



196 HVC ENYCAP™ Frequently Asked Questions (FAQs)

Q: HOW CAN AN HVC SERIES DEVICE BE CHARGED?

A: The HVC series can be charged via:

- **Constant voltage (CV)** at RT using a series resistor from an accurate CV source (same as for EDLC).
For pulse charging, the fast charge voltage must not be exceeded and the maximum pulse duration has to be respected
- **Constant current (CC)** with voltage limitation
- **IC charging controllers** with an external charging IC, e.g.: LTC3355 (see evaluation kit MAL219699001E3)

Q: WHAT ARE THE EXPECTED CHARGE AND DISCHARGE CYCLES OF THE HVC SERIES?

- A:
- The cycle life is dependent on the charge and discharge conditions
 - The 196 HVC series is able to perform up to 100 000 cycles, depending on the depth of the discharge and temperature

Q: WHAT IS THE OPERATING TEMPERATURE OF THE 196 HVC SERIES?

- A:
- The operating temperature is -20 °C to +85 °C (15 F / 45 F / 90 F) and to a maximum of +70 °C for 4 F
 - Please note: performance on charge or discharge and also cycle life / endurance depend on operating temperatures

Q: WHY HAVE THE 196 HVC IN A SERIES CONNECTION WITH AN UNCHANGED CAPACITANCE: $C_1 \approx C_2 \approx \dots \approx C_n$?

- A:
- This is a result of applied balancing of the internal energy storage principles:
 - Electrochemical energy storage (Faradaic reactions)
 - Electrical double layer storage (electrostatic energy storage)
 - The 196 HVC series uses a combination of the above processes in a hybrid technology, which offers nearly the same capacitance (F) in a series connection as for the single capacitor

Q: WHAT IS THE ADVANTAGE OF 196 HVC CELLS VERSUS BATTERIES?

- A:
- HVC systems are maintenance-free and usually have a longer lifetime expectancy
 - Due to their recharge ability over the full operating life, they are able to supply more backup energy than a comparable battery (batteries would have to be replaced)
 - HVC systems have the higher permissible maximum operating temperature (85 °C vs. below 60 °C or 40 °C)
 - The HVC series has lower series resistance, allowing higher currents (burst power support) and usually higher power density
 - HVC devices are more cycle-resistant than (rechargeable) batteries and are more safe than lithium batteries

Q: WHAT IS THE DISADVANTAGE OF 196 HVC CELLS VERSUS BATTERIES?

- A:
- 196 HVC systems have less energy density than batteries
 - The self-discharge of HVC systems is usually higher than for batteries

Q: HOW IS THE SELF-DISCHARGE OF THE HVC SERIES?

- A:
- Classical EDLCs have a higher self-discharge than the 196 HVC.
At room temperature, EDLC products are usually discharged within 10 to 30 days
 - The HVC series has a very low self-discharge rate, which can be less than 5 % per month or less than 15 % after three months
 - The self-discharge rate increases with temperature

Q: ARE 196 HVC SERIES CAPACITORS RoHS-COMPLIANT?

A: Yes, see our official RoHS statements for further details.

Q: ARE 196 HVC SERIES CAPACITORS SUSCEPTIBLE TO VIBRATION?

A: 196 HVC ENYCAP capacitors are approved up to 10 g for safe use in consumer, automotive, and industrial environments.