LS Ultracapacitor

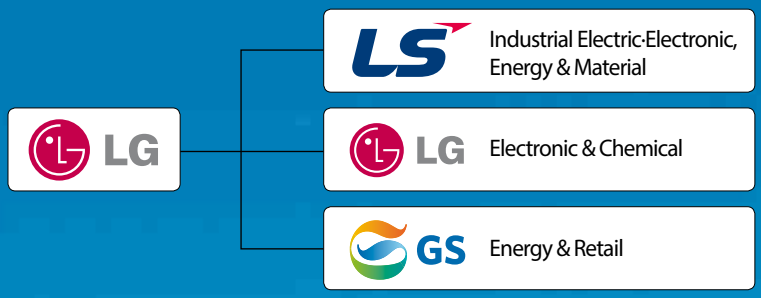
New-generation Energy Storage Devices with
Low Resistance and Great Reliability

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 devloping 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 a market knowledge that can meet the challanges of our 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.

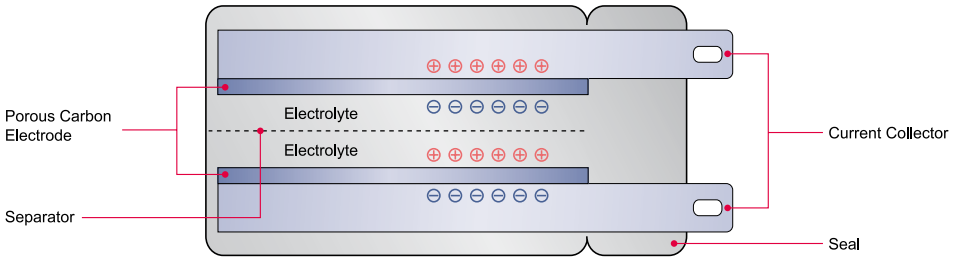
· Rated voltage : up to 3.0V
· High power performance (vs. Battery)
· High energy performance (vs. Conventional electrolytic capacitor)
· Environmentally friendly
· Maintenance-free
· Wide operating temperature range (-40°C ~ +65°C)

LS Mtron Ltd.
www.ultracapacitor.co.kr
LSUC 2.85V 3400F
Mtron Ltd.
LSUC 2.7V
1500F
LSUC 2.7V 2000F
LSUC 2.7V
650F

Introduction to LS Ultracapacitor Technology

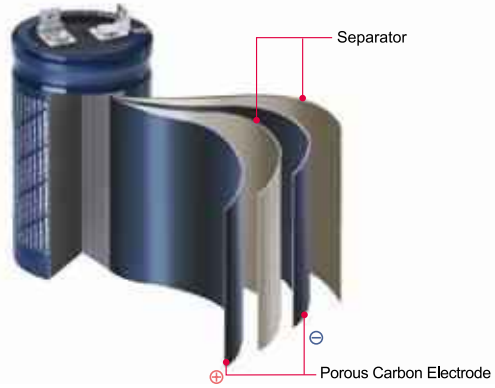
Structure

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.

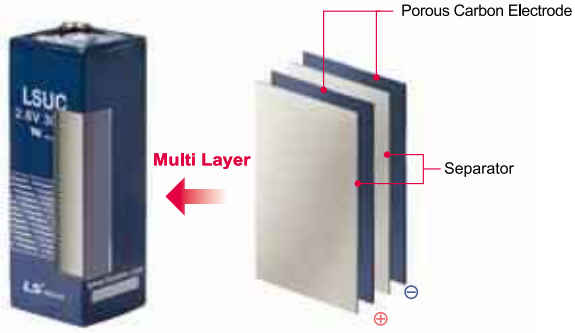


LS Mtron provides optimal package design to provide the best in performance and reliability.

LS Ultracapacitor Cylindrical Type

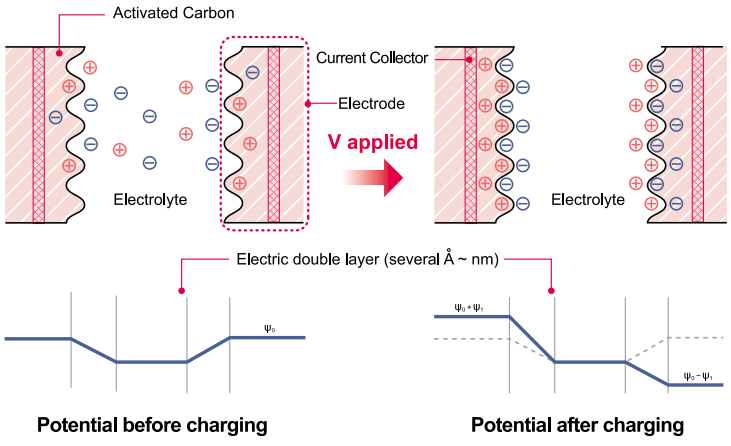


LS Ultracapacitor Prismatic Type



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.

