TECHNICAL PAPER

Conductive Polymer Capacitors Basic Guidelines

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Abstract:
Conductive Polymer Capacitors are relatively new solid electrolytic capacitor technology on the market. The range of application is growing also due to their low ESR and safe operational characteristics. The paper addresses frequently asked questions about product life, construction, parametric performance, product specifications, recommendations and applications.

A Basic Guide to AVX Conductive Polymer Capacitors (Q&A)

1: Introduction to Polymer Capacitors

The AVX solid electrolyte capacitor product range provides an exceptional portfolio of technologies, including traditional manganese oxide electrolytic capacitors (Tantalum/MnO_2), the award winning Niobium Oxide (OxiCap®) series, and a wide range of low ESR conductive polymer solid electrolytic capacitors, including market highest voltage ratings and also hermetically sealed high reliability polymers (award winner).

Being based on similar electrochemistry and design principals, all these solid electrolytic technologies share the same basic electrical characteristics and behavior which are described in AVX catalog and technical papers, ref. [1],[3],[4]. However it is the small differences that suit the different series to specific applications, and this guide is intended to help the design engineer better understand the performance strengths and design considerations for each series.

AVX has developed broad range of Polymer solid electrolytic capacitors offering very low ESR, high bulk capacitance and improved capacitance retention at higher frequencies. The range of AVX Conductive Polymer capacitor series includes:

- **EIA standard, miniature and low profile** molded body case sizes (with J-lead design);
- **Face-down / "undertab" and ultraminiature** designs for high density circuit assemblies;
- **Extended Capacitance**
- **Extended voltage** ratings (up to 125V);
- **Multi-anode series** for Ultra-Low ESR;
- **High Energy Density** (Joule / cc) series;
- **Automotive, Professional Grade** and **COTSplus** series for specific market needs.

All series components are 100% surge current tested, 100% temperature / voltage aged and 100% reflow preconditioned followed by 100% test for all electrical parameters (Capacitance, DF, ESR, DC leakage).

2: Frequently Asked Questions

2.1 Polymer Electrolytics compared

Q1: What are the **key advantages** of Conductive Polymer Solid Electrolytic capacitors?

A: Compared to traditional (MnO_2 electrolyte) tantalum capacitors, they have:

- **Significantly lower ESR** (with associated higher ripple current ratings);
- **Improved Capacitance retention** at high frequency
- **Higher energy density** (Joules/cc);
- **Wider voltage range** (with ratings available from 2.5v to 125v);
- **Less voltage derating required;**
- **Benign failure mode** if short-circuited.

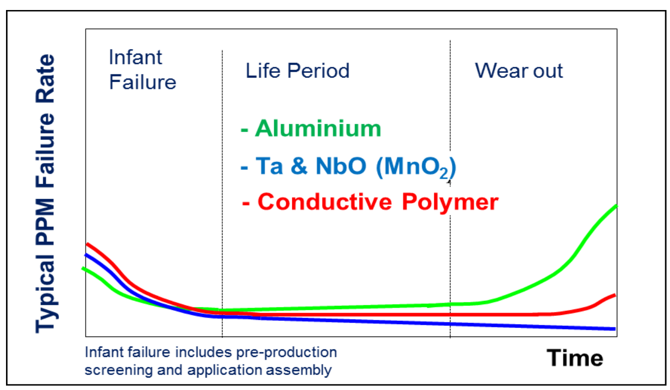
Q2: What are the **key limitations** of Conductive Polymer Capacitors?

A: Compared to traditional (MnO_2 electrolyte) Tantalum capacitors, they typically have:

- **Temperature range of -55ºC to 105ºC max.** (for standard series; Professional Grade series are rated to 125ºC max.);
- **Moisture Sensitivity Level MSL = 3 rating** (as with many Low ESR Tantalum capacitor ratings);
- **Sensitivity to excessive thermo-mechanical stress** is higher than MnO_2 Tantalum capacitors
- **Higher intrinsic DCL and longer DCL stabilization time** required at lower temperatures;
- A **defined lifetime** with respect to capacitance change (see section 5).

Q3: What are **other typical Polymer Solid Electrolytic capacitor characteristics** and **how do they compare to other capacitor** technologies?

