

Hybrid supercapacitors explained

How are hybrid supercapacitors different than traditional supercapacitor (EDLC)?

Hybrid supercapacitors have higher operating voltage (3.8 V maximum) and much higher capacitance and energy density (up to 10 times) than symmetric supercapacitors. They also have much lower self-discharge and standby current. Alternatively, traditional supercapacitors have higher power capability due to lower ESR, the temperature range is broader and they can be discharged to zero volts for safety; hybrid supercapacitors cannot be discharged fully. From a construction standpoint, they are very similar, but a hybrid supercapacitor uses an anode made from graphite laced with lithium and a different electrolyte. The video below explains how they operate.

What are the unique characteristics of hybrid supercapacitors?

The working voltage is 25% higher and the capacitance is 6 to 9 times than symmetric capacitors. They also have much lower leakage current of about 10% of a similar EDLC.

How do I solder hybrid supercapacitor cells?

Hand soldering is recommended. The soldering iron should be kept below +350 °C and applied for less than 5 seconds. No clean solder should be used to avoid short circuiting the cells with a liquid cleaning solution.

Are hybrid supercapacitors safe?

The cells have undergone overvoltage testing, overdischarge testing, short circuit and puncture tests with no safety issues. These conditions should be avoided however as they can cause accelerated degradation or permanent cell damage. Do not connect the parts in reverse polarity. Despite these precautions, short circuit does not result in thermal runaway as might be expected in a Li-ion battery.

The electrolyte inside is flammable and can be harmful. The cells should not be put into a fire, immersed in liquid or used if damaged. This risks contact with the electrolyte. Please consult with the MSDS for the electrolyte in these cases.

How do I ship hybrid supercapacitor parts?

Shipment of lithium-based hybrid supercapacitors is governed by the United Nations Dangerous Goods shipment regulation 3508 for Asymmetric Capacitors. As all Eaton cells are less than 0.3 Wh, no declaration is required for dangerous good shipment. However, parts should be packaged in a manner to prevent short circuit of the leads.

Do hybrid supercapacitors require a battery management system?

A cell management system (CMS) is recommended. This is much simpler than a battery management system (BMS) associated with lead acid or lithium ion batteries. With a supercapacitor (standard or hybrid), the management system is to maximize the life time of the product, whereas battery systems need a management system for safety. The CMS is needed to stop discharging at 2.2 V and to keep the cell voltages equal in designs where multiple cells are connected in series.

What is the performance over temperature for hybrid supercapacitors?

See the below charts for reference.

