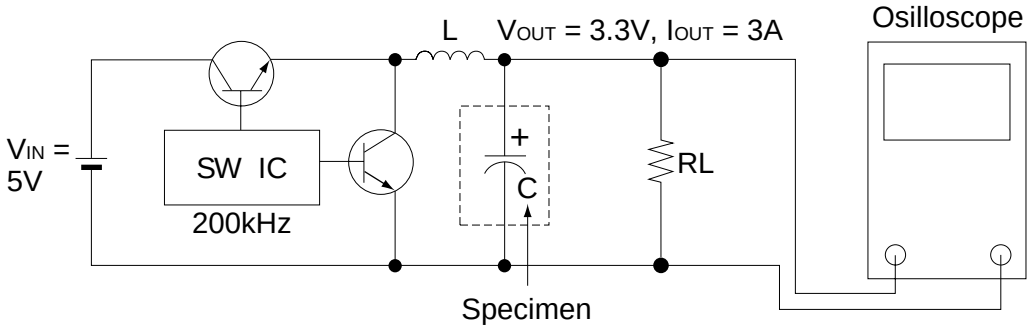
Ripple removal capability of OS-CON

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** 100uF/6.3V (6SVP100M ϕ6.3mm×L6.0mm) 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** 100uF/6.3V 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

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

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

XI. Application

Table-1

Ambient temperature	25°C		
Capacitor type	OS-CON	Aluminum Electrolytic capacitor	Tantalum capacitor
capacitance/voltage	100μF/6.3V	680μF/6.3V	100μF/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	100μF/6.3V	680μF/6.3V		100μF/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	100μF/6.3V	680μF/6.3V		100μF/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

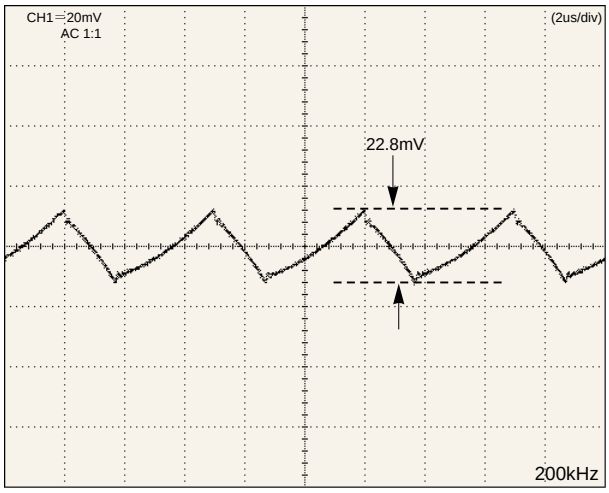
※1）Figures in brackets ( ) are conditions at 25°C.
※2）For items other than Ta, rather than the element diameter, the base plate dimensions were taken as the maximum dimensions.

