

PRODUCT GUIDELINE

PRODUCT TYPE:

Liquid Electrolyte Aluminum Electrolytic Capacitors

FEATURES:

- High Capacitance Value
- High Voltage
- Low Cost
- Good Immunity to Transients
- Stable Characteristics under VDC



SUGGESTED APPLICATIONS:

- Decoupling
- Bulk Storage
- Filtering
- Suppression

The nature of the construction of liquid electrolyte aluminum electrolytic capacitors results in limitations in use of these devices. This guideline is designed to aid the user in understanding and accounting for these limitations.

GOAL: Select the capacitor suitable for the operating environment, the service life of the equipment, and use within the performance limits of the product specification.

[Industry Reference: EIAJ RCR-2367]

NON-ENDORSED APPLICATIONS:

- Life Support & Safety Controls
- Timing Circuit Applications*
- Aerospace & Aviation
- Environments containing ozone, ultraviolet rays, nuclear radiation, toxic gasses or salt mist, splashing of water or oil

*- Aluminum electrolytic capacitors are typically not suited for use in timing circuit applications, due to high VDC leakage current (LC) common to electrolytic capacitors, normal decrease in capacitance value over time, and variations in LC and capacitance within each manufacturing batch. Typically these characteristics will result in circuit timing variation from unit to unit and over the service life of the equipment. Please refer to "SELECTION AND APPLICATION OF CAPACITORS" (1982), by John D. Moynihan [Components Technology Institute]; Pages 96 & 100 indicate the limitations of using aluminum electrolytic capacitors in timing circuit applications.

CAPACITANCE TOLERANCE:

Standard capacitance tolerance for Aluminum Electrolytic Capacitors is $\pm 20\%$ (M). Under special order $\pm 10\%$ (K) tolerance products may be available. Capacitance tolerance limits apply to material **prior to exposure to PCB assembly**. Please account for capacitance value decrease below tolerance minimum limit, after exposure to reflow soldering process (such as SAC alloy reflow) and also under operation (or storage) at elevated temperature and time.

SHIPMENT & STORAGE CONDITIONS:

Transportation Conditions: (Per JIS C5070 & EIAJ RCR-2367)

1. Temperature Range: -40°C - $+30^{\circ}\text{C}$ (-40°F - $+86^{\circ}\text{F}$)
2. Lowest atmospheric pressure: 30 KPa
3. Maximum speed of pressure change: 6 KPa/minute

Storage Conditions: (Per JIS C5070 & EIAJ RCR-2367)

1. Indoors
2. Temperature: $+5^{\circ}\text{C}$ - $+30^{\circ}\text{C}$ (41°F - $+86^{\circ}\text{F}$)
3. Relative humidity: 40% - 75%

PRINTED CIRCUIT (PC) BOARD DESIGN PRECAUTIONS

Liquid Electrolyte Aluminum Electrolytic Capacitors -

1. Do not locate any circuit pattern or trace under the end seal (terminal end) of the capacitor

1.1 If printed circuit pattern (trace) is located under the end seal (terminal end) of an aluminium electrolytic capacitor, any electrolyte leakage from capacitor could result in short-circuit condition or equipment failure.

1.2 Under normal use, electrolyte vapor transfers through the rubber end seal of the capacitor. The electrolyte can accumulate between the rubber seal and the surface of the PC board. PCB pattern or trace located under capacitor could result in component and/or equipment failure due to material corrosion.

1.3 Corrosion accelerants include:

- Moisture condensation (use moisture proof coatings)
- Electric field
- Halogen ions, such as contained in activators of flux, solder alloys or within cleaning agents
- Conductive materials; i.e. Silver, Copper, Tin, etc.

2. Avoid locating any heat-producing object around the capacitor, or on reverse side of the printed circuit board under the capacitor

2.1 Locating heat-producing object near capacitor or on the reverse side of the PC board under the capacitor, may raise the capacitor temperature and may adversely affect the life expectancy of the capacitor. Capacitor temperature, not ambient temperature, will determine the lifetime of the capacitor

2.2 Heat radiation from nearby objects, may locally raise the capacitor temperature above ambient temperature.

2.3 Heat producing objects, located on the reverse side of the PC board, may locally raise the capacitor temperature above ambient temperature.

