

Time Dependent Capacitance Drift of X7R MLCCs Under Exposure to a Constant DC-Bias Voltage

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Until recently, it was assumed that multilayer ceramic capacitor (MLCC) manufacturers' data stating the typical voltage coefficient of capacitance (VCC) and capacitance loss due to aging (no bias) could be additive, and that further capacitance drift over time will not be significant. However, recent research of the capacitance changes of X7R MLCCs under exposure to a constant DC bias voltage has shown that a time-related capacitance drift exists that can be much larger than the typical VCC and normal aging effect combined. This was first questioned by an automotive manufacturer and reported as an issue in critical systems that was related to capacitance loss and bias aging. A study of the DC Bias aging for a very common MLCC (0603 X7R 100nF 50V) was performed which subjected the capacitors to DC bias at 40% and 100% of the rated voltage for more than 1000 hours. The capacitance was measured intermittently to measure the drift. Results indicated the construction and/or material system of the part affected the degree of capacitance drift. Recovery of the capacitance after the bias was removed, also tended to depend on this construction.