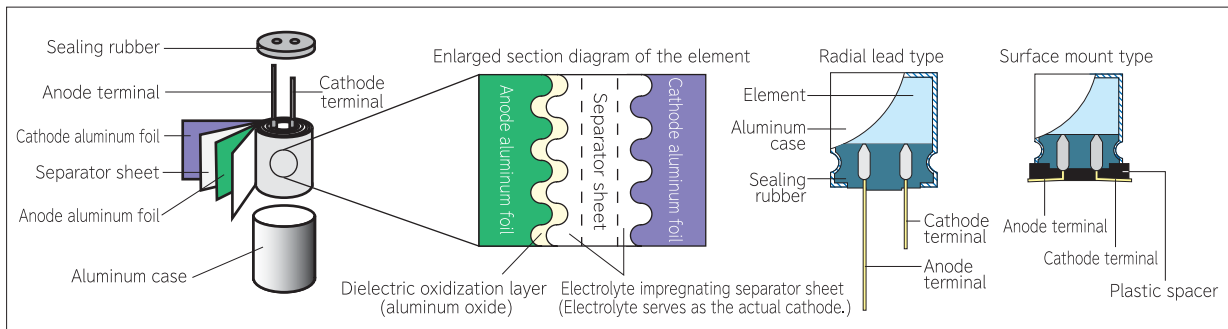


## 1. Basic structure of OS-CON

OS-CON has a basic construction similar to an aluminum electrolytic capacitor. A distinctive difference lies in **electrolyte**.

Aluminum electrolytic capacitor	Separator sheet impregnated with <b>electrolytic solution</b> .	Liquid electrolyte
<b>OS-CON</b>	Separator sheet impregnated with <b>conductive polymer</b> .	Solid electrolyte



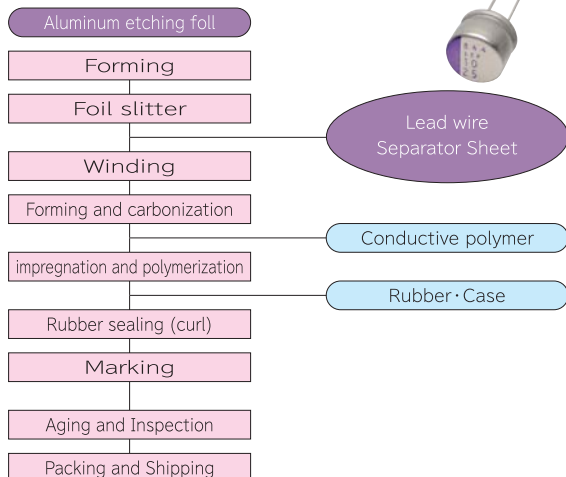
Characteristics between OS-CON and aluminum electrolytic capacitor due to a difference in electrolyte

	Aluminum electrolytic capacitor	OS-CON
Conductivity	0.01S/cm <ul style="list-style-type: none"> <li>• Difficult to lower ESR due to low conductivity</li> <li>• ESR augments, in particular, in low temperature conditions</li> </ul>	100S/cm <ul style="list-style-type: none"> <li>• The highest electronic conductivity, realizing super low ESR.</li> <li>• ESR is stable in low temperature conditions</li> </ul>
Reliability, lifespan	<ul style="list-style-type: none"> <li>• Liquid electrolyte is evaporable at high temperature</li> <li>• Static capacitance is on the decline at high temperature</li> <li>• Limited lifespan resulting from dry-up</li> <li>• Major fluctuations in temperature characteristics</li> </ul>	<ul style="list-style-type: none"> <li>• Little evaporation due to solid electrolyte</li> <li>• Little decrease in static capacitance</li> <li>• Long lifespan even at high temperature</li> <li>• Very minor fluctuations in temperature characteristics</li> </ul>
Temperature coefficient (for lifespan)	2 times by 10°C reduction	10 times by 20°C reduction
	105°C/2,000h → 85°C/8,000h	105°C/2,000h → 85°C/20,000h