As with traditional MnO_2 electrolyte tantalum capacitors, Conductive Polymer capacitors are polar devices and



carry a positive polarity marking. These capacitor families share the following characteristics:

Chart 1: Relative failure rate (ppm) over time for solid electrolytic capacitors

- **Proven long term reliability**;
- **High volumetric efficiency** (high capacitance / voltage per cc);
- **Good Parametric stability** over a temperature range

of -55°C to 105°C / 125°C;
- **No voltage coefficient** (change of capacitance with applied DC bias).
- **Excellent low frequency / acoustic** (low frequency) noise performance characteristics;
- **Excellent mechanical robustness**.
- **Low inductance**, especially with facedown / undertab termination designs.

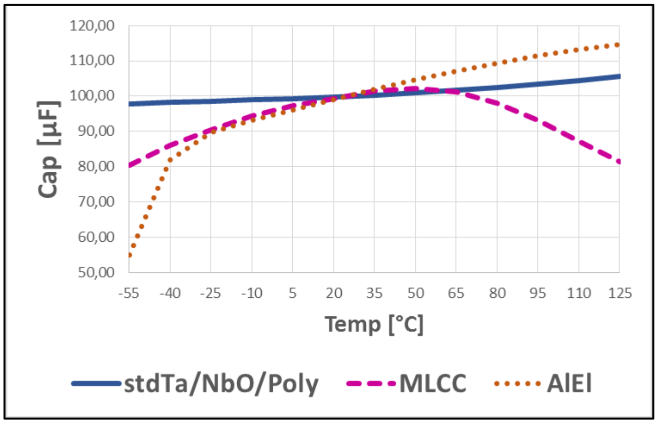


***Chart 2: Typical Capacitance Temperature characteristics** for different Capacitor technologies*

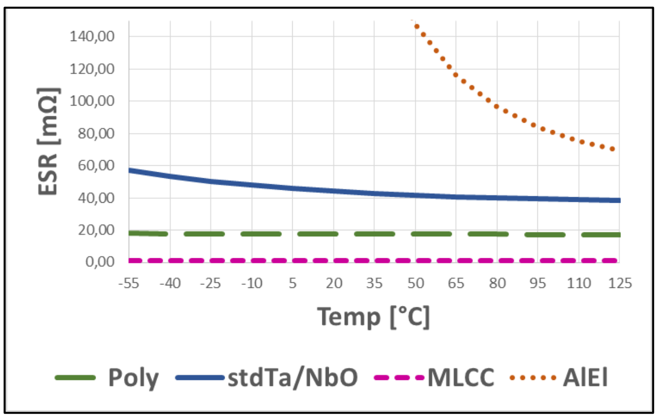


***Chart 3: Typical ESR Temperature characteristics** for different Capacitor technologies*

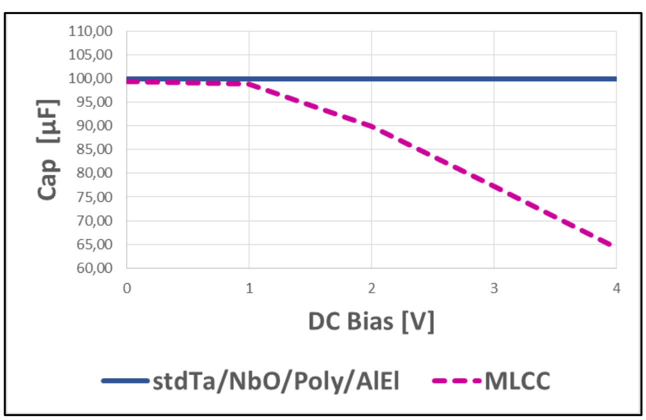


***Chart 4: Typical Capacitance DC bias characteristic** for different Capacitor technologies*

2.2 Voltage Derating & Surge Current

Q4: Why do we need voltage derating for Polymer capacitors?

A: Voltage derating is the term used when selecting a capacitor with rated voltage (Ur) higher than the application operating voltage. In general, voltage derating is the most effective way to reduce the failure rate. Parts can withstand full rated voltage ~~for~~ **under** the endurance **conditions** specified in **the individual** product specifications, but derating **reduces** failure rate significantly and **provides additional safety margin** in the circuit design.

Conductive **polymer capacitor steady state derating** is based on two main factors:

- **operating voltage derating**, which is necessary to protect the capacitor in case of any voltage or current overload conditions;
- **operating temperature derating,** which is to compensate for high temperature load conditions.

Both Voltage and Temperature factors are stress factors to dielectric increasing leakage current so it must be compensated by reduced voltage to achieve the same lifetime.

