

鋁電解電容器使用需知

一、電路設計的注意事項

1. 在確認使用環境及安裝環境的基礎上，在電容器的產品目錄及規格書上所規定的性能範圍內進行設計。
2. 在設計上，應該避免在下述情況下使用：
 - (1) 不可超過電容器的最高使用溫度。
 - (2) 不可有超過額定紋波電流的電流通過。
 - (3) 不可有超過額定電壓的電壓通過電容器。
 - a. 要注意紋波電壓 (交流部分)重疊到直流電壓上時的峰值不可超過額定電壓。
 - b. 當兩個電容器串聯時，通過各個電容器的電壓不可超過額定電壓。此時，要在各個電容器上並聯用於防止漏損電流的分壓電阻器。
 - (4) 電容器為極性電容器。要確認有無連接反向電壓或交流電壓。在極性反轉電路中請用雙極性電容器，但是雙極性電容器也不可以用於交流電路。
3. 進行電路設計時，請選用與機器壽命相符的電容器。
4. 在需要重複進行急速充放電的電路中請選用與條件相符的電容器。
5. 電容器的外殼、輔助引出端子與正、負極以及電路板間必須完全隔離。
6. 當電容器套管的絕緣不能保證時，在有絕緣性能特定要求的地方請不要使用。需要外套具有絕緣功能時請諮詢我們。
7. 電容器如果在以下環境中使用，可能會發生故障。
 - (1) 直接與水、油類、鹽水相接觸的環境或高溫高濕或結露的環境。
 - (2) 充滿有毒氣體(硫化物、亞硫酸、亞硝酸、氯氣、氨水等)的環境。
 - (3) 不能置於日照、O₃、紫外線及有放射性物質環境下使用。
 - (4) 有酸性及鹼性溶劑濺落的環境。

一、Caution During Circuit Design

1. Please make sure the application and mounting conditions to which the capacitor will be exposed are within the conditions specified in the catalog or alternate product specification (Referred as to specification here after).
2. Design Aluminum Electrolytic Capacitors, please pay attention to the points listed below:
 - (1) The capacitor shall not be used in an ambient temperature which exceeds the operating temperature specified in the specification.
 - (2) Do not apply excessive current which exceeds the allowable ripple current.
 - (3) Make sure that no excess voltage (that is higher than the rated voltage) is applied to the capacitor.
 - a. Please pay attention that the peak voltage, which is DC voltage overlapped by ripple current, should not exceed the rated voltage.
 - b. 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 capacitors.
 - (4) Aluminum electrolytic capacitors are polarized. Make sure that no reverse voltage or AC voltage is applied to the capacitors. Please apply bi-polarized capacitor to reverse polarity circuit but bi-polarized capacitors can not be applied to AC circuit.
3. Appropriate capacitors which comply with the life requirement of the products should be selected when designing the circuit.
4. For a circuit that repeats rapid charging/discharging of electricity, an appropriate capacitor that is capable of enduring such a condition must be used.
5. Aluminum case, cathode lead wire, anode lead wire and circuit pattern must be isolated .
6. The sleeve of capacitors is not recognized as an insulator, and therefore, the standard capacitor should not be used in a place where insulation function is needed. If you require a higher grade of insulating sleeve, please consult us.
7. Capacitors may fail if they are used under the following conditions:
 - (1) Damp conditions such as water, saltwater spray, or oil spray or fumes. High humidity or humidity condensation situations.
 - (2) In an atmosphere filled with toxic gasses (such as hydrogen sulfide, sulfurous acid, nitrous acid, chlorine, ammonia, etc.)
 - (3) Being exposed to direct sunlight, ozone, ultraviolet ray, or radiation.
 - (4) Being exposed to acidic or alkaline solutions.

