Ⅰ. Operating Precautions

OS-CON is uniquely structured solid aluminum electrolytic capacitor.
Please note the following points in order to take full advantages of the OS-CONs performance and to ensure the most stable quality possible.

Circuit designing

Crucial precautions [Important]

1. Polarity

OS-CON is a solid aluminum electrolytic capacitor with positive and negative electrodes.
Do not reverse the polarity when using. If it is used with the polarities reversed, increased leakage current or a decreased life span may result.

2. Prohibited circuits

Leakage current may increase after soldering. Therefore, OS-CON cannot be used on the following circuits.

(a) High impedance voltage retention circuits
(b) Coupling circuits
(c) Time constant circuits
In addition to the leakage current fluctuation, capacitance may also fluctuate depending on operational temperature and humidity. The fluctuation of the capacitance may cause problem if it is used as a time constant capacitor, which is extremely sensitive to the fluctuation of the capacitance. Do not use it as a time constant capacitor.
(d) Circuits which has high impact from leakage current
Please contact SANYO when using two or more OS-CONs in series for high voltage proof in circuit.

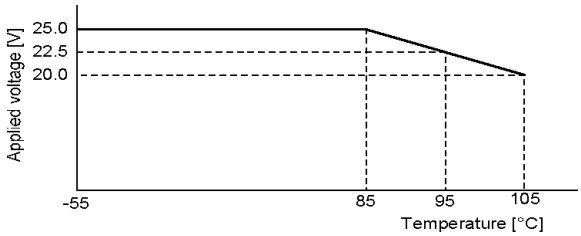
3. Compliance with rated performance

OS-CON must be used under rated performance prescribed in the specification. Operational and installation condition must be carefully examined.

(a) Over-voltage exceeding the rated voltage should not be applied even for an instance since it may cause a short circuit.
(b) Operating temperature (ambient of OS-CON) must be within the category temperature range of specification.
(c) Do not apply current that exceeds the rated ripple current. When excessive ripple current is applied, the OS-CON may result in shorter life due to the internal heat increase.

4. Applied voltage

(a) OS-CON can be applied with 100% of rated voltage except for 25V product.
In case of 25 V product, if the operating temperature is above 85 deg.C, derating voltage shown in the following figure must be applied. If the temperature is below 85 deg.C, derating is not necessary. In any event, over voltage exceeding the rated voltage must not be applied even for a moment.



(b) Sum of the DC voltage value and the ripple voltage peak values must not exceed the rated voltage.
(c) When DC voltage is low, negative ripple voltage peak value must not become a reverse voltage that exceeds 10 % of the rated voltage.
(d) Use the OS-CON within 20 % of the rated voltage for applications which may cause the reverse voltage during the transient phenomena when the power is turned off or the source is switched.

Ⅰ. Operating Precautions

5. Sudden charge and discharge

Sudden charge and discharge may result in short circuits and the large Leakage current. Therefore, protection circuits are recommended to design in when the following conditions are available.

(a) The rush current is over 10 A.

(b) The rush current is over 10 times of allowable ripple current of **OS-CON**.

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

6. Failure and life-span

Failure rate in use is based on Failure rate level 0.5%/1000hours in the specification (Confidence level 60%) based on upper category temperature and rated voltage applied.

It is possible to cause a failure circuit even if **OS-CON**s have a lowest failure rate. As the above reason, please insert a protection circuit to prevent unlikely event by accident. Meanwhile, please design your circuit using **OS-CON** which cause no damage to social or person directly, or use after checking that it causes no problem even if it fails.

The failure modes mainly have two types (a) and (b) as follows.

(a) Contingency failure

The contingency failure mainly has short circuit. The phenomenon of after short is on following.

(1) Phenomenon of after short circuit mode

(a) Resin sealing type. (SC,SA,SL,SH,SS,SP,SPA,SF Series)

In the event that a short circuit causes the current to become relatively small (less than approximately 3 A for φ10 and less than approximately 1 A for φ6.3), the **OS-CON** itself will generate a little heat, but the appearance will not be affected even when electricity is supplied continuously.

However, if the short circuits current value exceeds the above mentioned values, the temperature inside the **OS-CON** will increase. When the temperature exceeds approximately 220°C, the impregnated organic semiconductor melts and liquefies, the internal pressure is raised, and the liquefied organic semiconductor and odorous gas is released from the space between the sealant and the aluminum case and lead terminals. In this case, Keep your face and hands away from the area.

(b) Rubber type. (SEP,SEQP,SEPC,SVP,SVQP,SVPA,SVPB,SVPC,SVPD Series)

In the event that a short circuit cause the current to become relatively small (less than approximately 1A for φ10, 0.5A for φ8 and less than approximately 0.2A for φ6.3), the **OS-CON** itself will generate a little heat, but the appearance will not be affected even when electricity is supplied continuously.