AVX considers voltage and temperature derating in the specified derating recommendations for each specific conductive polymer product – ref Q5.

Based on design and process specifics and tunes to meet application requests, AVX splits conductive polymer products to **specific categories by their temperature performance**. The maximum operating temperature and appropriate voltage derating level of the part number should **follow the product category displayed in the datasheet** – ref AVX conductive polymer series catalog.

Q5: What are the **recommended derating guidelines** for AVX conductive polymer capacitors?

A: Typical conductive polymer voltage derating levels are:
- **90% (10% derating)** for products rated up to 10Vr
- **80% (20% derating)** for products 16Vr and higher

The steady-state derating guidelines are shown in chart 5 below, which gives the maximum recommended Voltage (as a percentage of rated Voltage) by application Temperature. Please refer to the specific series datasheet for any given part number.

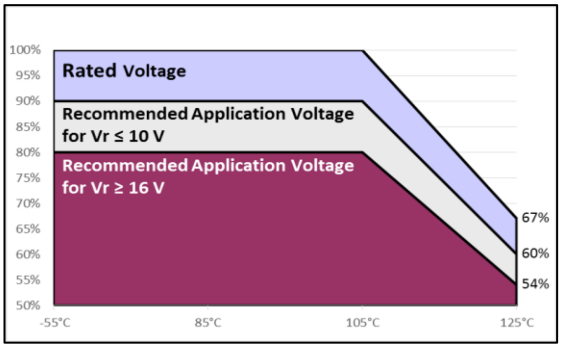


Chart 5: Example of derating chart in datasheet

Please note that derating guidelines are subject to update as a result of both continual improvement programs associated with capacitor design, and the evolution of target applications. Always refer to the latest series datasheet, and, in case of any application concerns, please contact AVX.

Q6: AVX specifies maximum Surge Voltage as 1.3x Rated Voltage (Vr). What is the **real maximum Surge voltage** that polymer capacitor can withstand?

A: The **maximum surge voltage is specified as 1.3xVr** (rated voltage) up to 85°C when tested with a high series resistance (1kOhm) and in dynamic (surge) conditions (typically at a maximum cycle rate of 10 times in an hour for periods of up to 30 seconds at a time).

Note also that the surge voltage should not be used as a parameter in the design of circuits in which the capacitor is periodically charged and discharged.

Please contact manufacture if need the additional information.

Q7: How does the **maximum Surge Voltage relates to voltage derating**?

A: The maximum Surge Voltage above 85°C follows the recommended derating curve with temperature. Please refer to the specific product datasheet.

Q8: What is the **Surge Current** that the capacitor can withstand?

A: The designer should consider the maximum surge current in the application, as excess current may damage the capacitor. As shown in the data sheet, **AVX conductive polymer capacitors can withstand relatively high surge currents**, **being 100% surge tested through very low circuit resistance**. If the voltage and temperature derating recommendations are followed, then conductive polymer capacitors **can be an ideal choice for critical power supply filtering applications.** For application support, please contact the factory.

AVX conductive polymer capacitors receive 100% surge current preconditioning using multiple high current cycles at 1.1x rated voltage in a proprietary AVX dynamic current monitoring system [4]. The peak surge current applied to each part is given by*:

$$I_P = \frac{1.1 * V_R}{0.45 + ESR}$$

Where: **I_P** is the peak surge current [A]
V_R is the rated voltage [V]
0.45 is external test circuit resistance [Ohm]
ESR for the capacitor under test [Ohm]

* Check limits for individual ratings in the series data sheet.

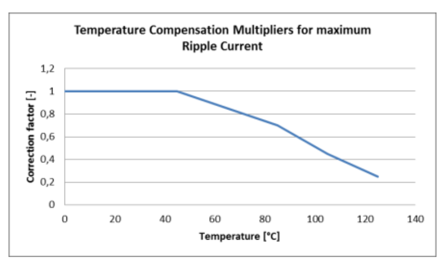
Q9: What is the **RMS ripple current** limit that the polymer capacitor can handle continuously?

A: The ripple current limit is calculated from the amount of Joule heating required to produce an increase in the body temperature of 30°C above ambient in free space at 100 kHz and is listed in the datasheet for each rating. In practice, the self-heating process is influenced by many parameters after board mounting such as the cooling impact of the board, nearby heat generation by other components, free air flow, heat convection path etc., as well as being a function of the applied frequency. Usually, once the component is assembled, the heat-sinking effect of the circuit board is often better than the free-air condition.

