Dc link current

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Unlike a toy car, electric vehicles do not operate directly from energy stored in the battery pack; a conversion is needed, Consider a system block diagram including a 3-stage power inverter for a hybrid/electric vehicle (HEV/EV) in Figure 3, where:

The DC-link capacitor''s purpose is to provide a more stable DC voltage, limiting fluctuations as the inverter sporadically demands heavy current. A design can use different technologies for DC-Link capacitors such as aluminum electrolytic, film, and ceramic types. The choice is not easy and depends strongly on the application.

Finding the best DC-Link capacitor starts by comparing nominal capacitance values and voltage ratings that translate to known energy requirements, while also shooting for high ripple current ratings. Ripples at DC-Link nodes, primarily generated by furiously fast-switching IGBTs or MOSFETs in Stage III (see Figure 3), affects performance because every real capacitor has some amount of impedance (and self-inductance). The DC-Link capacitor must regulate voltage and absorb ripples in the current, as well.

In general, nominal capacitance values can change due to changes in ambient operating temperature or changes in the applied voltage and frequency. Other variables for consideration: self-inductance can significantly reduce a capacitor''s effective impedance at high frequencies, thus changing the capacitor''s expected behavior. Regardless of the type of capacitor chosen, noise suppressors such as KEMET Flex Suppressors(R) can help suppress high-frequency noise generated by the surrounding environment.

While considering design options, ask whether DC-Link capacitor under consideration can hold up a reasonable level of charge voltage after the input voltage is removed in between switching cycles. To find the amount of energy that is stored in the DC-Link capacitor-to feed the load as the capacitor discharges (as well as the discharge voltage and the hold capacitor values)-calculate hold up capacitance:

Where Vin_max is the peak value of the rectified voltage (Vin_max= o Vline}, Vdisch is the discharge voltage (Vdisch = /2 o Vin_max) at some load value and line frequency (o), Vline is line voltage, Pload is load power, Pin is the inverter''s input average power, and VC_av is the voltage across the average value of Ch:

Furthermore, the ESR of the capacitor is often the limiting factor for the ripple current rating (i.e., the ripple current that the capacitor can handle without overheating). To achieve the needed low ESR and a long lifetime at high dissipation, the physical size of a film capacitor is such that it often results in a capacitor that already meets or surpasses the voltage ripple or hold-up calculations.

Finally, in any high-power design one must consider if cooling is provided and if so, what type? The ambient temperature profile is important to ensure thorough attention to choosing the best DC-Link capacitor.

A good example of film capacitors suitable for HEV/EVs is KEMET''s C4AQ film capacitor, which is AEC-Q200 rated for automotive applications and holds several significant advantages in DC-Link architectures. As mentioned above, KEMET''s C4AQ capacitors have all the superior benefits attributed to film capacitors. Alternatively, KEMET''s C4AE power film capacitors are similar to the C4AQ series of capacitors, but are not automotive-rated. Other capacitors suitable for non-automotive DC-Link applications include Ceramic KC-LINK and C44U and C4DE can film capacitors.

Monitoring can be critical to successful operation for high power inverter design. KEMET''s C/CT series of high current sensors enable real-time current measurement in a live wire. Thermal sensors are often integrated with safety requirements. KEMET''s fast-response OHD thermal sensors are dust, explosion, and corrosion proof with a wide range of operating temperatures up to 120?C.

As demonstrated above, selecting the appropriate DC-Link Capacitor can be an involved, but critically important, process. KEMET has the products and people necessary to streamline this process for you.

A DC link is an element connected between multiple power supplies. It can both couple these power supplies and act as a buffer storage for electrical energy. In practice, it is used to synchronize frequencies of different power supplies, for example. Its industrial use in electric drives offers further advantages, because it helps to conserve energy. Since DC links can act as an energy store, they can also be operated as a generator, e.g. to store braking energy for other uses. They can also be used to mitigate power peaks.