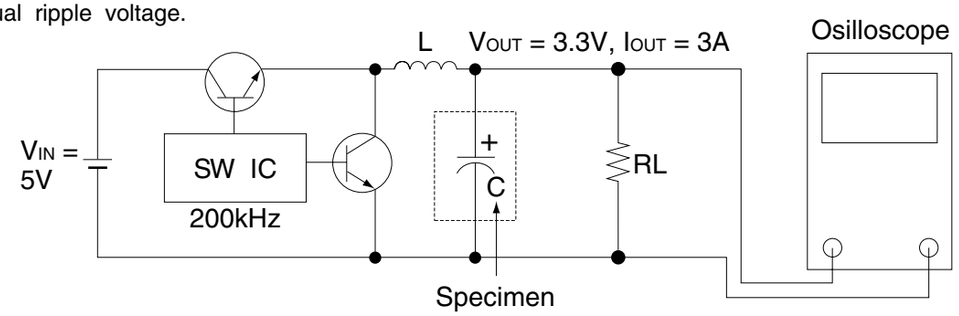
Ripple removal capability of OS-CON

While there is a tendency to downsize switching power supplies, capacitors remain one of the parts occupying large areas of circuit boards. Furthermore, since capacitors vary widely in characteristics with working temperatures in general, selection in consideration of working temperature range is required.
With this being the situation, the ripple removal capability of the OS-CON at high frequencies in a wide range of working temperatures is shown by the following experiment.

Experiment

Using a general chopper switching power supply, the OS-CON, low-impedance aluminum electrolytic capacitors, and low-ESR tantalum capacitors were connected as the capacitor in the output-side smoothing circuit at working temperatures of –20°C, 25°Cand 70°C for comparisons of output residual ripple voltage.



Using the OS-CON • 100μF/6.3WV(6SVP100M ϕ6.3mm X 6mm) as the output-side smoothing capacitor (C) in the above test circuit, the residual ripple voltage was measured at ambient temperatures of –20°C, 25°C and 70°C.
Next, low-impedance aluminum electrolytic capacitors and low-ESR tantalum capacitors were selected for measurement at each temperature (-20°C, 25°C, and 70°C) so that the residual ripple voltage became equal to that achieved when the OS-CON • 100μF/6.3WV was used.
Finally, the residual ripple voltage was measured at each temperature (-20°C and 70°C) with output-side smoothing capacitors equal in number under 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

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

From the above results, it can also be understood how the OS-CON excels in temperature characteristics.

Ⅸ. Application

Table-1

Ambient temperature	25°C		
Capacitor type	**OS-CON**	Aluminum Electrolytic capacitor	Tantalum capacitor
Capacitor capacitance	100μF/6.3WV	680μF/6.3WV	100μF/10WV
Quantity	1pc	3pcs	2pcs
Residual ripple voltage	22.8mV	23.8mV	24.8mV
Size (※2)	6.6 X 6.6(mm)	10.5 X 10.5(mm)	7.5 X 4.5(mm)
On-board area ratio	1	7.15	1.46
Oscillation frequency	200kHz		
Fig	Fig1	Fig4	Fig9

Table-2

Ambient temperature	- 20°C			
Capacitor type	**OS-CON**	Aluminum Electrolytic capacitor		Tantalum capacitor
Capacitor capacitance	100μF/6.3WV	680μF/6.3WV		100μF/10WV
Quantity (※1)	1pc	7pcs	(3pcs)	2pcs
Residual ripple voltage	20.8mV	24.4mV	(57.6mV)	25.2mV
Size (※2)	6.6 X 6.6(mm)	10.5 X 10.5(mm)		7.5 X 4.5(mm)
On-board area ratio	1	16.7		1.46
Oscillation frequency	250kHz			
Fig	Fig2	Fig5	Fig6	Fig10

Table-3

Ambient temperature	70°C			
Capacitor type	**OS-CON**	Aluminum Electrolytic capacitor		Tantalum capacitor
Capacitor capacitance	100μF/6.3WV	680μF/6.3WV		100μF/10WV
Quantity (※1)	1pc	2pcs	(3pcs)	2pcs
Residual ripple voltage	25.6mV	24.0mV	(16.4mV)	24.8mV
Size (※2)	6.6 X 6.6(mm)	10.5 X 10.5(mm)		7.5 X 4.5(mm)
On-board area ratio	1	4.77		1.46
Oscillation frequency	170kHz			
Fig	Fig3	Fig7	Fig8	Fig11

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

Ⅸ. Application

Circumference temperature	OS-CON	Aluminum Electrolytic capacitor	Tantalum capacitor
25°C			
- 20°C			
70°C			