If there is any concern about the continuous capacitor power loading, it is a good idea to monitor the component temperature in the application with a thermocouple or IR camera. The final temperature should not exceed the maximum specified operating temperature for the specific product – please refer to the datasheet.

Because component temperature rise due to ripple current is dependent on the heat dissipation of the surrounding material, **the component operating temperature must be also considered** for maximum ripple current calculation. If operated above 45°C, these derating coefficients must be considered:

Temperature (°C)	Ripple factor
0	1
45	1
85	0,7
105	0,45
125	0,25



For more details about AVX ripple ratings please refer to **AVX Polymer, Tantalum and Niobium Oxide capacitors catalog, Technical Summary and Application Guidelines, section 2.**

Q10: What is the **maximum continuous RMS ripple voltage** that can be applied to conductive polymer capacitors?

A: The RMS continuous voltage is calculated by Ohms's law from the RMS continuous ripple current and ESR of the capacitor, and is listed in the data sheet for each rating:

$$V_{RMS} = I_{RMS} * ESR.$$

where I_{RMS} is the ripple current [A]
ESR for the capacitor under test [Ohm]

Please refer to question Q9 above for the RMS current.

Q11: **How many current surges can be applied** to conductive polymer capacitors?

A: First, verify that the maximum surge current does not exceed the peak value as defined in Q8, then ensure that the application conditions (duty cycle, operating frequency etc.) do not induce additional self-heating in the capacitor and that it stays within 10°C of ambient.

If this is maintained, then there is no limit to the number of current surges that can be applied.

Improved surge current performance is a major focus of AVX continuous improvement programs. This has resulted in a very low occurrence of early-life ("infant mortality") surge failures seen, and of these more than 90% of surge current failures occur during the first two repeated hard current surges (per equation given in Q8).

Q12: What is the **maximum allowable reverse voltage** for conductive polymer capacitors?

A: Conductive polymer capacitors are polarized devices and attention has to be paid to the correct use and application that is not causing continuous operation in reverse voltage. Nevertheless conductive polymer capacitors can tolerate some small reverse volt spikes, provided that the peak reverse voltage applied to the capacitor **must not exceed:**

15% of the rated DC working voltage at 25°C
5% of the rated DC working voltage at 85°C
3% of the rated DC working voltage at 125°C

Please contact AVX for specific application questions.

Q13: What is the **maximum allowed AC ripple voltage** for conductive polymer capacitors?

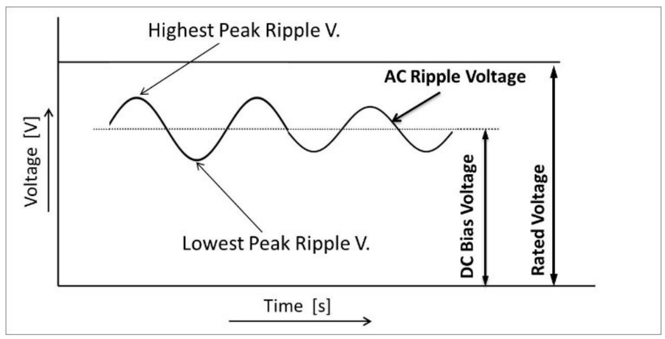
A: The maximum AC ripple voltage is limited by the following conditions: (see also chart 6)

1. The sum of DC bias voltage and AC highest peak ripple voltage must not exceed the rated voltage of the capacitor.

2. The DC bias voltage must be set to ensure, preferably, that the voltage does not go below zero volts, and certainly does not go below the allowed reverse voltage, at the minimum of the ac cycle. – see Q12

3. The continuous RMS voltage shall not exceed the specification value – see Q9 and Q10

Chart 6. AC Ripple Voltage



Q14: What is the **capacitance change with AC ripple voltage**?

A: Conductive polymer capacitors exhibit **almost no change in capacitance** (typically <1%) with applied AC ripple voltage.

Q15: Is **PSpice simulation model** available for conductive polymer capacitors?

A: Yes, AVX has been a leader in development of accurate, user-friendly simulation tools for conductive polymer capacitors. The AVX web site offers an online simulation tool - SpiTan - that provides typical frequency and temperature characteristics. The charts, equivalent circuits and S-parameters can be downloaded and used with a wide range of PSpice simulation software.

