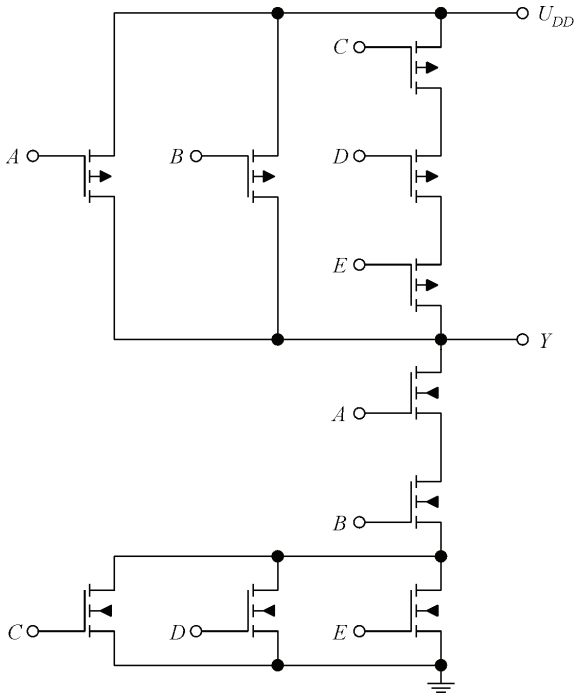
1. zadatak



Rješenje:

a)

$$Y = \overline{AB\left(C + D + E\right)}.$$

b) $W_{nA} = W_{nB} = W_{nC} = W_{nD} = W_{nE} = W_{pA} = W_{pB} = 0{,}9\ \mu\text{m}$, $W_{pC} = W_{pD} = W_{pE} = 2{,}7\ \mu\text{m}$.

c)

$$C_{CD} = \left(W_{pC} + W_{pD}\right)\frac{C_{\min}}{W_{\min}} = \left(2{,}7 + 2{,}7\right)\frac{0{,}4}{0{,}3} = 7{,}2\ \text{fF},$$

$$C_{DE} = \left(W_{pD} + W_{pE}\right)\frac{C_{\min}}{W_{\min}} = \left(2{,}7 + 2{,}7\right)\frac{0{,}4}{0{,}3} = 7{,}2\ \text{fF},$$

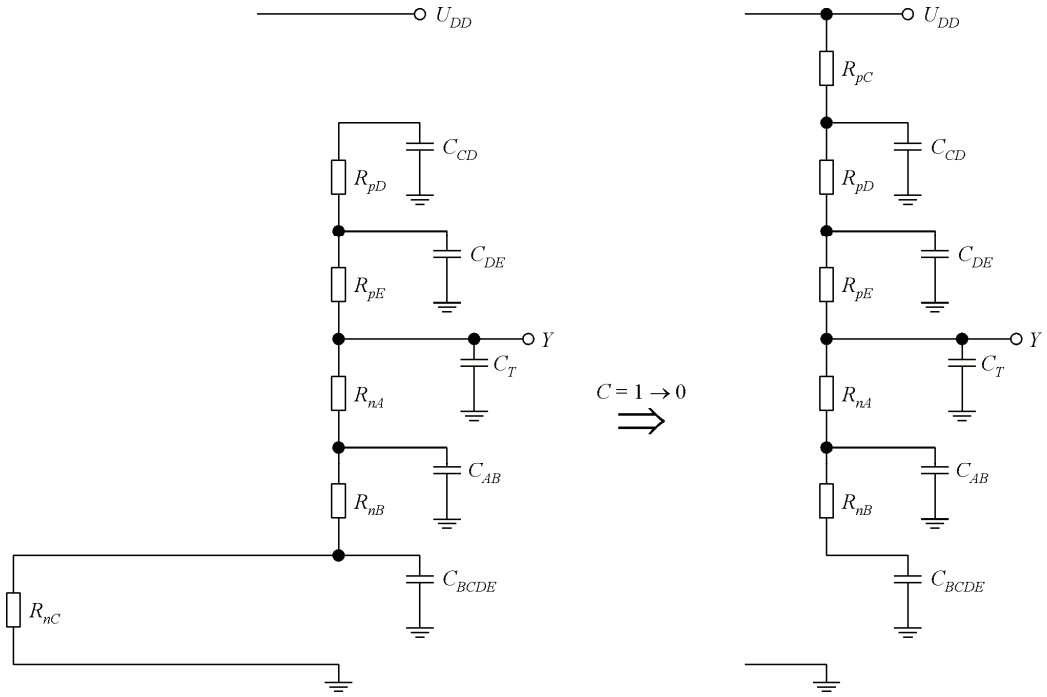
$$C_{AB} = \left(W_{nA} + W_{nB}\right)\frac{C_{\min}}{W_{\min}} = \left(0{,}9 + 0{,}9\right)\frac{0{,}4}{0{,}3} = 2{,}4\ \text{fF},$$

$$C_{BCDE} = \left(W_{nB} + W_{nC} + W_{nD} + W_{nE}\right)\frac{0{,}5}{W_{\min}} = \left(0{,}9 + 0{,}9 + 0{,}9 + 0{,}9\right)\frac{0{,}4}{0{,}3} = 4{,}8\ \text{fF},$$

$$C_T = \left(W_{pA} + W_{pB} + W_{pE} + W_{nA}\right)\frac{C_{\min}}{W_{\min}} = \left(0{,}9 + 0{,}9 + 2{,}7 + 0{,}9\right)\frac{0{,}4}{0{,}3} = 7{,}2\ \text{fF},$$

