



$$R_1 := 47 \frac{\text{V}}{\text{A}} = 47 \, \Omega \quad U_{\text{dropDiode}} := 0.3 \, \text{V} \quad C := 100 \, \mu\text{F}$$

$$U_{\text{VCCmin1}} := 2.5 \, \text{V}$$

$$U_{\text{VCCmin2}} := 1.8 \, \text{V}$$

1) charging time

$$\text{Calculation} := U_{\text{VCCmin}} = (3.3 \, \text{V} - U_{\text{dropDiode}}) \cdot \left(1 - e^{\frac{-t}{R_1 \cdot C}}\right)$$

$$t_{\text{charge}} := \text{Calculation} \xrightarrow{\text{solve, } t} -4700.0 \cdot \Omega \cdot \mu\text{F} \cdot \ln\left(1.0 - \frac{U_{\text{VCCmin}}}{3.3 \cdot \text{V} - 0.3 \cdot \text{V}}\right) = ? \, \text{ms}$$

$$t_1 := \text{Calculation} \xrightarrow{\text{solve, } t, \text{ substitute, } U_{\text{VCCmin}} = U_{\text{VCCmin1}}} -4700.0 \cdot \Omega \cdot \mu\text{F} \cdot \ln\left(\frac{28.0 \cdot \text{V} - 33.0 \cdot \text{V}}{3.0 \cdot \text{V} - 33.0 \cdot \text{V}}\right) = 8.421 \, \text{ms}$$

$$t_2 := \text{Calculation} \xrightarrow{\text{solve, } t, \text{ substitute, } U_{\text{VCCmin}} = U_{\text{VCCmin2}}} -4700.0 \cdot \Omega \cdot \mu\text{F} \cdot \ln\left(\frac{7.0 \cdot \text{V} - 11.0 \cdot \text{V}}{\text{V} - 11.0 \cdot \text{V}}\right) = 4.307 \, \text{ms}$$