ALUMINUM ELECTROLYTIC CAPACITORS

2017-2018Y

Provide Aluminum Electrolytic Capacitor To The World With Excellent Performance

www.aihuaglobal.com
Stock code: 603989
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<th>Capacitance Range(pF)</th>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>For input and output circuit</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RR</td>
<td>High frequency, low impedance, long life</td>
<td>105°C</td>
<td>2,000</td>
<td>10 - 25</td>
<td>0.8 - 2.0</td>
<td>8.4 - 470</td>
</tr>
<tr>
<td>RS</td>
<td>High frequency, low impedance, long life</td>
<td>105°C</td>
<td>2,000</td>
<td>10 - 25</td>
<td>0.8 - 2.0</td>
<td>8.4 - 470</td>
</tr>
<tr>
<td><strong>High Reliability</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RH</td>
<td>High frequency, low impedance, long life</td>
<td>105°C</td>
<td>2,000</td>
<td>10 - 25</td>
<td>0.8 - 2.0</td>
<td>8.4 - 470</td>
</tr>
<tr>
<td>RL</td>
<td>High frequency, low impedance, long life</td>
<td>105°C</td>
<td>2,000</td>
<td>10 - 25</td>
<td>0.8 - 2.0</td>
<td>8.4 - 470</td>
</tr>
</tbody>
</table>
ALUMINUM ELECTROLYTIC CAPACITORS

RADIAL TYPE

5~9mm L

ML
105°C Long life

5mm L

M5
85°C 1,000h
H5
105°C 1,000h
M7
85°C 1,000h
H7
105°C 1,000h
L7
105°C 2,000h

7mm L

5mm L

RE
2,000~4,000h Low Z
RR
2,000h Low Z
RN
105°C 5,000~10,000h large capacitance, long life
RH
Standard
2,000~8,000h GBL
RG
4,000~5,000h GBL
RV

105°C Low Impedance

RF
3,000~6,000h Low Z
RS
4,000~10,000h Low Z
RZ
6,000~10,000h Low Z
RJ
8,000~12,000h Low Z

Radial type standard

WK
85°C Standard
WH
105°C Standard
RK
105°C For charger

Low LC

Bi-polar

Long life

LL
105°C 2,000h
HP
105°C 1,000h
RM
105°C 10,000h

Special Type

RD
Low water content
GH
For intelligent instrument
NB
High reliability
BG
For airbags
BH
For automobile electronics

For Power Supply

HH
105°C High ripple current, 3,000~5,000h
HS
105°C 5,000~10,000h
HF
105°C 8,000~12,000h
HL
105°C 8,000~12,000h

FOR LIGHTING APPLICATION

CD11GM
105°C 3,000h High cost performance

CD11GD
105°C 6,000h Miniaturized

CD11GN
130°C 1,000~2,000h 105°C 8,000~12,000h Ultra-miniaturized

CD11GK
105°C 12,000~20,000h Ultra-miniaturized

WH
105°C 2,000h Standard

CD11GZ
105°C 12,000h Long life for outdoor lighting

CW
130°C 4,000~5,000h 105°C 15,000~20,000h

CD11GES
130°C 3,000h 105°C 12,000h Miniaturized

CD11GHS
105°C 6,000h Miniaturized, long life

CD11GAS
105°C 10,000h Miniaturized, long life

Economical

Long life

High ripple current
### SNAP-IN & LUG TERMINAL TYPE

**Standard**
- **LK**
  - 85°C 2,000h
- **LS**
  - 85°C 3,000h
- **LQ**
  - 85°C 5,000h
- **LG**
  - 85°C 12,000h

**105°C Long life**
- **LM**
  - 105°C 3,000h
- **LT**
  - 105°C 5,000h
- **LX**
  - 105°C 7,000h
- **LB**
  - 105°C 10,000h

- **LC**
  - 105°C 2,000h
- **LP**
  - 105°C 3,000h

Wide temperature range, smaller size
Higher ripple current
No spark with DC overvoltage
Higher capacitance & ripple current

### SCREW-MOUNT TERMINAL TYPE

**Screw mount standard**
- **NR**
  - 85°C 2,000h
  - Standard
- **NS**
  - 105°C 2,000h
  - Standard

**Special series**
- **NE**
  - 85°C 20,000h
  - High ripple current, long life
- **NK**
  - 105°C 5,000h
  - High ripple current

**Long life**
- **NX**
  - 85°C 5,000h
- **NF**
  - 105°C 5,000h
- **NL**
  - 85°C 12,000h
**ALUMINUM ELECTROLYTIC CAPACITORS**

**SNAP-IN & LUG TERMINAL TYPE**

<table>
<thead>
<tr>
<th>Standard</th>
<th>105°C Long Life</th>
</tr>
</thead>
<tbody>
<tr>
<td>LK</td>
<td>85°C 2,000h</td>
</tr>
<tr>
<td>LH</td>
<td>105°C 2,000h</td>
</tr>
<tr>
<td>LS</td>
<td>85°C 3,000h</td>
</tr>
<tr>
<td>LC</td>
<td>105°C 2,000h</td>
</tr>
<tr>
<td>LQ</td>
<td>85°C 5,000h</td>
</tr>
<tr>
<td>LG</td>
<td>85°C 12,000h</td>
</tr>
</tbody>
</table>

Wide temperature range, smaller size

Higher capacitance & ripple current

No spark with DC overvoltage

**SCREW-MOUNT TERMINAL TYPE**

<table>
<thead>
<tr>
<th>Screw mount standard</th>
<th>Special series</th>
</tr>
</thead>
<tbody>
<tr>
<td>NR</td>
<td>NE</td>
</tr>
<tr>
<td>NS</td>
<td>NK</td>
</tr>
<tr>
<td>85°C 2,000h Standard</td>
<td>85°C 20,000h High ripple current, long life</td>
</tr>
<tr>
<td>105°C 2,000h Standard</td>
<td>105°C 5,000h High ripple current</td>
</tr>
</tbody>
</table>

**Failure Modes**

Aluminum Electrolytic Capacitors Show Various Failure Modes in Different Applications

<table>
<thead>
<tr>
<th>Failure mode</th>
<th>Failure mechanism</th>
<th>Causes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short circuit</td>
<td>Short circuit between electrodes</td>
<td>Electrode-cutting burns, metal particles</td>
</tr>
<tr>
<td>Open circuit</td>
<td>Breakdown of lead tab</td>
<td>Mechanical stress</td>
</tr>
<tr>
<td>Electrolyte leakage</td>
<td>Insufficient sealing</td>
<td>Insufficient connection of lead tab</td>
</tr>
<tr>
<td></td>
<td>Corrosion</td>
<td>Improper sealing</td>
</tr>
<tr>
<td></td>
<td>Halogen infiltration</td>
<td>Use of halogenated solvent</td>
</tr>
<tr>
<td></td>
<td>shortage of electroly</td>
<td>Use of coating material</td>
</tr>
<tr>
<td></td>
<td>Electrolyte deterioration and reduction</td>
<td>Use of adhesive</td>
</tr>
<tr>
<td></td>
<td>-capacitance reduction</td>
<td>Usage for a long period of time</td>
</tr>
<tr>
<td></td>
<td>-reduced anode foil capacitance</td>
<td>Excessive ripple current</td>
</tr>
<tr>
<td></td>
<td>-reduced cathode foil capacitance</td>
<td>Usage at a high temperature</td>
</tr>
<tr>
<td></td>
<td>-internal pressure increase</td>
<td>Reverse voltage applied</td>
</tr>
<tr>
<td></td>
<td>-leakage current increase</td>
<td>Severe charging/discharging</td>
</tr>
<tr>
<td></td>
<td>-deterioration of oxide film</td>
<td>Excessive voltage applied</td>
</tr>
<tr>
<td></td>
<td>-AC voltage applied</td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**
- NE: 85°C 20,000h High ripple current, long life
- NK: 105°C 5,000h High ripple current