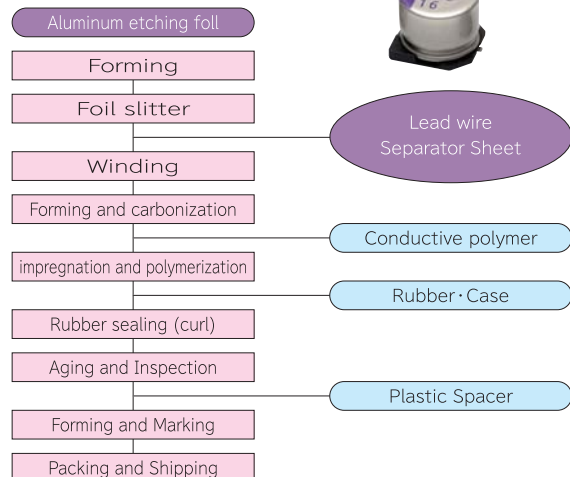
※Please contact us separately if you require life factor of SXV, SXE series.

## 2. OS-CON Manufacturing Method

### 【Radial lead type】



### 【Surface mount type】



# 1. OS-CON Electrical characteristics

## 1-1. Frequency characteristics

Fig.A Impedance frequency characteristics (OS-CON vs other types)

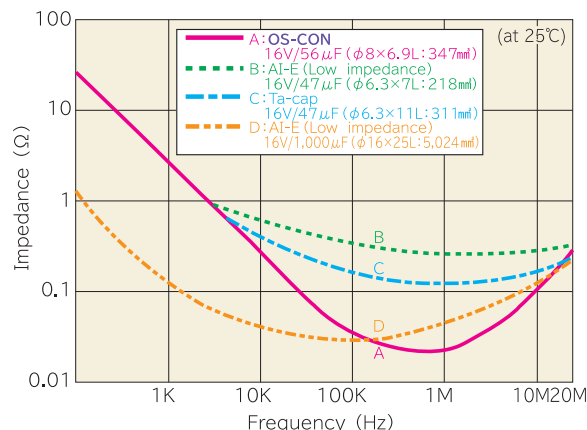
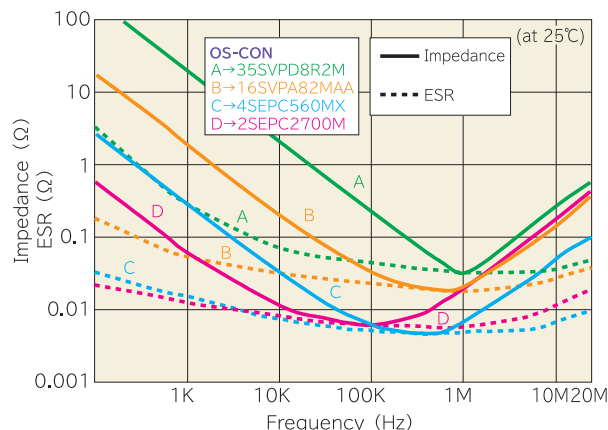


Fig.B Impedance & ESR frequency characteristics (several OS-CON models)



The OS-CON is an electrolytic capacitor that has excellent frequency characteristics. It improves ESR greatly, and provides the excellent frequency characteristics because the OS-CON uses a high conductive polymer as electrolyte. Fig.A: The OS-CON's frequency characteristic shows a nearly ideal curve. When compared at 100kHz, The OS-CON 56μF, and low impedance aluminum electrolytic capacitor 1,000μF nearly have the same feature. Fig.B: The resonance point of the OS-CON is at 100kHz to 10MHz. The ESR is an extremely small value approximately 5mΩ at 100kHz of 560μF.

## 1-2. Characteristics at high temperature and low temperature

Fig.A ESR temperature characteristics (OS-CON vs other types)

