APPLICATION GUIDELINES FOR ALUMINUM ELECTROLYTIC CAPACITORS

1. Circuit Design

(1) Please make sure the environmental and mounting conditions to which the capacitor will be exposed to are within the conditions specified in Nichicon's catalog (or alternate Nichicon specifications, such as series drawings).

(2) Operating temperature and applied ripple current must be within Nichicon specification.
①The capacitor must not be used in an ambient temperature which exceeds the operating temperature specified in the Nichicon catalog.
② Do not apply excessive current which exceeds the allowable ripple current.

(3) Appropriate capacitors which comply with the life requirement of the products should be selected when designing the circuit.

(4) Aluminum electrolytic capacitors are polarized. Do not apply reverse voltage or AC voltage. Please use non−polarized capacitors for a circuit that can possibly see reversed polarity. Note: Even non−polarized capacitors can not be used for AC voltage application.

(5) Do not use aluminum electrolytic capacitors in a circuit that requires rapid and very frequent charge / discharge. In this type of circuit, it is necessary to use a special design capacitor with extended life characteristics.

(6) Do not apply excess voltage.
① Please pay attention so that the peak voltage, which is DC voltage overlapped by ripple current, will not exceed the rated voltage.
② In the case where more than 2 aluminum electrolytic capacitors are used in series, please make sure that applied voltage will be lower than rated voltage and the voltage be will applied to each capacitor equally using a balancing resistor in parallel with the capacitor.

(7) Aluminum electrolytic capacitors must be electrically isolated as follows:
①(a) Case and negative terminal (except axial leaded part such as JIS configuration 02 type)
(b) Case and positive terminal
(c) Case and circuit pattern
②(a) Blank terminal of can type such as JIS configuration 693, 694 or 695 and negative and positive terminal, including the circuit pattern.

(8) Outer sleeve of the capacitor is not guaranteed as an electrical insulator. Do not use a standard sleeve on a capacitor in applications that require the electrical insulation. When the application requires special insulation, please contact our sales office for details.

(9) Capacitors must not be used under the following conditions:
①(a) Capacitors must not be exposed to water (including condensation), brine or oil.
(b) Ambient conditions that include toxic gases such as hydrogen sulfide, sulfurous acid, nitrous acid, chlorine, ammonium, etc..
(c) Ambient conditions that expose the capacitor to ozone, ultraviolet ray and radiation.
②Severe vibration and physical shock conditions that exceed Nichicon specifications.

Vibration:
Test condition

·vibration frequency range	: 10～55～10Hz
·sweep rate	: 10～55～10Hz/minute
·sweep method	: logarithmic
·amplitude or acceleration	: 1.5mm (max.acceleration is 10G)
·direction of vibration	: X, Y, Z direction
·testing time	: 2 hours per each direction

Shock is not applicable normally.
If a particular condition is required, Please contact to our sales office.

(10) When designing a circuit board, Please pay attention to following:
①Make the hole spacing on the P.C. board match the lead space of the capacitor.
②There should not be any circuit pattern or circuit wire above the capacitor safety vent.
③Unless otherwise specified, following clearance should be made above the pressure relief vent.

Case Diameter	Gap Required
φ6.3～16	2mm or more
φ18～35	3mm or more
φ40 or more	5mm or more

④ In case the vent side is placed toward P.C. board (such as end seal vented parts), make a corresponding hole on the P.C. board to release the gas when vent is operated. The hole should be made to match the capacitor vent position.
⑤ Do not install screw terminal capacitor with end seal side down. When you install a screw terminal capacitor in a horizontal mount, the positive terminal must be in the upper position.

(11) The main chemical solution of the electrolyte and the separator paper used in the capacitors are combustible. The electrolyte is conductive. When it comes in contact with the P.C. board, there is a possibility of pattern corrosion or short circuit between the circuit pattern which could in result smoking or catching fire. Do not locate any circuit pattern beneath the capacitor end seal.

(12) Do not design a circuit board so that heat generating components are placed near an aluminum electrolytic capacitor or reverse side of P.C. board (under the capacitor).

(13) Please refer to the pad size layout recommendations in our catalog when designing in surface mount capacitors.

(14) Electrical characteristics may vary depending on changes in temperature and frequency. Please consider this variation when you design circuits.

(15) When you are designing capacitors for use on double-sides P.C. boards, avoid circuit patterns or through holes (such to connect both sides), that are placed under the capacitor.

(16) The torque for terminal screw or brackets screws must be within the specified value on Nichicon s drawings.

(17) When you install more than 2 capacitors in parallel, consider the balance of current flowing into the capacitors.