**REFERENCES**
- [AiSHi](#)
ALUMINUM ELECTROLYTIC CAPACITORS

Flow Chart
Aluminum Electrolytic Capacitors Flow Chart

1. Polarity
AishiCAP is a solid aluminum electrolytic capacitor with positive and negative electrodes. Do not reverse the polarity when using. If it is used with the polarities reversed, its life may be shortened because of increasing leakage current or short circuit.

2. Prohibited circuits
Since leakage current may be increased during soldering and other processes, AishiCAP cannot be used in the following circuits.
1) High impedance circuits;
2) Coupling circuits;
3) Time-limited constant circuits;
4) Connection of two or more capacitors in series for higher withstand voltage;
5) Circuits to get bad influence by large leakage current.
* In addition to the leakage current fluctuation, the operational conditions such as characteristics at high and low temperature, damp heat and endurance stipulated in the specifications will affect the capacitance. The fluctuation of the capacitance may cause problem if it is used as a time-limited constant capacitor, which is extremely sensitive to the fluctuation of the capacitance. So do not use it as a time-limited constant capacitor.

Additionally, please contact Hanan Alhua Group Co., Ltd. for usage of two or more AishiCAP in series for voltage proof.

3. Over voltage
Over voltage cannot be applied even for an instant as it may cause a short circuit.

4. Sudden charge and discharge
Sudden charge and discharge are prohibited (for maintenance of high reliability). A protection circuit is recommended when a sudden charge or discharge causes excessive rush current because this is a main cause of short circuits and large leakage current. Use protection circuits if the rush current exceeds 10A. If the rush current exceeds 10 times the maximum allowable ripple current of AishiCAP, be sure to insert a protection resistor of about 1kΩ for charge and discharge when measuring the leakage current.

5. Considerations when soldering
The soldering conditions are to be within the range prescribed in specifications. If the specifications are not followed, there is a possibility of the intensive increase of leakage current, and the capacitance reduction. Things to be noted before mounting:
1) Do not reuse capacitors that have been assembled in a set and energized.
2) Capabilities that have been removed for measuring electrical characteristics during a periodic inspection also cannot be reused.
3) Leakage current may increase when capacitors are stored for one year. In this case, apply rated voltage for 2 hours at 105℃ with load of 11kΩ resistor.
4) Reflow soldering
   a) Do not apply reflow soldering to radial lead type capacitors.
   b) Handling after soldering
      1) Do not twist or cast the AishiCAP.
      2) Do not move PCB by sticking AishiCAP itself. When stacking PCB, make sure that the AishiCAP does not touch other PCB or components.
5) Appearance
   Do not apply the AishiCAP with other objects.

6. Application of AishiCAP in industrial equipments
To ensure reliability, when using the AishiCAP in industrial equipments, appropriate design is required.

7. Use of AishiCAP for human life equipments
In case of using in equipments regarding human life (e.g. Space equipment, aeronautic equipment and atomic equipment, etc.), be sure to consult with Hanan Alhua Group Co., Ltd. Don’t use products without recognition document of Hanan Alhua Group Co., Ltd.

8. Storage
1) Store AishiCAP with the temperature range between 5℃ to 35℃(if between 35℃ to 85℃, it should be less than three months) and the relative humidity of 75% without direct sunshine and store AishiCAP in the package states if possible.
2) It is recommended that you open the bag just before use and use up as early as possible.
3) Store the capacitors in places free from water, oil or salt water or in condensation status.
4) Never store AishiCAP in any area filled with poisonous gases (including hydrogen sulfide, sulfuric acid, nitric acid, chlorine and ammonia).
5) Store the capacitors in places free from ozone, ultraviolet rays or radiation. Before use, keep within 1 year after delivery After seal; within 7 days from opening

9. Cleaning
Concerning about HCFC, soak with high concentration alcohol, petroleum and tetrane, water or surface active agent and other solvents (separate or blended), wash under the maker’s recommendation by ultrasonic wave, boiling and evaporation, etc. Please contact us if you require further details.

10. Notes on circuit designs for AishiCAP
10.1 Performance
Use AishiCAP within the rated performance ranges defined in this specification.
10.2 Operating temperature and ripple current
If AishiCAP is used at a temperature higher than the upper category temperature(105℃), or exceeds ripple current flows through AishiCAP, there are high possibilities of service life reduction or leakage current increase to cause AishiCAP defective.
10.3 Leakage current
The leakage current of AishiCAP may increase slightly by soldering conditions. The application of DC voltage enables the capacitors to be repaired by itself and this leads the leakage current to be smaller gradually.
10.4 Applied voltage
For the reliability of AishiCAP, it is recommended that the voltage applied to AishiCAP should be less than 80% of the rated voltage. Peak value of the DC and AC voltage should not exceed its rated voltage.
10.5 Failure mode
AishiCAP contains conductive polymer. The life ends mostly due to random failure mode, mainly short circuit. In case of short circuit, AishiCAP can be overheated by continuous current flow, and then Al case of AishiCAP would be separated by increased internal pressure.
Application Guidelines for Conductive Polymer Aluminum Solid Electrolytic Capacitors

1. Polarity
AishiCAP is a solid aluminum electrolytic capacitor with positive and negative electrodes. Do not reverse the polarity when using. If it is used with the polarities reversed, its life may be shortened because of increasing leakage current or short circuit.

2. Prohibited circuits
Since leakage current may be increased during soldering and other processes, AishiCAP cannot be used in the following circuits.
1) High impedance circuits;
2) Coupling circuits;
3) Time-limited constant circuits;
4) Connection of two or more capacitors in series for higher withstand voltage;
5) Circuits to get bad influence by large leakage current.
   * In addition to the leakage current fluctuation, the operational conditions such as characteristics at high and low temperature, damp heat and endurance stipulated in the specifications will affect the capacitance. The fluctuation of the capacitance may cause problem if it is used as a time-limited constant circuit, and which is extremely sensitive to the fluctuation of the capacitance. So do not use it as a time-limited constant capacitor.
   Additionally, please contact Hunan Athua Group Co., Ltd. for usage of two or more AishiCAP in series for voltage proof.

