TRA Certification International (TRAC) hereby declares that this facility has been audited to the requirements of ISO 14001:2004 and meets the audit criteria defined in the certification scheme of TRAC Certification International (TRAC). The certificate is valid for two years.

Certificate No.: ISO 14001:2004

Authorized By:

Hwanseog Yu - Chairman

REGISTRERED ENVIRONMENTAL MANAGEMENT SYSTEM

LS Miron Ltd. Anyang Hi-Tech Center

ISO 14001:2004

Design & Development, Manufacturer of Connectors and Antennas for Electronic Equipment, Ultra Capacitors

TRA Certification International (TRAC) hereby declares that this facility has been audited to the requirements of ISO 14001:2004 and meets the audit criteria defined in the certification scheme of TRAC Certification International (TRAC). The certificate is valid for two years.

Certificate No.: ISO 14001:2004

Authorized By:

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Global Network

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