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- (5) 振動或衝擊條件超過交貨仕様書規定範圍的惡劣環境。 .
- (5) Under severe conditions where vibration and / or mechanical shock exceed the applicable ranges of the specification.
8. 在設計電容器的安裝時，必須確認下述內容：
8. In designing a circuit, the following matters should be ensured in advance to the capacitor assembly on the P.C. board.
- (1) 線路板的孔距必須與電容器兩端子的間距相吻合。
- (1) Design the appropriate hole spacing to match the lead pitch of capacitors.
- (2) 在電容器防爆閥的上方盡量不要安裝配線及其它元件，應在防爆閥的上方保留一定的空間。
- (2) Do not locate any wiring and circuit patterns directly above the capacitor vent. Ensure enough free space above the capacitor vent.
- (3) 請勿在電容器的四周及電路板的背面 (電容器下面)配置發熱元件。
- (3) 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).
9. 電容器的電氣特性根據溫度及頻率的變動及變化，請在確認該變化量的基礎上進行電路設計。
9. Electrical characteristics may vary depending on changes in temperature and frequency. Please consider this variation when you design circuits.
- 10.在雙面印刷板上安裝電容器時，電容器的安裝位置避免多餘的基板孔和過孔。
10. When you mount capacitors on the double-sided P.C. boards, avoid excess substrate holes and vias to capacitor location.
- 11.並聯兩個以上的電容器時，要充分考慮電流平衡。
11. When you install more than 2 capacitors in parallel, consider the balance of current flowing through the capacitors.
- 12.串聯兩個以上的電容器時，要充分考慮電壓平衡和插入並聯用分壓相抗。
12. 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 each capacitor.

二、安裝的注意事項

二、Caution For Assembling Capacitors

1. 除了定期點檢時為檢測電氣性能而拆卸的電容器外，對組裝到設備上已經通電的電容器，拆除後均不能再使用。
1. Once a capacitor has been assembled in the set and power applied, even if a capacitor is discharged, an electric potential (restricting voltage) may exist between the terminals.
2. 當電容器產生再生電壓時，請通過約1K Ω 的電阻器進行放電。
2. Electric potential between positive and negative terminal may exist as a result of returned electromotive force, so please discharge the capacitor using a 1K Ω resistor.
3. 長期保存的電容器，需通過約1K Ω 的電阻加壓處理。
3. Leakage current of aluminum electrolytic capacitors may be increased during long storage time. In this case, the capacitors should be subjected to voltage treatment a 1K Ω resistor before using.
4. 請確認電容器的規格(靜電容量及額定電壓)及極性後，才可進行安裝。
4. Please confirm ratings (voltage and capacitance) and polarity before in stalling capacitors on the P.C. board.
5. 掉落在地上的電容器及本體已經變形的電容器，請勿再使用。
5. Do not drop capacitors on the floors and damage, nor use a capacitors that was dropped.
6. 安裝時請確認電路板的孔距是否與電容器兩端子的間距吻合。
6. Please confirm that lead spacing of the capacitor matches the hole spacing of the P.C. board prior to installation.
7. 自動插入機扭結固定電容器引線的強度不可過大。
7. Please pay attention that the clinch force is not too strong when capacitors are placed and fixed by an automatic insertion machine.
8. 焊接時請注意以下內容：
8. Soldering
- (1) 焊接條件(溫度、時間)不可超出承認書中所規定的範圍。
- (1) Soldering condition (temperature and times) must be confirmed to be within Su'scon specification.
- (2) 請勿讓烙鐵的烙鐵頭接觸到電容器的本體及不要將電容器本體浸入焊錫溶液中。
- (2) Soldering iron should never touch the capacitors body and do not dip capacitors body into melted solder.

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- (3) 在進行焊接時，避免其它物件倒下碰到電容器。
- (4) 在進行焊接時，除端子外電容器其它部位不可附著有焊劑。

9. 電容器焊接在電路板後，請注意以下內容：

- (1) 不可將電容器本體傾斜、扭轉等。
- (2) 不可讓其它物體碰到電容器。

10. 電解電容器不得以鹵化化學藥品類似溶劑，作為電容器洗滌用。

11. 在使用固定劑與塗層劑時，電路板與電容器的封口部之間須乾淨，不可留有焊劑殘渣及污垢。

- (3) Please avoid contact between other components and the aluminum capacitor.