(18) If more than 2 aluminum electrolytic capacitors are used in series, make sure the applied voltage will be lower than the rated voltage and that voltage will be applied to each capacitor equally using a balancing resistor in parallel with the capacitor.

2. Mounting

(1) Once a capacitor has been assembled in the set and power applied, do not attempt to re-use the capacitor in other circuits or application.

(2) Electric potential between positive and negative terminal may exist as a result of returned electromotive force, so please discharge the capacitor using a 1kΩ resistor.

(3) Leakage current of the parts that have been stored for more than 2 years may increase. When leakage current has increased, please perform a voltage treatment using 1kΩ resistor.

(4) Please confirm ratings before installing capacitors on the P.C. board.

(5) Please confirm polarity before in stalling capacitors on the P.C. board.

(6) Do not drop capacitors on the floor, nor use a capacitor that was dropped.

(7) Be careful not to deform the capacitor during installation.

(8) Please confirm that the lead spacing of the capacitor matches the hole spacing of the P.C. board prior to installation.

(9) Snap-in can type capacitor such as JIS configuration 692, 693, 694 and 695 type should be installed tightly to the P.C. board (allow no gap between the P.C. board an bottom of the capacitor).

(10) Please pay attention that the clinch force is not too strong when capacitors are placed and fixed by an automatic insertion machine.

(11) Please pay attention to that the mechanical shock to the capacitor by suction nozzle of the automatic insertion machine or automatic mounter, or by product checker,or by centering mechanism.

(12) Hand soldering.

①Soldering condition must be confirmed to be within Nichicon specification.
Bit temperature: 350 ± 10°C
Application time of soldering iron: 3 ± $_0$ second

② If it is necessary that the leads must be formed due to a mismatch of the lead space to hole space on the board, bend the lead prior to soldering without applying too much stress to the capacitor.

③ If you need to remove parts which were soldered, please melt the solder enough so that stress is not applied to lead.

④Please pay attention so that solder iron does not touch any portion of capacitor body.

(13) Flow soldering (Wave solder)

①Aluminum capacitor body must not be submerged into the solder bath. Aluminum capacitors must be mounted on the "top side" of the P.C. board and only allow the bottom side of the P.C. board to come in contact with the solder.

②Soldering condition must be confirmed to be within Nichicon specification.
Solder temperature: 260±5°C Immersing lead time:10±1 second Thickness of P.C. board : 1.6mm

③Please avoid having flux adhere to any portion except the terminal.

④Please avoid contact between other components and the aluminum capacitor.

(14) Reflow soldering (SMD only)

①Soldering condition must be confirmed to be within Nichicon specification.
Pre-heationg : Less than 150°C, 90 seconds max.
Max. temperature at capacitor top during reflow : 230°C
The duration for over 200°C temperature at capacitor top: 20 seconds max.
The duration from the pre-heat temperature to peak temperature of reflow varies due to changes of the peak temperature. Refer to page 21 for details.

②When an infrared heater is used, please pay attention to the extent of heating since the absorption rate of infrared, will vary due to difference in the color of the capacitor body, material of the sleeve and capacitor size.

③The number of reflow time for SMD aluminum electrolytic capacitors shall be one time. If this type of capacitor has to be inevitably subjected to the reflow twice, enough cooling time between the first and second reflow (at least more than 30 minutes) shall be taken to avoid consecutive reflow. Please contact our sales office if you have questions.

(15) Do not tilt lay down or twist the capacitor body after the capacitor are soldered to the P.C. board.

(16) Do not carry the P.C. board by grasping the soldered capacitor.

(17) Please do not allow anything to touch the capacitor after soldering. If P.C. board are stored in stack, please make sure P.C. board or the other components do not touch the capacitor.
The capacitors shall not be effected by any radiated heat from the soldered P.C. board or other components after soldering.

(18) Cleaning

①Do not clean capacitors with halogenated cleaning agent. However, if it is necessary to clean with halogenated cleaning agent, use cleaning proof capacitors but within the range specified in the specification.

②Recommeded cleaning method

Applicable : Any type, any ratings

Cleaning agents : Pine Alpha ST−100S, Clean Through 750H/750L/710M, Sanclek B−12, Aqua Cleaner 210SEP,Techno Care FRW14~17, Isopropyl Alcohol

Cleaning conditions : Total cleaning time shall be within 5 minutes by immersion,ultrasonic or other method.(Temperature of the cleaning agent shall be 60°C or lower.) After cleaning, capacitors should be dried using hot air for minimum of 10 minutes along with the PC board.
Hot air temperature should be below the maximum operating temperature of the capacitor. Insufficient dries dry after water rinse may cause appearance problems, sleeve shrink, bottom-plate bulge and such.

