

Quiz 2 Solution

a)

$$\tau = 0.69 R_e$$

$$\begin{aligned} &= 0.69 \times 50 \times 7.5 \text{ ps} \\ &= 258.75 \text{ ps} = 2.59 \times 10^{-10} \text{ s} \end{aligned}$$

b)

$$v = \frac{e}{\sqrt{\epsilon \pi}} = \frac{3 \times 10^{10}}{\sqrt{9.4}} = 1.043 \times 10^{10} \text{ cm/s}$$

$$\text{time of flight} = \frac{L}{v} = 3.5 \times 10^{-10} \text{ s}$$

$$\text{total delay} = 6.09 \times 10^{-10} \text{ ps}$$

c)

$$Z_0 = \frac{\sqrt{\epsilon \pi}}{e C_{wire}}$$

$$C_{wire} = \frac{\sqrt{\epsilon \pi}}{e Z_0} = 0.014 \times 10^{-10} \text{ F/cm}$$

$$C_{wire} = 5 \times 0.014 \times 10^{-10} \text{ F} = 7 \text{ pF}$$

$$\begin{aligned} \text{total capacitance} &= (1 + 7.5 + 7) \text{ pF} = \underline{\underline{15.5 \text{ pF}}} \\ &= 15.5 \text{ pF} \end{aligned}$$

$$P = I V$$

$$= \frac{Q V}{t}$$

$$= C V^2 b$$

$$= (15.5 \text{ pF}) \times (3.3)^2 \times \frac{3 \times 10^8}{2}$$

$$= \underline{\underline{0.024 \text{ W}}}$$

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two switching occur