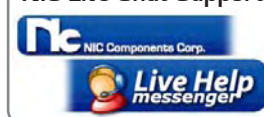
3. For surface mount capacitors, design the land pads on the print circuit board according to the product specification. Improper land pattern on the PC board may result in poor solderability, and poor component alignment.

For further guidance, please review Aluminum Electrolytic Capacitor Guideline EIAJ RCR-2367 or contact NIC's technical support personnel at tpmg@niccomp.com

NIC Support

If in doubt or uncertainty, please review your specific application - process details with NIC's technical support personnel
→ tpmg@niccomp.com

NIC Live Chat Support



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General Information For Non Solid Aluminum Electrolytic Capacitors

NIC Aluminum Electrolytic Capacitors are world renowned for their long life and high levels of performance. Advanced techniques in the etching and forming of aluminum foil provides greater volumetric efficiency and high reliability. Along with high purity materials and advanced production technology, stringent quality control insures your company of the best possible components. Unique NIC part numbers are used to identify RoHS compliant aluminum electrolytic capacitors through-out the supply chain.

NOTES FOR SAFETY

1. Limitation of use of the products in this catalog
 - 1-1 The products described in this catalog were designed and manufactured for standard applications; such as general electronics devices, office equipment, data and communication equipment, measuring instruments, household appliances and audio-video equipment.
 - 1-2 The products described herein are not intended for applications in atomic power plant, as well as other nuclear radiation related equipment or facilities.
 - 1-3 For special applications in which quality and reliability are required, or if the failure or malfunction of the products may directly jeopardize life or cause threat of personal injury (such as for aircraft and aerospace equipment, traffic and transport equipment, combustion equipment, medical equipment, accident prevention and anti-theft devices, and safety equipment), please use only after your company has sufficiently tested our products' suitability for that application.
2. In automotive applications it is requested to design based upon guaranteed specifications, in particular category temperature range, thermal shock resistance, mechanical shock as well as anti-vibration performance. Please contact NIC sales representative or consult NIC technical support [tpmg@niccomp.com] to review your application requirements and conditions prior to product selection or use. It is not the scope of our guarantee for unsatisfactory results due to misuse or inadequate usage of products on this catalog.
3. This catalog defines performance, characteristics and functions of each product under predetermined conditions. It does not guarantee them when used in actual customer systems. Please be sure to check your system before using the product for possible problems or incidents that cannot be detected during the evaluation testing of each product.
4. The products and product specifications described on this catalog are subject to change for improvement without prior notice. Therefore, be sure to request and confirm in advance the most current specifications, before the final stage of your design, purchasing or use for any application.
5. NIC Component Corp. shall not be held responsible for any problems affecting a third party's intellectual properties arising from use of our products unless such problems are caused by structural or manufacturing flaws of our products.



- ▶ See [EIAJ RCR-2367A](#) Specification - "Guideline Of Notabilia For Fixed Aluminum Electrolytic Capacitors For Use In Electronic Equipment" for [Precautions](#), [Design Layout](#), [Component Handling](#), and [Processing Guidelines](#)
 - ▶ In addition to EIAJ RCR-2367A, please review the notes and precautions on pages T10 & T11 of this catalog
 - ▶ Additional performance and technical support documentation can be found at www.niccomp.com
- If in doubt or uncertainty, please review your specific application - process details with NIC's technical support personnel tpmg@niccomp.com

REFERENCE STANDARDS:

Unless specifically noted, NIC non-solid aluminum electrolytic capacitors comply with, or are capable of meeting, the electrical and environmental requirements of JIS C5101 and IEC 384-4.

NOTES FOR PROPER USE

1 TEMPERATURE RANGE & PERMISSIBLE RIPPLE CURRENT

Please use capacitors according to the temperature range and permissible ripple current as noted in the catalogue specification.