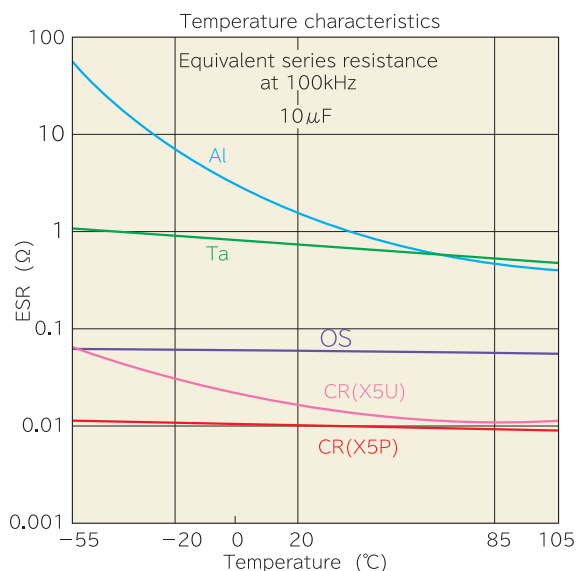
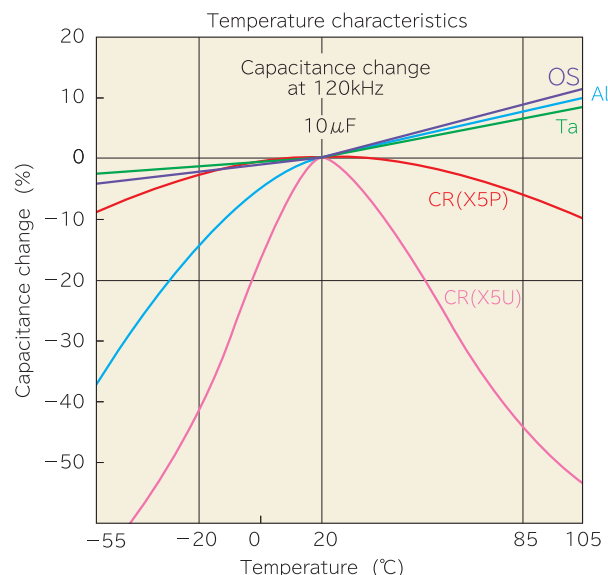


Fig.B Capacitance temperature characteristics (OS-CON vs other types)



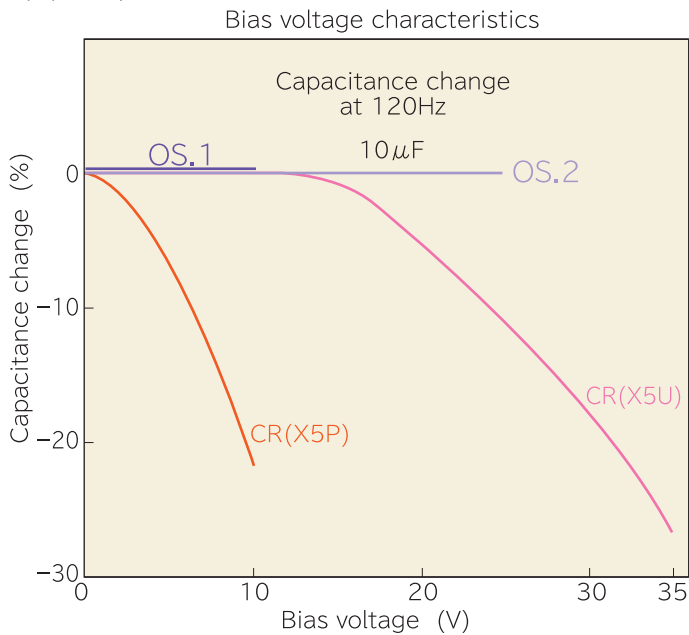
OS-CON's Characteristics at high temperature and low temperature is that it features little change in temperature for the ESR.

What ESR changes a little against temperature means that noise clearing ability changes a little against temperature as well. The OS-CON is suitable for outdoor apparatus.

OS = OS-CON ————— Purple  
 AI = AL-E. Cap ————— Blue  
 Ta = Tantalum Cap. ————— Green  
 CR(X5P) = Cera Cap. (X5P Type) — Red  
 CR(X5U) = Cera Cap. (X5U Type) — Pink