3: Board Mounting and Assembly

Q16: What are the **recommended board mounting conditions** for conductive polymer capacitor?

A: Conductive polymer capacitors can be sensitive to excessive thermo-mechanical stress, so **care needs to be taken to keep the board mounting** and assembly conditions within AVX recommendations (based on JEDEC 020):

- **Hand soldering is not recommended** due to the difficulty to control heat exposure time; for rework, a hot air jet is recommended.

- **Wave soldering is allowable** based on the short duration that the part is exposed to the maximum solder wave temperature.

- **AVX reflow recommendations follow JEDEC 020 requirements**, and extend these to a maximum of three reflows cycles with a peak of 260°C for a total duration of 30 seconds. Nevertheless, it is always good practice to keep the number of reflows and peak temperature as low as practical to minimize the potential for defects.

- A **critical reflow parameter is the maximum peak temperature gradient** – this should not exceed 2.5°C per second. The reflow profile should also include a preheating period to allow slow moisture evaporation from the capacitor.

- **The MSL level** associated with the capacitors will define the procedures to be followed after dry pack opening to minimize moisture exposure prior to board mounting and reflow.

- **Re-finishing** of conductive polymer capacitor terminations by hot solder dip **is not recommended**.

Q17: What is the **MSL level** for conductive polymer capacitors?

A: Molded conductive polymer capacitors are typically assessed as MSL level 3 components; this means they are supplied in dry pack and need to be processed within 168 hours after opening, or dried at 40**°C** for 168 hours prior to use. However, for MSL level specified, please always refer to the product instruction label affixed to the sealed bag.

In order to improve humidity robustness of conductive polymer capacitors in the application, **additional moisture barriers can be applied such as conformal coatings** after the components PCB assembly process. (reference also Section 5 of this guide: Reliability and Life Time)

TCH series hermetically sealed polymer capacitors are MSL level 1 components.

4: Applications Related Questions

Q18: What are the **main circuit applications** for conductive polymer capacitors? Are there any circuit applications that are **NOT recommended?**

A: Conductive polymer capacitors are the preferred choice in wide range of switching, filtering, coupling/decoupling, timing and back up circuits due their reliability and **parametric stability**.

They exhibit **negligible piezo** noise (a characteristic of Class II ceramic dielectrics that can cause an audible hum at low frequency or spurious voltage spikes under shock or vibration conditions), suiting them to low distortion applications in audio/video circuits and also LED backlighting. Their **low ESR** makes them an ideal choice for high power filtering, but it is important to follow the correct voltage derating, surge current and maximum ripple allowances in these applications – see Q5 to Q11.

Many mission-critical applications can benefit from Low ESR characteristics of Conductive Polymer Capacitors. For high reliability applications support please contact AVX.

AVX products are designed for use in general electronic equipment and **not specifically for use in the following environments:**
- In liquids, such as water, oil or organic solvents.
- In vapor, condensed vapor or in air with a high concentration of corrosive gas (Cl2, H2S, NH3, SO2, or NOx,..) acid, or alkaline environments
- In an environment where strong static electricity or electromagnetic waves exist.
- Mounting or placing heat-generating components or inflammable materials near these products.

In case of intended usage in any of the above environments, please contact AVX.

Q19: Is high altitude / low pressure / high pressure and vacuum operation influencing the conductive polymer performance?

A: **No.** High altitude / low pressure and vacuum operation have no impact on the function of conductive polymer capacitors. However, attention must be paid to the power dissipation as there will be limited convectional air cooling. It is important not to exceed the recommended maximum self-heating body temperature increase of 10°C by RMS current. See questions Q9-Q10 above. In case of operation in high pressure environments, please consult AVX.

Q20: Are conductive polymer capacitors sensitive to radiation exposure?

A: **No**. In general both MIL and ESA space application specifications classify these components as **not radiation sensitive.** Conductive polymer capacitors have been evaluated at total ionization dose (TID) test using a Co60 γ source up to 200k rad irradiation at dose rate 500rad/hr without impact to the part performance (contact AVX for testing details).

Q21: Are conductive polymer capacitors ESD (Electrostatic Discharge) sensitive devices?