- a) Life time of aluminum electrolytic capacitors is chiefly dependent upon the ambient operational temperature. Generally the life time will double as the temperature decreased by 10 degrees (see Life Expectancy below). It is recommended that capacitors be used at a lower temperature than the maximum operation temperature.
- b) Capacitors should be used at current levels below the permissible ripple current rating. If subjected to excessive ripple current, heat generation may acutely increase, potential leading to decreasing capacitance or damage to the capacitor. Please refer to permissible ripple current ratings shown on catalogue specification sheet for each NIC part number.

If in doubt or uncertainty, please review your operating environment conditions with NIC's technical support personnel [tpmg@niccomp.com]

2 LIFE EXPECTANCY

- a) Please choose the capacitor that matches the lifetime of the intended circuit design.
- b) Operational life at the specified maximum operating temperatures is indicated in NIC product specifications. The life expectancy of non-solid aluminum electrolytic capacitors is dependent upon case size, ambient temperature, ripple current, and voltage rating. The life expectancy at lower temperature than the specified maximum temperature may be estimated by the following equation:

$$L = L_0 \times 2^{\frac{T - T_0}{10}}$$

where, L_0 = Expected life period (hrs) at maximum allowable operating temperature
 L = Expected life period (hrs) at the actual operating temperature
 T = Maximum operating temperature (°C) allowed
 T_0 = Actual operating temperature

Note: This life expectancy formula does not apply for ambient temperatures below +35°C

See Life Expectancy Tables (on P2) for expected life period (hours) to meet load life specifications per product specifications.

Also see www.LowESR.com and www.niccomp.com for typical load life test results.

General Information For Non Solid Aluminum Electrolytic Capacitors

LIFE EXPECTANCY TABLES

L = Expected Life (hours) @ Operating Temperature

+35°C	+45°C	+55°C	+65°C	+75°C	+85°C
32,000	16,000	8,000	4,000	2,000	1,000
64,000	32,000	16,000	8,000	4,000	2,000
96,000	48,000	24,000	12,000	6,000	3,000
128,000	64,000	32,000	16,000	8,000	4,000
160,000	80,000	40,000	20,000	10,000	5,000
320,000	160,000	80,000	40,000	20,000	10,000

L = Expected Life (hours) @ Operating Temperature

+35°C	+45°C	+55°C	+65°C	+75°C	+85°C	+95°C	+105°C
128,000	64,000	32,000	16,000	8,000	4,000	2,000	1,000
256,000	128,000	64,000	32,000	16,000	8,000	4,000	2,000
320,000	192,000	96,000	48,000	24,000	12,000	6,000	3,000
512,000	256,000	128,000	64,000	32,000	16,000	8,000	4,000
640,000	320,000	160,000	80,000	40,000	20,000	10,000	5,000
1,280,000	640,000	320,000	160,000	80,000	40,000	20,000	10,000

Hours	Years
16,000	1.83
24,000	2.74
32,000	3.65
48,000	5.48
64,000	7.31
96,000	11.00
128,000	14.60
256,000	29.20

3 PROHIBITED ENVIRONMENTS FOR USE

- In environments of water (splash or spray), salt water, or oil contacting the capacitor
 - In the presence of poisonous gas (Hydrogen Sulfide, Sulfurous Acid, Chlorine, Ammonia, etc.)
 - In environments of applied ozone, ultraviolet rays and radiation rays
 - Where vibration or shock exceeds the allowable values as noted in the catalog specification sheet
- If in doubt or uncertainty, please review your operating environment conditions with NIC's technical support personnel [tpmg@niccomp.com]

4 POLARIZATION

Electrolytic capacitors have polarity. Make sure to insert correctly according to the polarity indicated on insulation sleeve, component case or terminal markings. If inserted incorrectly, damage will occur to the capacitor, increased internal pressure may result in venting, rupture or exploded capacitor depending upon voltage and period of reverse voltage application. NIC aluminum electrolytic capacitors with case diameters of 8mm and larger (on some model 6.3mm & larger) have pressure sensitive vents designed to minimize damage due to misuse of the capacitor. For circuits where polarity is reversible, Bi-polar types such as NNR, NRE-SN, NSRN, NACEN and NACNW are recommended.