3. Over voltage
Over voltage cannot be applied even for an instant as it may cause a short circuit.

4. Sudden charge and discharge
Sudden charge and discharge are prohibited (for maintenance of high reliability). A protection circuit is recommended when a sudden charge or discharge causes excessive rush current because this is a main cause of short circuits and large leakage current. Use protection circuits if the rush current exceeds 10A. If the rush current exceeds 10 times the maximum allowable ripple current of AishiCAP, be sure to insert a protection resistor of about 1kΩ for charge and discharge when measuring the leakage current.

5. Considerations when soldering
The soldering conditions are to be within the range prescribed in specifications. If the specifications are not followed, there is a possibility of the intensive increase of leakage current, and the capacitance reduction. Things to be noted before mounting:
a) Do not reuse capacitors that have been assembled in a set and energized. Capacitors that have been removed for measuring electrical characteristics during a periodic inspection also cannot be reused.
b) Leakage current may increase when capacitors are stored for one year. In this case, apply rated voltage for 2 hours at 105°C with load of 1 kΩ resistor.
c) Reflow soldering
   Do not apply reflow soldering to radial lead type capacitors.
d) Handling after soldering
   Do not lift, bend or twist the AishiCAP.
   Do not move the PCB with catching AishiCAP itself.
   When stacking PCB, make sure that the AishiCAP does not touch other PCB or components.
   Do not drop the AishiCAP with other objects.

6. Application of AishiCAP in industrial equipments
To ensure reliability, when using the AishiCAP in industrial equipments, appropriate design is required.

7. Use of AishiCAP for human life equipments
In case of using in equipments regarding human life (e.g Space equipment, aeronautic equipment and atomic equipment(etc.), be sure to consult with Hunan Athua Group Co., Ltd. Don’t use products without recognition document of Hunan Athua Group Co., Ltd.

8. Storage
1) Store AishiCAP with the temperature range between 5 to 35°C (if between 35 to 85°C, it should be less than three months), and the relative humidity of 75% without direct sunshine and store AishiCAP in the package states if possible.
2) It is recommended that you open the bag just before use and use up as early as possible.
3) Store the capacitors in places free from water, oil or salt water or in condensation status.
4) Never store AishiCAP in any area filled with poisonous gases (including hydrogen sulfide, sulfuric acid, nitric acid, chlorine and ammonia).
5) Store the capacitors in places free from ozone, ultraviolet rays or radiation.
   Before usage: within 1 year after delivery
   After seal: within 7 days from opening

9. Cleaning
Concerning about HCF, soak with high concentration alcohol, petroleum and kerosene, water or surface active agent and other solvents (separate or blended), wash under the maker’s recommendation by ultrasonic wave, boiling and evaporation, etc. Please contact us if you require further details.

10. Notes on circuit designs for AishiCAP
10.1 Performance
Use AishiCAP within the rated performance ranges defined in this specification.
10.2 Operating temperature and ripple current
   If AishiCAP is used at a temperature higher than the upper category temperature(105°C), or excessive ripple current flows through AishiCAP, there are high possibilities of service life reduction or leakage current increase to cause AishiCAP defective.
10.3 Leakage current
   The leakage current of AishiCAP may increase slightly by soldering conditions. The application of DC voltage enables the capacitors to be repaired by itself and this leads the leakage current to be smaller gradually.
10.4 Applied voltage
   For the reliability of AishiCAP, it is recommended that the voltage applied to AishiCAP should be less than 80% of the rated voltage. Peak value of the DC and AC voltage should not exceed its rated voltage. 10.5 Failure mode
   AishiCAP contains conductive polymer. The life ends mostly due to random failure mode, mainly short circuit. In case of short circuit, AishiCAP can be overheated by continuous current flow, and then Al case of AishiCAP would be separated by increased internal pressure.
### Application Guidelines for Aluminum Electrolytic Capacitors

#### Designing Device Circuits
1. Select the capacitors to suit installation and operating conditions, and use the capacitors such that the performance limits prescribed in this catalog or the product specifications.
2. Polarity
   - Aluminum Electrolytic Capacitors are polarized.
   - Apply neither reverse voltage nor AC voltage to polarized capacitors. Using reverse polarity causes a short circuit or venting. Before use, refer to the final product specifications or capacitor body to identify the polarity marking. (The shape of rubber seal does not represent the directional rule for polarity.) Use a bi-polar type of non-solid aluminum electrolytic capacitor for a circuit where the polarity is occasionally reversed. However, note that even a bi-polar aluminum electrolytic capacitor must not be used for AC voltage applications.
3. Operating voltage
   - Do not apply a DC voltage which exceeds the full rated voltage. The peak voltage of a superimposed AC voltage (ripple voltage) on the DC voltage must not exceed the full rated voltage. A surge voltage value, which exceeds the full rated voltage, is prescribed in the catalogs, but it is a restricted condition, for especially short periods of time.
4. Ripple current
   - The rated ripple current has been specified at a certain ripple frequency. The ripple current at several frequencies must be calculated by multiplying the rated ripple current at the original frequency using the frequency multipliers for each product series.
5. Category temperature
   - The use of a capacitor outside the maximum rated category temperature will considerably shorten the life or cause the capacitor to vent. The relation between the lifetime of aluminum electrolytic capacitors and ambient temperature follows Arrhenius’ rule that the lifetime is approximately halved with each 10°C rise in ambient temperature.
6. Life expectancy
   - Select the capacitors to meet the service life of a device.
7. Charge and discharge
   - Do not use capacitors in circuits where heavy charge and discharge cycles are frequently repeated. Frequent and sharp heavy discharging cycles will result in decreasing capacitance and damage to the capacitors due to generated heat. Specified capacitors can be designed to endure such a condition. Rapid charging/discharging may be repeated in a circuit where the ripple voltage at the two terminals of the aluminum electrolytic capacitor fluctuates greatly. If the variation range of voltage exceeds 70%, please consult us.
8. Failure modes of capacitors
   - Non-solid aluminum electrolytic capacitors, in general, have a lifetime which ends in an open circuit, the period is dependent upon temperature. Consequently, lifetime of capacitors can be extended by reducing the ambient temperature and/or ripple current.

#### Insulating
9. Insulating
   a) Electrically isolate the following parts of a capacitor from the negative terminal, the positive terminal and the circuit traces.
   - The outer can case of a non-solid aluminum electrolytic capacitor.
   - The dummy terminal of a non-solid aluminum electrolytic capacitor, which is designed for mounting stability.
   - The outer sleeve of a capacitor is not assured as an insulator (Except for screw type). For applications that require an insulated outer sleeve, a custom-designed capacitor is recommended.
10. Conditions
    - Do not assemble capacitors to the following conditions.
    a) Oil, water, salty water. Avoid storage in damp locations.
    b) Direct sunlight.
    c) Toxic gases such as hydrogen sulfide, sulfuric acid, nitric acid, chlorine or its compounds, and mercury.
    d) Gown, ultraviolet rays or radiation.
    e) Severe vibration or mechanical shock conditions beyond the limits prescribed in the catalogs or the product specification.