Ⅺ. Application

●Comparison at 25°C

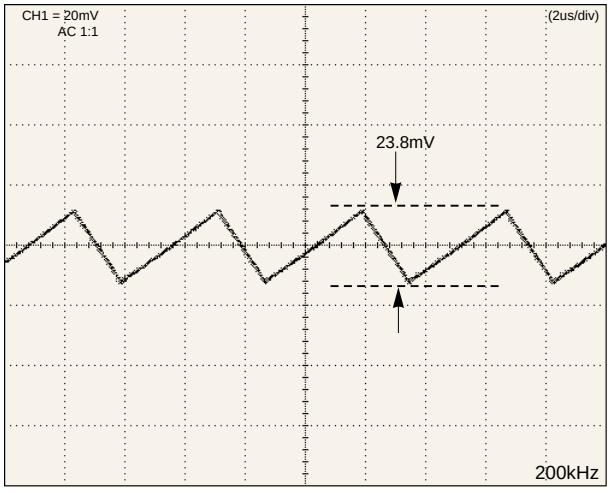
OS-CON 100μF/6.3V

Fig 1 **25°C (1pc)**



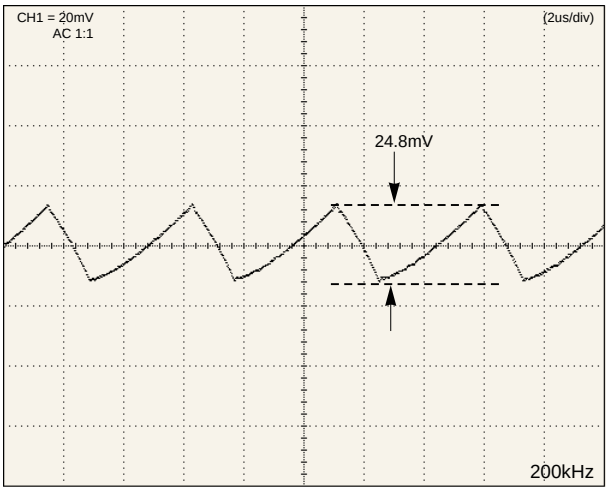
Low-impedance aluminum electrolytic capacitor 680μF/6.3V

Fig 2 **25°C (3pc)**



Low-ESR Tantalum capacitor 220μF/10V

Fig 3 **25°C (2pc)**

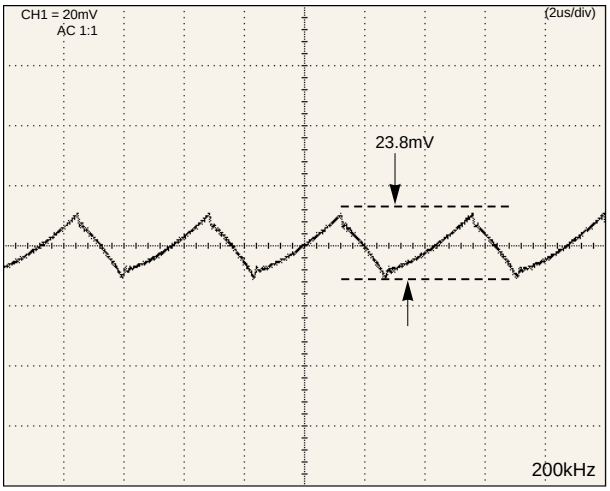


Ⅺ. Application

●Comparison at -20°C

OS-CON 100μF/6.3V

Fig 4 -20°C (1pc)



Low-impedance aluminum electrolytic capacitor 680μF/6.3V

Fig 5 -20°C (7pc)

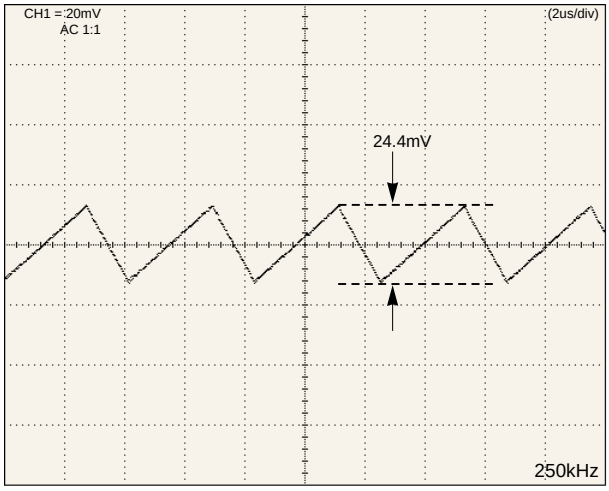
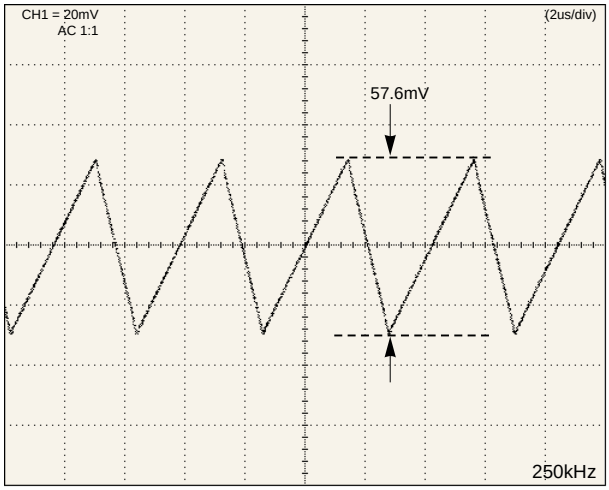
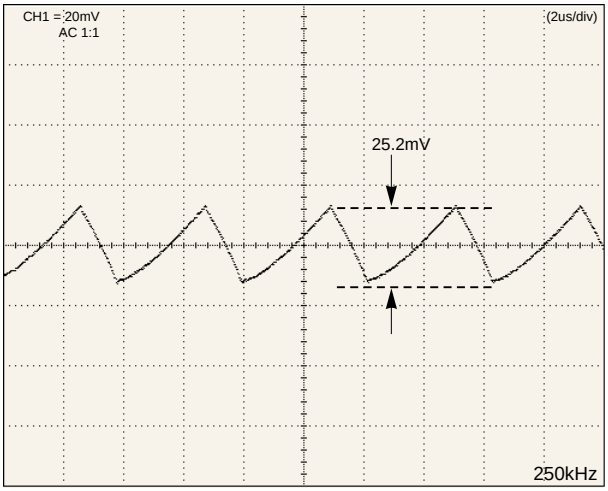