### 1-3. Bias characteristics

#### (a) Capacitance



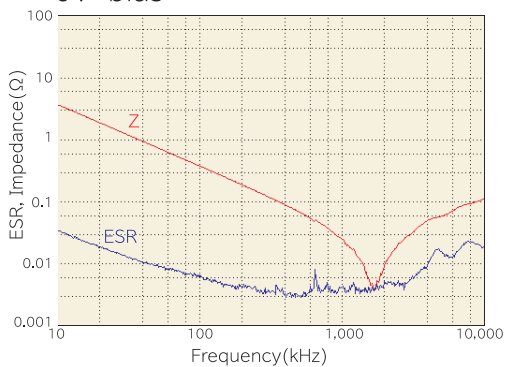
OS.1 = OS-CON(10SVP10M) — Purple  
 OS.2 = OS-CON(25SVPD10M) — Light Purple  
 CR(X5P) = Cera Cap. — Red  
 (X5P Type ; 10V/10 $\mu$ F)  
 CR(X5U) = Cera Cap. — Pink  
 (X5U Type ; 50V/10 $\mu$ F)

When voltage is applied to ceramic capacitors, they show a bias characteristics where static capacitance is reduced. Our OS-CON product, however, will show no reduction in capacitance for applied voltage within its rating.

#### (b) Impedance, ESR

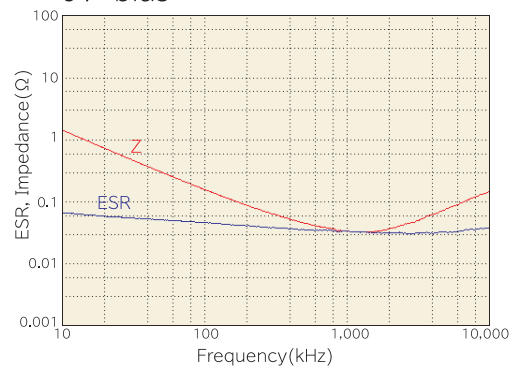
Bias characteristics of OS-CON & ceramic capacitors

Multi-layer ceramic capacitor (25V/4.7 $\mu$ F)  
 0V bias

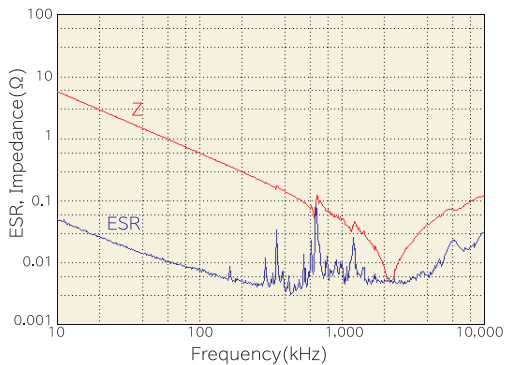


OS-CON (25SVPD10M)