#### Mounting
11. Mounting
   a) The electrolytic paper and the electrolytic-conductive electrolyte in a non-solid aluminum electrolytic capacitor are flammable. Leaking electrolyte on a printed circuit board can gradually erode the copper traces, possibly causing smoke or burning by short-circuiting the copper traces.
   b) Check the following points when designing a PCB. Provide the appropriate hole spacing on the PCB board to match the terminal spacing of the capacitor. Make the following open space over the vent so that the vent can operate correctly.
   - Case diameter
     - Clearance
     - Ø6.3 to Ø16mm 2mm minimum
     - Ø18 to Ø35mm 3mm minimum
     - Ø40mm or more 5mm minimum
   - Do not place any wires or copper traces over the vent of the capacitor.
   - Insulate the capacitor with the vent facing the PCB board needs an appropriate ventilation hole in PCB board.
   - Do not pass any copper traces beneath the seal side of a capacitor. The trace must pass 1 or 2mm to the side of the capacitor.
   - Avoid placing any heat-generating objects adjacent to a capacitor or even on the reverse side of the PCB board.
   - Do not pass anything via holes or underneath a capacitor.
   - In designing double-sided PCB boards, do not locate any copper trace under the seal side of a capacitor.
   - Do not mount the terminal side of a screw mount capacitor downwards. If a screw terminal capacitor is mounted on its side, make sure the positive terminal is higher than the negative terminal. Do not fasten the screws of the terminals and the mounting clamps over the specified torque prescribed in the catalog or the product specifications.

#### Installing Capacitors
1. Installing
   a) Used capacitors are not reusable, except in the case that the capacitors are detached from a device for periodic inspection to measure their electrical characteristics.
   b) If the capacitors have self-charged, discharge the capacitors through a resistor of approximately 1kΩ before use.
   c) If capacitors are stored at a temperature of 35°C or more and more than 70% RH, the leakage current may increase. In this case, they can be re-formed by applying the rated voltage through a resistor of approximately 1kΩ.
   d) Verify the rated capacitance and voltage of the capacitors when installing them in the PCB board.
   e) Verify the polarity of the capacitors.
   f) Do not use the capacitors if they have been dropped on the floor.
   g) Do not deform the cases of capacitors.
   h) Verify that the lead spacing of the capacitor fits the hole spacing in the PCB board before installing the capacitors. Some standard pre-formed leads are available.
   i) For pin terminals or snap-in terminals, insert the terminals into PCB board and press the capacitor downward until the bottom of the capacitor body reaches PCB board surface.
   j) Do not apply any mechanical force in excess of the limits prescribed in the catalogs or the product specifications of the capacitors. Also, note the capacitors may be damaged by mechanical shocks caused by the vacuum/insulation head, component choker or centering operation of an automatic mounting or insertion machine.

#### Soldering and Solidarity
2. Soldering and Solidarity
   a) When soldering with a soldering iron
      - Soldering conditions (temperature and time) should be within the limits prescribed in the catalogs or the product specifications.
      - If the terminal spacing of a capacitor does not fill the terminal hole spacing of the PCB board, reform the terminals in a manner to minimize a mechanical stress into the body of the capacitor.
      - Remove the capacitors from the PCB board, after the solder is completely melted; revolving by using a soldering iron minimizes the mechanical stress to the capacitors.
      - Do not touch the capacitor body with the hot tip of the soldering iron.
   b) Flow soldering
      - Do not dip the body of a capacitor into the solder bath, only dip the terminals. The soldering must be done on the reverse side of PCB board.
   c) Soldering conditions (preheat, solder temperature and dipping time) should be within the limits prescribed in the catalogs or the product specifications.
   - When setting the temperature infrared heaters, consider that the infrared absorption causes material to be dissolved and change in appearance.
   - Do not solder capacitors more than once using reflux. If it should be done for twice, please consult us first.
   - Make sure capacitors do not come into contact with any other components while soldering.
   - Ruffle soldering (only applicable for SMD type)
      - Soldering conditions (preheat, solder temperature and dipping time) should be within the limits prescribed in the catalogs or the product specifications.
      - When setting the temperature infrared heaters, consider that the infrared absorption causes material to be dissolved and change in appearance.
      - Do not solder capacitors more than once using reflux. If it should be done for twice, please consult us first.
      - Make sure capacitors do not come into contact with any other components while soldering.
      - When soldering, the body of a capacitor into the solder bath, only dip the terminals. The soldering must be done on the reverse side of PCB board, and then use a soldering iron within the prescribed conditions.
      - Confirm whether reflow soldering is applicable for the capacitors.

3. Handling after soldering
   - Do not apply any mechanical stress to the capacitor after soldering onto the PCB.
   - Do not use the capacitors for lifting or carrying the assembly board.
   - Do not hit or poke the capacitor after soldering to PCB board.
   - When stacking the assembly board, be careful that other components do not touch the aluminum electrolytic capacitors.
   - Do not drop the assembly board.

4. Cleaning PCB board
   - Do not wash capacitors by using the following cleaning agents.
     - Methylated spirits: cause capacitors to fail due to corrosion.
     - Acetyl alcohol: cause capacitors to fail due to corrosion.
     - Petroleum and terpene system solvents: cause the rubber seal material to deteriorate.
     - Acetone: erase the marking. Solution-proof capacitors are only suitable for use within the cleaning conditions prescribed in the catalogs or the product specifications. In particular, ultrasonic cleaning will accelerate damaging capacitors.
5. Precautions for using adhesives and coating
a) Do not use any adhesive and coating materials containing halogenated solvent.

b) Use the following before using adhesive and coating material.
   - Remove flux and dust from the surface of the through holes and the PC board before applying adhesive or coating materials to the capacitor.
   - Dry and remove any residual cleaning agents before applying adhesive and coating materials to the capacitors. Do not cover over the whole surface of the rubber seal with the adhesive or coating materials.
   - Pay attention to heat conditions for curing adhesives or coating materials. Follow the instructions in catalogs or the specifications of the capacitors.
   - Covering over the whole surface of the capacitor rubber seal with resin may result in a hazardous condition because inside pressure cannot be released completely. Also, a large amount of halogen ions in resin will cause the capacitors to fail because the halogen ions penetrate into the rubber seal and the inside of the capacitor.

6. Fumigation
In many cases when exporting or importing electronic devices, such as capacitors, wooden packaging is used. In order to control insects, most often, it becomes necessary to fumigate the shipments. Precautions during "Fumigation" using halogenated chemical such as Methyl Bromide must be taken. Halogen gas can penetrate packaging materials used, such as cardboard boxes and vinyl bags. Penetration of the halogenated gas can cause corrosion of electrolytic capacitors.

7. The Operation of Devices
a) Do not touch a capacitor directly with bare hands.

b) Do not short-circuit the terminal of a capacitor by letting it come into contact with any conductive object. Also, do not spill conductive liquid such as acid or alkaline solution on the capacitor.

c) Do not use capacitors in circumstance where they would be subjected to exposure to the following materials:
   - Oil, water, salty water or damp location.
   - Direct sunlight.
   - Toxic gases such as hydrogen sulfide, sulfurous acid, nitrous acid, chlorine or its compounds, and ammonium.
   - Ozone, ultraviolet rays or radiation.
   - Severe vibration or mechanical shock conditions beyond the limits prescribed in the catalogs or product specifications.