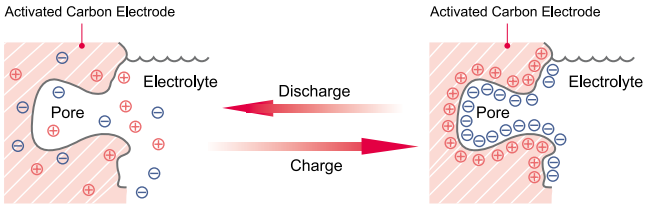


Potential before charging **Potential after charging**

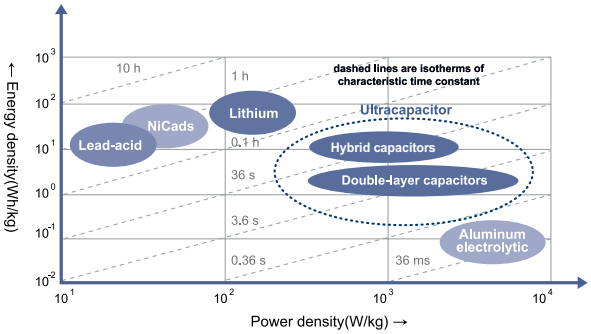
Differences Between LS Ultracapacitor & Other Energy Storage Devices

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.

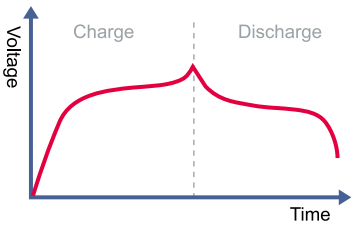


High power, long shelf and cycle life performance of Ultracapacitors originate in the energy storage mechanism differing from batteries. With batteries, energy is stored and released via chemical reaction inside electrode material that causes degradation of the entire system. On the other hand, Ultracapacitors 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.

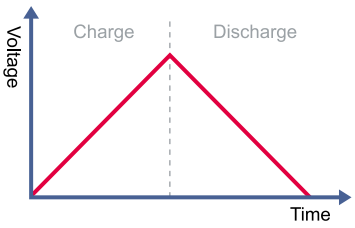


Charge & Discharge

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.



Battery



Ultracapacitor

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.

Energy (Joule) = 1/2 x Capacitance (Farad) x Voltage^2 (Volt)

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

Energy (Watt hour) = Energy (Joule) / 3600 (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.

LS Ultracapacitor Cells

Specifications

Series	Part No.	Capaci-tance	Rated Voltage	ESR (DC)	Max. Current	Leakage Current	Max. Stored Energy	Weight	Operating Temperature Range	Type	Dimension
Snap-in & Lug Type	LSUC 002R8S 0100F EA	100F	2.8V	9mΩ	74A	<0.3mA	0.11Wh	0.023kg	-40~65°C	Snap-in	Φ22 X L46mm
	LSUC 002R8S 0120F EA	120F	2.8V	9mΩ	81A	<0.4mA	0.13Wh	0.023kg	-40~65°C	Snap-in	Φ22 X L46mm
	LSUC 002R8L 0350F EA	350F	2.8V	3.2mΩ	231A	<1mA	0.38Wh	0.072kg	-40~65°C	Lug/Snap-in	Φ35 X L61mm
	LSUC 002R8L 0400F EA	400F	2.8V	3mΩ	255A	<1mA	0.44Wh	0.080kg	-40~65°C	Lug/Snap-in	Φ35 X L66mm
	LSUC 002R8L 0450F EA	450F	2.8V	3mΩ	268A	<1mA	0.49Wh	0.088kg	-40~65°C	Lug/Snap-in	Φ35 X L71mm
	LSUC 003R0L 0380F EA	380F	3.0V	3.2mΩ	257A	<1mA	0.48Wh	0.072kg	-40~65°C	Lug/Snap-in	Φ35 X L61mm
	LSUC 003R0L 0430F EA	430F	3.0V	3mΩ	282A	<1mA	0.54Wh	0.080kg	-40~65°C	Lug/Snap-in	Φ35 X L66mm
	LSUC 003R0L 0480F EA	480F	3.0V	3mΩ	295A	<1mA	0.60Wh	0.088kg	-40~65°C	Lug/Snap-in	Φ35 X L71mm

- Endurance time (65°C, V_R) : 1500 hours for 2.8V / 1000 hours for 3.0V (ΔC<20% decrease, ΔESR<100% increase of initial specified value)
- Life time (25°C, V_R) : 10 years (ΔC<20% decrease, ΔESR<100% increase of initial specified value)
- Cycle life time (25°C, V_R) : 500,000 cycles (ΔC<20% decrease, ΔESR<100% increase of initial specified value)