- (4) Please avoid having flux adhere to any portion except the terminal.

9. After Soldering

- (1) Do not bend or twist the capacitors body after soldering on P.C. board.
- (2) Do not hit the capacitors and isolate capacitors from the P.C. board or other device when stacking P.C. boards in store.

10. Standard Aluminum Electrolytic Capacitors should be free from halogenated solvents during P.C. board cleaning after soldering.

11. Do not use halogenated adhesives and coating materials to fix aluminum electrolytic capacitors.

三、組裝使用注意事項

- 1. 不可直接觸摸電容器的端子，有導致觸電的危險。
- 2. 不可有導體靠近電容器的兩端子，避免電容器端子之間短路。
- 3. 裝配了電容器的設備請不要在以下環境中使用：
 - (1) 直接與水、油類、鹽水相接觸的環境或高溫高濕或結露的環境。
 - (2) 充滿有毒氣體(硫化物、亞硫酸、亞硝酸、氯氣、氨水等)的環境。
 - (3) 不能置於日照、O₃、紫外線及有放射性物質環境下使用。
 - (4) 有酸性及鹼性溶劑濺落的環境。
 - (5) 振動或衝擊條件超過交貨仕様書規定範圍的惡劣環境。

四、電容器的保養與檢修

電容器在工業機器中使用時要進行定期檢修，檢修時請注意電容器的外觀及電氣性能是否符合產品的標準。

五、安全注意事項

- 1. 在設備使用過程中，電容器的防爆閥開裂，並冒出氣體時，應切斷設備的主電源或從設備上拔下電線插頭。
- 2. 電容器的防爆閥開裂時，因為超過100℃高溫氣體噴出，臉不要接近。噴出的氣體進入眼睛時，立即用水清洗眼睛。如果噴出的電解液濺到皮膚上，請立即使用肥皂進行沖洗。

六、儲存條件

- 1. 電容器建議在環境溫度5~35℃、相對濕度低於75%的條件下存放。

三、Caution For Assembling Capacitors

- 1. Do not directly touch terminal by hand.
- 2. Keep electric conductor off terminals to avoid short circuit.
- 3. Do not use following conditions for assembling capacitors.
 - (1) Damp conditions such as water, saltwater spray, or oil spray or fumes. High humidity or humidity condensation situations.
 - (2) In an atmosphere filled with toxic gasses (such as hydrogen sulfide, sulfurous acid, nitrous acid, chlorine, ammonia, etc.)
 - (3) Being exposed to direct sunlight, ozone, ultraviolet ray, or radiation.
 - (4) Being exposed to acidic or alkaline solutions.
 - (5) Under severe conditions where vibration and / or mechanical shock exceed the applicable ranges of the specification.

四、Maintenance Inspection

Please periodically inspect the capacitors that are installed in industrial equipment. Remarkable abnormality such as vent operating, leaking electrolyte, etc. Capacitance, dielectric loss tangent, leakage current, and items specified in the specification.

五、Safe Precautions

- 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 bring your face near the capacitor when the pressure relief vent operates, because the gases emitted from that are over 100℃. If the gas gets into your eyes, please flush your eyes immediately with pure water. If electrolyte exposed on your skin, please wash it with soap and water.

六、Storage

- 1. It is recommended to keep capacitors between the ambient temperatures of 5℃ to 35℃ and a relative humidity of 75% or below.

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2. 請勿儲存於下列所述的環境中。

- (1) 直接與水、油類、鹽水相接觸的環境或高溫高濕或結露的環境。
- (2) 充滿有毒氣體(硫化物、亞硫酸、亞硝酸、氯氣、氨水等)的環境。
- (3) 不能置於日照、O₃、紫外線及有放射性物質環境下使用。
- (4) 有酸性及鹼性溶劑濺落的環境。
- (5) 振動或衝擊條件超過交貨仕様書規定範圍的惡劣環境。

2. Confirm that the environment does not have any of the following conditions:

- (1) Damp conditions such as water, saltwater spray, or oil spray or fumes. High humidity or humidity condensation situations.
- (2) In an atmosphere filled with toxic gasses (such as hydrogen sulfide, sulfurous acid, nitrous acid, chlorine, ammonia, etc.)
- (3) Being exposed to direct sunlight, ozone, ultraviolet ray, or radiation.
- (4) Being exposed to acidic or alkaline solutions.
- (5) Under severe conditions where vibration and / or mechanical shock exceed the applicable ranges of the specification.