Maintenance Inspection
a) Make periodic inspections of capacitors that have been used in industrial applications. Before inspection, turn off the power supply and carefully discharge the electricity in the capacitors. Verify the polarity when measuring the capacitors with a voltmeter. Also, do not apply any mechanical stress to the terminals of the capacitors.

b) The following items should be checked during the periodic inspections.
   - Significant damage in appearances: venting and electrolyte leakage.
   - Electrical characteristics: leakage current, capacitance, and other characteristics prescribed in the catalog or product specifications. We recommend replacing the capacitors if the parts are out of specification.

In Case of Venting
a) If a non-solid aluminum electrolytic capacitor expels gas when venting, it will discharge odors or smoke, or burn in the case of a short-circuit failure. Immediately turn off or unplug the main power supply of the device.

b) When venting, a non-solid aluminum electrolytic capacitor blows out gas with a temperature of over 100°C. (A solid aluminum electrolytic capacitor discharges decomposition gas or burning gas while the outer resin case is burning.) Never expose the face close to a venting capacitor.

If your eyes inadvertently become exposed to the spouting gas or you inhale it, immediately flush the open eyes with large amounts of water and gargle with water respectively. If electrolyte is on the skin, wash the electrolyte away from the skin with soap and plenty of water. Do not lick the electrolyte of non-solid aluminum electrolytic capacitors.

Storage
We recommend the following conditions for storage.

a) Do not store capacitors at high temperature or in high humidity. Store the capacitors indoors at a temperature of 5 to 35°C and a relative humidity of 75% or below.

b) Store the capacitors in places free from water, oil or salt water.

c) Store the capacitors in places free from toxic gases (hydrogen sulfide, sulfurous acid, chlorine, ammonium, etc.)

d) Store the capacitors in places free from ozone, ultraviolet rays or radiation.

e) Keep capacitors in the original package.

Disposal
Please consult with a local industrial waste disposal specialist when disposing aluminum electrolytic capacitors.

Catalog
Specifications in the catalog may be subject to change without notice. Please consult us first before use. Hunter Ahrua Group reserves the right to final interpretation of all the content.

Soldering Recommendation

Flow Soldering (Radial Lead Type)

Reflow Soldering

For Polymer SMD Type

ALUMINUM ELECTROLYTIC CAPACITORS

Recommended Reflow Profile

ALUMINUM ELECTROLYTIC CAPACITORS

Soldering Recommendation

Flow Soldering (Radial Lead Type)

Preheating Soldering Cooling

260°C max

Tamb

30~90 sec. 1 sec. <10 sec.

130±20°C

Note 1: (1~3°C)/sec.
Note 2: Approx.200°C/sec.
Note 3: 5°C/sec.(max.)

Temperature

Time

T1

T2

T3

180°C

150°C

130°C

100°C

190°C

210°C

230°C

250°C

130°C

100°C

190°C

210°C

230°C

250°C

Preheating T1(T°C) T2(T°C) T3(T°C) T1(sec.) T2(sec.) T3(sec.) Rework cycle

Condition 1

105°C to 180°C Within 90sec.

≤290 ≤230 ≥200 ≤60 ≤40 ≤60 1

Condition 2

≤290 ≤230 ≥200 ≤60 ≤40 ≤60 2

Time(sec.)
PRECAUTIONS AND GUIDELINES

b) Verify the following points when washing capacitors:
• Monitor conductivity, pH, specific gravity, and the water content of cleaning agents. Contamination adversely affects these characteristics.
• Be sure not to keep the capacitors in an atmosphere containing the cleaning agent or in an air tight container.

In addition, please dry the solvent sufficiently on the PCB board and the capacitor with an air knife (temperature should be less than the maximum rated category temperature of the capacitor) over 10 minutes. Aluminum electrolytic capacitors can be characteristically and catastrophically damaged by halogen ions, particularly by chlorine ions, though the degree of the damage mainly depends upon the characteristics of the electrolyte and rubber seal material. When halogen ions come into contact with the capacitors, the foil corrodes when voltage is applied. This corrosion causes extremely high leakage current, which in turn, causes venting and an open circuit.

5 Precautions for using adhesives and coating
a) Do not use any adhesive and coating materials containing halogenated solvents.
b) Verify the following before using adhesive and coating material:
• Remove flux and dust from the groove between the rubber seal and the PCB board before applying adhesive or coating materials to the capacitor.
• Dry and remove any residual cleaning agents before applying adhesive and coating materials to the capacitor. Do not cover over the entire surface of the rubber seal with the adhesive or coating materials.
• For permeable heat conditions of curing adhesives or coating materials, follow the instructions in the catalogs or the product specifications of the capacitors.
• Covering over the entire surface of the rubber seal and the inside of the capacitor may result in a hazardous condition because the inside pressure cannot be released completely. Also, a large amount of halogen ions in re-lease will cause the capacitors to fail because the halogen ions penetrate into the rubber seal.
c) Some of coating material cannot be cure over the capacitor. Please note that loose tacker and whitening on the surface of the outer sleeve might be caused according to the kind of solvents used for mounting adhesives and coating agents.

6. Fumigation
In many cases when exporting or importing electronic devices, such as capacitors, wooden packaging is used. In order to control insects, most often, it becomes necessary to fumigate the shipments. Precautions during “Fumigation” using halogenated chemical such as Methyl Bromide must be taken. Halogen gas can penetrate packaging materials used, such as cardboard boxes and vinyl bags. Penetration of the halogen gas can cause corrosion of electrolytic capacitors.

The Operation of Devices
a) Do not touch a capacitor directly with bare hands.
b) Do not short-circuit the terminal of a capacitor by letting it come into contact with any conductive object. Also, do not spill conductive liquid such as acid or alkaline solution over the capacitor.
c) Do not use capacitors in circumstances where they would be subjected to exposure to the following materials:
• Oil, water, salt water or damp location.
• Direct sunlight.
• Toxic gases such as hydrogen sulfide, sulfurous acid, nitrous acid, chlorine or its compounds, and ammonium.
• Ozone, ultraviolet rays or radiation.
• Severe vibration or mechanical shock conditions beyond the limits prescribed in the catalog or product specifications.

Maintenance Inspection
a) Make periodic inspections of capacitors that have been used in industrial applications. Before inspection, turn off the power supply and carefully discharge the electricity in the capacitors. Verify the polarity when measuring the capacitors with a voltmeter. Also, do not apply any mechanical stress to the terminals of the capacitors.
b) The following items should be checked during the periodic inspections:
• Significant damage in appearance: venting and electrolyte leakage.
• Electrical characteristics: leakage current, capacitance, and other characteristics prescribed in the catalog or product specifications. We recommend replacing the capacitors if the parts are out of specification.

