FAMILY COMPARISON

Application Note

INTRODUCTION

Advantages of tantalum capacitors are:

- High volumetric efficiency.
- Stable electrical performance over temperature (T.C. 12%).
- Wide Operating temperature range.
- Better frequency characteristics than aluminum electrolytics.
- Self-Healing, no wear out mechanism. No degradation in performance or reliability.
- No limitation on shelf life.

In this application note, we discuss the benefits of Tantalum Capacitors versus the different types of capacitors on the market; as well as provide a Family Comparison Guide that gives a quick summary and areas of application

Benefits of Tantalum Capacitors:
Tantalums are a special member of the electrolytic family of capacitors. The unique use of tantalums gives this family of capacitors advantages and disadvantages when compared to other types of capacitors.

- High volumetric efficiency – Refers to the quantity of capacitance per unit physical volume. General aluminum electrolytics can be challenge with size. General ceramic capacitors and film capacitors are limited to lower capacitance values. Tantalum capacitors offer one of the best efficiencies as a class of capacitors – with sizes smaller than 7.3 by 6.1mm and with upwards of 1500 µF capacitance.

- Stable electrical performance over temperature (Temperature Coefficient of 12%) – Tantalums offer predictable and stable electrical performance over temperature. Polypropylene (polymer) film capacitors has as stable a TC for surface mount compact sized capacitors. Generic ceramics capacitors can go upwards of ± 15% and ± 22% that can change with age.

- As a class of capacitors, Tantalums offer a wider range of operating temperatures. For the Nemco SPT, MPT, PCT, LSR and TB – the Operating temperature range –55°C to +125°C, 2/3 Vr (linear derating) above +85°C. The Nemco CGT series is derated above +40°C.

- Better frequency characteristics than aluminum electrolytics - All capacitors exhibit non-zero equivalent series resistance. A higher ESR limits the use of the capacitor family to lower frequency and DC applications. The standard aluminum electrolytic capacitor is in the 1 to 50Ω; though recently there has been Low-ESR aluminum electrolytic capacitors that can get into the 0.1 and even 0.010Ω range. In contrast, Nemco standard tantalums 0.3 to 25Ω but with a wider offering of Low ESR versions from 0.04 to 9Ω range.

- Self-Healing, no wear out mechanism. No degradation in performance or reliability – Ceramic capacitors are susceptible to mechanical stress from the PCB. Tantalums are able to self-heal from mechanical stress cracks. This gives tantalums no degradation in performance and reliability over time.

- No limitation on shelf life – Tantalum capacitors have virtually no limitation on shelf life due to the self-healing properties. For the Nemco Series CGT, SPT, and MPT, baking may be required if stored at >10% Relative Humidity. Refer to MSL 3 Handling Application Note for more details.

Benefits of Polymer Tantalum Capacitors:
The Nemco SPT and MPT series Polymer Tantalum Capacitors uses a polymer electrolyte instead of the typical manganese dioxide. This construction gives the SPT and MPT Series benefits in addition to the ones listed above.

- High frequency applications – The Nemco SPT series has ESRs of <0.5Ω; and MPT Series has ESRs of <0.05Ω. Therefore the SPT and MCT Series can be used in high frequency applications that were previously covered by ceramic capacitors; but with all the stability, reliability of a tantalum class of capacitors.

- Reduced failure mode – The polymer electrode and construction of polymer capacitors reduces ignition failures and destructive burning that can sometimes occur with standard tantalums.

Family Comparison Guide

Nemco SPT Series Standard Polymer Tantalum Capacitor	**Nemco MPT Series** Multi-anode Polymer Tantalum Capacitor	**Nemco PCT Series** Standard Tantalum Capacitor	**Nemco LSR Series** Low ESR Tantalum Capacitor	**Nemco MCT Series** Miniature Tantalum Capacitor	**Nemco CGT Series** Consumer Grade Tantalum Capacitor	**Nemco TB Series** Dipped Tantalum Capacitor
0.47 to 470µF 2.5V to 125V	10 to 100µF 4V to 100V	0.10 to 1500µF 4V to 50V	0.15 to 1500µF 4V to 50V	0.47 to 22µF 2V to 16V	0.47 to 47µF 2V to 25V	0.10 to 330µF 6.3V to 50V
Lower ESR	Extremely Low ESR	Low Profile Sizes Available	Low ESR Low Profile Sizes Available	0402 and 0603	0402 and 0603 miniature footprint	Lead forming and cutting
Displays and signage, Power circuitry, High Voltage, Higher Frequency	Telecommunication, Base stations High Voltage, High Frequency	Low frequency, Low noise; Temperature variant applications and long-life designs.	Longer life, low noise, lower voltage fluctuations; DC-DC convertors and conversion circuits	High stability and reliability in mini-footprints; Long-life miniature designs	High stability in mini- footprints; Consumer-grade miniature designs	Low frequency, Low noise; Temperature variant applications and long-life designs.