5 WORKING VOLTAGE

- Do not apply a voltage exceeding the rated working voltage
- An excessive voltage will damage or shorten the potential life expectancy
- The sum of DC voltage and peak value of ripple voltage shall not exceed the rated working voltage of the capacitor

6 CHARGE-DISCHARGE APPLICATION

Standard polarized capacitors are not suitable for rapid and frequent charge and discharge applications. Please consult NIC technical support [tpmg@niccomp.com] when this application is required.

7 SOLDERING CONDITIONS

SMT Versions:

When soldering by reflow method, please review reflow soldering heat limit specifications [www.niccomp.com/reflow] for preheating, peak temperature and reflow time to assure compatibility with your PCB reflow process.

If in doubt or uncertainty, please review your specific reflow process details with NIC's technical support personnel [tpmg@niccomp.com]

Radial & Snap-In Leaded Versions:

The capacitor leads should be soldered at a temperature less than +260°C for a maximum period of 5 seconds. Exposure of the capacitor body to excessive heat, during curing, preheat and soldering operations, may result in damage to the insulation sleeve. It is recommended that leaded capacitors be installed onto the PCB after reflow soldering of surface mount components is completed.

8 DO NOT APPLY EXCESSIVE FORCE TO LEAD WIRE OR TERMINAL AND MAKE NO CONTACT WITH OR APPLY PRESSURE TO CAPACITOR CAN

Most miniature type electrolytic capacitors are sealed by rubber end seal. Use correct lead spacing for the PCB insertion pitch to avoid excess stress to lead wires which may damage the component. Due to miniaturization, lead spacing of specific values may be changed. Consult our sales department for lead forming or alternative series for correct lead spacing. No contact or pressure should be applied to the aluminum electrolytic capacitor can by surround components, any enclosures or when stacking pcb's.

9 ELECTROLYTIC CAPACITORS AFTER LONG PERIOD OF TIME

Testing of samples after long term storage (up to ten years) suggests NIC aluminum electrolytic capacitors do not require any special treatment (i.e. reforming) prior to use. Typical test data on components after long term storage finds electrical characteristics are within product specification limits. Leakage current (at rated VDC) is typically within product specification limit within 2 ~ 5 minutes.

10. CLEANING AGENTS AND CONDITIONS

a.) Most of NIC electrolytic capacitors can withstand cleaning by immersion, vapor, spraying or ultrasonic for durations of less than 5 minutes at 60°C using Pine Alpha ST-100S, Clean Through 750H, 750L and 710M, Sanelek B-12, Aqua Cleaner 210SEP, Techno Care FRW 14-17, Isopropyl Alcohol and DI Water Wash.

b.) In addition washing by immersion, ultrasonic, vapor, spraying or other methods using CFC substitute AK-225AES is acceptable with a cleaning duration of 2 minutes for SMT types, 2 minutes for ultra-small case size leaded capacitors (NSR, NRE-S, NRE-SW, NSRW, NLE, NLE-S, NRE-SN, NRE-SX, NSRZ AND NSRN) and 5 minutes for standard case size leaded capacitors at +40°C (review compatibility of other CFC substitutes cleaning solvents with NIC).

Additional notes on cleaning

- The following solvents cannot be used: Halogenated solvents, Alkali or Petroleum based solvents, Xylene or Acetone.
- Review with NIC cleaning methods that will be utilized on high voltage parts (160V and over) and radial lead ultra low ESR characteristics (NRSJ, NRSJ, NRSJ, NRSJ and NRSJ series).
- Chlorine FREE flux, adhesives and sealants must be used.
- Care should be taken when water washing under pressure is used in order to minimize shrinking or swelling of the insulations sleeving on leaded parts.