However, if the short circuits current value exceeds the above mentioned values, the temperature inside the **OS-CON** will increase, the internal pressure is raised, rubber packing is turned over, odorous gas is released.

(2) If a short circuit occurs and odorous gas is released, either turn off the main power of the equipment or unplug the power cord from the outlet.

(3) If a short circuit occurs, it may take from a few seconds to a few minutes before the organic semiconductor liquefies and an odorous gas produces, depending on the conditions. It is recommended to set up a power protection circuit to function during this time.

(4) If the gas comes in contact with eyes, rinse immediately. If the gas is inhaled, gargle immediately.

(5) Do not lick the **OS-CON**s electrolyte. If the electrolyte comes in contact with skin, wash it off with soap immediately.

(6) The electrolyte, separator, resin, tube, rubber and plastic spacer used in the **OS-CON** are all combustible. When the current is extraordinarily large after a short circuit, in the worst case, the shorted-out section in the lead terminal or inside the capacitor may have catch fire to the resin and / or rubber.

(b) Performance characteristic and failure (life-span)

The **OS-CON**s characteristics can possibly change (Capacitance reduction and ESR increase) within the specified range in specifications when it is used in the condition of Rated voltage, Electric and mechanical performance.

When life span exceeded the specified guarantee time of Endurance and Damp heat, electric characteristic might change and cause electrolyte insulation. This is called Open circuit mode.

Ⅰ. Operating Precautions

(1) Please confirm the following item when select and design **OS-CON**.

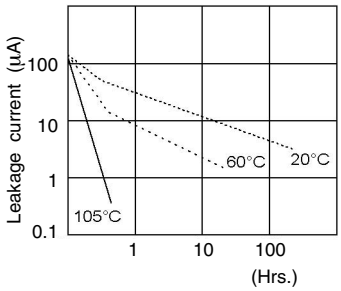
	Electric performance	Confirmation Item
Delivery	Capacitance	Capacitance tolerance of rated capacitance.
Mounting SMD type: Reflow soldering Radial lead type: Flow soldering	Capacitance	Change rate in Capacitance to initial value after mounting. Note: This item also applied to SMD type-reflow mounting of SANYO Recommended reflow condition. Heat stress to **OS-CON** will be influenced by the different of reflow equipment, board material, size, and numbers of mounting. Please check your reflow condition whether it is within the above SANYO Recommendable Reflow Condition or not and confirm **OS-CON**'s electric characteristic change before and after reflow.
	ESR	The specification after mounting.
	Leakage current	Leakage current less than or equal to the value of specification after voltage treatment. Leakage current may increase and exceed the specification value after mounting. In such a case, Leakage current will decrease and return back to specification after applying voltage.
In use	Capacitance	(1) Change rate in Capacitance before and after Endurance test (2) Change rate in Capacitance before and after Damp heat test
	ESR	(1) The specification after Endurance test. (2) The specification after Damp heat test.
	Leakage current	(1) Leakage current is less than or equal to specification after Endurance test. (2) Leakage current may increase and exceed the specification value after Damp heat test. In such case, Leakage current will decrease and return back to specification after applying voltage.
Others	Ripple current	It is necessary to apply a frequency coefficient according to an usable frequency which is beside 100kHz to 500kHz.

Cautions

1. Leakage current

Leakage current may increase even when soldering condition is within the specification. It may also increase after high temperature test without load, damp heat test without load or rapid temperature change test. In such a case, leakage current will gradually decrease by applying voltage in the temperature within the specification. The restoration speed is maximum one when rated voltage is applied within category temperature. (Please refer to the diagram below)

OS-CON leakage current restoration characteristics 10μF/16V (16V DC applied)



2. Capacitor insulation

(a) Insulation in the marking sleeve and the laminate resin is not guaranteed. Be aware that the space between the case and the negative electrode terminal is not insulated and has some resistance.

(b) Be sure to completely separate the case, negative lead terminal, positive lead terminal and PC board patterns with each other.

3. Operating environmental restrictions

Do not use the **OS-CON** in the following environments.

(a) Places where water, salt water or oil can directly fall on it, and places where condensation may form.

(b) Places filled with noxious gas (hydrogen sulfide, sulfurous acid, nitrous acid, chlorine, ammonia, etc.).

(c) Places susceptible to ozone, ultraviolet rays and radiation.

4. PCB (PC board) design

(a) Avoid locating heat-generating components around the **OS-CON** and on the underside of the PC board (underneath the **OS-CON**).

