

AVNET<sup>®</sup> ABACUS

Avnet Abacus:  
Power solutions guide

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## Our power partners

### POWER SUPPLIES



### BATTERIES



### ENERGY STORAGE



# Powering your designs

However your application is powered, Avnet Abacus can help you design-in a reliable and effective solution that's right first time, enabling you to take your product to market faster. We offer state-of-the-art products from the world's leading power manufacturers and extensive support at every step of your design process.

## EXTENSIVE TECHNICAL AND MARKET SUPPORT

Our dedicated European and local-market power specialists are continually trained on the latest solutions and what's coming to the market next, so they'll help ensure that you're always up-to-date with the latest innovations and new products in the marketplace.

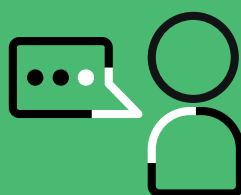
## AN EXTENSIVE PRODUCT RANGE TO GIVE YOU CHOICE AND FLEXIBILITY

- AC-DC power supplies
- DC-DC converters
- LED drivers
- Batteries
- Energy storage devices

## UNRIVALLED END-TO-END DESIGN SUPPORT

- Off-the-shelf or custom solutions give your products the edge in features, price and performance
- We service many end-markets including industrial, healthcare and wearables, remote monitoring, lighting, transportation and more
- Large stock holdings in Europe ensure that you get products when you need them
- Fast turnaround on samples
- Supply chain expertise tailored to your requirements
- Advice and support on environmental legislation, safety and EMC requirements
- Technical resources, datasheets, white papers available to support your design

## ARE YOU READY TO POWER YOUR NEXT DESIGN?



### LET'S TALK

Speak to your local sales representative, or get in touch with our power and battery specialists in your local language at [www.avnet-abacus.eu/ask-an-expert](http://www.avnet-abacus.eu/ask-an-expert)

Visit [avnet-abacus.eu/power](http://avnet-abacus.eu/power) to:



View our linecard



Download technical brochures, white papers and datasheets



Read our guide to European power legislation and safety requirements

# AC-DC power supplies

The large variety of power supplies is mainly driven by different application requirements, but is also affected by industry regulations, the laws of physics and market trends.

Efficiency rating is no longer the sole consideration when selecting power supplies. New environmental directives are increasingly driving manufacturers to consider other factors that will limit energy losses; such as digital remote control and management, low standby and no-load power consumption. Other markets require increased safety measures and enforce higher isolation ratings such as on 'household' EN60335, medical EN60601 or more stringent environment requirements such as ATEX/Ex.

## THE NEWEST AND MOST INNOVATIVE AC-DC POWER SUPPLIES IN STOCK AT AVNET ABACUS

We offer you the latest NPIs on a wide range of AC-DC products, including conduction cooled AC-DC power supplies for low audible noise targeted at medical, audio/video and office applications, as well as adapters for the new generation of USB type-C connected devices, for fast and ultra-fast charging.

### AC-DC LINECARD

	Enclosed/open frame	Board or chassis mounted	Conduction cooled/fanless	DIN rail	LED drivers and LED system accessories	Modular	Railway/rugged	Adaptors/chargers	Front end/high power
<b>ABB</b>	•		•			•			•
<b>Aimtec</b>	•	•		•	•				
<b>Artesyn</b>	•		•	•	•	•		•	•
<b>Bel Power Solutions</b>	•		•	•		•	•		•
<b>Delta</b>	•	•	•	•	•	•	•	•	•
<b>Excelsys</b>	•		•			•			•
<b>Fulham</b>			•		•				
<b>MEAN WELL</b>	•	•	•	•	•	•	•	•	•
<b>Murata Power Solutions</b>	•	•	•						•

## PRODUCT HIGHLIGHTS AC-DC

### ABB POWER ELECTRONICS – CP3500AC65TEZ SERIES

#### Features and benefits

- Efficiency exceeding 96% (meets 80+ titanium)
- Compact 1RU form factor with 40W/in<sup>3</sup> density
- 3500W from nominal 200VAC to 240VAC
- 1500W from nominal 100VAC to 120VAC for VO >40VDC
- Output voltage programmable from 23VDC to 65VDC



### AIMTEC – AMEL5-277NZ SERIES

#### Features and benefits

- Universal input: 85VAC to 305VAC/100VDC to 430VDC
- Operating temp.: -40°C to +70°C
- High isolation voltage: 4000VAC
- Low ripple and noise: 100mV(p-p), max.
- Output short circuit, over-current, over-voltage protection
- Outputs: 3.3VDC to 24VDC
- PCB-mount, chassis or DINrail mounting



