

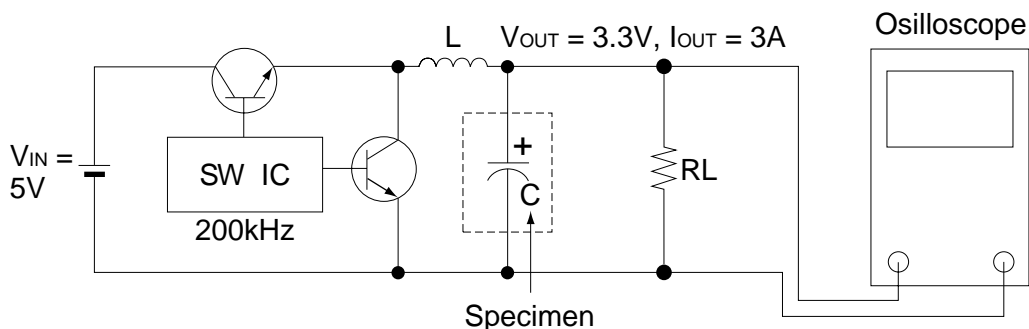
XI. Application

Ripple removal capability of OS-CON

While there is a tendency to downsize switching power supplies capacitors still remain one of the parts occupying large areas of circuit boards. The working temperature is an important consideration when selecting a capacitor, since it generally results in widely varying capacitor characteristics. The following experiment shows the superior ripple removal capability of the OS-CON at high frequencies in wide range of working temperatures.

Experiment

A general chopper switching power supply was used to test the OS-CON against two alternatives. SANYO OS-CON, low-impedance aluminum electrolytic capacitor, and low-ESR tantalum capacitors were each connected as the capacitor in the output side smoothing circuit at working temperatures of -20°C , 25°C and 70°C to compare the output residual ripple voltage.



Initially SANYO OS-CON 100 $\mu\text{F}/6.3\text{V}$ (6SVP100M $\phi 6.3\text{mm} \times \text{L}6.0\text{mm}$) was used as the output side smoothing capacitor (C) in the above test circuit, the residual ripple voltage was measured at ambient temperature of -20°C , 25°C , 70°C .

Low-impedance aluminum electrolytic capacitors and low-ESR tantalum capacitors were selected for measurement at each temperature -20°C , 25°C , 70°C so that the residual ripple voltage became equal to that achieved when the OS-CON 100 $\mu\text{F}/6.3\text{V}$ was used.

Finally, the residual ripple voltage was measured at each temperature (-20°C to 70°C) with an equal number of side smoothing capacitors to the 25°C conditions, and the rates of change in the ESR of the smoothing capacitors were calculated from the amounts of change.

Result

Table1 On-board area ratios of capacitors at each temperature (when the residual ripple voltage is on the same level)

Ambient temperature	OS-CON	Aluminum Electrolytic capacitor	Tantalum capacitor
25°C	1	7.15	1.46
-20°C	1	16.7	1.46
70°C	1	4.77	1.46

Table2 Rates of change in ESR on the basis of 25°C ※

Ambient temperature	OS-CON	Aluminum Electrolytic capacitor	Tantalum capacitor
25°C	1	1	1
-20°C	1.14	3.03	1.27
70°C	0.952	0.587	0.85

$$\text{※Rate of change in ESR} = \frac{\text{Residual ripple voltage at ambient temperature} \times \text{Oscillation frequency at ambient temperature}}{\text{Residual ripple voltage at } 25^{\circ}\text{C} \times \text{Oscillation frequency at } 25^{\circ}\text{C}}$$

From the above results, it can be seen that SANYO OS-CON excels in temperature characteristics.

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Table-1

Ambient temperature	25°C		
Capacitor type	OS-CON	Aluminum Electrolytic capacitor	Tantalum capacitor
capacitance/voltage	100 μ F/6.3V	680 μ F/6.3V	100 μ F/10V
Quantity	1pc	3pcs	2pcs
Residual ripple voltage	22.8mV	23.8mV	24.8mV
Size (※2) (mm)	6.6 X 6.6	10.5 X 10.5	7.5 X 4.5
On-board area ratio	1	7.15	1.46
Oscillation frequency	200kHz		
Fig	Fig1	Fig2	Fig3

