1. Circuit Design
(1) Rated Voltage and Operating Voltage
As shown in Fig. 1, rated voltage signifies the maximum peak voltage applied to the capacitor at the maximum rated temperature. The rated voltage consists of the sum of both DC voltage and ripple peak voltage. It is recommended that capacitors be used at a voltage less than the rated voltage. (Reduce rated voltage should be applied at higher than 85°C temperature)

It is also recommended to properly derate the voltage to improve operating reliability.

The NASA APPLICATION NOTE shown in Fig. 2 is commonly used to consider the derated voltage.

(2) Low Impedance Circuit
In low impedance circuit applications such as power supply circuits, the failure rate may increase due to inrush current. Additionally, if a short occurs within the capacitor, burning may possibly occur. Therefore, sufficient voltage derating (less than 1/2 to rated voltage) is recommended. If you need assistance, please contact your local Nichicon sales office.

(3) Operating Temperature
All parts must be used within the specified category temperature range, since, the temperature has a great effect on reliability. Therefore, when using capacitors, please try to keep the temperature as low as possible. Please take into consideration that the capacitor itself generates heat which affects the atmospheric temperature.

(4) Ripple Capability
The ripple capability of solid tantalum electrolytic capacitors is defined by both Equivalent Series Resistance (ESR) and power dissipation due to ripple current.
If the capacitor sees a higher than specified amount of ripple current, heat generation within the capacitor will increase eventually causing a failure.
The capacitors should be used at a voltage less than the rated voltage that consists of the sum of both DC voltage and ripple peak voltage. Also, reverse voltage due to variation of ripple peak voltage should not be applied to the capacitor.
If you need detailed information about permissible ripple voltage and permissible ripple current, please contact your local Nichicon sales office.
(5) Reverse Voltage
Solid tantalum electrolytic capacitors are polarized, and therefore, no reverse voltage is acceptable. (Electrical characteristics shall be deteriorated when reverse voltage is applied.) When checking a part using a tester, please make sure the polarity of the tester before the probes touch both capacitor terminals.

(6) Leakage current value differs depending on the voltage applied. Please use higher ratings, especially when it is used in the integration circuit or time-constant circuit.

(7) Low voltage application or High resistance connected to the capacitor in series
A problem could possibly result if the following application exists:
Low voltage, high resistance connected to the capacitor in series, and a circuit sensitive to leakage current. A problem could occur due to the lower recovery of the leakage current characteristic of tantalum capacitor, caused by heat stress during the soldering process.

(8) Cautions on designing
When tantalum capacitor is used at high frequency circuit, please note that the electrical characteristics may change drastically.

2. Mounting
(1) Recommended mounting pad dimensions for chip type are as shown in Table -1 and Table -2. Dimensions may vary depending upon reflow conditions, type of solder and/or board size.

Fig. 4

[Cautions when mounting F72, F75, F95 and MUSE F95 chip]
Adjustment of $\Delta C$ toward anode side is required when mounting, as there is a difference between the center of total length of anode tab (portion) and the center of board land dimension.

<table>
<thead>
<tr>
<th>Case</th>
<th>Type F91 • F92 • F93 • F97 • F98</th>
<th>Case F95 • MUSE F95</th>
</tr>
</thead>
<tbody>
<tr>
<td>U</td>
<td>0.35 0.4 0.4 0.4</td>
<td>R-P 1.4 0.6 0.5 0.7 $\Delta C$ +0.2</td>
</tr>
<tr>
<td>M</td>
<td>0.65 0.7 0.7 0.6</td>
<td>Q-S 1.7 0.7 0.6 1.1 $\Delta C$ +0.2</td>
</tr>
<tr>
<td>S</td>
<td>0.9 0.7 0.7 0.8</td>
<td>A 1.8 0.7 0.6 1.1 $\Delta C$ +0.2</td>
</tr>
<tr>
<td>P</td>
<td>1.0 1.1 1.1 0.4</td>
<td>T 2.6 0.7 0.6 1.2 $\Delta C$ +0.2</td>
</tr>
<tr>
<td>A</td>
<td>1.3 1.4 1.4 1.0</td>
<td>B 2.6 0.8 0.7 1.1 $\Delta C$ +0.2</td>
</tr>
<tr>
<td>B</td>
<td>2.3 1.4 1.4 1.3</td>
<td>In the case of F95 • MUSE F95 • F72 • F75 chip mounting, make the centering with the dimensions except anode tab (portion) length.</td>
</tr>
<tr>
<td>C</td>
<td>2.3 2.0 2.0 2.7</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>2.5 2.0 2.0 4.0</td>
<td></td>
</tr>
</tbody>
</table>