### ARTESYN EMBEDDED TECHNOLOGIES 4-SLOT MODULE FOR µMP SERIES

#### Features and benefits

- High power density: 13.9W/cu-in
- Full EN60950 ITE and EN60601 medical safety approvals
- Rugged MIL-STD-810E
- Optional conformal coating
- Industrial temperature range: -40°C to +70°C



### BEL POWER SOLUTIONS – TET4000 SERIES

#### Features and benefits

- Best-in-class efficiency of up to 98%
- Optional standby output 12VDC/60W
- Output 48Vnom. (42Vadj to 58Vadj)
- CAN-bus communication
- Hot-plug capable
- High density design: 44W/in<sup>3</sup>
- Small form factor: 69mm x 40.6mm x 528mm



### DELTA – PJU SERIES

#### Features and benefits

- Universal AC input voltage range
- Zero switch over time from loss of AC to battery operation
- Protection against reverse polarity battery connection
- Built-in diagnostic monitoring for AC OK and battery low status
- Overvoltage/overcurrent/over temperature/short circuit protections
- UPS-PSU 12V or 24V



### EXCELSYS – COOLX1800

#### Features and benefits

- Up to 1800W – modular design
- Up to 12 outputs – PMbus controlled
- All outputs isolated (1850VAC)
- Variable fan speed control



### MEAN WELL – CSP-3000 SERIES

#### Features and benefits

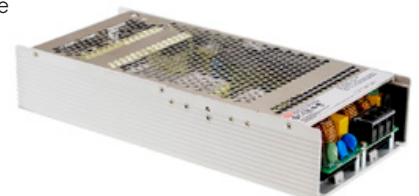
- 180VAC to 264VAC input
- Built-in active PFC function
- High efficiency up to 93%
- Built-in DC fans for forced air cooling
- Output voltage/current programmable
- Output 120VDC/250VDC/400VDC



### MEAN WELL – UHP-2500 SERIES

#### Features and benefits

- Fanless conduction-cooled design
- Full range 90VAC to 264VAC input
- High efficiency up to 96%
- Operating altitude up to 5000 metres
- Operating temperature range: -30°C to +70°C
- Output 24VDC or 48VDC



# DC-DC converters

The primary role of DC-DC converters is twofold: conversion to another stable DC voltage and galvanic isolation between two circuits. Point-of-Load regulators (PoL) are placed near the load and are small form-factor. High power non-isolated converters are used to efficiently perform the final voltage conversion.

Whilst each solution simply manages the conversion from DC input to a regulated and/or isolated/non-isolated DC output, there is a wide range of options based on size, power, cost and converter technology requirements.

Our technical specialists can advise on all of these aspects, whilst also addressing the issues of efficiency, heat dissipation, isolation and voltage regulation, and can help you choose the most appropriate model for your requirement.

A Distributed Power Architecture (DPA) for boards and systems is often used to break power conversion into 3 sections to control and manage the power train:

- AC mains power: rectifiers and front-end power supplies will achieve isolation from the mains and a rectified stable voltage to a distributed voltage bus at either 48V or 12V
- Intermediate Bus Converters (IBC) isolate application boards from the 48V bus voltage down to 12V at a typical narrow load regulation
- Point-of-Load (PoL) regulators convert the 12V bus voltage to high precision, high efficiency and fast responding low voltages (0.6V to 3.3V) with high current capabilities (300mA to 180A)

## DC-DC LINECARD

	Miniature/Industrial/bricks	Digital brick + PoL	Point of load/PiM/power block	Switching regulators	Transportation/railway	DIN rail/chassis mount	LED	Medical	High voltage input	Filter boards for DC-DC	DC-DC for IGBT/MOSFET driver
<b>ABB</b>	•	•	•	•						•	
<b>Aimtec</b>	•			•	•	•	•	•	•	•	•
<b>Artesyn</b>	•	•	•		•	•		•	•		
<b>Bel Power Solutions</b>	•	•	•		•	•		•		•	
<b>Cyntec</b>			•								
<b>Datel</b>	•		•	•	•			•			
<b>Delta</b>	•	•	•	•	•	•		•	•	•	•
<b>Flex Power</b>	•	•	•		•						
<b>Fulham</b>							•				
<b>MEAN WELL</b>	•			•	•	•	•	•	•		•
<b>Murata Power Solutions</b>	•	•	•	•	•			•			•
<b>TDK</b>		•	•								

### AIMTEC - AM2LO-Z SERIES

#### Features and benefits

- Operating temperature: -40°C to +105°C
- High isolation voltage: 4200VDC
- Low ripple and noise, 150mV(p-p), typ.
- SMD type package
- Input: 3.3VDC or 5VDC, ±10%
- Output: 3.3VDC, 5VDC, ±3.3VDC or ±5VDC



