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# Aluminum and Energy Storage Capacitors

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March/2026



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Product Marketing Aluminum Capacitors

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# Vishay Aluminum Capacitors

**BUILT TO WIN**  
VISHAY EVERY DAY

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## Division

- European location
- Specialty focus
- Broad portfolio
- Flexible production

## Products

- EDLC
- SMD
- Snap-ins / Screw terminals
- Radials
- Axials



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# Aluminum Capacitors – Product Portfolio

## Energy Storage



## Miniatures



## Power Capacitors



Axial

R

ap-In



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# Aluminum Focus Products



## EDLC



- Automotive power backup
- e-latches
- Cameras
- “Last gasp”



## SMD



- Automotive control
- Infotainment
- Under the hood applications



## Power Capacitors



- EV chargers
- Inverters
- DC-Link
- Traction

# EDLC

Supercapacitors for Energy Storage

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# Typical Applications for Supercapacitors in Automotives

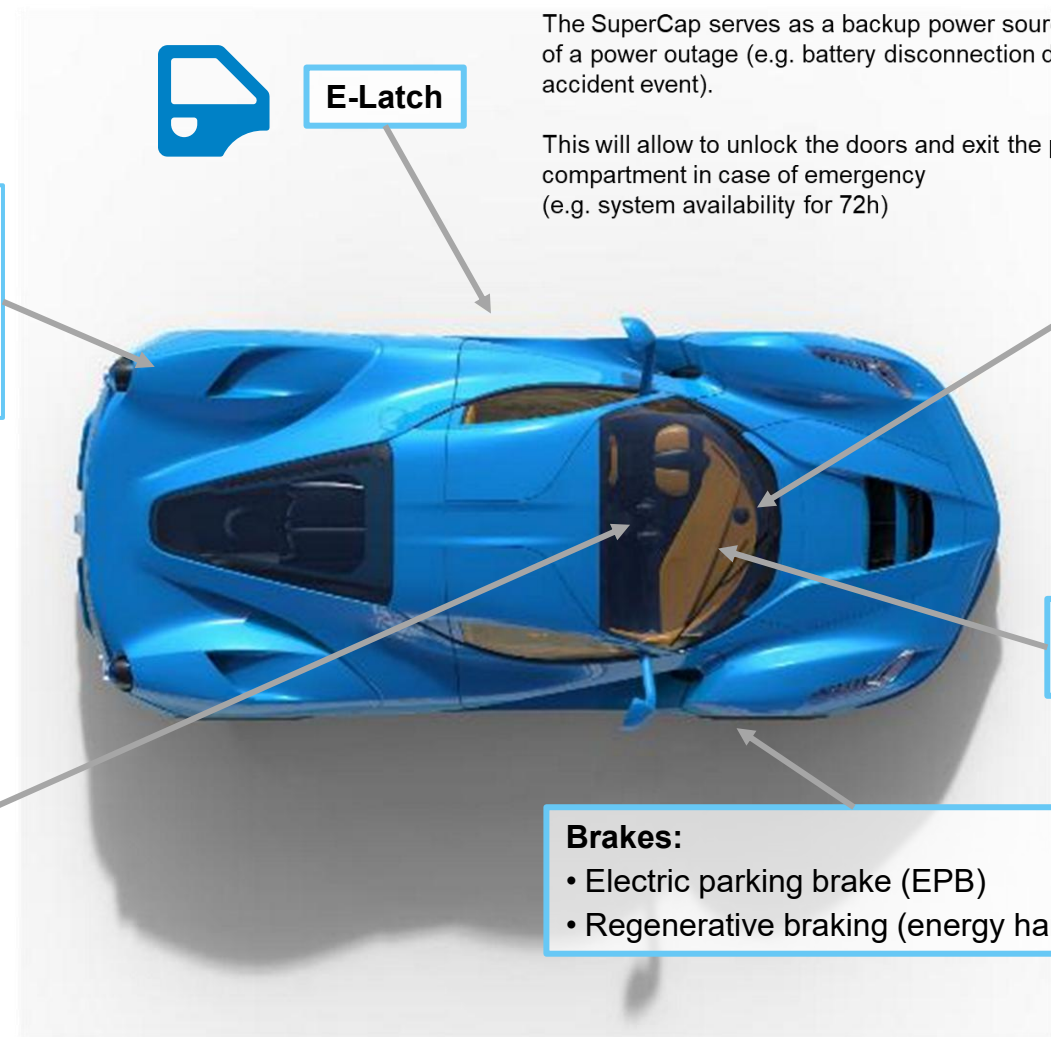


Vishay has a unique offering of **AEC-Q200** parts on the market with **enhanced vibration** specifications vs our competitors. We also have the highest range of automotive-qualified products on the market as of now.

