

X-CON should be used in compliance with the following guidelines.

1. Circuit Design

1.1 Prohibited Circuits

Do not use the capacitors in the following circuits, because leakage current may increase.

- 1) Time constant circuits
- 2) Coupling circuits
- 3) Circuits which are greatly affected by leakage current
- 4) High impedance voltage retention circuits

1.2 Polarity

X-CON is a polarized solid aluminum electrolytic capacitor with positive and negative electrodes. Do not apply reverse voltage on the capacitors, otherwise it may cause leakage current increase or life span decreased.

1.3 Voltage Applied

The applied voltage is equal to the voltage value including the peak value of the transitional instantaneous voltage and that of ripple voltage, not just steady line voltage.

- 1) Do not apply over-rated voltage or reverse voltage as it may lead to the increase in leakage current and short circuit.
- 2) When DC voltage is low, a negative ripple voltage peak value must not become a reverse voltage that exceeds 10% of the rated voltage.

1.4 Restriction on Sudden Charge or Discharge

Sudden charge and discharge may result in short circuits or larger leakage current. Therefore, protection circuits are suggested to build in when one of the following conditions are anticipated.

- 1) The rush current exceeding 10A
- 2) The rush current exceeding 10 times of rated ripple current of X-CON

A protection resistor (1K Ω) must be inserted to the circuit during the charge and discharge when measuring the leakage current.

1.5 Ripple Current

Use the capacitors within the rated ripple current. When excessive ripple current is applied to the capacitor, it may causes the increase in leakage current and short circuits due to self-heating.

1.6 Leakage Current

There is a risk of leakage current increasing even if the following usage environments are within the suggested range. Owing to the self-correction mechanism, the leakage current returns to a small value in most cases after the application of voltage.

- 1) After soldering or re-flow
- 2) High temperature under no loading
- 3) High humidity under no loading
- 4) Sudden temperature changes

1.7 Capacitor Insulation

- 1) Insulation of the marked sleeve is not guaranteed. Be aware that the space between the case and the negative electrode terminal is not insulated and has some resistance.
- 2) Completely separate the case, negative lead terminal, positive lead terminal and PCB patterns with each other.

1.8 Precautions for Using Capacitors

X-CON capacitors should not be used in the following environments.

- 1) Direct contact with salt water, oil & chemically active gases
- 2) Exposure direct under sunlight
- 3) High temperature owing to heat generating components around the X-CON and on the underside of the PCB
- 4) High humidity where condensation can form on the surface of the capacitor
- 5) Acid or alkaline environments
- 6) High-frequency induction
- 7) Excessive vibration and shock

2. Failure and Life-span

The failure rate is 0.5% / 1,000 hours (with a 60% reliability standard) based on JIS-C-5003. The mainly failure modes are as follows.

2.1 Contingency Failure

The main causes of failure are thermal stresses cause by the soldering or thermal use environment, along with heat stresses, electrical stresses or mechanical stresses.

The most common failure mode is a short circuit.

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- a) Phenomenon after a short circuit
 - 1) If the pass-through current is 1A or less on $\Phi 10$, 0.5A or less on $\Phi 8$ and 0.2A or less on $\Phi 6.3$ in case of a short circuit, the X-CON will become heated, but no effects are visible even when the current is continuously carried.
 - 2) If the short circuit currents exceed the mentioned value above, the temperature inside the X-CON will increase. The rubber sealing will be turned over and odorous gas will be released. In this case, keep your face and hands away from the area.
- b) In case a short circuit occurs, ensure safety by fully considering the followings.
 - 1) If odorous gas is released, turn off the main power of the equipment.
 - 2) If the gas comes in contact with eyes, rinse immediately. If the gas is inhaled, gargle immediately.
 - 3) Do not lick the electrolyte. If the electrolyte comes in contact with skin, wash it off with soap immediately.
 - 4) X-CON contains combustible substances. In case a large current continues to flow after a short circuit, in the worst case, the shorted-out section may ignite. For safety, install a redundant circuit or a protective circuit, etc.