七、廢棄處理

1. 在電容器上開孔或壓碎後焚燒。
2. 電容器不焚燒時，請交給專業的工業廢棄物處理廠處理。

七、Disposal

1. Make a hole the in the capacitor body or crush capacitors and incinerate them.
2. If incineration is not applicable, hand them over to a waste disposal agent and have them buried in a landfill.

八、特別注意事項

在選用電容器時，如果在產品目錄及規格書中沒有找到符合要求的系列或規格時，請直接與我司的業務部或研發部聯繫，我司可根據客戶的要求開發特殊性能產品。上述鋁電解電容器的使用注意事項依據EIAJRCR-2367B 2002年3月發行的《電子機器用固定鋁電解電容器使用注意事項指南》製作而成，詳情請參照該指南。

八、Special Notice

When choosing capacitors, if clients couldn't find the series or specification in catalogue and data sheet, please contact with our Sales or RD department, we are able to base on clients' needs to develop product with special functions. For further details, please refer to EIAJ RCR-2367B-Guideline of notabilia for fix for use in electronic equipment [Technical Standardization Committee on Passive Components (established in March 1995, revised in March 2002)]

Environment Protection Policy

We are reducing environmentally harmful substances to do our capacitors in global environmental protection activities. Products compatible with Pb-free and products with non-PVC encasing and ROHS Compliance materials are available.

● ROHS Compliance

Our capacitors do not use any of the materials specifically identified and restricted hazardous material under ROHS Prohibited

Pb : Lead, Cr6+: Hexavalent chromium, Hg:Mercury, Cd:Cadmium, PBB:Polybrominated biphenyls, PBDE : Polybrominated diphenylethers, PVC:Polyvinyl chloride

● PVC free Capacitors

We use PET (Polyethylene Terephthalate) sleeve to instead of PVC (Polyvinyl Chloride) sleeve since 2005 January. As there is a size limitation for this counter measure, Please consult our sales representative their availability in big size capacitors.

● Pb-Free Capacitors

Our Capacitors lead wire and terminal doesn't contain lead.

We follow up those conditions as rule and standards to use right materials to production capacitors for maintain earth environment everlasting for human.

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Effects of ambient temperature to life (for reference)

Because an aluminum electrolytic capacitor is essentially an electrochemical component, increase temperatures accelerate the chemical reaction producing gas within the capacitor, diffuse the gas to outside through the end seal, and consequently accelerate a gradual decrease in capacitance and a gradual increase in $\tan\delta$ and ESR, the following equation has been experimentally found to express the relationship between the temperature acceleration factor and the deterioration of the capacitor.