0V bias

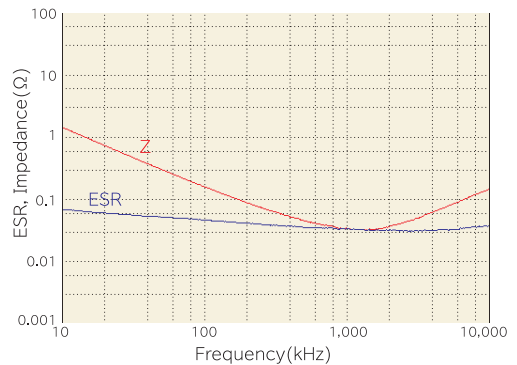


Multi-layer ceramic capacitor (25V/4.7 $\mu$ F)  
 20V bias



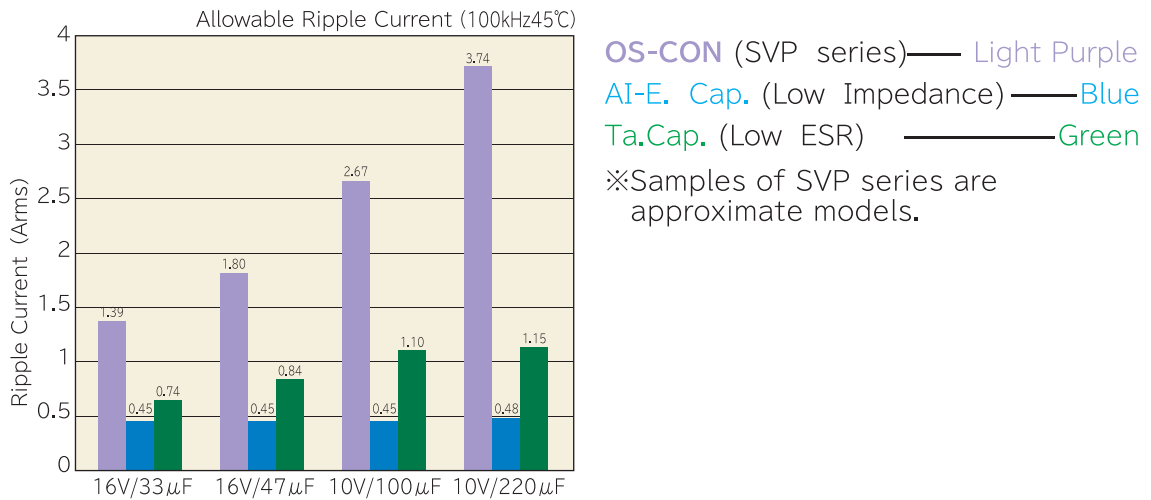
OS-CON (25SVPD10M)

20V bias



ESR & impedance of ceramic capacitors change largely between 300kHz to 1MHz. As for OS-CON, neither ESR nor impedance changes.

## 1-4. Allowable Ripple Current



When selecting smoothing capacitors for power supply, the allowable ripple current of a capacitor is one of criterion.

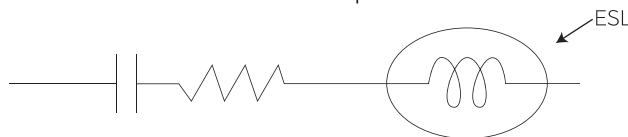
The allowable value of ripple current is decided by the generated heat of a capacitor, this heating is due to the ESR. Since a large ESR capacitor generates larger heat value, it can not make the flow of ripple current greater.

Compared to other electrolytic capacitors, ESR of the OS-CON is so small that it can allow much ripple currents.

## 1-5. ESL Characteristics

The OS-CON is a capacitor of high performance with low ESR and large capacitance. Recently in circuit technologies, the constituent of ESL is important in the domain of the high frequency with that of electronic equipment.

(a) Equivalent series circuit of capacitor



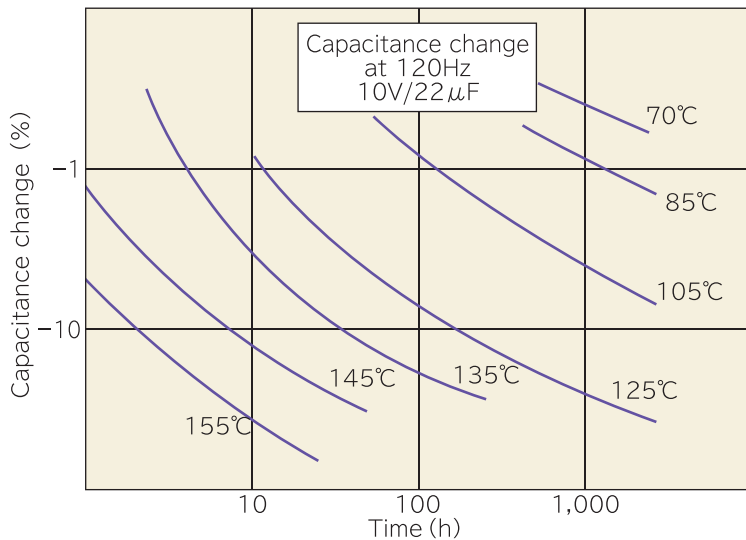
(b) Approximate ESL values of SEPC series

(unit:nH)

Size Code	at 10 MHz	at 40 MHz
B9	1.6	1.5
C55	2.4	2.3
C6	2.6	2.5
C7	2.3	2.3
C9	2.2	2.1
E7	2.9	2.8
E9	2.7	2.6
E12	4.3	4.1
E13	4.3	4.1
F13	6.0	5.8

※Measuring position: root of lead terminal  
 ※Measuring method: Based on JEITA RC-2003  
 ※All values on left figure are not guaranteed but reference.  
 Please contact SANYO for details of measurement.

