The Basics of Power Conversion and KEMET's New Film Capacitors

As electronic circuits evolve and advance, the demand for stable components capable of handling more power in extreme environments increases. Innovations in power supply designs, such as the use of wide bandgap semiconductors, require capacitors that operate at higher frequencies, at higher temperatures, and in smaller spaces. All the while, expectations of high reliability, safety, and long life also increase.

Film capacitors have been around for a long time, but modern technologies and processes have radically expanded the capabilities of these devices. Now, higher capacitance densities, frequencies, environmental ratings, low losses, and life expectancies are all being realized. Today's power film capacitors are the ideal solution for power conversion in sustainable energy, energy storage, industrial, or automotive applications.

Understanding Power Conversion

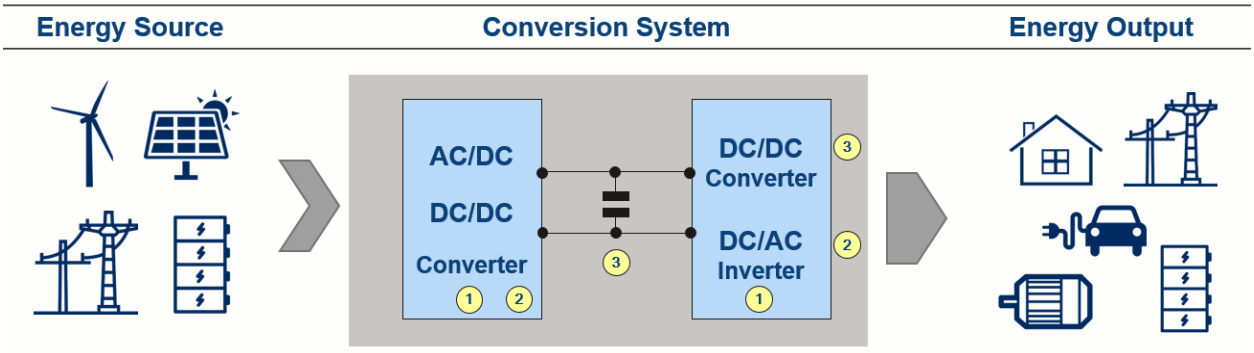

Figure 1: Energy Conversion Model

Power conversion circuitry takes energy from a power source and converts it into an output format usable by end devices. Energy sources could be the traditional power grid, renewable energy generators like solar or wind, or stored energy in batteries or capacitor banks. Those sources provide energy that is not conditioned for end devices, but rather it is conditioned for transmission or the raw output from the source.

Power conversion systems have an input stage, where the power is converted from AC or DC to the desired DC level, and then an output stage where the DC voltage is converted to the AC or DC level required by the end devices. These systems also include an intermediate stage where the DC-link capacitor, or capacitor bank, reside. The DC-link capacitor is responsible for filtering the voltage, and providing energy storage for a clean, consistent, and fast energy source to the output stage.

In each conversion stage, input and output, snubber capacitors (1, in figure above), are used to suppress undesirable voltage and current pulses created by the switching stages of the semiconductor devices. In either the input or output stage, AC filter capacitors can be found if AC voltage is coming in or going out

(2, in the figure above). In the input or intermediate stages, DC filter or DC-link capacitors (3, in the figure above) are found in all power conversion circuits. DC filter capacitors can also be found in the output stage if it is a DC/DC converter stage.

Applications and Industries

KEMET Film Capacitors serve the power converter needs of all kinds of industrial and commercial applications. They are particularly ideal for advanced technologies, in that they support high-frequency converters and harsh conditions, allowing them to work with new silicon and wide bandgap (WBG) semiconductors. These higher-efficiency power converters support the latest in energy storage, renewable generators such as wind and solar, and electric vehicles.

KEMET's Power Conversion Capacitor Solutions

KEMET's new film capacitors for power conversion meet the needs of today's most demanding applications. The entire package of R53B Emi Suppression, the C4AF-F AC filters, and the C4AU DC link capacitors is particularly suitable for latest power converters design used in renewable generators and it fits well with Solar and Wind application requirements in terms of extreme environment conditions and Long lifetime expectancy.

KEMET's Design Tools

KEMET's Film Division offers the experience and help to engineers with KEMET online design tools for simulating and picking the right capacitor for their application. The KEMET Film Lifetime calculator can help predict the service life of KEMET Metallized Film Capacitors capable to withstand harsh environmental conditions. It is the first tools of its kind to consider three key factors in a capacitor's life: Temperature, Relative Humidity & Voltage. To find out more about the tools visit the page https://ksim3.kemet.com/film-lifetime