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Electric Double Layer Capacitors (EDLC)

Benefits of a strong partner

We are the only top broadliner in Europe who generates one third of its turnover from passive components. Furthermore, we buy more passive components in Europe than any other distributor.

Our focus is to provide a comprehensive product portfolio combined with high quality and technical standards.

Electric Double Layer Capacitors – the intelligent, cost saving and green solution

The EDLC technology was developed a long time ago but is still nearly unknown. There are daily new applications arising for those products based on new requirements from the market.

They offer the highest energy density of all capacitors and close the gap between common capacitors and batteries. Especially for safety relevant applications or in harsh environments, this technology could be a clever and a cheaper solution over a couple of operation years compared to batteries.

On the other hand there are a lot of applications where batteries and EDLCs work together very well.

We offer you:

- European franchises with major manufacturers and world market leaders for electronic components, we can also offer Electric Double Layer Capacitors like Maxwell, Panasonic, Nesscap and AVX
- High reliability due to multiple suppliers for the same products
- Competent products, consulting and technical support based on exceptional expertise from product specialists with great market experience

Our key customer list includes leading companies in the following sectors:
Industrial, Automotive, Consumer, Telecommunications, Information, Communication and Medical



Our Product Portfolio

Semiconductors	Displays & Boards
Passive Components	Storage Technologies
Electromechanical Components	Wireless Technologies

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Consult – Know-how. Built-in.

[The technical competence from Rutronik](#)

Worldwide and individual consulting on the spot: by competent sales staff, application engineers and product specialists.

Components – Variety. Built-in.

[The product portfolio from Rutronik](#)

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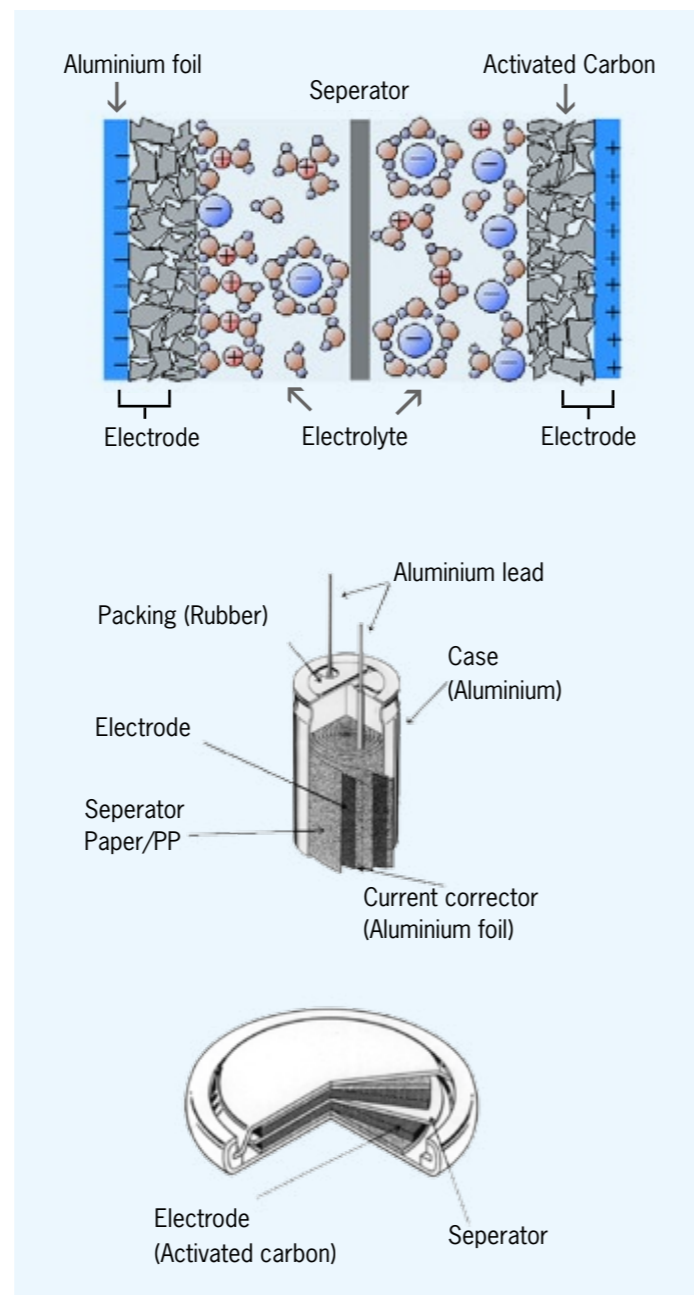