A: **No.** They are designated as non-ESD sensitive devices, and do not require anti-static or conductive tape & reel packaging. ESD is characterized by a short duration, very high voltage spike, but with a small energy charge. Polymer capacitors are very high capacitance devices. Because of this, the short duration of a typical ESD pulse only allows charging to take place on the external body of the capacitor, which only results in a voltage increase in the 100mV range and has no impact on the capacitor dielectric layer. In general, polymer capacitors are both good absorbers and suppressors of ESD pulses.

Q22: Are conductive polymer capacitors available as automotive grade components?

A: **Yes**. AVX has introduced **TCQ series**, **a range of AEC-Q200 compliant** Conductive Polymer Capacitors. Standard Conductive Polymer technology is capable of withstanding harsh mechanical shock and vibration, as well as exposure to wide temperature range environments. To meet the additional high humidity requirements of automotive applications, the AEC-Q200 compliant series incorporates specific enhancements in design, polymerization process and additional humidity protection coats. This series is suited to a wide range of automotive applications such as cabin electronics, entertainment, telematics, etc.

Note that for some higher temperature applications above 105°C, such as in the engine compartment, or in hot fluid sensors, AVX AEC-Q200 series of tantalum chip (TAJ, TRJ, THJ etc.) or OxiCap® capacitors are recommended.

Please check the AVX web site or contact AVX for the latest information on AEC-Q200 compliant products.

5: <u>Reliability and Lifetime</u>

Q23: How is the application failure rate in steady state calculated for Conductive Polymer Capacitors?

A: The steady state failure rate (F) is calculated by multiplying the base failure rate (Fb) by other factors: Operating voltage (Fv), operating temperature (Ft) and circuit resistance (Fr):

F = Fb x Fv x Ft x Fr

The typical <u>base failure rate</u> (Fb) for Conductive Polymer Capacitors is established at **1%/1000hrs at rated voltage at 85°C** and 60% confidence level. However some series may offer lower failure rate **-** please refer to the appropriate series data sheet.

For derating in a given application, the factors for Fv x Ft x Fr can be found from these charts:

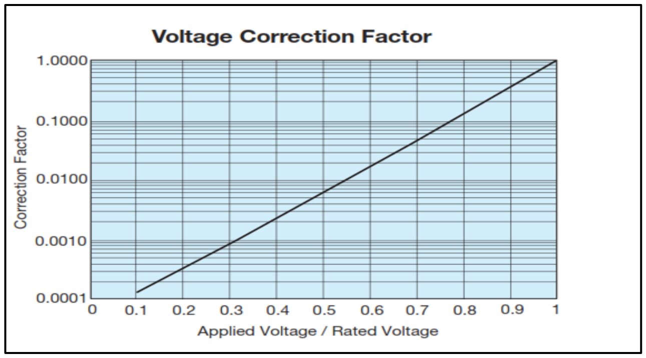


Chart 7: Operating voltage correction factor Fv

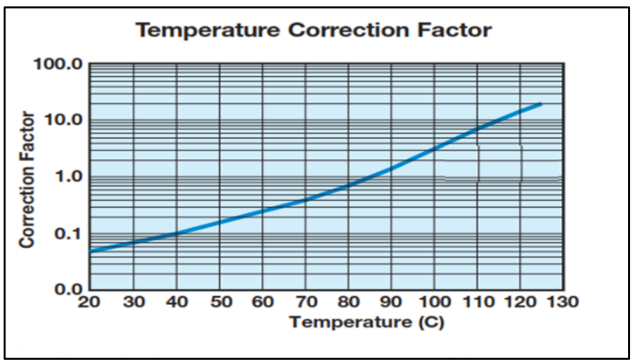


Chart 8: Operating temperature correction Ft

Circuit Resistance ohms/volt	FR
3.0	0.07
2.0	0.1
1.0	0.2
0.8	0.3
0.6	0.4
0.4	0.6
0.2	0.8
0.1	1.0

Chart 9: Circuit Impedance (Series Resistance) correction Fr

Failure rate will decrease as external series resistance increases. Nominal failure rate is standardized at 0.1 Ohms per volt, and Chart 9 gives the correction factor to be applied as external series resistance is increased.

AVX maintains a **periodic qualification monitor which shows that Conductive Polymer Capacitors generally achieve a much lower base failure rate** than shown above. For current failure rate data for a specific rating, please contact AVX**.**

Q24: What is the lifetime for Conductive Polymer Capacitors?

