

1.

$$f_{\text{clk}} = \frac{1}{T_{\text{OF}}} \quad \left. \begin{array}{l} \\ \end{array} \right\}$$

$$(d = 1\text{cm}) \quad T_{\text{OF}} = \frac{2 \cdot 10^{-2}}{340} \quad \left. \begin{array}{l} \\ \end{array} \right\}$$

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

2.

$$(1) : \frac{V_{DD}}{2} = V_{DD} + \left[-\frac{V_{DD}}{2} - V_{DD} \right] e^{-\frac{t-t_{in}}{R_{71}C_{71}}} \quad \downarrow \quad Z_1 = t - t_{in}$$

$$\underline{Z_1 = R_{71} C_{71} \ln(3)}$$

$$(2) : -\frac{V_{DD}}{2} = -V_{DD} + \left(\frac{V_{DD}}{2} + V_{DD} \right) e^{-\frac{Z_2}{R_{71}C_{71}}} \quad \downarrow \quad \underline{Z_2 = R_{71} C_{71} \ln(3)}$$

$$Z_{\text{TOTAL}} = Z_1 + Z_2 = 2 \cdot R_{71} \cdot C_{71} \cdot \ln(3)$$

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

3.

$$f = \frac{1}{2\pi} = \frac{1}{2 \cdot \ln(3) \cdot R_{71} \cdot C_{71}} \quad \left| \begin{array}{l} \\ C_{71} = 1 \mu F \end{array} \right. \quad R_{71} = \frac{1}{2,19 \mu F}$$

$$15k < f < 20k$$

$$f = 15k: \quad R_{71} = \frac{1}{2,19 \mu F \cdot 15k} = \underline{\underline{30,34 \text{ k}\Omega}}$$

$$f = 20k: \quad R_{71} = \frac{1}{2,19 \mu F \cdot 20k} = \underline{\underline{22,76 \text{ k}\Omega}}$$

$$\Rightarrow 22,76 \text{ k}\Omega < R_{71} < 30,34 \text{ k}\Omega \quad //$$