Table-2

Ambient temperature	- 20°C			
Capacitor type	OS-CON	Aluminum Electrolytic capacitor		Tantalum capacitor
capacitance/voltage	100 μ F/6.3V	680 μ F/6.3V		100 μ F/10V
Quantity (※1)	1pc	7pcs	(3pcs)	2pcs
Residual ripple voltage	20.8mV	24.4mV	(57.6mV)	25.2mV
Size (※2) (mm)	6.6 X 6.6	10.5 X 10.5		7.5 X 4.5
On-board area ratio	1	16.7		1.46
Oscillation frequency	250kHz			
Fig	Fig4	Fig5	Fig6	Fig7

Table-3

Ambient temperature	70°C			
Capacitor type	OS-CON	Aluminum Electrolytic capacitor		Tantalum capacitor
capacitance/voltage	100 μ F/6.3V	680 μ F/6.3V		100 μ F/10V
Quantity (※1)	1pc	2pcs	(3pcs)	2pcs
Residual ripple voltage	25.6mV	24.0mV	(16.4mV)	24.8mV
Size (※2) (mm)	6.6 X 6.6	10.5 X 10.5		7.5 X 4.5
On-board area ratio	1	4.77		1.46
Oscillation frequency	170kHz			
Fig	Fig8	Fig9	Fig10	Fig11

※1) Figures in brackets () are conditions at 25°C.

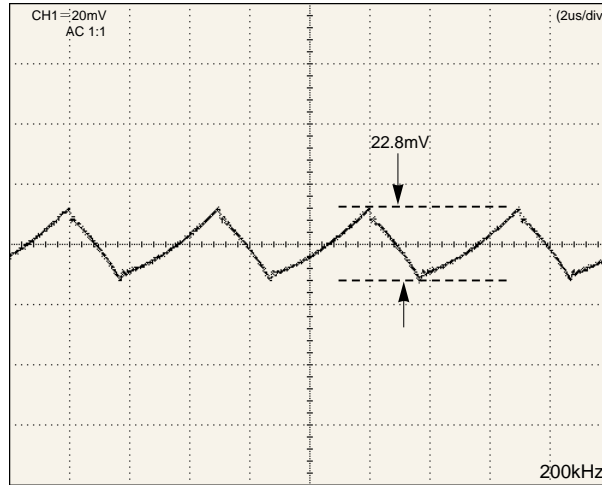
※2) For items other than Ta, rather than the element diameter, the base plate dimensions were taken as the maximum dimensions.

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● Comparison at 25°C

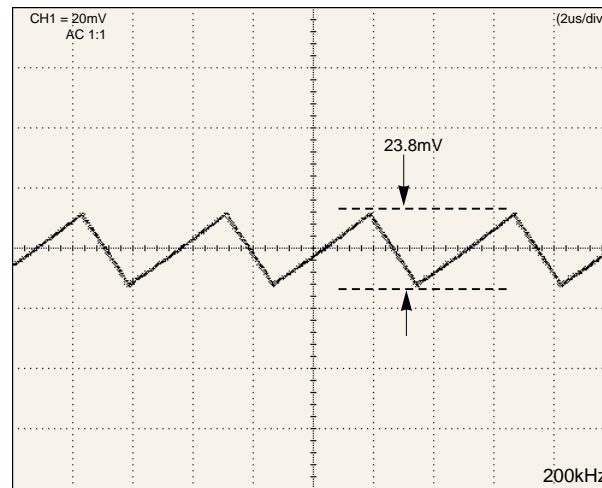
OS-CON 100μF/6.3V

Fig 1 25°C (1pc)



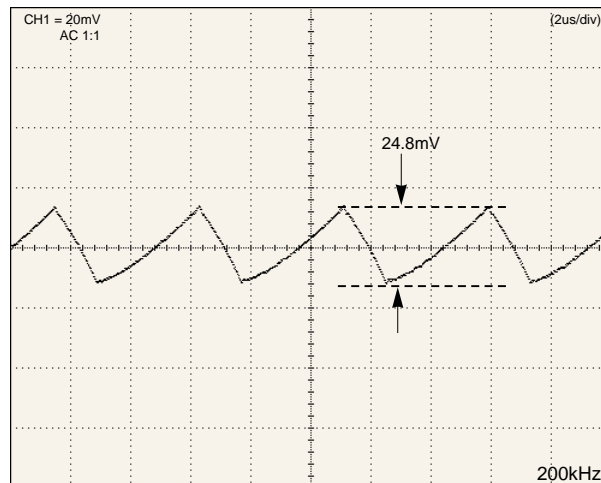
Low-impedance aluminum electrolytic capacitor 680μF/6.3V