The Electric Double Layer Capacitors (EDLC)

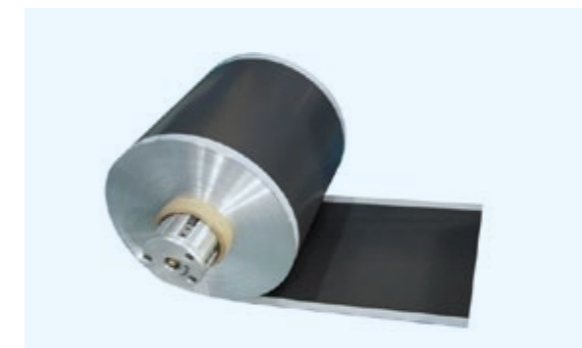
Electric Double Layer Capacitors (EDLC) also known as Ultracapacitors, Goldcaps or Supercapacitors are proven rechargeable alternative energy storage devices. The EDLC Technology is not a new one and was developed in the middle of the last century, but now the technology becomes more and more important and the number of different applications are uncountable. The Electric Double Layer Capacitors are mainly used in tandem with a battery but in some cases the real option is to replace the battery. The EDLCs are an ideal source of back-up and peak-power.

The charge in an Ultracapacitor is stored electrostatically by separating positive and negative charges. This means they do not use a chemical reaction to store energy. That's the reason why an Electric Double Layer Capacitor can be charged and discharged up to 1,000,000 times and much faster than a battery.

Basically, there are two different types of constructions: On the one hand the stacked and on the other hand the wound construction forms. The construction of the wound types is similar to the construction of ordinary radial electrolytic capacitors. Available with a maximum cell voltage between 2.1V and 3V, capacities of up to 3400F can be reached with these cells. The stacked types called "Coin", however, generally offer a capacitor voltage of 5.5V (integrating cells in row). Available with capacities of up to 1.5F, these cells are used especially in RTC (Real Time Clock) applications.





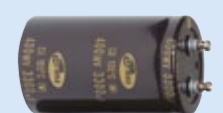
The key point of this technology is the special electrode with its surface coated with activated carbon. The porous structure of this coating expands the surface significantly and allows a capacity up to thousands of Farad. The Electric Double Layer Capacitor does not have a typical dielectric rather it uses the electrolyte solution as a function of the dielectric.



Benefits

- Fast charge-/discharge cycles (only a few seconds)
- High charge-/discharge currents (up to hundreds of A)
- Long lifetime (up to over one million cycles)
- Very long operating lifetime (up to 10 years and even more)
- No memory effect
- Reliable operation in harsh environments
- Wide operating temperature range (-40 °C up to +85 °C)
- Virtually maintenance free
- Higher energy vs. electrolytic
- Higher power vs. batteries
- Series- and parallel-connection possible

Comparison to Batteries

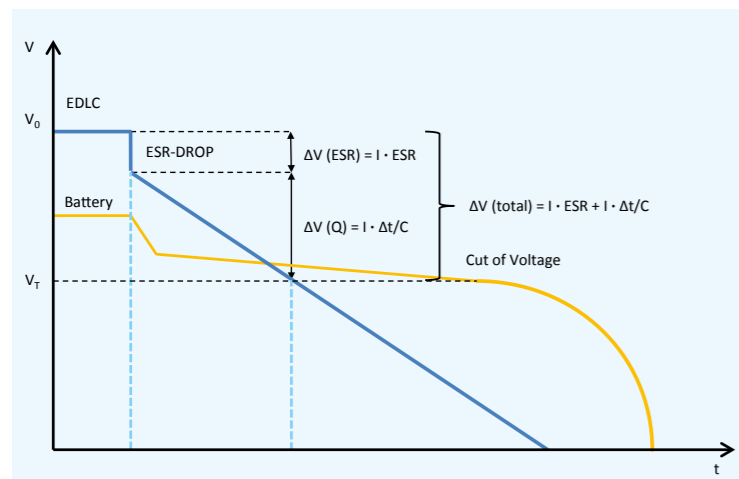
Type	Batteries	EDLC	Conv. Capacitors
			
Time of charge	1 to 5 h	0.3 to 30 s	10^{-3} to 10^{-6} s
Time of discharge	0.3 to 3 h	0.3 to 30 s	10^{-3} to 10^{-6} s
Spec. energy [Wh/kg]	20 to > 100	< 10	< 0.1
Lifetime [cycles]	1000	up to 1 Mio.	> 500000
Spec. power [W/kg]	< 1000	> 10000	> 100000
Efficiency	0.7 to 0.85	0.9 to 0.98	> 0.95