③CFC substitute

The capacitors can be cleaned using AK-225AES as shown in table below. Please monitor contamination of solution by measuring conductivity, pH, specific gravity, water content and such. Do not store capacitors in a cleaning agent atomosphere or sealed container after cleaning.

Cleaning Agent	AK-225AES		
Applicable Series	Miniature Type	Chip (SMD) Type	ZR, ZS, ZP, WX, WP, WT,WF, UP, UT, UD, UR, UX, UK, UN, UH UG (Less than 100V) UL (Less than 100V)
		Ultra-Miniature Type	MA, ML, MP, MT, MF, MJ, SA, SR, SL, SP, ST, SF
		Standard Products	VK (Less than 100V) VR (Less than 100V) VX 04 type (Less than 100V) VY (Less than 100V) VZ (Less than 100V) RS (Less than 100V) RZ (Less than 100V) RU (Less than 100V) RY (Less than 100V), VP, ET
		High-Reliability Type	PM (Less than 100V) PW (Less than 100V) HD,HC PJ (Less than 100V) PS (Less than 100V) PR (Less than 100V) PY, PF, PL, PV, PB (Less than 100V),ST
		For Special Circuit	KL, TM, SH, HA, JB VX 02 type (Less than 100V)
		For Audio Use	KZ, FG, FX, FW, SK, MC, ES, DB, GB
	Large Can Type	Standard Products	LQ(Less than 100V)
		High-Reliability Type	GQ(Less than 100V) GK-HH(Less than 100V)
Cleaning Conditions	With in 5 minutes, total cleaning time by immersion, vapor spray, or ultrasonic and such. For SMD and ultra-miniature type, within 2 minutes total cleaning time (Temp. of agent: 40°C or below)		

④Avoid using ozone depleting substances for cleaning agents to concern about global environment.

⑤Please consult us regarding other cleaning agents or cleaning methods.

(19) Fixing materials and coating materials

①Do not use any ingredients which contain halogen.

②Please pay attention to remove flux and any contamination which remains in the gap between the end seal and P.C. board and dry that portion well before coating.

③Please do not apply any material all around the capacitor body but apply it partially.

④Please contact our sales office to make sure whether the curing condition of coating material would cause any problems.

3. In the equipment

(1) Do not directly touch terminal by hand.

(2) Do not short between terminals by conductor, nor spill conductible liquid such as alkaline or acidic solution on or near the capacitor.

(3) Please make sure that the ambient conditions where the set is installed will be free from spilling water or oil, direct sunlight, ultraviolet rays, radiation, poisonous gases, vibration or mechanical shock.

4. Maintenance and Inspection

(1) Please periodically inspect the aluminum capacitors that are installed in industrial equipment. The following items should be checked:

①Appearance : Remarkable abnormality such as vent operation, leaking electrolyte etc.

②Electrical characteristic: Capacitance, dielectric loss tangent, leakage current etc., which are specified in the drawing exchanged between Nichicon and our customers or the Nichicon catalog.

5. In an Emergency

(1) If you see smoke due to operation of safety vent, turn off the main switch or pull out the plug from the outlet.

(2) Do not draw your face the safety vent since gas which in over 100°C will be emitted when the safety vent operates.
If the gas has entered your eyes, please flush your eyes immediately in pure water.
If you breathed the gas, immediately wash out your mouth and throat with water.
Do not ingest electrolyte. If your skin is exposed to electrolyte, please wash it away using soap and water.

6. Storage

(1) Do not keep capacitor in high temperature and high humidity.
Storage ambient should be:
Temperature : 5°C~35°C, Humidity : lower than 75%.
Place: Indoor

(2) Avoid ambient conditions: where capacitors can be covered with water, brine or oil.

(3) Avoid ambient conditions: where capacitors are exposed poisonous gases such as hydrogen sulfide, sulfurous acid, nitrous acid, chlorine, ammonium etc.

(4) Do not keep capacitor in conditions, that expose the capacitor to ozone, ultraviolet ray or radiation.

7. Disposal

(1) Please dispose capacitors in either of the following ways :
① Incinerate capacitors after crushing parts of making a hole on the capacitor body.
② Bury capacitors in the ground. Please have a disposal specialist do it.

The above mentioned material is according to EIAJ RCR—2367A (issued in March, 1999), titled "Guideline of notabilia for fixed aluminum electrolytic capacitors for use in electronic equipment".
Please refer to the book for details.

Type numbering system