### BEL - RCM500

#### Features and benefits

- Optimised for 72V or 110V railway batteries
- Output voltage 24V, 500W, fanless design
- Closed housing for chassis mounting
- Extremely high efficiency and high power density



### FLEX POWER MODULES - BMR480

#### Features and benefits

- Full digital converter platform, efficiency up to 97%
- Quarter brick with base-plate, many configurations
- 40V to 60V input, 12V output, digital adjustable, 108A/1300W max.
- Monotonic start-up and droop load sharing



### FLEX POWER MODULES - PKM4516ADPIHS SERIES

#### Features and benefits

- Voltage 28Vnom. (range: 14V to 35V)
- Output power up to 504W
- Input voltage range: 36V to 75V
- Isolation rating: 2250VDC
- Ideal for 28V laterally diffused MOSFET



### MEAN WELL - DDR-240 for RAILWAY AND INDUSTRY

#### Features and benefits

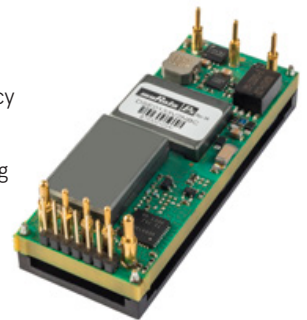
- Compliance to EN50155 and EN45545-2
- Fanless design, cooling by free air convection
- 2:1 wide input 24VDC, 48VDC, 110VDC
- -40°C to +70°C ultra-wide operating temperature range
- Adjustable 24V and 48V output versions
- Power boost 360W (3sec.)



### MURATA - DSE/DAE/DCE SERIES 8BRICK 400W 12V IBC

#### Features and benefits

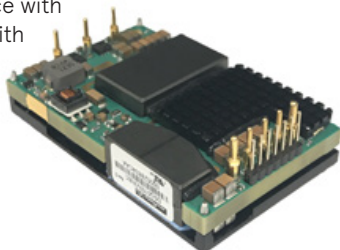
- Optional DOSA PMbus interface
- 36V to 75V input voltage range
- 12Vout at 95.5% typical efficiency
- 2250VDC I/O isolation
- DSE: PMbus + droop load sharing
- DAE: trim + sense, no PMbus
- DCE: no trim + sense pins



### MURATA - DSQ/DAQ/DCQ SERIES QBRICK 600W IBC

#### Features and benefits

- Designed, tested and qualified according to the industry standard IPC9592 for reliability requirements
- State-of-the-art performance with an efficiency rating of 96% with 600W output power @55°C
- DSQ: PMbus + droop load sharing
- DAQ: trim + sense, no PMbus
- DCQ: no trim + sense pins



### TDK μPOL™ FS1406 SERIES

#### Features and benefits

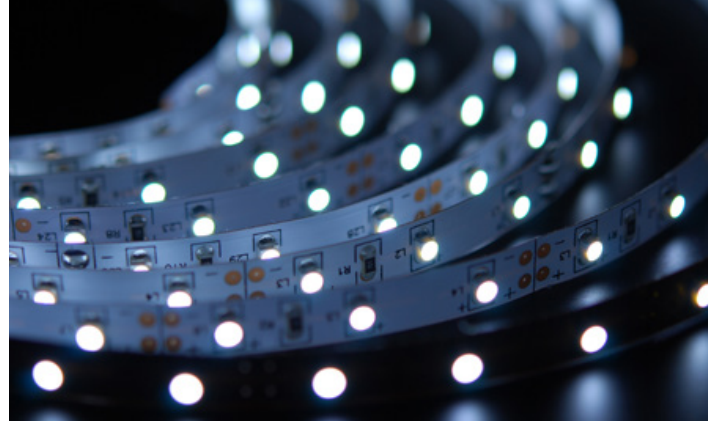
- μPOL™ package with output inductor included
- Small size: 3.3mm x 3.3mm x 1.5mm
- Continuous 6A load capability, 0.6V to 2.5V
- Plug-and-play: no external compensation required
- Programmable operation using the I2C serial bus (fast mode and fast mode plus)
- Wide input voltage range: 4.5V to 16V for single supply and 2.5V to 16V for dual supply



# LED drivers

As LEDs rapidly become the prominent source of lighting, the key benefits of technology (lower power, operation, reliability and long-life) can only be achieved through careful luminaire design, using highly efficient and reliable ancillary components. This is especially true of the LED driver, and regulatory agencies have created a series of directives to help manufacturers select the most appropriate product for efficiency.