OS-CON 100μF/6.3WV

Fig 1 25°C

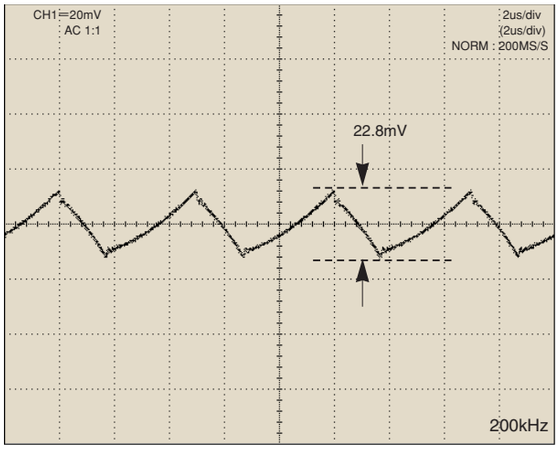


Fig 2 -20°C

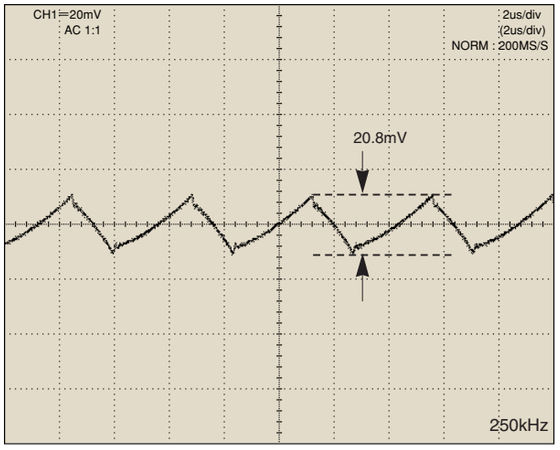
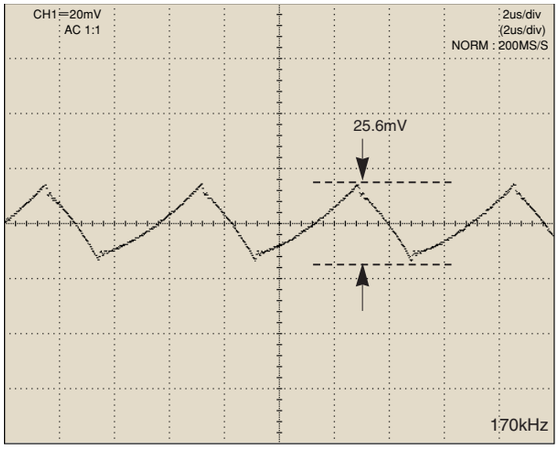


Fig 3 70°C



Low-impedance aluminum electrolytic capacitor 680μF/6.3WV

Fig 4 25°C (3pcs)

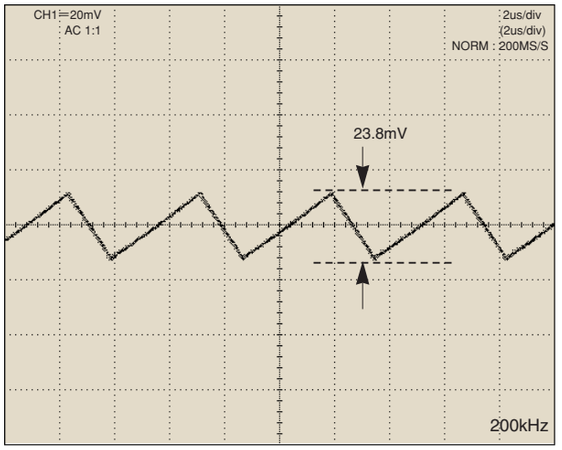


Fig 5 -20°C (7pcs)

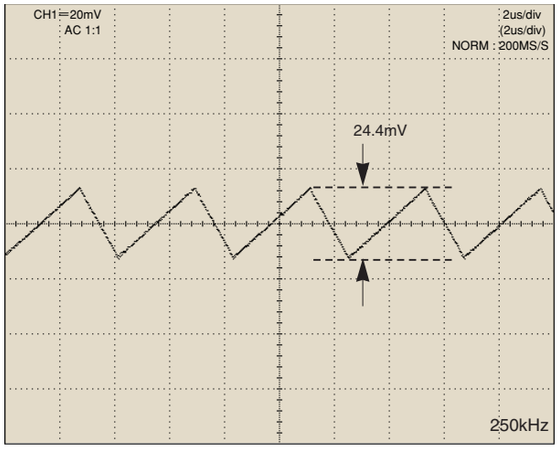


Fig 6 -20°C (3pcs)

