

ELE415 Analog Tümdevreler
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Devredeki transistörler için $V_{TN} = 0.8V$, $V_{TP} = -0.8V$, $k_N' = 2k_P' = 24\mu A/V^2$, $\lambda_N = 0.01V^{-1}$, $\lambda_P = 0.02V^{-1}$ olarak verilmiştir.

$$a- \quad b = \frac{(g_{m1} - g_{m2})C_3}{(C_1 + C_3)(C_2 + C_3) - C_3^2} \Rightarrow b = 0 \Rightarrow g_{m1} = g_{m2} = g_m$$

$$\Omega_O^2 = (2\pi f_O)^2 = \frac{g_{m1} \cdot g_{m2}}{(C_1 + C_3)(C_2 + C_3) - C_3^2} = \frac{g_m^2}{(C_1 + C_3)(C_2 + C_3) - C_3^2}$$

$$g_m^2 = [(C_1 + C_3)(C_2 + C_3) - C_3^2] \Omega_O^2 = (2\pi)^2 \cdot f_O^2 [(C_1 + C_3)(C_2 + C_3) - C_3^2]$$

$$\Omega_O^2 = 74.02 \times 10^{-9} (A/V)^2 \Rightarrow g_m = g_{m1} = g_{m2} = 272 \mu A/V$$

b-

$$\Delta V_{NI} \leq \sqrt{\frac{2I_B}{k_N' \left[\frac{W}{L} \right]_1}} \Rightarrow \left[\frac{W}{L} \right]_1 = \frac{2I_B}{k_N' \cdot \Delta V_I^2} = \frac{2 \times 50 \times 10^{-6}}{24 \times 10^{-6} \times 0.5^2} = \frac{50}{3}$$

$$B = \frac{G}{\sqrt{k_N' \cdot I_B \cdot \left(\frac{W}{L} \right)_1}} = \frac{g_m}{\sqrt{k_N' \cdot I_B \cdot \left(\frac{W}{L} \right)_1}} = \frac{272 \times 10^{-6}}{\sqrt{24 \times 10^{-6} \times 50 \times 10^{-6} \times \left(\frac{50}{3} \right)}} = 1.92$$

$$\left[\frac{W}{L} \right]_5 = \left[\frac{W}{L} \right]_6 = \left[\frac{W}{L} \right]_9 = \left[\frac{W}{L} \right]_{10} = B \cdot \left[\frac{W}{L} \right]_{3-4-7-8} = 1.92 \times \frac{10}{3} = \frac{19}{3}$$