Typical Shapes

	Flat packs	SMD	Coin	Radial / lead	Snap-In	Screw	Module
Capacitance	0.0068F – 0.1F	0.033F – 0.47F	0.022F – 1.5F	3F – 100F	100F – 400F	650F – 3400F	variable
Temperature	-20/-25 – 70/75°C	-10-25 – 60/70°C	-25/-40 – 70/85°C	-25/-40 – 60/65/70°C	-25/-40 – 60/65/70°C	-25/-40 – 60/65°C	-40 – 60/65°C
Operating currents	mA / A	µA	µA / mA	mA / A	A	A	A

Discharging behaviour compared with a battery and ESR-Drop



The ESR-Drop (ΔIR) shown in red at the figure on the left is caused by and is directly proportional to the capacitor's ESR. Especially in cases of high discharge currents the voltage drop can be a matter which should be calculated. The continuous voltage drop with time (ΔVC), is a function of the available charge. Related to the continuous voltage drop the cut off voltage of customers application has to be considered to make sure to reach the required back-up time.

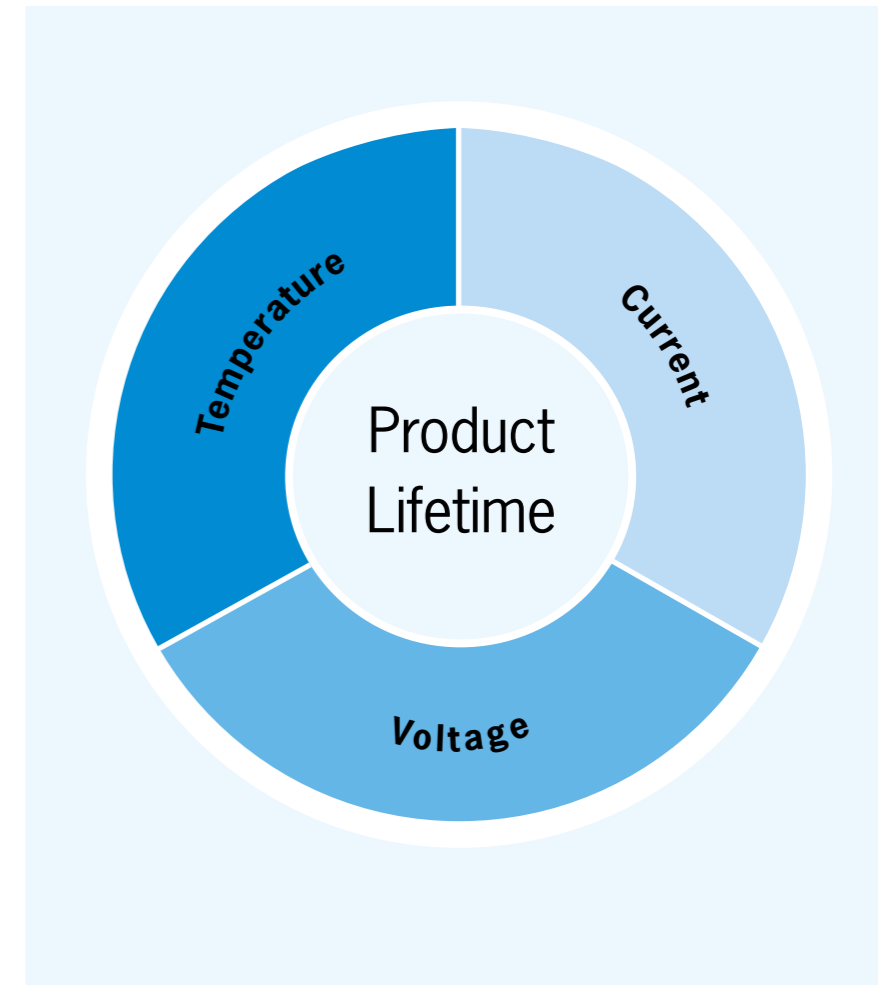
Lifetime advantage over batteries

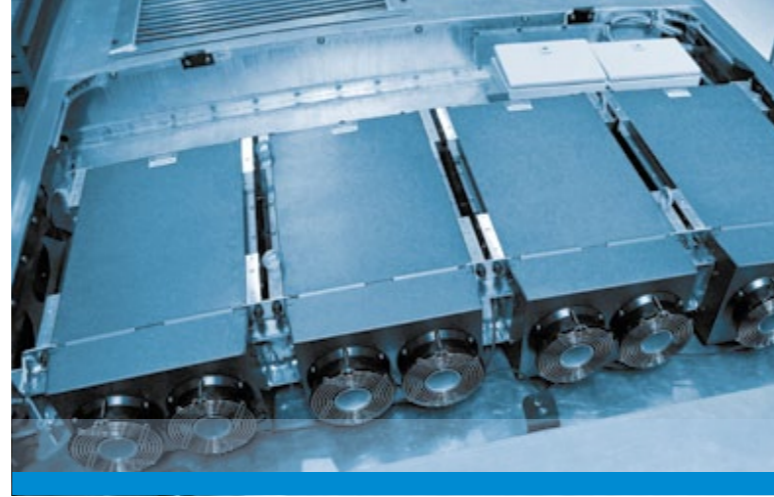
Due to the liquid electrolyte inside of the Electric Double Layer Capacitor they have a life behaviour similar to conventional Electrolytic Capacitors. Over many years the Electric Double Layer Capacitor will dry out. Despite of this fact, the EDLC offers a much higher lifetime than batteries.

Electric Double Layer Capacitor life is predominantly affected by a combination of operating voltage and operating temperature.

A decrease of the ambient temperature by 10°C will increase the lifetime of the Double Layer Capacitor by a factor of two similar to the Electrolytic Capacitors. This allows the application to reach a lifetime up to 10 years and even more.

The basic End-Of-Life failure mode for an EDLC is a decrease in capacitance and/or an increase in ESR. It has to be considered that each manufacturer has his own End-Of-Life-Criteria. The life specified by industry standards is a 20% decrease in capacitance and/or 100% increase in resistance.





Applications

- Solar battery operated circuits:
Toys, Lamps, Parking Lot, etc.
- Electric vehicles:
Forklift Trucks, Golf Cart, etc.
- Battery Backup:
PC, Network&Server, etc.
- White Goods:
Washing Machine, Tumble Dryer, (mostly RTC)
