KEMET

New and Lower ESR Capabilities in Polymer Products

KEMET Electronics Corp's latest polymer based tantalum and aluminum product lines now include ESR capabilities lower than initial offerings. With this family, a suffix is now included with the part number to define the maximum ESR at 100 kHz for each offering of each part type. These offerings are too extensive to view in this article, so for the sake of brevity, the following details the ESR range with a single tantalum-polymer ("KO" or T520 part type):

EIA Size Code	KEMET Part Type	Capacitance (uF)	DC Rating DCV	Leakage @ Rated (uA)	100 kHz ESR (mOhm)
7343-20	T520V337M003ASE025	330	3.0	99	25
	T520V337M003ASE015				15
	T520V337M003ASE012				12

The difference in these parts is limited to the variation of ESR achievable with each. This difference is attributable to process, material, and sort limits, creating a distribution that is more exacting with the lower ESRs. A view of expected or typical Impedance and ESR versus frequency is shown in Figure 1. The early or lower frequency impedance is dominated by the capacitance of the part, but as the frequency approaches self-resonance, the impedance continues down for the lower ESR values while remaining higher for the higher ESR values.

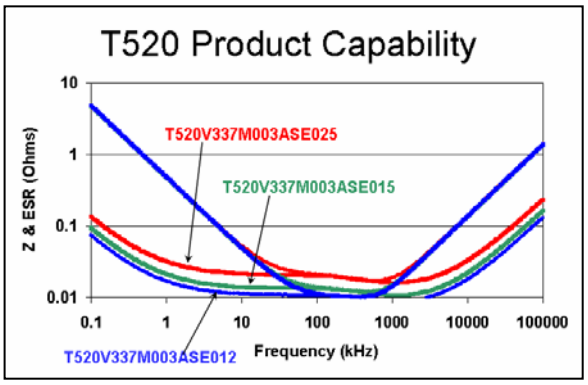

Figure 1. Multiple ESR limits defining single part type.

This difference in impedance, dictated by the ESR capability, is directly related to the ripple capability for these three variations of this part type. In Figure 2, the plot of ripple current capability (creating the power to raise the internal temperature by +20°C over the ambient – an arbitrary value) shows an increasing current capability as the ESR values are lower. In Figure 2, the listed ripple currents for the three ESR suffix codes of this part type at 100 kHz, are 2.48 (E025), 3.07 (E015), and 3.42 ARMS (E012).

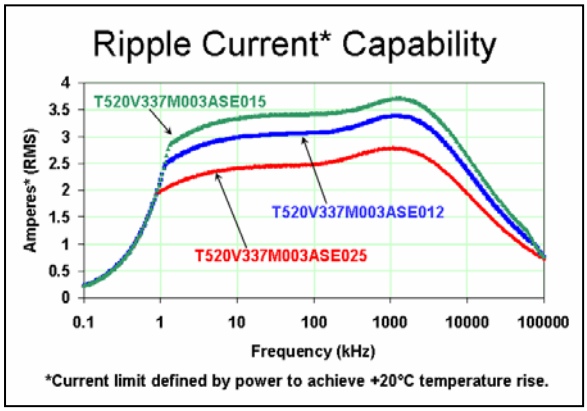

Figure 2. RMS Ripple Current capability.

Not only does the ESR have a direct impact on the impedance, but because this device (as with all electrolytics) responds as an RC-Ladder, the capacitance retained in the higher frequencies is related to the resistive elements of the RC-Ladder (assuming the capacitive elements remain the same). The effective capacitance retained at the higher frequencies is inversely proportional to the ESR – the higher the ESR, the lower the capacitance,. This effect is frequency related but to compare the effects, the capacitances at 100 kHz are shown in Figure 3, along with the associated 100 kHz ESR for these devices. Again, for the three suffix coded parts, the capacitances are 236 uF (E025), 275 uF (E015), and 293 uF (E012).

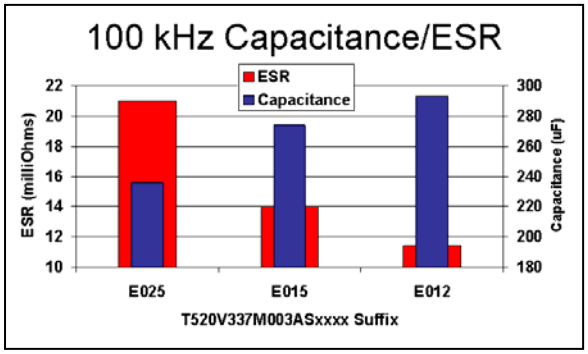

Figure 3. Relationship between capacitance and ESR.

The ESR offerings in the polymer tantalum (T520), are also defined for the T525 family (high temperature version of T520), the T530 (multiple-pellet versions of the single pellet T520) and the A700 family (aluminum-polymer construction with aluminum replacing tantalum as the anode or valve metal).

The selection of the ESR limit is left to the designer, with an understanding that as we get stricter with our ESR limits, the yield normally decrease and this can impact pricing. To get a list of the latest offerings of lower ESR capacitors, visit the KEMET web site at www.kemet.com, or contact our sales office.