**E-Latch is an intelligent door locking / unlocking system** that eliminates mechanical components and controls all features and functions electrically, providing convenient use and higher reliability

The SuperCap serves as a backup power source in the event of a power outage (e.g. battery disconnection due to an accident event).

This will allow to unlock the doors and exit the passenger compartment in case of emergency (e.g. system availability for 72h)



**E-Latch**

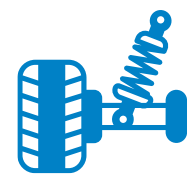
**Pawl lock**

**Stabilization of 12 V / 48 V voltage rails**

**Brakes:**  
• Electric parking brake (EPB)  
• Regenerative braking (energy harvesting)

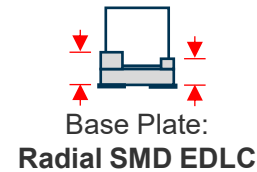
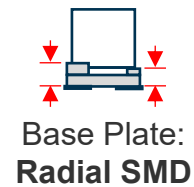
• Electrification of mechanical / hydraulic systems such as electric power steering, suspension, roll stabilization, ....

**Dying / last gasp, safe shutdown:**  
• Driving video recorders (DVR)  
• Central gateways  
• On-board diagnostics (OBD)  
• And more ...



# In Development: Industry-First EDLC SMD

## Vishay – Non-Solid SMD EDLC (Standard V-Chip)

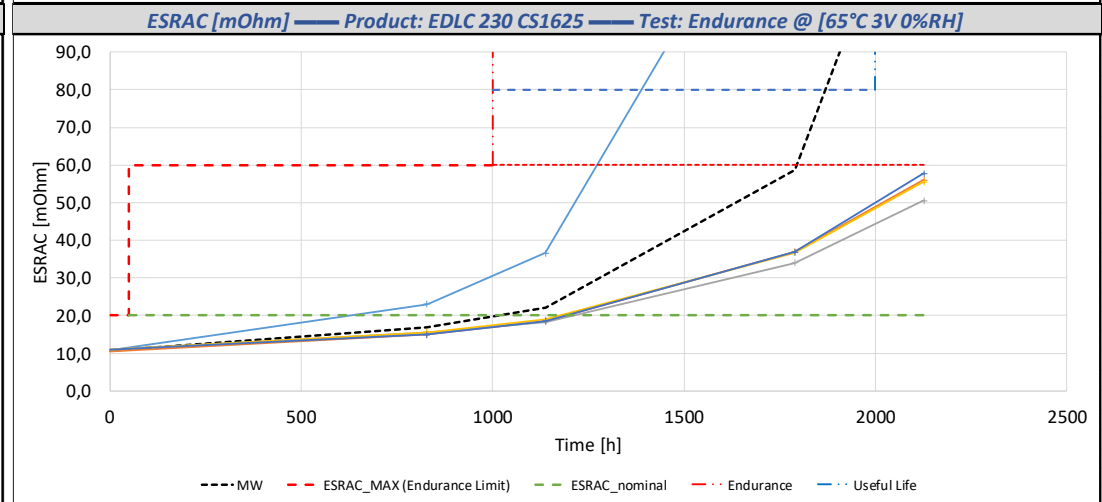
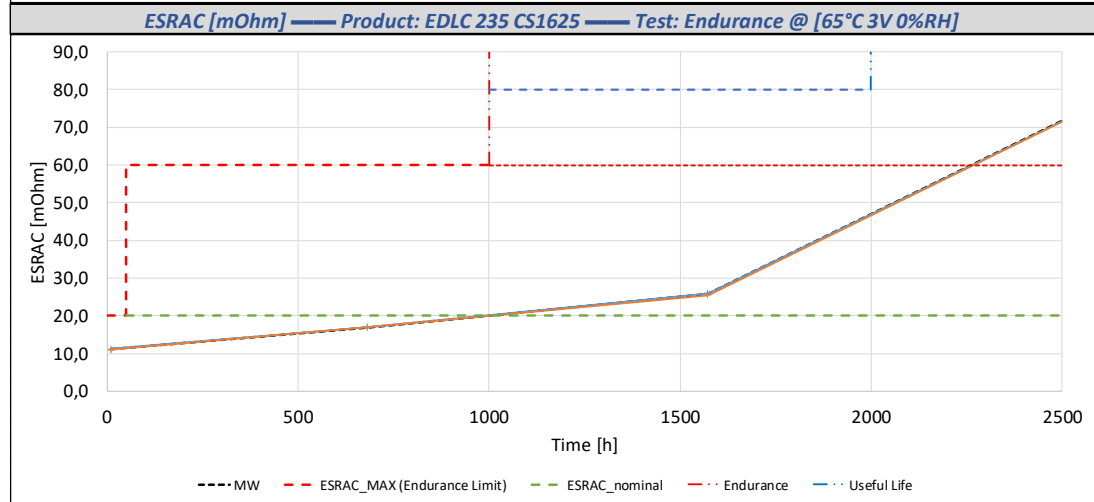
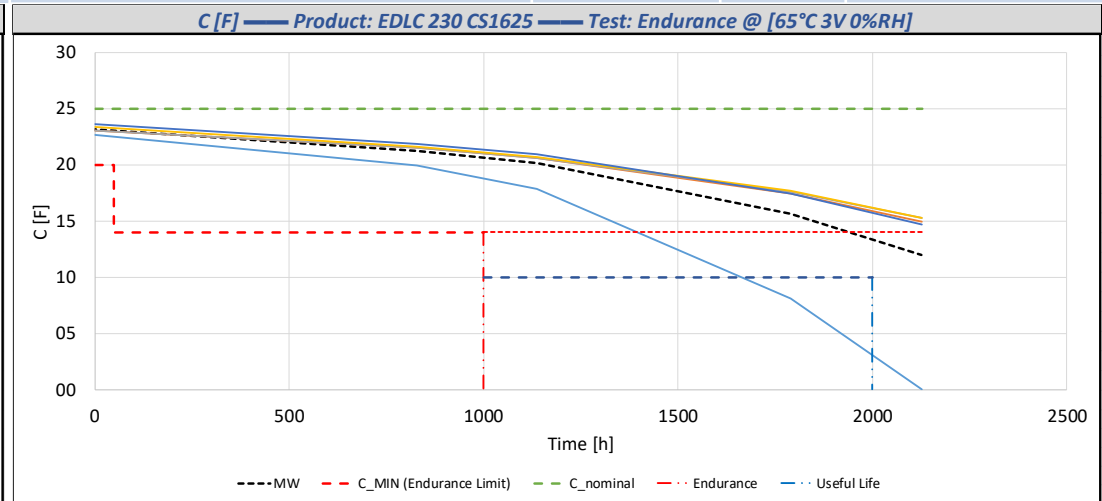
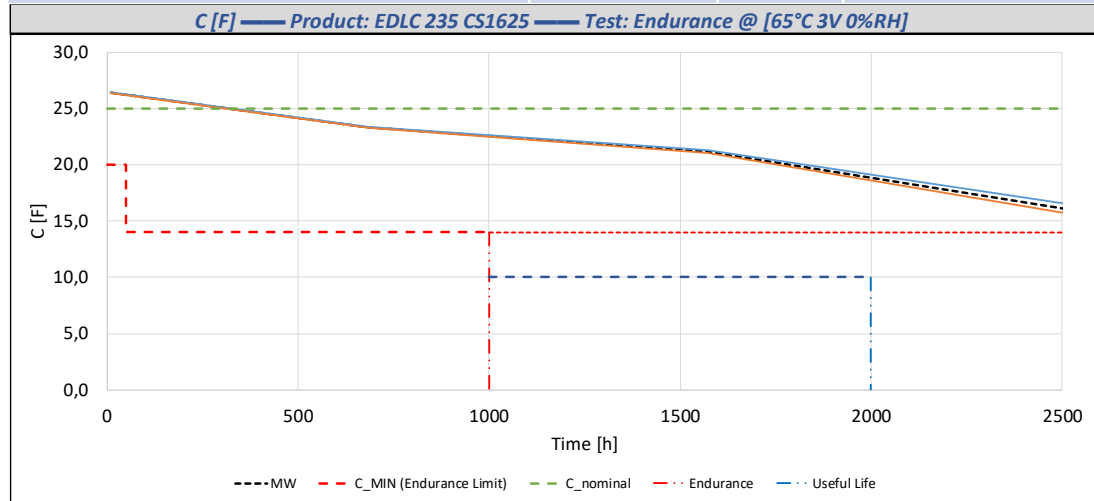