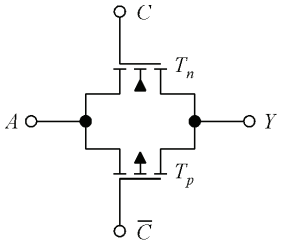
$$R_{pC} = R_{pD} = R_{pE} = R_{p\max}\frac{W_{\min}}{W_{pC}} = R_{p\max}\frac{W_{\min}}{W_{pD}} = R_{p\max}\frac{W_{\min}}{W_{pE}} = 12 \cdot \frac{0{,}3}{2{,}7} = 1{,}33\ \text{k}\Omega,$$

$$R_{nA} = R_{nB} = R_{n\max}\frac{W_{\min}}{W_{nA}} = R_{n\max}\frac{W_{\min}}{W_{nB}} = 7\cdot\frac{0,3}{0,9} = 2,33\ \text{k}\Omega\ .$$



$$\tau_{DY} = R_{pC}\,C_{CD} + \left(R_{pC} + R_{pD}\right)C_{DE} + \left(R_{pC} + R_{pD} + R_{pE}\right)\left(C_{AB} + C_{BCDE} + C_T\right) = 86,2\ \text{ps}\ .$$

2. zadatak



Rješenje:

a)

$$R_{PS} = R_n = \frac{1}{K_n'\left(W/L\right)_n\left(U_{GSn} - U_{GS0n}\right)} = 185\ \Omega\ .$$

b)

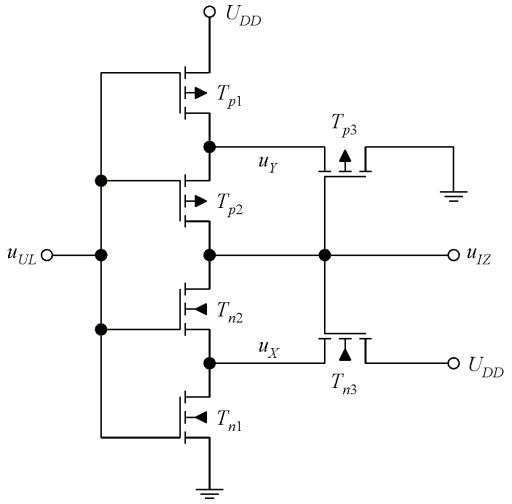
$$R_{PS} = R_p = \frac{1}{K_p'\left(W/L\right)_p\left(U_{GSp} - U_{GS0p}\right)} \quad \to \quad W_p = 7,2\ \mu\text{m}\ .$$

c)

$$R_{PS} = R_n \left\| R_p \right. .$$

U_A, V	U_{GSn}, V	U_{GSp}, V	R_n, Ω	R_p, Ω	R_{PS}, kΩ
0,4	0,8	– 0,4	333	1670	278
0,6	0,6	– 0,6	556	556	278
0,8	0,4	– 0,8	1670	333	278

3. zadatak



Rješenje:

$$K_{n1}\left(U_{UL+} - U_{GS0n}^0 - \frac{U_{DSzasn}}{2}\right)U_{DSzasn} = K_{n3}\left(U_{DD} - u_X - U_{GS0n3} - \frac{U_{DSzasn}}{2}\right)U_{DSzasn} =$$
$$= K_{n3}\left(U_{DD} - U_{UL+} - \frac{U_{DSzasn}}{2}\right)U_{DSzasn} ,$$

$$U_{UL+} = \frac{(W/L)_3\left(U_{DD} - U_{DSzasn}/2\right) + (W/L)_1\left(U_{GS0n}^0 + U_{DSzasn}/2\right)}{(W/L)_3 + (W/L)_1} = 1{,}1 \text{ V} .$$

$$K_{p1}\left(U_{UL-} - U_{DD} - U_{GS0p}^0 - \frac{U_{DSzasp}}{2}\right)U_{DSzasp} = K_{p3}\left(0 - u_Y - U_{GS0p3} - \frac{U_{DSzasp}}{2}\right)U_{DSzasp} =$$
$$= K_{p3}\left(-U_{UL-} - \frac{U_{DSzasp}}{2}\right)U_{DSzasp} ,$$

$$U_{UL-} = \frac{(W/L)_1\left(U_{DD} + U_{GS0p}^0 + U_{DSzasp}/2\right) - (W/L)_3\left(U_{DSzasn}/2\right)}{(W/L)_3 + (W/L)_1} = 0{,}7 \text{ V} .$$