These directives are based on considerations including ripple/flicker, standby/no-load power consumption, start-up time, safety, EMC and harmonic distortion. With the use of LEDs a whole new world of controlling light is possible - from dimming to wireless control to day-night colour mixing - in smart city street lighting, illumination and horticulture lighting applications.



## PRODUCT HIGHLIGHTS LED

### AIMTEC - AMEPR16

#### Features and benefits

- IP20 indoor LED lighting
- Independent applications
- Constant current mode: 12W to 17W, 290mA to 360mA, 24V to 58V
- Efficiency up to 88%
- Short and open circuit protection
- Active PFC
- Long life



### ARTESYN - iHP

#### Features and benefits

- Multi output intelligent and modular high power system
- Standard 19" rack 12kW and 24kW base units
- 3kW modular units managed by GUI via PMbus-IP-RS485 Ethernet
- Outputs: 0.6V to 1000V, parallel/series up to 1600A
- Industrial, medical and LED/laser applications



### DELTA - LNE SERIES

#### Features and benefits

- International AC input voltage with worldwide certified cable use
- Up to 96.0% efficiency
- 10kV common mode and 10kV differential mode surge immunity
- IEC/EN 61000-4-2, level 4 criteria A, 15kV air discharge, 8kV contact discharge
- IP67 mechanical design for indoor and outdoor applications



### FULHAM - BLUETOOTH LED DRIVERS

#### T1C1UNV150P-40

#### Features and benefits

- 40W CC Bluetooth LED driver
- Built-in applications with external bluetooth antenna

#### CTBRCB03JM03

#### Features and benefits

- Bluetooth 0V to 10V bridge
- Adds SIG qualified Bluetooth mesh capability to existing 0V to 10V LED drivers





## FULHAM - EMERGENCY UPS LED DRIVER

### Features and benefits

- 40W to 70W emergency LED driver
- Internal long life LiFePO4 replaceable battery
- Fully programmable: current, timer, dimming
- Application: LED panel with emergency lighting
- 70W linear shape version available now



## MEAN WELL - ELG(C) 75W-300W

### Features and benefits

- Comprehensive series of CC or CV mode LED drivers
- Many options: Trim-0-10V-PWM dimmable, DALI, smart timer
- Metal IP65-67 housing for built-in applications
- No-load and standby power consumption <0.5W



## MEAN WELL - HBGC-300

### Features and benefits

- IP67 metal housing design for indoor or outdoor installations
- Constant power mode with current adjust by trimpot
- Dimming solutions: 3 in 1 and DALI dimming
- Wide universal input range 90VAC to 305VAC
- High efficiency up to 94.5% and operates between -40°C to +80°C



## MEAN WELL - HVGC-1000 SERIES

### Features and benefits

- Wide input range 180VAC to 528VAC
- Constant power mode output
- Metal housing with class design I
- Surge protection with 8KV/4KV
- Built-in active PFC function



## MEAN WELL - SLD-80 80W LED DRIVER

### Features and benefits

- Wide input range 110VAC to 305VAC
- Slim and linear housing design
- Built-in active PFC function and efficiency up to 92%
- Design with class 2/II and SELV
- Protections: short circuit/over voltage/over temperature



## MEAN WELL - XLG SERIES 25-240

### Features and benefits

- Wide universal AC input with almost no derating at low AC input
- Current adjust by trimpot and/or 3 in 1 dimming (dim to off)
- 12V, 24V constant voltage or various constant power models
- Metal housing with functional ground
- No load/standby power consumption



# Batteries

Our comprehensive linecard featuring world-leading suppliers offers you a complete range of battery types from coin cells to custom design and multicell battery packs. Our service to you includes:

- Leading brand name suppliers for every battery chemistry
- An extensive and expanding range of standard lithium-ion and polymer packs, offering reduced design cycles and lowest implementation cost
- Design service for non-standard battery packs through our network of approved pack makers
- Expert advice on battery approvals for shipping and safety
- Easy access to the latest battery trends and developments
- Exclusive Dobilier product from verified and approved partners for high-volume, low-cost applications