While there is no dielectric wear-out mechanism to affect reliability, the electrolyte used in Conductive Polymer Capacitors **can exhibit small parametric changes over time if operated continuously at high temperature, especially in a high humidity environment.** This parametric change is typically a small reduction in capacitance and small increase in ESR, and lifetime is defined as the number of the hours at maximum temperature to give rise to a certain percentage capacitance loss (similar to plastic film capacitor technology). In general, the lifetime effect is less for Conductive Polymer Capacitors than aluminum electrolytic capacitor technologies - see Q25.

Q25: **What is the typical lifetime** (Capacitance change over time)?

A: Conductive Polymer Capacitors are designed to operate within the limits of the environmental conditions specified for each series. **If operated continuously at their maximum temperature and / or humidity limit beyond these limits, capacitors may exhibit a parametric shift in Capacitance and increases in ESR**, related to the effects of oxygen and humidity to conductive polymer cathode. These changes may occur earlier if the specified environmental conditions are exceeded. Similarly, their normal operational time period will be significantly extended if their general duty cycle includes operation below maximum temperature within humidity controlled environments.

Note: TCH series hermetically sealed polymer capacitors do not exhibit this life-time effect.

Careful attention should be paid to maximum temperature with associated high humidity environments as well as voltage derating, ripple current and current surges. Reference sections 2, 3 and 4 of this guide line.

Lifetime can be extended if the PCB is conformally coated with parylene or similar environmental protection material.

The level of change over time is a function of the operating conditions, applied voltage and also the capacitor design. The conservative design of molded Conductive Polymer professional series, with enhanced encapsulation protection, also provides a higher level of resistance to oxygen and humidity effects, and thus more stable capacitance lifetime behavior. **The higher specification Conductive Polymer Capacitor series such as TCQ automotive or TCH hermetic are strongly recommended for use in high end / long lifetime applications**.

Even for the standard commercial TCJ series, the capacitance decrease with lifetime under typical application conditions may not be significant, **but it should be factored in for applications requiring long operational lifetimes.**

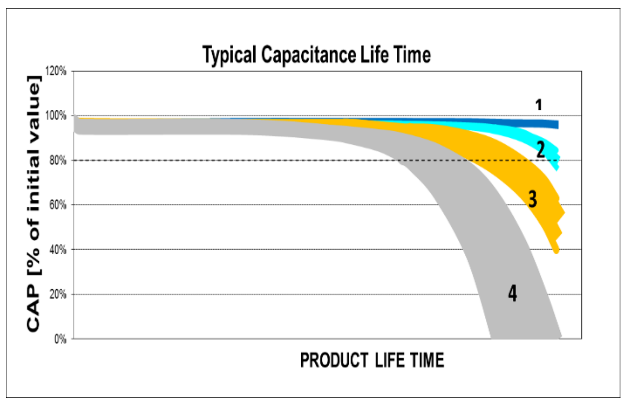


Chart 10. Typical long life time for Capacitance for solid electrolytics

*1 – **Ta/MnO2, NbO/MnO2** solid electrolytics and **hermetically sealed polymer**, such as AVX TCH*
*2 – **Conductive polymer COTSplus, professional** and **automotive** series such as AVX TCQ, TCB*
*3 – **Commercial cond.polymer** series, such as TCJ*
*4 – **Other electrolytics***

Q26: Can the lifetime effect be reduced or eliminated by circuit design?

A. Yes, the parametric changes for conductive polymer capacitors noted in Q24 and Q25, are associated with long term exposure to harsh or excessive conditions (mainly high temperature, humidity and voltage overload combined), which is possible to control by the correct choice of product series, application design (with respect to voltage derating) and circuit board protection methods (e.g. parylene conformal coating).

For details, please contact AVX.

Q27: What is the **allowable change in electrical parameters** over time at maximum temperature & voltage?

A: For details, see the specific product series data sheet.

Q28: What is the **impact of Biased Humidity Test** on Polymer capacitors?

A: **The standard humidity qualification test for Conductive Polymer Capacitors is DHSS** - Damp Heat Steady State (unbiased) for 65±2ºC and 95±2% RH (Relative Humidity) for 500 hours. If bias is applied, standard Conductive Polymer Capacitors can operate at a lower temperature damp heat load condition of 40ºC and 90% RH. However, the higher specification Conductive Polymer Capacitor series – TCQ automotive or TCH hermetic are designed for higher humidity resistance. For example, for the highly accelerated Biased Humidity Test (85ºC and 85% RH), TCB series can meet 500/1000hrs with rated voltage applied, and TCQ AEC-Q200 compliant series for automotive applications can meet at least 1000hrs with rated voltage applied.