In Case of Venting
a) If a non-solid aluminum electrolytic capacitor expels gas when venting, it will discharge odors or smoke, or burn in the case of a short-circuit failure. Immediately turn off or unplug the main power supply of the device.

b) When venting, a non-solid aluminum electrolytic capacitor blows out gas with a temperature of over 100°C. (A solid aluminum electrolytic capacitor discharges decomposition gas or burning gas while the outer resin case is burning.) Never expose the face close to a venting capacitor.

If your eyes inadvertently become exposed to the spouting gas or you inhale it, immediately flush the open eyes with large amounts of water and gargle with water respectively. If electrolyte is on the skin, wash the electrolyte away from the skin with soap and plenty of water. Do not lick the electrolyte of non-solid aluminum electrolytic capacitors.

Storage
We recommend the following conditions for storage:
 a) Do not store capacitors at a high temperature or in high humidity. Store the capacitors indoors at a temperature of 5 to 35°C and a relative humidity of 75% or below.
b) Store the capacitors in places free from water, oil or salt water.
c) Store the capacitors in places free from toxic gases (hydrogen sulfide, sulfurous acid, chlorine, ammonium, etc.)
d) Do not store the capacitors in places free from ozone, ultraviolet rays or radiation.
e) Keep capacitors in the original package.

Disposal
Please consult with a local industrial waste disposal specialist when disposing aluminum electrolytic capacitors.

Catalog
Specifications in the catalog may be subject to change without notice. Please consult us first before use. Human Airsh Group reserves the right of final interpretation of all the content.

ALUMINUM ELECTROLYTIC CAPACITORS

Soldering Recommendation

■ Flow Soldering (Radial Lead Type)

Flow Soldering Preheating Soldering Cooling

260°C max

130±20°C

Tamb

30~50 sec. <1 sec. <10 sec.

Note 1: (1~3 sec)/sec.
Note 2: Approx. 200°C/sec.
Note 3: 5°C/sec. (max.)

Time

Tamb

Reflow Soldering

(For Polymer SMD Type)

Recommended Reflow Profile

Preheating

T1(T°C) T2(T°C) T3(T°C) T1(sec.) T2(sec.) T3(sec.) Reflow cycle

Condition 1

150°C to 180°C Within 90 sec.

260 230 200 610 40 60 1

Condition 2

250 230 200 610 40 60 2

Condition 2

150°C to 180°C Within 90 sec.

260 230 200 610 40 60 1

Condition 2

250 230 200 610 40 60 2
• (For Liquid SMD Type)

Case size: Ø6.3-Ø10mm:
- Temperature at surface of capacitor shall not exceed 1°C.
- The duration for over 200°C temperature and T°C at surface of capacitor shall not exceed t and t, respectively.
- Preheat shall be done at 100°C to 200°C for and Maximum 180 seconds.

Part Numbering System

1. Category code
2. Voltage code
3. Capacitance code
4. Capacitance tolerance code
5. Cap. (μF)

Tolerance code

Capacitance code

Capacitance tolerance code

Cap. (μF) Code

Code

7 8 9

-10+10 K

-20+20 M

-10+30 Q

0+10 E

-10+20 V

0+20 A

-5+20 C

-10+20 B

5+15 D

10+20 F

-15+20 N

100 1 1

220 2 2

470 4 4

1000 1 1

4100 4 4

8470 8 8

10000 1 1

22000 2 2

33000 3 3

68000 6 6

12. Case size (mm) T°C (°C) T°C (°C) t (sec.) t (sec.) R (sec.) reflow cycle

- ø6.3 250 230 90 40 1

- ø6.8 240 230 90 30 1

- ø10 230 230 60 30 1

1. Peak temperature
2. The duration over 200°C (max.)
3. The duration over T°C

Please contact us if capacitors are subject to the conditions other than the allowable range of reflow.

ALUMINUM ELECTROLYTIC CAPACITORS

ALUMINUM ELECTROLYTIC CAPACITORS
Application Guidelines for Aluminum Electrolytic Capacitors

1. Designing Device Circuits
   a. Select the capacitors to suit installation and operating conditions, and use the capacitors to meet the performance limits prescribed in this catalog or the product specifications.

2. Polarity
   a. Aluminium Electrolytic Capacitors are polarized. Apply neither reverse voltage nor AC voltage to polarized capacitors. Using reversed polarity causes a short circuit or burning. Before use, refer to the type, product specifications or capacitor body to identify the polarity marking. (The shape of rubber seal does not represent the directional rule for polarity.) Use a bipolar type of non-solid aluminum electrolytic capacitor for a circuit where the polarity is occasionally reversed. However, note that even a bipolar aluminum electrolytic capacitor must not be used for AC voltage applications.

3. Operating voltage
   a. Do not apply a DC voltage which exceeds the full rated voltage. The peak voltage of a superimposed AC voltage (ripple voltage) on the DC voltage must not exceed the full rated voltage. A surge voltage value, which exceeds the full rated voltage, is prescribed in the catalogs, but it is a restricted condition, for especially short periods of time.

4. Ripple current
   a. The rated ripple current has been specified at a certain ripple frequency. The rated ripple current at several frequencies must be calculated by multiplying the rated ripple current at the original frequency using the frequency multipliers for each product series.

5. Category temperature
   a. The use of a capacitor outside the maximum rated category temperature will considerably shorten the life or cause the capacitor to vent. The relation between the lifetime of aluminum electrolytic capacitors and ambient temperature follows Arrhenius' rule that the lifetime is approximately halved with each 10°C rise in ambient temperature.

6. Life expectancy
   a. Select the capacitors to meet the service life of a device.

7. Charge and discharge
   a. Do not use capacitors in circuits where heavy charge and discharge cycles are frequently repeated. Frequent and heavy discharging cycles will result in decreasing capacitance and damage to the capacitors due to generated heat. Specified capacitors can be designed to endure such a condition. Rapid charging/discharging may be repeated in a circuit where the ripple voltage at the two terminals of the aluminum electrolytic capacitor fluctuates greatly. If the variation range of voltage exceeds 70% of p-p, please consult us.

8. Failure modes of capacitors
   a. Non-solid aluminum electrolytic capacitors, in general, have a lifetime which ends in an open circuit, the period is dependent upon temperature. Consequently, lifetime of capacitors can be extended by reducing the ambient temperature and/or ripple current.

9. Insulating
   a. Electrically isolate the following parts of a capacitor from the negative terminal, the positive terminal and the circuit traces.
      - The outer can of a non-solid aluminum electrolytic capacitors.
      - The dummy terminal of a non-solid aluminum electrolytic capacitors, which is designed for mounting stability.
      - The outer sleeve of a capacitor is not assumed as an insulator (Except for screw type). For applications that require an insulated outer sleeve, a custom-designed capacitor is recommended.

10. Conditions
    a. Do not use capacitors to the following conditions.
       - Oil, water, salty water. Avoid storage in damp locations.
       - Direct sunlight.
       - Toxic gases such as hydrogen sulfide, sulfuric acid, nitric acid, chlorine or its compounds, and ammonia.
       - Ozone, ultraviolet rays or radiation.
       - Severe vibration or mechanical shock conditions beyond the limits prescribed in the catalogs or the product specification.