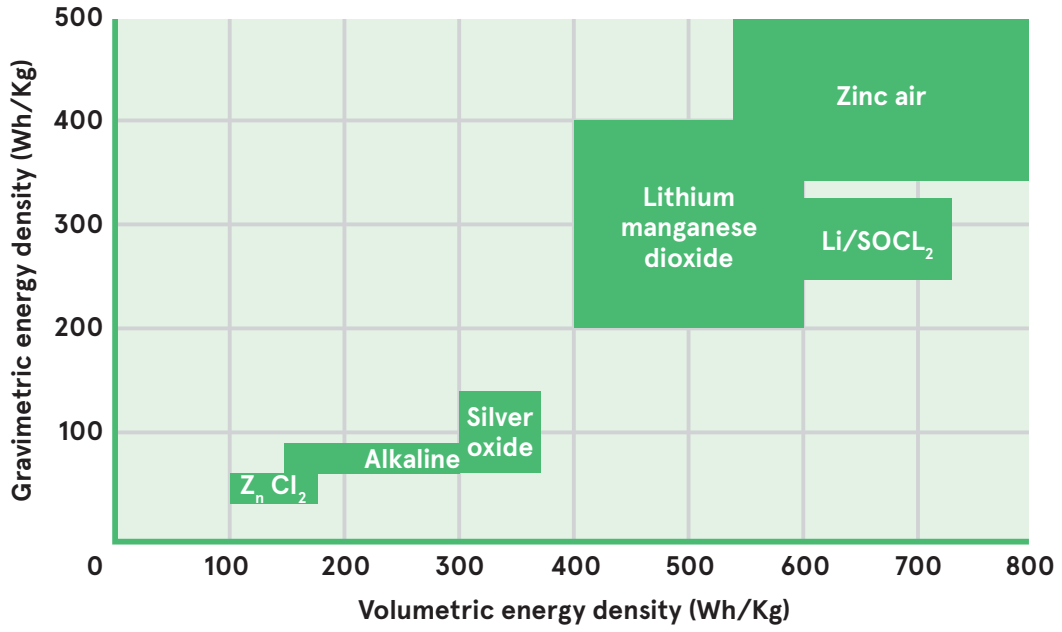
## BATTERY SOLUTIONS LINECARD

	Zinc carbon	Alkaline manganese	Silver oxide	Zinc air	Lithium manganese dioxide	Lithium iron disulfide	Lithium thionyl chloride	Lithium poly-carbon	Sealed lead acid	Nickel metal hydride	Lithium-ion	Lithium-ion polymer	Lithium iron phosphate	Lithium nickel manganese cobalt	Lithium vanadium pentoxide	All-ceramic multilayer	Chargers and power adapters
	Primary							Rechargeable									
Artesyn																	•
Dobilier					•		•			•	•	•					
Energys								•									
GP Batteries	•	•	•	•	•	•				•	•						
MEAN WELL																	•
Molex	•																
Murata		•	•		•												
Panasonic Industry	•	•		•	•			•	•	•	•				•		
RRC											•	•					•
Tadiran							•				•						
TDK																•	
Varta		•	•	•	•		•		•	•	•	•	•	•			
Wamtechnik										•	•						

## STANDARD BATTERY OVERVIEW

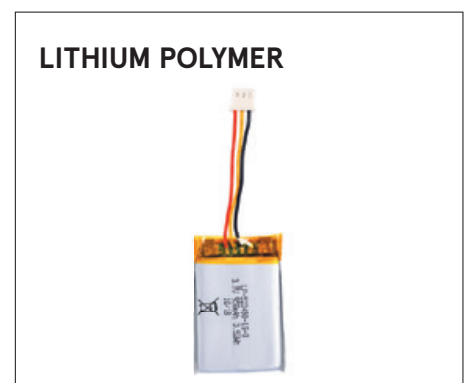
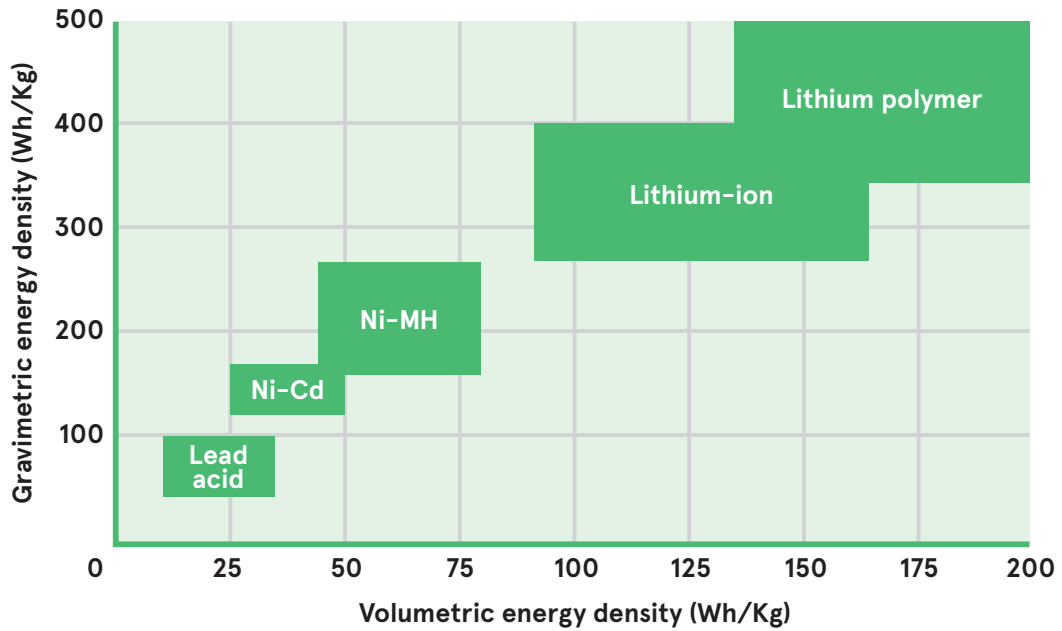
	Zinc carbon	Alkaline manganese	Silver oxide	Zinc air	Lithium manganese dioxide	Lithium thionyl chloride	Sealed lead acid	Nickel metal hydride	Lithium-ion	Lithium-polymer
	Primary						Rechargeable			
Cell voltage (V)	1.5	1.5	1.55	1.65	3	3.6	2.1	1.2	3.3-3.8	4.2
Energy density (Wh/L)	92	250-434	500	442	1673	1000	60-75	401	250-693	250-730
Specific energy (Wh/Kg)	36	85-190	130	470	280	500-700	30-50	100-120	100-265	100-265
Fast charge time (hours)	-	-	-	-	-	-	8-16	2-4	1 or less	1 or less
Cycle life (80% discharge)	-	-	-	-	-	-	200-300	300-500	500-1000	500-1000
Cost	Low	Low	Medium	Low	Medium	High	Low	Medium	Medium	High

