



# Application Notes for Tantalum Solid Electrolytic Capacitor (Hermetically sealed capacitors in metal case)

## 1. Operating Voltage

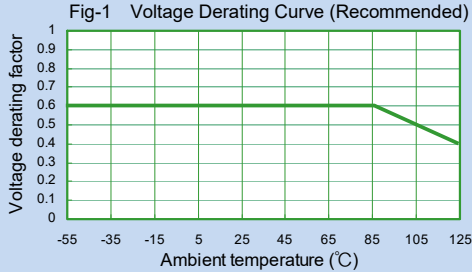
Tantalum Solid Electrolytic Capacitor shall be operated at the rated voltage or lower.

**Rated voltage:** The "rated voltage" refers to the maximum DC voltage that is allowed to be continuously applied between the capacitor terminals at the rated temperature.

**Surge voltage:** The "surge voltage" refers to the voltage that is allowed to be instantaneously applied to the capacitor at the rated temperature or the maximum working temperature. The capacitor shall withstand the voltage when a 30-second cycle of application of the voltage through a 1000 Ω series resistance is repeated 1000 times in 6-minute periods.

Rated voltage (VDC)	6.3	10	16	20	25	35	50	75	100
Surge voltage (VDC)	8	13	20	25	32	44	63	98	125

When designing the circuit, the equipment's required reliability must be considered and appropriate voltage derating must be performed. Figure 1 shows the recommended voltage derating curve for Tantalum capacitors as described by NASA APPLICATION NOTES.



## 2. Application that contain AC Voltage

Special attention to the following 3 items.

- (1) The sum of the DC bias voltage and the positive peak value of the AC voltage should not exceed the rated voltage.
- (2) Reverse voltage should not exceed the allowable values of the negative peak AC voltage.
- (3) Ripple current should not exceed the allowable values.

## 3. Reverse Voltage

Tantalum solid electrolytic capacitor is polarity. Please do not impress reverse voltage. As well, please confirm the potential of the tester beforehand when both ends of the capacitor are checked with the tester etc.

## 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. Application on low-impedance circuit

The failure rate of low impedance circuit at 0.1Ω/V is about five times greater than that of a 1Ω/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, less than 1/3 of the rated voltage is recommended.

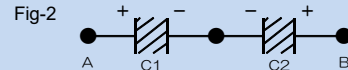
## 6. Non Polar Application(BACK TO BACK)

Tantalum capacitors can be used as a non-polar unit if two capacitors are connected "BACK-TO-BACK" when reserve 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 (This will be the same, as the capacitors should be identical.)

**Capacitance:**  $(C1 \times C2) / (C1 + C2)$

**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

The soldering of Type 111 should be operated per the following recommended conditions.

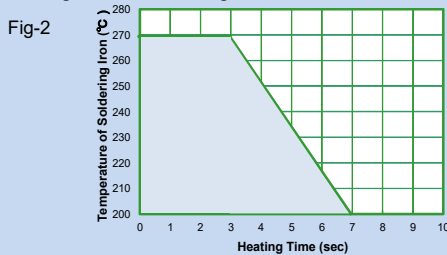
- (1) Flow Soldering (Direct heating from the substrate)

Solder temperature: 260°C or less

Dipping time: 10 s

Note1: Noted that solder part of hermetic could be melted if soldering temperature is too high or dipping time is too long for the operation.

- (2) Soldering with a Soldering Iron



Note2: Please be noted that soldering should be done more than 4mm apart from product body.

## 8. Example of trouble phenomenon happening by excessive heating when soldering

When mounting, the following breakdown phenomena might be caused when excessive heating that exceeds the above-mentioned tolerance is done. Therefore, please pay attention to the operation.

In a case that solder is used for cathode connection of molding type product, Ag in silver paste could merge into solder if solder in product have melted. That might cause excessive Leakage Current and Short etc. by changing in deterioration in DF and the high frequency impedance or internal stresses in that case.

Mechanical stress according to heat stress and expansion shrinkage or concentrations of internal stress might increase failure rate. Defect sealing could sometimes come for solder melting in seal entrance part of Type 111. Or, solder flows, might become a bridge between inside and outside circles of the Hermetic seal, be good at the solder grain if inhaled, and the phenomenon such as a short or intermittent shorts be caused.

### 9. Flux

Please use flux as much as possible with non-acidity and little content of both chlorine and amine.

### 10. Cleaning

Cleaning by organic solvent may damage capacitor's appearance and performance. However, our capacitors are not effected even when soaked at 20 ~ 30°C 2-propanol for 5 minutes. When introducing new cleaning methods or changing the cleaning term, please consult us.

### 11. Protective Resin Coating

After components are assembled to substrate, 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.

### 12. Vibration

Approximately 300 G 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.

### 13. Additional Notes

- When more than one capacitor is connected in series, a resistor that can distribute the voltage equally to the capacitors shall be connected in parallel.
- The capacitor cases shall not be cut even if the mounting space is insufficient.
- Do not process lead wire terminal in a way other than cutting or bending the part that projects from printed circuit board (plated through hole).
- Do not add the outside power more than regulations to lead wire terminal. Do not add excessive power to capacitor.
- During a customers 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.
- When testing capacitors, please examine the power source before conducting test to insure the tester's polarity and applied voltage.
- Do not touch terminals of other parts if electrode is applied and checked while energizing. Do not bend the lead wire terminal with the electrode testers.
- 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.
- If a capacitor be electrical shorted, it becomes hot, and the capacitor element may ignite. In this case, the printed board may be burnt out.
- A for capacitors (Type 111) with the metal casing, pressure in the cases might go up by Short before they explode, and then high-temperature solder might disperse.
- Capacitors should be stored at room temperature under low humidity. Capacitors should never be stored under direct sunlight, and should 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 Industria Waste since they contain various metals and polymers.
- Capacitors submitted as samples should not be used for production purposes.

These application notes are prepared based on "Guideline of notabilia for fixed tantalum electrolytic capacitors with solid electrolyte for use in electronic equipment" (EIAJ RCR-2368) issued by Japan Electronics and Information Technology Industries Association (JEITA). For the details of the instructions (explanation, reasons and concrete examples), please refer to this guideline, or consult our Sales Department.



## MATSUO ELECTRIC CO., LTD.

Please feel free to ask our Sales Department for more information on Tantalum Solid Electrolytic Capacitor.

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