11. Mounting
    a. The electrolytic paper and the electrolytic-conductive electrolyte in a non-solid aluminum electrolytic capacitor are flammable. Leaking electrolyte on a printed circuit board can gradually erode the copper traces, possibly causing smoke or burning by short-circuiting the copper traces.
    b. Verify the following points when designing a PCB.
       - Provide the appropriate hole spacing on the PCB board to match the terminal spacing of the capacitor.
       - Make the opening size over the vent so that the vent can operate correctly.

Case diameter Clearance Ø6.3 to Ø16mm 2mm minimum Ø18 to Ø35mm 3mm minimum Ø40mm or more 5mm minimum
    - Do not place any wires or copper traces over the vent of the capacitor.
    - Installing a capacitor with the vent facing the PCB board needs an appropriate ventilation hole in PC board.
    - Do not pass any copper traces beneath the seal side of a capacitor. The trace must pass 1 or 2mm to the side of the capacitor.
    - Avoid placing any heat-generating objects adjacent to a capacitor or even on the reverse side of the PCB board.
    - Do not pass anything via hole or underneath a capacitor.
    - In designing double-sided PCB boards, do not locate any copper trace under the seal side of a capacitor.
    - Do not mount the terminal side of a screw mount capacitor downwards. If a screw terminal capacitor is mounted on its side, make sure the positive terminal is higher than the negative terminal.
    - Do not fasten the screws of the terminals and the mounting clamps over the specified torque prescribed in the catalog or the product specifications.
    - For a surface mount capacitor, design the copper pads of the PCB board in accordance with the catalog or the product specifications.

12. Others
    a. The electrical characteristics of capacitors vary in respect to temperature, frequency and service life. Design the device circuits by taking these changes into account.
    b. Capacitors mounted in parallel need the current to flow equally through the individual capacitors.
    c. Capacitors mounted in series require resistors in parallel with the individual capacitors to balance the voltage.
    d. Using capacitor for applications which always consider safety. Consult with our factory before use in applications which can affect human life (space equipment, aerial equipment, nuclear equipment, medical equipment, vehicle control equipment, etc.). Please note that the product which is designed only for specific usage can not be used for other purposes (ex: Photo flash type, etc.)

Installing Capacitors

1. Installing
   a. Used capacitors are not replaceable, except in the case that the capacitors are detached from a device for periodic inspection to measure their electrical characteristics.
   b. If the capacitors have self-charged, discharge the capacitors through a resistor of approximately 1kΩ before use.
   c. If capacitors are stored at a temperature of 35°C or more and more than 75% RH, the leakage current may increase. In this case, they can be re-formed by applying the rated voltage through a resistor of approximately 1kΩ.
   d. Verify the rated capacitance and voltage of the capacitors when installing.
   e. Verify the polarity of the capacitors.
   f. Do not use the capacitors if they have been dropped on the floor.
   g. Do not deform the cases of capacitors.
   h. Verify that the lead spacing of the capacitor fits the hole spacing in the PCB board before installing the capacitors. Some standard pre-formed leads are available.
   i. For pin terminals or snap-in terminals, insert the terminals into PCB board and press the capacitor downward until the bottom of the capacitor body reaches PCB board surface.
   j. Do not apply any mechanical force in excess of the limits prescribed in the catalogs or the product specifications of the capacitors. Also, note the capacitors may be damaged by mechanical shocks caused by the vacuum/insertion head, component checker or centering operation of an automatic mounting or insertion machine.

2. Soldering and Solderability
   a. When soldering with a soldering iron
      - Soldering conditions (temperature and time) should be within the limits prescribed in the catalogs or the product specifications.
      - If the terminal spacing of a capacitor does not fill the terminal hole spacing of the PCB board, reform the terminals in a manner to minimize a mechanical stress into the body of the capacitor.
      - Remove the capacitors from the PCB board, after the solder is completely melted, reworking by using a soldering iron minimizes the mechanical stress to the capacitors.
      - Do not touch the capacitor body with the hot tip of the soldering iron.
   b. Flow soldering
      - Do not dip the body of a capacitor into the solder bath, only dip the terminals. The soldering must be done on the reverse side of PCB board.
      - Soldering conditions (preheat, solder temperature and dipping time) should be within the limits prescribed in the catalogs or the product specifications.
      - When setting the temperature: infrared heaters, consider that the infrared absorption causes material to be dissolved and change in appearance.
      - Do not solder capacitors more than once using reflow. If it should be done for twice, please consult us first.
      - Make sure capacitors do not come into contact with any other components while soldering.
      - Reflow soldering (only applicable for SMD type)
      - Soldering conditions (preheat, solder temperature and dipping time) should be within the limits prescribed in the catalogs or the product specifications.
      - When setting the temperature: infrared heaters, consider that the infrared absorption causes material to be dissolved and change in appearance.
      - Do not solder capacitors more than once using reflow. If it should be done for twice, please consult us first.

3. Handling after soldering
   a. Do not apply any mechanical stress to the capacitor after soldering onto the PCB board.
   b. Do not use the capacitors for Lifing or carrying the assembly board.
   c. Do not hit or pull the capacitor after soldering to PCB board, and then use a soldering iron within the prescribed conditions.
   d. Confirm whether reflow soldering is applicable for the capacitors.

4. Cleaning PCB board
   a. Do not wash capacitors by using the following cleaning agents.
      - Halogenated solvents: cause capacitors to fail due to corrosion.
      - Analine system: solvents corrosive (dissolve) an aluminum case.
      - Petroleum and terpene system solvents: cause the rubber seal material to deteriorate.
      - Acetone: erase the marking. Soldering proof capacitors are only suitable for cleaning within the cleaning prescribed in the catalogs or the product specifications. In particular, ultrasonic cleaning will accelerate damaging capacitors.
(For Liquid SMD Type)

Case size: ø6.3~ø10mm:
- Temperature at surface of capacitor shall not exceed T°C.
- The duration for over 200°C temperature and T°C at surface of capacitor shall not exceed t₁ and t₂ seconds, respectively.
- Preheat shall be done at 100°C to 200°C and for Maximum 180 seconds.

1. Peak temperature
2. The duration over 200°C (max.)
3. The duration T°C
   ■ Please contact us if capacitors are subject to the conditions other than the allowable range of reflow.

Case size: ø12.5~ø18mm:
- Temperature at surface of capacitor shall not exceed T°C.
- The duration for over 200°C temperature and T°C at surface of capacitor shall not exceed t₁ and t₂ seconds, respectively.
- Preheat shall be done at 100°C to 180°C and for Maximum 150 seconds.

1. Peak temperature
2. The duration over 200°C (max.)
3. The duration T°C
   ■ Please contact us if capacitors are subject to the conditions other than the allowable range of reflow.