PRIMARY SYSTEMS



# Batteries

## RECHARGEABLE SYSTEMS



# Energy storage

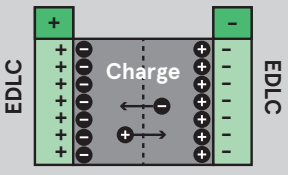
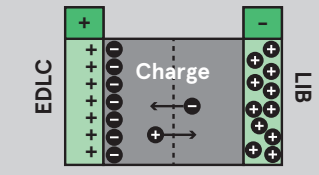
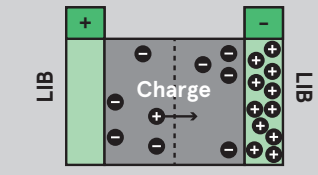
Supercapacitors offer an alternative to using a battery in many energy storage applications, and can be used as backup power or for high-surge demand applications. Also known as ultracapacitors or Electric Double-Layer Capacitors (EDLCs), these devices come with many advantages, including a maintenance-free long life. Additionally, as supercapacitors don't contain lead or other potentially harmful substances, they are compliant to EU directives such as RoHS. As the environmental impact of products becomes increasingly important, this is an essential factor to consider in new product design.

Supercapacitors can address a diverse range of applications, from long-life replacements for coin-cell batteries that back up real-time clocks, up to high capacity units that power servomotors in industrial control. In terms of energy storage, supercapacitors fit nicely into the gap between aluminium electrolytic capacitors and batteries: offering significantly greater capacitances and energy densities than conventional capacitors, but still only a fraction of the energy density offered by batteries.

Li-ion capacitors, or hybrid capacitors, are effectively a combination of the battery and supercapacitor technologies. While supercapacitors hold energy using electrostatic charge, and Li-ion batteries use an electrochemical method, Li-ion capacitors use one electrostatic electrode and one electrochemical. The result is a device with better energy density than a supercapacitor, but without the self-discharge characteristic, and higher durability (more charge-discharge cycles) than a Li-ion battery, without the potential for dangerous thermal runaway.

Our highly knowledgeable team of experienced product specialists can help you select the best supercapacitor or hybrid capacitor for your design from our world-leading suppliers, including AVX, Eaton, Kemet, Nichicon, Panasonic Industry, Tadiran, Taiyo Yuden, TDK and Vishay.

