

I .Device Circuits Design Considerations

1.Prohibited to Use Circuit

Conductive polymer(hybrid) solid aluminum electrolytic capacitor (The following is called capacitor) may cause the leak current occur changing due to the heat stress in welding. Please avoid to use in the below circuit.

- ① High resistance voltage holding circuit.
- ② Coupled circuits.
- ③ The other circuits that affected leakage current larger

2.Circuit Design

Please design circuit on the basis of confirming the following content.

- ① As the change of temperature and frequency, electric property of capacitor will changes.Please design circuit after confirming those changes.
- ② When more than 2 capacitors in parallel , please consider the balance of current when design circuit.
- ③ When more than 2 capacitors in series , as the difference of load voltage , it may load overvoltage, so please consulting us when using.
- ④ Please don't install heating components around the capacitor and the back of the printed wiring board.

3.Using Capacitors for Significantly Safety-Oriented Applications

Consult us about capacitors for a device application affecting human safety (①Aviation and aerospace ②Nuclear ③Medical) or for any device whose failure will make an impact on society.

4.Polarity

The conductive polymer(hybrid) capacitor of our company is a capacitor with polarity. Never apply a reverse voltage or AC voltage. Connecting with wrong polarity will short circuit in initial State. About polarity, please confirm product catalogue or the diagram in the product specifications.

5.Operating Voltage

Do not apply an overvoltage that exceeds rated voltage, Because even if to load the voltage that more than the rated voltage only for an instant , it can also lead to increased leakage current and short circuit. The total peak value of the ripple voltage plus the DC voltage must not exceed the rated voltage of the capacitors. In the work, it doesn't need to reduce the voltage. Although capacitors specify a surge voltage, in the temperature range, if under the rated voltage, whatever is the environment temperature; it also has limited and does not assure long-term use.

6.Ripple Current

Do not apply an overcurrent that exceeds the rated ripple current specified for the capacitors.Excessive ripple current will increase heat production within the capacitors, shortening the life and short circuit.

7.Operating Temperature

If use beyond working temperature range of environment, can lead to aging and failure performance, please use in working temperature range.

8.Charging and Discharging

Don not use capacitor in the circuit of rapid charge and discharge repeatedly. If capacitors are used in the circuits that repeat a charge and discharge, capacitance will decrease and/or the capacitors will be damaged by internal heat generation. When the peak of current value more that 20A, we recommend to use protect circuit in order to keep the reliability.

9.Leakage Current

Sometime the leakage current will increase , but if load voltage in working temperature, it will decrease gradually though self-healing effect. In addition, the more closely to the limit temperature, the faster of the reduce speed of leakage current. The reasons for leakage current increase as below :

- ① Welding
- ② High temperature without load, high temperature and high humidity, rapid temperature change test and so on.

10.Failure Mode

- ① Reduce the failure rate by reducing the surrounding temperature, ripple current and load voltage.
- ② Electrostatic capacity decreases caused by product temperature rise and opening mode wear caused by ESR rise, which are the main failure mode. Sometimes it will occur short circuit mode due to the overvoltage and large current.
- ③ Lead to short circuit due to load the voltage that more than rated voltage, when the current is larger, the shell will expansion or peeling off, give out bad smell due to the internal pressure rising.
- ④ The constitute material of products containing flammable materials , the short circuit parts will fire may due to the spark. The install ways , location , graphic design of the product, please consider the following importance points of design to ensure the absolute safety.
 - * Setting up protection circuit and protection devices to ensure that equipment safety.
 - * Setting up long circuit etc. , so that the devices will stabilization even of a single fault.

11.The Insulation of The Capacitor

The outer sleeve of a capacitor does not assure electrical insulation Please have electrical insulation between the capacitor sleeve and cathode terminal and anode terminal and circuit board.

12.Operating Conditions

Do not use/expose capacitors to the following conditions:

- ① Direct contact with water, salt water or oil, or high condensation environment.
- ② Direct sunlight.
- ③ Toxic gases such as hydrogen sulfide, sulfurous acid, nitrousacid, chlorine and its compounds, bromine and its compounds and ammonium.
- ④ Ozone, ultraviolet rays or radiation.
- ⑤ Extreme vibration or mechanical shock that exceeds limits in the catalogs or product specifications.

13. Capacitor Mounting

- ① SMD product (mould SMD 、 SMD) solder graphics of the Capacitor printed wiring board, Please refer to the provisions of the catalogue or specifications for graphic design.
- ② For radial lead type capacitors, please make sure the terminal spacing of a capacitor equals the holes spacing on the PC board.
- ③ Do not print any copper trace under the seal (terminal) side of a capacitor. Copper traces should be 1 mm (preferably 2mm or more) spaced apart from the side of the capacitor body.
- ④ In designing a double-sided PC board, do not locate any through-hole via or unnecessary hole underneath a capacitor.
- ⑤ In designing a double-sided PC board, do not print any circuit pattern underneath a capacitor.