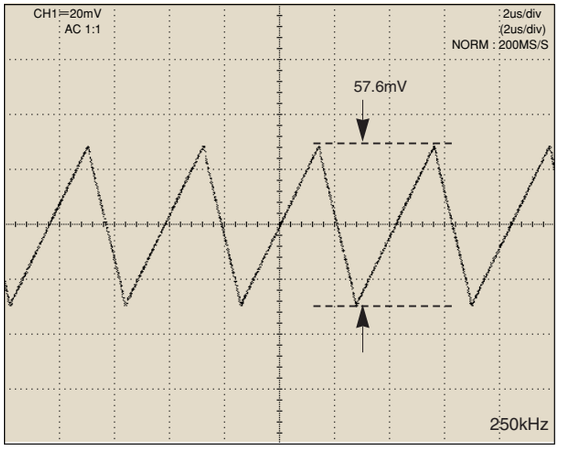


Fig 7 70°C (2pcs)

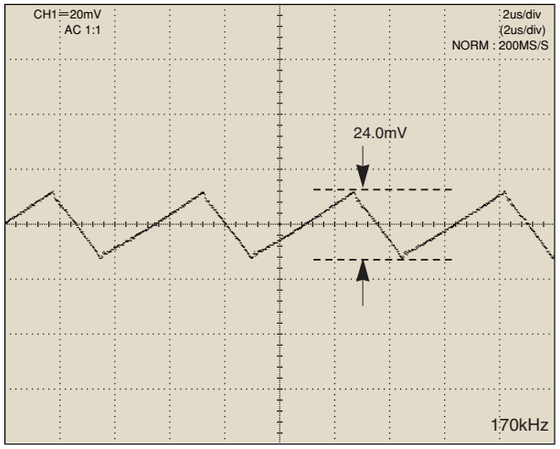
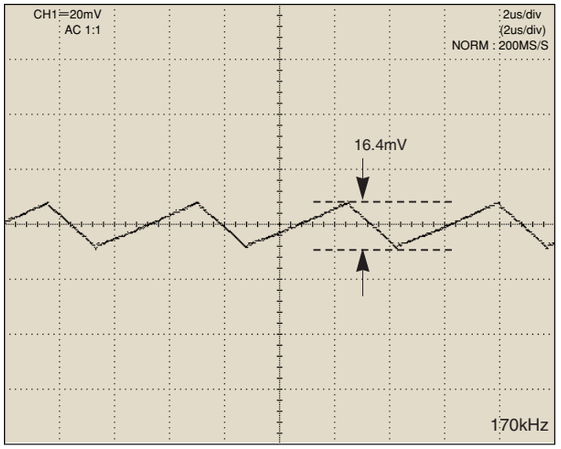


Fig 8 70°C (3pcs)



Low-ESR Tantalum capacitor 220μF/10WV

Fig 9 25°C (2pcs)

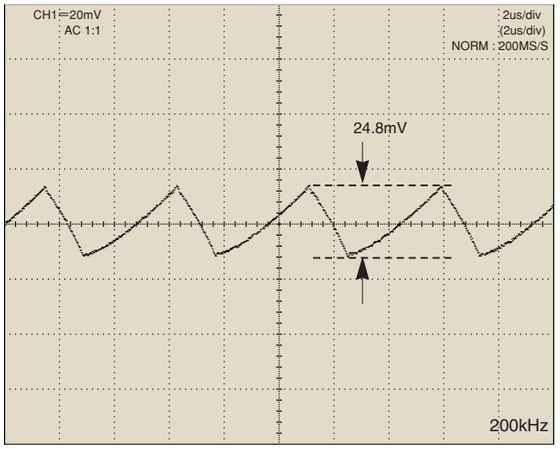


Fig 10 -20°C (2pcs)

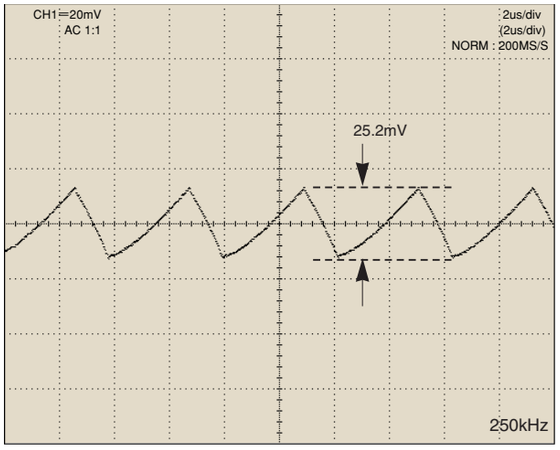


Fig 11 70°C (2pcs)