(b) Follow the recommendations given in the specifications for land patterns for SMD type PC board when designing circuits.

(c) The pitch and diameter of PCB holes to which radial lead type of **OS-CON** is mounted should be designed to conform to the dimensional tolerance stipulated in the specifications.

Ⅰ. Operating Precautions

5. Parallel connection

A large amount of ripple current may be applied to the OS-CON when it is used in parallel with another capacitor. Carefully select the type of capacitor.

6. Others

Design circuits after checking the following items.

(a) Electric characteristics are affected by temperature and frequency fluctuations. Design circuits after checking the following items.

(b) When mounting an OS-CON on a double-sided PC board, extra PC board holes and the through holes for connecting the front and back of the PCB must not exist underneath the OS-CON.

Mounting precautions

1. Considerations when soldering

The soldering conditions are to be within the range prescribed in specifications. If the specifications are not followed, there is a possibility of the cosmetic defection, the intensive increase of leakage current, and the capacitance reduction.

2. Things to be noted before mounting

(a) Do not reuse OS-CONs that have been assembled in a set and energized. Excluding OS-CONs that have been removed for measuring electrical characteristics during a periodic inspection, OS-CONs cannot be reused.

(b) Leakage current may increase when OS-CONs are stored for a long period of time. In this case, apply rated voltage for 1 hour at 60 to 70 deg.C with load of 1 kohm resistor.

3. Mounting-1

(a) Mount after checking the capacitance and the rated voltage.

(b) Mount after checking the polarity.

(c) Do not drop the OS-CON on the floor. Do not use OS-CONs that have been dropped.

(d) Do not deform the OS-CON.

4. Mounting-2

(a) Mount after checking that SMD types of the OS-CONs terminal pitch and the PCB land pattern.

(b) Mount after checking that radial lead types of the OS-CONs terminal pitch and diameter of PCB holes. When an automatic inserter is used to clinch the OS-CONs lead terminals, make sure it is not set too strong.

(c) Be careful to the shock force that can be produced by absorbers, product checkers, and centers on automatic inserters and installers.

(d) Do not apply excessive external force to the lead terminal and the OS-CON itself.

5. Soldering with a soldering iron

(a) Set the soldering conditions (temperature, time) so that they fall within the stipulated range in the specifications.

(b) When the lead terminal for radial lead type must be processed because the lead pitch and the PCB holes in spacing do not match, process it before soldering so that no stress is applied to the OS-CON itself.

(c) Do not subject the OS-CON itself to excessive stress when soldering.

(d) When a soldering iron is used to repair an OS-CON that has already been soldered once and needs to be removed, remove it after the solder has been completely melted so that no stress is applied to the OS-CONs lead terminal.

(e) Do not let the tip of the soldering iron touch the OS-CON itself.

(f) The leakage current value after soldering may increase a little (from a few μA to several hundred μA) depending on the soldering conditions (preheating and solder temperature and time, PCB material and thickness, etc.). The leakage current can be reduced through self-repair by applying voltage.

Ⅰ. Operating Precautions

6. Flow soldering

(a) Do not use flow soldering for SMD type.

(b) Do not solder the **OS-CON** by submerging it in melted solder. Use the PCB to protect the **OS-CON** and only solder the opposite side that the **OS-CON** is mounted on.

(c) Set the soldering conditions (soldering temperature, terminal submersion time) so that they fall within the stipulated range in specifications.
The leakage current value after soldering may increase a little (from a few μA to several hundred μA) depending on the soldering conditions (preheating and solder temperature and time, PCB material and thickness, etc.). The leakage current can be reduced through self-repair by applying voltage. Meanwhile, preheating (120deg.C, 120s max) is recommendable.

(d) Take care that flux does not adhere to anywhere expect the lead terminal.

(e) When soldering, take care that other components do not fall over and touch the **OS-CON**.

(f) Flow soldering under extremely abnormal conditions may reduce the capacitance of products after soldering.

7. Reflow soldering

(a) Reflow soldering is unapplicable to Radial lead type.

(b) Set the soldering conditions (soldering temperature, terminal submersion time) so that they fall within the stipulated range in the specifications. The leakage current value after soldering may increase a little (from a few μA to several mA) depending on the soldering conditions (preheating and solder temperature and time, PCB material and thickness, etc.). The leakage current can be reduced through self-repair by applying voltage.

(c) Please contact SANYO for setting VPS soldering conditions

(d) Reflow soldering may reduce the capacitance of products after soldering even if stipulated soldering conditions in specifications are met.

8. Handling after soldering

(a) Do not tilt, bend or twist the **OS-CON** after it has been soldered on the PCB.

