

1.

$$f_{clk} = TOF^{-1}$$

$$(d = 1cm) \quad TOF = \frac{2 \cdot 10^{-2}}{340}$$

$$f_{clk} = \frac{340}{0,02} = 17kHz //$$

2.

$$(1) : \frac{V_{DD}}{2} = V_{DD} + \left[-\frac{V_{DD}}{2} - V_{DD} \right] e^{-\frac{t-t_{i1}}{R_{71} \cdot C_{71}}}$$

$$\rightarrow \tau_1 = t - t_{i1}$$

$$\tau_1 = R_{71} \cdot C_{71} \cdot \ln(3)$$

$$(2) : -\frac{V_{DD}}{2} = -V_{DD} + \left(\frac{V_{DD}}{2} + V_{DD} \right) e^{-\frac{\tau_2}{R_{71} \cdot C_{71}}}$$

$$\tau_2 = R_{71} \cdot C_{71} \cdot \ln(3)$$

$$\tau_{TOTAL} = \tau_1 + \tau_2 = 2 \cdot R_{71} \cdot C_{71} \cdot \ln(3)$$

$$f = \frac{1}{\tau_T} = \frac{1}{2 \cdot R_{71} \cdot C_{71} \cdot \ln(3)} //$$

3.

$$f = \frac{1}{\tau_T} = \frac{1}{2 \cdot \ln(3) \cdot R_{z1} \cdot C_{z1}} \quad \left| \begin{array}{l} \longrightarrow R_{z1} = \frac{1}{2,19 \text{ m} \cdot f} \\ C_{z1} = 1 \text{ m} \end{array} \right.$$

$$\boxed{15 \text{ k} < f < 20 \text{ k}}$$

$$f = 15 \text{ k}: R_{z1} = \frac{1}{2,19 \text{ m} \cdot 15 \text{ k}} = \underline{\underline{30,34 \text{ k} \Omega}}$$

$$f = 20 \text{ k}: R_{z1} = \frac{1}{2,19 \text{ m} \cdot 20 \text{ k}} = \underline{\underline{22,76 \text{ k} \Omega}}$$

$$\Rightarrow 22,76 \text{ k} \Omega < R_{z1} < 30,34 \text{ k} \Omega //$$