- Bicycle Lamps and Photoflashes, Solar-LED-Lighting,
Road Signs
- Windmills, renewable energy:
Pitch control
- Recuperation / Start Stop:
Cars, Trains, Bus, Fuel cell car, Electric car
- UPS-Systems
- Emergency Door actuators (A380)
- Safety relevant applications:
fire siren, presence detector, emergency exit light
- Memory Backup for video and audio equipment:
TV, Digital photo frame
- GPRS/GSM Applications
- Heavy Lifting
- Metering
- Roller Coaster

Portfolio

Technology	Flat packs	SMD	Coin	Radial / lead	Snap-In	Screw	Module
AVX							
EATON							
KORCHIP							
MAXWELL							
NESSCAP							
PANASONIC							
SAMWHA							
Examples	<ul style="list-style-type: none"> ■ Barcode scanner ■ Metering ■ Personal locators (GPS/GSM) ■ Wireless Modems 	<ul style="list-style-type: none"> ■ Subsidiary power supply ■ Memory backup during battery exchange ■ RTC ■ Bike Light 	<ul style="list-style-type: none"> ■ Backup of CMOS microcomputers ■ Memory backup ■ RTC ■ Metering 	<ul style="list-style-type: none"> ■ UPS ■ Garden Light ■ Toys ■ Solar battery operated circuits ■ Metering ■ Emergency Light 	<ul style="list-style-type: none"> ■ UPS ■ Windmill ■ Electric Car ■ Electric Scooter ■ Power Tools 	<ul style="list-style-type: none"> ■ UPS ■ Windmill ■ Electric Car ■ Electric Scooter ■ Power Tools 	<ul style="list-style-type: none"> ■ UPS ■ Windmill ■ Electric Car ■ Electric Scooter

■ Focus supplier
 ■ 2nd source



Information Request Form (EDLC) - Modules

General Information:

Customer:		Application:	
Contact:		Demand/Year:	
Contact Tel.:		SOP:	
Project name:		Target Price:	

Technical Information:

Aim of application:			
Kind of application:	<input type="checkbox"/> Stand-By	<input type="checkbox"/> Cycles-appl.	<input type="checkbox"/> Battery hybrid
Typical Cycle Condition:	Charge	Nom. Voltage (V)	
		Max. Voltage (V)	
		Nom. Current (A)	
		Max. Current (A)	
		Time (sec)	
	Discharge	Cut off Voltage (V)	
		Nom. Current (A)	
		Max. Current (A)	
		Time (sec)	
		Power (W)	
Number of cycles by day / hour			
Temperature Range (°C)	min.		
	nom. / Average		
	max.		
Lifetime: <small>(for a detailed lifetime calculation, pls. fill in the table below)</small>	Years		
	Cycles		

