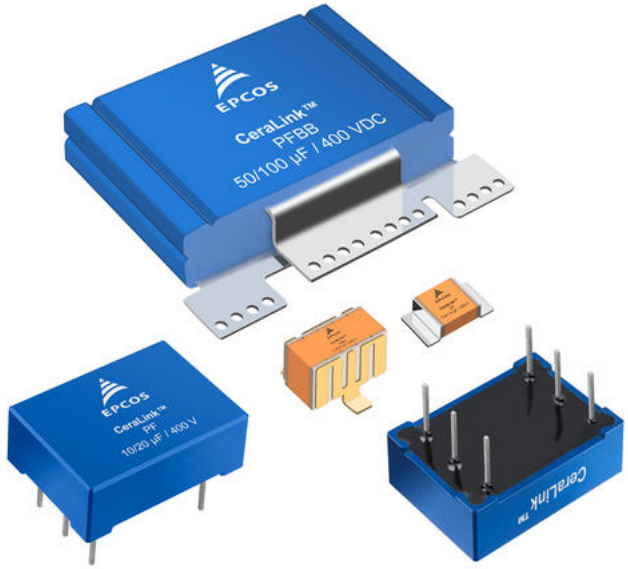
Ceramic technology designed to meet requirements of modern inverter designs



TDK Corporation presents CeraLink™, a new ceramic technology that is designed to meet the requirements of modern inverter designs in power electronics. Driven by the need for further efficiency improvements and compactness, innovative semiconductor technology is moving to higher switching frequencies, placing high demands on the capacitors used: stable operation at elevated temperatures, high current capability at high switching frequencies, and no drop of capacitance under high DC bias. Due to their basic material properties, existing capacitor technologies such as film, aluminum electrolytic, or classical multilayer ceramic are presently very challenged by these emerging requirements in power electronics.

TDK’s competence in the area of electroceramic materials and expertise in ceramic multilayer technology were the key enablers in the development of CeraLink™, a new and innovative ceramic capacitor technology which can fulfill these requirements. The heart of the new solution is an antiferroelectric PLZT ceramic material (lead lanthanum zirconate titanate), which offers an extremely high permittivity that even increases with rising bias voltage. CeraLink™ is designed as a ceramic multilayer component with copper inner electrodes in order to keep ESR to a minimum.

As a result, CeraLink™ is a ceramic component featuring outstanding high capacitance density, while at the same time offering extremely low ESR and ESL. The maximum temperature for continuous operation lies above 100 °C, and even allows much higher temperatures for short periods. Moreover, the current handling capability at frequencies beyond 10 kHz is outstanding.

Broad prototype portfolio

The present prototype portfolio covers a capacitance range from 1 µF to 100 µF at an operating voltage of 400 V. Several terminal designs, including SMD solutions, pin contacts and busbars are available.
First reference designs show that CeraLink™ can improve the system performance substantially. For example, a fast-switching IGBT DC/DC converter design using a 20-µF CeraLink™ achieves the same performance as a best in-class MOSFET solution using conventional DC link. A very compact main propulsion inverter for plug-in hybrid vehicles is also being designed featuring the new 100 µF CeraLink™ capacitors with busbar terminals and mounted on top of the 3 halfbridge IGBT modules.

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