Prismatic Type	LSUC 002R8P 3000F EA	3000F	2.8V	0.36mΩ	2019A	<5mA	3.27Wh	0.650kg	-40~65°C	Prismatic	W55 X D55 X L155mm

- Endurance time (65°C, V_R) : 1500 hours (ΔC<20% decrease, ΔESR<100% increase of initial specified value)
- Life time (25°C, V_R) : 10 years (ΔC<20% decrease, ΔESR<100% increase of initial specified value)
- Cycle life time (25°C, V_R) : 500,000 cycles (ΔC<20% decrease, ΔESR<100% increase of initial specified value)

Products

Terminal Type

• Snap-in (100F/ 120F)

• Lug (350F ~ 480F)

• Snap-in (4pin, 350F ~ 480F)

• 2.8/3.0V Lug & Snap-in Type Cell

• Prismatic Type Cell

Specifications

Серия	Part No.	Capaci-tance	Rated Voltage	ESR (DC)	Max. Current	Leakage Current	Max. Stored Energy	Weight	Operating Temperature Range	Type	Dimension
Cylindrical Type	LSUC 002R7C 0650F EA	650F	2.7V	0.57mΩ	640A	<1.5mA	0.66Wh	0.200kg	-40~65°C	Cylindrical	Φ60 X L51.5mm
	LSUC 002R7C 1200F EA	1200F	2.7V	0.33mΩ	1160A	<2.7mA	1.22Wh	0.280kg	-40~65°C	Cylindrical	Φ60 X L74mm
	LSUC 002R7C 1500F EA	1500F	2.7V	0.28mΩ	1426A	<3.0mA	1.52Wh	0.320kg	-40~65°C	Cylindrical	Φ60 X L85mm
	LSUC 002R7C 2000F EA	2000F	2.7V	0.27mΩ	1753A	<4.0mA	2.03Wh	0.380kg	-40~65°C	Cylindrical	Φ60 X L102mm
	LSUC 002R7C 3000F EA	3000F	2.7V	0.23mΩ	2396A	<5.0mA	3.04Wh	0.515kg	-40~65°C	Cylindrical	Φ60 X L138mm
	LSUC 02R85C 3400F EA	3400F	2.85V	0.23mΩ	2719A	<8.0mA	3.84Wh	0.515kg	-40~65°C	Cylindrical	Φ60 X L138mm

- Endurance time (65°C, VR) : 1500 hours (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) : 1,000,000 cycles (ΔC<20% decrease, ΔESR<100% increase of initial specified value)

Products

• Cylindrical Type Cell

Terminal Type

• Short Screw • Weldable

• Long Screw (LT01) ※M16 Terminal

• Long Screw (LT02) ※M12 Terminal

Cell/Module Part No. Rule

LS □□ □□□R□□ □□□□F □□ (□□□□)

- LS □□ : • Series(AN Series, PC Series) - Code U; • Series(Hybrid Series) - Code H
- □□ : • Product(Cell) - Code C; • Product(Module) - Code M
- □□□R□□ : • Voltage
- □□□□F : • Capacitance
- □□ : • Cell Type(Prismatic) - Code P; • Cell Type(Radial) - Code R; • Cell Type(Snap-in) - Code S; • Cell Type(Lug) - Code L; • Cell Type (Cylindrical) - Code C
- □□ : • Electrolyte(AN) - Code EA; • Electrolyte(PC) - Code EP
- (□□□□) : • Internally Control Code