2.2 Wear-out Failure (Life-span)

When life span exceeded the specified guarantee time of Endurance and Damp heat, electrolyte might insulate and cause electric characteristic changed. This is called an open circuit. The electric characteristics of capacitance and ESR may possibly change within the specified range in specifications when it is used under the condition of the rated voltage, electric and mechanical performance. Please note it when design.

3. Mounting Precautions

Phases	Things to be noted	Disposition												
Before mounting	1) Check the marking on the body	Don't use products without marked polar, capacitance and rated voltage.												
	2) Check the pitch between lead terminal and PCB	Use X-CON only when the said pitch is matched.												
	3) Find the leakage current increased after long storage	Apply the capacitor with rated voltage in series with 1K Ω resistance for 1 hour at the range between 60 and 70°C.												
	4) Drop to the floor	Don't use												
	5) Handling	Use X-CON with lead terminal and body not subject to any stress.												
	6) Adopt a used X-CON	No re-used												
Mounting	1) Soldering with a soldering iron	<ul style="list-style-type: none"> Meet the temperature and duration requirements of out-going specification; Not allow any stress during mounting; Don't let the tip of the soldering iron touch X-CON. 												
	2) Flow soldering (for radial type)	<ul style="list-style-type: none"> Don't submerge X-CON body in melted solder; Meet the temperature and duration requirements of out-going specification; Not allow the flux to adhere to anywhere except the lead terminal. The details for flow soldering are as follows: <table border="1" style="margin-left: 20px;"> <thead> <tr> <th></th> <th>Temperature</th> <th>Duration</th> <th>Flow times</th> </tr> </thead> <tbody> <tr> <td>Preheating</td> <td>$\leq 120^{\circ}\text{C}$ (ambient temp.)</td> <td>$\leq 120\text{sec.}$</td> <td>1</td> </tr> <tr> <td>Soldering conditions</td> <td>$\leq (260 \pm 5)^{\circ}\text{C}$</td> <td>$\leq (10 \pm 1)\text{sec.}$</td> <td>$\leq 2$</td> </tr> </tbody> </table>		Temperature	Duration	Flow times	Preheating	$\leq 120^{\circ}\text{C}$ (ambient temp.)	$\leq 120\text{sec.}$	1	Soldering conditions	$\leq (260 \pm 5)^{\circ}\text{C}$	$\leq (10 \pm 1)\text{sec.}$	≤ 2
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3) Reflow soldering (for SMD type)	Allow for UVG, UVR series. (see page 7 for details)													
After mounting	1) Handling	<ul style="list-style-type: none"> Do not tilt, bend, twist X-CON; Do not allow other things touching X-CON. 												
	2) Wash the PCB (Suggested cleaning agents) <ul style="list-style-type: none"> High quality alcohol-based cleaning fluids such as st-100s, 750L, 750M; Detergents including substitute freon such as AK-225AES and IPA) 	<ul style="list-style-type: none"> Use immersion or ultrasonic waves to clean for a total of less than 5 minutes and adjust the temperature of the agents not higher than 60°C; Observe the contamination of the agents (conductivity, pH, specific gravity, water cleaning and etc.); Dry X-CON in hot air with the air temperature less than the maximum operating temperature. 												

4. Reflow Soldering Conditions

Item	Recommended Condition 1	Recommended Condition 2
	Peak Temperature	260°C or less
Preheating	150°C to 180°C 90 seconds	150°C to 180°C 90 seconds
A	200°C and higher Within 60 seconds	200°C and higher Within 60 seconds
B	230°C and higher Within 40 seconds	230°C and higher Within 40 seconds
The number of reflow	Only 1 time	Twice or less

All temperatures are measured on the topside of the Al-can and terminal surface.

Attention:

Reflow soldering may reduce the capacitance of products before or after soldering even if meeting soldering conditions per Recommended Reflow Condition. Soldering considerably deviating from these conditions will cause problems such as a 50% reduction in capacitance, and a considerable increase in leakage current. Thus, the peak temperature at the top of Al-case/Electrode terminals and the duration of the reflow over 200°C should not exceed the specifications.

