

# Aluminum Capacitors

## WARNING

Correct application and strict adherence to the important information listed below will ensure optimum performance of the capacitors over their entire specified useful life.

Please note that ignoring these rules may reduce the equipment lifetime or even destroy the capacitor, together with parts of the equipment or property involved. The consequences may be a short or open circuit of the component, leakage of electrolyte or heat generation. Opening of the case or vent (danger of injury) may be regarded as hazardous and cause liquids, vapors or dust to be released. Similar precautions should be taken when testing aluminum capacitors.

Please consult your local Vishay sales organization, if one or more of these limits cannot be adhered to.

GUIDELINES		
PARAMETER	IMPORTANT INFORMATION - PRODUCT SAFETY	MORE DETAILS
<b>DESIGN</b>		
<b>VOLTAGE</b>	<p><b>Do not apply a voltage exceeding the capacitor's voltage rating.</b></p> <p>Check the maximum voltage across the capacitor that may occur over the whole equipment life. In normal operation the rated voltage of the capacitor shall not be exceeded; if so, early failures may occur. However, for short periods the voltage may be raised up to surge voltage value (see Detail Specification); for conditions and maximum parameter changes, see section "Tests and Requirements".</p>	<p>Detail Specification</p> <p>TESTS AND REQUIREMENTS</p>
<b>RIPPLE LOAD</b>	<p><b>Do not allow excessive ripple current to pass.</b></p> <p>The rated ripple current as calculated for the application conditions (see section "Introduction"), shall not be exceeded. If so, early failure may result.</p> <p><b>Keep ripple voltage within ratings.</b></p> <p>The sum of DC-bias and maximum amplitude of ripple voltage shall be within rated voltage and 0 V. Aluminum capacitors are not normally designed for AC application.</p>	<p>Detail Specification</p> <p>INTRODUCTION</p>
<b>TEMPERATURE CHANGE</b>	<p><b>Use capacitors within specified temperature range.</b></p> <p>Applicable temperature range is given in the relevant detail specification.</p> <p>A general principle is that lower ambient temperature means longer life; therefore, wherever possible, aluminum capacitors should be placed at the coolest positions on the board (please ensure that aluminum capacitors are placed away from 'heating' components such as power resistors, switching diodes/transistors or transformers). Exceeding the permitted temperature range may cause early failures.</p>	<p>Detail Specification</p>
<b>CHARGE-DISCHARGE</b>	<p><b>Observe charge-discharge limitations.</b></p> <p>Frequent charge-discharge load via low resistance may cause capacitance drop or destroy the capacitor. Under well defined conditions (see section "Tests and Requirements") frequent charge-discharge operation is allowed. The resulting current through the capacitor must not exceed the ripple current limit. Standard aluminum capacitors are not suitable for flash applications.</p>	<p>TESTS AND REQUIREMENTS</p>
<b>SERIES/PARALLEL CONNECTIONS</b>	<p><b>When connecting in series/parallel, apply corresponding design rules.</b></p> <p>Connecting aluminum capacitors in series/parallel is possible, provided that balancing resistors are applied to each capacitor, in order to stabilize the voltage over each individual capacitor. Rules for correct design are given in section "Introduction".</p>	<p>INTRODUCTION</p>
<b>PC BOARD DESIGN</b>	<p>Conducting tracks or lands should not be located under upright mounted aluminum capacitors; short circuits under the capacitor with danger of fire could be the result.</p>	
<b>INSULATION</b>	<p><b>The capacitor case is not insulated from the cathode terminal.</b></p> <p>Axial capacitors have a direct contact between case and cathode terminal; radial and power capacitors exhibit an indeterminate resistance between the cathode terminal and the metal case. Metal parts other than terminals should never make contact with conducting tracks or metal parts of other components. Dummy pins should be connected to the cathode.</p>	
<b>MOUNTING</b>		
<b>POLARITY, REVERSE VOLTAGE</b>	<p><b>Aluminum capacitors for DC applications require polarization.</b></p> <p>Check the polarity of each capacitor: both in circuit design and in mounting (polarity is clearly indicated on the capacitor). For short periods a limited reverse voltage is allowed (see Detail Specification); for conditions and maximum parameter changes, see section "Tests and Requirements". Exceeding reverse voltage may result in early failures.</p>	<p>Detail Specification</p> <p>TESTS AND REQUIREMENTS</p>