### Advantages

- Reflow-solderable
- Allows customers to go full SMD
- Same specifications as radial EDLC: best in class lifetime, AEC-Q200 qualified

# Endurance Testing @ 65°C 3V

Label	Case Size	Nom. C [F]	Rated Voltage U [V]	Label	Case Size	Nom. C [F]	Rated Voltage U [V]
VISHAY EDLC235 25F 3V (5pcs on test)	CS1625	25	3	Competitor 1 Supercap 25F 3V (5pcs on test)	CS1625	25	3



# EDLC

## Value Proposition

# 1

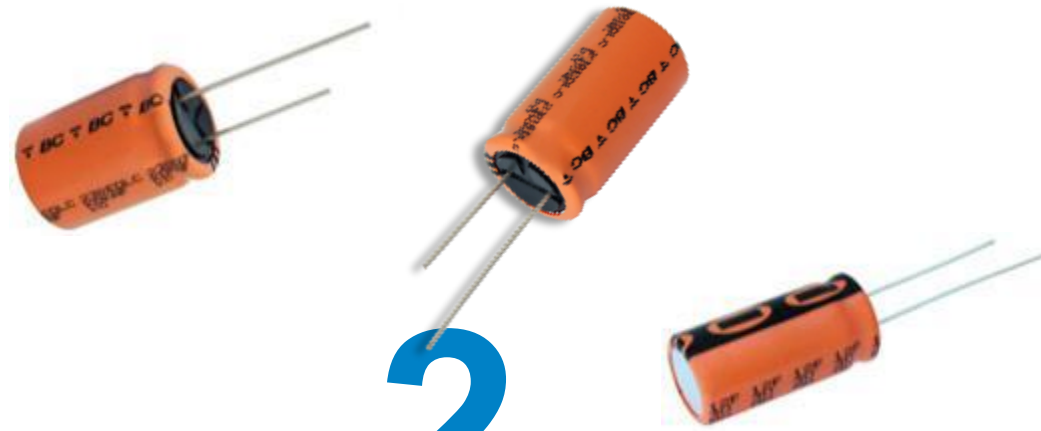
### Where to Hunt

Segments: automotive power backup, industrial automation, data protection

Applications: e-latch / door locks, transmission controls, data backup

Competitors: Maxwell, Eaton, Jianghai, Vinatech

Target customers: Tier 1(GM, Ford, Stellantis), Tier 2 (Magna, Borg Warner, Lear, Aumovio, ZF ...); data protection (AWS, Nvidia)



# 2

### How to Engage Customers

Door opener questions and positioning...

- Is the EDLC the last leaded part in your board?
- Do you require AEC-Q200 qualification?
- Does your application require high performance and long life?
- Do you need a source outside of China+1?