LS Ultracapacitor Modules

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

Part No.	Capaci-tance	Rated Voltage	ESR (DC)	Max. Continuous Current ($\Delta T = 40^{\circ}C$)	Leakage Current(1)	Energy Density	Weight	Balancing	Monitoring	Operating Temperature Range	Dimension
LSUM 016R8L 0058F EA	58F	16.8V	22mΩ	20A	<11mA	3.2Wh/kg	0.7kg	Active or Passive	-	-40 ~ 65°C	L245 x W47 x H76.6mm
LSUM 168R0L 0005F EA	5.8F	168V	240mΩ	12A	<25mA	3.5Wh/kg	6.5kg	Passive	Temperature (NTC) Half Voltage Terminal	-40 ~ 65°C	L235 x W367 x H79mm
LSUM 0380R8L 0002F EA	2.5F	380V	650mΩ	12A	<12mA	2.6Wh/kg	19kg	Passive	Temperature (PTC) / Over Voltage	-40 ~ 65°C	L191 x W750 x H163mm
LSUM 016R2C 0250F EA AG	250F	16.2V	2mΩ	150A	<3mA	2.3Wh/kg	3.9kg	Active or Passive	Temperature (NTC)	-40 ~ 65°C	L311 x W166 x H70mm
LSUM 016R2C 0500F EA	500F	16.2V	1.7mΩ	200A	<5mA	3.3Wh/kg	5.6kg	Active or Passive	Temperature (NTC)	-40 ~ 65°C	L67.2 x W416.2 x H175.9mm
LSUM 016R2C 0500F EA AG	500F	16.2V	1.7mΩ	200A	<5mA	3.3Wh/kg	5.4kg	Active or Passive	Temperature (NTC)	-40 ~ 65°C	L470 x W166 x H70mm
LSUM 032R4C 0250F EA	250F	32.4V	3.3mΩ	150A	<120mA	3.6Wh/kg	10kg	Passive	Temperature (NTC)	-40 ~ 65°C	L137.1 x W426.6 x H184mm
LSUM 048R6C 0166F EA DC	166F	48.6V	5mΩ	130A	<5mA	3.9Wh/kg	14kg	Active or Passive	-	-40 ~ 65°C	L194.5 x W419.5 x H175.4mm
LSUM 048R6C 0166F EA YJ	166F	48.6V	5mΩ	200A	<5mA	3.2Wh/kg	17.2kg	Active or Passive	Temperature (NTC)	-40 ~ 65°C	L471 x W418 x H71mm
LSUM 086R4C 0093F EA	93F	86.4V	11.3mΩ	80A	<120mA	3.6Wh/kg	27kg	Passive	Temperature (PT100)	-40 ~ 65°C	L517 x W265 x H210.5mm
LSUM 129R6C 0062F EA	62F	129.6V	13.2mΩ	260A	<5mA	2.6Wh/kg	55kg	Active or Passive	Temperature & Voltage (CAN2.0B)	-40 ~ 65°C	L720 x W405 x H226mm

- 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

LS Ultracapacitor

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

• LSUM 016R2C 0500F EA AG

• LSUM 048R6C 0166F EA YJ

Size Scalable (Up or Down)

• LSUM 016R8L 0058F EA

• LSUM 168R0L 0005F EA

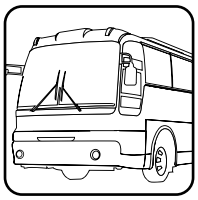
• LSUM 016R2C 0500F EA

• LSUM 048R6C 0166F EA DC

• LSUM 086R4C 0093F EA

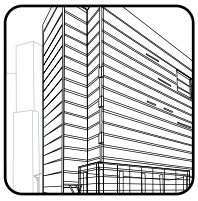
• LSUM 129R6C 0062F EA

Markets for LS Ultracapacitors



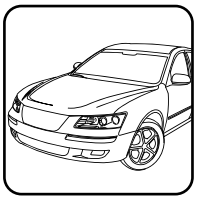
HEV (Hybrid Electric Vehicle)

- 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



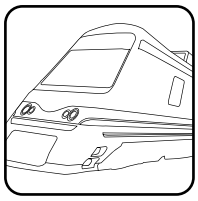
Power Quality Solution (UPS)

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



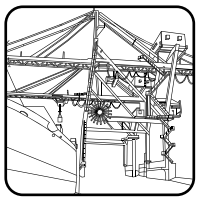
FCEV (Fuel Cell Electric Vehicle)

- Output load compensation for fuel cell
  Provide peak power compensation
  (Fuel cell has constant power performance)



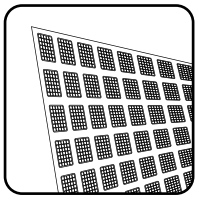
Locomotives

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



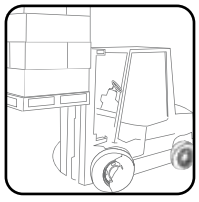
Hybrid Harbor Crane

- Auxiliary power
  Regenerate the energy while lowing the container Provide output load compensation during lifting container Reduce size of ICE Increase energy efficiency of crane



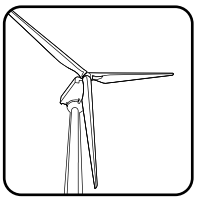
Photovoltaic & Solar light

- 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



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



Wind Turbine

- Emergency backup power
  Provide emergency power for pitch system
  Increase reliability of pitch system

Certificate of Registration
nqa

REGISTERED
ENVIRONMENTAL
MANAGEMENT
SYSTEM
LS Mtron Ltd. Anyang Hi-Tech Center
ISO 14001:2004
Design & Development, Manufacture of
Connectors and Antenna for Electronic Equipment, Ultra Capacitors
Authorized By:
Hwandeog Yu - Chairman

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HEALTH AND SAFETY
MANAGEMENTSYSTEM
LS Mtron Ltd. Anyang Hi-Tech Center
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Hwandeog Yu - Chairman

Capacitors, Electrochemical - Component

Outstanding People, Best-in-Class Product, Winning Partnership

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1573 Laperriere Ave. Ottawa ON K1Z 7T3
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