GUIDELINES		
PARAMETER	IMPORTANT INFORMATION - PRODUCT SAFETY	MORE DETAILS
PLACEMENT	<p><b>Avoid excessive stress to the lead wires or terminals.</b></p> <p>Excessive stress can be caused by component processing machines if lead wires are not sufficiently fixed during bending, cutting, cropping or inserting operations. Other possible reasons are incorrect hole distance on the printed circuit or bending of the component after soldering. Care should be taken when the manual bending of terminals or mounted capacitors is required. For maximum allowed mechanical load and time of application, see section "Tests and Requirements".</p> <p>Mechanically damaged capacitors may not be used.</p> <p>Pressure relief should have enough space to function correctly.</p>	TESTS AND REQUIREMENTS
SOLDERING	<p><b>Keep soldering temperature and time under control.</b></p> <p>For maximum soldering conditions, see section "Tests and Requirements". Additional temperature load e.g. for curing the glue of Surface Mount Devices (SMDs) are allowed to a certain limit, which depends on series and exact details. Please apply to your sales engineer for your specific conditions. Molten solder or the soldering iron should not make contact with the capacitor's insulation. Reflow soldering is only suitable for SMD components.</p>	TESTS AND REQUIREMENTS
BOARD CLEANING	<p><b>No guarantees can be given with regard to solvents based on halogenated hydrocarbons or ozone depleting chemicals (ODCs).</b></p> <p><b>Warning: such solvents are hazardous to the environment.</b></p> <p>Component cleaning using solvents such as demineralized or distilled water, isopropanol, methanol, ethanol and propanol would not normally have any detrimental effects and therefore do not require any special precautions. Aqueous cleaning methods may be used in conjunction with saponification using a neutral detergent like calgonite at 20 g/l. It is recommended that immediate drying of the component in hot air is carried out at approximately 85 °C (or 70 °C for products with an upper category temperature of 70 °C) for at least 5 minutes. For further information regarding the application of solvent temperatures exceeding the temperature mentioned in "IEC 60068-2-45", consult your local Vishay sales organization.</p>	
ADHESIVES, COATING MATERIALS	<p><b>Some adhesives and coating materials affect capacitors adversely.</b></p> <p>For varnishing, coating, lacquering, embedding or gluing at the capacitor's sealing, ensure that the materials used are halogene-free in all their constituent parts (base material, thinners, binders, reacting agents, propellants, additives). For reasons see 'BOARD CLEANING' above.</p> <p>When applying such materials, ensure that non-aluminum parts, e.g. the rubber area, are not completely sealed off.</p>	
<b>STORAGE AND TRANSPORT</b>		
STORAGE CONDITIONS, HANDLING	<p><b>Excessive storage time or conditions may have adverse effects on capacitors.</b></p> <p>Capacitors should be stored at room temperature, low humidity and out of direct sunlight. Storage at elevated temperature and/or high relative humidity may have a negative influence on taping accuracy, solderability, leakage current and life expectancy.</p> <p>Packages with aluminum capacitors should be handled with care, otherwise bent leads and/or incorrect taping dimensions could be the result.</p>	INTRODUCTION TESTS AND REQUIREMENTS
HIGH AIR PRESSURE	<p><b>Do not expose capacitors to overpressure.</b></p> <p>Maximum operating pressure is 150 kPa. Higher pressure may cause a short circuit.</p>	
LOW AIR PRESSURE	<p><b>The capacitors may be used up to an altitude of <math>\leq 12\,000</math> m.</b></p> <p>Minimum air pressure: 8.5 kPa for short periods (in accordance with "IEC 60384-4, sub clause 4.11.4").</p>	TESTS AND REQUIREMENTS
DISINFECTING E.G. FOR SARS	<p><b>No guarantees can be given when disinfectants are/have been used.</b></p> <p>Disinfectants may contain halogens like chlorine, fluorine, bromine etc. and alkaline solutions. Disinfectants should not be used near or on the capacitor. Over time they can cause corrosive reactions to capacitors resulting in reduced capacitance, open circuits etc.</p> <p>For further information please consult your local Vishay sales organization</p>	
<b>EMERGENCY</b>		
PERSONNEL SAFETY	<p><b>WARNING NOTE.</b></p> <p>Non-solid aluminum capacitors may contain chemicals which can be regarded as hazardous if handled incorrectly. Caution is necessary if the outer case is fractured; vapors or dust particles should not be inhaled (good ventilation is essential); skin, eye or clothing contact with liquids should be avoided. In case of such contact, flush thoroughly with running water as soon as possible, then wash skin or clothing with soap and water or a mild detergent. Any possible discoloration of the wetted skin will disappear after a few days.</p> <p>In the event of fire, the organic parts of aluminum capacitors may release such constituents as carbon monoxide, nitric oxides or dust particles; take caution when breathing-in.</p>	
<b>END OF LIFE</b>		
DISPOSAL	<p><b>Aluminum capacitors are subject to special waste regulations.</b></p> <p>Aluminum capacitors are free from PCB- or PBDE-containing substances. Dioxines or furanes are not constituent parts of aluminum capacitors. However, because of other polluting ingredients, larger quantities (in weight) of aluminum capacitors are subject to special waste regulations in accordance with the relevant national laws; please consult your local Vishay sales organization.</p> <p>In general, disposal of aluminum capacitors must take place under controlled circumstances in a high temperature incinerator at minimum 900 °C.</p>	