## ENERGY STORAGE OVERVIEW

	EDLCs	TAIYO YUDEN Lithium-ion hybrid capacitors	Lithium-ion batteries
Electrodes			
Internal resistance	Low	Medium	High
Operating temperature (°C)	-40 to +70	-25 to +85	-20 to +60
Maximum rated voltage (V)	2.3 to 2.7	3.8	4.1 to 4.3
Minimum operating voltage (V)	0	2.2	2.5
Capacitance/ energy vs device volume	Lowest	2 to 3 x EDLC	Highest (100 x EDLC)
Charge/discharge cycles	100k	100k	500-1000
Self discharge	Susceptible	Very low	Very low
Safety	Highly stable	Highly stable	Safety consideration required
Voltage monitoring required?	No	Yes	Yes

# Energy storage

## PRODUCT HIGHLIGHTS

### AVX – SCC SERIES

#### Features and benefits

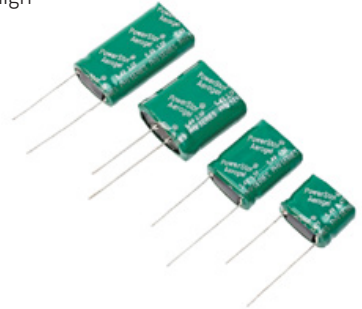
- Cap values from 1F to 3000F
- High pulse power capability
- Low ESR
- Low leakage current



### EATON – PHV SERIES

#### Features and benefits

- Large capacitance for high energy density
- Ultra-low ESR for high power density



### KEMET – FT SERIES

#### Features and benefits

- Wide temperature range: -40°C to +85°C
- Maintenance free
- Maximum operating voltage: 5.5VDC
- Highly reliable against liquid leakage



### PANASONIC INDUSTRY GOLD CAPS

#### Features and benefits

- Low resistance: 30mΩ max. (1 kHz)
- Wide capacitance range: 2.5F to 100F
- Wide temperature range: -40°C to 85°C
- Flexible case sizes: diameter 8mm, 10mm, 18mm



### TAIYO YUDEN – LITHIUM-ION CAPACITORS

#### Features and benefits

- Operating temperature range: -25°C to +85°C
- Electrode material: activated charcoal carbon based material
- Electrolytic: organic solvent
- Electrical storage method: using the electrical double-layer and ion doping and de-doping



### TDK CERACHARGE

#### Features and benefits

- Rechargeable, long life/cycling
- All-ceramic-structure
- RoHS compatible
- SMT compatible chip, Pb free reflow solderable
- Li-based ceramic oxide electrolyte/electrode and copper charge collector



### TDK – 041720 SERIES

#### Features and benefits

- Length: 27.00mm ±0.50mm
- Width: 17.00mm ±0.50mm
- Thickness: 0.50mm max.
- Capacitance (typ.): 10mF



