



Capacitors for Electric Vehicle Applications

Capacitors are crucial for electric vehicle (EV) systems, enabling high efficiency, compact designs, and robust performance under demanding conditions. Modern EVs require specialized capacitor types for power conversion, noise suppression, energy storage, and voltage stabilization. With the move to higher voltages (400V–800V systems and beyond), the need for advanced, automotive-grade capacitors is rapidly growing.

KEY APPLICATIONS IN EVs

- **DC Link Filtering**
- **Smoothing and Ripple Filtering**
- **EMI Filtering**
- **Resonant & Snubber Circuits**

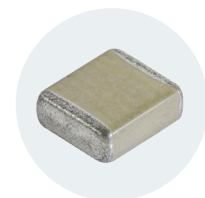
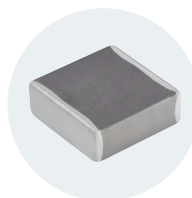


DESIGN CONSIDERATIONS

- **High Voltage & Ripple Handling:** Solutions up to 1,500V; low ESR for high-frequency performance.
- **Thermal Stability:** Reliable operation at automotive temperature extremes, often beyond -40°C to $+125^{\circ}\text{C}$.
- **Compact & Robust:** Surface-mount MLCCs offer high capacitance and voltage in small packages, reducing overall system size.
- **Fast Charge/Discharge:** Especially beneficial in applications like traction inverters, DC-DC converters, and on-board chargers.
- **Automotive-Grade Reliability:** AEC-Q200, IEC, and other automotive and safety certifications for stringent EV requirements.

SPECIALTY TECHNOLOGIES

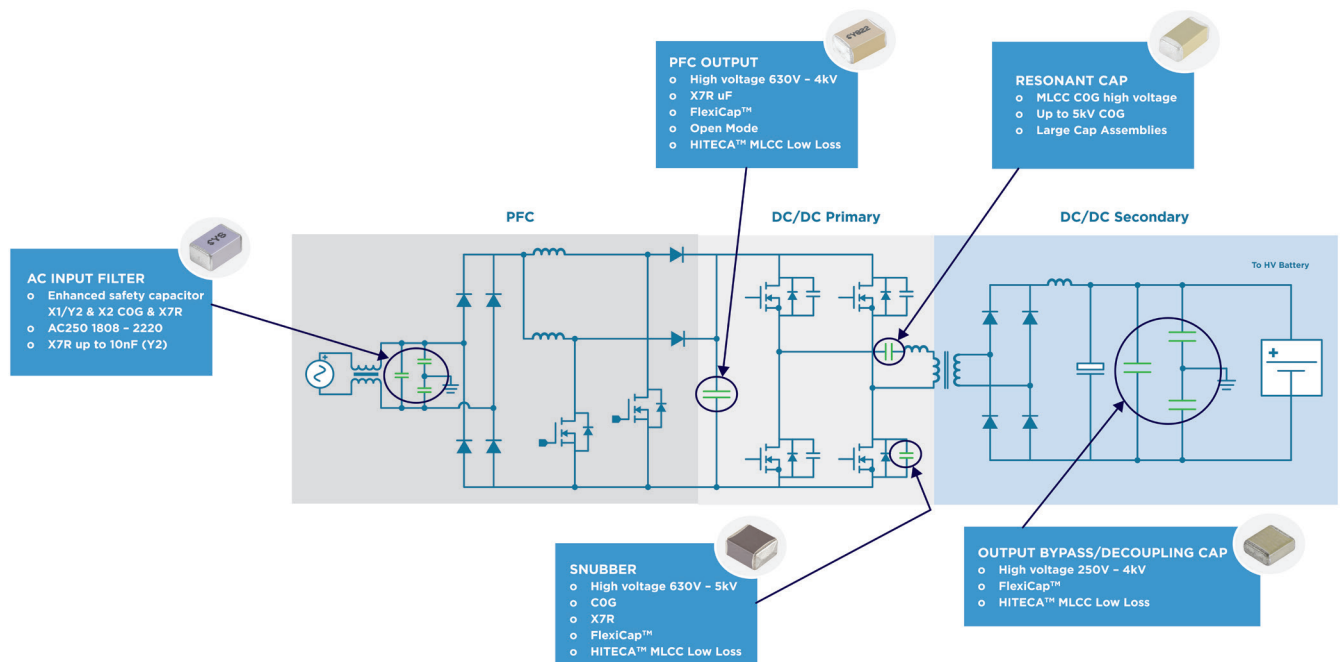
- **StackiCap & Hiteca MLCCs:** Enhanced thermal and electrical performance for DC link filtering and smoothing arrays.
- **Safety X/Y Capacitors:** For EMI suppression in power factor correction (PFC) and filter circuits with robust impulse ratings.
- **Resonant MLCCs:** COG dielectrics provide superior frequency and temperature stability for demanding resonant and snubber capacitor roles in EV DC/DC converters.





Recommended Capacitor Types for Critical EV Subsystems

TYPE	DESCRIPTION	PRODUCT RECOMMENDATIONS
AC Filter: EMI Filter	Use safety-rated, automotive-grade MLCC X and Y capacitors rated at 250–305Vrms, impulse tested to 2.5–8kV, with X7R or C0G dielectric, sized 1812–2220 or larger, with AEC-Q200 and IEC 60384-14 certifications for PFC EMI filters in electric vehicles	High Voltage Safety Capacitors
DC Link: Filter	A typical MLCC used for DC link filtering in electric vehicle applications will be a high-voltage (250V–1,200V), high-capacitance (100nF–5.6μF per device, often paralleled), X7R dielectric, AEC-Q200 qualified part in a large surface-mount package (e.g., 1812, 2220, 4040), with very low ESR and high RMS current capability	Stackicap Assemblies Hiteca High Temperature Capacitors
DC Link: Smoothing	A typical MLCC smoothing capacitor in EVs is a large, high-voltage, automotive-grade part (250V–1,500V, 1–100μF per device, SMD 1812/2220/4040), using X7R dielectric, with low ESR and AEC-Q200 qualification. Designers often use arrays of MLCCs to achieve both total capacitance and high-frequency ripple filtering required for EV inverter DC links and other smoothing tasks	Stackicap Assemblies J Lead Capacitor Assemblies
Resonant	A typical MLCC for a resonant capacitor in an LLC DC/DC converter for EVs is a surface-mount C0G (Class I) part, 10nF–50nF, voltage rating 1000V–1250V, case size 1210 or 2220, with extremely low ESR and AEC-Q200 qualification, selected to ensure outstanding stability and reliability under demanding automotive condition	Surface Mount J Lead C0G Capacitors
Snubber	A typical MLCC snubber capacitor for electric vehicles is a surface-mount, automotive-grade (AEC-Q200), high-voltage (600V–2,000V), low-ESR capacitor, 1nF–1μF, using C0G or X7R dielectric, in a 1206–3640 (often 2220) case size, capable of withstanding high-frequency, high-power stress with excellent reliability	Surface Mount J Lead C0G Capacitors



Contact us to discuss how our advanced MLCCs and safety-rated capacitors can optimize your EV designs for safety, efficiency, and long-term reliability.

Technical references available upon request. For specific design assistance or custom module solutions, our engineering team can help select the best capacitor technology for your requirements.