# 3

### How to Win

Industry-first SMD version in development

Fully AEC-QA200 Rev-E qualified, UL810A-recognized

Ruggedized version will withstand 85 % RH / 85 °C testing

Best in class lifetime 2000 h / 85 °C

# SMD Aluminum Capacitors

V-Chip

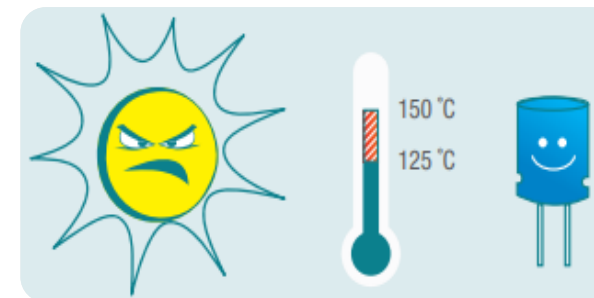
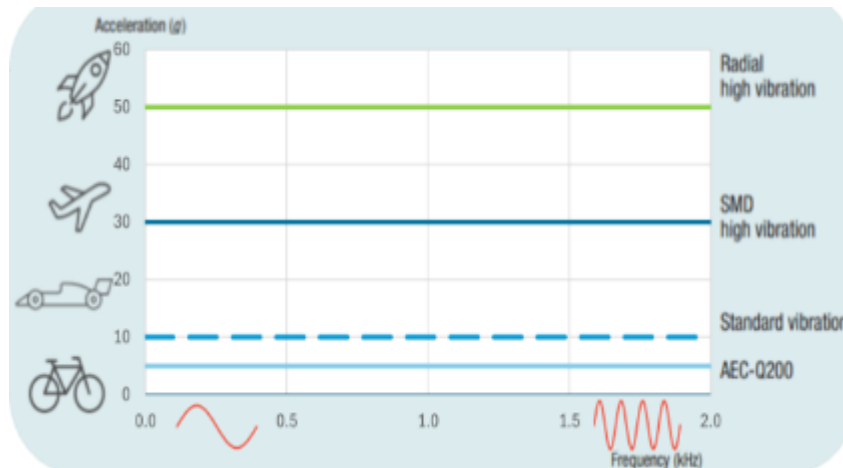
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# Aluminum Radial and SMD for Harsh Environments

## High Temperature – High Vibration



### Advantages

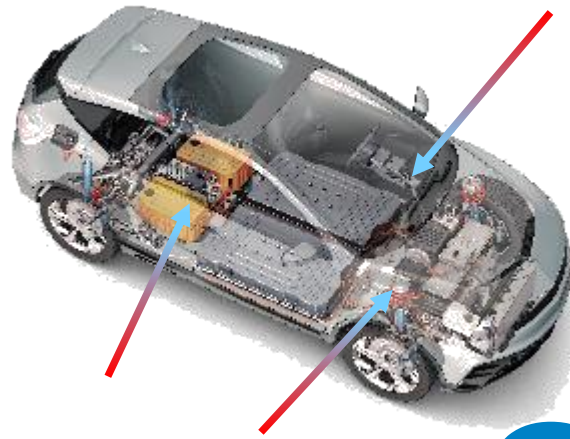
- AEC-Q200 approved capacitors that surpass specification up to 10 times
- Best in class high temperature capability
- Made in Austria

### Operating Conditions

- Up to 30 g for SMD capacitors
- Up to 150 °C operating temperature
- Long lifetime

# SMD

## Value Proposition



# 1

## Where to Hunt

Segments: automotive

Applications: high temperature e-mobility: e-compressors, converters, OBCs, coolant; infotainment, motor control

Competitors: Nichicon, Chemi-Con, Lelon

Target customers: Tesla, Tier 2 (Magna, Borg Warner, Lear, Aptiv, Aumovio, ZF, Bosch, Valeo ...)

# 2

## How to Engage Customers

Door opener questions and positioning...

- Do you require high temperature resistivity?
- Do you need high vibration resistivity
- Do you need a source outside of China+1?

