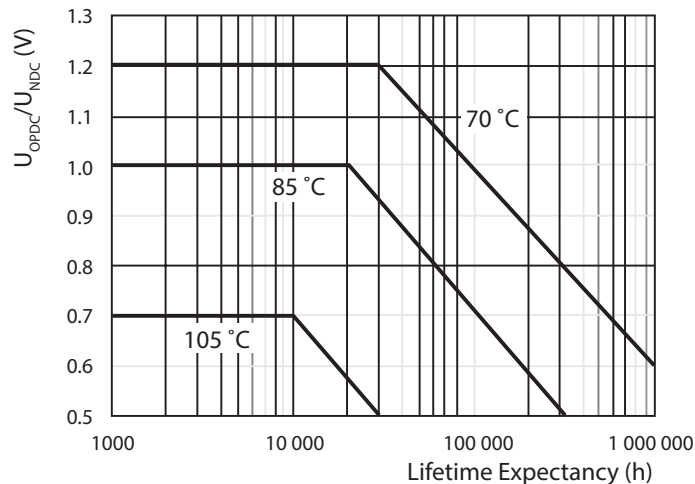




DID YOU KNOW? LIFE EXPECTANCY⁽¹⁾⁽²⁾ FOR DC-LINK FILM CAPACITORS

DC-Link film capacitors offer a very long life expectancy, a key requirement for OEMs interested in offering long warranties and reducing refurbishment maintenance costs. The main factors driving aging in a film capacitor are the voltage and temperature (including self-heating) at the capacitor during its service life, as depicted in the graph below.⁽¹⁾⁽²⁾



U_{NDC} is the nominal DC voltage at the nominal temperature of 85 °C, and U_{OPDC} is the DC operating voltage in a given application. The ratio between U_{OPDC} and U_{NDC} will influence the lifespan of the DC-Link capacitor.

Taking as an example the nominal conditions of U_{NDC} at 85 °C, the calculated life expectancy of the part is 20 000 hours. The same life expectancy is achieved if the capacitor is subjected to $1.2 V \times U_{NDC}$ at 70 °C, meaning that an increase in voltage at lower operation temperatures is possible without impairing life expectancy.

In another example with a voltage derating of $0.9 V \times U_{NDC}$ at an operating temperature of 70 °C, the life expectancy of the DC-Link film capacitor is extended to 200 000 hours. At the same temperature but at an U_{OPDC} of $0.6 V \times U_{NDC}$, the capacitor withstands 1 000 000 hours of operation.

At the other end of the spectrum, and by submitting the capacitor to the maximum operating temperature of 105 °C, the designer must be aware that the DC voltage must be limited to $0.7 V \times U_{NDC}$, and that under these conditions the lifespan will be limited to 10 000 hours. However, as in previous examples, further voltage derating will improve the lifespan even at this maximum permissible operating temperature.

A smart design focused on a long lifetime is closely linked with the voltage and temperature applied. By considering voltage deratings and ensuring lower operating temperatures, designers can extend the life expectancy of DC-Link film capacitors to well above 100 000 hours.

(1) Expected lifetime is calculated as MTTF (mean time to failure) based on stress models according to IEC 61709

(2) Statements about lifetime are based on calculations which are based on internal tests. They have to be understood exclusively as estimations.

Also, due to external factors, the lifetime in the field application may deviate from the calculated lifetime