Solid Aluminum Capacitors with Organic Semiconductor Electrolyte Surface Mount Chip

HIGH TEMPERATURE LOAD (AT + 105 °C)

Figure 1

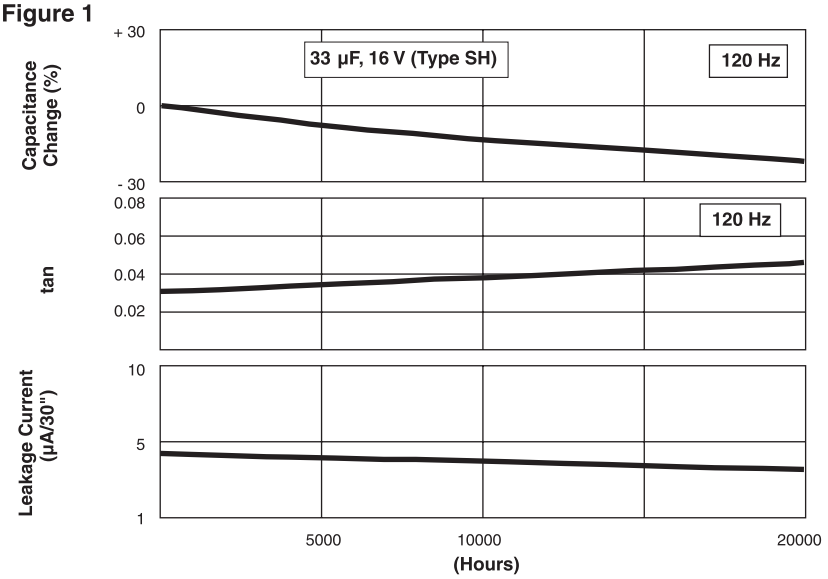
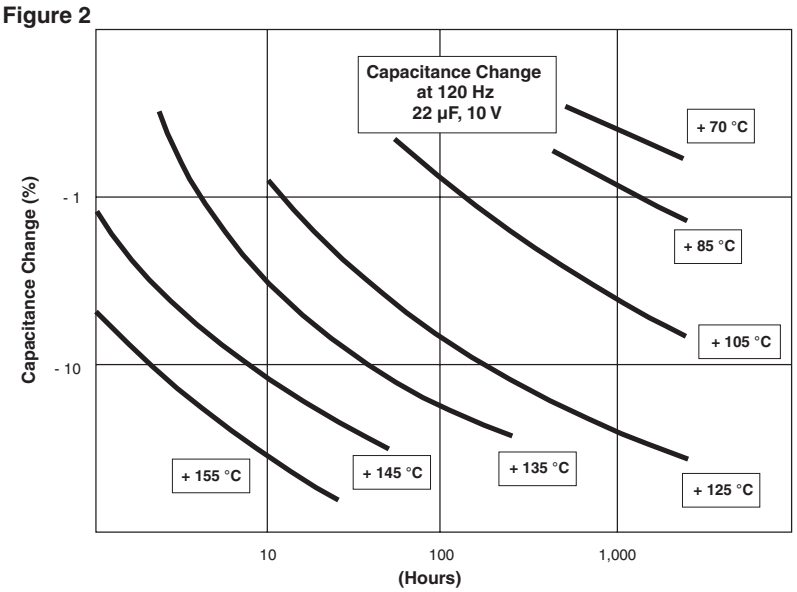


Figure 1 shows a graph with the tendency of each characteristic of the Vishay OS-CON capacitor on high-temperature load test. The change in capacitance shows a tendency for reduction as that of the aluminum electrolytic capacitor does. However, with the aluminum electrolytic capacitor there is a yield point (time) depending on the dry-up of the electrolytic solution, but with the Vishay OS-CON capacitor, there is not such a phenomenon, and the tendency for gradual decrease continues semi-permanently. The change in standing almost never differs in the presence of voltage application except for the change of leakage current.

TEMPERATURE ACCELERATION TEST (HIGH-TEMPERATURE LOAD)

Figure 2



The decrease of capacitance causes a failure in the lifetime of the Vishay OS-CON capacitor. The capacitance decreases mainly due to temperature. Figure 2 shows the decreasing speed in capacitance at each temperature. From this, the temperature coefficient of the Vishay OS-CON capacitor's lifetime becomes 10 times at 20 °C reduction.
The temperature coefficient of the aluminum electrolytic capacitor becomes twice at 10 °C reduction compared to that in the usual lifetime.
This indicates that, for instance, their deterioration at + 105 °C x 2000 hours, can be converted into those at + 105 °C, + 85 °C and + 65 °C as follows:

Estimation of Life Time:	Vishay OS-CON Capacitor	Aluminum Electrolytic Capacitor
	+ 105 °C = 2000 hours	+ 105 °C = 2000 hours
	+ 85 °C = 20000 hours	+ 85 °C = 8000 hours
	+ 65 °C = 200000 hours (22 years)	+ 65 °C = 32000 hours (3.6 years)

(These are estimated values, not actual amounts that can be guaranteed.)
This means that the Vishay OS-CON capacitor has extremely longer life in practical use even for + 105 °C x 2000 hours, guaranteed products.

RELIABILITY PRESUMPTION OF LIFE

The Vishay OS-CON capacitor, as pointed out on previous page, loses capacitance as times goes by, as shown in Figure 1.
From this, the wear-out failure of the Vishay OS-CON leads to an open mode by decreasing of the capacitance. This wear-out failure by the decrease of the capacitance mainly causes the failure of a Vishay OS-CON capacitor. The occurrence time of this wear-out failure (lifetime) varies according to the ambient temperature in which the products are used, also selfheating temperature through the flow of Ripple Current. Estimate of a Vishay OS-CON capacitor's life is approximately 10 times at 20 °C reduction.
The estimated life Lx (hours) of a Vishay OS-CON capacitor at ambient Temperature Tx (°C) may be roughly expressed by the following equation:

$$Lx = Lo \times 10^{\frac{To - (Tx + \Delta Tx)}{20}}$$

Lx = Life Expectance (hours) in actual use (Temperature Tx)
Lo = Guaranteed (hours) at maximum temperature in use
To = Maximum operating temperature
Tx = Temperature in actual use (°C)
ΔTx = Self-heating temperature by Ripple Current (°C)
$\Delta Tx = (Ix/Io)^2 \times \Delta T$ $Ix \leq Io$
Io = Maximum allowable Ripple Current at + 45 °C or less (Arms)
Ix = Actual flow of Ripple Current (Arms)

Self heating value ΔT by maximum allowable Ripple Current (+ 45 °C or less) varies according to case size. Refer to the rough values in the chart below:

Case Size	A, A'	B, B'	C, C'	D	E, E'	F, F', Fo	G	H
ΔT (°C)	8	10	15	16	18	20	20	20

This estimation comes out of presumed values based on actual measurement results, which does NOT guarantee the entire production lots.