Precautions and Guidelines for Aluminum Electrolytic Capacitors

1. Guidelines for Circuit Design

Selecting the capacitors to suit installation and operating conditions, and using the capacitors to meet the performance limits prescribed in this cataloge or the product specifications

(1) Polarity

Aluminum electrolytic capacitors are polarized. Make sure of the polarity, if used in reverse polarity, the circuit life may be shortened or the capacitor may be damaged. When the polarity in a circuit sometimes can be reversed or unknown, a bi-polar capacitor shall be used. Also, note that DC capacitors cannot be used for AC application. Reverse voltage **1** voltage acceptable within specified temperature and working voltage.

(2) Operating Voltage

Do not apply DC voltage, which exceeds the rated voltage of the capacitor and not be reverse voltage. If a voltage exceeding the capacitor's voltage rating is applied, the capacitor may be damaged as leakage current increase. Using capacitors at recommended working voltage prolongs capacitor life. The surge voltage rating is the maximum DC over-voltage to which the capacitors may be subjected of short periods.

(3) Ripple Current

(a) The combined value of DC voltage and the peak AC voltage shall not exceed the rated voltage. When an excessive ripple current passes, the capacitor may be damaged with the vent operating, etc. Use the electrolytic capacitor within the permissible ripple range current at specified frequency and temperature.

(b) The temperature coefficient shows the limit of ripple current exceeding the rated ripple current that can be applied to the capacitor at the temperature. The expected life of a capacitor is nearly equal to the lifetime at the upper category temperature.

(4) Operating Temperature

Use the capacitors according to the specified operating temperature range. If used the capacitor outside the maximum rated temperature will considerably shorten the life or cause the capacitor to vent. Usage at room ambient will ensure longer life.

(5) Leakage Current

The leakage current shall be within specified levels. When capacitors are applied at a lower voltage, the actual leakage current will be reduced proportionately.

(6) Charge and Discharge

The capacitor is not suitable for a circuit in which charge and discharge are frequently repeated. The capacitance value may drop by forming oxide layer on the cathode foil, or the capacitor may be damaged by generating heat due to continuous rapid charge and discharge.

(7) Condition of Use

(a) The capacitors shall not be exposed to water, saltwater spray, oil or fumes, high humidity or humidity condensation and direct sunlight.

(b) Ambient conditions that include hazardous gases/fumes such as hydrogen sulfide, sulfurous acid, nitrous acid, chlorine or bromine gas, ammonia, etc.

(c) Exposed to ozone, ultraviolet rays and radiation.

(d) Severe vibration or physical shock that exceeds the condition in specification sheets.

(8) Consideration to Circuit Design

(a) Please make sure the application and mounting conditions that the capacitor will be used are within the conditions specified in the catalog. If the conditions are beyond the conditions specified in the catalog, please contact Lelon.

(b) Do not design a circuit board so that heat-generating components are places near an aluminum electrolytic capacitor or reverse side of PCB. A cooling system is recommended.

(c) Operating temperature, applied voltage and ripple current shall be within specification. The ambient temperature shall not exceed the operating temperature and applied ripple current shall not exceed the allowable ripple current specified in the specification.

(d) Performances of electrical characteristics of aluminum electrolytic capacitors are affected by variation of operating temperature and frequency. Consider this variation designing the circuit.

(e) When two or more aluminum capacitors are connected in parallel, consider the current balance that flow through the capacitors.

(f) If more than two capacitors are connected in series, make sure the applied voltage will be lower than the rated voltage and that voltage will be applied to each equally using a balancing resistor in parallel with each capacitor.

(g) For appropriate choice of capacitors for circuit that repeat rapid charge and discharge, please consult Lelon.

(h) Outer sleeve of the capacitor is not guaranteed as an electrical insulator. Do not use a standard sleeve on a capacitor that requires the electrical insulation. When the application requires special electrical insulation, please contact Lelon.

(i) Do not tilt lay down or twist the capacitor's body after the capacitor is soldered to the PCB.

2. Caution for Assembling Capacitors

(1) Mounting

(a) Aluminum electrolytic capacitors cannot be re-used once the capacitor has assembled in the set and power applied.

(b) Aluminum electrolytic capacitors may have electrical potential between positive and negative terminal, please discharge through a 1kΩ resistor before use.

(c) Leakage current of Aluminum electrolytic capacitors may be increased after storage a long period of time. When leakage current has increased, please perform a voltage treatment before use.

Voltage treatment:

The capacitors shall be applied with DC rated voltage through a resistor of 1kΩ in series for one hour, and then discharge through a resistor of 1kΩ. When the capacitors have been assembled in the board, use a volt regulator to input voltage gradually to the rated voltage of the board.

(d) Please confirm the rated voltage before mounting.

(e) Please confirm the polarity before mounting.

(f) Do not use the capacitor that once dropped on the hard floor.

(g) Do not damage the capacitor while mounting.

(h) Capacitors shall be mounted that hold spacing on PCB matches the lead pitch of the capacitors.