### Part Numbering System

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<th>Code</th>
<th>Voltage code</th>
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### Capacitance code

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<td>±25%</td>
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<td>Tap-in (SMS Type)</td>
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### Terminal code

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<td>Lead Cut L=5.5mm</td>
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<td>3</td>
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<td>Lead Forming &amp; Cut L=4.5mm</td>
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<td>Snap-in type: Terminal 4.5mm in length</td>
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<td>Three Terminals</td>
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<td>Ring dip-molding special design</td>
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ALUMINUM ELECTROLYTIC CAPACITORS

Lead Forming
Taping Specifications

Fig. 1 code: X

Fig. 2 code: B

Fig. 3 code: B

Fig. 4 code: P

ALUMINUM ELECTROLYTIC CAPACITORS

Lead Forming
Specification Fig. 1 & Fig. 2 & Fig. 3

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<thead>
<tr>
<th>Items</th>
<th>Symbol</th>
<th>Case size</th>
<th>Tolerance</th>
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</tr>
<tr>
<td>Hole down tape position</td>
<td>W2</td>
<td>3.0, 3.0, 3.0</td>
<td></td>
</tr>
</tbody>
</table>

Specification Fig. 4

<table>
<thead>
<tr>
<th>Items</th>
<th>Symbol</th>
<th>Case size</th>
<th>Tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pin Code</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lead wire diameter</td>
<td>Ød</td>
<td>0.45, 0.45, 0.5</td>
<td>±0.05</td>
</tr>
<tr>
<td>Pitch of body</td>
<td>P</td>
<td>12.7, 12.7, 12.7</td>
<td>±1.0</td>
</tr>
<tr>
<td>Feed hole pitch</td>
<td>P0</td>
<td>12.7, 12.7, 12.7</td>
<td>±0.2</td>
</tr>
<tr>
<td>Distance from hole center to lead</td>
<td>P1</td>
<td>3.85, 3.85, 3.85</td>
<td>±0.7</td>
</tr>
<tr>
<td>Distance from lead hole center to body center</td>
<td>P2</td>
<td>6.35, 6.35</td>
<td>±1.0</td>
</tr>
<tr>
<td>Lead-to-lead distance</td>
<td>F</td>
<td>1.5, 2.0, 2.0, 2.0</td>
<td>±0.5</td>
</tr>
<tr>
<td>Height of body from tape center</td>
<td>H</td>
<td>18.5, 18.5, 18.5</td>
<td>±0.75</td>
</tr>
<tr>
<td>Lead wire clinch height</td>
<td>H0</td>
<td>16.0, 16.0, 16.0</td>
<td>±0.5</td>
</tr>
<tr>
<td>Base tape width</td>
<td>W</td>
<td>18.0, 18.0, 18.0</td>
<td>±0.5</td>
</tr>
<tr>
<td>Adhesive tape width</td>
<td>W0</td>
<td>6.0, 6.0, 6.0</td>
<td>min</td>
</tr>
<tr>
<td>Hole position</td>
<td>W1</td>
<td>9.0, 9.0, 9.0</td>
<td>max</td>
</tr>
<tr>
<td>Hole down tape position</td>
<td>W2</td>
<td>3.0, 3.0, 3.0</td>
<td></td>
</tr>
</tbody>
</table>
A1 series
- Endurance: 2,000 hours at 105°C
- Low ESR
- Recommended Applications: System Board, Display Card, Small Charger and intelligent TV
- RoHS Compliant and lead-free

**Specifications**

<table>
<thead>
<tr>
<th>Item</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category Temperature Range</td>
<td>-45~+105°C</td>
</tr>
<tr>
<td>Rated Working Voltage Range</td>
<td>2~25 Vdc</td>
</tr>
<tr>
<td>Nominal Capacitance Range</td>
<td>0.8~470μF</td>
</tr>
<tr>
<td>Capacitance Tolerance</td>
<td>±20%(M) (at 20°C, 120Hz)</td>
</tr>
<tr>
<td>DC Leakage Current</td>
<td>iso:0.666 μA/V -2V~10V, iso:0.1μA/V -25V</td>
</tr>
<tr>
<td>Where: L leakage current (μA), C: Nominal capacitance (μF), V: Rated voltage (V) (at 20°C after 2 minutes)</td>
<td></td>
</tr>
<tr>
<td>Dissipation Factor (tanδ)</td>
<td>Rated Voltage(Vdc)</td>
</tr>
<tr>
<td>tanδ (max.)</td>
<td>0.06</td>
</tr>
<tr>
<td>ESR/10kHz ~ 100kHz, 20°C</td>
<td>Value in characteristic table</td>
</tr>
<tr>
<td>Temperature Characteristic (Impedance Ratio at 100kHz)</td>
<td>Z1 (105°C)/Z2 (25°C) = 1.25</td>
</tr>
<tr>
<td>Z1 (~55°C)/Z2 (20°C) = 1.25</td>
<td></td>
</tr>
</tbody>
</table>

**Endurance**
- After applying rated voltage with rated ripple current for 2,000 hours at 105°C, the capacitors shall meet the following requirements.
- Appearance: No significant damage
- Capacitance Change: ±20% of the initial value
- D.F. (tanδ): ≤100% of the initial specified value
- Leakage Current: ≤100% of the initial specified value

**Humidity Test**
- After subjecting to 90% ~ 95% RH for 505 hours at 80°C (cold voltage), the capacitors shall meet the requirement as Endurance.
- Appearance: No significant damage
- Capacitance Change: ±10% to ±30%
- D.F. (tanδ): ≤100% of the initial specified value
- Leakage Current: ≤100% of the initial specified value

**Surge Test**
- After subjecting to 1,000 cycles each consisting of charge with the surge voltage specified at normal temperature for 30 seconds through a protective resistor and discharge for 5 minutes 30 seconds, the capacitors shall meet the following requirements.
- Appearance: No significant damage
- Capacitance Change: ±20% of the initial value
- D.F. (tanδ): ≤100% of the initial specified value
- Leakage Current: ≤100% of the initial specified value

**Dimensions (mm)**

<table>
<thead>
<tr>
<th>Case Size</th>
<th>Lx0.3(mm)</th>
<th>Wx0.2(mm)</th>
<th>Txd1(mm)</th>
<th>W1x0.2(mm)</th>
<th>Sx0.2(mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>7.3</td>
<td>4.3</td>
<td>1.9</td>
<td>2.4</td>
<td>1.3</td>
</tr>
<tr>
<td>12.5</td>
<td>7.3</td>
<td>4.3</td>
<td>1.9</td>
<td>2.4</td>
<td>1.3</td>
</tr>
<tr>
<td>16</td>
<td>7.3</td>
<td>4.3</td>
<td>1.9</td>
<td>2.4</td>
<td>1.3</td>
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<tr>
<td>18</td>
<td>7.3</td>
<td>4.3</td>
<td>1.9</td>
<td>2.4</td>
<td>1.3</td>
</tr>
</tbody>
</table>

**Marking**

**Part Numbering System**

- Special code
- ESR code
- Size code
- Capacitance code
- Capacitance tolerance code
- Voltage code
- Series code
- Category code