Fig 2 25°C (3pc)



Low-ESR Tantalum capacitor 220μF/10V

Fig 3 25°C (2pc)



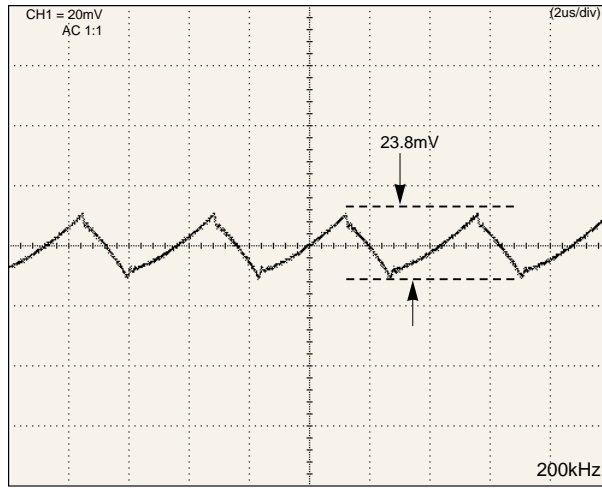
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● Comparison at -20°C

OS-CON 100 μ F/6.3V

Fig 4 -20°C (1pc)



Low-impedance aluminum electrolytic capacitor 680 μ F/6.3V

Fig 5 -20°C (7pc)

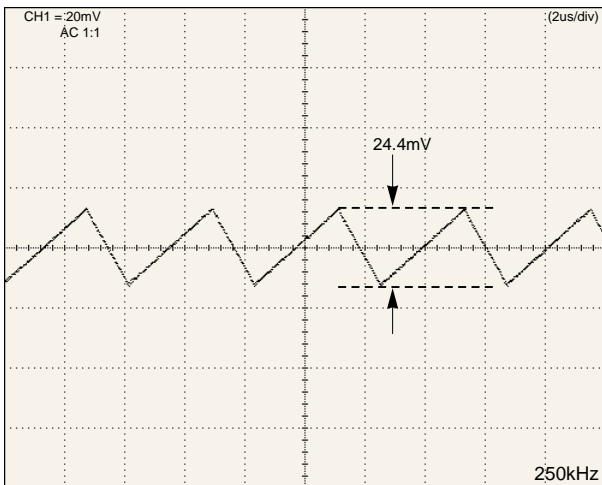
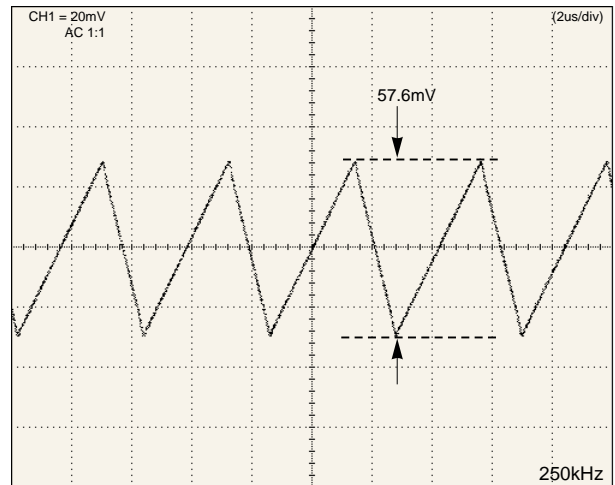
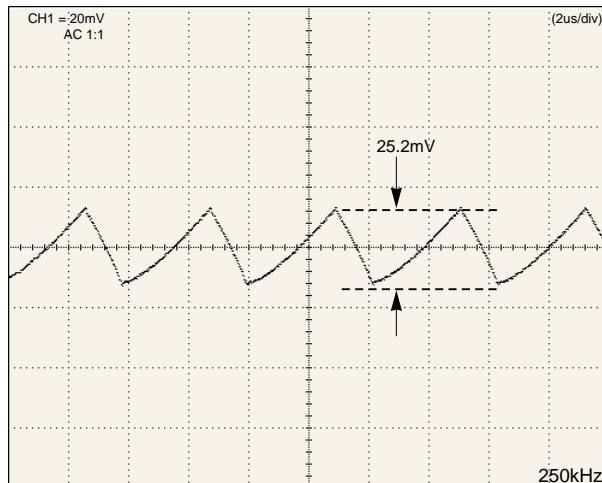


Fig 6 -20°C (3pc)