(b) Do not move the PCB with catching **OS-CON** itself by hand after soldering.

(c) Do not dump the **OS-CON** with objects after it has been soldered to the PCB. When stacking PCBs, make sure that the **OS-CON** does not touch other PCBs or components.

(d) Do not subject the **OS-CON** to excessive stress after it has been soldered to PCB.

9. Washing the PCB

Check the following items before washing the PCB with these detergents: high quality alcohol-based cleaning fluid such as Pine-α ST-100S, Clean thru 750H, 750L, 710M, 750K, or Techno Care FRW 14 through 17; or detergents including substitute freon as AK-225AES and IPA.

(a) Use immersion or ultrasonic waves to clean for a total of less than five minutes. (SVP,SVQP,SVPA,SVPB, SVPC,SVPD,SEP,SEQP and SEPC series are less than two minutes.)

(b) The temperature of the cleaning fluid should be less than 60 °C.

(c) Watch the contamination of the detergent (conductivity, pH, specific gravity, water content, etc.).

(d) After cleaning, do not store the **OS-CON** in a location subject to gases from the cleaning fluid or in an airtight container. Dry the PCB and **OS-CON** with hot air (lass than the maximum operating temperature). Please do not heat (heat run, dry, etc.) soon after cleaning.

(e) Please contact SANYO for details about detergents and cleaning methods, and about detergents other than those listed above.

10. Fixatives and coatings

(a) Select appropriate materials for the **OS-CON**s marking material and sealant. In particular, make sure the fixative, coating and thinner do not contain acetone.

(b) Before applying the fixative or coating, completely remove any flux residue and foreign matter from the area where the PCB and **OS-CON** are to be jointed together.

(c) Allow any detergent to dry before applying the fixative or coating.

(d) Please contact SANYO for fixative and coating heat curing conditions.

Ⅰ. Operating Precautions

11. Precautions with completed board

(a) Do not touch the lead terminals of **OS-CON** directly.
(b) Do not use electric conductors to cause short circuits between the **OS-CON**s lead terminals. Do not subject the **OS-CON** to conductive solutions such as acids and alkaline water solutions.
(c) Check the installation environment of the board the **OS-CON** is installed in.
(d) Age the board at conditions that fall below the capacitors ratings.
(e) It is recommended that the board be used at room temperature and in ordinary humidity.

Storage and Disposal

1. Storage conditions

(a) Do not store the **OS-CON** at high temperatures and high humidity. Store it in a location that is not subject to direct sunlight and that has temperatures less than 35 °C and a relative humidity less than 75 % generally.
(b) To keep good solderability, store the **OS-CON**s in its plastic bag under shipping condition. SMD types (SVP, SVQP, SVPA, SVPB, SVPC and SVPD series) are sealed up in specifically designed aluminum laminate bags to prevent deterioration in characteristic and solderability before and after reflows resulting from moisture absorption.
(c) To keep good solderability, store radial lead types packed in bags for not more than one year (after delivery), and radial lead types with taping and SMD types for not more than six months (after delivery) before opening.(Please refer to the following table.)
(d) Open the bags just before mounting, and use up all products once opened. In case of leftovers, put radial lead types packed in bags, SMD types and unpackaged ones back into the storage bags (specifically designed aluminum laminate bags for SMD types), and seal up the opening with tape etc. Put radial lead types with taping in plastic bags as they are put into storage boxes and seal up the opening with tape etc. Please follow the storage term as stated in the below table, in case of storage after once opened.
(e) Do not store the **OS-CON** in damp conditions such as with water, salt spray, or oil spray, and high humidity.
(f) Do not store the **OS-CON** in places filled with noxious gas (hydrogen sulfide, sulfurous acid, nitrous acid, chlorine, ammonia, etc.).
(g) Do not store the **OS-CON** in places susceptible to ozone, ultraviolet rays and radiation.

	Before unseal	After unseal
Taping product (SMD)	Within 6 months after delivery (Unopened condition)	Within 30 days from opening (Packaged condition with carrier tape)
Bag packing product (radial type)	Within 1 year after delivery (Unopened condition)	Within 7 days from opening (1 week)
Radial taping product	Within 6 months after delivery (Unopened condition)	Within 7 days from opening (1 week)

2. Disposal

OS-CON comprises solid organic compounds, various metals, resin, rubber, etc. Treat it as industrial waste when disposing of it. In case of disposing a large amount of **OS-CON**, SANYO can dispose on behalf.

Note:
In case of some problems concerning industrial possessive rights of third party by using this product, we don't take responsibility except for what to be directly conceded with structure processes **OS-CON**. Please design with safety measures taking into consideration any social damage, such as personal or fire accident when using this product.