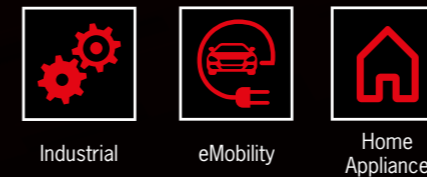
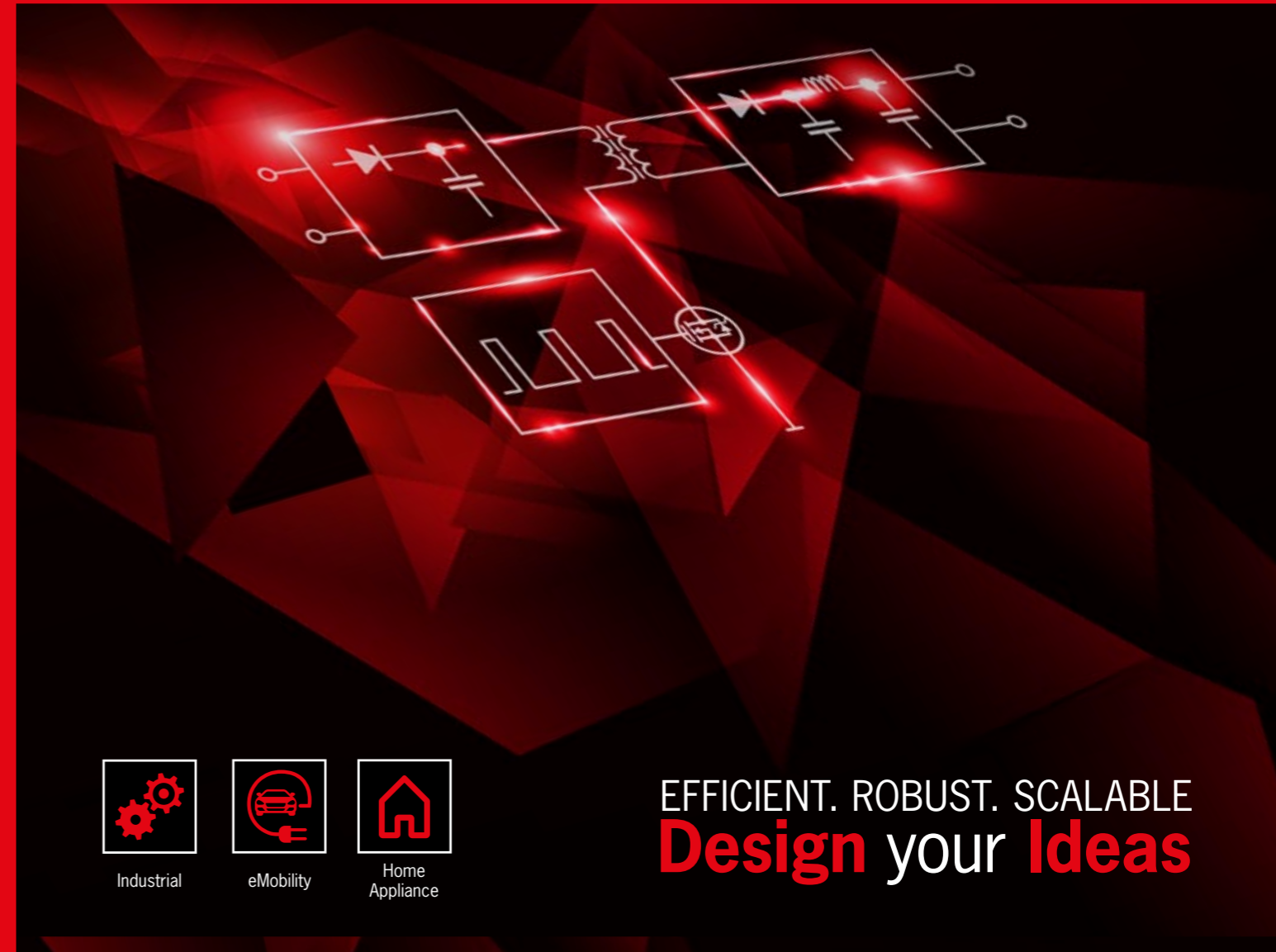
Temperature [°C]	% of time	Temperature [°C]	% of time
-30		+30	
-20		+40	
-10		+50	
0		+60	
+10		+70	
+20		> ??	

Coupling:	<input type="checkbox"/> with charge / direct	<input type="checkbox"/> over an DC-DC-converter
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Max Dimensions:	_____ x _____ x _____ mm (LxHxW)
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Comments:	
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