# 3

## How to Win

150 °C rated SMD up to 80 V

30 g vibration resistivity

Long lifetime and reliability

# Power Capacitors

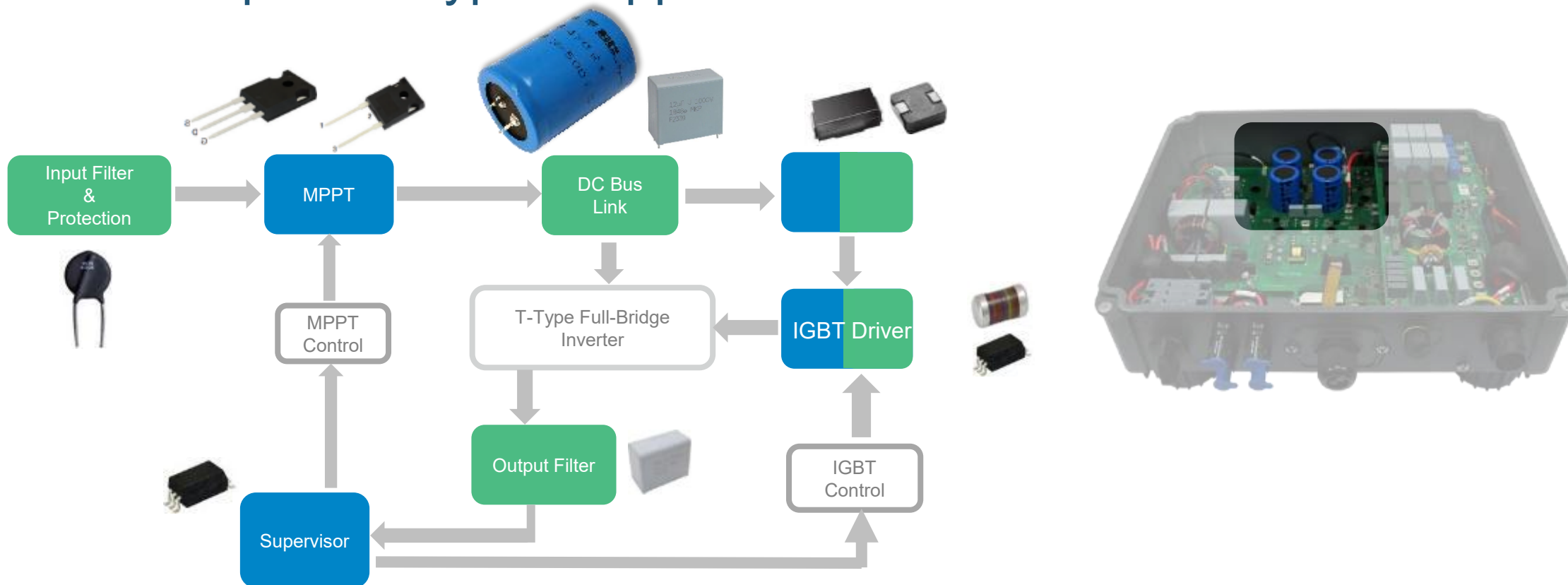
Snap-Ins and Screw Terminals

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# Power Capacitor Typical Application



## Advantages

- 2, 3, or 4 pins for assembly options, replacing bus bars to lower costs
- Lifetimes up to 15 years at 65 °C

## Operating Conditions

- Voltage range: up to 600 V
- Temperature range up to 105 °C
- Useful life: up to 5000 h at 105 °C
- High ripple current capability

# Power Capacitors

## Value Proposition



# 1

## Where to Hunt

Segments: industrial high power, EV charging

Applications: power supplies, DC-Link

Competitors: Nichicon, Chemi-Con, Lelon

Target customers: ABB; Eaton; Rockwell, Parker SSD; Transit Authorities

# 2

## How to Engage Customers

Door opener questions and positioning...

- Do you require high reliability and performance?
- Does your application require high voltages up to 600 V and high reliability?

# 3

## How to Win

600 V rated snap-in

Long lifetime and reliability

# Design Resources and Selling Tools

Available on the Vishay Website

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# Design Resources

## Selector Tool

- Parametric search based on:
  - Capacitance
  - Voltage
  - Size
  - Temperature rating
  - Lifetime
  - Packaging
- Access to specs and other resources
- Will allow inventory check and order placement with “Buy Now”

### Some Ways to Find the Right Product...

The screenshot shows the Vishay website interface. At the top, there are navigation tabs: PRODUCTS, APPLICATIONS, RESOURCES, CUSTOM CAPABILITIES, and COMPANY. Below this is a search bar with a magnifying glass icon. To the right of the search bar are three buttons: 'Product Search', 'X-Ref', and 'Distribution Stock'. Below the search bar, there is a section for 'CAPACITORS - ALUMINUM ELECTROLYTIC'. Below this, there is a 'Parametric search' section with a table of search criteria. Below the table is a 'Selector Tool' section with a table of product results. The 'Selector Tool' table has columns for 'Part #', 'Product Image', 'Order Code', 'Buy Now', 'Cap (µF)', 'Voltage (V)', 'Form', 'Case Size', 'Temp Max (°C)', 'Useful Life', 'Style', and 'Technology'. The table contains three rows of product data.

Product Search

X-Ref

Distribution Stock

Parametric search

Cap (µF)	Voltage (V)	Form	Case Size	Temp Max (°C)	Useful Life	Style	Technology
1	25	Radial	024 S15	+100 °C	3000	"Radial, Bulk or Paper in Box"	Aluminum Electrolytic
3.3	10	SMD	0805 3x11 F	+100 °C	2000	"Large Cap. 3-Terminal SMD, Cardboard Box"	Aluminum Electrolytic
10	16	Radial	024 S15	+100 °C	3000	"Radial, Bulk or Paper in Box"	Aluminum Electrolytic