II . Installation

1.Assembling

- ① Do not try to reuse the capacitors once assembled and electrified.

② Capacitors may have been spontaneously recharged with time by a recovery voltage phenomenon. In this case, discharge the capacitors through a resistor of approximately 1kΩ before use.

③ If have been stored at any conditions more than 35°C and 75%RH for long storage periods of time more than the limits specified in the catalogs or product specifications, they may have high leakage current. In this case, discharge by applying the rated voltage through a resistor of approximately 1kΩ.

④ Confirm the rated capacitance and voltage of capacitors before installation.

⑤ Confirm the polarity of capacitors before installation.

⑥ Do not try to use the capacitors that were dropped to the floor and so forth.

⑦ Do not deform the can case of a capacitor.

⑧ Make sure that the terminal spacing of a capacitor equals the holes spacing on the PC board before installing the capacitor.

⑨ Do not apply excessive mechanical force to capacitors more than the limits prescribed in the catalogs or product specifications. If apply excessive force, the terminal will break off or deformation and affect install, even cause short circuit, break line, increase LC and damage package. Avoid excessive mechanical force while the capacitors are in the process of vacuum-picking, placing and positioning by automatic mounting machines or cutting the lead wires by automatic insertion machines.

2. Soldering and Heat Resistance

Ensure that the soldering conditions meet the specifications recommended of our company. Note that the leakage current may increase or capacitance may decrease due to thermal stresses that occur during soldering, etc. Furthermore, the leakage current which rose gradually decreases, when voltage is applied at below the category upper limit temperature. Additionally the self repairing action is faster when voltage near the rated voltage rather than at a higher voltage is applied at below the category's upper temperature limit.

(1) Verify the following before using a soldering iron:

① That the soldering conditions (temperature and time) are within the ranges specified in the catalog or product specifications.

② That the tip of the soldering iron does not come into contact with the capacitor itself.

(2) Verify the following when flow soldering:

① Do not dip the body of a capacitor into the solder bath only dip the terminals in. The soldering must be done on the reverse side of PC board.

② Soldering conditions should be within the limits prescribed in the catalog or the product specifications.

③ Do not apply flux to any part of capacitors other than their terminals.

④ Make sure the capacitors do not come into contact with any other components while soldering.

Please note the SMD product (SMD type) non-corresponding wave-soldering.

(3) Verify the following when reflow soldering:

① Soldering conditions (preheat, solder temperature and soldering time) should be within the limits prescribed in the catalogs or the product specification.

② The heat level should be appropriate. (Note that the thermal stress on the capacitor varies depending on the type and position of the heater in the reflow oven, and the color and material of the capacitor.)

Except for the surface mount type, reflow soldering must not be used for the other capacitors.

(4) Do not reuse a capacitor that has already been soldered to PC board and then removed. When using a new capacitor in the same location, remove the flux, etc. first, and then use a soldering iron to solder on the new capacitor in accordance with the specifications.

3. Handling After Soldering

① Do not lean or twist the body of the capacitor after soldering the capacitors onto the PC board.

② Do not use the capacitors for lifting or carrying the assembly board.

③ Do not hit or poke the capacitor after soldering to PC board. When stacking the assembly board, be careful that other components do not touch the aluminum electrolytic capacitors.

④ Do not drop the assembled board.

4. Cleaning PC Boards

(1) Do not wash capacitors by using the following cleaning agents. Solvent resistant capacitors are only suitable for washing using the cleaning conditions prescribed in the catalog or the product specification. In particular, ultrasonic cleaning will accelerate damage to capacitors.

* Halogenated solvents → cause capacitors to fail due to corrosion.

* Alkali system solvents → corrode (dissolve) an aluminum case.

* Petroleum system solvents → cause the rubber seal material to deteriorate.

* Xylene → causes the rubber seal material to deteriorate

* Acetone → erases the markings

CFC alternatives or the other cleaners above; please consult with us.

(2) Verify the following points when washing capacitors.

① Monitor conductivity, pH, specific gravity and the water content of cleaning agents. Contamination adversely affects these characteristics.

② Be sure not to expose the capacitors under solvent rich conditions or keep capacitors inside a closed container.

In addition, please dry the solvent sufficiently on the PC board and the capacitor with an air knife (temperature should be less than the maximum rated category temperature of the capacitor) for 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 a voltage is applied. This corrosion causes an extremely high leakage current which results venting and an open circuit.

(3) Verify the following when reflow soldering:

① Higher alcohol cleaning agents.

Using these cleaning agents, capacitors are capable of withstanding immersion or ultrasonic cleaning for 10 minutes at a maximum liquid temperature of 60°C. Find optimum condition for washing, rinsing, and drying. Be sure not to rub the marking off the capacitor which can be caused by contact with other components or the PC board. Note that shower cleaning adversely affects the markings on the sleeve.

② Non-Halogenated Solvent Cleaning.