5. Emergency Procedure

If the capacitor is overheated, the resin case may emit smoke. If this occurs, immediately switch off the unit's main power supply to stop operation. Keep your body away from the capacitor as the temperature may be high enough to cause the capacitor to ignite and burn.

6. Disposal and Storage Conditions

6.1 Disposal

Since capacitors are composed of various metals and resins, dispose them as industrial waste.

6.2 Storage Conditions

- Do not store the X-CONs in the environment of high temperature and high humidity, or in the location subject to direct sunlight. The X-CONs should be stored under the conditions within 5°C ~ 35°C and relative humidity below 75%;
- Store the X-CONs in the condition as they are shipped to keep good solder ability. SMD types (UVR and UVG series) should be sealed in specifically designed aluminum laminate bags to avoid deterioration in characteristics and solder ability before and after reflows, which results from moisture absorption;
- Store the X-CONs in sealed package bags after delivery per the table below;

X-CON type	Before unsealing	After unsealing
Radial lead type packed in bags	Must be used within 24 months after delivery (unsealed status)	Must be used within a week (opened status)
Radial lead type packed in taping method	Must be used within 24 months after delivery (unsealed status)	Must be used within a week (opened status)
SMD type	Must be used within 24 months after delivery (unsealed status)	Must be used within a week (opened status)

- Don't open package bags until mounting, and use up all products once open. In case of leftovers, pack radial lead types in bags, return SMD types and unpackaged ones back into special storage bags (designed aluminum laminate bags for SMD types), and seal up the opening. Put radial lead types with taping in plastic bags as they are put into storage boxes and seal up the opening, too. Regarding leftover storage, please follow the storage instructions as shown in above table;
- Don't store X-CONs in damp conditions or as stated in Item 1.8;
- Don't store X-CONs in places filled with toxic gases or susceptible to ozone, ultraviolet ray and radiation.

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7. Compliance with RoHS Directive

Our company is committed to comply with the European Union Restriction of Hazardous Substance (RoHS) Directive. We hereby guarantee that our products do not contain the following materials exceeding the content regulated in RoHS Directive.

Lead (Pb)	≤1000ppm
Mercury (Hg)	≤1000ppm
Cadmium (Cd)	≤100ppm
Hexavalent Chromium, Cr ⁶⁺	≤1000ppm
Polybrominated Biphenyls (PBBs)	≤1000ppm
Polybrominated Diphenyl Ethers (PBDEs)	≤1000ppm

8. Halogen Free Compliant

The products identified in the catalogue, and their homogeneous subcomponents, do not contain any of the following substances in concentrations greater than the listed maximum limits.

Substance	Maximum Limit (ppm)
Bromine (Br)	900 ppm (0.09%)
Chlorine (Cl)	900 ppm (0.09%)
Total concentration of Chlorine (Cl) + Bromine (Br)	1500 ppm (0.15%)

9. Reliability Presumption of Life

$$L_x = L_0 \times 10^{\frac{T_0 - T_x}{20}}$$

L_x: Life expectancy (Hours) in actual use (T_x)

L₀: Guaranteed (Hours) at maximum temperature (T₀)

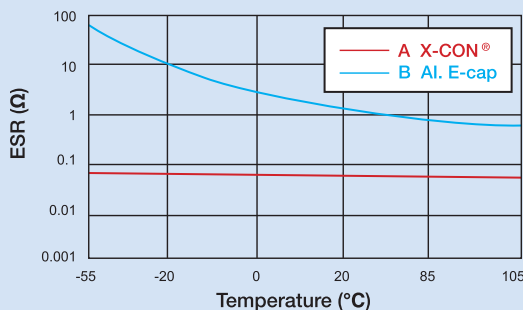
T₀: Maximum operating temperature (°C)

T_x: Temperature in actual use (Ambient temperature of X-CON) (°C)

Owing to the excellent heat-proof characteristics of conductive polymer, the estimated life expectancy can be calculated without consideration of self-heating under application of the ripple current.

10. General Electrical Characteristics of X-CON

Temperature Variation on ESR (Ω)



Frequency Variation on ESR