(i) During the auto-insertion process and parts inspection, capacitors shall avoid the excessive force and shock.

(j) Do not design to locate any wiring or circuit around the capacitor's pressure relief vent. The following clearance should be made above the pressure relief vent. The pressure relief vent will not open without the appropriate free space.

Case Diameter	ϕ6.3 ~ ϕ16	ϕ18 ~ ϕ35	ϕ40 or more
Clearance (min)	2 mm	3 mm	5 mm

(2) Soldering

(a) Be careful of temperature and time when soldering. Dip of flow soldering of the capacitors should be limited at less than 260±5℃ for 10±1 seconds or soldering iron with 350±10℃ for 3+1/-0 seconds. Do not dip capacitor's body into melted solder.

(b) High humidity will affect the solder ability of lead wire and terminals. High temperature will reduce long-term operating life.

(c) **Except SMD type, reflow soldering can not be used for any types of aluminum electrolytic capacitors.** When using SMD type capacitor, please check the reflow profile. The temperature and duration shall not exceed the specified temperature and duration in the specification. If the temperature or duration is higher than the value specified, please consult Lelon before usage.

(d) Standard aluminum electrolytic capacitors cannot withstand more than one reflow process. Please consult our engineering department when needed.

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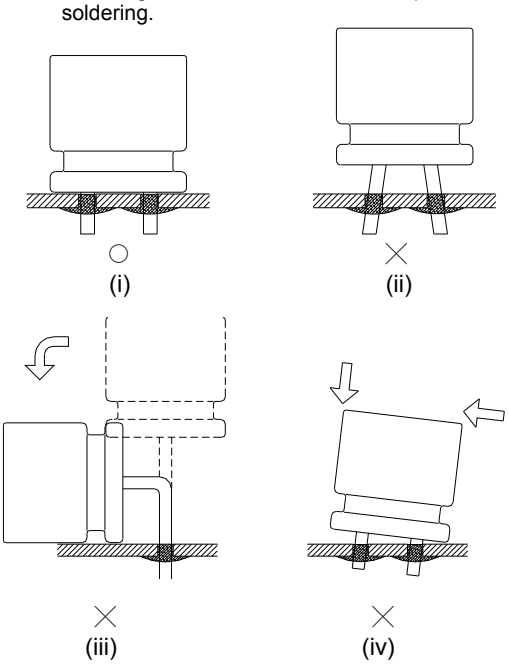
(e) Defective mounting on PCB and improper external strength applied on the lead wires or case body after soldering (see below drawings) may damage insdie structure of the capacitor and may cause short circuit, high leakage current or leakage problems.
(i) Good soldering
(ii) Hole-to-hole space on board differs from the lead space of lead wires.
(iii) Lead wires are bent after soldering.
(iv) Case body doesn't stand vertical on board after soldering. Do not bend or twist the capacitor's body after soldering.



(3) Cleaning Circuit Boards after Soldering

Halogenated solvent cleaning is not available for aluminum electrolytic capacitors. IPA (Isopropyl Alcohol) is one of the most acceptable cleaning agents; it is necessary to maintain a flux content in the cleaning liquid at a maximum limit of 2 Wt. %. If you use other cleaning agents, please consult Lelon.

3. Maintenance Inspection

Periodical inspection is necessary for using the aluminum capacitors with industrial equipment. The following items should be checked:

(1) Appearance: Vent operation, leaking electrolyte, etc.

(2) Electrical characteristic: Capacitance, dissipation factor, leakage current, and other specified items listed in specification.

Lelon recommend replacing the capacitors if the parts are out of specifications.

4. Storage

(1) Aluminum electrolytic capacitor should not be stored in high temperature or high humidity condition. The suitable condition is 5℃ ~ 35℃ and less than 75% in relative humidity indoor.

(2) Do not store the capacitors in damp conditions such as water, brine or oil.

(3) Do not store the capacitors that exposed to hazardous gas such as hydrogen sulfide, sulfurous acid, nitrous acid, chlorine, ammonium, etc.

(4) Do not store the capacitors that exposed to ozone, ultraviolet rays or radiation.

(5) Do not expose the capacitors to acidic or alkaline solutions.

(6) It is not applied to a regulation of JEDEC J-STD-020(Rev. C).

5. Disposal

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

6. Environmental Consideration

Lelon already have receivd ISO 14000 certificate. Cadmium (Cd), Lead (Pb), Mercury (Hg), Hexavalent Chromium (Cr+6), PBB and PBDE have never been useing in capacitor. If you need "Halogen-free" products, please consult with us.

For further details, please refer to
IEC 60384-4 - Fixed capacitors for use in electronic equipment – Part 4: Sectional specification – Aluminium electrolytic capacitors with solid (MnO2) and non-solid electrolyte (Established in January 1995, Revised in March 2007), and
EIAJ RCR-2367B - Guideline of notabilia for fixed aluminium electrolytic capacitors for use in electronic equipment [(Technical Standardization Committee on Passive Components (Established in March 1995, Revised in March 2002)]