## 1. Temperature acceleration test (Endurance)



The decrease in capacitance of the **OS-CON** depends on temperature. The left figure shows the speed of capacitance decrease at each temperature. This graph indicates that temperature coefficient of the **OS-CON** lifetime is 10 times by 20°C reduction. Compared with this, aluminum capacitor lifetime is 2 times by 10°C reduction.

Estimation of life time

<b>OS-CON</b>	Aluminum electrolytic capacitor
105°C ⇒ 2,000h	105°C ⇒ 2,000h
95°C ⇒ 6,324h	95°C ⇒ 4,000h
85°C ⇒ 20,000h	85°C ⇒ 8,000h
75°C ⇒ 63,245h	75°C ⇒ 16,000h

※Guaranteed temperature of the **OS-CON** is 105°C, except for SEQP, SVQP and SVPD series.

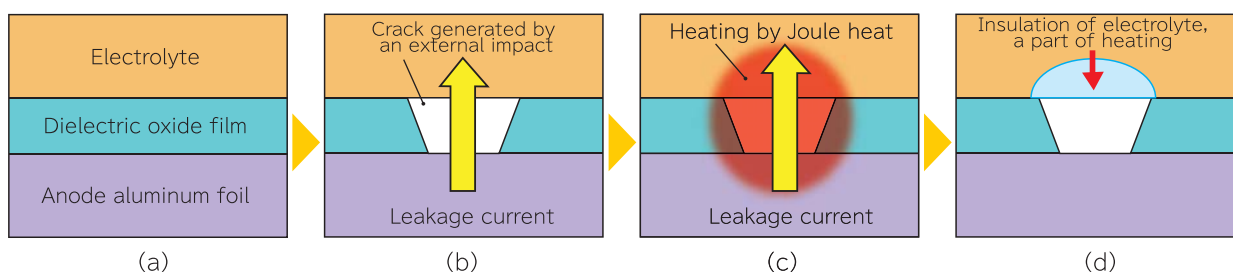
※Time is an estimate, not guaranteed.

Though the **OS-CON** and an aluminum electrolytic capacitors are guaranteed on 2,000 hours at 105°C, the life span results in differences as temperature drops.

The **OS-CON** has a longer life span compared with an aluminum electrolytic capacitor.

## 2. Self-Healing Mechanism

The dielectric substance of the **OS-CON** is a non-conductive oxide film that has formed on the surface of an anode aluminum foil. Since the oxide film is solid and thin, leakage current may temporarily increase if micro cracks are generated by external stress (i.e. mechanical, thermal, electrical) [see figure (b)]. When this happens, the leakage current generates Joule heat [see figure (c)] and with this heat the electrolyte turns non-conductive and insulates the outlet of the leakage path [see figure (d)]. The leakage current from the micro cracks is thus suppressed through this function. This is known as "self-healing mechanism."



## 3. Reliability presumption of life for the OS-CON

The capacitance of the OS-CON is getting smaller as time goes with endurance test. This means wear-failure of the OS-CON is open mode, which is a main failure factor. The life time is different by each operating temperature and self-heating by ripple current. The following formula is used to estimate the presumptive lifetime of the OS-CON at ambient temperature

$T_x$  (°C).

The result of the following estimation is not guaranteed but presumptive values based on actual measurement. The estimated life-span is limited up to 15 years.

### 3-1. Calculation formula of estimated life expectancy

$$L_x = L_o \times 10^{\frac{T_o - T_x}{20}}$$

$L_x$ : Life expectancy (h) in actual use (temperature  $T_x$ )

$L_o$ : Guaranteed (h) at maximum temperature in use

$T_o$ : Maximum operating temperature (°C)

$T_x$ : Temperature in actual use (ambient temperature of the OS-CON) (°C)

Please contact us separately about estimated life expectancy of new series (SXV, SXE series) and products (SVQP, SVPD, SEQP series) guaranteed at 125°C.