Immersion, ultrasonic or vapor cleaning for 5 minutes. However, from an environmental point of view, these types of solvent will be banned in near future. We would recommend not using them if at all possible.

③ Isopropyl Alcohol (IPA).

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.%.)

5. Precautions for Using Adhesives and Coating Materials

- (1) Do not use any adhesive and coating materials containing.
- (2) Verify the following before using adhesive and coating material.
 - ① Remove flux and dust left over between the rubber seal and the PC board before applying adhesive or coating materials to the capacitor.
 - ② 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.
 - ③ For permissible heat conditions for curing adhesives or coating materials, please consult with us.
 - ④ Covering over the whole surface of the capacitor rubber seal with resin may result in a hazardous condition because the inside pressure cannot be completely released. Also, a large amount of halogen ions in resins will cause the capacitors to fail because the halogen ions penetrate into the rubber seal and the inside of the capacitor.
 - ⑤ Some coating materials, it cannot be implemented to 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 it may become necessary to fumigate the shipment. Precautions during “Fumigation” using halogenated chemical such as Methyl Bromide must be taken. Halogen gas can penetrate packaging materials such as cardboard boxes and vinyl bags. Penetration of the halogenated gas can cause corrosion of Electrolytic capacitors. Our company uses packaging methods that do not require fumigation treatment when importing and exporting. Verify whether the assembled PC board, products and capacitors themselves are subjected to Fumigation during their transportation or not.

III. The Operation of Devices

1. Do not touch the capacitor terminals directly.

2. Do not short circuit the terminal of a capacitor by letting it come into contact with any conductive object.

Also, do not spill electric-conductive liquid such as acid or alkaline solution over the capacitor.

3. Please make sure the assembly of the complete circuit of capacitor installation environment.

Do not use capacitors in circumstances where they would be subject to exposure to the following materials

- ① Oil, water, salty water or damp location.
- ② Direct sunlight.
- ③ Ozone, ultraviolet rays or radiation.
- ④ Toxic gases such as hydrogen sulfide, sulfurous acid, nitrous acid, chlorine or its compounds, and ammonium.
- ⑤ Severe vibration or mechanical shock conditions beyond the limits prescribed in the catalog or product specification.

IV. Maintenance Inspection

1. 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 voltohm meter. Do not apply any mechanical stress to the terminals of the capacitors.

2. The following items should be checked during the periodic inspections.

- ① Significant damage in appearance.
- ② Electrical characteristics: leakage current, capacitance, $\tan\delta$ and other characteristics prescribed in the catalog or product specification.

We recommend replacing the capacitors if the parts are out of specification.

V. Contingencies

- 1) If gas has vented from the capacitor during use, there is a short circuit and burning, or the capacitor discharges an odor or smoke, turn off the main power supply to the equipment or unplug the power cord.
- 2) If there is a problem with the capacitor or a fire breaks out, the capacitor may produce a burning gas or reactive gas from the outer resin, etc. If this happens, keep your hands and face away from the gas. If vented gas is inhaled or comes into contact with your eyes, flush your eyes immediately with water and/or gargle. If vented gas comes into contact with the skin, wash the affected area thoroughly with soap and water.

VI. Storage

We recommend the following conditions for storage.

- (1) Store capacitors in a cool, dry place. Store at a temperature between 5 and 35°C, with a humidity of 75% or less. (table-1 Maximum storage term)

The duration, please refer to the table below.

	Before the bag is opened	After the bag is opened
SMD(Resin-Molded chip type)	within six months after delivery	Within 30 days after the bag is opened
DIP(Radial lead type)	within one year after delivery	Within 7 days after the bag is opened

- ① SMD products are sealed in a PE plastic bag. Use all capacitors in desposit period once the bag is opened.
- ② If the bag have open and need to storage, please return unused capacitors to the bag, and seal it with a zipper.
- ③ Be sure to follow our recommendations for reflow soldering.
- (2) Store the capacitors in a location free from direct contact with water, salt water, and oil.
- (3) Store in a location where the capacitor is not exposed to toxic gas, such as hydrogen sulfide, sulfurous acid, nitrous acid, chlorine or chlorine compounds, bromine or other halogen gases, methyl bromide or other halogen compounds, ammonia, or similar.
- (4) Store in a location where the capacitor is not exposed to ozone, ultraviolet radiation, or other radiation.
- (5) It is recommended to store capacitors in their original packaging wherever possible.

VII. Disposal

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

VIII. About AEC-Q200

AEC is the abbreviation of the Automotive Electronics Council, which establishes the certification and reliability standards for various electronic components, and also specifies the reliability test standards for our main products. The product design and services provided by our company can meet the relevant needs of customers. If you need to meet the requirements of AEC-Q200 products, please contact us directly for details.

IX. Catalogs

Specifications in the catalogs are subject to change without notice. Test data shown in the catalogs are not assured as the whole performance values, but typical values.