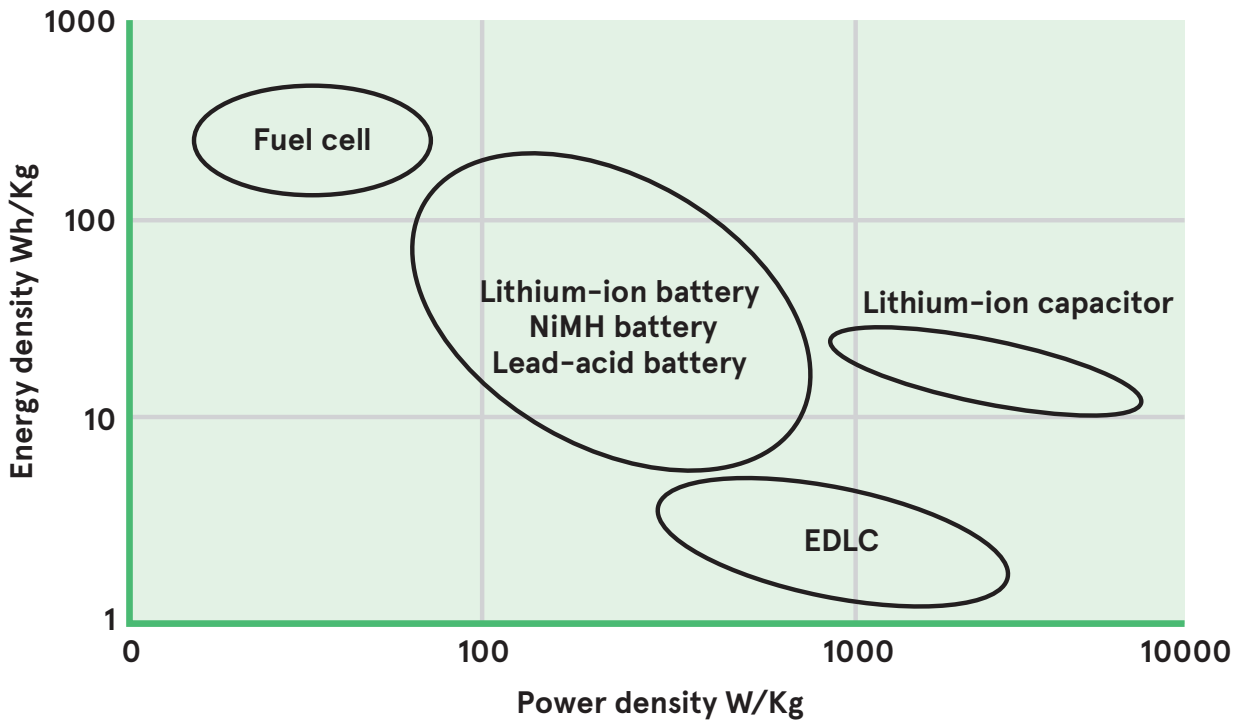
### VISHAY – 225 EDLC-R ENYCAP™

#### Features and benefits

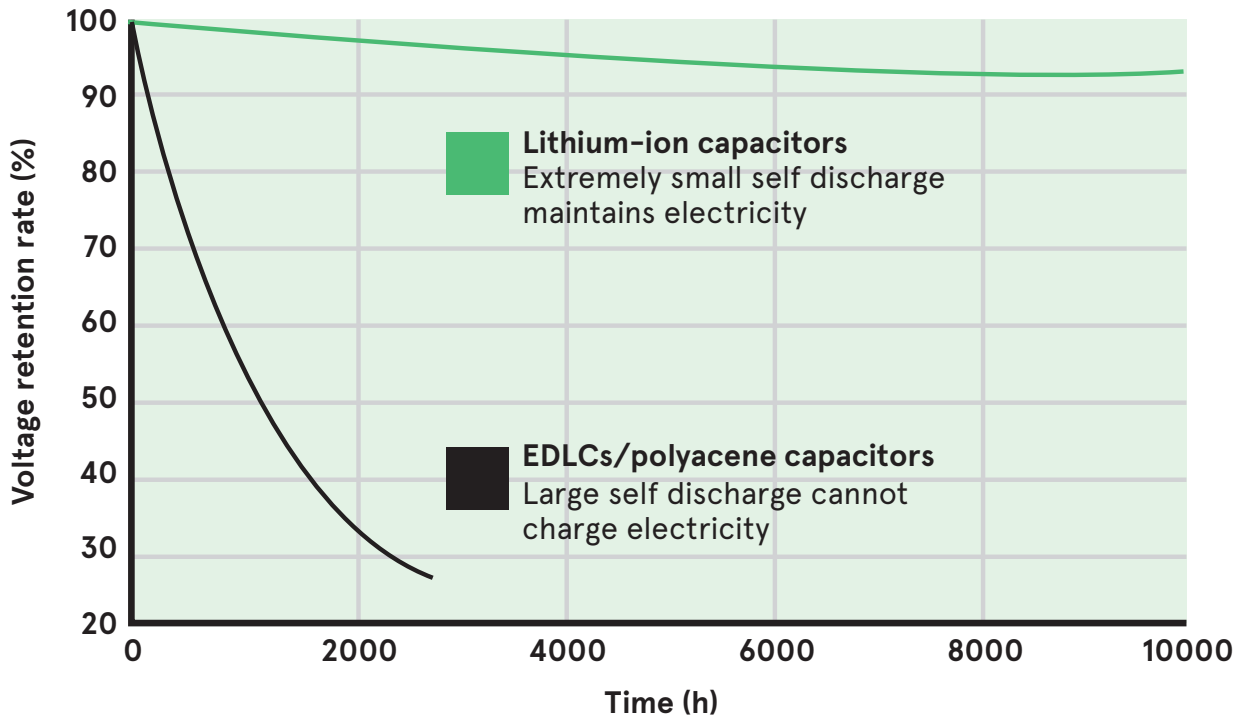
- Polarised energy storage capacitor with high capacity and energy density
- Rated voltage: 2.7VDC
- Available in through-hole (radial) version
- Useful life: 2000hrs at +85°C



## ENERGY STORAGE COMPARISON OVERVIEW



## ENERGY DISCHARGE COMPARISON CHART



# Powering your designs

Determining the right type of power supply for your application can be complex. Avnet Abacus provides the expertise to guide you to the optimal solution, helping to reduce your design cycles and take your product to market faster.

## Visit our website to:

View our power linecard from industry leading manufacturers

Download our power brochures

Read our guide to European power legislation

## Ready to discuss your next design?

Get in touch with one of our technical specialists in your local language at [avnet-abacus.eu/ask-an-expert](https://www.avnet-abacus.eu/ask-an-expert)



[avnet-abacus.eu/power](https://www.avnet-abacus.eu/power)