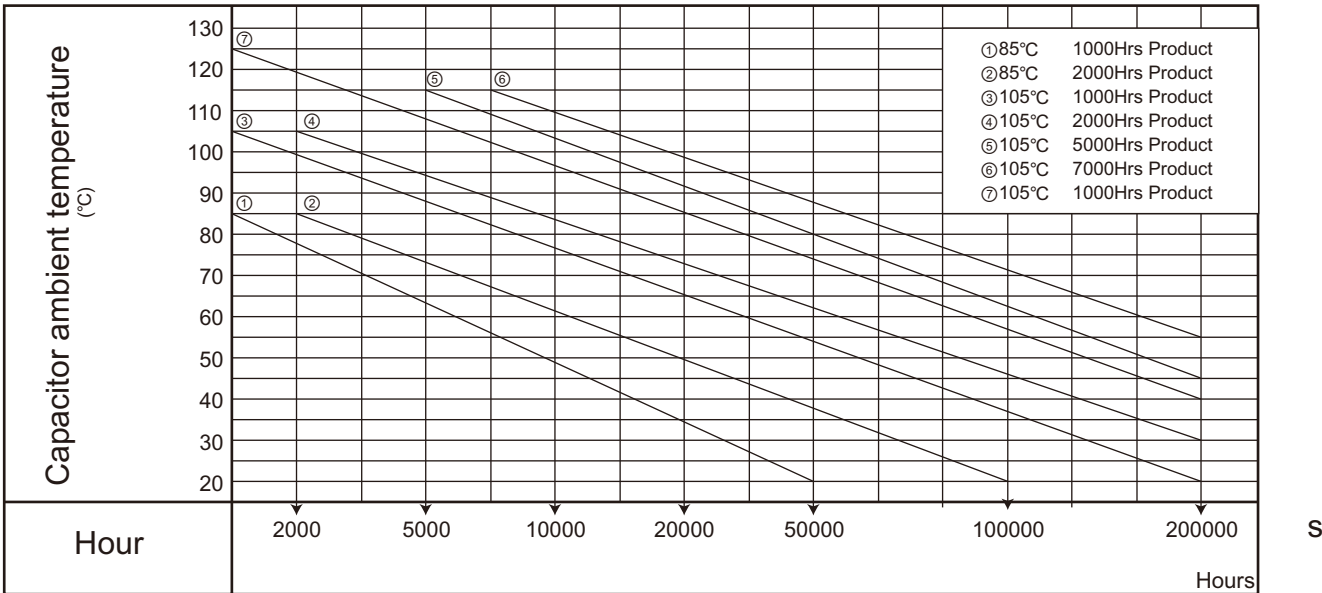
$$L_x = L_o \cdot K_{temp} = L_o \cdot B^{(T_o - T_x)/10}$$

Where : $K_{temp} = B^{(T_o - T_x)/10}$
 L_x = Life time (hour) of capacitor to be estimated
 L_o = Base life time (hour) of capacitor
 T_o = Maximum rated operating temperature (°C) of capacitor shown in catalog
 T_x = Actual ambient temperature (°C) of capacitor
 B = Temperature acceleration factor (=2)

This equations is similar to Arrhenius equation that express a relationship between chemical reaction rates and temperature and called Arrhenius rule of aluminum electrolytic capacitors.

The temperature acceleration factor (B) is approximately 2 over an ambient temperature range (T_x) from 40 °C to the maximum rated operating temperature of the capacitor, and it means that the lifetime is approximately halved with every 10°C rise in ambient temperature and can be extended by using the capacitors at low temperatures.

For an ambient temperature range (T_x) of 20°C to 40°C, the factor B will be close to 2, and the lifetime will be actually extended. However, the environment where the devices are placed and their operating conditions influence ambient temperature, and in particular the ambient temperature in this range will be very inconstant. Therefore, a minimum lifetime should be estimated form the above formula by using the 40°C as T_x .



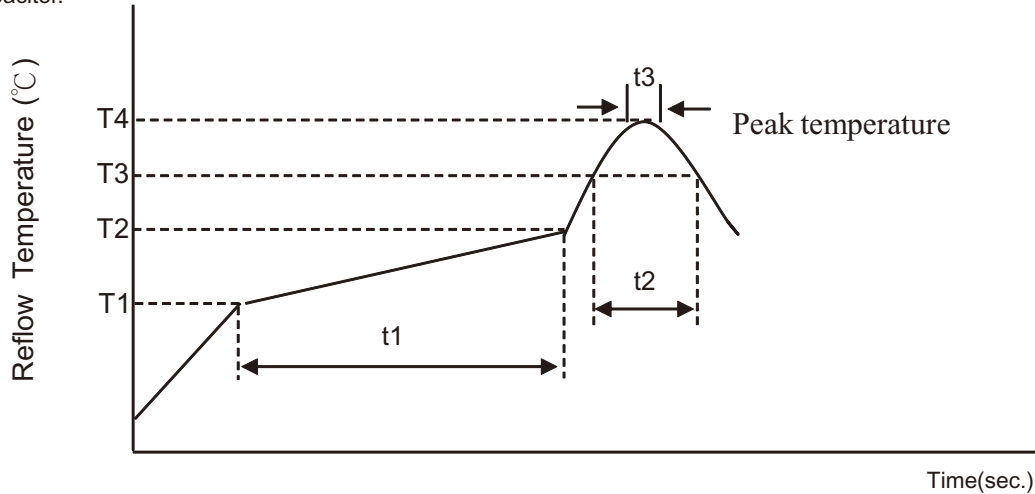
※ 1. A guide limit of the calculated like Aimo is 15 years max
2. $T_x \geq 40^\circ\text{C}$