Selector Tool

Part #	Product Image	Order Code	Buy Now	Cap (µF)	Voltage (V)	Form	Case Size	Temp Max (°C)	Useful Life	Style	Technology
013 RL E		MAL20101038L2	Buy Now	33	16	Radial	024 S15	+100 °C	3000	"Radial, Lead in Ammo Pack, Formed Lead"	Aluminum Electrolytic
013 RL C		MAL20101038L4	Buy Now	33	16	Radial	024 S15	+100 °C	3000	"Radial, Long Straight Leads, Bulk"	Aluminum Electrolytic
013 RL C		MAL20101038L3	Buy Now	33	16	Radial	024 S15	+100 °C	3000	"Radial, Short Straight Leads, Bulk"	Aluminum Electrolytic

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Aluminum Electrolytic | Capacitors | Vishay

# Some Ways to Find the Right Product...

Product Search

X-Ref

VISHAY

PRODUCTS ▾ APPLICATIONS ▾ RESOURCES ▾ CUSTOM CAPABILITIES COMPANY

Keyword/Part #  Stock Check/Qty New  Cross Ref Part #

Products > Capacitors > Aluminum Electrolytic

### CAPACITORS - ALUMINUM ELECTROLYTIC

Aluminum Electrolytic Capacitors provide a smaller capacitor option when high power ratings and high capacitance values are needed. Vishay offers a broad line of aluminum electrolytic capacitors, including SMD, through-hole, and surface-mount. Contact us for more information or to specify the ideal products for automotive, medical, alternative energy, and other high-demand applications.




Distribution Stock

Parametric Search | Aluminum Electrolytic | Design Tools | Document Library | Press Releases | Product Videos

To select multiple values, Ctrl-click or click-drag over the items

Cap (µF)	Voltage (V)	Form	Case Size	Temp Max (°C)	Useful Life	Style	Technology
1	2.5	Axial	04.5x10	+60 °C	1000	"Axial, Bulk or Paperstrip in Box"	Aluminum Electrolytic
1.5	4	Radial	06x11	+85 °C	1250	"Axial, Taped in Ammo-pack"	Aluminum Polymer
2.2	6.3	Screw-Terminal	06.3x11	+105 °C	1500	"Axial, Taped on Reel"	
3.3	10	SMD	06.3x12.7	+125 °C	2000	"Large Can, 2-Terminal SI, Cardboard Box"	
3.9	18	Snap-In	06.5x18	+150 °C	2500	"Large Can, 3-Terminal SI, Cardboard Box"	
4.7	20	Solder Pin	06x10		3000	"Large Can, 4-Terminal SI, Cardboard Box"	
5.6	25		07.7x12.7		3500	"Large Can, Printed Wiring, Cardboard Box"	
6.8	35		08.2x11		4000	"Large Can, Solder Lug, Cardboard Box"	

Reset All

Series	Product Image	Order Code	Buy Now	Cap (µF)	Voltage (V)	Form	Case Size	Temp Max (°C)	Useful Life	Style	Technology
013 RLC	 <a href="#">Enlarge</a>	MAL201331339E3	<a href="#">Buy Now</a>	33	50	Radial	08.2x11	+85 °C	3000	"Radial, Taped in Ammo-pack, Formed Leads"	Aluminum Electrolytic
013 RLC	 <a href="#">Enlarge</a>	MAL2013b1339E3	<a href="#">Buy Now</a>	33	50	Radial	08.2x11	+85 °C	3000	"Radial, Long Straight Leads, Bulk"	Aluminum Electrolytic
013 RLC	 <a href="#">Enlarge</a>	MAL201361339E3	<a href="#">Buy Now</a>	33	50	Radial	08.2x11	+85 °C	3000	"Radial, Short Straight Leads, Bulk"	Aluminum Electrolytic

Selector Tool

# Design Resources

## Lifetime Calculator

- Selects product parameters by entering PN
- Allows for calculation of product lifetime based on customer's application
- Need to enter frequencies, temperatures, and duty cycle

### Lifetime Calculation Tool

Products » Aluminum Capacitors Lifetime Calculator

#### LIFETIME CALCULATOR FOR ALUMINUM CAPACITORS

Ordering Code:

Series Name:

Useful Life [h]:

Rated Ripple Current [A]:

Target Lifetime [year]:

Number of Parallel Branches:

**INPUT**

Main Frequency of Ripple Current [Hz]:

