Last Lecture → Large Signal Model

11/4/2019

Condition

- **Strong Inversion – Ohmic**

$$I_D = \mu C_{ox} \frac{W}{L}\left[(V_{GS} - V_{th})V_{DS} - \frac{V_{DS}^{\,2}}{2}\right]$$

$V_{GS} > V_{th}$
$V_{DS} < V_{OV}$

- **Strong Inversion - Saturation**

$$I_D = \frac{\mu C_{ox}}{2}\frac{W}{L}(V_{GS} - V_{th})^2(1 + \lambda V_{DS})$$

$V_{GS} > V_{th}$
$V_{DS} > V_{OV}$

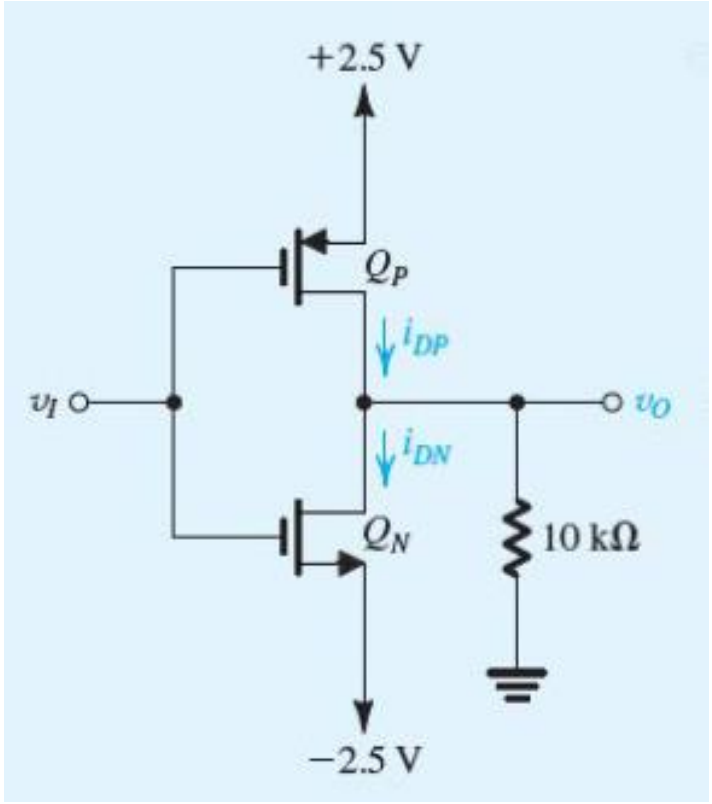
- **Weak Inversion - Saturation**

$$I_D = I_0 . e^{\frac{V_{GS} - V_{th}}{nU_T}}$$

$V_{th} - 5 \cdot U_T < V_{GS} < V_{th} - 2 \cdot U_T$

Example 5.8

Assuming matched NMOS and PMOS transistors with $V_{thn}=-V_{thp}=1V$, $K_n=K_p=1mA/V^2$ and $\lambda=0$, find the drain currents I_{Dn} and I_{Dp}, as well as the voltage v_o, for $v_I=0V$, +2.5V, and -2.5V.



Exercise 5.15

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Assuming matched NMOS and PMOS transistors with $V_{thn} = -V_{thp} = 1V$, $K_n = K_p = 1mA/V^2$ and $\lambda = 0$, find the drain currents I_{Dn} and I_{Dp}, as well as the voltage v_o, for $v_I = 0V$, +2.5V, and -2.5V.