Q29: What are the **typical DCL characteristics** for Conductive Polymer Capacitors?

A: As with all electrolytic technologies, Conductive Polymer Capacitors exhibit an **exponential decrease in DCL over time as they are charged, with a specified time of 5 minutes allowed for them to reach their specification limit at 25°C and above**. DCL is not specified below 25°C, but **it will take and increasing time to stabilize as temperature decreases.** The shape of the DCL curve, while charging, is affected by humidity. The capacitor in a "dry" state, such as immediately after dry pack opening or immediately after reflow, will exhibit a slower DCL drop with time than a capacitor that has been exposed to a higher humidity environment for a period of time. This is a normal and reversible behavior characteristic of Conductive Polymer Capacitors. If, following PCB assembly, an ICT (In Circuit Test) with a DCL level check is used, then it should be set accordingly – as the ICT will typically measure the DCL at much less than the 5 minutes specification electrification time, so the limit will need to be adjusted higher. This characteristic is described in more detail in the referenced technical paper [8].

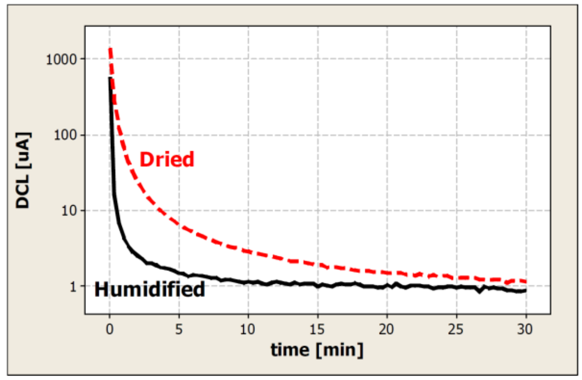


Chart 11. Typical DCL in humid vs dry conditions

For TCH series hermetically sealed Conductive Polymer Capacitors, the hermetic environment enables the modification of the semiconducting interface layers in order to reduce the DCL to the lowest level ever achieved for tantalum SMD capacitors. – see ref. [8]

6: Polymer Capacitors Summary in Brief

Conductive Polymer Capacitors share their base electrical characteristics and behavior with other solid electrolytic technologies such as conventional Tantalum / MnO_2 or NbO / MnO_2 capacitors. **For general characteristics not discussed in this guide above, please refer to the AVX Polymer, Tantalum and Niobium Oxide Catalogue**, Technical Summary and Application Guidelines [9], or contact AVX.

One of the major contributors to ESR in solid electrolytic (polar) capacitor is the counter electrode. A conventional tantalum capacitor uses MnO_2 as the 2nd electrode. This material has a relatively high resistivity. In Conductive Polymer Capacitors, it is replaced by an organic material – conductive polymer. The use of this material leads to a significant reduction in ESR, especially at frequencies above 100kHz.

The organic conductive polymer cathode promotes a more benign failure mode, as the conductive polymer, unlike MnO_2, is not an oxidation agent. Also, the conductive polymer has a different self-healing process. The failure site is insulated within the defect site – essentially becoming a hot spot that stops further current flow through the failure site. See figure 3. and references [1] and [2] for more details.

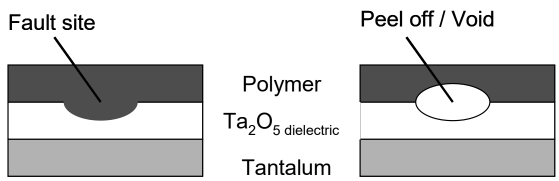


Fig.3. The self-healing process in polymer

Conductive Polymer Capacitors technology is today's fastest growing segment of tantalum based capacitor technology mainly due to its low ESR, more benign failure mode, higher rated voltage availability and lower voltage derating requirements. They are the best choice for applications with low ESR requirements such as DC/DC converters in notebooks, PDA, telecom and other applications. Recent advances in AVX conductive polymer technology has significantly improved its voltage rating capability - up to 125V – while providing improved robustness in high humidity environments, further expanding their application range.

Manufacturer's specifications and recommendations for lead-free reflow process, temperature range, leakage current and appropriate storage/handling in accordance with the designated MSL level should be verified for specific application needs.

Acknowledgment

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