Low-ESR Tantalum capacitor 220 μ F/10V

Fig 7 -20°C (2pc)



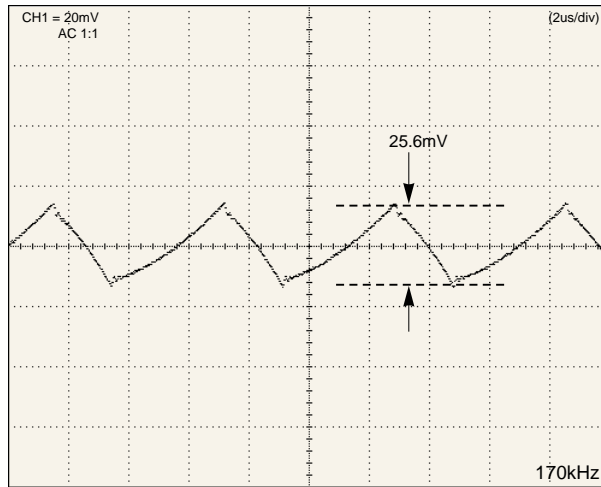
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● Comparison at 70°C

OS-CON 100 μ F/6.3V

Fig 8 70°C (1pc)



Low-impedance aluminum electrolytic capacitor 680 μ F/6.3V

Fig 9 70°C (2pc)

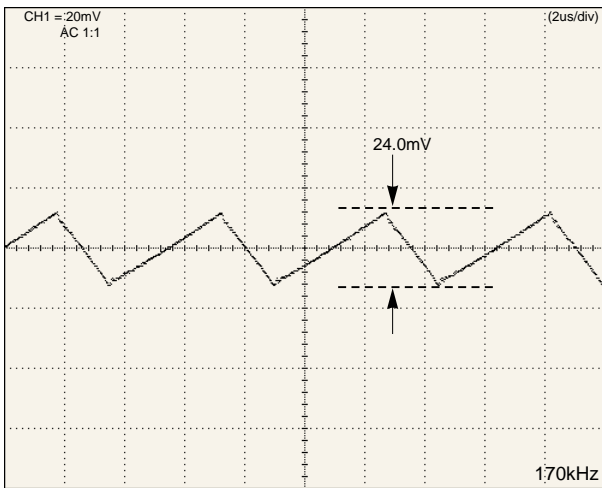
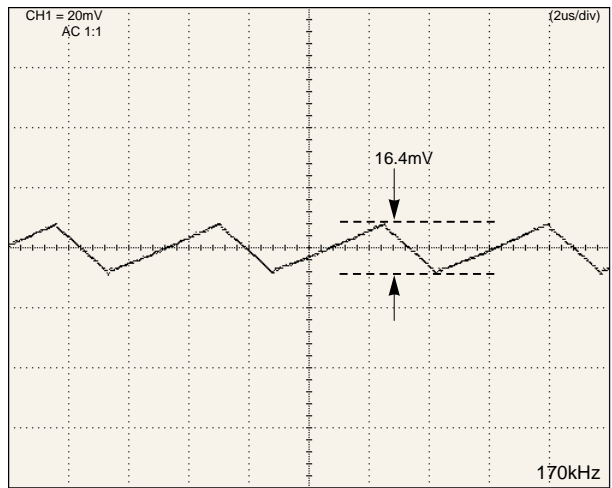
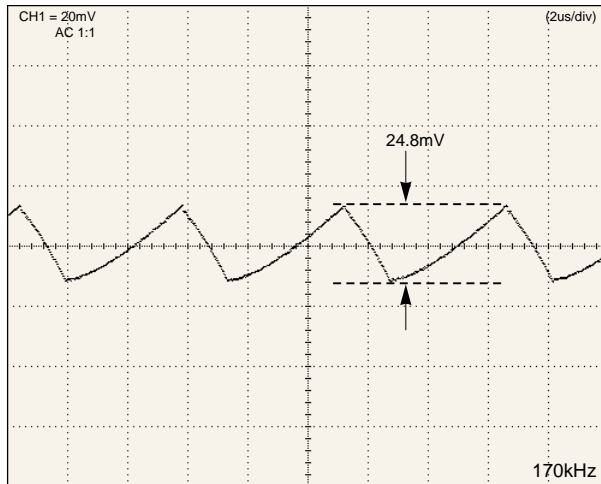


Fig 10 70°C (3pc)



Low-ESR Tantalum capacitor 220 μ F/10V

Fig 11 70°C (2pc)



Application