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RECOMMENDED PB-FREE REFLOW SOLDERING CONDITIONS

The following conditions are recommended for air or infrared reflow soldering of the surface mount capacitors onto a glass epoxy circuit board of 95 x 50 x 0.8mm (with resist) by cream solder (eutectic solder). The temperatures shown are the surface temperature values of the top of the capacitor.



TEMPERATURE PROFILE

Profile Feature	Pb Free Assembly	
	4~6.3Ø	8~10Ø
Average Ramp-up Rate	3°C/second max.	3°C/second max.
Preheat		
Temperature Min(T1 min)	150°C	150°C
Temperature Max(T2 max)	180°C	180°C
Time (t1 Max)	120sec.	120sec.
Ramp-up Rate (T2 ~T3)	3°C/second max.	3°C/second max.
Time maintained above Temperature(T3)	217°C	217°C
Time(t2 Max)	90sec.	40sec.
Peak Temperature(T4)	260°C	245°C
Time(t3 Max)	5sec.	5sec.
Reflow cycles	1	2 or less

PRECAUTIONS FOR USERS

Soldering method

The capacitors of Alchip-series have no capability to withstand such dip or wave soldering as totally immerses components into a solder bath.

Reflow soldering

Reflow the capacitors within recommended reflow soldering conditions. Verify no temperature stress to the capacitors because the following differences might degrade capacitors electrically and mechanically. Please consult us if other reflow conditions are employed

1. Location of components : Temperature increases at the edge of PC board more than the center.
2. Population of PC board : The less the component population is the more temperature rises.
3. Material of PC board : A ceramic made board needs more heat than a glass epoxy made board. The heat increase may cause damage of the capacitors.
4. Thickness of PC board : A thicker board needs more heat than a thinner board. The heat increase may damage the capacitors.
5. Size of PC board : A larger board needs more heat than a smaller board. The heat increase may damage the capacitors.
6. Location of infrared ray lamps : IR reflow as well as hot plate reflow applies heat only on the reverse side of the PC board to lessen heat stress to the capacitors.
7. Vapor heat transfer systems (VPS) are not recommended.

Rework of soldering

Avoid reflow soldering more than once. Use a soldering iron for rework. Do not exceed an iron tip temperature of $380 \pm 10^{\circ}\text{C}$ and an exposure time of 3 ± 0.5 seconds.

Mechanical stress

Do not use the capacitors for lifting the PC board and give stress to the capacitor. Avoid bending the PC board. These may damage the capacitors.

Cleaning assembly board

Immediately after solvent cleaning, remove residual solvent for at least 10 minutes with an air knife. The solvent is so insufficiently dry for a long period of time that the capacitors may be cored.

Coating on assembly board

1. Before curing coating material remove the cleaning solvents from the assembly board.
2. Before conformal coating, a chloride free pre-coat material is recommended to use for lessening stress to the capacitors.

Moldering with resin

Internal chemical reaction gradually produces gas in the capacitor; then, internal pressure is increasing. If the end seal of the capacitor is completely molded with a resin. The gas stays inside the capacitor. It will face dangerous situation. The chlorine contained resin will penetrate into the end seal, reach the inside element, and cause damage of the capacitor.

Others

Precautions and Guidelines for Aluminum Electrolytic Capacitors shall be referred.