Fig 6 -20°C (3pc)



Low-ESR Tantalum capacitor 220μF/10V

Fig 7 -20°C (2pc)

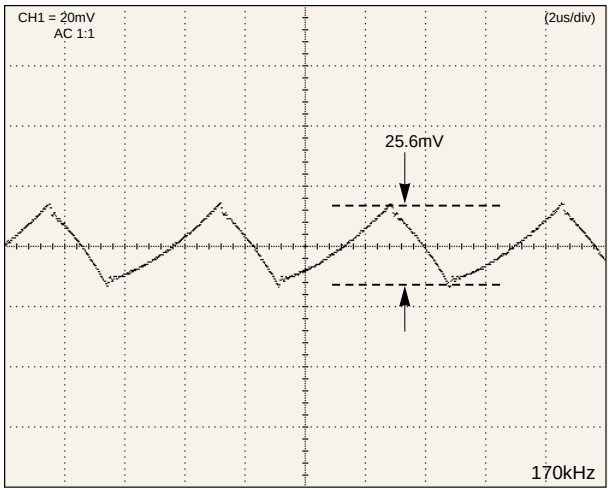


XI. Application

●Comparison at 70°C

OS-CON 100μF/6.3V

Fig 8 70°C (1pc)



Low-impedance aluminum electrolytic capacitor 680μF/6.3V

Fig 9 70°C (2pc)

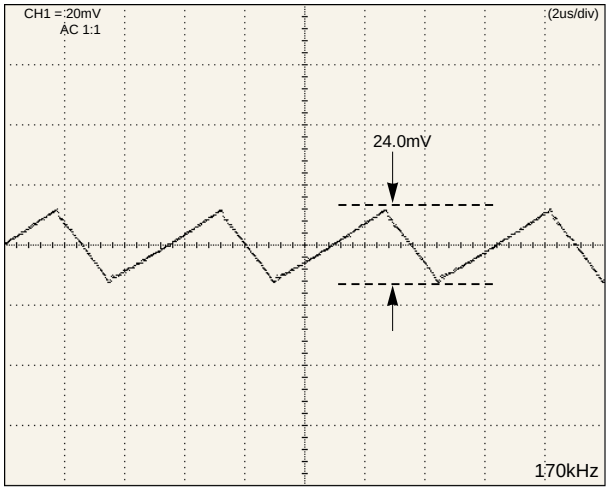
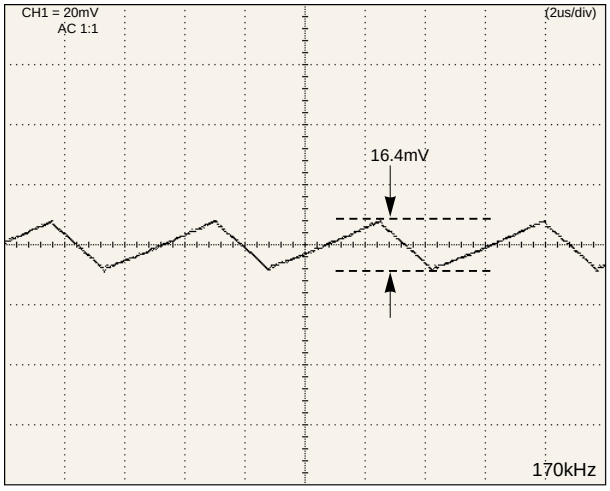


Fig 10 70°C (3pc)



Low-ESR Tantalum capacitor 220μF/10V

Fig 11 70°C (2pc)