※The estimated life expectancy of conductive polymer electrolyte type can be calculated without consideration of self-heating under application of the ripple current

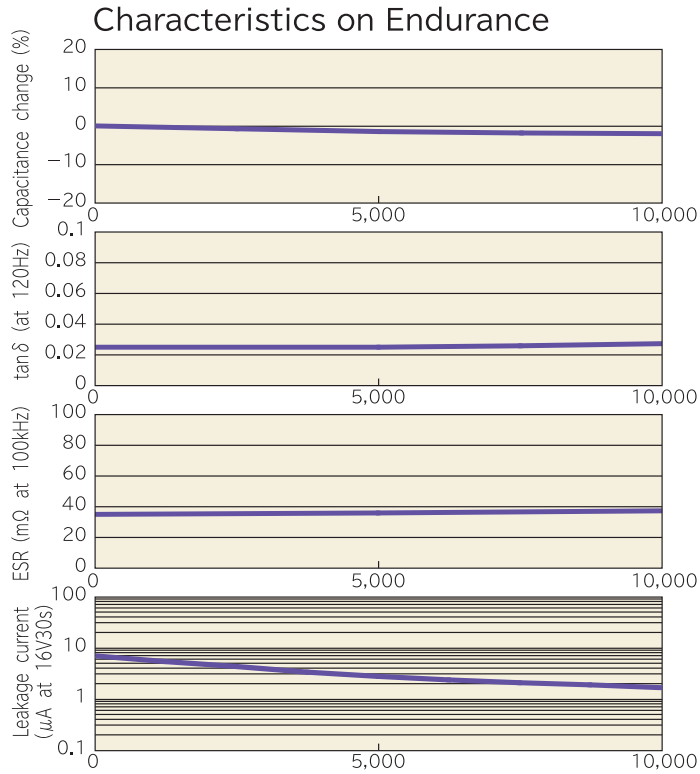
※SVPS series: Self-heating temperature when applied the allowable ripple current.

### Self-heating temperature when applied the rated ripple current

series	size	Self-heating
SVP, SVPA, SVPC, SVPS*	Except for A5, B6	approx. 20°C
SVP, SVPA, SVPC, SVPS*	A5, B6	approx. 10°C
SVPB, SVPE, SVPF, SVPG, SXV, SEP, SEPC, SEPF, SXE	All	approx. 20°C
SVQP, SEQP, SVPD	All	approx. 2°C

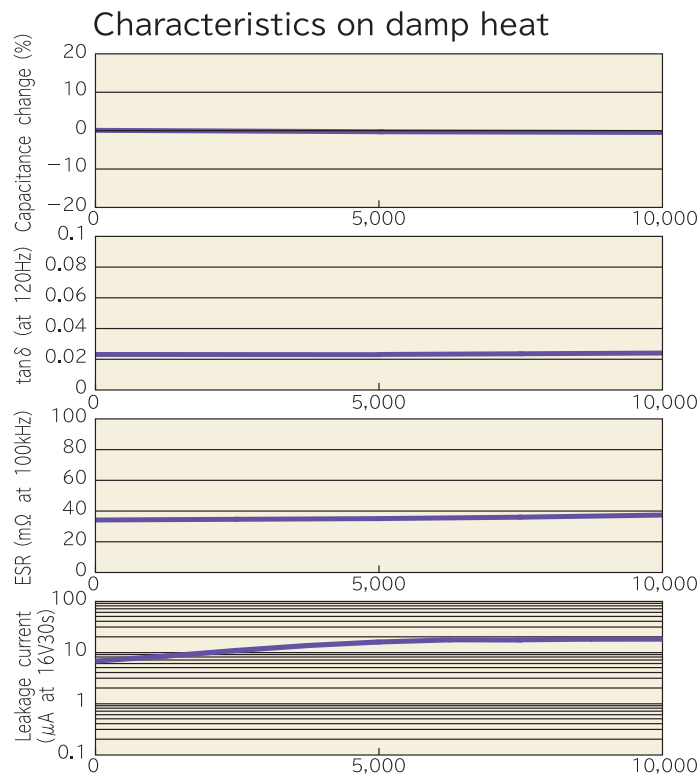
## 4. Conductive polymer type (16SVP39M)

### 4-1. Endurance (105°C, 16V applied)



Little change in characteristics can be seen after 10,000 hours because of adoption of conductive polymer that excels in thermal stability.

### 4-2. Damp heat (60°C/90% RH, without load)



Little change in characteristics can be seen after 10,000h hours in a high temperature and damp heat environment because of the excellent thermal stability of conductive polymer.