

Application Notes for Solid Tantalum Capacitors

Capacitors should only be specified after confirming operating conditions and performance requirements.

1 Operating Voltage

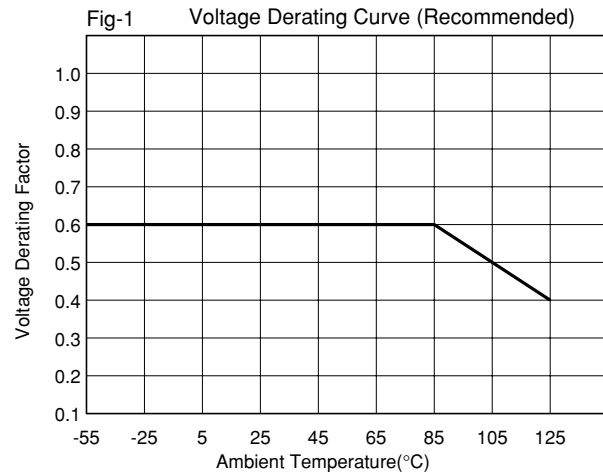
The rated voltages at temperatures up to 85°C and derated voltages at 125°C are shown in Table 1.

Appropriate derating shall increase reliability in Tantalum capacitors.

Figure 1 shows the recommended voltage derating curve for Tantalum capacitors as described by NASA APPLICATION NOTES.

Table-1 Surge Voltage & Derating Voltage (Specifications)

85°C		125°C	
Rated Voltage	Surge Voltage	Derating Voltage	Surge Voltage
3.15	4	2	2.5
4	5	2.5	3.2
6.3	8	4	5
10	13	6.3	8
16	20	10	13
20	25	13	16
25	32	16	20
35	44	22	28
50	63	32	40
75	98	50	64
100	125	67	86



Concerning the relationship between Voltage, Temperature, Circuit Resistance, and Failure Rates, please refer to Matsuo's Engineering Bulletin.

2 Applications that contain AC Voltage

A) The sum of the DC bias voltage and the positive peak value of the AC voltage should not exceed the rated voltage.

B) The negative peak AC voltage should not exceed the values listed in Table 2.

C) Ripple voltage should not exceed the allowable values.

Table-2

Ambient Temperature	25°C	55°C	85°C	125°C
Permissible Reverse Voltage	R.V. × 10%	R.V. × 6%	R.V. × 3%	R.V. × 1%
	or 0.5V whichever is greater.			

Note: The above information in Table 2 applies to circuits with incidental reverse voltage being applied.

For constant reverse voltage in a circuit, a non-polar device is always recommended.

3 Permissible Reverse Voltage

To avoid an increase in failure rate and changes in leakage current, reverse voltage should be kept below the values listed in Table 2.

4 Permissible Ripple Voltage

Permissible ripple voltage is determined by the heat loss of the element and heat radiation of the lead wire. This is influenced by capacitance, ESR, operating temperature, and frequency or ripple. Please consult Matsuo's Engineering Bulletin for details on calculating ripple current values.

5 Low Impedance Applications

The failure rate of a low impedance circuit at 0.1 Ohm/V is about five times greater than that of a 1 Ohm/V circuit. To curtail this higher failure rate, Tantalum capacitors used in low impedance circuits, such as filters for power supplies (particularly switching power supplies), or for noise by-passing, require that operating voltage be derated to less than half of the rated voltage. Actually, 1/3 of the rated voltage is recommended.

An increase of the failure rate due to low impedance is caused by dielectric breakdown due to a large rush current concentrated on a weak point of the Ta₂O₅ film at which point heat is generated.

Concerning the relationship between Voltage, Temperature, Circuit Resistance, and Failure Rates, please refer to Matsuo's Engineering Bulletin.

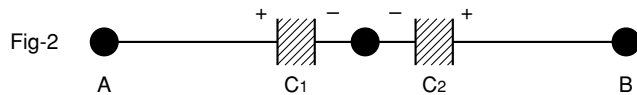
6 Non Polar Application

Tantalum capacitors can be used as a non-polar unit if two capacitors are connected “BACK-TO-BACK” when reverse voltage is applied at a more than permissible value, or in a purely AC circuit. The two capacitors should both be of the same rated voltage and capacitance tolerance, and they should both be twice the required capacitance value.

Ripple Voltage: Permissible Ripple Voltage shall not exceed the value allowed for either C₁ or C₂. (Note: This will be the same, as the capacitors should be identical.)

Capacitance: $\frac{C_1 \times C_2}{C_1 + C_2}$

Leakage Current: If terminal A is (+), the Leakage Current will be equal to C₁'s Leakage Current.
If terminal B is (+), the Leakage Current will be equal to C₂'s Leakage Current.

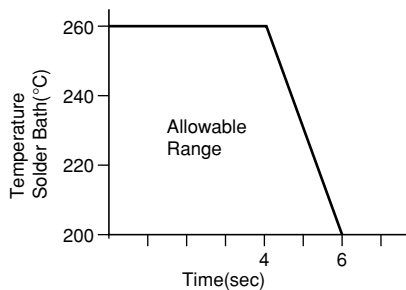


7 Soldering

A)The soldering of solid Tantalum capacitors should be operated per the following recommended conditions:

- 1.Radial Leaded Resin Coated Types
- 2.Radial Leaded Resin Molded Types

Fig-3 Reflow Soldering
(Direct heating from the substrate)



B)An acid free flux containing low levels of chlorine and amine should be used. The flux should be cleaned to reduce the harmful influences of the chlorine and the amine.

8 Solvents

The following solvents may be used to remove flux:

Freon TMC, TMS, Trichlorethane, and alcohols.

Cleaning should take place at room temperature for approximately 5 minutes.

9 Protective Resin Coating

After components are assembled to substrates, a protective resin coating is sometimes applied. As this resin coating cures, it gives mechanical and thermal stress to Tantalum capacitors. This stress can cause damage to the capacitors which affects their reliability.

Before using a resin coating, proper research must be done in regards to the material and process to insure that excessive stress will not be applied to capacitors and other components.

10 Vibration

Approximately 300G shall be applied to a capacitor, when dropped from 1 meter to a concrete floor.

Although capacitors are made to withstand this drop test, stress from shock due to falling or striking does cause damage to the capacitors and increases failure rates. Do not subject capacitors to this type of mechanical stress.

Do not use fallen parts for production purposes.

Capacitors should not be used under conditions that exceed EIA specifications for allowable stress.

11 Additional Notes

- *During a customer's aging process, voltage should remain under the rated voltage at all times.
- *Capacitors should never be touched or manipulated while operating.
- *Capacitors are not meant to be dismantled. If you suspect a problem with a capacitor, please contact the Matsuo Sales Department and arrange for Matsuo's QA Department to examine the capacitor.
- *When testing capacitors, please examine the power source before conducting tests to insure the tester's polarity and applied voltage.
- *In the event of a capacitor burning, smoking, or emitting an offensive smell during operation, please turn the circuit "off", and keep hands and face away from the burning capacitor.
- *Capacitors should be stored at room temperature under low humidity. Capacitors should never be stored under direct sunlight, and should not be stored in an environment containing dust.
- *If the capacitors will be operated in a humid environment, they should be sealed with a compound under proper conditions.
- *Capacitors should not be stored or operated in environments containing acids, alkalis, or active gasses.
- *When capacitors are disposed of as "scrap" or waste, they should be treated as *Industrial Waste* since they contain various metals and polymers.
- *Capacitors submitted as samples should not be used for production purposes.

Reference: Electronic Industries Association of Japan (EIAJ). EIAJ RCR-2386 May, 1995 Issue.