Ripple Current Multiplier:

Operating Condition Name	Operating Time per Year [h]	Percent per Year [%]	Operating Temperature T <sub>amb</sub> [°C]	Ripple Current I <sub>r</sub> [A]	Ripple Current I <sub>s</sub> [A]	Ripple Current I <sub>l</sub> [A]
On	4380	50.00	25	0		
Idle	1752	20	25	0.1		
On	2628	30	70	10		

**OUTPUT**

Operating Time [h]	I <sub>r</sub> [A]	Ratio I <sub>r</sub> / I <sub>e</sub>	Lifetime Multiplier	Error Message	Equivalent Useful Life [h]
43800	0	0	100	No errors occur	402
17520	0.08	0	100	No errors occur	161
26280	8.33	0.6	4.8	No errors occur	5475
Lifetime Used by Operating Conditions[h]:					6036

Capacitor's Lifetime at Tmax [h]:

Calculated Lifetime of Capacitor in Application:  h or  yr

Error Message:



[Aluminum Capacitors Lifetime Calculator | Vishay](#)

# Lifetime Calculation Tool

Products » Aluminum Capacitors Lifetime Calculator

## LIFETIME CALCULATOR FOR ALUMINUM CAPACITORS

Ordering Code:  ?

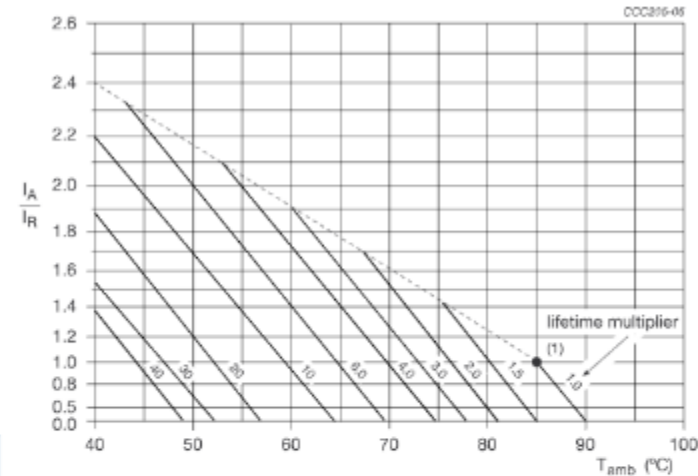
Series Name:  ?

Useful Life [h]:  ?

Rated Ripple Current [A]:  ?

Target Lifetime [year]:  ?

Number of Parallel Branches:  ?



[Help](#)

[Save as PDF](#)

[Print](#)

INPUT						
Main Frequency of Ripple Current [Hz]:		<input type="text" value="1000"/>				
Ripple Current Multiplier: ?		<input type="text" value="1.20"/>				
Operating Condition Name	Operating Time per Year [h]	Percent per Year [%]	Operating Temperature T <sub>amb</sub> [°C]	Ripple Current I <sub>1</sub> [A]	Ripple Current I <sub>2</sub> [A]	Ripple Current I <sub>3</sub> [A]
<input type="radio"/> Off	4380	50.00	25	0		
<input type="radio"/> Idle	1752	20	25	0.1		
<input type="radio"/> On	2628	30	70	10		

OUTPUT					
Operating Time [h]	I <sub>A</sub> [A]	Ratio I <sub>A</sub> / I <sub>R</sub>	Lifetime Multiplier	Error Message	Equivalent Useful Life [h]
43800	0	0	109	No errors occur	402
17520	0.08	0	109	No errors occur	161
26280	8.33	0.6	4.8	No errors occur	5475
Lifetime Used by Operating Conditions[h]:					6038

Capacitor's Lifetime at Tmax [h]:

Calculated Lifetime of Capacitor in Application:  h or  yr

Error Message:

[Store & Compute](#) [Reset](#)

# Call to Action

## How Will We Win Together?

- Bring any identified EDLC opportunity to Division. Competitors are seeing offering non-automotive products
- Heavy focus on ruggedized product capabilities, and advantages against competition (AEC-Q200)
- Look for EDLC opportunities in AI servers
- Focus on high temperature products such as 160-CLA, showing long operational lifetime (lifetime nomograms)
- Leverage European manufacturing vs Chinese competition for customers wanting to move away from China sources



# Capacitor Business Segment

*Aligning for Profitable Growth*

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