

LIFETIME CALCULATION FORMULA

OF ALUMINUM ELECTROLYTIC CAPACITORS

1. Lifetime Calculation Formula

$$L = L_b \cdot 2 \left(\frac{T_{max} - T_a}{10} \right) \cdot 2 \left(\frac{\Delta T_{j0}}{10 - 0.25 \times \Delta T_{j0}} - \frac{\Delta T_j}{10 - 0.25 \times \Delta T_j} \right)$$

- L : Life expectancy at the time of actual use.
 L_b : Basic life at maximum operating temperature
 T_{max} : Maximum operating temperature
 T_a : Actual ambient temperature
 ΔT_{j0} : Internal temperature rise when maximum rated ripple current is applied.
 USR, USC, USG : 10 °C
 VXP : 3.5 °C
 Other type : 5 °C

ΔT_j : Internal temperature rise when actual ripple current is applied.

$$\Delta T_j = \Delta T_{j0} \times \left(\frac{I/F}{I_0} \right)^2$$

- F : Frequency coefficient
 I₀ : Rated ripple current at maximum operating temperature
 I : Actual ripple current

2. Ambient Temperature Calculation Formula

If measuring ambient temperature (T_a) is difficult, T_a can be calculated from surface temperature of the capacitor as follows.

$$T_a = T_c - \frac{\Delta T_j}{\alpha}$$

- T_a : Calculated ambient Temperature
 T_c : Surface Temperature of capacitor
 α : Ratio of case top and core of capacitor element

CaseφD	≤8	10,12.5	16, 18	20, 22	25	30	35
α	1.0	1.1	1.2	1.3	1.4	1.5	1.6

3. Ripple Current Multiplier

(1) Temperature coefficient

Temperature coefficients are shown as below.

USR, USC, USG:

Ambient Temp.(°C)	85	≤ 65
Coefficient	1.0	1.3

Other 85°C type:

Ambient Temp.(°C)	85	70	≤ 50
Coefficient	1.0	1.6	2.0

105°C type:

Ambient Temp.(°C)	105	85	≤ 65
Coefficient	1.0	1.7	2.1

Note: Where the temperature coefficient is used, life extension cannot be expected any more because the temperature coefficient is set up on condition of the same life time at maximum operating temperature.

(2) Frequency Coefficient

Frequency coefficients for each series are shown in the catalogue or specifications.

Should you have any questions, please don't hesitate to ask us.



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