(2) Soldering temperature and soldering time for chip type should be within limits as shown below when measured at terminal surface. In case you repeat soldering process more than 1 time, please contact your local Nichicon sales office to get advice.

<table>
<thead>
<tr>
<th>Time (Sec.)</th>
<th>10</th>
<th>20</th>
<th>30</th>
<th>40</th>
<th>50</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temp. (°C)</td>
<td>150</td>
<td>180</td>
<td>150</td>
<td>180</td>
<td>180</td>
</tr>
</tbody>
</table>

- Reflow (Infrared Ray, Hot Plate, Hot Air, etc.)

Fig. 5
• Flow (Dipping, Wave Soldering, etc.)

(Pre-heat is subject to “Reflow.”)

Fig. 6

Vapor Phase Soldering

30 sec. max. at 215 °C (Pre-heat is subject to “Reflow.”)
Series : F72, F75, F91, F92, F93, F95, F97, F98

• Soldering-iron (30 watts or less)

Fig. 7

NOTE : Preheat is required to reduce heat shock regardless of the method of soldering. Preheat time for F72, F75, F95 and MUSE F95 series should be as long as possible.

(3) Cleaning

Please wash P.C. board as soon as possible after soldering process to eliminate flux, and acid and alkaline material.
In case of ultrasonic cleaning, attention should be paid to the following:
① Cleaning condition : Frequency=25 to 40kHz,
Power=10 to 20W/l, Time = within 3 minutes.
② Do not allow a circuit board to touch the agitator.
③ Do not stack circuit boards in the cleaning bath.

3. Notes on Storage

• It is desirable to store capacitors at normal temperatures 35 °C Max. and normal humidity.
• Keep out of direct sunlight.
• Don’t apply force to capacitor’s body and especially terminal.
• Don’t apply shock and vibration by dropping etc.
• It is preferable to store for no more than 1 year under the above condition.

(when you use part that has been stored more than 1 year, please contact your local sales office to have assistance)

4. Disposal of capacitors

When disposing, scrap it as industrial wastes.

5. Others

① This product has been designed and manufactured for general electronic equipment. If you use them on extremely high quality or safety electronic equipment such as Medical equipment, Aerospace equipment, etc., please contact to your local Nichicon sales office for conformity specifications.
② The above mentioned material is according to EIAJ RCR-2368B (revised in March 2002, titled “Guideline of notabilia for fixed tantalum electrolytic capacitors with solid electrolyte for use in electronic equipment”). Please refer to this book for details.
③ Please refer to Nichicon individual technical material for further information of ② and contents in this catalog.

The corelations among rated voltage, surge voltage at 85 °C and derated voltage at 125 °C are as shown.

<table>
<thead>
<tr>
<th>Rated voltage (V)</th>
<th>4</th>
<th>6.3</th>
<th>10</th>
<th>16</th>
<th>20</th>
<th>25</th>
<th>35</th>
</tr>
</thead>
<tbody>
<tr>
<td>85°C Surge voltage (V)</td>
<td>5.2</td>
<td>8</td>
<td>13</td>
<td>20</td>
<td>26</td>
<td>32</td>
<td>46</td>
</tr>
<tr>
<td>125°C Derated voltage (V)</td>
<td>2.5</td>
<td>4</td>
<td>6.3</td>
<td>10</td>
<td>13</td>
<td>16</td>
<td>22</td>
</tr>
<tr>
<td>Type</td>
<td>Classification</td>
<td>Series</td>
<td>NICHICON ELECTRONICS (TIANJIN) CO., LTD.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
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<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Chip Solid Tantalum Electrolytic Capacitors</td>
<td>Chip Type</td>
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</tbody>
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